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Mr Hugo Klingenberg
Senior Manager Network Development
ElectraNet Pty Ltd

and

Mr Joe Spurio
Group Manager Network Development
Australian Energy Market Operator

Via email: consultation@ElectraNet.com.au; Planning@aemo.com.au

Dear Sirs,

Re: South Australia - Victoria (Heywood) Interconnector Upgrade, RIT-T: Project Assessment Draft Report (PADR)

Infigen Energy (Infigen) thanks the Australian Energy Market Operator (AEMO) and ElectraNet for the opportunity to comment on the Project Assessment Draft Report (PADR). The level of rigour and attention to detail applied to the draft report is welcomed as commensurate with the importance of the investment decision at hand and the quantum of market benefits potentially available.

Infigen offers the following key points for considerations with a view to ensuring this process is concluded in a timely manner whilst achieving the best possible outcome in line with the National Electricity Objective.

A more detailed explanation of our high level considerations and further suggestions on the modelling approach are provided within the attached appendix, including further options not previously considered.

An expanded South East South Australia 132 kV control scheme should be assessed

Options 1b and 6b substantially increase transfer capacity from South East South Australia to Victoria and have the highest net market benefits. However, there are existing bottlenecks on the underlying 132 kV system connecting to the South East substation due to transmission line ratings and the South East 275/132 kV transformer ratings.

It is proposed that an expanded South East South Australia 132 kV control scheme to manage loadings on the south east South Australia 132 kV system should be assessed, both in isolation and in conjunction with other options. It is recommended that the investigation should include consideration of the:

- low cost opportunities to increase the rating of the 132 kV system,
- replacement of limiting protection and terminal equipment, and
- application of dynamic ratings should be explicitly considered.

Consideration should be given to enhancing Option 1b

Option 1b includes a third Heywood transformer and 500 kV bus tie. There may well be a further benefit in further refining this option, specifically:

- Replacing the existing 500/275 kV transformers with higher rated units should be considered so as to increase the N-1 rating of the South Australia - Victoria interconnector. This would increase transfer limits in the absence of a control scheme and mitigate against the system reliability implications of sustained outage of one of these transformers.
- Specification of the new 500/275 kV transformer(s) to ensure that they are able to be operated to their full non-firm capacity in conjunction with a future control scheme.

Option 1b and 6b (with an expanded south east South Australia 132 kV control scheme) need to be considered together

Infigen proposes that further market benefits may be achieved by re-packaging and sequencing the components of Option 1b, 6b and an expanded South East South Australia 132 kV control scheme together. Specifically:

- An expanded South East South Australia 132 kV control scheme is likely to have a relatively short lead time and could be in service prior to either Option 1b or 6b.

- The control scheme component of Option 6b applied in conjunction with Option 1b would release further transfer capacity from South Australia to Victoria.
- It is considered likely that the control scheme component would be able to be commissioned in advance of longer lead time items such as the series capacitor and third Heywood 500/275 kV transformer.
- The control scheme component of Option 6b applied in conjunction with Option 1b would provide substantial mitigation against the risk of reduction in transfer limits during outage of a Heywood 500/275 kV transformer.

“Catch 22” effect for future upgrade of the interconnector and large scale south east South Australian wind projects can and should be addressed

Due to the large size of the South East South Australian wind projects relative to the South Australia - Victoria interconnector, a “Catch 22” effect may occur whereby justification of interconnector upgrade is contingent on commitment of the wind projects and vice versa.

As a practical means of negating this issue in the context of this specific application of the RIT-T, the following steps are recommended:

- Comprehensively confirm (or otherwise), the technical feasibility of a control scheme to support non-firm operation of the Heywood 500/275 kV transformers and Heywood South East 275 kV transmission lines;
- Comprehensively confirm the commercial feasibility of the control scheme; and
- For the current preferred option, estimate the additional capital cost and associated market benefits for a scenario in which the control scheme outlined above is applied in conjunction with 500 MW of new wind generation connected to the Electranet 275 kV transmission system at or around South East substation.

Please do not hesitate to contact me should you have any questions or would like to discuss this submission.

Yours sincerely,



Scott Taylor
Group General Manager, Australia

South Australia – Victoria (Heywood) Interconnector Upgrade
RIT-T: Project Assessment Draft Report (PADR)
Detailed Considerations

Infigen Energy (Infigen) welcomes the work of AEMO and ElectraNet in respect to the joint study of the technical and economic viability of a Heywood interconnector upgrade including a formal application of the Regulatory Investment Test for Transmission (RIT-T). When undertaken transparently and correctly, this work will support the National Electricity Objective (NEO) to:

“...promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:

- (a) price, quality, safety, reliability and security of supply of electricity; and*
- (b) the reliability, safety and security of the national electricity system.”*

The correct and transparent application of the RIT-T in this instance will support the NEO by:

- a) promoting the efficient connection of new renewable electricity generation to the Australian National Electricity Market required by the LRET;
- b) unlocking significant benefits associated with generation assets currently being constrained in South Australia and the inability of Victorian generation to be used to meet South Australian peak demand by ensuring the full utilisation of the interconnector; and
- c) increasing the interconnector flow which should promote efficient market outcomes.

Infigen has examined the options presented in the PADR and provide the following detailed comments and recommendations to be considered as input to finalisation of this assessment.

CREDIBLE OPTIONS INCLUDED IN THE RIT-T ANALYSIS:

Option 1b – Installation of a third 370 MVA 500/275 kV transformer at Heywood and 500 kV bus tie, plus 275 kV series compensation in South Australia and reconfiguration of the 132 kV network between Snuggery-Keith and Keith-Tailem Bend (South Australia).

It is noted that costing information associated with the installation of a third 500/275 kV Heywood transformer, the 500 kV bus tie and associated augmentation of the Electranet network are both reliant to a degree on input from Electranet and SP AusNet.

As both these parties have considerable interest in the outcomes of the process, it is proposed that the costing of these options be independently assured prior to finalisation of the assessment. It is further proposed that full transparency of the assessment of the independent review would provide further assurances as to their reliability.

Infigen requests that analysis be completed to understand if the reconfiguration of the 132 kV network could be fast tracked and completed well before the installation of the third transformer at Heywood.

Option 6a – Control schemes applying to specific wind generation in South Australia and South East substation and 500 kV bus tie; and

Option 6b – Control scheme applying to specific wind generation in South Australia and South East substation plus Option 1b minus the third Heywood transformer

Concerns with the analysis of the control schemes are dealt with in this section and apply to both Options 6a and 6b. At a high level, it appears undue caution has been applied with regard to the costing and technical feasibility of these options, which should be addressed prior to finalisation of the assessment.

Costs:

The costs included in the analysis are substantially higher than the costs outlined in the report obtained from David Strong & Associates (DSA), which was a key deliverable of the DSA scope. The justification given within the PADR for an increase of 25% on top of the costs as advised by DSA was that SP AusNet provided an indicative estimate that was at the upper end of the DSA estimate. Infigen notes again that SP AusNet has considerable interest in the outcomes of the process and suggests reliance be placed on the views of the independent expert.

It is further noted that DSA provided significant contingencies within its cost estimates, although it appears that these have been excluded when the costs have been adjusted upwards.

Infigen contends that SP AusNet should have specifically raised its points of difference with DSA in regards to the costs within the report and DSA should have adjudicated on what it considered the fair and reasonable costs to have been.

In arriving at final costs, it is proposed that the final cost benefit assessment should be based on most probable costs, as opposed to a “conservative” or “worst case” assessment.

One of the major cost items of the control schemes is the communications required to send trip signals from the control system hardware to the generator sites and for collecting and sending operational data. The capital cost estimate for the control schemes includes \$4.5m for communication infrastructure required for the control scheme.

Infigen notes that ElectraNet has proposed that communications capability be put in place for other network operational purposes as part of its current submission to the Australian Energy Regulator (AER), with a draft determination due at the end of November 2012. Infigen agrees with the comment in the PADR that these costs would no longer need to be incorporated as part of the costs of the control scheme if the AER approves this expenditure as part of prescribed transmission services and requests that a sensitivity of the net benefits associated with Option 6b be performed without these costs.

Further, Infigen believes that if the draft determination from the AER indicates that these communication costs will form part of ElectraNet's prescribed transmission services then AEMO and ElectraNet should exclude these costs from the analysis undertaken as part of preparing the Project Assessment Conclusions Report.

Risks identified as reasons for not progressing with control schemes:

ElectraNet and AEMO noted that they consider there to be a number of risks associated with selecting a control scheme solution in preference to adding a third transformer at Heywood. These concerns (taken directly from the PADR) are numbered 1 through to 5 below in italics.

Given the potential benefits of a scheme of this nature, and indeed the precedents of the successful implementation of the arguably more complex Bass Link and Murray Link control schemes, Infigen offers the following recommendations to increase the certainty around this scheme prior to finalisation of the assessment.

- 1. There is substantial uncertainty in relation to the commercial feasibility of the control schemes, as issues relating to liabilities and associated indemnities would need to be worked through. It is anticipated that significant further work would be required, with an uncertain outcome, since initial investigation of commercial issues for the PADR indicates that the commercial issues are not straightforward.*

The RIT-T is an economic test, and as such assignment of risk and liabilities is a matter of wealth transfers rather than quantification of economic surplus and as such is of no consequence beyond quantification of transactional costs associated with allocation of the risk.

In application of an economic test of this type, commercial behaviour should be assumed to be rational as driven by the economic signals imposed on the relevant parties.

Therefore the risk of highly infrequent disconnection in return for substantially improved market access would provide adequate incentive for generators to participate in such a scheme. Infigen is the owner and operator of the existing wind generation that would participate in such a scheme, and is the proponent of the advanced Woakwine Wind Farm project that intends to participate into the future. Infigen would

welcome dialogue with AEMO with a view to identifying means to give assurance as to the terms under which these generators would participate in the control schemes.

Further, schemes similar to what has been proposed, operate in the NEM via the Bass Link and Murray Link control schemes, presumably with commercial arrangements across a range of transmission network service providers and generators that are of a similar or greater level of complexity as what is proposed.

It is proposed that the potential benefits of the control schemes are sufficient to justify further detailed investigation with a view to addressing these concerns as part of the current process.

2. *The issue of technical feasibility would need to be subject to further detailed investigation, particularly in relation to issues of wider system security and the overload ratings of the Heywood transformers.*

The proposed potential benefits of the control schemes justify further detailed investigation, with a view to addressing the concerns as part of the current process.

3. *The RIT-T assessment has included benefits associated with additional wind generation locating at Krongart and participating in the control scheme. However there is currently no application from new wind generators to connect at Krongart, and so this portion of the market benefit remains speculative.*

Infigen recently received development approval for its Woakwine Wind Farm project, which is located along the same ridgeline as the existing Lake Bonney wind farms. The proposed Woakwine Wind Farm has development consent for 124 wind turbines, which could potentially allow the wind farm to be between 350 – 500 MW in size. Further opportunity exists to expand the size of the wind farm along the Woakwine ridgeline, with the wind resource appearing to indicate that a total aggregate capacity of 800 – 1,000 MW being theoretically possible.

Infigen has spent considerable time, effort and money in getting this project approved and is well advanced in discussions with ElectraNet in regards to connecting the proposed wind farm. Infigen and ElectraNet initially discussed the Woakwine connection via a new substation at Krongart and were at an advanced stage of negotiating a connection agreement in 2008/09.

It is proposed that the potential benefits of the control schemes are sufficient to justify detailed investigation into the capability of the control scheme to allow additional generation to connect in the South East of South Australia. The costs of these investigations are considered minimal when compared with investment in the advance South East South Australian wind farm projects that are dependent on its feasibility.

As noted in the PADR, South Australia is recognised as having one of the best wind resources in the NEM and Infigen considers that Woakwine Wind Farm has the potential to be one of the lowest cost large scale renewable generation plant that could be delivered in the near term.

Confirmation of the capability of such a scheme to allow significant, low cost wind generation to connect would avoid creating a 'Catch 22' situation whereby confirmation of the benefits of the control scheme is contingent on commitment of the wind projects and vice versa.

As a practical means of negating this issue in the context of this specific application of the RIT-T, the following steps should be taken:

- Comprehensively confirm, or otherwise, the technical feasibility of a control scheme to support non-firm operation of the Heywood 500/275 kV transformers and Heywood South East 275 kV transmission lines;
- Comprehensively confirm the commercial feasibility for the control scheme; and
- For the current preferred option, estimate the additional capital cost and associated market benefits for a scenario in which the control scheme outlined above is applied in conjunction with 500MW of new wind generation connected to the Electranet 275 kV transmission system at or around South East substation.

4. *The costs of the control scheme component are relatively uncertain, including the assumption of zero participation fees for existing and new generators.*

Now that the scheme has been shown to potentially have high net market benefits, Infigen believes that there is sufficient justification in reducing the uncertainty of these costs with further work and analysis and is willing to assist as much as possible in this regard.

5. *Adding a third transformer at Heywood would have the added benefit of reducing the risks associated with a prolonged outage of one of the existing transformers, compared with the alternative of adopting the control schemes. Although the probability of a transformer outage is low, if a catastrophic failure of one of the Heywood transformers did occur (for example, due to a failure in the transformer tank) then the replacement time would be in the order of two years. During this period, the interconnector limits would become 460 MW (each way) if there was a third Heywood transformer in place (Option 1b). However, if the control schemes were to be adopted instead (Option 6b), the interconnector limits would fall to approximately 250 MW (South Australia to Victoria) and 210 MW (Victoria to South Australia).*

The reliability of the Heywood transformers should be treated as an input into the economic analysis and described in detail in the project assessment conclusions report, not treated as an unquantifiable risk.

Further, Infigen contends that the control scheme component of Option 6b applied in conjunction with Option 1b would provide substantial mitigation against risk of reduction in transfer limits during outage of a Heywood 500/275 kV transformer.

OPTIONS NOT CONSIDERED:

New Option (6c) – Stand-alone South East control scheme

It is considered that the South East transformer constraint justifies immediate action in the form of implementation of a control scheme to allow non-firm operation of the 132 kV system through tripping of South East area wind generation immediately upon the loss of either transformer.

Infigen proposes that the South East control scheme as proposed by DSA being assessed both in isolation and conjunction with other options.

Due to the longer lead time associated with the preferred options, it is suggested a separate case be investigated with a view to confirming feasibility and progressing to implementation of such a scheme in the shortest possible time.

New Option (6d) – Expanded South East control scheme

There are existing bottlenecks on the underlying 132 kV system connecting to South East substation due to transmission line ratings, the South East 275/132 kV transformer ratings and terminal equipment ratings at Keith, Kincaid, Penola West and Taillem Bend.

The South East control scheme that has been proposed focusses purely on managing the loading on the South East transformers, with no consideration of the potential market benefits of managing loadings on additional elements of the south east South Australia 132 kV system.

In addition to the above, an expanded South East control scheme should be investigated. This would include monitoring of additional network elements and the fast tracking of low cost opportunities to increase the rating of the 132 kV system via the replacement of limiting protection and terminal equipment as well as application of dynamic ratings should be explicitly considered. The low cost opportunities are outlined in greater detail in new Option 6 (f) below.

New Option (6e) – Control scheme applying to specific wind generation in South Australia and South East substation plus Option 1b (in its entirety)

Infigen proposes full technical and economical investigation of an option that combines the Heywood transformer and the control scheme. This should also include the coming to a conclusive view as to the economic benefit of utilising a control scheme to:

- allow the non-firm operation of three Heywood transformers; and
- operate two transformers non-firm both prior to the installation of the third unit and during a sustained outage of one of the transformers, which would mitigate some of the risks associated with a prolonged outage of one of these transformer.

Notwithstanding there remains some potential for the costs of the control scheme in the PADR to come down with a favourable AER ruling on the communications infrastructure or by reconciling the difference of opinion on costs between DSA and SP AusNet, the PADR indicates that this could be delivered for \$10.0m, being the cost of the control schemes of \$17.6m less the \$7.6m of costs associated with the bus tie which would already be incurred as part of Option 1b.

The quantum of the additional capacity that this would release on the interconnector is anticipated to be significant, for relatively little incremental cost and would appear to be worthy of a full technical and economic assessment.

The control scheme component of Option 6b applied in conjunction with Option 1b would also provide substantial mitigation against risk of reduction in transfer limits during outage of a Heywood 500/275 kV transformer because the remaining two transformers could be operated non-firm. If the control scheme was in place prior to the installation of the third transformer this would also reduce the potential disturbance to the market during its installation, relative to the preferred option as it stands.

New Option (6f) – Control scheme applying to specific wind generation in South Australia and South East substation plus Option 1b and:

- 1. Extended control scheme on south east area 132 kV network and compressive review of asset capability;**
- 2. Replacement / refurbishment of the existing Heywood transformers to ensure short term overloading capability of all three transformers;**
- 3. Dynamic ratings for the Heywood to South East 275 kV transmission line; and**
- 4. Consistent ratings for their whole of the Heywood to South East 275 kV transmission line.**

Installation of three 370 MVA transformers at Heywood with short term overloading to allow non-firm operation, in conjunction with non-firm operation of the 275 kV transmission lines would appear to have the potential to allow in excess of 900 MW of interconnector capacity from South Australia to Victoria, compared to 650 MW in the preferred option.

This would naturally depend on the availability of generation assets to participate in the control scheme. The additional 250+ MW could therefore be released at a very low cost and would appear to be worthy of a full technical and economic assessment.

We note that there has been no consideration given in this option to retrofit the existing transformers with short term overloading capability nor/or entirely replacing the existing assets under the same program of installing a new transformer at Heywood.

Given the relative costs of the transformers in regards to the total costs of this option, the age of the existing units and the importance of the Heywood transformers in regards to interconnector capacity between South Australia and Victoria, Infigen believes that the RIT-T could provide the opportunity to cost effectively ensure that the Heywood transformers do not constraint interconnector capacity below that of the existing transmission lines.

It is proposed that the South East 132 kV system also be comprehensively reviewed with a view to releasing full capability of the assets in the area. This would include:

- Application of dynamic ratings through real time monitoring of transmission line conditions. This could include tension monitors installed in transmission lines, weather stations, ground based LIDAR under critical spans and real time monitoring of transformer temperatures;
- Review of opportunity to replace terminal equipment that constrains operation of transformers and transmission lines to their full rating. This would cover CTs, line traps, droppers, substation buses and protection schemes; and
- Application of control schemes to release the full non-firm capacity of the network by means of tripping upstream stream generation on loss of 132 kV transmission elements.

Infigen agrees that dynamic ratings may not be required at this time for the Heywood to South East transmission lines, as the line rating is higher than the Heywood transformer rating. However, if the transmission lines became the limiting factor, which we consider would be the result of this option, the benefits of dynamic or temperature based rating may in fact become substantial.

We note that ElectraNet and SP AusNet apply different ratings for their sections of the Heywood to South East 275 kV transmission lines, primarily due to different assumptions regarding wind speed. Infigen contends that the whole of the line should be rated in accordance with the design capabilities of the assets.

As detailed above, Infigen contends that there would be substantial risk reduction benefits of having the control scheme component of Option 6b applied in conjunction with Option 1b.