THE HEYWOOD INTERCONNECTOR: OVERVIEW OF THE UPGRADE AND CURRENT STATUS

SOUTH AUSTRALIAN ADVISORY FUNCTIONS

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AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

IMPORTANT NOTICE

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1. UPGRADE OVERVIEW AND CURRENT STATUS

1.1 Introduction

The South Australian Government asked that AEMO, as a part of its South Australian advisory function, provide an overview of the outcomes of the Heywood Interconnector Regulatory Investment Test for Transmission (RIT-T) completed in January 2013, and an update on progress of the interconnector upgrade for South Australian energy consumer benefit.

AEMO has provided ongoing updates to the South Australian Government, and the Heywood upgrade project remains on schedule for completion by mid-2016.

The project scope is to incrementally increase Heywood Interconnector transfer capacity from 460 megawatts (MW) to 650 MW in both directions, by installing a third 500/275 kV transformer at the 500 kV Heywood Terminal Station. The RIT-T assessed that implementing the upgrade yielded a net market benefit of more than $190 million over the life of the project through reductions in generation dispatch costs.

This report provides the following information:

- Background.
- Benefits.
- RIT-T assessment undertaken since June 2012.
- AER approvals.
- Construction and development status.

1.2 Background

South Australia's transmission network is connected to the National Electricity Market (NEM) via the Murraylink and Heywood interconnectors. These interconnectors allow electricity to flow between South Australia and Victoria. In the past two years, electricity has been flowing from Victoria to South Australia via the Heywood interconnector about 80% of the time. At times of high South Australian wind generation, electricity tends to flow from South Australia to Victoria.[1]

The Murraylink Interconnector connects South Australia to north-west Victoria via the Riverland region. It has a nominal transfer capability of 220 MW, although the actual limit depends on flow direction and local conditions.

The Heywood Interconnector connects South Australia to south-west Victoria. The Heywood transformers currently limit the interconnector transfer to 460 MW, but other factors can limit interconnector flow to less than this, including:

- Thermal limitations and voltage stability in the south-east South Australian transmission network.
- Thermal limitations and transient stability around South Morang in the Victorian transmission network.
- Oscillatory stability limits between Victoria and South Australia.

In February 2011, ElectraNet and AEMO published a joint feasibility study that identified NEM benefits associated with upgrading Heywood Interconnector transfer capability, particularly for Victorian and South Australian energy consumers.[2] This was followed by a joint RIT-T, which commenced in October 2011. Appendix A outlines the process the RIT-T followed and the subsequent AER approvals.

The RIT-T aims to identify the credible option that maximises the net present value to all who produce, consume, and transport electricity in the NEM.

[1] Further details on the historical interconnector flows between South Australia and Victoria are available in the South Australian Historical Market Information report. See: http://www.aemo.com.au/Electricity/Planning/South-Australian-Advisory-Functions/South-Australian-Historical-Market-Information-Report. Viewed 25 August 2015.

[2] AEMO is the Victorian transmission network service provider (TNSP) in this context and ElectraNet is the South Australian TNSP.

1.3 Heywood Interconnector capacity upgrade benefits

ElectraNet and AEMO found that increasing Heywood Interconnector transfer capacity from 460 MW to 650 MW would:

- Provide extra electricity supply capacity and reliability to South Australia in peak demand times, which generally occur during summer heatwaves, and further develop South Australia's renewable energy resources by increasing export capacity.
- Alleviate electricity transmission congestion.
- Facilitate more efficient generation dispatch in Victoria and South Australia.

Since completion of the RIT-T, the generation mix in South Australia has continued to change, with recently announced closures of coal and gas generators and continued uptake of rooftop photovoltaics (PV). This is leading to greater reliance on interconnection between Victoria and South Australia and, in particular, the upgrade of the Heywood Interconnector.

The recent withdrawal of Pelican Point Power Station Unit 2 and proposed withdrawals of Torrens Island Power Station A, Northern Power Station and Playford B Power Station by 2017 amount in total to the withdrawal of more than 1500 MW of the existing electricity supply provided by coal and gas generators in South Australia. AEMO's 2015 Electricity Statement of Opportunities[3] (ESOO) highlighted that these withdrawals contribute to the emergence of low reserve conditions in South Australia by 2019-20, if additional generation capacity is not made available to the state. A low reserve condition indicates that a region is at risk of breaching the NEM Reliability Standard which targets less than 0.002% of unserved energy for each financial year. In the absence of additional generation capacity within South Australia, there will be greater reliance on imports from Victoria to South Australia during peak demand times.

Under low demand conditions, AEMO's 2015 National Energy Forecasting Report (NEFR) shows that, based on continued uptake of rooftop PV and its contribution to supply in South Australia, rooftop PV may offset 100% of operational minimum demand, during midday periods, by 2023–24. This increases the need for export from South Australia to Victoria during these periods.

It should also be noted that the changing generation mix may have operational impacts on the Heywood interconnector with its upgraded capacity. Ongoing work is:

- Understanding the range of technical issues associated with managing the power system with little or no synchronous generation on-line.
- Developing the tools and models to analyse performance of a power system with little or no synchronous generation on-line.
- Investigating the existing fleet of rooftop PV inverters and their response to frequency and voltage disturbances.
- Investigating the impact of high levels of rooftop PV penetration in South Australia on the operation of the Under Frequency Load Shedding scheme[4] in the state.

The findings of this work are expected to be published later this year.

[3] AEMO. 2015 Electricity Statement of Opportunities (ESOO). Available at: http://www.aemo.com.au/Electricity/Planning/Electricity-Statement-of-Opportunities. Viewed: 25 August 2015.

[4] The Under Frequency Load Shedding scheme seeks to maintain power system stability where there is under-supply of generation, by intentionally shedding load until the supply-demand balance is restored.

1.4 Construction and development status

The Heywood interconnector (VIC-SA) transfer capacity upgrade project is scheduled for completion by 31 July 2016. The Victorian component of the upgrade works includes commissioning of a third 500/275 kV transformer at Heywood Terminal Station. The commissioning date of the third transformer is scheduled for mid-December following manufacturer factory acceptance testing.

The completed Victorian component of this project is expected to deliver part of the overall estimated market benefit by relaxing the present thermal transfer limit. Other limitations to interconnector transfer will be unchanged until the South Australian part of the interconnector upgrade works is complete. The South Australian component includes:

- Series compensation on 275 kV transmission lines.
- A control scheme for South East transformers.
- Re-configuring the existing South Australian 132 kV transmission network.

This work remains on schedule for completion by mid-2016, increasing transfer capacity from 460 MW to 650 MW in both directions.

The first release of capacity after the transformer is commissioned will allow an increase in bi-directional power transfer capacity of 40 MW, and provide an upper transfer limit of 500 MW in either direction. Actual transfers will be subject to other existing constraints that may bind first.

To maintain system security during project implementation, the extra transfer capacity provided by the transformer upgrade will be released in 50 MW increments, with each capacity release beyond the first to occur after monitoring (and potentially some testing).

AEMO will continue to inform the market via MT PASA and constraint advice notices of increases in interconnector transfer capacity. To improve the transparency of the constraint impacts of the upgrade, AEMO has created an information page listing the affected constraints for the different stages of the upgrade.[5]

[5] http://www.aemo.com.au/Electricity/Resources/Reports-and-Documents/Network-Operations/NEM-Increase-in-the-Maximum-Transfer-Capability-of-the-Heywood-Interconnection-between-SA-to-VIC. Viewed: 26 August 2015

APPENDIX A. REGULATORY ASSESSMENT AND APPROVALS

A.1 RIT-T: Project Assessment Draft Report

On 14 September 2012, the Project Assessment Draft Report (PADR) was published. [6] It included a full options analysis and draft results for several variations and combinations of the following key upgrades:

Upgrade 1: An incremental upgrade to increase Heywood Interconnector transfer capacity from 460 MW to 650 MW in both directions, by installing a third 500/275 kV transformer at the 500 kV Heywood Terminal Station.

This included removing existing intra-regional limitations by:

- Installing shunt- or series-reactive compensation in the South Australian network.
- Installing additional 275/132 kV transformer capacity in south-east South Australia.
- Re-configuring the existing South Australian 132 kV transmission network.
- Developing weather stations and real-time dynamic line ratings to be applied to 275 kV and 132 kV lines in South Australia.

These upgrade costs ranged from $80 to $130 million.[7]

Upgrade 2: A new 500 kV line from Heywood Terminal Station into the South Australian network at Krongart, providing up to 2,000 MW of additional capacity in both directions.

This option cost ranged from $500 to $800 million. It included supporting transmission augmentation projects that would be required in South Australia to support the higher transfer capability.

Upgrade 3: Non-transmission network expansion options. These were:

- Demand-side management (also known as demand-side response).
- A control scheme to operate some existing network assets at higher short-term ratings.

These upgrade costs ranged from $141 to $317 million.

The PADR options analysis showed that for Upgrade 1, an increase in the Heywood Interconnector's transfer capability, could deliver a net market benefit through reductions in generation dispatch costs over the longer term.

The upgrade would enable increased wind energy exports from South Australia to Victoria and increase imports of lower-cost generation from Victoria into South Australia, particularly at peak demand times. Upgrade 1 was preferred as it showed the highest net market benefits. Specific works involved:

- Installing a third 500/275 kV transformer and bus-tie at the 500 kV Heywood Terminal Station in Victoria.
- In the south-east South Australian transmission network:
  - Installing a 275 kV series reactive compensation and 132 kV shunt reactive compensation.
  - Reconfiguring the existing 132 kV transmission network.

The estimated total capital cost of this option was $108 million ($2011-12). Of this, $63 million was allocated to the South Australian network and $45 million to the Victorian network. The net market benefit of this option exceeded $190 million (in present value terms) over the project life.

The project is expected to deliver positive net benefits in the first year of operation.

The estimated commissioning date for the selected option is July 2016.

On 27 September 2012, ElectraNet and AEMO held a public forum to present the PADR results. Consultation on the PADR closed on 26 October 2012. Eight submissions were received and

[6] Available at: http://www.aemo.com.au/Electricity/Planning/Regulatory-Investment-Tests-for-Transmission/~/media/Files/Other/planning/RITTs/SA_VIC_Heywood_Interconnector_Upgrade_RIT_T_PADR.ashx. Viewed 25 August 2015.

[7] The demand-side component ranged from $120 to $233 million and the control scheme component ranged from $21 to $84 million.

considered in the subsequent Project Assessment Consultation Report (PACR). The submissions are available on AEMO's website.[8]

A.2 RIT-T: Project Assessment Consultation Report

On 9 January 2013 the PACR was published[9] as the third and final stage of the RIT-T process.

The PACR recommended no change to the preferred option or outcomes from the PADR.

In response to PADR submissions requesting further information, the PACR elaborated on certain aspects of the process and analysis undertaken for this RIT-T.

No formal disputes were raised within the 30-day dispute period following publication of the PACR.

A.3 RIT-T dispute

In February 2013, the AER received correspondence from EnerNOC seeking to raise a formal RIT-T dispute regarding the treatment of demand management costs in the PACR.[10] This could not be raised because it was received after the 30-day dispute period.

The National Generators Forum and Macquarie Generation also raised concerns about other areas of the RIT-T modelling and assumptions.[11]

The AER addressed these concerns in its consultation process about whether the preferred option identified in the PACR satisfied the RIT-T. This is described in Section 1.5.

A.4 AER approvals

On 5 April 2013, ElectraNet submitted a written request to the AER for a determination on whether the preferred option identified in the PACR satisfied the RIT-T.[12]

On 4 September 2013, following consultation with interested parties, the AER published its determination that the preferred option satisfied the RIT-T.[13]

On 21 November 2013, ElectraNet's Board committed to proceed with the project, subject to the AER amending its revenue determination.

On 13 December 2013, ElectraNet submitted a contingent project application to the AER seeking approval to adjust its maximum allowed revenue (MAR) for the South Australian portion of capital expenditure for the Heywood Interconnector upgrade, in accordance with National Electricity Rules (NER) clause 6A.8.2.[14] This allowed ElectraNet to submit a contingent project application to the AER to recover expenditure for its portion of the Heywood Interconnector upgrade funding.

On 28 March 2014, the AER approved ElectraNet's contingent project application to increase its MAR for 2013-18.[15] The AER estimated the cost at $47 million; lower than the $66 million proposed by ElectraNet.[16] The AER identified cost savings associated with delaying decommissioning works of Snuggery-Keith and Keith-Tailem Bend No.1 132 kV lines.

The AER noted that the Heywood Interconnector upgrade would have a modest impact on electricity prices. Given transmission prices in South Australia make up about 9% of retail prices, the average retail price increase per bill is expected to be less than 0.1%. The AER expects the benefits of lower peak energy costs to more than offset this small increase in electricity prices.[17]

[8] Available at: http://www.aemo.com.au/Electricity/Planning/Regulatory-Investment-Tests-for-Transmission/Heywood-Interconnector-RIT-T. Viewed 25 August 2015.
[9] Available at: http://www.aemo.com.au/Electricity/Planning/Regulatory-Investment-Tests-for-Transmission/~/media/Files/Other/planning/RITTs/SA_VIC_Heywood_Interconnector_Upgrade_RIT_T_PACR.ashx. Viewed 25 August 2015.
[10] The correspondence is available at: http://www.aer.gov.au/sites/default/files/EnerNOC%20dispute%20of%20Heywood%20RIT-T.pdf. Viewed 25 August 2015.
[11] Available at: http://www.aer.gov.au/sites/default/files/130222%20%20Heywood%20Interconnector%20Upgrade%20AER.PDF and http://www.aer.gov.au/sites/default/files/2013-02-22%20MG%20to%20AER_Heywood%20RIT_v2.pdf. Viewed 25 August 2015.
[12] See NER clause 5.16.6.
[13] Available at: http://www.aer.gov.au/node/19916. Viewed 25 August 2015.
[14] ElectraNet's submission is available at: http://www.aer.gov.au/node/23187. Viewed 25 August 2015.
[15] See footnote 13.
[16] ElectraNet's $66 million estimated capital cost differs from the $63 million ($2011 12) estimate in the PADR because it is escalated for $2012 13.
[17] Available at: http://www.aer.gov.au/node/23187. Viewed 25 August 2015.