ACIL ALLEN CONSULTING

REPORT TO
ELECTRANET
3 JULY 2018

SOUTH AUSTRALIA NEW SOUTH WALES INTERCONNECTOR

PRELIMINARY ANALYSIS OF POTENTIAL IMPACT ON ELECTRICITY PRICES

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EXECUTIVE SUMMARY

ACIL Allen Consulting was engaged by ElectraNet to provide preliminary estimates of the impact a new interconnector between New South Wales and South Australia would have on wholesale electricity prices and, therefore, on retail electricity bills:

- for residential and small business customers
- in South Australia and New South Wales.

The modelling was conducted using *PowerMark*, ACIL Allen's proprietary model of the National Electricity Market, wholesale spot market.

The modelling indicates that the new interconnector is projected to place downward pressure on the wholesale spot price of electricity in South Australia and New South Wales.

The projected impact on retail bills largely follows the impact on the wholesale spot price:

- we project that residential and small business customers in South Australia will experience a reduction in their electricity bills with the new interconnector, with the reduction varying each year
- in nominal terms, over the first three years to 2026, the modelling indicates that annual residential customer bills would reduce by up to about $30 in South Australia and $20 in New South Wales for a representative customer
- similarly, in the three year period to 2026, the modelling indicates that the annual retail bill of a representative small business customer would reduce by up to about $60 in South Australia and $50 in New South Wales
- over the longer term, the modelling indicates that the new interconnector will lead to lower retail electricity prices overall for both residential and business customers in New South Wales and South Australia over the forecast period to 2050, in both annual average and net present value (NPV) terms.

For modelling purposes the new interconnector was assumed to be introduced on 1 July 2023, the midpoint of ElectraNet's delivery window for the project. It was assumed to have bi-directional transfer capacity of 800MW between New South Wales and South Australia.

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1 INTRODUCTION

ElectraNet is the electricity Transmission Network Service Provider in South Australia. ACIL Allen Consulting (ACIL Allen) was engaged by ElectraNet to provide preliminary modelling of the potential impact of a proposed the new interconnector between South Australia and New South Wales (new interconnector). Specifically, ACIL Allen was engaged to project the impact the new interconnector would have on wholesale electricity (spot) prices in South Australia and New South Wales and, therefore, on customers' electricity bills in those states.

This report provides summary results of that analysis. The rest of this report is structured as follows:

— Chapter 2 describes the methodology we used to model the potential impact of the new interconnector, which centred around *PowerMark*, our proprietary model of the National Electricity Market (NEM) wholesale electricity market

— Chapter 3 provides the results from our preliminary modelling.

2 METHODOLOGY

We have modelled the impact of the new interconnector on customers' electricity bills by considering the impact of the new interconnector on the wholesale electricity market and estimates of the transmission network costs associated with the new interconnector. The methodology for modelling the wholesale electricity market is discussed in section 2.2. The transmission network cost estimates were provided by ElectraNet.

2.1 Modelling the wholesale electricity market

The impact of the new interconnector on the wholesale electricity market was assessed using *PowerMark*, ACIL Allen's proprietary model of the NEM's wholesale electricity market.

At its core, *PowerMark* is a simulator that emulates the settlements mechanism of the NEM. *PowerMark* uses a linear program to settle the market, as does the Australian Energy Market Operator's (AEMO) NEM Dispatch Engine in its real time settlement process. *PowerMark* is part of an integrated suite of models, including models of the market for Renewable Energy Certificates and the wholesale gas market.

A distinctive feature of *PowerMark* is its iteration of generator bidding. *PowerMark* constructs an authentic set of initial offer curves for each unit of generating plant prior to matching demand and determining dispatch through the market clearing rules. Unlike many other models, *PowerMark* encompasses re-bids to allow each major thermal generation portfolio in turn to seek to improve its position — normally to maximise (uncontracted) revenue, given the specified demand and supply balance for the hourly period in question.

PowerMark has been developed over the past 17 years in parallel with the development of the NEM, NEMS (Singapore) and WESM (Philippines). We use the model extensively in simulations and sensitivity analyses conducted on behalf of industry and Government clients.

PowerMark routinely operates at *hourly* price resolution, unlike the NEM spot market which is settled on a half hourly basis. Half hourly modelling is possible, but our experience is that hourly modelling has very little impact on the outcomes, but simplifies the model run time and analytical task substantially. We rarely use half hourly projections of the wholesale spot price of electricity and have not proposed half hourly projections here. Rather, in assignments such as this, we routinely assume that the modelled price remains the same for the whole hour. Our experience, and that of our clients, is that this makes little or no practical difference to the results.

PowerMark relies on a range of assumptions, which are set out in section 2.1.1.

The scenarios that have been modelled are discussed in section 2.1.2.

2.1.1 Assumptions

PowerMark is based on a large number of detailed input assumptions. For the most part these are drawn from our understanding of the physical and other properties of generators in the NEM and other relevant sources. ACIL Allen's standard June 2018 reference case assumption set is used in undertaking market projection exercises for clients. It was not adjusted for this exercise other than to create a scenario in which the new interconnector was introduced.

The key assumptions upon which the modelling is based are set out in Table 2.1.

TABLE 2.1 KEY ASSUMPTIONS

Item	Summary of assumption	Rationale
Macro-economic variables	– Exchange rate of AUD to USD converging to 0.75 AUD/USD – Inflation of 2.5% p.a.	– Long term average – Mid-point of RBA range
Greenhouse gas (GHG) emissions abatement policies	– Between 26 and 28 percent reduction in GHG emissions below 2005 levels by 2030 in line with Australia's international commitments – Assuming a pro-rata share – equates to an emissions budget for the NEM of around 1,215 Mt CO2-e in the period 2020-21 to 2029-30 – Implementation of an Emissions Intensity Scheme (EIS) as a proxy for future carbon pricing in some form. The EIS enters the model in two tranches – the first from 1 July 2020, and the second from January 2031 – Retention of the Large-scale Renewable Energy Target (LRET) in its current form with its current expiry date – No ongoing implementation of state based renewable energy schemes in Victoria and Queensland, beyond Victoria's reverse auction for 650 MW of renewable energy in 2017-18 and Queensland's "Renewables 400" reverse auction in 2017-18	– State-based schemes are likely to be absorbed if an effective national scheme is developed
Electricity demand	– AEMO 2017 Electricity Forecasting Insights with adjustments for aluminium smelter closures, and ACIL Allen's projections for PV, storage uptake and electric vehicle uptake	– Aluminium smelters with long term electricity supply agreements in place are assumed to become uncompetitive once these long term agreements expire
Supply side assumption	– Named new entrant projects are included in the modelling where there is a high degree of certainty that these will go ahead (i.e. project has reached the Financial Investment Decision stage) – Beyond this, only generic new entrants which are commercial are introduced – Committed or likely committed generator retirements included where the retirement has been announced by the participant (i.e. Liddell) – Retirements of other existing generators where the generator is projected to be unprofitable over an extended period of time	– The number of announced projects far exceeds the requirements of the electricity market and hence only those that are firmly committed to go ahead are included in the modelling – The assessment of generator profitability under the modelled scenario provides a consistent method to assess closure decisions

Item	Summary of assumption	Rationale
Gas a fuel for electricity generation	– Gas market is modelled in ACIL Allen's GasMark Australia model – Gas prices for power generation are projected to rise from $ 7-9/GJ to $ 10-12 per GJ by 2030	– The combined demand for gas from Australia's domestic gas users and the LNG export industry means higher cost gas resources need to be developed to satisfy demand
Coal as a fuel for electricity generation	– The marginal price of coal for electricity generation is assessed considering the specific circumstances for each generator: – Short term supply issues in New South Wales – Suitability of coal for export and the assumed international thermal coal price – Location of power station in relation to the mine and export terminals – Mining costs – Existing contractual arrangements – International thermal coal prices are assumed to converge to USD 60/t in the long term	– International thermal coal prices are assumed to converge to their long term average price
Representation of bidding behaviour	– Contracted capacity: – Minimum generation levels are offered at negative of zero price – Remaining contracted capacity offered at short run marginal cost – Remaining capacity: – Maximisation of dispatch for price takers – Maximisation of net uncontracted revenue for price makers	– Observations of generator bidding behaviour in the NEM
New entrant capital costs (AUD /kw, real 2018)	– Wind – $ 2,000/kW in 2019 – $ 1,650/kW in 2030 – Solar (Single Axis Tracking) – $ 1,470/kW in 2019 – $ 1,050/kW in 2030 – Storage (with four hours) – $ 1,650/kW in 2019 – $ 950/kW in 2030	– Near-term prices based on observations in the market from actual projects – Long-term projection based on an average of long-term projections by various forecasters for new technologies

SOURCE: ACIL ALLEN

2.1.2 Scenarios analysed

The analysis presented in this report comprises two scenarios:

— a *reference case* based on our standard assumptions on the future of the NEM

— a *new interconnector* scenario, which is described below.

The projection period was from 2019 to 2050. Results are presented annually to 2030 and then at five year increments.

The new interconnector scenario is the same as the reference case with the sole exception that the new interconnector is introduced to the model from 1 July 2023, the midpoint of ElectraNet's delivery timeframe for the new interconnector. For the purposes of this analysis, the new interconnector was assumed to have the following properties:

— transfer capacity of 800 MW in either direction

— Heywood interconnector limited to thermal capacity of 750MW when the new interconnector is in place

— aggregate transfer limit of 1,300MW across the new interconnector and the existing Heywood interconnector.

Electrical losses on the new interconnector were assumed to be the same as those on the Heywood interconnector.

2.2 Modelling the impact on customers' electricity bills

We have modelled the impact of the new interconnector on residential and small business customers in South Australia and New South Wales.

We have assumed a representative residential customer consumes 5,000 kWh per annum in South Australia and 4,215 kWh per annum in New South Wales, consistent with assumptions made by the Australian Energy Market Commission in its 2017 electricity residential price trends report.

We have assumed a representative small business customer consumes 10,000 kWh per annum in South Australia, which is consistent with the approach the Essential Services Commission of South Australia took in its 2017-17 Energy Retail Offers Comparison Report.[1] We made the same usage assumption in New South Wales for ease of comparison.

The impact of the new interconnector on customers' electricity bills was assessed by considering the "building blocks" of retail electricity bills, namely:

— energy costs
— network costs
— retail operating costs and margin
— costs associated with environmental schemes

We have assumed that the new interconnector will impact on the:

— energy costs building block through the impact on the wholesale electricity market
— the network cost component to recover the costs for building and operating the new interconnector.

The new interconnector is assumed to have no impact on the other building blocks, that is, the movement in the other costs will be the same under the reference case and with the new interconnector.

The methodology for assessing the impact of the new interconnector on the wholesale electricity market was discussed in section 2.1.

ElectraNet provided estimates to us of the transmission network costs of building and operating the new interconnector.[2] Those estimates place the cost of the new interconnector at between $ 3.24 and $ 14.40 per customer per annum depending on their consumption and whether they are in South Australia or New South Wales.

This report presents the change in the customers' electricity bills rather than the level of the customers' electricity bills.

While wholesale spot price impacts are projected to 2050, annual retail bill impacts are presented only for the first three years of the new interconnector's operation. Beyond this period, they would follow the wholesale price projection if all else remains equal. However, changes in retail tariff structures and/ or the way customers use energy are quite possible. The former can be expected to flow from ongoing changes to the way distribution network services charge for the service they provide. Further changes in energy use at the residential level which may flow from improvements in energy efficiency, ongoing uptake of solar technology and the use of batteries could be expected. Therefore, the indicative longer term net impact on customer bills is presented in an aggregate form over the balance of the modelling period in both annual average and present value terms.

[1] https://www.escosa.sa.gov.au/ArticleDocuments/540/20170831-Energy-RetailOffersComparisonReport2016-17.pdf.aspx?Embed=Y
[2] At this stage we have assumed that there will be no change in distribution network costs.

3 RESULTS

The results from the modelling are presented in this chapter. The results from the modelling of the wholesale electricity market are presented in section 3.1 and the results from the modelling of the change in customers' electricity bills are presented in section 3.2. All financial results are in nominal terms (i.e. not adjusted for inflation).

3.1 Wholesale spot price

The results from the reference case are presented in section 3.1.1 and the results from the new interconnector scenario are presented in section 3.1.2.

3.1.1 Reference case

The projected wholesale spot price of electricity in South Australia and New South Wales, under the reference case, is summarised in Table 3.1 and Figure 3.1.

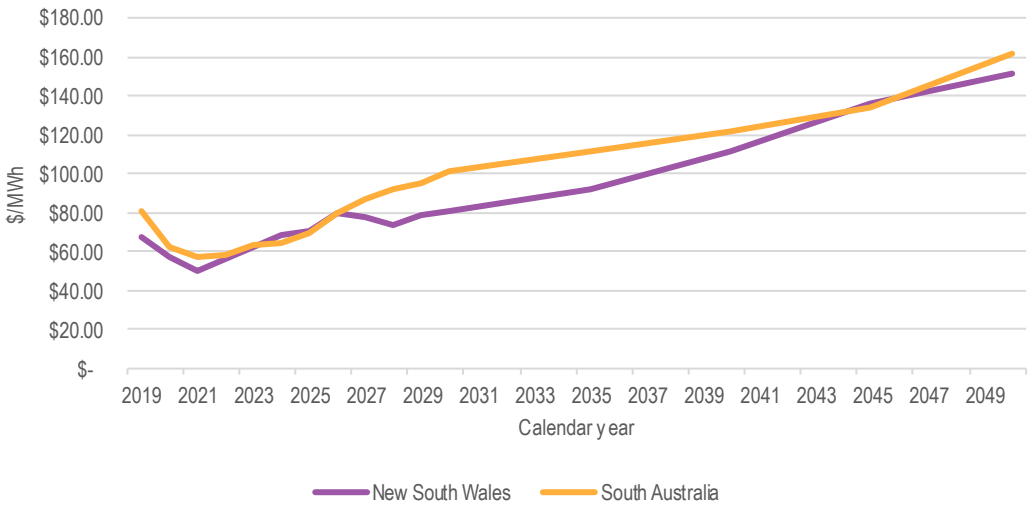
These show that we project wholesale electricity prices to fall in the short term due to substantial uptake of wind capacity. It then increases in the second half of the next decade as the supply demand balance tightens gradually. It is noted that the longer term spot price outlook is essentially flat in real terms once the impact of inflation is removed.

TABLE 3.1 SUMMARY OF PROJECTED WHOLESALE SPOT PRICE OF ELECTRICITY, NOMINAL, CALENDAR YEARS – ANNUAL AVERAGE, 2019 TO 2050, REFERENCE CASE – SOUTH AUSTRALIA AND NEW SOUTH WALES

	New South Wales	South Australia
	$/MWh	$/MWh
2019	$ 67.09	$ 80.52
2020	$ 57.08	$ 62.67
2021	$ 50.03	$ 57.26
2022	$ 56.04	$ 58.44
2023	$ 62.87	$ 63.95
2024	$ 68.13	$ 64.82
2025	$ 70.32	$ 69.16
2026	$ 79.93	$ 79.74
2027	$ 78.28	$ 87.15
2028	$ 73.21	$ 92.50
2029	$ 78.93	$ 94.70
2030	$ 80.63	$ 101.70
…	…	…
2035	$ 91.83	$ 111.92
…	…	…
2040	$ 112.07	$ 121.61
…	…	…
2045	$ 136.14	$ 134.20
…	…	…
2050	$ 151.97	$ 162.14

SOURCE: ACIL ALLEN POWERMARK MODELLING

FIGURE 3.1 SUMMARY OF PROJECTED WHOLESALE SPOT PRICE OF ELECTRICITY, NOMINAL, CALENDAR YEARS – ANNUAL AVERAGE, 2019 TO 2050, REFERENCE CASE – SOUTH AUSTRALIA AND NEW SOUTH WALES



NOTE: PROJECTIED VALUES ARE ANNUAL TO 2030 AND FIVE YEARLY THEREAFTER.

SOURCE: ACIL ALLEN POWERMARK MODELLING

3.1.2 New Interconnector scenario

The projected wholesale spot price of electricity in South Australia and New South Wales under the new interconnector scenario is shown in Table 3.2 and Figure 3.2. Figure 3.2 also shows the projected wholesale spot prices of electricity under the reference case scenario to highlight the difference between the two projections. The differences are set out in Table 3.3.

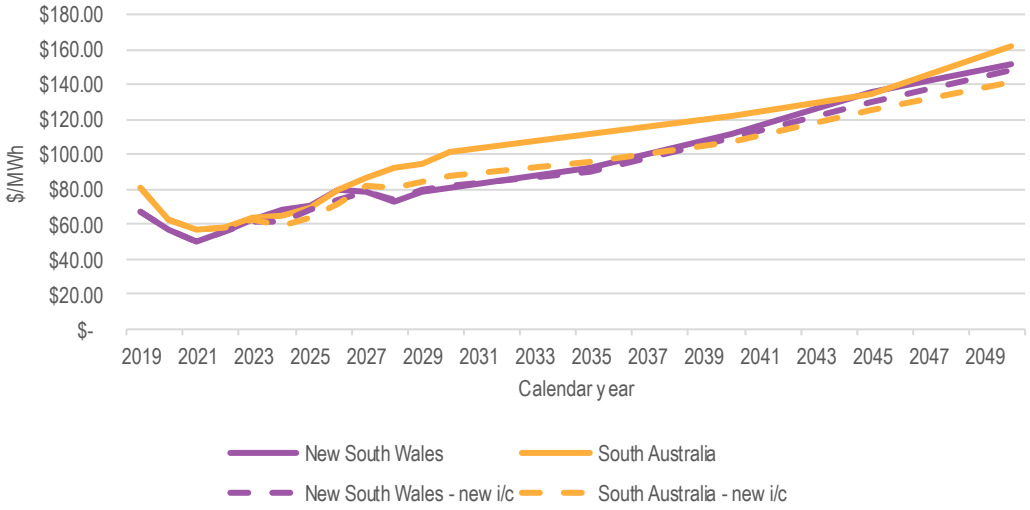
TABLE 3.2 SUMMARY OF PROJECTED WHOLESALE SPOT PRICE OF ELECTRICITY, NOMINAL, CALENDAR YEARS – ANNUAL AVERAGE, 2019 TO 2050, THE NEW INTERCONNECTOR SCENARIO – SOUTH AUSTRALIA AND NEW SOUTH WALES

	New South Wales	South Australia
	$/MWh	$/MWh
2019	$ 67.09	$ 80.52
2020	$ 57.08	$ 62.67
2021	$ 50.03	$ 57.26
2022	$ 56.04	$ 58.44
2023	$ 61.26	$ 62.67
2024	$ 61.77	$ 58.78
2025	$ 68.05	$ 63.61
2026	$ 73.87	$ 71.74
2027	$ 78.35	$ 81.82
2028	$ 74.50	$ 80.69
2029	$ 80.29	$ 83.88
2030	$ 81.95	$ 88.23
…	…	…
2035	$ 90.62	$ 95.28
…	…	…

	New South Wales	South Australia
2040	$ 109.87	$ 106.79
…	…	…
2045	$ 130.35	$ 125.04
…	…	…
2050	$ 148.49	$ 140.94

SOURCE: ACIL ALLEN POWERMARK MODELLING

FIGURE 3.2 SUMMARY OF PROJECTED WHOLESALE SPOT PRICE OF ELECTRICITY, NOMINAL, CALENDAR YEARS – ANNUAL AVERAGE, 2019 TO 2050, REFERENCE CASE AND THE NEW INTERCONNECTOR SCENARIO – SOUTH AUSTRALIA AND NEW SOUTH WALES



NOTE: PROJECTIED VALUES ARE ANNUAL TO 2030 AND FIVE YEARLY THEREAFTER.
SOURCE: ACIL ALLEN POWERMARK MODELLING

The analysis indicates that the new interconnector is projected to place downward pressure on the wholesale spot price of electricity in South Australia and New South Wales.

In South Australia, the reduced spot price is evident in the new interconnector's first year of full operation (2024) and this reduction grows as time passes. In the first few years the reduction is projected to be in the order of $5/ MWh, rising above $10/MWh after 2028.

Reductions in the wholesale spot price of electricity are also projected in New South Wales, though they are smaller and return to zero in 2027. In the latter part of the next decade small increases in the spot price in New South Wales are projected with the new interconnector than without it, followed by projected falls in the spot price thereafter.

The modelling suggests that over the forecast period the new interconnector will lead to lower wholesale spot prices overall in both New South Wales and South Australia.

TABLE 3.3 SUMMARY OF REDUCTION IN PROJECTED WHOLESALE SPOT PRICE DUE TO THE NEW INTERCONNECTOR, NOMINAL, CALENDAR YEARS – ANNUAL AVERAGE, 2019 TO 2050 – SOUTH AUSTRALIA AND NEW SOUTH WALES

	New South Wales	South Australia
	$/MWh	
2019	$ -	$ -
2020	$ -	$ -
2021	$ -	$ -
2022	$ -	$ -
2023	$ (1.61)	$ (1.28)
2024	$ (6.36)	$ (6.03)
2025	$ (2.27)	$ (5.56)
2026	$ (6.07)	$ (8.00)
2027	$ 0.07	$ (5.33)
2028	$ 1.29	$ (11.81)
2029	$ 1.36	$ (10.81)
2030	$ 1.32	$ (13.47)
…	…	…
2035	$ (1.21)	$ (16.64)
…	…	…
2040	$ (2.20)	$ (14.81)
…	…	…
2045	$ (5.78)	$ (9.17)
…	…	…
2050	$ (3.48)	$ (21.20)

SOURCE: ACIL ALLEN POWERMARK MODELLING

3.2 Projected customer bill impacts

The projected impact of the new interconnector on customers' electricity bills is consistent with the forecast reduction in wholesale spot prices in both states across the forecast period as a result of the new interconnector. The projected impact on retail bills is summarised in Table 3.4.

The table shows that residential and small business customers in South Australia are projected to experience a reduction in their electricity bills with the new interconnector, with the reduction varying each year.

In nominal terms, over the first three years to 2026, the modelling indicates that annual residential customer bills would reduce by up to about $30 in South Australia and $20 in New South Wales for a representative customer.

Similarly, in the three year period to 2026, the modelling indicates that the annual retail bill of a representative small business customer would reduce by up to about $60 in South Australia and $50 in New South Wales.

Over the longer term, the modelling indicates that the new interconnector will lead to lower prices overall for both residential and business customers in New South Wales and South Australia over the forecast period to 2050. These results are summarised in Table 3.4 in both annual average and net present value (NPV) terms.

TABLE 3.4 PROJECTED CUSTOMER BILL IMPACTS DUE TO NEW INTERCONNECTOR – CALENDAR YEARS 2024 TO 2026 AND AGGREGATED TO 2050

	Representative residential customer – SA	Representative residential customer – NSW	Small business customer – SA	Small business customer – NSW
Annual consumption (MWh/annum)	5.0	4.215	10.0	10.0
Transmission network cost impact ($ /annum)	9.0	5.0	18.0	12.0
2024	$ (21.00)	$ (22.00)	$ (42.00)	$ (52.00)
2025	$ (19.00)	$ (5.00)	$ (38.00)	$ (11.00)
2026	$ (31.00)	$ (21.00)	$ (62.00)	$ (49.00)
Annual average to 2050	$ (55.56)	$ (5.07)	$ (111.11)	$ (11.85)
NPV to 2050	$ (680.93)	$ (45.67)	$ (1,362.31)	$ (104.31)

Note: NPV and annual average are calculated from 2024 to 2050. Values for years that were not modelled were interpolated as straight lines. The NPVs were calculated using 6% discount rates

SOURCE: ACIL ALLEN POWERMARK MODELLING

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ABOUT ACIL ALLEN CONSULTING

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