Paper information

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Summary

Project EnergyConnect is a $2.3 billion landmark project that will deliver the first new electricity interconnector between Australian states in 15 years, providing benefits to customers across the National Electricity Market and supporting the ongoing transformation of the power system. It involves the construction of a new high voltage interconnector over a route of approximately 900 km between the electricity networks of South Australia at Robertstown and New South Wales at Wagga Wagga, together with a spur line linking to Victoria at Red Cliffs.

A comprehensive economic assessment was performed under the Regulatory Investment Test for Transmission (RIT-T) and subsequent review processes between 2016 and 2021 in consultation with stakeholders, which concluded that Project EnergyConnect was the preferred option that delivered the greatest net market benefits.

The key benefits of the project are to:

- Lower dispatch costs through increasing access to supply options across regions
- Facilitate the transition to a lower carbon emissions future in the National Electricity Market (NEM) and the adoption of new technologies through improving access to high quality renewable resources across all regions
- Enhance the security of electricity supply in South Australia.

Key market benefits and costs that were assessed in the RIT-T included avoided fuel costs, avoided transmission capital expenditure, avoided voluntary load curtailment, avoided generator fixed costs, avoided unserved energy, generator and storage capital deferral, network capital expenditure deferral, network support agreements, capital costs, and routine maintenance.

There have been significant changes in both project costs and benefits compared with those assessed in the RIT-T. An updated cost benefit analysis was undertaken in 2020 and 2021 to confirm the economic case for the project, based on updated inputs and assumptions in key areas. The updated analysis showed increased expected benefits of Project EnergyConnect compared to the RIT-T assessment.

Since the 2021 assessment, the expected benefits of Project EnergyConnect have continued to increase, due to changes such as increases in gas and coal prices, project synergies with the New South Wales component of VNI West (a proposed new interconnector between Victoria and New South Wales), and recent Australian Energy Market Operator (AEMO) system security assessments.

Project EnergyConnect is a positive example of the benefits that increased interconnection can deliver between previously weakly interconnected systems.

The project has in many ways been a trailblazer with the challenges needing to be overcome driving change to streamline regulatory planning and approval processes to enable more timely and efficient investment in other major transmission projects required to support the clean energy transition in the NEM.

Keywords

Interconnection, Market benefits, Scenarios, Economic assessment

1 Introduction

Project EnergyConnect (Figure 1) is a $2.3 billion landmark project that will deliver the first new electricity interconnector between Australian States in 15 years, providing benefits to customers across the National Electricity Market and supporting the ongoing transformation of the power system. It will have a route of approximately 900 km between the electricity networks of South Australia at Robertstown and New South Wales at Wagga Wagga, with a spur line linking to Victoria at Red Cliffs.

Figure 1 Route of Project EnergyConnect

The key steps in the development of Project EnergyConnect are outlined in Table 1.

Year(s)	Step	Description
2016 – 2019	Regulatory Investment Test for Transmission (RIT-T)	Economic assessment test administered by the Australian Energy Regulator (AER) and required by the Australian National Electricity Rules (NER) to be applied by a Transmission Network Service Provider (TNSP) to justify investment in the regulated transmission system (Figure 2)
2019 – 2020	AER RIT-T determination that "the RIT-T has been successfully completed"	Formal determination by the AER was necessary as a precondition for ElectraNet and Transgrid to seek project funding from the AER – as part of this process, the economic analysis was reviewed
2020 – 2021	Contingent Project Application	Contingent Project Applications submitted by ElectraNet and Transgrid were assessed and approved by the AER, releasing the capital expenditure and revenue required to deliver the project – as part of this process, the economic analysis was again reviewed
2021	Design and construct (D&C) contracts	ElectraNet entered into D&C contracts for works in South Australia; Transgrid entered into D&C contracts for works in New South Wales
2021 – 2022	Environmental and development approvals	Environmental and development approvals were required in both South Australia and New South Wales
2022 – 2023	Construction of Stage 1	Stage 1 is the section between Robertstown and Buronga: commissioning and release of up to 150 MW transfer capacity to occur in mid-2024
2023 – 2024	Construction of Stage 2	Stage 2 is the section between Buronga and Wagga Wagga
2025 – 2026	Commissioning, energisation and testing	Internetwork testing, culminating in the release of full 800 MW power transfer capability

Table 1 Steps in the development of Project EnergyConnect

A comprehensive and transparent economic assessment was performed to justify regulated investment in Project EnergyConnect.

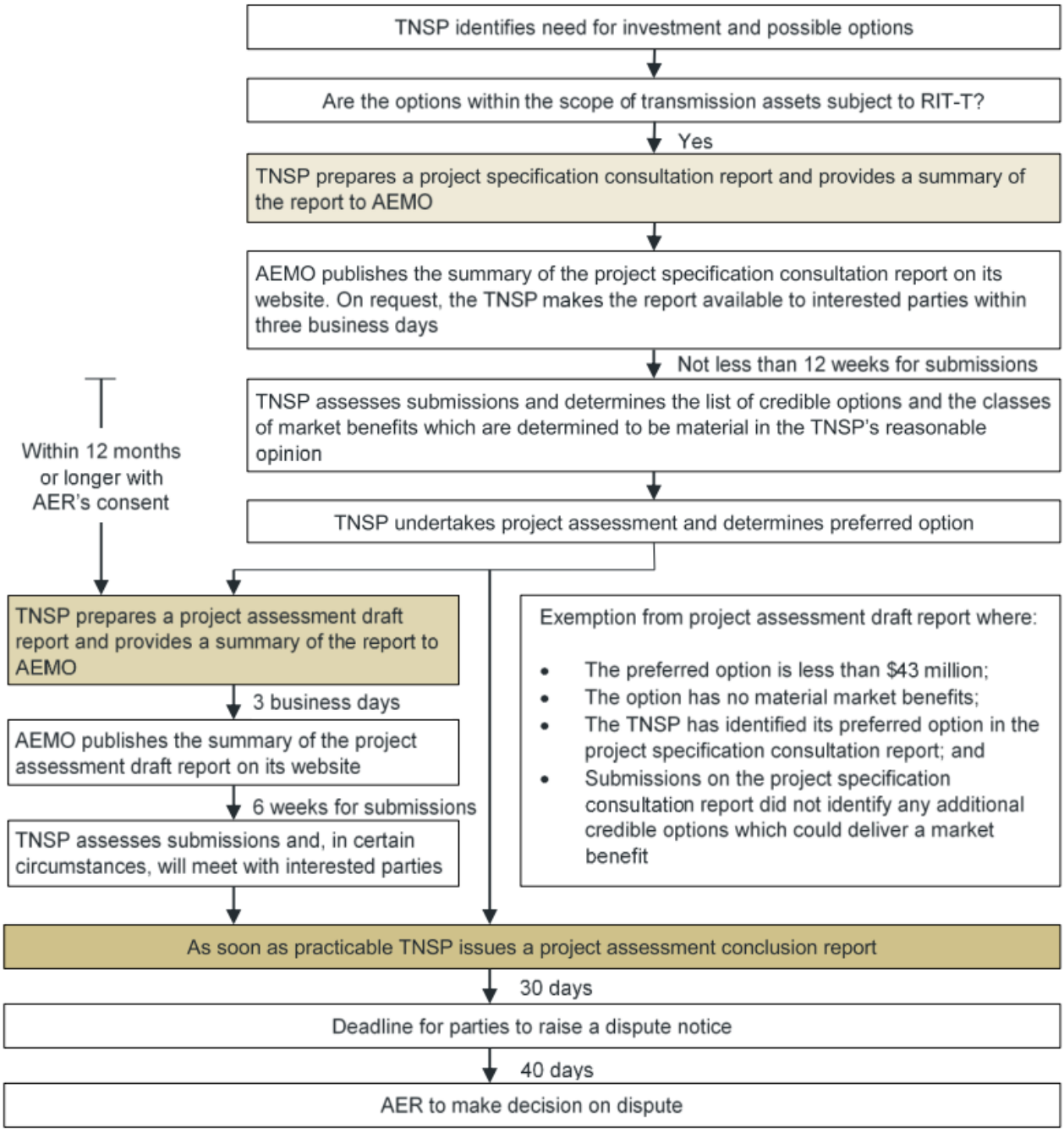

Figure 2 RIT-T process as at the time of the assessment

2 Background

South Australia has reached significant levels of Variable Renewable Energy (VRE) penetration through large scale wind and solar generation developments and rooftop solar photovoltaic (PV) installation. Around 51 % of South Australia's power generation was estimated to have come from renewable energy sources in 2017-18 [1], rising to about 68 % in 2021-22 [2].

Successfully integrating this changing supply mix, while maintaining affordability, reliability and security of supply for customers is a key priority for the energy sector.

This was illustrated dramatically in South Australia in September 2016 when an extreme weather event caused the loss of a large part of the dispatched generation fleet, leading to loss of the existing HVAC interconnector to Victoria and a subsequent black system condition in South Australia.

Challenges relevant to South Australia include a reliance on high-cost gas plant to provide dispatchable capacity, as well as increased variability of demand and supply due to intermittent renewable generation (both grid-scale and rooftop solar PV). In addition, the South Australian region is seen as vulnerable to extreme weather events and system disturbances.

There is a need for large scale renewable generation development to meet future supply needs, while meeting Australia's policy commitments for emissions reduction. This is particularly the case for New South Wales, with the progressive retirement of around half or more of the New South Wales coal fleet expected by 2030 [3].

The identified need for Project EnergyConnect is to:

- Lower dispatch costs through increasing access to supply options across regions
- Facilitate the transition to a lower carbon emissions future in the NEM and the adoption of new technologies through improving access to high quality renewable resources across all regions
- Enhance the security of electricity supply in South Australia.

3 Application of the Regulatory Investment Test for Transmission

Options to meet this identified need were explored through the application of the RIT-T from 2016 to 2019 [4, 5, 6].

The RIT-T considered a non-interconnector option along with options for new interconnection between South Australia and Queensland, New South Wales or Victoria. It showed that Project EnergyConnect, a new 330 kV interconnector between Robertstown in South Australia and Wagga Wagga in New South Wales, via Buronga and with a minor augmentation between Buronga and Red Cliffs in Victoria, was expected to deliver the highest net market benefits and is therefore the preferred option.

A weighting of three future scenarios was used to assess the benefits that would be delivered by each option: Central, Low, and High (Table 2). These scenarios utilised forecasts that had been published by the Australian Energy Market Operator (AEMO) in its 2018 Electricity Statement of Opportunities (ESOO) [7] and 2018 Integrated System Plan (ISP) [8].

To develop the RIT-T scenarios, the 2018 ISP scenarios developed by AEMO were drawn upon. However, to provide a broader range of assumptions to adequately test the robustness of the RIT-T outcome, some divergence from the ISP scenarios was applied.

Assessment conducted for the RIT-T indicated that several categories of market benefit were either unlikely to affect the ranking of the credible options for the RIT-T analysis or would require a disproportionate level of analysis.

Categories of market benefits considered and whether they were included in or excluded from the analysis are discussed below.

3.1 Market benefits included

Changes in fuel consumption arising through different patterns of generation dispatch

New interconnectors enable efficient sharing of generation resources, existing and new, between regions, allowing lower cost generation to displace higher cost generation and, overall, reduce aggregate fuel costs in the NEM.

This is a key category of market benefit for all options considered due to the reduced need for expensive gas generation to operate in South Australia, as well as the high quality of new renewable generation able to be built.

In addition, the options contribute to meeting system security standards in South Australia at lower cost than would otherwise be the case.

Variable	Central Scenario	Low Scenario	High Scenario
Electricity demand (including impact from distributed energy resources)	AEMO 2018 ESOO neutral demand forecasts	AEMO 2018 ESOO slow change demand forecasts	AEMO 2018 ESOO fast change demand forecasts plus potential South Australian spot load development of 345 MW
Gas prices – long-term	$9.17/GJ (AEMO 2018 ISP Neutral scenario)	$7.40/GJ ($0.62/GJ lower than AEMO 2018 ISP Slow Change scenario)	$11.87/GJ in Adelaide ($1.68/GJ higher than AEMO 2018 ISP Fast Change scenario)
Emission reduction renewables policy	Emissions reduction around 28% from 2005 by 2030 (AEMO 2018 ISP Neutral scenario; then-Federal government policy)	No explicit emission reduction target	Emissions reduction around 52% from 2005 by 2030 (AEMO 2018 ISP Fast Change scenario)
Jurisdictional emissions targets	Victoria: 25 % from renewable energy by 2020 and 40 % by 2025 Queensland: 50% from renewable energy generation by 2030		
SA inertia requirement	<3 Hz/s RoCoF limit for non-credible loss of Heywood Interconnector (South Australian Government requirement)		
Generator capital costs	AEMO 2018 ISP	15% lower than central scenario	15% higher than central scenario

Table 2 Scenarios used in the RIT-T market modelling

Changes in voluntary load curtailment

The time sequential modelling component of the market modelling incorporates voluntary load curtailment. The market benefit associated with changes in voluntary load curtailment is reflected in the difference in dispatch cost outcomes. These benefits were relatively minor in this RIT-T assessment.

Changes in involuntary load shedding

The impact of changes in involuntary load shedding for each credible option was quantified via a time sequential modelling component of the market modelling. The unserved energy in each trading interval was estimated over the modelling period, and a value of customer reliability applied to the estimated value of avoided unserved energy for each option. These benefits were relatively minor in this RIT-T assessment.

Changes in costs for other parties, other than the RIT-T proponent, due to: (A) differences in the timing of new plant; (B) differences in capital costs; (C) differences in the capital and maintenance costs

The options encourage more efficient investment in lower cost generation sources than would be built without these investments.

An enhanced ability to export low-cost power from South Australia, including significant high-quality renewables, provides market benefits by enabling supply in other jurisdictions to be met at a lower overall cost as existing coal-fired plant retires. This is particularly the case for options involving new interconnection between South Australia and New South Wales, due to the forecast retirement of New South Wales coal plant, and which would otherwise rely on higher cost sources of generation to fill the resulting supply gap. The market benefits are derived from avoided generator fixed operating costs and new generator and storage capital cost deferral (or avoidance).

Differences in the timing of expenditure

New interconnection has the potential to substitute for the additional intra-regional transmission investment that would otherwise be required to unlock REZs to enable the NEM clean energy transition. This provides a market benefit through the avoidance or deferral of unrelated transmission investment.

In addition, the interconnector options allowed for other minor transmission expenditure to be deferred, further adding to this benefit.

Changes in network losses

The time sequential market modelling accounted for the change in network losses that may be expected to occur because of the implementation of any of the credible option, compared with the level of network losses which would occur in the base case, for each scenario.

The benefit of changes in network losses was captured within the dispatch cost benefits of avoided fuel costs and changes to voluntary load shedding.

3.2 Excluded market benefits

Changes in ancillary services costs

The inclusion of all, or some, of the FCAS markets in the market modelling would have led to a substantial increase in the complexity and cost of the RIT-T assessment. Such increased complexity was not warranted given that changes in FCAS costs were not expected to impact selection of the preferred option, as all interconnector options were expected to reduce South Australian-specific FCAS costs to close to zero.

Further, there was no expected change to the costs of Network Control Ancillary Services (NCAS) and System Restart Ancillary Services (SRAS) because of the options being considered. These costs are therefore not material to the outcome of the RIT-T assessment.

Competition benefits

All new interconnector options allow significantly higher transfer capacity, opening up the market for more competition. However, competition benefits arising from the options considered were expected to be similar in magnitude, and so were unlikely to affect their ranking under the RIT-T.

Option value

It was not considered that there was materially more (or less) option value between the credible options investigated. Therefore, real option valuation techniques were not applied to explicitly model any ‘option value’ because doing so is a computationally intensive task that was unlikely to have a material impact on the relative ranking of options, or the sign of the net benefits.

3.3 RIT-T assessment of market benefits for Project EnergyConnect

The costs and included market benefits were assessed for each scenario (Table 3).

Scenario Weighting	Low 25%	Central 50%	High 25%	Weighted outcome
Market benefits ($million, Net Present Value)				
Avoided unserved energy	0.0	0.0	0.0	0.0
Avoided transmission capex	91.8	96.5	192.3	119.3
Avoided fuel costs	1,823.2	1,791.5	1,671.7	1,769.5
Avoided voluntary load curtailment	0.01	0.8	0.0	0.4
Generator and storage capex deferral	-374.4	-310.9	322.0	-168.6
Avoided generator fixed costs	148.5	155.5	123.4	145.7
Network capex deferral	10.3	10.3	10.3	10.3
Total	**1,699.4**	**1,743.7**	**2,319.7**	**1,876.6**

Table 3 Assessed RIT-T benefits for Project EnergyConnect

4 Contingent Project Application

To recoup the costs of Project EnergyConnect from regulated electricity transmission charges, the relevant TNSPs[1] were required to submit Contingent Project Applications for funding to the AER.

At the time of the Contingent Project Application, engagement with the market had indicated that there would be significant changes in project costs to construct Project EnergyConnect compared with the costs that had been assessed in the RIT-T. A general increase in transmission costs was being experienced across the NEM, with AEMO's 2020 ISP incorporating a 30% increase in costs for transmission projects compared to the 2018 ISP. A range of key input assumptions contributing to market benefits had also changed.

If, at any time up until project commencement, a material change in circumstances occurs that could lead to the preferred option identified in an earlier RIT-T no longer being the preferred option, the project proponent is required to re-apply the RIT-T.

4.1 September 2020 updated cost benefit assessment

Accordingly, an updated cost benefit analysis was performed in September 2020, considering updated information on costs and benefits, aligning with the inputs and assumptions in the 2020 ISP. Key updates included demand forecasts, committed generation projects, gas prices, coal prices, new entrant generator capital costs, other projects in the ISP and updated Renewable Energy Targets.

The updated cost benefit analysis confirmed that Project EnergyConnect remained the preferred option and continued to deliver net market benefits.

In particular, the outcomes of the September 2020 updated cost benefit assessment showed that:

- Project EnergyConnect would deliver a positive net benefit of $148 million in present value terms after considering the updated information on benefits and costs
- Net benefits would increase with later delivery of the proposed VNI West interconnector between Western Victoria and New South Wales (as expected under most 2020 ISP scenarios) by between $115 million and $176 million in present value terms
- The closest ranked option (a new interconnector between South Australia and Victoria) was found to deliver minimal net benefits and remained a less preferable option.

[1] The relevant TNSPs involved in construction of Project EnergyConnect are ElectraNet (South Australia) and Transgrid (New South Wales).

Based on the September 2020 updated cost benefit analysis, there had been no material change in circumstances as defined in the NER and the outcome of the RIT-T remained unchanged.

4.2 March 2021 review of economic assessment

Several policy announcements and other changes in the NEM occurred after September 2020 and before the AER finalised a decision on the contingent project applications for Project EnergyConnect. The economic assessment was again reviewed to consider whether those changes represented a material change in circumstances.

Overall, the policy and other changes were considered likely to have a positive impact on the modelled benefits of Project EnergyConnect (Table 4), as discussed briefly in the following sections.

The conclusion of the assessment was that it was not reasonably likely that there had been a material change of circumstances that could lead to Project EnergyConnect no longer being the preferred option.

Development after September 2020	**Assessed impact on benefits (present value)**	**Planning status**
NSW Government's Roadmap	Positive 0-$50 million	Legislated
Federal Government support of Hunter Valley GPS	Zero	Publicly announced
Victorian Government support for Renewable Energy Zone developments	Minimal ~$1 million	Publicly announced
Tasmanian Government's Renewable Energy Target	Positive 0-$50 million	Legislation presented to Tasmanian parliament
Battery at Torrens Island in South Australia	Negative $50 million to zero	Publicly announced
AEMO's IASR updated gas assumption	Positive 0-$50 million	Draft subject to consultation
Declining international coal prices	Positive 0-$50 million	Preliminary
South Australian Government's Climate Change Action Plan 2021-25	Large >$100 million	Elements of the Plan in various stages of deployment
Yallourn early closure	Zero	Publicly announced
AER's preliminary position on CPAs	Positive $140 million	Published
Overall	**Positive >$190-440 million**	

Table 4 Impact of developments between September 2020 and March 2021

NSW Electricity Infrastructure Roadmap (December 2020)

The NSW Electricity Infrastructure Roadmap 2020 (the Roadmap) built on the NSW Transmission Infrastructure Strategy 2018 (the Strategy) under the NSW *Electricity Infrastructure Investment Act 2020* which was enacted in December 2020.

The Roadmap extended the Strategy to include supporting investment in renewable generation directly, backed by legislation.

The New South Wales Roadmap is expected to increase the net market benefits of Project EnergyConnect as the accelerated development of renewable projects increases access to lower cost generation.

Federal Government support of Hunter Valley Gas Powered Generator

The then-Federal Government's announced support for a gas plant in New South Wales was assessed as having a neutral impact on the net market benefits of Project EnergyConnect, as modelling indicated that from 2036 the plant would only operate with a capacity factor around 2% both with and without Project EnergyConnect.

Victorian Government support for Victorian Renewable Energy Zone developments

This policy was assessed as having a neutral market benefit impact, as modelling indicated that Project EnergyConnect has little impact on transmission developments in Victoria.

Tasmanian Government's Renewable Energy Target

The Tasmanian Government's Renewable Energy Target showed a small increase in the benefits of Project EnergyConnect but has little impact on avoided gas fired generation in South Australia.

Battery at Torrens Island in South Australia

In November 2020, a 250 MW battery at Torrens Island in South Australia was announced. At the time of the impact assessment, the project did not meet the RIT-T requirements for a committed project, but the likelihood of the project progressing was increasing. Should connection of this battery become committed, Project EnergyConnect would no longer avoid this investment, reducing the modelled benefits of Project EnergyConnect.

As of March 2023, the new battery was expected to enter service in June 2023 [9].

AEMO's IASR updated gas assumption

AEMO's consultation on inputs, assumptions and scenarios for the 2022 ISP included forecasts of gas prices that were higher until 2030 and then marginally lower than the forecasts used in the RIT-T.

Modelling showed that higher forecast gas prices tend to increase the market benefits of Project EnergyConnect.

Declining international coal prices

Prices in international coal prices declined over the 12 months to March 2021, but have since risen again. A reduction in the coal price in New South Wales would further increase the benefits of Project EnergyConnect by reducing the costs of replacement fuel substituting relatively expensive gas use in South Australia.

South Australian Government's Climate Change Action Plan 2021-2025

In December 2020 the then-South Australian Government published a Climate Change Action Plan.

A key focus area was to support development of new industries in South Australia such as green steel manufacturing and international hydrogen exports, while investing in electrification of transport through the 2020s. The South Australian Government also forecast the potential for South Australia to be generating 500% of existing domestic demand in electrical renewable generation by 2050.

Project EnergyConnect is a key enabler of this potential future and the benefits of Project EnergyConnect would be expected to increase significantly, driven by increased electricity demand due to electrification of South Australian industry, the attraction of new energy intensive industries and renewable exports and corresponding additional fuel cost savings.

Early closure of Yallourn Power Station

On 10 March 2021, plans were announced to close the Victorian coal-fired Yallourn Power Station in mid-2028, four years ahead of schedule. This assumption had already been adopted in the market modelling for Project EnergyConnect, sourced from the optimal development path in the 2020 ISP.

5 Conclusions

Project EnergyConnect will deliver positive net market benefits to Australia's National Electricity Market and will:

- Lower dispatch costs through increasing access to supply options across regions
- Facilitate the transition to a lower carbon emissions future in the NEM and the adoption of new technologies through improving access to high quality renewable resources across all regions
- Enhance the security of electricity supply in South Australia.

Project EnergyConnect is a positive example of the benefits that increased interconnection can deliver between previously weakly interconnected systems.

The project has in many ways been a trailblazer with the challenges needing to be overcome driving change to streamline regulatory planning and approval processes to enable more timely and efficient investment in other major transmission projects required to support the clean energy transition in the NEM.

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