TRANSMISSION CONTESTABILITY IN AUSTRALIA

Enabling the Clean Energy Transition

June 2023

nexa ADVISORY

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About Nexa Advisory

Nexa is a full-service advisory firm. We work with public and private clients including renewable energy developers, investors and climate impact philanthropists to help accelerate efforts towards a clean energy transition. We've been shaping the energy industry for over 20 years. With a proven track record across policy creation, advocacy, political risk assessment and project delivery, we're holistic in our approach and deliver solutions with commercial intent.

The Nexa Advisory team is a collaboration of passionate energy specialists, all committed to the successful transformation of Australia's energy markets. The team is focused on helping clients grasp the unpredicted opportunities the energy transformation will bring with trusted and innovative thinking and advice.

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Transmission Competition in Australia

Enabling the Clean Energy Transition

The research set out in this report was undertaken to facilitate understanding and discussion around whether Australia's electricity transmission markets are in a fit state to meet the challenges of the transition to a low-carbon energy system.

Nexa Advisory believes that the current regulatory barriers to entering Australia's electricity transmission markets, which result in monopoly provision by primary transmission network service providers (PTNSPs), are resulting in increased costs to Australian consumers, and delaying the transition to reliable and secure clean energy.

There is significant support, among the diverse group of stakeholders, for opening the transmission market in Australia to competition from across the diverse stakeholders.[1]

Nexa Advisory engaged Tahu Consulting to undertake the modelling which supports the analysis and policy recommendations in this report.

A note on open markets and "contestability"

At present Australia's transmission markets are closed or have very high barriers to entry.

When using the term "contestability" in this report, we mean that the delivery of the new transmission identified as being nationally significant should be delivered through a competitive tender at the federal level via the Rewiring the Nation Office, or through the jurisdictions where contestable transmission applies such as Victoria and in some cases NSW.

The Australian Energy Market Operator (AEMO)'s Integrated System Plan (ISP) identifies the new transmission needed. That transmission should then be competitively designed, procured, constructed, owned, operated, maintained and controlled by the party that demonstrates it maximises the benefits to consumers, while minimising the costs.

An "open competitive market" for the provision of new transmission infrastructure would mean that both new third parties and the current primary regulated transmission monopolies can bid to deliver new transmission.

The primary regulated transmission monopolies in the National Electricity Market (NEM) are the five primary Transmission Network Service Providers (PTNSP) in each state (see table 2, page 10 for details)

1 See Appendix 2 for detail

Executive summary

Australia has set goals to be 82 per cent renewable electricity generation by 2030 and net zero by 2050.

It is estimated that we will require an additional 138.5 TWh of wind and solar generation by 2035, and 197 TWh by 2042, to replace the retiring coal power stations.

In addition, new investment in electricity transmission infrastructure is essential to this clean energy transition. Australia needs to build 10,000km of transmission lines in the next 10 years to connect the new clean generation and storage capacity required to achieve the transition goals; 25 per cent of the length of the current grid.

However, development of new electricity transmission has been identified as a potential bottleneck to new renewable generation.[2,3]

Australia's transmission markets are uncompetitive thanks to complex and fragmentated regulation. Regulatory barriers to entry are preventing new operators with experience, and global supply chain bargaining power, to support Australia's energy transition.

This means that transmission is costing Australians far more than it should and it is not being built fast enough. Modelling in this report suggests up to $13 billion of costs, and considerable time, could be saved by opening Australian transmission markets to effective competition.

We recommend that the Federal Government immediately:

- Embed competition as a pre-requisite for accessing the Re-wiring the Nation funds

Adoption of open transmission markets should be made a pre-requisite for financing from the Rewiring the Nation program.

By using financing incentives, instead of regulatory arrangements, to facilitate entry to otherwise closed markets, the time and cost of developing complex new arrangements are avoided. This national approach can then be applied to fragmented state-based markets, reducing market entry costs, expanding the pool of potential market participants, and increasing economies of scope and scale, including access to global expertise and resources.

- Trigger jurisdictional competitive tenders for transmission build where it is applicable:

Jurisdictions may need to exercise existing powers under the current arrangements for competitive transmission infrastructure.

This will give the each government more control over the declaration and development of new regulated transmission as well as Regional Energy Zone (REZ) transmission. The new frameworks can be developed in ways that facilitate acquiring social licence and alignment of transmission, generation and storage infrastructure development with jurisdictional emissions and renewable generation targets.

2 https://www.aemc.gov.au/markets-reviews-advice/review-of-energy-market-frameworks-in-light-of-cli

3 https://www.aemc.gov.au/market-reviews-advice/transmission-planning-and-investment-review

Introduction (situation report)

Australia is behind before it really gets started on building the infrastructure for the clean energy transition

In this report we seek to advance understanding and discussion of:

- Australia's electricity transmission markets and whether they are in a fit state to meet the challenges of the transition to a low carbon energy system
- barriers to entering Australia's electricity transmission markets, which result in transmission services by regulated and unregulated monopolies
- impacts on and direct costs to Australians
- risks to the clean energy transition and to reliable and secure energy supply
  The energy transition to low carbon emissions is critical to meeting Australia's climate targets, to our energy security and supply stability, and to controlling and abating cost of living pressures on Australians. As a result, Australia has set goals to have 82 per cent renewable generation by 2030 and to be net zero by 2050.

New investment in electricity transmission infrastructure is essential to Australia's clean energy transition. We need to build 10,000km of new transmission lines 25 per cent of the current grid in the next 10 years to connect the new clean generation and storage capacity to achieve the transition goals.

What do we need to build? The Australian Energy Market Operator (AEMO)'s Integrated System Plan (ISP)[4] process, inaugurated in 2018, has consistently identified the key new regulated transmission projects, and non-regulated transmission for REZs, that are necessary to underpin a timely, least-cost, clean energy transition.

AEMO's ISP 2022 Step Change scenario implies that we will also require an additional of 138.5 TWh of wind and solar generation by 2035, and 197 TWh by 2042, to replace the retiring coal power stations and decarbonise Australia's economy.[5]

Recent decisions to accelerate closure of coal-fired power stations[6] have exacerbated an already critical need in Australia for investment in renewable generation and the associated transmission network capacity.

In addition to the new transmission needed, over 75 per cent of the existing transmission network in the NEM was installed before 1970, and is now over 50 years old. This aging network will need to be maintained or replaced in coming years.[7]

AEMO and jurisdictional bodies estimate that total new transmission capital costs over the period 2020 to 2030 will exceed $25billion. As outlined in Table 1, of this, 57 per cent is monopoly regulated transmission (non-contestable), and 43 per cent is non-regulated transmission (REZs notionally contestable).

Table 1: New Transmission projects[8]: Monopoly regulated versus notional competitive unregulated transmission

Transmission market	Estimated capital value ($m)	Percentage of capital value
Total	$25,761	100
Monopoly regulated transmission (non-contestable))	$14,807	57
Non-regulated transmission (REZs notionally contestable)	$10,954	43

4 https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp

5 A Dictionary on Electricity – Contribution on Australia – CIGRE, page 9

6 https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/nem_esoo/2022/2022-electricity-statement-of-opportunities.pdf?la=en&hash=AED781BE4F1C692F59B1B9CB4EB30C4C

7 https://www.aer.gov.au/system/files/State%20of%20the%20energy%20market%202022%20-%20Full%20report.pdf

- **What have we done so far?** Of the projects identified in the ISP 2018, only the Queensland to New South Wales Interconnector (QNI) minor upgrade has been delivered; it took five years to deliver by the Primary Transmission Network Service Provider (PTNSP) and to date has failed to deliver the additional transfer capacity stated in the Regulated Investment Test - Transmission (RIT-T) or ISP due to the emergence of other intra-regional network constraints.
- The Victoria to NSW minor upgrade is near completion. Riverlink/Project EnergyConnect commenced construction in 2022, following a 50 per cent increase in its originally estimated construction costs and is expected to see electricity flow in 2024, meaning it will have taken over 10 years from start to commission.[9]
- The Western Renewables link approved in 2018 has yet to achieve agreement from landholders for its route and it is currently unclear when such agreement will be reached due to the lack of achievement of social license for the project by AEMO, the Victorian PTNSP with affected landholders.
  Many more are still in early planning stages.

Problem (we are not building fast enough)

Transmission markets are uncontested thanks largely to complex and fragmented regulation

The Australian Energy Market Commission (AEMC) has explored a variety of approaches to delivering transmission.

There was a review in 2008 of the approaches needed to underpin meeting the Renewable Energy Targets (RET) and reducing the issues related to the energy transition.[10] The Transmission Planning and Investment Review[11] commenced in 2021 and is ongoing.

The AEMC's review started to explore a national framework to support contestable delivery of new transmission, but paused this work in 2022[12], even as both NSW and Victoria continued to deliver and expand on their contestable approaches for REZ.

The significant upfront capital cost and economic risks of building energy infrastructure are barriers to delivering what is needed.

Much of the cost and risk is related to the size of the market and the monopoly power that results from the current regulatory framework, as discussed below.[13] There are two other key factors:

8 List sourced from AEMO 2022 ISP, NSW Electricity Roadmap, Victorian Renewable Development plan, QLD Renewables and Energy plan.

9 https://www.aemc.gov.au/sites/default/files/2022-09/transmission_planning_and_investment_review_-_stage_3_draft_report.pdf

10 https://www.aemc.gov.au/markets-reviews-advice/review-of-energy-market-frameworks-in-light-of-cli

11 https://www.aemc.gov.au/market-reviews-advice/transmission-planning-and-investment-review

12 https://www.aemc.gov.au/news-centre/media-releases/contestability-workstream-paused-while-aemc-continues-broader-transmission-review

13 https://nexaadvisory.com.au/site/wp-content/uploads/2022/04/Removing-transmission-roadblocks-discussion-paper-080422.pdf

Transmission and generation mismatch -The costs and risks of building are exacerbated by the reality that development lead times for transmission are almost always longer than for the associated new generation and/or storage.

This mismatch arises because transmission corridors require the acquisition of multiple easements over extended geographies, (as opposed to more contained areas with fewer stakeholders for generation and storage facilities), and have potentially broad impacts on communities and the environment. This results in potentially high coordination costs, and long delays in obtaining regulatory and planning approvals as well as achieving social license from the affected communities', indigenous groups and landholders.

The mismatch in lead times means transmission is a potential bottleneck to new renewable generation[14,15] and a key contributor to increasing transmission access congestion. This congestion often results in significant curtailment of renewable generation output and reduction in revenue from higher transmission loss factors when generation is located in weak areas of the transmission network. These two factors reduce generation revenue and increase financing costs for new renewable generation due to higher revenue risk.[16]

Those higher costs and risk result in higher non-regulated transmission charges, higher wholesale costs, and a greater potential for reliability standards to be breached , with resulting impacts on customer bills. For example, if transmission is delayed, then legacy generation may need to operate at higher levels and for longer.

As such, the transmission related aspect of the National Electricity Market (NEM) transformation needs to:

- Minimise or avoid delays to the permitting, financing, design, procurement, construction and energisation of new regulated and non-regulated transmission.
- Put down downward pressure on transmission capital costs, by ensuring that:
  - The best global supply chains and innovation are applied to all aspects of the process.
  - Inefficient duplication of transmission build outs is avoided.
  - Financing costs and risks are allocated appropriately.

14 https://www.aemc.gov.au/markets-reviews-advice/review-of-energy-market-frameworks-in-light-of-cli

15 https://www.aemc.gov.au/market-reviews-advice/transmission-planning-and-investment-review

16 2023-03-14-CEIG-Q2-FY23-Investor-Survey95.pdf

The question of who pays - The required expansion of Australian transmission markets is significant, and at present it is expected that customers will continue to fund much of this investment through regulated charges from the PTNSPs. The regional PTNSPs also plan and coordinate the investments.

Regulated Asset Bases (RABs) are expected to double over the period to 2040, as transmission capacity is expanded and interconnectors are augmented. As a result, Network Use of System charges can also be expected to more than double in real terms and may increase as a portion of customer bills. Some of these cost increases are likely to be offset by lower wholesale costs as coal and gas generation exits and is replaced by cheaper forms of renewable generation, such as wind and solar.

As well as the need to invest in interconnectors, new regulated and non-regulated connection assets are expected to more than double over the same period as renewable generators connect in REZ. In addition, there is the costs of connecting the new REZ infrastructure to the existing network. It appears highly likely that a substantial portion of financing and depreciation costs of these REZ connection assets will be transferred to consumers under the various jurisdictional arrangements.

Decisions about how this new transmission is funded is a of primary concern for consumers who are unwilling to underwrite the risk that generation and transmission diverge from the most efficient outcomes or are not in the best interests of consumers.

Current transmission markets are largely protected from competition

There are currently nine transmission asset owning entities in the interconnected NEM, encompassing the five regional PTNSPs (see table 2, page 10), with the NEM-wide transmission system operated by AEMO.

There is no reason to believe that the current number of transmission entities, one per state, is the upper limit or optimal number in the NEM. However, current jurisdictional arrangements appear to prevent entry of new transmission entities to the Australian market.[17] While there are many barriers to entry the key issues of interest in this report are:

- electricity sector economic regulation, including a reliance on regulated and quasi-regulated cost recovery under jurisdictional schemes
- the over-dependence on historic and legacy ways of operating and securing the system, limited to the current status quo restricts participation by new transmission companies
- industry practice where procurement is outsourced to contractors without capacity or incentives on PTNSPs to maximise benefits
- overreliance on economic regulation to discover efficient capital and financing costs
- market bodies don't trust third party providers to operate and maintain critical infrastructure[18]

Cost of monopolies- regulated customer funded transmission

The regulated monopoly model for funding transmission in the NEM ensures all costs fall to customers. Meanwhile, there are weak incentives for the monopoly PTNSPs to minimise capital costs, ensure timely energisation, and to maximise opportunities for innovation and the adoption of new technology and methods.

RIT-T does not guarantee the lowest cost augmentation option, whether network or non-network options are selected. At the time the RIT-T decision on the preferred network or non-network solution is made, there still remains a high level of uncertainty regarding the capital costs of different solutions. Capital cost estimates have an error margin of -30 per cent and +50 per cent[19], meaning that the selected solution may turn out to be higher in cost than alternatives.

There is currently a limited revenue penalty for PTNSPs where capital costs increase beyond the estimates, and while new rules[20] require a reopening of RIT-T final decisions where there is a material change of circumstances, this rule change has yet to be applied in practice.

No revenue penalty arises from delays in the scheduled commissioning of new transmission capacity[21], as PTNSPs are able to recover financing and depreciation costs on an "as spent" rather than "as commissioned" basis.[22] This reduces incentives to ensure timely energisation.

There is also no financial penalty where the increase in network services on which the project was approved fail to meet the values stated in the RIT-T on which the benefits of the project was calculated. There is currently no post-commissioning review of actual service provision compared to claimed service provision conducted by the Australian Energy Regulator (AER).

17 https://www.energynetworks.com.au/resources/reports/2021-reports-and-publications/farrier-swier-transmission-contestability-principles

18 AEMC, Coordination of generation and transmission investment, Final report, December 2018, p.34.

19 https://www.aer.gov.au/system/files/AER%20-%20Determination%20-%20SAET%20RIT-T%20-%2024%20January%202020.pdf

20 https://www.aemc.gov.au/rule-changes/material-change-network-infrastructure-project-costs

21 The AEMC has suggested a "Timely Delivery Incentive, TDI" as an option in the current review work, but this is likely to increase costs to customers: https://www.aemc.gov.au/sites/default/files/2022-09/transmission_planning_and_investment_review_-_stage_3_draft_report.pdf

22 https://www.aemc.gov.au/sites/default/files/2022-09/transmission_planning_and_investment_review_-_stage_3_draft_report.pdf

The AER's Capital Expenditure Sharing Scheme (CESS) provides for a review of capital expenditure by a PTNSP, where actual costs exceed the allowed regulated investment. However, this calculation is based on the total allowed revenue and not undertaken on a project-by-project basis. In the event a PTNSP overspends on one project it is possible for it to defer other capital projects during the current regulatory period to a later regulatory period and remain within their total allowed revenue. The costs of any deferred project are allowed to be claimed again in the later regulatory period even where the project was never completed. If the increased costs are deemed to be inefficient, then the capital expenditure can be reduced, limiting the amount added to the RAB, and reducing recoverable depreciation and financing charges, so reducing costs to customers. The CESS has yet to be applied to large scale transmission projects, so its effectiveness is currently uncertain. To date we are not aware of any outcomes where a PTNSP has overspent its allowable revenue and the AER has discounted the actual costs that were rolled into the RAB.

Economic regulation of PTNSPs regulated revenues does not appear to constrain PTNSP's ability to extract excess returns on equity. This reflects systematic failures in the system for regulating network returns that have so far not been addressed.[23]

Over the long life of most transmission assets, the excess returns increase the total equity financing cost recovered from consumers by around 42 per cent.[24]

Cost of monopolies-non-regulated transmission in REZs

There is a contestable framework for non-regulated generator funded transmission connections in the NEM and in REZ. However, contestability in generator funded transmission is more notional than real.

The contestability arrangements for the new generator connections, such as the Dedicated Connection Asset (DCA), Identified User Shared Assets (IUSA) and Designated Network Assets (DNA) frameworks have yet to be applied in practice. This may be because of the very high transaction costs associated with multiple market participants contracting with potential third-party providers, while also needing connection agreements with the regulated PTNSP and the fact that some key decisions and tasks remain non-contestable. Generators are not allowed to own transmission assets beyond those deemed to form part of a facility, due to structural separation requirements, and once competitively provided generator connections are energised, they are subject to PTNSP control. While in theory DNA may be owned by third parties, in practice once they are energised ownership is transferred to PTNSPs. We have been unable to identify a single case where DNAs have been built and owned by entities other than the PTNSP.

The transmission investment framework does not provide "real" contestability

International evidence suggests that regulated transmission investments often result in capital cost escalations relative to initial estimates. This reflects the findings of a 2018 report by the Brattle Group on potential customer savings from competitive transmission planning and provision processes in the US under a FERC Order.[25]

Further international examples, such as offshore wind connections in the UK, and transmission delivery in multiple US regions (PJM, CAISO, NYISO, MISO) demonstrate the practical delivery of real benefits through contestable transmission.[26]

In Australia, PTNSPs typically undertake a contestable process to appoint civil engineering contractors to undertake procurement and construction of new transmission. However, there is limited public information on processes and outcomes of these. For example, TransGrid's public portal on its portion of the EnergyConnect project does not include details on the procurement process.[27] In addition, while a PTNSP may contract out the construction of a project, the bulk of the income from the investment is from the ownership and operation of the transmission asset over its long life.

23 https://ieefa.org/media/3227/download?attachment

24 https://ieefa.org/media/3227/download?attachment

25 https://www.brattle.com/wp-content/uploads/2021/05/14786_brattle_competitive_transmission_wires_10-25-18.pdf

26 https://www.aemc.gov.au/sites/default/files/2022-07/KPMG%20Report%20-%20International%20and%20domestic%20examples%20of%20transmission%20contestability%20%28case%20studies%20report%29.pdf

27 See for example https://www.transgrid.com.au/projects-innovation/energyconnect

In addition, whilst the PTNSP may undertake open tendering, it is not bound to accept the lowest price. We understand that tenders submitted are not subject to AER review or scrutiny so it's unclear on what basis a tender is accepted or what mark-up is applied to the tendered costs by the PTNSP for the provision of project management or other services.

Where subcontractors are appointed by the PTNSP, it is possible subcontractors may have limited expertise and capacity to ensure low cost and timely procurement from global supply chains for the reasons explained below.[28] PTNSP's contestable procurement of some limited elements of new transmission delivery does not reduce barriers to entry to transmission markets or necessarily reduce the costs of new transmission for Australian customers as the PTNSP retains control over the costs submitted to the AER for project funding approval.

Opening transmission markets to contestability provision from the planning to the build, operate and maintain stage could likely result in avoided delays. At present, the NEM relies on economic regulation to "discover" the efficient capital costs of regulated transmission, via the RIT-T process and the modified RIT-T for actionable transmission ISP projects. Even the expedited RIT-T process for actionable ISP projects continues to have lengthy timelines involving the following key steps:

- The project needs to be incorporated in an ISP as an actionable project.
- A project assessment draft report (PADR) must be published, including a cost benefit analysis consistent with AER guidelines and set out the identified need.
- The PADR must subject to consultation of at least four weeks.
- A project assessment conclusions report (PACR) must respond to matters raised in the PADR consultation.
- Following this, the AER needs to make a draft then final RIT-T determination.
- Following the AER determination, the proponent would then initiate its procurement process to establish actual price discovery.

This regulated process can be lengthy, ranging from 17 months (QNI augmentation only) to 54 months (Project EnergyConnect, an entirely new interconnector)[29], depending on the complexity of the project and the PTNSPs involved, with 48 months (4 years) typical for an ISP transmission project.[30]

In contrast, for a contestable transmission project, price discovery by the AER and by the regulated proponent could be by-passed. Instead, following the PSCR, a contestable process would be undertaken to market test the total capital cost. A contestable process for selecting the party to deliver the transmission procurement and build could be expected to take up to 12 months.

As an example, the Western Renewables Link (WRL) was approved for build in 2018. This was a contestable project handed over by AEMO with no selected or agreed route. AEMO as the PTNSP had not engaged with landholders with whom easements would need to be negotiated. Jurisdictional approaches adopted by government corporations may support a better engagement in the future.

28 https://www.reuters.com/article/australia-clough-energy-idAFL1N32W013

29 For more information see Appendix X

30 https://www.aemc.gov.au/sites/default/files/2022-09/transmission_planning_and_investment_review_-_stage_3_draft_report.pdf

The Australian market is small compared to global transmission-network markets

Australian PTNSPs do not have economies of scope and scale necessary to access global supply chains and leverage global expertise and innovation.

The tables below summarise the structure of Australia's major interconnected transmission markets in terms of revenues and assets funded by consumers via Transmission Use of Service (TUoS) charges.

Table 2: Assets and revenue for Australian PTNSPs

PTNSP FY 2021 ($m)	Regulated revenue ($m)	Regulated Asset Base ($m)	Customers	Percent of revenue
TransGrid	784	6,696	3,977	28
AusNet (T)	615	3,272	3,019	28
Powerlink	743	7,164	2,257	27
ElectraNet	320	2,787	914	12
TasNetworks (T)	141	1,484	295	5
Total	**2,604**	**21,404**	**10,462**	**100**

Source: Australian Energy Regulator Electricity Network Performance Report July 2022[31]
This excludes: Ausgrid, Directlink and Murraylink.

PTNSPs have minimal international purchasing power when accessing highly specialised assets from supply chains with limited capacity. The French transmission owner, RTE, has an annual revenue equivalent to that of each of the three largest PTNSP in the NEM, but an asset base that is larger than the entire NEM ($28 billion versus $21 billion).

Table 3: Assets and Revenue of global transmission system owner/operators

Entity	Revenue ($m)	Assets ($m)	Structure
State Grid of China[32]	$543,299	$833,837	Vertically integrated
National Grid (UK)[33]*	$7,010	$36,626	Structurally separated
RTE (France)[34]	$812	$28,719	Govt majority owned (50.1 pct)
American Electric Power[35]*	$2,224	$18,088	Publicly listed
National Grid USA[36]	$16,136	$35,169	National Grid UK

*Electricity Transmission Network Operator/Owner figures only
Notes: Currency conversions at 19Feb2023; Figures from most recently available accounts

31 https://www.aer.gov.au/system/files/2022%20Electricity%20network%20performance%20report%20-%20July%202022.pdf
32 https://rise.esmap.org/data/files/library/china/Financials/China_State%20Grid%20Corporation%20of%20China_Annual%20Report%202019.pdf
33 https://www.nationalgrid.com/document/142126/download
34 Rapport 2021vf_EN (1)
35 https://www.aep.com/assets/docs/investors/AnnualReportsProxies/docs/20annrep/2021ProxyAppendixA.pdf
36 https://www.nationalgrid.com/document/142126/download

We are in a global race for supply chains and procurement certainty and therefore delivering transmission cost effectively, efficiently, and on time, is a challenge:

Australia's clean energy transition is occurring within a global decarbonisation and energy security race. This means that Australia must compete on the international stage for highly specialised assets and skilled labour, such as project management of large infrastructure projects.

This competitive tension is further heightened by countries, such as the USA, China and the European Union, developing specific incentive programs to accelerate their transitions.

The worldwide growth in renewable energy over the next three decades, spurred by 2030 and 2050 emissions targets and high fossil fuel prices, will significantly increase demand for labour, expertise, materials and specialised electrical equipment.[37]

Australian transmission construction is highly reliant on global supply chains. Managing supply-side constraints is paramount for the effective and timely delivery of the transmission projects identified as "critical" to Australia's transition.

Infrastructure Australia's initiative[38] for the energy sector found that between 80,000 and 95,000 people would be needed over the next 15 years in a variety of roles.

In addition, they found skill shortages would likely be exacerbated by any peaks in construction, competition between states and regions, and by a lack of diversity in projects. Both the electricity generation and transmission industries have developed a significant reliance on international skilled migration, which in turn increases the supply risks.

The initiative also forecast that the electricity sector's (NEM-wide) demand for steel would increase by ~50 per cent from 2021 to 2027, and that demand for concrete would double.

Other major capital inputs for new transmission facilities include (much of which is imported):

- pre-construction or early works – survey, design, planning, planning consents, regulatory consent
- specialised grid integration hardware (synchronous condensers, static var compensators)
- standard equipment (transformers, circuit breakers, switch gear, digital protective relays, other system control equipment)
- conductors and insulators
- civil works for towers and substations
- easements

In addition to practical issues related to congested and potentially constrained supply chains, transmission asset suppliers can hold a significant level of pricing power. Given the size of Australia's PTNSPs (see table 2 above), relative to other players in the global market, they do not have significant buying power.

There are significant global transmission network players that have strong interest in Australia's growing energy transmission needs. This is evident from global interest in NSW REZ non-regulated transmission.

37 https://aemo.com.au/-/media/files/major-publications/isp/2022/2022-documents/2022-integrated-system-plan-isp.pdf?la=en, P86

38 https://www.infrastructureaustralia.gov.au/sites/default/files/2021-10/Market%20Capacity%20for%20Electricity%20Infrastructure%20211013.

Table 4: Global transmission network entities with a presence in Australia

PTNSP 2021 ($m)	Regulated revenue ($m)	Regulated Asset Base ($m)	Customers	Percent of revenue	Year of report	Notes
ATCO	3,136	20,264	2.0	15	Dec-21	Overall asset base
Iberdrola	28,333	78,355	34.0	36	Dec-21	
Kepco	71,196	137,925	-	52	Dec-21	
RWE	4,056	10,293	29.0	39	Dec-21	
EDF	27,703	98,000	37.6	28	Dec-21	
APA	2,271	9,501	1.4	24	Jun-21	Overall asset base
Total	**136,696**	**354,338**		**39**		

These organisations not only bring significant global private capital and financing, but their scale means they would bring supply chain partnerships and resources, and countervailing market power relative to global transmission equipment manufacturers.

As well as the domestic regulated monopoly PTNSPs being minor players in comparison to their global counterparts, these large global transmission development entities have annual capital procurement purchases in excess of the total forecast capital transmission cost in the NEM for 2020-2040 of $A25 billion, including labour costs.[39]

Annual purchases on this scale are ongoing. This means that specialist global suppliers to the transmission industry are likely to size their capacity to ensure they can meet demand from large global transmission companies.

The relative lack of buying power of Australian transmission market participants has the following adverse consequential impacts:

- High volume discounts are unlikely and small volume premia are possible.
- Relatively small volumes mean lead times between ordering and delivery may be longer due to scheduling priority given to bigger customers.

There is also a possibility that smaller customers, including Australian PTNSPs, may not be given access to the most recent technical solutions necessary to support innovation in design, construction and operation.

Australia's current fragmented transmission markets are likely to lead to delays in all aspects of delivering new regulated and non-regulated transmission, arising from permitting, financing, design, procurement, construction and energisation. Additionally, delays may mean that transmission capital costs can blow out, which are further compounded by the fact there are limited incentives for PTNSPs to minimise costs and currently no or penalties for delays.

Delays and inefficiencies in building and financing new transmission have cost implications for Australia and are explored in the modelling.

39 https://www.iberdrola.com/documents/20125/42388/IB_Integrated_Report.pdf

Modelling avoidable transmission costs

Today, in Australia, most new transmission is delivered by the current five regulated incumbent transmission monopolies. To understand how opening up transmission markets to providers other than these regulated incumbent transmission monopolies would benefit Australians, modelling was undertaken to explore the costs of the current regulated model, focusing on the impact of:

- Supply chain and cost of capital limitations.
- The absence of a requirement to ensure that new transmission is built on time and on budget.
- Delays in delivering new transmission on wholesale electricity prices.

Modelling Approach and Assumptions

The model combined the approach of Endgame Economics on wholesale electricity price impacts related to transmission delays in a model for the costs and revenue experienced by the regulated incumbent transmission monopolies developed by Tahu Consulting, over the period 2022 to 2040.

Cost savings related to improved procurement, access to global supply chains, and through opening up transmission markets were assumed to be a conservative 15 per cent, based on the 20-30 per cent average obtained by the Brattle Group.[40]

It was assumed that full contestability would reduce the costs associated with the regulated returns of the incumbent transmission monopolies, which incorporate increased delivery costs for new transmission due to cost and time overruns. Analysis of AER data on the performance of electricity networks[41] that showed that profits exceeded allowable regulated income by 15.8 percent.[42]

The cost per customer of a one-year delay in delivering transmission was found to be $327 because of impacts on the wholesale cost of electricity.[43] It was assumed that open transmission markets (full contestability) would result in a conservative average reduction in the time taken to deliver a new transmission line of three months (or 25 per cent of a year) over the period of the model to 2040. The number of residential customers in the NEM was taken as 11.2 million, based on the number of customers in 2021[44] and assuming growth of 1.5 per cent per year, over five years.

For further information on the modelling approach, see Appendix 1.

40 https://www.brattle.com/wp-content/uploads/2021/05/17805_cost_savings_offered_by_competition_in_electric_transmission.pdf

41 https://www.aer.gov.au/system/files/2022%20Electricity%20network%20performance%20report%20-%20July%202022.pdf

42 https://ieefa.org/media/3227/download?attachment

43 https://nexaadvisory.com.au/site/wp-content/uploads/2022/06/Report-Modelling-Electricity-bill-impact-due-to-transmission-delay_2022-06-07.pdf

44 https://www.aer.gov.au/system/files/2022%20Electricity%20network%20performance%20report%20-%20July%202022.pdf

The modelling showed that there would be avoided costs (customer savings) of over $13 billion through reductions in delays and costs through leveraging the global reach, access to international finance and supply chains and avoiding regulated overspends and over-capitalisation, through opening up Australia's transmission market.

This avoided cost of $13 billion, compares with the $12.5 billion that AEMO gave for the cost of delivering the optimal development pathway for new regulated transmission recommended in the 2022 ISP.[45]

Close to $1 billion ($952 m) in capital cost reductions would come as a result of opening the transmission market to globally-proven non-incumbent transmission entities, who have the established scale and procurement partnerships, (as we can see from the NSW REZ tenders).

Additional reductions in costs, of $2.98 billion, could be achieved through avoiding excess regulated returns on equity, via the opening of markets for the ownership as well as construction of new transmission.

Most significantly, reducing the delays in delivering new operational transmission, by just three months, would avoid a $9.2 billion increase in wholesale electricity costs.

Table 4: Modelling results showing potential cost savings of contestability

Key results for 2026-2040 ($m 2023 nominal)	Status quo Current model	Possible efficiency gain	Full contestability Open transmission market	Avoidable cost
Depreciation charge (capital cost)	$6,346.4	15%	$5,394.5	$952.0
Excess regulated returns on equity	$18,845.1	15.8%	$15,867.2	$2,977.9
Wholesale market impact from transmission buildout delay	$36,777.1	25%	$27,582.8	$9,194.3
Total	**$61,968.6**		**$48,844.5,**	**$13,124.15**

45 https://aemo.com.au/-/media/files/major-publications/isp/2022/2022-documents/2022-integrated-system-plan-isp.pdf?la=en

Conclusion - Transmission contestability is key

Proposed solutions and approaches

Evidence from our research shows that the current market frameworks, regulated and non-regulated, for delivering new transmission infrastructure, are complex and as a result, retain high barriers to market entry. Barriers to entry inefficiently fragment transmission markets, allow transmission operators opportunities to exercise market power. This in turn results in generally higher cost and slower delivery environment than is the case in high performing overseas markets that less fragmented and more open to competition.

The modelling shows that reducing or removing barriers to entry to Australian transmission markets could avoid the costs and delays associated with the current closed and fragmented markets, and save over $13 billion dollars of unnecessary costs to customers on the journey to net zero and meeting renewable generation targets.

More competitive delivery of new transmission would also:

- Encourage innovation in both technical approach and delivery, promoting long-term efficiency and reducing energy costs to customers.[46]
- Attract international private finance and capital quickly and efficiently, potentially alleviating financing constraints in the delivery of transmission by regulated PTNSPs.[47]
- Achieve greater efficiency in the construction, operation and maintenance of transmission assets.[48]

Victoria has an existing contestable framework for new regulated and non-regulated transmission, which is in the process of being updated by the state government[49] and NSW has a relatively new (2020) framework that applies to REZ.[50]

However, a more radical approach is needed to ensure we build this critical infrastructure on time and ensure the impacts of delays are not borne by consumers.

There is a solution, which allows full contestability to be rapidly adopted from the detailed planning and approvals stage through to provision and operation and that is already accommodated in the current National electricity Rules and Laws and that has already been leveraged by individual Australian states and can be used to encompass all jurisdictions. This approach would require identification of the project need in the ISP or regional Annual Transmission Planning Report following which the relevant jurisdiction would call for tenders to progress all major project, those above a specific cost threshold, through the various project stages.

46 https://engage.vic.gov.au/download/document/27045

47 https://www.aemc.gov.au/sites/default/files/2022-08/aer_submission_-_tpir_-_contestability_options_paper_-_august_2022_0.pdf

48 https://www.aemc.gov.au/sites/default/files/2022-07/KPMG%20Report%20-%20International%20and%20domestic%20examples%20of%20transmission%20contestability%20%28main%20report%29.pdf

49 https://engage.vic.gov.au/download/document/27045

50 https://legislation.nsw.gov.au/view/html/inforce/current/act-2020-044

We suggest the following approaches:

1. Embed competition as a pre-requisite in the Rewiring the Nation approach:

Immediately progress a national approach, leveraging the Rewiring the Nation program to embed a pre-requisite for transmission procurement entities in each jurisdiction to adopt open contestability in the provision of new transmission infrastructure before receipt of funding. This would have the advantage of minimising the need to develop complex new arrangements spanning the National Energy Laws (NEL) and jurisdictional regulatory arrangements. Other advantages include a single national approach and efficiencies of scope and scale in terms of competitive transmission procurement arrangements.

Other advantages include a single national approach and efficiencies of scope and scale in terms of competitive transmission procurement arrangements.

Rewiring the Nation would need to invest in the development of a well-designed contestable procurement framework for new transmission assets and capacity. The framework could operate under the current Clean Energy Finance Corporation (CEFC) legislation. It would ensure that:

- There are clear criteria that transmission asset projects must meet in order to access the funding.
- Entrants to markets to supply new transmission infrastructure are required to demonstrate they have capacity and capability to ensure project delivery is on time and not delayed.
- There is a well-designed process for contestable procurement and market rather than administrative discovery of efficient capital and ongoing operating and other costs.
- There is a procurement process that avoids unnecessary delays under existing administrative transmission project cost discovery and that rewards bids from parties that not only provide adequate technical capabilities and financial resources, but also support innovation and timely project completions and energisations.
- Project risks, including increases in capital expenditure requirements and project delays, are managed to avoid excessive risk transfers to electricity consumers.
- Long term ownership arrangements are efficient and designed to avoid excessive long-term financing and operating costs.

Once the ISP has identified the optimal development path, the key transmission projects would then be declared projects of national significance, falling under the Rewiring the Nation program. These projects would then be subject to contestability under the Rewiring the Nation and an independent cost-benefit test. Rewiring the Nation office would, through the CEFC, commence a competitive design and investment tender involving both third party providers and the PTNSPs, to select the transmission developer and ensure that beneficial outcomes flow to Australian customers.

While funding from Rewiring the Nation is welcome and necessary for a successful transmission delivery strategy, in and of itself it is not sufficient to reduce the overall capital costs of new transmission in Australia. Potential transmission projects still need to progress through the relevant national or jurisdictional arrangements for investment approval, construction and operation.

The current regulated approach does not motivate or incentivise the PTNSP to deliver new transmission projects in a timely manner as there is no competitive tensions to drive efficiency.

To maximise the benefits of Rewiring the Nation, it needs to focus not just on the financing of critical transmission projects, but also on delivering a robust framework that can underpin investment decisions and leverage experienced competitive third-party large infrastructure developers to reduce total lifetime costs of new transmission.

As this may require lead time to develop and implement, our second recommendation should be implemented in parallel, as an interim solution. This alternative pathway leverages the state jurisdictional regulation where contestability is an option and where transmission is mostly needed.

2. Trigger jurisdictional competitive tenders for ISP-related transmission projects:

The bulk of new transmission detailed in the 2022 ISP optimal development pathway needs to be built in or between Victoria, NSW and Tasmania.

Current arrangements in relevant jurisdictional instruments and established regulations allow for energy ministers in each state to "opt in" to contestability. This is an important step that represents an expeditious route to set up open transmission markets in each of the relevant jurisdictions.

This will give the jurisdictional government more control over the declaration and development of new regulated transmission as well as REZ transmission.

The new frameworks can then be developed in ways that facilitate acquiring social licence and alignment of transmission, generation and storage infrastructure development with jurisdictional emissions and renewable generation targets.

The jurisdictional body would seek the development of scenarios, oversee the development of candidate pathways, determine the optimal pathway, oversee the delivery of the transmission by a competitive party, undertake the approvals process (planning, environmental etc.) and undertake a review of each project to feed into the development of future scenarios.

The successful transmission provider, whether an incumbent regulated monopoly or a new entrant, would own or be conceded (concession period) the new transmission and be responsible for the delivery, operation, maintenance and augmentation of the new transmission line.

51 https://www.legislation.sa.gov.au/LZ/C/A/NATIONAL%20ELECTRICITY%20(SOUTH%20AUSTRALIA)%20ACT%201996.aspx , Section 50C

The jurisdictional bodies could appoint AEMO (as in the current competitive Victorian model) or AEMO Services (as in some parts of the NSW competitive model), or a separate body such as VicGrid (Victoria) or EnergyCo (NSW).

Under this model, we propose that a jurisdictional body is established or appointed to take on the planner and coordination role in each state. They should:

- identify the solutions that could be contestably delivered. This would be based on the ISP with a focus on jurisdictional needs. The solutions must also seek unsolicited projects and pathways from third parties and industry stakeholders
- lead community engagement and preparatory activities associated with that initial planning to ensure that there is sufficient community support for particular pathways being assessed
- be appropriately resourced with engineering, technical, and commercial project delivery expertise.

With a single entity responsible for the entire transmission project, bar the delivery, efficiencies in timing can be made, reducing the projected time for the delivery of a new transmission line reduced to under five years (see table 5 below). Most of the savings will come from access to global supply chains, resources, material by experienced international transmission providers and operators, due to their bargaining reach.

Table 5: Outline description of a framework for competitive delivery of new transmission

Function	Description	Responsible	Estimated time (not consecutive & will overlap)
Initiation stage	Using the ISP as the main source and working third parties and transmission providers (Regulated and contestable) to identify and develop a set of candidate options for building out transmission grid in a way that balances economics and engineering with investor interest, land use considerations, regional strategic opportunities and community preferences. This phase should also kick off strategic land assessment and engineering analysis of different pathways.	Jurisdictional Body	6 months (This does not include ISP development)
Approval process	Identifies the transmission projects preferred pathway that most efficiently meets the optimal REZ pathway and seeks EOI for transmission delivery and cost benefit assessment to be included in the Expression of Interests. Risk approaches and key criteria on procurement, delivery, social license etc. Decision on preferred candidate to deliver The CEFC could be used as the central financial arm of the Jurisdictional body for assessment of projects and candidates.	Jurisdictional Body in consultation with Transmission providers – regulated and contestable	12 months
Announcement of preferred provider and kick off of project			
Contract and service agreement established	Procurement (underpinned by a negotiated contract & service agreement for the life of the asset – 40-50 years). In parallel competitive transmission provider seeks planning and environmental approvals required under relevant legislation.	Jurisdictional Body in consultation with Preferred Transmission provider	6-9 months
Delivery	Competitive transmission provider delivers project in accordance with contract terms and conditions	Transmission provider	2-3 years

Next steps

Commonwealth Government to make transmission investment contestability compulsory for access to Rewiring the Nation funding

Immediately progress a national approach, leveraging the Rewiring the Nation program to embed a pre-requisite to adopt competition in the provision of new transmission infrastructure before receipt of funding.

Immediately support jurisdictional frameworks that allow competition in the provision of new transmission infrastructure. Trigger competitive tenders for the transmission network projects identified as "actionable" at jurisdictional level where possible

Call for state energy ministers to leverage current arrangements where possible to:

- declare competitive tenders for the "actionable" transmission projects identified and agreed as needed.
- appoint jurisdictional corporations established such as VIC Grid in VIC and EnergyCo in NSW to oversee the entire transmission project including the project approval process and management of the competitive tenders for the transmission network project.

Extend the economic modelling

Finally, we encourage further development and extension of the initial economic modelling undertaken for this paper, taking into account the following:

- The impact of higher wholesale prices since mid-2022, reflecting a higher outlook for global primary energy costs since Russia's invasion of Ukraine in February 2022.
- The impact of inflation and new information on capital expenditure estimates, beyond the rising capital investment costs post-pandemic already included in this report.
- The impact on transmission financing costs from the Rewiring the Nation Corporation initiative, and mechanisms for cost recovery of regulated transmission.

Appendix 1

Modelling shows large economic costs of transmission market entry barriers

To understand the potential cost impact of the current barriers to delivering new transmission and a current model that favours the PTNSPs, an initial, high-level, analysis of the potential gross benefits from reducing the barriers to entry to transmission markets was undertaken. The analysis is indicative and intended to require a legislation review to be undertaken, as required under Section 5 of the Competition Principles Agreement.[52]

A model was developed to test the possible scale of efficiency gains and avoidable costs associated with the identified three benefit categories, relative to the status quo.

Details of the model and key inputs are described below;
they build on and synthesise results from two earlier models of:

- the wholesale market impacts of delays in transmission energisation (by EndGame Economics)[53]
- regulated network costs and revenues by Tahu Consulting.[54]

The three benefit types have been quantified for the 14-year period 2026-2040.
The potential changes under a counterfactual case are:

- A reduction in transmission depreciation costs associated with reductions in the capital cost of regulated and REZ transmission. This reduction reflects the procurement efficiencies where incentives for efficiency and economies of scope and scale are applied.
- A reduction in the financing cost associated with removal of some of the supernormal profits derived from returns on equity that are substantially in excess of regulatory allowances generated by regulated electricity networks under chapter 6A of the NER. Where non-regulated transmission is not fully contestable, inefficient regulated transmission financing costs may spill over into non-regulated transmission financing costs.
- A reduction in wholesale electricity prices associated with earlier energisation of transmission capacity, allowing earlier access to lower cost renewable generation, and allowing greater intra-regional and inter-regional sharing of generation and storage capacity.

The key outputs from the model show the incremental benefits (avoidable cost) under a counterfactual scenario. The values in the table below should be treated as indicative only. However, the clearly underline the need for a comprehensive regulatory impact assessment of the economic impact of existing barriers to entry to transmission markets.

Table A1.1: Modelling results showing potential cost savings of contestability

Key results for 2026-2040 ($m 2023 nominal)	Status quo	Possible efficiency gain	Counterfactual	Avoidable cost
Depreciation charge (capital cost)	$6,346.4	15%	$5,394.5	$952.0
Excess regulated returns on equity	$18,845.1	15.8%	$15,867.2	$2,977.9
Wholesale market impact from transmission buildout delay	$36,777.1	25%	$27,582.8	$9,194.3
Total	**$61,968.6**		**$48,844.5**	**$13.124.15**

Source: Tahu Consulting

52 See Competition Principles Agreement – as amended to 13 April 2007. While COAG has been replaced by National Cabinet, we understand the Competition Principles Agreement remains effective.

53 https://nexaadvisory.com.au/site/wp-content/uploads/2022/06/Report-Modelling-Electricity-bill-impact-due-to-transmission-delay_2022-06-07.pdf

54 Citations provided below.

The modelling implies that over $13billion in costs over the modelling period can be avoided by removing barriers to entry and opening up the Australian transmission markets to deliver the new transmission needed.

The major benefits from improving transmission market efficiency relate to wholesale markets. That is, improved access to lower cost renewable generation and storage reduces reliance on very high-cost peaking generation and storage. The avoided cost estimate draws on a report by Endgame Economics 2022.[55]

Endgame estimated that, over the entire modelling period, a one-year delay in transmission added $327 to the average residential customer bill. Using estimated customer numbers in the base year, the wholesale market cost of an average of one year transmission energisation delay is equivalent to $36.8 billion over the modelling period.[56]

For present modelling purposes, in the counterfactual scenario, it is assumed that transmission energisation delay can be reduced on average by three months (or 25 per cent of a year) over the period. This results in avoided wholesale market costs of around $9.2 billion.

The potential direct savings from improving transmission market efficiency, in the form of lower transmission capital and financing costs, are substantial. The modelling suggests an avoidable cost in the order of $6.2 billion over the period, as detailed below.

A significant reduction in the capital cost of new transmission could be expected, associated with improved procurement and other efficiencies from the introduction of transmission market competition. For example, a 2019 report by the Brattle Group[57] estimates that competitive transmission development processes from more open transmission markets yield capital cost savings ranging from 20 per cent to 30 per cent on average. For present purposes, over the period, a conservative 15 per cent reduction in capital cost is assumed. This results in a $952 million of avoided cost in the form of lower depreciation charges over the period.

A reduction in financing cost is possible by reducing the excessive profits derived by PTNSPs from returns on equity that are substantially in excess of regulatory allowances over the period. These persistent excess profits were identified using network return data published by the Australian Energy Regulator in July 2022 to identify that excessive network profits resulted in total PTNSP regulated revenues exceeding total regulated costs by 10.8 per cent.[58]

For modelling purposes, it is assumed that, in the counterfactual, excessive profits are reduced by 15.8 per cent[59] (the demonstrated impact on customers of current returns over the lifetime of transmission assets). This translates into an avoidable cost of $5.9 billion dollars over the modelling period.

REZ transmission capital expenditure represents around 43 per cent of estimated total transmission investment (see table 1, page 6). REZ transmission investment is not subject to economic regulation under chapter 6A of the NER. In some jurisdictions, such as NSW, REZ network development is notionally contestable.

To the extent REZ transmission is financed by regulated networks, nationally, excessive regulated returns may spill over to REZ transmission. This is because regulated networks will require returns for REZ transmission that at least match those for regulated transmission.

55 https://nexaadvisory.com.au/site/wp-content/uploads/2022/06/Report-Modelling-Electricity-bill-impact-due-to-transmission-delay_2022-06-07.pdf

56 The base year customer number forecast is 11.2m, representing 1.5% customer growth from 2021 to 2026. The 2021 value is sourced from Australian Energy Regulator's Network performance report, 2022. Customer growth over 2014-2021 averaged 1.5%, excluding periods impacted by reductions in immigration.

57 https://www.brattle.com/wp-content/uploads/2021/05/17805_cost_savings_offered_by_competition_in_electric_transmission.pdf

58 https://ieefa.org/media/3227/download?attachment

59 The 15.8 per cent represents the aggregate difference between efficient and allowed network profits for regulated assets only, over the period 2026-

Appendix 2

CEIG supports the introduction of transmission contestability

CEIG supports increasing competition in the construction, ownership, financing, and operation of transmission infrastructure assets (including poles, wires, and related network components).

In August 2021, CEIG published the Clean Energy Investor Principles[60], which highlighted that enhancing investor certainty could reduce the risk premium for new generation in the NEM, potentially delivering consumer savings of up to $7 billion by 2042. The report also emphasised that over the past two decades, transmission companies have primarily focused on maintaining large electricity grids, rather than developing complex infrastructure projects. Moreover, the current regulatory framework may not incentivise efficient scoping and procurement.

In contrast, a broader range of private investors could bring the following benefits:

- Extensive experience in managing large infrastructure projects;
- Handling complex risks;
- Bring valuable experience from other sectors and countries; and
- Access larger capital pools at lower costs, benefiting consumers.

Revised market rules should allow for a broader range of private sector participation, which could bring a higher risk appetite and access to more significant capital resources for riskier projects. This could lead to the emergence of new business models, such as leveraging private sector expertise and lower capital costs to mitigate project risks from the outset (e.g., managing route planning or community consultations).

CEIG's commissioned research by Baringa on transmission planning and investment for clean energy[61] emphasises the potential benefits of increased contestability in the sector. These advantages include:

- Decreased costs and increased innovation;
- Overcoming the issue of incumbent TNSPs holding exclusive development rights without obligation;
- Addressing financiability concerns by allowing tenderers to submit financeable bids; and
- Providing the AER with a more suitable and precise means to benchmark and evaluate efficient project costs for major transmission projects.

Timely development of transmission infrastructure is paramount to ensure delivery of low-cost renewable energy and support grid resilience. Prioritising transmission upgrades and fostering innovation can overcome energy distribution challenges and accelerate the energy transition.

Simon Corbell

CEO, Clean Energy Investor Group

60 CEIG, Clean Energy Investor Principles (Aug-21)

61 Baringa, Advice on Transmission Reform Report

There is strong support to open transmission market in Australia

Organisation	Submission URL	Comments from submission
AEC	https://www.aemc.gov.au/sites/default/files/2022-08/20221808_aec_sub_aemc_tpir_contestability_final_0.pdf	"the AEC considers contestability for major transmission projects critical in delivering the most efficient outcomes for electricity consumers"
AEMO	https://www.aemc.gov.au/sites/default/files/2022-08/aemo_submission_transmission_planning_and_investment_review_er0087_18082022_0.pdf	"When considering contestability arrangements, consideration should be given to aspects of project delivery that are better suited to contestable provision, and those which are more suitable to be delivered by the Jurisdictional Planning Body"
AER	https://www.aemc.gov.au/sites/default/files/2022-08/aer_submission_-_tpir_-_contestability_options_paper_-_august_2022_0.pdf	"contestability offers the potential to leverage the current NEM transition to maximise efficiencies for consumers. A contestable framework can best promote the innovation in solutions to network needs arising from the rapid pace of technological development we are currently seeing"
AGL	https://www.aemc.gov.au/sites/default/files/2022-08/agl_tpir_contestability_sub_final_0.pdf	"AGL strongly supports increased contestability in the provision of major transmission projects in the NEM"
APA	https://www.aemc.gov.au/sites/default/files/2022-08/apa_response_to_aemc_transmission_contestability_consultation_august_2022_-_final_0.pdf	"This is a monumental task that will require careful planning and execution. Given the delays associated with actioning and delivering ISP projects, we fully support the adoption of contestability to help drive innovation, more timely service delivery, and better outcomes for customers"
Ausgrid	https://www.aemc.gov.au/sites/default/files/2022-08/2022.08.19_ausgrid_submission_to_aemc_re_transmission_planning_and_investment_contestability_0.pdf	"we strongly support contestability got major transmission projects if it can be shown to benefit electricity customers"
Ausnet	https://www.aemc.gov.au/sites/default/files/2022-08/AusNet%20Submission%20-%20Response%20to%20TPIR%20Contestability%20Options%20Paper%20vFINALv2.pdf	"AusNet [is] in a strong position to articulate why the AEMC should explore the net-benefits of introducing contestability for major transmission projects as a no regrets action"
Capella Capital	https://www.aemc.gov.au/sites/default/files/2022-08/capella_capital_-_aemc_ref_epr0087_submission_18_august_2022_0.pdf	"At a high level, Capella supports increasing contestability in the delivery of major transmission projects and believes there are significant opportunities to increase net benefits to consumers under a contestability model"
CEIG	https://www.aemc.gov.au/sites/default/files/2022-08/2022-08-18_ceig_response_-_aemc_contestability_paper_0.pdf	"CEIG is supportive of mechanisms that increase competition in the right to build, own, finance and operate transmission infrastructure assets"
ENGIE	https://www.aemc.gov.au/sites/default/files/2022-08/engie.pdf	"has provided robust evidence that contestability can be a viable approach to delivering transmission services"
Iberdrola Australia	https://www.aemc.gov.au/sites/default/files/2022-08/iberdrola_australia_-_submission_for_aemc_contestability_option_paper_0.pdf	"Therefore, we believe that the existing regulated monopoly arrangements for Transmission networks are not sufficient to deliver the scale of investment and build needed in the timeframes required. Opening the transmission build to competition will attract the funding, financing and resourcing required to deliver these major projects"
PIAC	https://www.aemc.gov.au/sites/default/files/2022-08/piac_0.pdf	"If appropriately implemented, contestability could provide a proportionate response to the risk of late or non-delivery of major transmission projects. Moreover, increased contestability in the provision of certain transmission activities could provide an avenue to more equitably share the costs and risks associated with the delivery of these projects"
Snowy Hydro	https://www.aemc.gov.au/sites/default/files/2022-08/snowyhydro_-_transmission_planning_and_investment_-_contestability_1_0.pdf	"We support in principle considering the competitive provision of transmission projects. In the long term new transmission ought to be procured by open tender."

Appendix 3

National regulatory framework development for contestable transmission

As a result of the growing adoption of jurisdictional arrangements for new transmission investment, in 2022, the AEMC announced a stop to its ongoing reviews intended to develop national transmission planning and development frameworks.[62] This reflected a concern that the new national arrangements under development would seldom if ever apply to new transmission projects.

The table below summarises alternative jurisdictional arrangements affecting barriers to transmission markets.

Table A3.1:

Jurisdiction	Arrangement	Comment
NSW	NSW Electricity Infrastructure Roadmap	Appears to increase barriers to transmission markets
Victoria	Victorian Transmission Investment Framework	Intended to enhance contestable framework in VIC however, the final report is still to be published.
Queensland	Queensland SuperGrid Infrastructure Blueprint	Powerlink is the regulated government owned monopoly provider
Tasmania	Tripartite funding arrangement for Marinus link	Marinus link is being pursued as monopoly infrastructure by TasNetworks

Jurisdictional arrangements seek to overcome the limitations of vertical separation between generation and transmission, in the national framework, by coordinating and integrating REZ transmission planning, design, investment and operations. However, they appear to by-pass attempts to reduce barriers to entry to transmission markets in the national electricity regulatory system.

New South Wales

The NSW arrangements not only seem to shift REZ transmission cost recovery from generators to consumers, via jurisdictional scheme arrangements, they also appear to increase rather than reduce barriers to entry to transmission markets.

Under the NSW Electricity Infrastructure Investment Act, the scope of network infrastructure projects includes both REZ network infrastructure projects and priority transmission infrastructure projects.

Provisions in the Act regarding competitive processes for long term energy services agreements do not apply to network infrastructure.[63] The minister may direct a network operator to carry out an infrastructure project, subject to certain conditions.[64] The EII Act provides for network operators to recover their costs from an electricity infrastructure fund, funded by consumers via charges levied by the Distribution Network Service Provider (DNSP).

62 See page i of Directions Paper, Transmission Review – Contestability, 24 November 2022, AEMC.

63 LTES tendering provisions in Division 4 appear not to apply to Network infrastructure projects in Part 5. The AER Guideline distinguishes between LTES agreement costs and Network operator costs.

64 Division 2 of the Act.

The EII Act prevails in the event of any conflict with the NEL.[65] Where approved by the economic regulator,[66] network operators may recover payments they make to the fund - whether for LTSAs or Network operator payments - from retailers which will in turn recover the amounts from NSW consumers through their retail bills.

The NSW cost recovery arrangements have been found by the AER to qualify as a jurisdictional scheme under the National Electricity Rules. Under jurisdictional schemes, ongoing transmission costs are not recovered under Chapter 5 or under AER determined regulated transmission charges (TUoS). They are instead added to Network Use of Service (NUOS) charges from DNSPs to retailers, which are then passed on in full to consumers.[67]

The AER has been appointed under the Act to be the regulator. The AER has released a guideline regarding contributions to the Electricity Industry Fund.

Figure A3.1: NSW REZ framework

From initiation to projected operation = +7 years						
18 months	Not Applicable	6 months^	24 months^	36 months^		
Community Engagement						
System Scenarios	Candidate Pathways	Optimal Pathway	Transmission Projects	Approvals	Delivery	Review
Develops plausible energy futures for next 25 years based on sector trends & policy, including net zero target via: • State input into ISP • AEMO ISP • AEMO Services IIO	EnergyCO develop NIS with a set of candidate options for building out transmission grid to meet different energy futures in a way that balances economics and engineering with investor interest, land use considerations, regional strategic opportunities and community preferences • Strategic land assessment • Available network capacity • Multi-criteria analysis • Least-cost engineering analysis • Verify candidate power system	EnergyCo develops optimal transmission pathway to provide for REZ development that is in the best interests of customers based on the advice of AEMO Services	EnergyCo Identifies the transmission projects that most efficiently meets the optimal REZ pathway • Transmission Efficiency Test performed by AER • Investment authorised by AEMO Services or Minister • Procurement (underpinned by regulated income determined by AER NSW)	EnergyCo seeks planning and environmental approvals required under relevant legislation	Competitive transmission provider delivers project in accordance with contract terms and conditions	Annual review and re-run of the process every 4 years to ensure planning is consistent with emerging developments

65 Clause 27 of the Act.

66 See Parts 5 and 7 of the NSW Electricity Infrastructure Investment Act and Figure 1 of the AER's NSW Infrastructure Fund – Contribution Determination Guideline, September 2022.

67 NUOS consists of DUoS, TUoS and recovery of qualifying jurisdictional schemes.

The Central-West Orana REZ was identified in the 2020 ISP and declared by the NSW government in August 2022[68] and the related transmission projected commenced in 2021, with the three shortlisted competitive providers announced in May 2022.[69] However, the transmission project for the REZ is not expected to be completed until 2027[70], suggesting that from the identification of need in July 2020[71] to delivery will take at least 7 years.

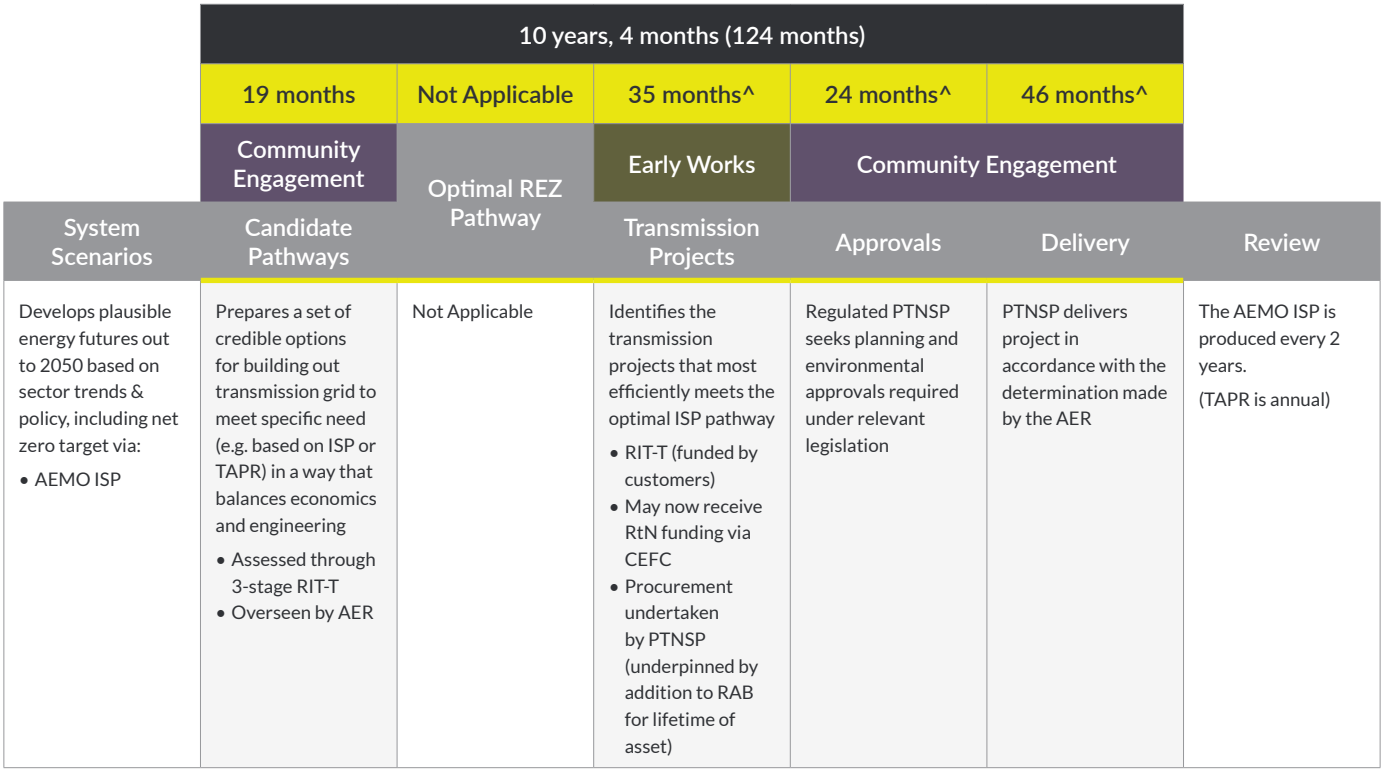
New South Wales (and South Australia)

The PTNSP in both NSW and South Australia are privately owned (see table) and also adhere to the NER for investment in new transmission.

Table A3.2: ownership of Transgrid and Electranet

Jurisdiction	PTNSP	Shareholders
NSW	TransGrid	Spark Infrastructure (15%) Utilities Trust of Australia fund (20%) Caisse de depot et placement du Quebec (25%) Abu Dhabi Investment Authority (20% Kuwait Investment Authority (20%).
South Australia	Electranet	EI by Australian Utilities Pty Ltd (53.44%) State Grid Corporation of China (46.56%).

Figure A3.2: NSW regulated transmission framework



68 https://www.energyco.nsw.gov.au/cwo-rez-draft-access-scheme-declaration

69 https://www.nsw.gov.au/media-releases/central-west-orana-renewable-energy-zone-tender-shortlist-announced

70 https://infrastructurepipeline.org/project/central-west-orana-rez

71 https://aemo.com.au/-/media/files/major-publications/isp/2020/final-2020-integrated-system-plan.pdf?la=en&hash=6BCC72F9535B8E5715216F8ECDB4451C

Project EnergyConnect, the interconnector between NSW and South Australia has so far taken six and a half years to reach the point of construction. The South Australian works began in February 2022 and the NSW works at the western end beginning in July 2022.[72] Project EnergyConnect is not expected to be operational until 2024. In addition, the contractor for the western end of the NSW portion went into administration in December 2022[73], which may impact the delivery of the interconnector.

Victoria

Victoria introduced contestability arrangements in the 1990s for all projects valued at over $10 million that pass the Regulatory Investment Test for Transmission (RIT-T).

Victoria established a model for contestable delivery of transmission assets, before the establishment of the NEM and the National Electricity Rules.

AEMO is currently responsible for identifying the need for new, and augmentation of, transmission assets. Subject to thresholds, AEMO will then seek competitive providers to deliver the new asset to AEMO design specification.

Victoria has separated the planning function from transmission asset ownership and delivery. In Victoria, AEMO undertakes the system planning function, via the annual Victorian Annual Planning Report (VAPR) and RIT-Ts. This potentially allows transmission owners/operators other than SP AusNet (the PTNSP) to undertake transmission projects.

In practice, transmission assets that have involved a competitive process have been awarded to the PTNSP or its associated unregulated business. Transgrid (NSW PTNSP) builds, owns and operates two terminal stations in Victoria.

Figure A3.3: Victorian Transmission Investment Framework for new

8 years, 7 months (103 months)					
36 months	7 months	12 months^	12 months^	36 months^	
		Community Engagement			
System Scenarios	Candidate Pathways	Optimal Pathway	Early Works Assesmenets	Approvals	Delivery	Review
Develops plausible energy futures for next 25 years based on sector trends & policy, including net zero target via: • State input into ISP • AEMO ISP	Prepares a set of candidate options for building out transmission grid to meet different energy futures in a way that balances economics and engineering with investor interest, land use considerations, regional strategic opportunities and community preferences • Strategic land assessment • Available network capacity • Multi-criteria analysis • Least-cost engineering analysis • Verify candidate power system	Develops optimal transmission pathway to provide for REZ and Other transmission development that is in the best interests of customers • Cost-benefit analysis • Optimal REZ pathway analysis • Optimal interconnector analysis	Transmission Projects Identifies the transmission projects that most efficiently meets the optimal REZ pathway • State-based investment test (supported by concessional financing from CEFC) • Procurement (underpinned by a negotiated contract & service agreement for the life of the asset – 40-50 years)	Competitive transmission provider seeks planning and environmental approvals required under relevant legislation	Competitive transmission provider delivers project in accordance with contract terms and conditions	Annual review and re-run of the process every 4 years to ensure planning is consistent with emerging developments

72 https://infrastructurepipeline.org/project/project-energyconnect
73 https://www.cloughgroup.com/news/clough-placed-under-voluntary-administration

In 2020, the Victorian government amended the National Electricity (Victoria) Act of 2005, to provide the government with the ability to exempt certain transmission projects from the usual regulatory processes, such as the RIT-T, to expedite the delivery of transmission.[74] To date, the 'NEVA Order' has not been used, with the Western Renewable Link and VNI-West progressing (slowly) through the RIT-T process.

In addition, the Victorian government is developing the Victorian Transmission Investment Framework (VTIF)[75], which will give the newly-formed VicGrid overall responsibility for planning and delivering REZ and associated transmission projects in Victoria.

The current Victorian contestability framework is allowed for in the NER and has been explored as an option to deliver contestability NEM-wide.[76]

The Victoria and NSW Interconnector (VNI) West, takes in a number of key REZ, is likely to take over eight years to deliver, having already taken over three and a half years to reach consideration of routes. There are many reasons for this. While contestability to deliver projects in Victoria has been a key feature, it has not been triggered by AEMO as the Transmission Victorian Planner. Further, the early works and engagement to date have been suboptimal. Community engagement in the pathway selection of a transmission project has been a major contributor to the delays of this project. This can be seen in Figure A2.3 above.

Queensland

The PTNSPs in both Queensland and Tasmania are state government owned and currently follow the NER for the delivery of new transmission networks.

Figure A3.4: Regulated, government-owned transmission network upgrade to existing transmission

4 years, 8 months (56 months)				
10 months	Not Applicable	7 months	12 months	27 months
		Community Engagement		

System Scenarios	Candidate Pathways	No Early Works		Approvals	Delivery	Review
		Optimal REZ Pathway	Transmission Projects			
Develops plausible energy futures out to 2050 based on sector trends & policy, including net zero target via: • AEMO ISP	Prepares a set of credible options for building out transmission grid to meet specific need (e.g. based on ISP or TAPR) in a way that balances economics and engineering • Assessed through 3-stage RIT-T • Overseen by AER	Not Applicable	Identifies the transmission projects that most efficiently meets the optimal ISP pathway • RIT-T (funded by customers) • May now receive RtN funding via CEFC • Procurement undertaken by PTNSP (underpinned addition to RAB for lifetime of asset)	Regulated PTNSP seeks planning and environmental approvals required under relevant legislation	PTNSP delivers project in accordance with the determination made by the AER	The AEMO ISP is produced every 2 years. (TAPR is annual)

74 https://www.energygridalliance.com.au/national-electricity-victoria-amendment-bill-2020/

75 https://engage.vic.gov.au/victorian-transmission-investment-framework

76 https://www.aemc.gov.au/sites/default/files/2022-07/Options%20paper%20-%20contestability%20-%20TPIR.pdf

The Queensland NSW Interconnector is an upgrade to an existing transmission line and established easement was recently completed. It was delivered in under five years, and the first ISP 2018 project to be commissioned.

Queensland is also considering developing its own REZs and REZ-related transmission investment framework. In it, Powerlink will be legislated as the state planner and monopoly transmission provider.

Supply chain timescales

We have used the publicly available information to illustrate an example of the potential procurement timelines for major transmission projects.

As can be seen in the table below, Transgrid's single element of Project EnergyConnect (western end) took more than 30 months from RFI (date not known) to breaking ground.

As a guide, this is still highly conservative when we consider the competing transmission projects domestically and globally seeking similar material and resources.

Table A3.3

Transmission Projects REGULATED Transgrid for Project Energy Connect	30 months	Not known	Transgrid RFI
		Jan 2020	RIT-T approved by AER
		Jan 2020	Short-list of 3 bidders
		Feb 2020	Tenders open
		Oct 2020	Successful tenderer announced: Clough + Elecnor JV (Clough went into administration December 2022)
		May 2021	AER approve CPA
		Jun 2021	Contract signed between Transgrid, Clough & Elecnor
		Sep 2021	Planning approval granted for western end
		May 2022	Early works (western end) commence
		Jul 2022	Main works (western end) commence

Appendix 4

The structure of electricity transmission markets in Australia

Electricity transmission markets in Australia have been shaped by regulation, beginning with the structural separation of transmission from generation, following the corporatisation of former state integrated electricity commissions in the mid-1990s.

Transmission markets can be defined in two dimensions: funding source and geography. This section outlines the ways in which regulation has constrained transmission markets.

The scope of this report is limited to the interconnected NEM, which includes nine separately owned and operated transmission systems.

Regulated market divisions – geographical

The national electricity market (NEM) refers to Australia's major interconnected system, excluding Western Australia and the Northern Territory. In each NEM jurisdiction, there is a designated Primary Transmission Network Service Provider (PTNSP) established under jurisdictional and national electricity law (NEL), for participating jurisdictions.

Each PTNSP holds a statutory monopoly defined by geography ('franchise') and asset type – e.g. minimum voltage of 132kV – relative to distribution monopolies in the same franchise area. This is summarised in the table below.

Table A4.1

Jurisdiction	PTNSP	Other TNSPs & MNSPs
NSW	TransGrid (Pr)	AusGrid (Pr), DirectLink (Pr), MurrayLink (Pr)
Queensland	Powerlink (Pb)	DirectLink (Pr)
Victoria	AusNet (Pr)	BassLink (Pr)
SA	ElectraNet (Pr)	MurrayLink (Pr)
Tasmania	TasNetworks (Pb)	BassLink (Pr)

Pr = Privately owned; Pb = Publicly owned

There are three regulated TNSPs that are not PTNSPs. These are Ausgrid in NSW and two TNSPs owned by the APA Group: DirectLink and MurrayLink operating in NSW, Queensland and SA. Basslink is operated as a Market Network Service Provider (MNSP, also now owned by APA Group).

There are a variety of ownership models for the TNSPs and PTNSPs in the NEM. Powerlink are TasNetworks are wholly-owned by their state government. All others are being privately owned and answerable to private shareholders.

These ownership models impacts both the operation of the PTNSP and their risk appetites, as was shown with the investment decisions by Transgrid[77] and Electranet[78] related to Project EnergyConnect.

77 https://www.aemc.gov.au/rule-changes/participant-derogation-financeability-isp-projects-transgrid#:~:text=TransGrid%20sought%20a%20rule%20change,System%20Plan%20(ISP)%20projects.

78 https://www.aemc.gov.au/rule-changes/participant-derogation-financeability-isp-projects-electranet#:~:text=ElectraNet%20sought%20a%20

Within each jurisdiction, entry to transmission markets is limited by the need to acquire jurisdictional licences. Jurisdictional licences impose various obligations on TNSPs, such as with respect to reliability of supply. TNSPs must also be registered by the AEMO and comply with its directions.

TNSPs are also subject to jurisdictional spatial or environmental planning systems that control the operation of existing and potential new easements for transmission corridors. Some TNSPs such as TransGrid have explicit recognition and privileges under jurisdictional planning systems for the development of new easements.

Regulated market division – funding sources

Under the current arrangements, within each transmission geography, the markets are further disaggregated by regulation of funding sources into:

- Consumer funded transmission markets that are explicit monopolies and regulated by the Australian Energy Regulator (AER).
- Generator funded markets that are notionally contestable and operate under either under:
  - a set of rules designed by the AEMC; or
  - jurisdictional specific regulations such as those developed under the NSW electricity infrastructure roadmap.

The table below summarises the differences in contestability, funding sources, and regulation within each geographical transmission market, according to the National Electricity Rules (NER). For simplicity, transmission markets are broadly defined by whether they are funded by consumers or generators.

Table A4.2

Asset	Funding source	Contestable?	Entity	Regulation	Type
Primary transmission network in participating jurisdictions	Consumer	No	PTNSP	• Regulated by AER • Regulatory investment test for prudency & efficiency	'Core' shared transmission network owned and operated by TNSPs
Identified User Shared Asset (IUSA) or Designated Network asset (DNA) owned by PTNSP	Generator	No	PTNSP	• Regulated by AER but outside the RAB • Negotiated contract with possibility of AER arbitration • Capital contribution to TNSP outside the RAB	Scale efficient network extensions – for example connections between generator DNA/DCAs and the core shared network
Third party designated IUSA or DNA	Generator	Yes, notionally	PTNSP and third party under network operating agreement	• Not regulated by the AER • Prohibition on generator ownership • Open access • Non-regulated below a certain threshold	Scale efficient network extensions – for example connections between generator DNA/DCAs and the core shared network
Dedicated Connection Asset (DCA)	Generator	Yes, Notionally B, O, Op & M	PTNSP or asset owner's facility	• Open access • Non-regulated	Discrete transmission asset connecting generator to shared transmission network
Network connection asset	Generator	Yes, Notionally B, O, Op & M	TNSP		
Facility of a transmission network user	Generator	Notional B, O, Op & M		• Registration required	Deemed part of the network customer's facility

Table key: B=Build; O-Own; Op=Operate; M=Maintain

Source: NER 5.2A.2

The 'core' transmission markets are consumer funded with prices set by the AER under chapter 6A of the NER. Network planning and expansion are regulated under Part D of chapter 5 of the NER.

PTNSPs are responsible for transmission planning in their respective franchise areas, producing a Transmission Annual Planning Report (TAPR). In the development of the biennial ISP, AEMO works with the PTNSP and incorporates the TAPR. For new transmission, depending on whether the project is identified as a priority transmission project in the ISP, a regulatory investment test – transmission (RIT–T), must be undertaken by the PTNSP.[79]

The regulated PTNSPs earn a regulated income on their Regulated Asset Base (RAB).[80] The objective of the RIT-T is to ensure prudent and efficient capital expenditure. This is to avoid or minimise a 'gold plating' problem, whereby regulated monopolies seek to expand their RAB to maximise income, and hence profits.

79 Victorian arrangements vary from this and are discussed below.

80 https://www.aer.gov.au/publications/guidelines-schemes-models/rate-of-return-instrument-2022

The rules include provision for Market Network Service Providers (MNSPs) to participate in NEM transmission markets.[81] There is currently only one transmission entity in the NEM that operates as an MNSP. Basslink is a High Voltage Deep Sea Cable (HVDC) link that connects Tasmania and Victoria. However, it has struggled too operationally[82] and economically.[83]

Both designated network assets (DNAs) and dedicated connection assets (DCAs) may be owned by the PTNSP or a third party. Network connection assets may only be owned by TNSPs. Transmission components deemed to be part of the facility of a transmission user may be owned by network users such as generators and end-consumers.

DNAs and DCAs are subject to the following requirements:

- Ownership separation from generation, including generation connected to and using DNAs and DCAs.
- Exclusive operation of DNAs and DCAs by the PTNSP once energised.
- Network operating agreements between the third-party operator and the TNSP.
- Connection and access under chapter 5 ('open' access).
- An access policy established by the TNSP or third-party consistent with NEM 'open access'.

Cut in works and upgrades, where the transmission network connects with DNAs, are non-contestable and may only be undertaken by the TNSP. The functional specification of Individual Use of System Agreement (IUSA) services must be undertaken by the TNSP and hence are not contestable.[84] The functional specification includes preferred equipment and suppliers, design specifications, and many other aspects. Possibly contestable IUSA services include provision of a site plan, asset layout and configuration, specification of vendor equipment, civil, structural, mechanical and electrical detailed design and other matters.

System operator functions

A notable feature of Australian electricity markets is that grid system operator functions are not undertaken by transmission entities. AEMO manages multiple transmission systems operated by separate transmission-asset owning licensed entities.

The core functions of a system operator include:

- Setting common quality and reliability standards for participating transmission, across the relevant transmission systems.
- Exerting control over transmission systems in real time.
- Responding to any threats to, or outages in, the transmission system, including by issuing directions to individual transmission, generation or storage facilities.

81 5.18

82 https://www.hydro.com.au/news/media-releases/2017/12/20/basslink-cable-failure-investigation

83 http://www.basslink.com.au/2021/11/12/basslink-enters-voluntary-administration/

84 See NER 5.2A.4

Market concentration and the international context

A notable feature of the current market structure is that it is highly concentrated, with 83 per cent of revenues being retained by the three major PTNSPs.

The table below summarises the structure of Australia's major interconnected transmission markets in terms of revenues and assets funded by consumers via transmission use of service (TUoS) charges.

Table A4.3

PTNSP FY 2021 ($m)	Regulated revenue ($m)	Regulated Asset Base ($m)	Customers	Per cent of revenue
TransGrid	784	6,696	3,977	28
AusNet (T)	784	3,272	3,019	28
Powerlink	743	7,164	2,257	27
ElectraNet	320	2,787	914	12
TasNetworks (T)	141	1,484	295	5
Total	**2,773**	**21,404**	**10,462**	**100**

Source: Australian Energy Regulator Electricity Network Performance Report July 2022 [Add footnote]

This excludes: Ausgrid, Directlink and Murraylink.

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