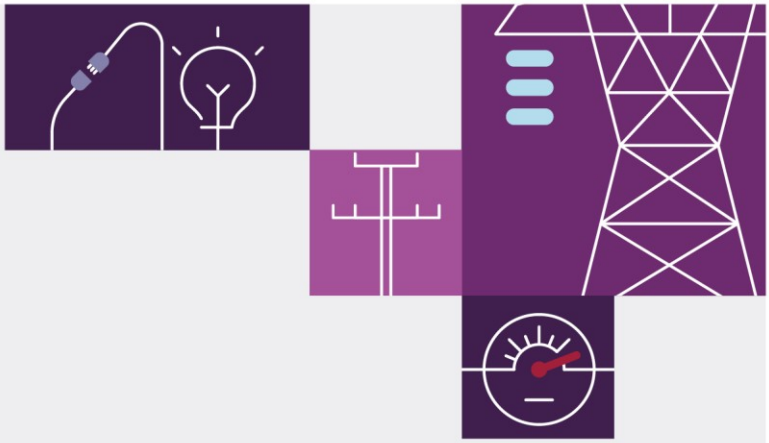
AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Appendix 8. Social Licence

June 2024

Appendix to the 2024 Integrated System Plan for the National Electricity Market



Important notice

Purpose

This is Appendix 8 to the 2024 *Integrated System Plan* (ISP) which is available at https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp. AEMO publishes the 2024 ISP pursuant to its functions under section 49(2) of the National Electricity Law (which defines AEMO's functions as National Transmission Planner) and its supporting functions under the National Electricity Rules. This publication is generally based on information available to AEMO as at 1 May 2024 unless otherwise indicated.

Disclaimer

The information in this document is provided for explanatory purposes and may be subsequently updated or amended. This document does not constitute legal, business, engineering or technical advice, and should not be relied on as a substitute for obtaining detailed advice about the National Electricity Law, the National Electricity Rules, or any other applicable laws, procedures, or policies. AEMO has made reasonable efforts to ensure the quality of the information in this document but cannot guarantee its accuracy or completeness.

Accordingly, to the maximum extent permitted by law, AEMO and its officers, employees and consultants involved in the preparation of this document:

- make no representation or warranty, express or implied, as to the currency, accuracy, reliability, or completeness of the information in this document; and
- are not liable (whether by reason of negligence or otherwise) for any statements or representations in this document, or any omissions from it, or for any use or reliance on the information in it.

Copyright

Version control

Version	Release date	Changes
1	26/6/2024	First release

AEMO acknowledges the Traditional Owners of country throughout Australia and recognises their continuing connection to land, waters and culture. We pay respect to Elders past and present.

ISP Appendices

Appendix 1. Stakeholder Engagement

- Engagement program overview
- Stakeholder feedback – key themes
- Preliminary engagement
- Major engagements

Appendix 2. Generation and Storage Opportunities

- Impacts of the changes since the Draft 2024 ISP
- A rapidly evolving NEM will transform energy supply
- Generation and storage development opportunities across scenarios
- Extended sensitivity analysis on generation and storage development opportunities
- Sensitivity analysis from the Draft 2024 ISP

Appendix 3. Renewable Energy Zones

- REZ candidates
- REZ development overview
- Regional outlook and REZ scorecards

Appendix 4. System Operability

- The NEM's demand profiles will continue to evolve
- VRE penetration and curtailment
- System flexibility manages increased variability
- Operating the power system during long, dark, and still conditions
- Storage technologies will firm VRE
- Implications for coal operation during the transition
- Impacts of gas system adequacy on system operability
- Maintaining reliability during the transition

Appendix 5. Network Investments

- Transmission development overview
- Committed and anticipated projects
- Actionable projects
- Future ISP projects

Appendix 6. Cost-Benefit Analysis

- Approach to the cost-benefit analysis
- Impacts of the changes since the Draft 2024 ISP
- Determining the least-cost development path for each scenario
- Determining the set of candidate development paths to identify the ODP
- Assessing the candidate development paths
- Selecting the optimal development path
- Testing the resilience of the candidate development paths
- NEM-wide distributional effects
- The impact of consumer risk preferences on transmission timings
- The optimal development path
- Sensitivity analysis from the Draft 2024 ISP

Appendix 7. System Security

- Recent reforms to the security planning frameworks
- AEMO's approach to system security planning
- System security concepts and requirements
- Projected outlook and opportunities

Appendix 8. Social Licence

- Social licence overview
- Social licence for infrastructure development
- Consumer mobilisation, adoption, and coordination

Social licence and the energy transition

Contents

Executive summary 5

A8.1 Social licence overview 6

A8.2 Social licence for infrastructure development 9

A8.3 Consumer mobilisation, adoption, and coordination 18

A8.4 Social licence and the energy transition 21

Glossary 22

Tables

Table 1 Social licence considerations 7

Table 2 Examples of drivers that can ‘dial up or down’ social licence 10

Table 3 2024 ISP social licence sensitivity parameters 12

Table 4 Social licence sensitivity outcomes 14

Table 5 Reforms and consultations underway 17

Executive summary

AEMO's *Integrated System Plan* (ISP) is a roadmap for the transition of the National Electricity Market (NEM) power system, with a clear plan for essential infrastructure that will meet future energy needs. The ISP's optimal development path (ODP) sets out the needed generation, storage and network investments to transition to net zero by 2050 through current policy settings and deliver significant net market benefits for consumers.

The change that Australians will experience through the energy transition over the coming years is significant, and all governments and organisations involved in the transition will need to work with consumers and the broader Australian community, to actively support and guide that change.

Crucial to the success of this transition is social licence, or the ability of involved groups to individually and collectively build and maintain trust and social acceptance with the people most affected by the impacts, opportunities and challenges it brings.

As a deeply personal and often intangible concept, social licence is difficult to measure meaningfully; it can be shaped by people's core values, views and experiences, shift and evolve over time in response to events, and is unique within and across different groups of people and communities.

AEMO acknowledges that social licence is an area of continued learning and development for the organisation. While AEMO is actively working with key groups to improve its understanding of the social, cultural, economic and other impacts, opportunities and challenges that the energy transition affords for local, regional and national communities, this will take time.

In seeking to better understand social licence and its role within the energy transition, AEMO has sought to define its potential influence and impact at three key levels:

- Local community acceptance of new infrastructure development.
- Social acceptance and mobilisation related to consumer energy resources (CER), including adoption of solar photovoltaic (PV) systems, batteries, electric vehicles (EVs), and the ability for CER to be coordinated or 'orchestrated'.
- Social acceptance of the broader energy transition.

While some of these elements have directly informed the development of the 2024 ISP, others are noted in this Appendix as an opportunity to recognise current thinking and work underway across industry, and consider how AEMO could integrate these insights in the ISP and broader work.

Key changes from the Draft 2024 ISP

- Updates to clarify social licence sensitivity parameters and outcomes.
- Updates to the overview of social licence reforms and reviews.
- Addition of new CER coordination sensitivity insights.

A8.1 Social licence overview

As part of the development of the 2024 ISP, AEMO has sought to quantify and take into consideration social licence challenges and opportunities. Integrating an issue as complex as social licence within the ISP is a difficult task.

As the ISP is a roadmap through the energy transition, it focuses on broad planning considerations, and its consideration of social licence can only be at a high level. Much of the responsibility to understand and engage with local communities sits with relevant project developers (whether generation developers, network service providers or others) and tiers of government, as development of infrastructure for the energy transition progresses.

Response to Draft ISP social licence consultation feedback

As part of its Draft 2024 ISP consultation AEMO invited stakeholder feedback on how social licence could be further considered in the ISP, and how to quantify the potential impact of social licence in sensitivity analysis.

On policy matters, AEMO received some valuable commentary around opportunities to highlight ongoing and substantive work underway by industry and governments to advance matters of social licence and community engagement in the sector and has provided further examples in Sections A8.2.3 and A8.2.4 of this Appendix.

Several groups suggested an opportunity to extend sensitivity modelling to consider specific technologies (such as gas-powered electricity generation and offshore wind) and broader social impacts. AEMO agrees that this extension of the modelling could provide additional insight but does not consider that these enhancements would ultimately change the broad outcomes of the sensitivity analysis.

Given the complexity and time constraints on sourcing useable inputs and consulting appropriately with experts to design new sensitivity parameters and modelling, it has not been feasible for AEMO to incorporate these suggestions in the 2024 ISP. Further clarification around social licence sensitivity parameters has been added to Sections A8.2.1 and A8.2.2 of this appendix.

AEMO recognises the importance of social impact, community sentiment and benefits related to the energy transition. AEMO will consider these elements further in 2026 ISP planning and in light of Energy Ministers' endorsement of recommendations in the Federal Government's review of the ISP, along with opportunities to seek insights from a diverse range of consumer and environmental, social and governance experts.

For more detail on how ISP feedback has been considered more broadly, see the *2024 ISP Consultation Summary Report*.

How social licence is considered in the ISP

Social licence is considered in the 2024 ISP in a range of ways, as summarised in Table 1 below.

Table 1 Social licence considerations

Consideration	Detail
Scenarios	AEMO creates planning and forecasting scenarios which include trends relevant for social licence such as economic conditions in Australia and the pace of investment to decarbonise the economy.
Sensitivities	In collaboration with the ISP Consumer Panel and Advisory Council on Social Licence, AEMO has used sensitivity analysis to test the resilience of development pathways in the ISP to *Reduced Social Licence* for new generation and transmission projects. AEMO has also tested *Reduced CER Coordination* and *Reduced Energy Efficiency* to test the impact of lower levels of consumer-led investment.
Joint planning	AEMO has collaborated with transmission network service providers (TNSPs) and jurisdictions to co-design conceptual transmission network options for the ISP. At the conceptual stage, potential routes and locations are indicative only and should not be considered as fixed locations or routes. As projects are further developed, AEMO incorporates the latest advice available from the relevant TNSP or jurisdiction based on their early engagement with potentially affected communities, landowners, and other stakeholders. Joint planning advice can impact on project scope, cost, build times, and even feasibility. As part of preparing transmission augmentation options for the ISP, AEMO takes into account advice on projects that can make use of existing easements, uprating of existing transmission elements, and consideration of existing network capacity that may be freed-up as existing generation exits the market. AEMO also acknowledges the need for community engagement as part of any network development, and a time allowance is included for this in the assumed 'lead time' for a transmission augmentation. AEMO also recognises the important role distribution network service providers (DNSPs) will play in the transition, including through hosting and facilitating the benefits of consumer energy resources. More active consideration of the role and investment needed in distribution networks will be considered in the 2026 ISP.
REZs – identification and location	Through the identification of candidate renewable energy zones (REZs), AEMO considers both the boundaries and development limits that should be applied to reduce negative community impact and has mapped Aboriginal and Torres Strait Islander title to provide additional information to TNSPs and governments about Indigenous land interests and enable early engagement. The selection of candidate REZs and their indicative location and boundaries are consulted on through each *Inputs, Assumptions and Scenarios Report* (IASR) and ISP cycle to take into account TNSP input, government feedback and other stakeholder advice. Examples of this are ensuring that the New South Wales REZs are updated as community consultation by EnergyCo occurs, and taking into account changes to offshore renewable zones following consultation by the Federal Government.
REZs – resource limits and land use limits	REZ resource limits are set in the ISP to estimate resources available for renewable energy developments. This availability is determined by existing land use (for example, agriculture) and environmental and cultural considerations (such as national parks), as well as the quality of wind or solar irradiance, and typical land use requirements for renewable energy generation. AEMO adjusts REZ resource limits when the boundary of a REZ changes or when appropriate evidence becomes available. In addition to assuming resource limits for each REZ when undertaking the ISP modelling, AEMO also sets a land use limit for each REZ for the amount of land that could be assumed to be used for renewable energy within a REZ. These land use limits are consulted on through the IASR cycle and were originally derived through consultation with governments and other stakeholders. More information on land use limits can be found in AEMO's 2023 IASR. The 2024 ISP also considers some, but not all, costs related to proposed land use, including some transmission augmentation cost elements, including land elevation, land use mapping, land acquisition, strategic landholder payments where applicable and biodiversity offsets. All capital costs (generation, storage and transmission) include land costs based on historical trends. Strategic land payment schemes have been added more recently and applied where relevant (Queensland, New South Wales and Victoria).

Further information can be found in:

- Appendix 1. Stakeholder Engagement.
- Appendix 3. Renewable Energy Zones.
- Appendix 6. Cost Benefit Analysis.

Social licence impact on the ISP and optimal development path (ODP)

While the outcome of AEMO's social licence sensitivity analysis did not change the proposed ODP, it did have a notable impact on the economy-wide net market benefits that could be realised overall, as outlined in Section A8.2.2 of this Appendix.

That said, AEMO is mindful that its application and consideration of social licence is only one potential approach to incorporate social licence at the national planning level. It is the first time AEMO has attempted to consider social licence more explicitly in the ISP, and stakeholder feedback about how the ISP incorporates social licence in the future is welcomed.

Given its nature, the ISP also does not account for shorter-term and more localised social licence impacts communities are experiencing in relation to projects happening here and now. AEMO continues to support the need for early and good practice engagement by project developers to ensure community voices and concerns are considered and responded to — both to enhance community outcomes and to support the timely delivery of works critical to Australia's ongoing energy security, reliability and affordability, and a net zero future.

Examples of good practice work being led by industry and governments to address these factors are further explored in Section A8.2.4 of this Appendix.

A8.2 Social licence for infrastructure development

Historically, the power system was developed to generate and transport large outputs of electricity generated from centrally located coal-fired generators to load centres. However, as coal retires and new renewable generation is developed to replace it, the structure of the power system needs to change.

Who is responsible for obtaining social licence?

Obtaining and granting social licence is not a specified process and will vary from location to location and project to project. However, it is evident that there are a number of parties involved. The aspects of social licence regarding specific projects require project proponents, project planners, relevant tiers of government and major construction partners all being involved in talking with communities, well before preferred project location and aspects are decided. A crucial aspect of seeking social licence is that all parties understand that there are many unanswered questions, and social licence starts with identifying the possibilities, concerns and opportunities of any potential projects on and for all parties.

Common principles and industry good practice engagement guidelines should also be applied to ensure a consistent and transparent approach to engagement that meets community expectations.

ISP forecast for new infrastructure development

The ODP in the 2024 ISP includes over 127 gigawatts (GW) of new utility-scale renewable generation by 2050. Future energy consumption from the NEM is forecast to almost double by 2050. To meet this growth, renewable energy connected with transmission and distribution, firmed with storage and backed up by gas-powered generation is the lowest cost way to supply electricity to homes and businesses as Australia transitions to a net zero economy. The 2024 ISP highlights the need for:

- Significant new renewable energy development in the coming years, from forecast investments by consumers in their own energy resources and complemented with significant developments at utility scale within designated REZs.
- Approximately 5,000 km of new transmission lines across the NEM over the next decade; and close to 10,000 km by 2050 to connect new generation and REZs to demand centres and ease congestion on existing transmission lines.

As part of the development of this infrastructure, the energy industry will need to establish and maintain social licence in local communities that are being asked to host new generation, storage, and transmission.

Establishing social licence for infrastructure development requires intentional and ongoing relationship-building between organisations and communities to foster acceptance and trust. Communities also have their own intrinsic social licence ‘commitments’ to and with each other (for example, the right for farmers to farm, rural communities to function harmoniously, and Aboriginal and Torres Strait Islander people to practice culture) which must be considered. Community acceptance of projects is fostered when organisations prioritise trust and

deliver overall positive impact and is granted or withdrawn by the community in line with their social, cultural, and economic conditions[1].

As a largely qualitative matter, social licence is also difficult to account for in the ISP due to the complexity of trying to define, quantify and model related costs and benefits in a meaningful way. Table 2 below outlines several social licence considerations AEMO has not yet accounted for in the ISP, but that will influence community views, experiences and engagement around ISP identified projects. This is not intended to be an exhaustive list.

Table 2 Examples of drivers that can 'dial up or down' social licence

Community expectations	People's understanding and acceptance of the need for new infrastructure development, their roles within this, and feeling that their voices, preferences and concerns are being considered and acted on by project proponents.
Social and cultural values	People's perceptions of potential developmental impacts on their sense of place and community, wellbeing, culture, ways of living, and connection to Country.
Environmental values	People's perceptions of potential impacts to local biodiversity, biosecurity, Indigenous heritage, sites of local and community significance, and the visual landscape.
Economic values	People's perceptions of the potential impacts to their households, livelihoods and ability to carry out business, local economies, and the equitable distribution of associated benefits within and across communities.

A8.2.1 Sensitivity analysis to explore low social licence for infrastructure

AEMO recognises the challenges associated with development and delivery of this scale of infrastructure. As part of developing the 2024 ISP, and for the first time, AEMO developed a social licence sensitivity as an input to help inform the selection of the ODP.

This sensitivity considers the more tangible, or quantifiable impact of 'reduced' or 'low' social licence with respect to new infrastructure development, including potential delays to project delivery timelines and increased costs related to proposed land use, including some transmission augmentation cost elements. These are explored further in the next section.

At the outset of the process, AEMO aimed to develop a social licence sensitivity to understand and consider any negative impacts of low social licence for the energy transition and the selection of the proposed ODP.

In this context, low social licence refers to a future state where there is low social acceptance of large-scale energy infrastructure development within a region, to the degree that a development cannot progress, is delayed, or requires considerable change to meet community expectations.

Assessing the potential impact of low social licence is challenging, as it requires defining and applying measurable metrics for what is a largely qualitative topic to the economic models that underpin the ISP. Again, AEMO recognises that the approach and assumptions used to model this sensitivity present just one option, and AEMO is still developing understanding of how social licence could be considered in power system planning.

AEMO greatly values the guidance of the 2024 ISP Consumer Panel and Advisory Council on Social Licence in shaping the design of this sensitivity.

[1] See The Energy Charter *Better Practice Social Licence Guideline*, at https://www.theenergycharter.com.au/better-practice-social-licence-guideline/.

Social licence sensitivity guiding principles

In looking to develop a social licence sensitivity, AEMO first sought to outline some high-level guiding principles to drive its direction, including:

- **Utility-scale infrastructure focus (social licence impacts on transmission, new generation developments and storage solutions)**. This principle reflects that as coal retires it will need to be replaced by substantial volumes of low-cost variable renewable energy (VRE), transported from new REZ locations to existing load centres via new transmission lines. While local distribution networks may be able to host small volume renewable projects at times, they will often encounter constraints when exporting to load centres and have highly correlated generation resources (increasing the impact of low production periods), making transmission-scale infrastructure a necessary option to meet increasing demand.
- **A generalised focus (social licence impact NEM-wide rather than analysing individual regions or projects)**. This principle reflects that localised social licence information is not available for all project options across the ISP horizon, making these difficult to account for.
- **Increasing understanding of impact (incorporate cost and delay impacts from social licence)**. This principle reflects that AEMO is still early on in its journey to understand, quantify and adjust inputs to the ISP model to accurately predict a future state where there is low social licence and particularly acceptance of large-scale energy infrastructure development in the NEM.

Social licence sensitivity parameters

Following the development of the above principles, AEMO considered, with ISP Consumer Panel and Advisory Council on Social Licence input, a number of modelling input parameters in the ISP that could be varied to reflect the impact of potentially adverse social licence outcomes. AEMO recognises that there was no consensus on the application of all principles among those consulted, given the complexity of the topic, and looks forward to doing further work on this in the development of the 2026 ISP.

Importantly, these parameters needed to be compatible with the cost-benefit analysis that AEMO applies to all ISP activities. That is, they needed to be able to quantify the potential impacts of low social licence on net market benefits (defined as the 'net economic benefit to all those who produce, consume and transport electricity in the market') associated with the ODP.

The parameters AEMO varied in modelling to consider social licence included:

- Transmission project delays (adding a delay to transmission to reflect longer lead times to develop transmission projects).
- Transmission projects that cost more to gain social acceptance (adding a cost impost to projects excluding committed and anticipated projects).
- REZ generation cost (adding a cost impost to onshore solar and wind generation build costs within a REZ to reflect increased cost to gain social acceptance).

More details on each of these are provided in Table 3 below.

Table 3 2024 ISP social licence sensitivity parameters

Sensitivity	Details
Transmission timing Extending project lead times for all transmission augmentation options by two years.	• Reflects delay impacts from low social licence for transmission. The delay did not apply to committed and anticipated projects, as these projects have already progressed towards delivery and there is more certainty surrounding their completion dates. • This reflects the impact of low social licence on extended lead times in obtaining transmission easements and property rights.
Transmission costs Project costs assumed to increase by approximately 15%. Reflects changes in work scope due to low social licence.	• Added a cost impost to transmission augmentations to reflect scope changes to routes and designs. The value of the cost increase was chosen by taking recent transmission project scope changes made by TNSPs in response to local stakeholder feedback, and then preparing a cost estimate change using AEMO's Transmission Cost Database to identify the project cost increase as a percentage. AEMO selected 15% as the increase as it was the approximate midpoint of the estimates prepared using recent major transmission project examples. • The scope changes were designed to capture small re-routings, re-design of towers, easement adjustments, and similar changes. The estimates also captured associated materials and labour, and were additional to existing cost estimates that already included scope changes and risks. This is intended to reflect the possibility that even more adjustments and engagements than are already allowed for in contingencies currently included in cost estimates may be needed for transmission projects to address social licence concerns. • This parameter has also been applied to pumped hydro projects, in addition to transmission project costs.
REZ generation costs REZ generation costs estimated to increase by approximately +5% to +60% based on private land parcel density, and applied to specific REZ generation costs by technology type (such as wind or solar)[2].	• Applied to onshore solar and wind generation build costs within each REZ. • Added a cost impost to REZ generation to reflect increased social licence costs within a REZ, such as scope changes and additional community engagement and benefit sharing. • Additional to existing cost estimates that already included community engagement and benefit sharing programs. • Reflects denser REZs that may have more stakeholders and pose higher social licence risks. • Used a generalised approach towards all NEM REZs. AEMO notes that uniformly increasing REZ generation costs reduces the net market benefits overall, as the ISP model optimises costs and benefits of various future generation, firming and transmission options to meet the NEM power system's reliability and security needs and supports government emissions reduction policies in the long-term interests of consumers.

What was not modelled in the sensitivity

Due to the issue complexity and infancy of this sensitivity, the below factors were excluded from modelling:

- **Reduced social licence for gas-powered generation (GPG) and batteries.** This was excluded based on the assumption that GPG and large-scale batteries require smaller land footprints than variable renewables, and are likely to be co-located near existing transmission substations. Depending on the depth[3] of the storage technologies, less land is required for these installations.

[2] For each REZ, the private land parcel density (parcels per square kilometre) was calculated, using state cadastral datasets. Less dense REZs (less than or equal to three parcels per square kilometre when compared to Central-West Orana REZ) had a minimum increase of 5% added to their generation costs. Only eight REZs were more dense than this threshold, and these REZs had proportional increases applied to their generation costs to reflect increased social licence costs. For example, Hunter-Central Coast REZ (N9) is 12 times more dense and a 60% uplift was applied.

[3] Depth refers to the duration of time that a storage technology can discharge at full output before exhausting its stored energy. Short duration technologies such as batteries typically have storage depth measured in hours, whereas deeper technologies such as pumped hydro could have depth that could be measured in hours, or days, depending on the bespoke solution.

- **Reduced social licence due to Native Title and Indigenous Land Use Agreements.** This was excluded based on the complexity of data available, and the fact that Native Title applications, claims and determinations can occur at different times in overlapping coverage areas, making it difficult to quantify in estimating impacts on REZ costs. More information is included in Section A8.2.3 in this Appendix.
- **Undergrounding transmission options.** This was excluded based on the assumption that undergrounding of high voltage alternating current transmission lines across Australia are used for short distance (<30 km), low capacity connections, and that they are cost-prohibitive compared to overhead lines (four to 20 times higher[4]), so they are less likely to be commercially feasible or actioned by project developers. More information is included in Section A8.2.3 of this Appendix.
- **Reduced social licence for offshore wind.** While AEMO does not dispute the applicability of social licence considerations to offshore wind projects, it has not been modelled in this sensitivity for several reasons. At a high level, these include the complexity of estimating associated costs (for example, visual amenity) and insufficiency of relevant data due to the relative immaturity of the offshore wind industry in Australia. At a broader level, the ODP in the 2024 ISP also does not identify the development of offshore wind in the NEM except in Victoria, where it forms a formal part of government policy and emission reduction targets.
- **Reduced social licence for non-REZ-based generation.** This was excluded based on the assumption that generation in REZs offers more scale efficiencies and lower costs than generation connecting outside of these areas.
- **Reduced social licence resulting in no major new transmission project developments**, apart from committed and anticipated projects as well as connection equipment for new generation and storage**.** This scenario, known as the 'counterfactual' development path, is explored separately. More description is provided in Appendix 6.
- **Consideration of community impacts.** Localised community sentiment data related to future transmission projects was not directly considered by AEMO for the 2024 ISP. However, it will be considered in future ISP delivery, in line with the recommendations in the Federal Government's review of the ISP accepted by Energy Ministers.

A8.2.2 Results of the social licence sensitivity analysis

Table 4 summarises the outcomes of the modelling for the Draft 2024 ISP. AEMO did not re-model this sensitivity for the 2024 ISP, as it considered that re-modelling the sensitivity to apply the updates included in the 2024 ISP would not have resulted in substantively different insights or outcomes.

[4] Underground and underground options, 2023 *Transmission Expansion Options Report*, at https://aemo.com.au/-/media/files/major-publications/isp/2023/2023-transmission-expansion-options-report.pdf.

Table 4 Social licence sensitivity outcomes

Key outcome	Details
Low social licence did not materially change the projects in the ODP	The results of the modelling confirmed that the high-level mix, timings and locations of projects identified in the ODP is still the most cost-effective option to support Australia's energy transition and ongoing power reliability and security. Specifically, the ODP is resilient to the *Reduced Social Licence* sensitivity, where its ranking does not change significantly (from first to second). The ODP, across a range of sensitivities and scenarios, remains the best candidate development path overall. There were, however, some noticeable smaller-scale shifts, including: • In REZs, AEMO observed a shift in some project locations from 'more dense' to 'less dense' areas – notably away from REZs near load centres, or those in particularly dense regional areas, with higher numbers of private landholders. The main implication of this is that impacted REZs may not be taking advantage of relatively nearby transmission – rather, more transmission needs to be built to these more remote areas. It also resulted in corresponding earlier development of pumped hydro to compensate, and more solar and less wind built overall. • For transmission projects on major flow paths, AEMO still saw a requirement for proposed new transmission augmentations, however delivered slightly later. AEMO notes that uniformly increasing transmission costs reduces the net market benefits overall, as the ISP model selects the least-cost solution of transmission and generation to meet electricity demand.
Low social licence did affect net market benefits	The additional costs and delays to ODP projects associated with low social licence were found to result in an approximately $4 billion decrease in net market benefits. This highlights the risks to the energy transition and importance of project proponents engaging early and genuinely with local communities to build trust and acceptance with respect to new electricity infrastructure. It is also important to highlight that the realisation of net market benefits is subject to the actions and reactions of local project proponents and communities, which the ISP has not been designed to account for. AEMO expects local TNSPs or jurisdictional bodies to engage early with stakeholders to minimise impacts to communities through the detailed design phase of projects.
Determining a 'tipping point' for low social licence impacts on the ODP would be complex and likely unproductive to model	AEMO considers that increasing the *Reduced Social Licence* sensitivity parameters to the extent that no new renewable transmission or generation is developed would result in a scenario that resembles the 'counterfactual development path' outlined in Appendix 6. Cost Benefit Analysis. This effectively means that where coal generation is retired, substantial tranches of GPG, carbon-capture and storage, and batteries are installed instead. This would cost consumers an extra $18.5 billion relative to the ODP.

More information on the economic outcomes for the social licence sensitivity is provided in Appendix 6.

In applying the above social licence sensitivity and parameters to ISP modelling for the first time, AEMO wishes to acknowledge the ISP Consumer Panel members and Advisory Council on Social Licence for their guidance and also constructive challenge in its shaping and application.

Importantly, AEMO also acknowledges that as an initial view of an incredibly complex and evolving topic, the social licence sensitivity and considerations present just one potential future view. AEMO will continue to seek feedback from stakeholders on opportunities to better integrate and model social licence considerations as part of its future ISP planning.

A8.2.3 Additional social licence considerations in the ISP

Community benefits

AEMO recognises there are challenges and risks associated with the energy transition for communities. However, the energy transition can also bring benefits to rural and regional communities through economic diversification, REZ development, new manufacturing zones, and new technology.

These benefits have the potential to bring significant opportunity to communities, and work is already underway across government and industry to identify and fund benefits to assist with both social licence for the energy transition and consumer mobilisation. For instance, economic opportunity work is being undertaken by state

governments, and the Federal Government's First Nations Clean Energy Strategy and Net Zero Economy Agency.

Opportunities to better coordinate local benefits and economic development around new electricity transmission infrastructure are also discussed in the Australian Energy Infrastructure Commissioner's (AEIC's) *Community Engagement Review* Final Report, released in February 2024. The Federal Government's *National Guidelines for Community Engagement and Benefits for Electricity Transmission Projects* are also expected to provide a consistent approach to building social licence with those impacted by new transmission infrastructure.

AEMO provides some insights in the 2024 ISP about potential workforce requirements indicated by the ODP but does not directly consider localised community benefits as part of its cost benefit analysis. The ODP is designed to optimise the net economic benefit to all those who produce, consume and transport electricity in the market. For more information, see Appendix 6.

AEMO encourages collaboration between governments, industry, and the community during the development of new infrastructure, to maximise the impact that these benefits bring to local communities.

Aboriginal and Torres Strait Islander considerations

The ISP includes candidate REZs that overlap with native title and Indigenous estates. Appendix 3 shows REZs overlaid on the National Native Title Tribunal Indigenous Estates map, reproduced with the permission of the Australian National Native Title Tribunal.

AEMO has undertaken this mapping and provided this information as a guide to assist insights to support governments, councils, and rule-makers with social licence frameworks. As REZs progress to pre-feasibility studies, it will be important that Traditional Owners and land councils are consulted early and regularly in the process. AEMO also recognises the view of the First Nations Clean Energy Network that the energy sector needs to ensure First Nations people play a central role and are able to also harness and benefit from the opportunities presented by the energy transition.

More broadly, the Federal Government is progressing with the First Nations Clean Energy Strategy, which seeks to give First Nations people a say in renewable energy policies and identify improvements and areas for future investment. The strategy aims to target fairer access to renewable energy for Indigenous households, reduce diesel-powered energy generation, and support cheaper energy finance and more skilled employment in remote areas.

Development of the First Nations Clean Energy Strategy will come in addition to the Federal Government's partnership with First Nations Australians through the *First Nations Community Microgrids program* to support deployment of microgrids in First Nations communities, and the *Hydrogen Headstart program* to help First Nations communities engage with hydrogen project developers.

The Federal Government released its First Nations Clean Energy Strategy consultation paper in November 2023, to inform the development of the strategy.

Undergrounding transmission lines

Overhead lines are often an economic, flexible, and responsive design choice for augmenting the high-voltage transmission network. Overhead lines represent the vast majority of the Australian transmission network and have reliably served the community for many years.

In the 2023 *Transmission Expansion Options Report*, AEMO found that the costs of underground cables are approximately four to 20 times higher[5] than overhead lines, depending on a range of design factors such as voltage, capacity and whether the cables can be direct buried or require tunnels. AEMO publishes a Transmission Cost Database that allows stakeholders to explore cost estimates for overhead transmission lines and underground cables.

In contrast to transmission projects in countries that have high population and energy density, Australian transmission projects tend to stretch very long distances. Implementing underground transmission network over these long distances will often be cost-prohibitive and should only be considered on a case-by-case basis. Opportunities for undergrounding network may be feasible for generator connection assets, where distances are shorter, and the investment cost is largely dictated by the capital cost of generation (for example, wind or solar farms).

Recognising the concerns many regional landholders and communities hold around the potential impact new overhead transmission development projects may have on their lives and livelihoods, and preference for undergrounding options, AEMO is also participating in The Energy Charter's 'Evaluating Transmission Undergrounding' initiative. Delivered in collaboration with industry and community representatives, the initiative seeks to enhance transparency around how underground compared to overhead transmission designs are evaluated by transmission businesses and improve communications and engagement for impacted landholders and communities. Expected deliverables include co-developing a shared knowledge and evidence-base, including better practice approaches to assessing and evaluating social costs and mitigating impacts, and addressing public information and evidence gaps through supporting materials.

This work is continuing to progress in 2024 and is likely to be further informed by other jurisdictional and industry-led initiatives including the New South Wales Government's Inquiry into Transmission Undergrounding and the AEIC's *Community Engagement Review Final Report*.

A8.2.4 Reforms and reviews

There are many programs of reform and review work currently underway in relation to social licence and this is a developing space for the energy sector, particularly in relation to transmission development.

AEMO actively participates in the extensive work being led by various jurisdictions, industry members and advocates on social licence. Although not all these components of work relate directly to the ISP, AEMO has sought to explore some of the key elements of social licence and the broader energy transition in Table 5 below. Many of these have progressed since release of the Draft 2024 ISP, and this is not intended to be an exhaustive list.

[5] Underground and underground options, 2023 *Transmission Expansion Options Report*, at https://aemo.com.au/-/media/files/major-publications/isp/2023/2023-transmission-expansion-options-report.pdf.

Table 5 Reforms and consultations underway

Initiative	Details
Australian Energy Regulator (AER) *Social Licence for Electricity Transmission Directions Paper*	The AER released its *Social Licence for Electricity Transmission Directions Paper* for consultation in October 2023. This will form the basis for subsequent, more detailed regulatory social licence guidance in 2024.
Federal Government *National Guidelines for Community Engagement and Benefits for Electricity Transmission Projects*	The Federal Government will publish *National Guidelines for Community Engagement and Benefits for Electricity Transmission Projects* in August 2024. The guidelines aim to provide a consistent approach to building social licence for transmission projects. The guidelines provide principles for community engagement, managing impacts and community benefits and supplement jurisdictional regulations and planning requirements. The guidelines also include evaluation principles for assessing and improving engagement activities to help maintain social licence.
Federal Government *Nationally Significant Transmission Projects* Framework	In addition to the national approach to social licence for transmission projects, the Federal Government is also creating a *Nationally Significant Transmission Projects* Framework to speed up delivery of transmission projects. AEMO understands that social licence will be a key consideration of the framework.
Energy and Climate Change Ministerial Council review of the ISP	In October 2022, Australia's Energy Ministers agreed to a review of AEMO's ISP to ensure it continues to best support Australia's energy transition. In March 2024, the Ministers accepted the review's recommendations and agreed to a set of actions to progress them. These actions include improving the accessibility of the ISP, incorporating community acceptance considerations into transmission expansion options, and more effective consideration of demand-side opportunities such as CER.
AEIC *Community Engagement Review*	In February 2024, the AEIC published its Community Engagement Review final report. The report considers community attitudes towards renewable energy infrastructure and includes nine recommendations, which the Australian Government has accepted in principle. The recommendations aim to maximise community engagement and benefit in planning, developing and operating renewable energy and transmission infrastructure. Work is underway by Energy Ministers to progress recommendation delivery
Australian Energy Market Commission (AEMC) *Enhancing Community Engagement* rule change	In November 2023, the AEMC published a final determination and rule in relation to enhancing community engagement in transmission building. This rule sets out requirements for community engagement and local community consultation on major transmission projects at the regulatory investment test for transmission (RIT-T) stage.
CSIRO *Australian Attitudes Toward The Renewable Energy Transition* report	In April 2024, the CSIRO released its latest report on Australian Attitudes Toward the Renewable Energy Transition. Based on detailed surveying of people in all states and territories, the report explores perceptions of the renewable energy transition generally, social licence aspects related to solar farms, onshore and offshore wind farms, and transmission lines specifically. AEMO understands its insights are intended to help inform planning, programs and other initiatives undertaken by government, industry, and communities, and the survey will form a basis to monitor and understand shifts in social acceptance of the transition as it rolls out over time. Recognising the evolving nature of energy transitions matters, CSIRO developed a core survey which can be enhanced with topical modules, and is open to partnering to explore current, underexplored aspects related to social licence.

A8.3 Consumer mobilisation, adoption, and coordination

As the energy transition progresses, many households and businesses are taking steps to shape their own energy futures. They are adopting innovative ways to reduce and manage their demand, investing in consumer energy resources (CER) including solar systems, batteries, electric vehicles, and contributing to virtual power plants to bring them together. These resources – supported by distribution networks, coordination systems and markets – are playing a transformative role in the energy transition.

Trends in CER

Today, one-third of detached homes in the NEM have rooftop solar, with growth in new systems averaging 12% year on year over the past five years. Rooftop solar is now three times as common in Australia as backyard pools, reaching 3.1 million systems in 2023, and in the summer (Q1) of 2024 contributed a substantial 13% to the NEM's total electricity generation, more than utility-scale solar (8.6%), wind power (11.8%), hydro (5.3%), and gas (4.1%)[6].

Residential and commercial batteries are becoming more numerous as costs decline, and electric vehicle (EV) ownership is expected to surge from the late 2020s, driven by falling costs, greater model choice and availability (assisted by new vehicle emission standards), and more charging infrastructure. Some EVs can also discharge electricity for direct use to household batteries or back into the grid (also known as vehicle-to-grid or 'V2G' enabled EVs).

The 2024 ISP incorporates CER forecasts for each of AEMO's scenarios for the future, with the *Step Change* scenario representing a future with rapid transformation of the energy sector, continued cost reductions for renewable energy investments and strong consumer appetite to contribute through high uptake of CER, and electrified transport. This includes, in 2050:

- 79% of detached homes possessing rooftop solar, and a total rooftop solar capacity of 72 GW.
- 34 GW of battery capacity to complement large-scale generation and provide network support (1 GW today).
- 81 TWh of EV consumption, and up to 97% of all vehicles expected to be battery EVs.

The 2023 IASR further details growth of these resources through to 2050, when they are expected to reach almost half the NEM's capacity and about a fifth of energy consumption (see Figures 2 and 5).

Understanding and unlocking the benefits of CER

As CER become an indispensable part of Australia's future energy system, they offer a range of significant short and long-term benefits for consumers, communities and at a broader systems level:

- At a NEM-wide level, growth in CER can help deliver reliable and secure energy, at lower cost for all consumers, and contribute to lower emissions.
- For individuals and organisations with the means to invest, these assets provide greater agency over energy use and bills, unlock new opportunities to participate in energy markets (through the generation, storage and 'trading' of energy), and enable a direct contribution to Australia's lower emissions future.

[6] AEMO *Quarterly Energy Dynamics Q1*, April 2024, at https://aemo.com.au/-/media/files/major-publications/qed/2024/qed-q1-2024.pdf.

- For communities, initiatives like neighbourhood solar gardens and community batteries can help maximise use of locally produced energy, cut bills by reducing the draw on the main grid, improve local power quality, and enable more equitable access to renewable technologies that may otherwise be out of reach.

An increasing proportion of rooftop solar, EVs, household and community batteries and even household hot water and pool pumps are also expected to have the 'smarts' to help manage the import and export of electricity to the distribution grid. If these consumer batteries are well coordinated or 'orchestrated', it would avoid up to $4.12 billion being spent on additional utility-scale storage in the NEM. This coordination is assumed to occur in all three scenarios applied for the ISP modelling, with differing forecasts depending on each scenario's narrative. This concept of CER coordination, and its modelling within the 2024 ISP, is explored further below.

A8.3.1 CER coordination and social licence

The term 'CER coordination' refers to the coordination of consumer-owned batteries that can be operated as VPPs. Facilitated by commercial energy management system operators, networks or other parties, VPPs aggregate these devices into larger systems, trading energy between them and the grid. As part of this, consumers are asked to enter into agreements to change the way their batteries are charged and discharged, to support reliability of the power system and manage power system security risks. In return, they may receive financial incentives, and the benefit of knowing they are helping to balance energy supply and demand for others across the grid.

If coordinated well, CER can help deliver more reliable and secure energy, offset the need for grid-scale investment, at lower cost for all consumers, and contribute to lower emissions. AEMO's *Step Change* scenario includes forecasts that coordinated CER storage are 37 GW in 2049-50, making up 66% of the NEM's energy storage capacity. Without effective coordination aligned with the scenario forecast additional grid-scale investment would be needed to take its place, increasing the costs that are reflected in consumer bills. For reference, current levels of coordinated CER are 0.2 GW.

Realising the full benefits of CER coordination will require new approaches, levels of cooperation and concerted action across industry, governments, market bodies, consumer groups and device owners themselves.

At a foundational level, NEM policy, market, and system settings could secure the potential for CER to ensure it can serve consumer energy needs without exacerbating any system security risks. The networks need to maintain safe operating margins; information needs to be shared across devices in a safe, consistent manner; and devices need to respond to market signals visibly and predictably.

The households and businesses who own these systems will also choose how they are used, and governments and industry will need to work collaboratively with consumers to ensure they have the transparency and material benefits needed to support, with confidence, their systems being coordinated with the power system.

AEMO will continue working with governments, market bodies, industry and consumers to seek to realise the benefits of CER coordination are realised.

CER coordination sensitivity analysis

To better understand the benefits that CER coordination can offer, AEMO has modelled a *Reduced CER Coordination* sensitivity as part of its 2024 ISP. The *Reduced CER Coordination* sensitivity examined the impact of lower coordination of consumer-owned batteries that can be operated in a coordinated fashion within VPP

arrangements. This sensitivity explored the impact on the need for utility-scale investments if coordination does not reach the level forecast in the *Step Change* scenario.

The results of the sensitivity analysis showed that, with no further coordination of CER batteries than exists currently, total system costs increase by $4.12 billion, due to the need for additional grid-scale investment to compensate for the lack of coordinated embedded storage devices. This additional utility-scale investment would take the form of medium-depth and deep duration utility storages (with the ability to operate for durations between four to 12 hours and more than 12 hours respectively, before needing to be re-charged) at times of high consumer demand.

For more information on sensitivity analysis outcomes, see Appendix 6.

A8.4 Social licence and the energy transition

As the pace of the energy transition accelerates, Australia needs to invest urgently in new energy generation, transmission, and storage. The transition presents many opportunities and challenges beyond the remit of the ISP, including affordability, economic and social change, considerations of equity, fairness and a 'just' transition.

AEMO acknowledges the many social licence and consumer considerations across the broader energy transition, which are being explored and addressed through a range of reforms and reviews.

AEMO is highly supportive of the development of a nationally consistent narrative to help build societal awareness and understanding of some of the broader issues of the energy transition, including the investment needed and change expected and economic opportunities. This will be central to establishing social acceptance, and AEMO welcomes the work being progressed by the Federal Government's Net Zero Economy Agency and Rewiring the Nation initiative, as well as state governments, to develop the national energy narrative.

A8.4.1 Affordability

AEMO understands that cost of living and electricity prices are at the forefront of the minds of many Australians. The whole energy sector has a stake in enabling the energy transition, and part of this is to ensure Australians have access to affordable energy.

The ISP must optimise value to end consumers by designing a low cost, secure and reliable energy system capable of meeting relevant Australian energy policies at an acceptable level of risk.

The 2024 ISP outlines an ODP that is designed to optimise the net economic benefit to all those who produce, consume and transport electricity in the market. Should the transmission projects it calls for not be delivered, there is a risk this will cost Australia and consumers $18.5 billion more than the cost of the transition in the ODP, and emission reductions valued at $3.3 billion could be foregone.

However, the ISP does not optimise the price of electricity (wholesale market price) and its overall affordability to consumers, which are subject to a range of market conditions. There are many elements that contribute to the ultimate price consumers pay, including market design, government policies and structures. It is important to ensure appropriate settings to put downward pressure on energy prices to gain and maintain support during the energy transition. The cost of the ODP ultimately forms a part of the energy cost paid for by consumers in electricity bills.

Glossary

This glossary has been prepared as a quick guide to help readers understand some of the terms used in the ISP. Words and phrases defined in the National Electricity Rules (NER) have the meaning given to them in the NER. This glossary is not a substitute for consulting the NER, the AER's Cost Benefit Analysis Guidelines, or AEMO's *ISP Methodology.*

Term	Acronym	Explanation
Actionable ISP project	-	Actionable ISP projects optimise benefits for consumers if progressed before the next ISP. A transmission project (or non-network option) identified as part of the ODP and having a delivery date within an actionable window. For newly actionable ISP projects, the actionable window is two years, meaning it is within the window if the project is needed within two years of its earliest in-service date. The window is longer for projects that have previously been actionable. Project proponents are required to begin newly actionable ISP projects with the release of a final ISP, including commencing a RIT-T.
Actionable New South Wales project and actionable Queensland project	-	A transmission project (or non-network option) that optimises benefits for consumers if progressed before the next ISP, is identified as part of the ODP, and is supported by or committed to in New South Wales Government or Queensland Government policy and/or prospective or current legislation.
Anticipated project	-	A generation, storage or transmission project that is in the process of meeting at least three of the five commitment criteria (planning, construction, land, contracts, finance), in accordance with the AER's Cost Benefit Analysis Guidelines. Anticipated projects are included in all ISP scenarios.
Candidate development path	CDP	A collection of development paths which share a set of potential actionable projects. Within the collection, potential future ISP projects are allowed to vary across scenarios between the development paths. Candidate development paths have been shortlisted for selection as the ODP and are evaluated in detail to determine the ODP, in accordance with the ISP Methodology.
Capacity	-	The maximum rating of a generating or storage unit (or set of generating units), or transmission line, typically expressed in megawatts (MW). For example, a solar farm may have a nominal capacity of 400 MW.
Committed project	-	A generation, storage or transmission project that has fully met all five commitment criteria (planning, construction, land, contracts, finance), in accordance with the AER's Cost Benefit Analysis Guidelines. Committed projects are included in all ISP scenarios.
Consumer energy resources	CER	Generation or storage assets owned by consumers and installed behind-the-meter. These can include rooftop solar, batteries and electric vehicles. CER may include demand flexibility.
Consumption	-	The electrical energy used over a period of time (for example a day or year). This quantity is typically expressed in megawatt-hours (MWh) or its multiples. Various definitions for consumption apply, depending on where it is measured. For example, underlying consumption means consumption being supplied by both CER and the electricity grid.
Cost-benefit analysis	CBA	A comparison of the quantified costs and benefits of a particular project (or suite of projects) in monetary terms. For the ISP, a cost-benefit analysis is conducted in accordance with the AER's Cost Benefit Analysis Guidelines.
Counterfactual development path	-	The counterfactual development path represents a future without major transmission augmentation. AEMO compares candidate development paths against the counterfactual to calculate the economic benefits of transmission.
Demand	-	The amount of electrical power consumed at a point in time. This quantity is typically expressed in megawatts (MW) or its multiples. Various definitions for demand, depending on where it is measured. For example, underlying demand means demand supplied by both CER and the electricity grid.
Demand-side participation	DSP	The capability of consumers to reduce their demand during periods of high wholesale electricity prices or when reliability issues emerge. This can occur through voluntarily reducing demand or generating electricity.

Term	Acronym	Explanation
Development path	DP	A set of projects (actionable projects, future projects and ISP development opportunities) in an ISP that together address power system needs.
Dispatchable capacity	-	The total amount of generation that can be turned on or off, without being dependent on the weather. Dispatchable capacity is required to provide firming during periods of low variable renewable energy output in the NEM.
Distributed solar / distributed PV	-	Solar photovoltaic (PV) generation assets that are not centrally controlled by AEMO dispatch. Examples include residential and business rooftop PV as well as larger commercial or industrial "non-scheduled" PV systems.
Firming	-	Grid-connected assets that can provide dispatchable capacity when variable renewable energy generation is limited by weather, for example storage (pumped-hydro and batteries) and gas-powered generation.
Future ISP project	-	A transmission project (or non-network option) that addresses an identified need in the ISP, that is part of the ODP, and is forecast to be actionable in the future.
Identified need	-	The objective a TNSP seeks to achieve by investing in the network in accordance with the NER or an ISP. In the context of the ISP, the identified need is the reason an investment in the network is required and may be met by either a network or a non-network option.
ISP development opportunity	-	A development identified in the ISP that does not relate to a transmission project (or non-network option) and may include generation, storage, demand-side participation, or other developments such as distribution network projects.
Net market benefits	-	The present value of total market benefits associated with a project (or a group of projects), less its total cost, calculated in accordance with the AER's Cost Benefit Analysis Guidelines.
Non-network option	-	A means by which an identified need can be fully or partly addressed, that is not a network option. A network option means a solution such as transmission lines or substations which are undertaken by a Network Service Provider using regulated expenditure.
Optimal development path	ODP	The development path identified in the ISP as optimal and robust to future states of the world. The ODP contains actionable projects, future ISP projects and ISP development opportunities, and optimises costs and benefits of various options across a range of future ISP scenarios.
Regulatory Investment Test for Transmission	RIT-T	The RIT-T is a cost benefit analysis test that TNSPs must apply to prescribed regulated investments in their network. The purpose of the RIT-T is to identify the credible network or non-network options to address the identified network need that maximise net market benefits to the NEM. RIT-Ts are required for some but not all transmission investments.
Reliable (power system)	-	The ability of the power system to supply adequate power to satisfy consumer demand, allowing for credible generation and transmission network contingencies.
Renewable energy	-	For the purposes of the ISP, the following technologies are referred to under the grouping of renewable energy: "solar, wind, biomass, hydro, and hydrogen turbines". Variable renewable energy is a subset of this group, explained below.
Renewable energy zone	REZ	An area identified in the ISP as high-quality resource areas where clusters of large-scale renewable energy projects can be developed using economies of scale.
Renewable drought	-	A prolonged period of very low levels of variable renewable output, typically associated with dark and still conditions that limit production from both solar and wind generators.
Scenario	-	A possible future of how the NEM may develop to meet a set of conditions that influence consumer demand, economic activity, decarbonisation, and other parameters. For the 2024 ISP, AEMO has considered three scenarios: *Progressive Change*, *Step Change* and *Green Energy Exports*.
Secure (power system)	-	The system is secure if it is operating within defined technical limits and is able to be returned to within those limits after a major power system element is disconnected (such as a generator or a major transmission network element).
Sensitivity analysis	-	Analysis undertaken to determine how modelling outcomes change if an input assumption (or a collection of related input assumptions) is changed.
Spilled energy	-	Energy from variable renewable energy resources that could be generated but is unable to be delivered. Transmission curtailment results in spilled energy when generation is constrained due to operational limits, and economic spill occurs when generation reduces output due to market price.

Term	Acronym	Explanation
Transmission network service provider	TNSP	A business responsible for owning, controlling or operating a transmission network.
Utility-scale or utility	-	For the purposes of the ISP, 'utility-scale' and 'utility' refers to technologies connected to the high-voltage power system rather than behind the meter at a business or residence.
Value of emissions reduction	VER	The VER estimates the value (dollar per tonne) of avoided greenhouse gas emissions. The VER is calculated consistent with the method agreed to by Australia's Energy Ministers in February 2024.
Virtual power plant	VPP	An aggregation of resources coordinated to deliver services for power system operations and electricity markets. For the ISP, VPPs enable coordinated control of CER, including batteries and electric vehicles.
Variable renewable energy	VRE	Renewable resources whose generation output can vary greatly in short time periods due to changing weather conditions, such as solar and wind.