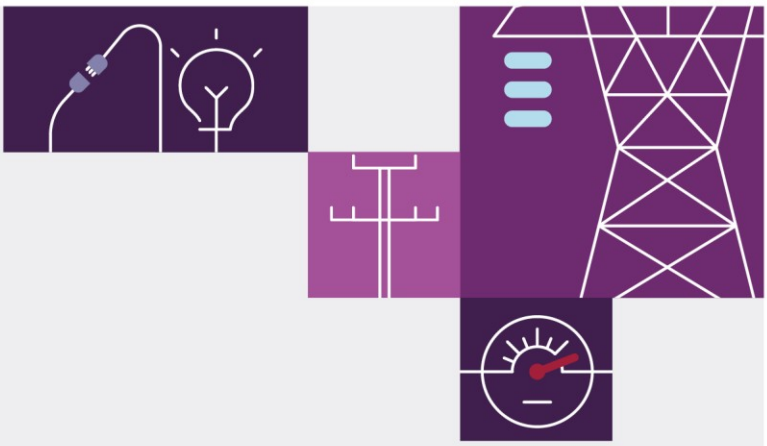
AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Consultation summary report – Update to the ISP Methodology

June 2023

Consultation summary report

For the Integrated System Plan (ISP) for the National Electricity Market



Important notice

Purpose

AEMO publishes this consultation summary report following its consultation on an update to the ISP Methodology pursuant to National Electricity Rules (NER) 5.22.8(d) and the Australian Energy Regulator's Forecasting Best Practice Guidelines. This report attaches the final ISP Methodology incorporating updates developed consistent with the Australian Energy Regulator's Cost Benefit Analysis Guidelines. This paper includes key information and context for the methodology used in AEMO's *Integrated System Plan* (ISP). This publication is generally based on information available to AEMO as at June 2023 unless otherwise indicated.

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Executive summary

AEMO will soon begin the market modelling and power system analysis required to prepare and release the Draft 2024 *Integrated System Plan* (ISP). Published every two years, AEMO's ISP provides a comprehensive roadmap for the National Electricity Market (NEM) to support Australia's highly complex and rapid energy transformation towards net zero emissions.

AEMO is now releasing an updated ISP Methodology for use in the 2024 ISP. This update follows consideration of stakeholder submissions received in response to changes proposed by AEMO in March 2023. This update is made consistent with the National Electricity Rules (NER) and in accordance with the Australian Energy Regulator's (AER's) Forecasting Best Practice Guidelines[1].

AEMO thanks stakeholders for their submissions

AEMO has considered all 25 written submissions to the ISP Methodology Consultation Paper. The material recommendations and AEMO's responses are outlined below.

Stakeholder feedback	AEMO's response
Mixed views were provided on the concept of an **actionable window**, and some suggested AEMO should introduce analysis to evaluate which projects should remain as actionable.	**Change made compared to draft position** – AEMO has amended the ISP Methodology to apply an actionable window concept. This will only impact projects that were actionable in the previous ISP (there is no change to the process for identifying new actionable projects). The approach used in the 2022 ISP assumed that any project that is required two or more years after the earliest in-service date could be actioned in a future ISP rather than now. The new methodology reflects that a project that was actioned in a previous ISP has been progressing for at least two years, and would need to repeat regulatory approval steps if its actionable status were removed (that is, its lead time is longer if actionability is removed because regulatory approvals would need to be repeated). With this change, a project that was first actioned in the previous ISP will potentially retain actionable status if it is required in the four-year period starting at the earliest in-service date.
Any **transmission project lead time adjustments** should be transparent, based on evidence, and ideally made through joint planning with transmission network service providers (TNSPs) and relevant jurisdictional bodies.	**No change compared to draft position** – AEMO will develop the lead times for transmission projects through joint planning with TNSPs, and will consult on them via the *Transmission Expansion Options Report*. Like all inputs for the ISP, lead times are subject to finalisation through public stakeholder consultation.
Generation and transmission build rates in some previous scenarios and sensitivities has been unrealistic.	**Change made compared to draft position** – If the generation or transmission build in the draft or final ISP is observed to be lumpy, sensitivity analysis could be conducted to assess the impact of limiting infrastructure delivery based on a supply chain constraints.
Storage should not be penalised in the ISP models. AEMO should use existing data to propose thresholds for modelling storage dispatch.	**Change made compared to draft position** – based on stakeholder feedback, AEMO has removed its proposed amendments to limit the foresight of storage devices in the ISP capacity outlook model. While the proposed approach for storage optimisation may be fit-for-purpose in reliability assessment models, further work is required to project accurate storage behaviour for capacity planning in the ISP. AEMO conducts reliability assessment periodically during the ISP development, and may refine the minimum reserve level to ensure a reliable system is achieved. AEMO conducts reliability assessment periodically during the ISP development, and may refine the minimum reserve level to ensure a reliable system is achieved.
AEMO's treatment of **renewable energy zone (REZ) transmission limits** should not reserve power system capacity for particular generation types and must be as close to true transmission limits as possible.	**Change made compared to draft position** – based on stakeholder feedback, AEMO has made revisions to clarify that transfer limits are not reserved for particular generation types. AEMO has also amended the REZ transfer limit formula to include large loads.

[1] AER. August 2020. *Forecasting Best Practice Guidelines*. At https://www.aer.gov.au/system/files/AER%20-%20Forecasting%20best%20practice%20guidelines%20-%2025%20August%202020.pdf.

Stakeholder feedback	AEMO's response
Stakeholders generally supported the proposed approach to **modelling losses in REZs and sub-regions**, with varying opinions on how marginal loss factors (MLFs) should be applied.	**Change made compared to draft position** – AEMO has amended the ISP Methodology to use loss equations to better represent power transfers between specific REZs and sub-regions. Existing static generator MLFs will be maintained in the modelling process to remain consistent with the existing pricing methodology and merit order dispatch process for the NEM.
While proposed changes to **resource quality** are supported, transparency is important.	**No change compared to draft position** – consistent with the Draft ISP Methodology, multi-criteria analysis is used to exclude non-go zones for the development of wind availability traces and its recalibration to existing wind performance.
The inclusion of a **value of carbon emissions** has strong support, and the determination of a value should be transparent.	**No change compared to draft position** – AEMO will use reasonable endeavours to apply a value of carbon emissions if it is developed by an authoritative body for use in the electricity sector.
The concept of gathering data to support the application of **consumer risk preferences** was broadly supported as long as the process is transparent.	**No change compared to draft position** – consistent with the Draft ISP Methodology, AEMO will consider evidence-based risk preference metrics in its application of professional judgement when selecting the optimal development path (ODP). AEMO will consult on the application of risk preferences in the Draft ISP.
Mixed views were given on the appropriate **duration of Demand Side Participation** (DSP) response, with some highlighting a need for more data.	**No change compared to draft position** – consistent with the Draft ISP Methodology, the duration of DSP will be limited to a maximum of two hours of continuous operation per day in the reliability response band. AEMO may revisit this assumption when more data is available.

AEMO has made eight key updates to the ISP Methodology

The updated ISP Methodology to be applied for the 2024 ISP includes the following updates compared to the version applied for the 2022 ISP:

- Accounting for **transmission project lead time uncertainty** by reviewing and extending lead times based on recent evidence, including through extensive joint planning with transmission network service providers (TNSPs) and jurisdictional bodies.
- An **actionable window** is used to determine which projects are potentially actionable. If a project is optimally required during the actionable window, then it is actioned in the ISP. Because regulatory approval for large transmission projects can take more than four years, the actionable window is used to assess whether a project that was previously actionable should retain its actionable status from one ISP to the next.
  - There is no change for projects that were not actionable in the previous ISP – if the project's optimal timing is two or more years after its earliest delivery date, then it is not actioned.
  - For a project that is already actionable, the actionable windows is two years (to account for the time between ISPs) plus two years for each ISP that previously maintained its actionable status (to reflect a need to repeat work if actionability were removed and subsequently reinstated).
- If the generation or transmission build in the draft or final ISP is observed to be lumpy, sensitivity analysis could be conducted to assess the impact of limiting infrastructure delivery based on a **supply chain constraints**. This could be modelled with annual limits on transmission, generation and storage.
- Better reflecting the **impact of fossil-fuelled generation and major loads on renewable energy zone (REZ) transmission limits** by adding additional variables to existing equations, as well as incorporating nearby flow path variables and options to include large loads such as hydrogen electrolysers.
- Creating new intra-regional loss equations to account for the **network losses for REZs and sub-regions**.
- Aligning **assumed renewable energy resource quality** in REZs with historical performance by incorporating values consulted on with stakeholders through the *Inputs, Assumptions and Scenarios Report* (IASR) process.

- Allowing for the **potential inclusion of a value of carbon emissions** if an explicit emissions value were to be quantified by an authoritative body.
- Explaining how AEMO may use informed judgement to finalise the optimal development path (ODP) with reference to **consumer risk preferences**.
- Using data from actual events to incorporate a more realistic representation of the **duration of demand-side participation (DSP) response** in the ISP modelling process.

AEMO will hold a public webinar on 13 July 2023 to provide information about the feedback received and the final updated ISP Methodology.

AEMO looks forward to continuing to consult with industry and other stakeholders throughout the delivery of the 2024 ISP.

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1 Introduction

Consultation and dialogue with all National Electricity Market (NEM) stakeholders is critical to AEMO's role as the National Transmission Planner for the NEM, helping improve and refine scenario development, forecasting, decision-making and assessment processes.

This report outlines how AEMO has taken stakeholder feedback into account in its consideration of updates to the ISP Methodology ahead of its application in the delivery of the 2024 *Integrated System Plan* (ISP).

1.1 Stakeholder consultation process

AEMO has consulted on its updates to the ISP Methodology in accordance with the National Electricity Rules (NER) and the Australian Energy Regulator's (AER's) Forecasting Best Practice Guidelines[2].

Note that this report uses terms defined in the NER, which are intended to have the same meanings. There is a glossary of additional terms and abbreviations in Appendix A1.

AEMO's process and timeline for this consultation is outlined in Table 1.

Table 1 Consultation process and timeline

Consultation steps	Dates
Notice of consultation, consultation paper and Draft 2023 ISP Methodology published	31 March 2023
Pre-submissions webinar	20 April 2023
Submissions closed on consultation paper	1 May 2023
Discussions with stakeholders to clarify submissions	30 May 2023 and 19 June 2023
Consultation summary report and final ISP Methodology published	30 June 2023
Consultation summary webinar	13 July 2023

AEMO has published all written submissions and other consultation documents[3]. No consultation materials were identified as confidential.

In response to its consultation paper, AEMO received 25 written submissions, and held one public webinar. AEMO also met with many stakeholders to discuss the updates to the methodology, and their submissions. Minutes from these meetings are available on the consultation webpage[4].

AEMO thanks all stakeholders for their feedback on the consultation paper, which has been considered in preparing this consultation summary report. A summary of material issues raised in submissions, and AEMO's response to each, is contained in Section 2 of this report.

[2] AER. August 2020. *Forecasting Best Practice Guidelines*. At https://www.aer.gov.au/system/files/AER%20-%20Forecasting%20best%20practice%20guidelines%20-%2025%20August%202020.pdf.

[3] At https://aemo.com.au/en/consultations/current-and-closed-consultations/consultation-on-updates-to-the-isp-methodology.

[4] Consultation materials for the 2023 update to the ISP Methodology are available at https://aemo.com.au/consultations/current-and-closed-consultations/consultation-on-updates-to-the-isp-methodology.

1.2 Context for this consultation

This section notes the purpose of the ISP Methodology, before listing the updates AEMO has considered in completing this consultation, and how this consultation fits in to the 2024 ISP development process.

The ISP is a whole-of-system plan that provides an integrated roadmap for the efficient development of the NEM over at least the next 20 years.

Leveraging expertise from across the industry is pivotal to the development of a robust plan that supports the long-term interests of energy consumers. AEMO is committed to facilitating a stakeholder engagement process that ensures a consultative approach to developing the 2024 ISP.

AEMO has developed the update to the ISP Methodology in accordance with the AER's Forecasting Best Practice Guidelines[5] and the Cost Benefit Analysis Guidelines[6]. This includes providing a transparent process, supporting and working with stakeholders in their understanding of AEMO's methodologies, and providing additional information to complement the formal documentation.

1.2.1 Purpose of the ISP Methodology

AEMO's ISP Methodology sets out the methodologies for:

- Modelling applied in the ISP – this includes the capacity outlook models, time-sequential model and engineering assessment.
- Cost benefit analysis used in the ISP – this includes:
  - AEMO's approach to applying the steps outlined in the AER's Cost Benefit Analysis Guidelines,
  - Differentiating between scenarios and sensitivities and their treatment in informing the determination of the optimal development path (ODP), and
  - Outlining how AEMO will determine weights for scenarios.

The combination of the processes described above leads to the determination of the ODP for an ISP. The ODP optimises net economic benefit to all those who produce, consume and transport electricity in the market.

1.2.2 Updates to the ISP Methodology considered in this consultation

AEMO is required to review its ISP Methodology at least every four years. When reviewing the ISP Methodology outside of the four-yearly process, AEMO is required to run the single stage consultation process set out in Appendix B of the AER's Forecasting Best Practice Guidelines. The current ISP Methodology was published in August 2021, but AEMO considered several matters warranted an earlier review.

This consultation summary report outlines AEMO's consideration of the feedback received in response to the consultation paper released in March 2023.

As such, AEMO is releasing a final ISP Methodology which includes the following updates:

[5] AER. August 2020. *Forecasting Best Practice Guidelines*. At https://www.aer.gov.au/system/files/AER%20-%20Forecasting%20best%20practice%20guidelines%20-%2025%20August%202020.pdf.

[6] AER. August 2020. *Cost benefit analysis guidelines – Guidelines to make the Integrated System Plan actionable*. At https://www.aer.gov.au/system/files/AER%20-%20Cost%20benefit%20analysis%20guidelines%20-%2025%20August%202020.pdf.

- Accounting for **transmission project lead time uncertainty** by reviewing and extending lead times based on recent evidence, including through extensive joint planning with transmission network service providers (TNSPs) and jurisdictional bodies.
- An **actionable window** is used to determine which projects are actionable. If a project is optimally required during the actionable window, then it is actioned in the ISP.
  - There is no change for projects that weren't actionable in the previous ISP – if the project's optimal timing is two or more years after its earliest delivery date, then it is not actioned.
  - For a project that is already actionable, the actionable windows is two years (to account for the time between ISPs) plus two years for each ISP that previously maintained its actionable status (to reflect a need to repeat work if actionability were removed and subsequently reinstated).
- Better reflecting the **impact of fossil-fuelled generation and major loads on renewable energy zone (REZ) transmission limits** by adding additional variables to existing equations, as well as incorporating nearby flow path variables and options to include large loads such as hydrogen electrolysers.
- Creating new intra-regional loss equations to account for the **network losses for REZs and sub-regions**.
- Aligning **assumed renewable energy resource quality** in REZs with historical performance by incorporating values consulted on with stakeholders through the *Inputs, Assumptions and Scenarios Report* (IASR) process.
- Allowing for the **potential inclusion of a value of carbon emissions** if an explicit emissions value were to be quantified by an authoritative body.
- Explaining how AEMO may use informed judgement to finalise the ODP with reference to **consumer risk preferences** by incorporating evidence-based risk metrics where available.
- Using data from actual events to incorporate a more realistic representation of the **duration of demand-side participation (DSP) response** in the ISP modelling process.

1.2.3 2024 ISP development process

Figure 1 below shows the status of the main ISP consultations.

Before developing and consulting on the Draft 2022 ISP, AEMO is required to:

- **Consult on inputs, assumptions and scenarios** – AEMO received submissions from 64 stakeholders on the Draft IASR and 20 stakeholders on the Draft *Transmission Expansion Options Report*. AEMO will release the final versions of these reports with accompanying consultation summary reports on 28 July 2023.
- **Consult on the ISP Methodology** – AEMO received 25 stakeholder submissions on the Draft ISP Methodology that was published in March 2023. AEMO released the final ISP Methodology, which accompanies this report, on 30 June 2023.

Figure 1 Parallel ISP consultations

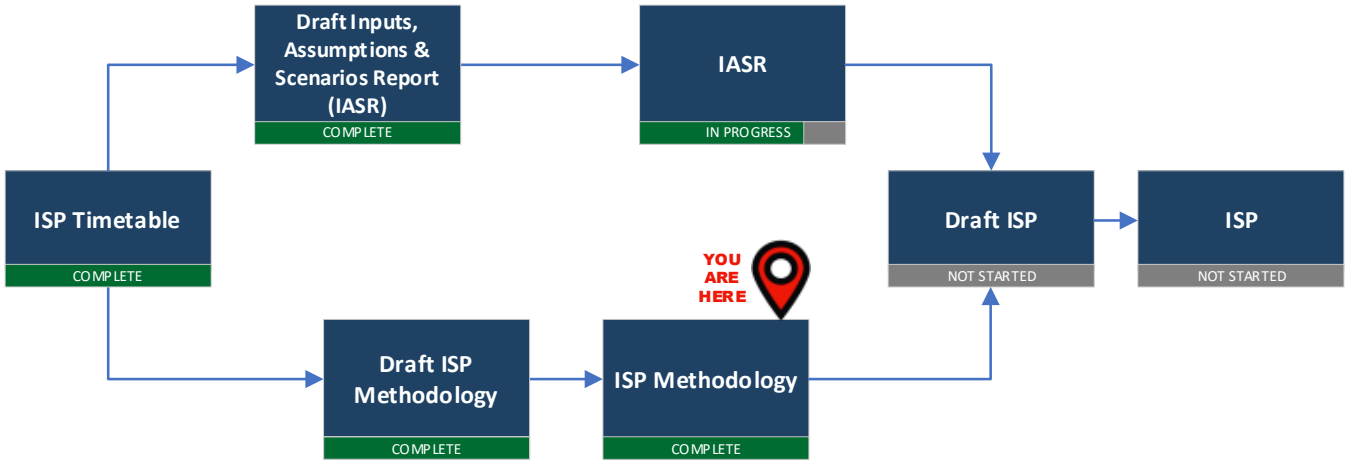


Figure 2 shows the ISP process, and current progress on all elements for the 2024 ISP[7].

In addition to releasing the final ISP Methodology, AEMO is currently finalising two other consultations that will inform the 2024 ISP:

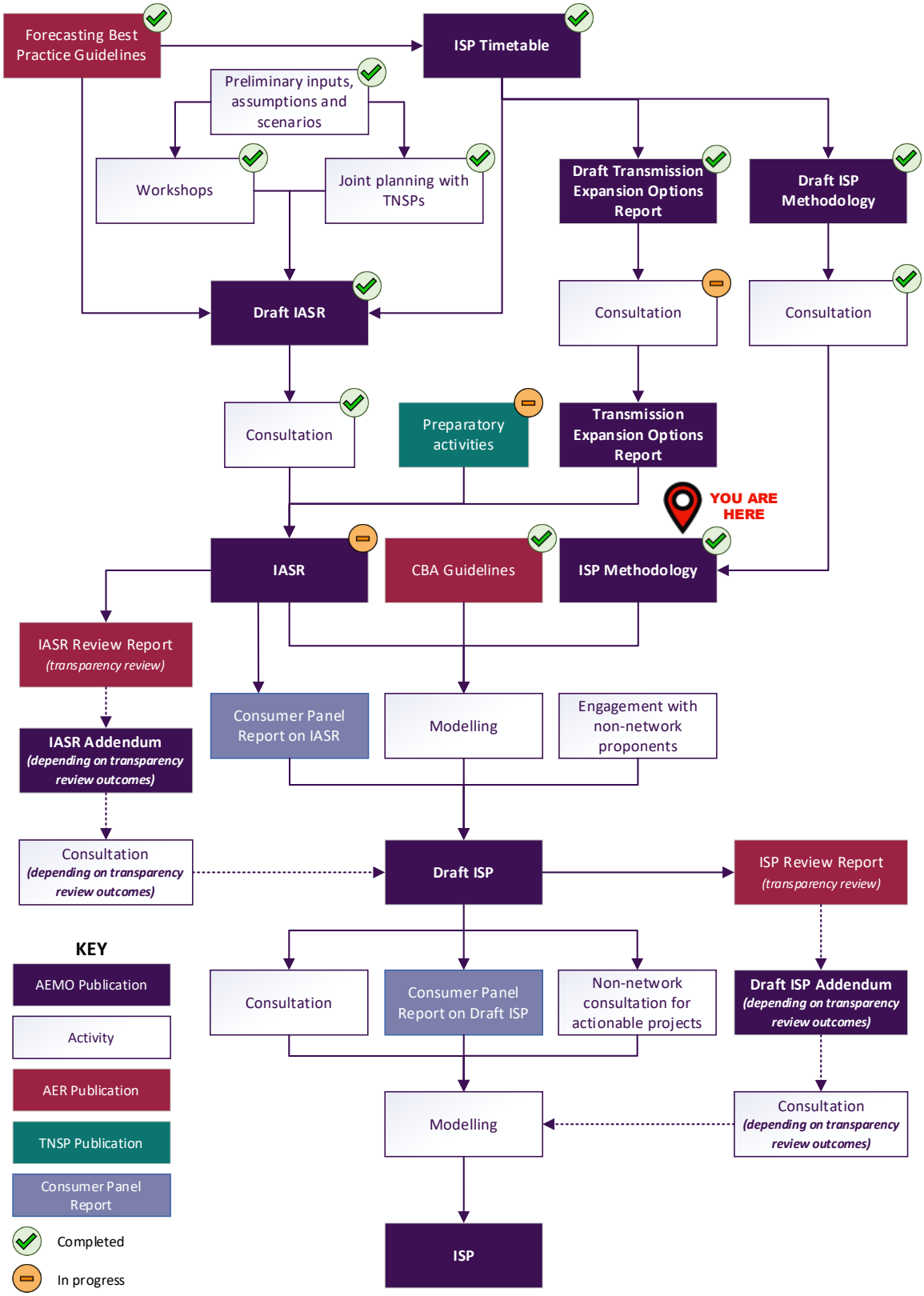
- **The 2023 *Transmission Expansion Options Report*** will present the transmission augmentation options and costs for the 2024 ISP. AEMO held a public webinar about the draft report on 18 May 2023, as well as a dedicated consumer advocate verbal submissions session, and received submissions on 31 May 2023. AEMO will release the final 2023 *Transmission Expansion Options Report* in July 2023. Consultation materials are available on AEMO's website[8].
- **The 2023 IASR** will catalogue the range of inputs, assumptions and scenarios for the 2024 ISP. At the time of publication of this paper, AEMO has received submissions on the Draft 2023 IASR, has hosted two webinars, and is preparing to publish the final 2023 IASR in July 2023[9].

[7] The 2024 ISP Timetable provides more information on the key milestones of the 2024 ISP development process, at https://aemo.com.au/-/media/files/major-publications/isp/2022/2024-isp-timetable.pdf?la=en.

[8] Consultation materials for the 2023 *Transmission Expansion Options Report* are available at https://aemo.com.au/consultations/current-and-closed-consultations/2023-transmission-expansion-options-report-consultation.

[9] Consultation materials for the 2023 IASR are available at https://aemo.com.au/consultations/current-and-closed-consultations/2023-inputs-assumptions-and-scenarios-consultation.

Figure 2 Navigating the ISP process



Note: The diagram above has been amended from the version published in the 2024 ISP timetable by adding a box containing "Draft Transmission Expansion Options Report" and "Transmission Expansion Options Report" with an additional "Consultation" box. The IASR will consider transmission development options and non-network alternatives.

2 Submissions and AEMO responses

This section summarises stakeholder submissions and provides AEMO's response:

- **Section 2.1** lists the stakeholders who provided submissions to this consultation, and a summary of the material issues raised in their submissions.
- **Section 2.2** provides the details of the material issues raised across stakeholder submissions, AEMO's assessment of the feedback received, and AEMO's conclusion.

2.1 Summary of submissions

This section provides an overview of the stakeholders who provided submissions to this consultation, and a summary of the material issues raised in their submissions.

2.1.1 List of stakeholders who provided submissions

The following table lists the stakeholders who provided submissions to this consultation.

Table 2 Stakeholders who provided submissions

Submissions		
AusNet Services (**AusNet**)	**First Nations Clean Energy Network**	Powerlink Queensland (**Powerlink**)
Australian Conservation Foundation (**ACF**)	**Flow Power**	Public Interest Advocacy Centre (**PIAC**)
Beyond Zero Emissions (**BZE**)	Fortescue Future Industries (**FFI**)	Queensland Conservation Council (**QCC**)
Clean Energy Council (**CEC**)	**Greenpeace** Australia Pacific (**Greenpeace**)	**RE-Alliance**
Clean Energy Investor Group (**CEIG**)	**Hydro Tasmania**	Shell Energy (**Shell**)
Climate Action Network Australia (**CANA**)	Institute for Energy Economics and Financial Analysis (**IEEFA**)	**Transgrid**
Climate Council	**ISP Consumer Panel**	**Windlab**
Energy Networks Australia (**ENA**)	**Nexa Advisory**	-
Environment Victoria	Origin Energy (**Origin**)	-

2.1.2 Summary of material issues

The following figure shows interest in the updates to the ISP Methodology that were proposed by AEMO in the consultation paper. Table 3 provides a summary of the material issues raised across the submissions.

Figure 3 Proportion of submissions that addressed the updates proposed in the consultation paper

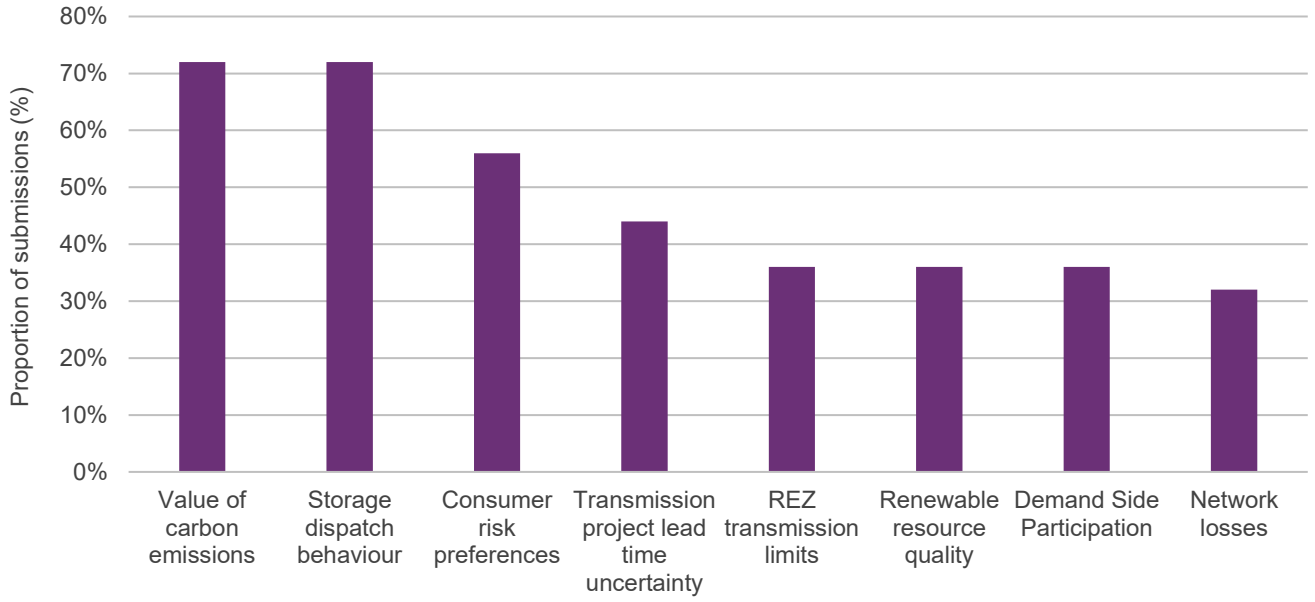


Table 3 Key topics from submissions received on the update to the ISP Methodology consultation

Topic	Description	Submitters
Accounting for transmission project lead time uncertainty	AEMO should include projects that have completed their regulatory investment test for transmission (RIT-T) among the projects that it considers revising earliest in-service dates (EISDs).	**ISP Consumer Panel**
	AEMO should manage the revision of EISDs through joint planning with TNSPs and jurisdictional bodies.	**Transgrid**, **ENA**, **AusNet**, and **Powerlink**
	AEMO should be transparent, and consult publicly, on the process taken and its decisions to revise EISDs, and should consider the revision of project EISDs on a project-by-project basis.	**AusNet**, **Origin**, **Hydro Tasmania**, and **CEC**
	The proposed update may reduce the urgency of transmission project delivery and will prevent the cost benefit analysis from testing if there is benefit in mitigating delay factors.	**AusNet**, **ENA** and **Shell**.
	Concerned that revising an EISD may result in approvals processes commencing earlier, when there is larger degree of uncertainty about the project benefits.	**Shell**
	The proposed update must not enable project proponents to delay projects (extend EISDs) for their own benefit without justification.	**CEC**
	The introduction of an 'actionable window' is also a suitable method for accounting for project lead time uncertainty.	**Transgrid**, **CEC**
	AEMO should consider the ongoing need to gain social licence as a factor contributing to project delays.	**PIAC**
	AEMO should consider revising EISDs for generation projects.	**Origin**
Impact of fossil-fuelled generation on REZ transmission limits	Concerned that the update will reserve transmission network capacity for fossil-fuelled generation, and suggested ISP modelling of losses could be improved.	**ISP Consumer Panel** and **Shell**
	AEMO should approximate the impact of factors such as location and technical characteristics of the generators in its updated transmission limit equations.	**Powerlink**
	AEMO should consider including specific terms in transmission limit equations for other assets such as storage and hydrogen electrolysers.	**Transgrid**
	Concerned that the proposed approach could lead to delays in REZ transmission network expansion by conflating the available network capacity.	**CEC**
	AEMO should create an annual publication on the indicative network capacity used by fossil-fuelled generators within a REZ.	**QCC**

Topic	Description	Submitters
Network losses for REZs and sub-regions	AEMO should align its definition of the Central and North Queensland sub-regions with **Powerlink**'s definition of the same geographical areas and should be careful not to penalise certain sub-regions in its formulation of new intra-regional loss equations.	**Powerlink**
	Renewable energy industrial precincts should be modelled in parallel with REZs to geographically guide development of industry.	**QCC**
	AEMO should use average loss factors instead of marginal loss factors (MLFs).	**CEIG** and **Windlab**
	AEMO should ensure losses are not double counted.	**Windlab**
	AEMO should reference new MLFs to new sub-regional reference nodes.	**Windlab** and **Shell**
Assumed renewable resource quality	AEMO did not provide enough information on the process taken to select the percentiles that delimit the wind resource quality tranches.	**Origin**
	AEMO should improve its consideration of cultural heritage, particularly with reference to Indigenous sites, in its screening of land use data and selection of areas that are suitable for development.	**ISP Consumer Panel**
	AEMO should publish changes to renewable resource quality and availability that result from this change.	**Powerlink**
	AEMO should stress test its approach.	**Transgrid**
	AEMO should include an additional class of wind turbines to increase accuracy.	**PIAC**
	AEMO should improve its inclusion of the value of cultural sites and habitats for threatened species in land use penalty factors.	**QCC**
	AEMO should undertake detailed land mapping and resource assessments in addition to considering historical wind farm performance.	**QCC**
	AEMO should be obligated to publish and consult on the sites deemed unsuitable for development.	**Shell**
	AEMO's assumed wind capacity factors for the Southwest NSW REZ are too low.	**Windlab**
Potential inclusion of a value of carbon emissions	AEMO did not provide sufficient information as to how the value of carbon emissions would be derived.	**ISP Consumer Panel** and **Shell**
	Queried how AEMO will ensure consistency with values used by other parts of the NEM, and how AEMO will avoid biasing the results.	**ISP Consumer Panel** and **Shell**
	AEMO should ensure that consumers do not pay for emissions abatements multiple times.	**ISP Consumer Panel**
	AEMO should be transparent in its application of a value of carbon emissions, as this is crucial for consumers.	**ISP Consumer Panel**
	The value of carbon emissions should be derived by a market body other than AEMO.	**AusNet**
	AEMO should consult further on the development and application of a value of carbon emissions.	**AusNet**, **Transgrid**, **Powerlink**
	The value of carbon emissions should not replace the currently used carbon budget and should not be used to justify the use of carbon offsets.	**IEEFA**
	AEMO should consider emissions outcomes to be equal, if not prioritised in the ranking of candidate development pathways.	**CEC**
	A value of carbon was not included in the 2023 Draft IASR.	**FFI**
	AEMO should only consider the marginal benefit of emissions abatement beyond the level of abatement already required by the carbon budget constraint.	**Shell**
Consumer Risk Preferences	AEMO has not been transparent as to how consumer risk preference metrics are being developed, or on how they will be applied in the 2024 ISP and should be more transparent going forward.	**ENA**, **Shell**, **First Nations Clean Energy Network**, **Nexa Advisory**, **PIAC**, and **QCC**
	AEMO must consider risk preference, not only risk neutrality and risk aversion.	**ISP Consumer Panel**
	AEMO should engage with a variety of consumer types and consult more widely than the **ISP Consumer Panel** and the **Advisory Council on Social Licence**.	**RE-Alliance**, **CEC** and **Nexa Advisory**
	AEMO should account for the impacts of factors that may influence results such as salience bias among respondents and data aggregation techniques.	**CEC**, **PIAC**

Topic	Description	Submitters
	AEMO should consider the asymmetrical risks of building transmission 'too early' versus building transmission 'too late'.	**CEC**, **Nexa Advisory**
	AEMO should update to ISP Methodology to reflect a need to publicly consult consumers on draft metrics.	**AusNet**
	AEMO should employ social scientists to inform the development of evidence-based risk preference metrics.	**RE-Alliance**
	AEMO should provide information on the composition and selection of the **ISP Consumer Panel** and **Advisory Council on Social Licence**.	**Nexa Advisory**
	Concerned that the developed metrics will prioritise traditional consumers (such as on the **ISP Consumer Panel**).	**QCC**
	AEMO should be transparent regarding the types of consumer risk preferences that it incorporates and how they are translated into quantitative metrics.	**Flow Power**
Dispatch behaviour of storage devices	AEMO should consider derating maximum output power (MW) of storage devices rather than, or in addition to, derating storage capacity (MWh).	**Origin**, **Shell**, **Windlab**
	AEMO should not unfairly bias ISP modelling against storage and bias it towards fossil-fuelled generation.	**ACF**, **CEIG**, **Greenpeace**, **Nexa Advisory** and **QCC**
	AEMO's proposed derating factors are too high.	**QCC**, **IEEFA** and **Nexa Advisory**
	AEMO's should not model future dispatch behaviour on storage based on historical behaviour.	**Origin**, **QCC**, **Nexa Advisory**, **IEEFA**, and **CANA**
Duration of DSP response	AEMO should not limit future DSP response based on historical observations.	**QCC**, **IEEFA** and **FFI**
	There is insufficient historical analysis to support the proposed update.	**Shell**
	Limiting the duration of DSP response for all demand-side participants does not align with experience with commercial and industrial customers.	**Flow Power**
Additional issues	AEMO should consider an alternate transmission planning standards within the ISP Methodology.	**Transgrid**
	AEMO should consider short- and medium-term transmission network congestion issues in the ISP.	**CEC**
	The ISP Methodology remains suited to modelling, and planning, a system with large amount of fossil-fuelled generation.	**FFI**
	AEMO should conduct a broader review of the methodology for the 2024 ISP to address the scale of change required to deliver the energy transition.	**FFI**
	The current ISP Methodology will result in a transmission schedule that "defers transmission development until well after it is first needed".	**FFI**
	In AEMO's treatment, "emissions from fossil fuels are underestimated by assuming the highest efficiency heat rates".	**FFI**
	The ISP Methodology does not acknowledge scarcity rent costs and AEMO should consider that scarcity rent has had a substantial impact on consumers.	**FFI**
	AEMO should consider that the difference in net market benefits associated with the top five candidate development pathways (CDPs) is small relative to the uncertainty of the net market benefit figures.	**FFI**
	AEMO has assumed that the distribution network will be adequately expanded to accommodate forecast photovoltaic (PV) generation.	**FFI**
	In the detailed long-term model, AEMO should replace the eight three-hour blocks per day with 24 one-hour blocks.	**Hydro Tasmania**
	AEMO should adopt a formal process to assess the commercial credibility of infrastructure build out rates in scenarios and sensitivities.	**CEIG**
	AEMO should improve the balance of demand- and supply-side solutions in the ISP cost optimisation. AEMO should also "provide greater clarity on the allocation of energy efficiency and electrification loads to half-hourly demand profiles".	**IEEFA**

Topic	Description	Submitters
	Requested that AEMO outline the level of government action that is required for specific scenarios to be realised and provide half-hourly generation results in the 2024 ISP.	**IEEFA**
	In the ISP, AEMO does not adequately consider the full breadth of the energy transition, including the take-up of electric vehicles (EVs), consumer energy resources (CER), smart appliances, the increasing thermal efficiency of buildings, and increasing energy efficiency of towns.	**PIAC**
	The ISP should have a greater focus on social licence, and AEMO should be more proactive in its management of social licence. In addition, AEMO should clarify the role of the **Advisory Council on Social Licence**.	**ISP Consumer Panel**, **RE-Alliance**, and **PIAC**

2.2 Detailed feedback

2.2.1 Transmission project lead time uncertainty

Issue summary and submissions

Project lead times and earliest in service dates assumed for transmission augmentation projects affect consideration of a project as a potential actionable ISP project. Factors driving uncertainty about project lead times include supply chain issues, workforce and skills shortages, and time to engage with communities and stakeholders. In the consultation paper, AEMO proposed to amend the ISP Methodology to account for transmission project lead time uncertainty by providing the option for AEMO to review and extend project proponents' lead times based on recent evidence. AEMO also noted a non-preferred option, the creation of an 'actionable window' which would extend the window of time beyond the EISD under which a project could be considered beneficial. This change would be included by substituting references to 'EISD + 1 year' with 'EISD + actionable window' and the inclusion of a definition of an actionable window.

Views on how and when to adjust project lead times

Several submissions (**ISP Consumer Panel**, **Powerlink**, **CEC**, **CEIG**, and the **PIAC**) supported an approach to reflect observed project delay factors. The **ISP Consumer Panel** identified that the consultation paper did not state whether the recommended approach would be applied to projects that have already completed their regulatory investment test for transmission (RIT-T). In the **ISP Consumer Panel**'s opinion, the approach should be applied to such projects.

A number of potential project proponents provided submissions. **Powerlink** recommended that AEMO should manage revision of EISDs through ongoing planning with relevant TNSPs. **Transgrid** and **ENA** both expressed concern that the proposed update may grant AEMO the ability to change EISDs in the ISP without agreement from the relevant TNSP. **Transgrid** expressed support for efforts to address lead time uncertainty but stated it would not support the proposal if it granted AEMO this ability without agreement of the respective TNSP, or recognition of efforts already underway to reduce specific project delay risk factors.

Origin stated that its support was conditional on transparent, early communication of the process that would be used to amend any EISDs.

Hydro Tasmania expressed support for careful consideration of the factors impacting project lead times. **Hydro Tasmania** stated that it does not support a "blanket delay to all EISDs" and that the decision to revise EISDs should be done on a project-by-project basis. **CEC** echoed a similar concern and recommended that AEMO revise EISDs on a project-by-project basis.

Views on potential risks associated with adjusting project lead times

Shell Energy supported the proposal to revise EISDs to reflect project lead time uncertainty, but raised concern that bringing forward actionable ISP project status for some projects could result in approvals processes commencing when large uncertainty may exist regarding supply-side resource investment and REZ implementation, and that this uncertainty could impact the timing and forecast net benefits of an ISP project. **Shell Energy** recommended that AEMO introduce ongoing analysis in each ISP to determine if actionable projects should remain in the ODP.

AusNet and **ENA** both expressed concern that the proposed update may reduce the urgency to deliver actionable ISP projects as soon as possible. **AusNet** expressed a second concern that, if a project's EISD is extended to a later date, the cost benefit analysis will not check if there is benefit in working to mitigate delay risks to achieve earlier delivery. However, **AusNet** acknowledged that extending EISDs may result in more projects becoming actionable sooner and allow TNSPs to investigate a broader scope of projects earlier. **AusNet** recommended that, if the update is made, AEMO consider a broader range of delay risks including regulatory risk, community acceptance risk, land and easement risk, procurement risk, environmental and planning risk, supply chain risk, and workforce risk. **AusNet** also recommended:

- A requirement for AEMO to consult publicly on EISDs before their application in the ISP Methodology.
- AEMO seek agreement from the relevant TNSP (**AusNet** does not support AEMO applying its own judgement and assessment to finalise EISDs without relevant TNSP agreement).

Finally, in **AusNet**'s opinion, further work is required to demonstrate whether the proposed update is preferred to the status quo.

The **CEC** cautioned that the proposed update must not enable project proponents to delay projects for their own benefit without justification.

Views on the actionable window option

Transgrid and the **CEC** both noted that in their opinion, the option to introduce an actionable window would also be suitable. **Transgrid** stated that "the option of introducing an 'actionable window' is a simple solution that may prudently allow some projects to be identified as actionable sooner, helping to address project lead time uncertainty." The **CEC** saw the introduction of an actionable window as suitable in light of the delay issues being faced by transmission infrastructure projects. The **CEC** emphasised as the volume of projects increase, these issues will become more prevalent, but also that the delays will not be like-for-like in how they affect project timelines.

PIAC preferred the EISD adjustment option to the actionable window option, considering that the latter option "may lead to an ODP that is too inclusive of transmission projects at the expense of cheaper non-network options".

Views on other matters relating to project lead time uncertainty

PIAC put forward an opinion that social licence issues will continue to contribute to project delays and may become increasingly difficult as communities organise more effectively, and costs are reflected in energy bills. However, **PIAC** noted that it does not view supply chain issues, and workforce and skills shortages, as delay factors which will persist in the long term.

CEIG noted that the proposed update will not resolve the issues leading to the delays. **CEIG** "proposed that Ministers should put in place a new mechanism to clearly commit the implementation of the ISP's transmission investment program".

Origin recommended that AEMO also consider revising EISDs for generation projects.

CEIG proposed the addition of a formal process to check the commercial credibility of scenarios be added to the ISP Methodology. **CEIG** stated its opinion that renewable generation build out rates required in the 2022 ISP's Strong Electrification sensitivity and the Hydrogen Superpower scenario were unrealistic.

AEMO's assessment

Whether agreement with TNSPs and jurisdictional bodies should be required to adjust project lead times

AEMO has a strong preference to only adjust EISDs through close joint planning and collaboration with the relevant TNSPs and/or jurisdictional bodies, as recommended by **Powerlink**, **Transgrid**, **ENA** and **AusNet**. AEMO recognises that each project proponent has the best knowledge and most up-to-date information about the potential delay factors affecting their projects. AEMO may request information from project proponents to support proposed project lead times, or to provide evidence for or against application of a delay. This information might include access to confidential tender advice, information from OEMs about queues for equipment orders, and outcomes of discussions with potential EPC providers.

AEMO has confidence in the joint planning processes that are undertaken between AEMO, TNSPs and jurisdictional bodies. AEMO expects that joint planning will lead to agreement about project lead times to be applied for projects in the ISP. As such, AEMO does not expect to adjust EISDs provided by TNSPs or jurisdictional bodies.

On balance, AEMO does consider it prudent to reserve the ability to apply adjustments to lead time based on transparent stakeholder feedback. This approach is consistent with all other inputs for the ISP (for example, if an expert consultant proposes a discount rate for use in the ISP, AEMO reserves the right to accept or reject that advice based on transparent stakeholder consultation).

Project stage at which adjustment of project lead time should be considered

The EISD for a project naturally becomes more certain as the project progresses through regulatory approval, project development and tendering stages. AEMO expects any revisions to EISDs could be made to projects which have not yet begun a regulatory approval process, or to projects which are still proceeding through a RIT-T (or equivalent, depending on the jurisdiction).

AEMO would not expect to adjust an EISD for a project which has completed a contingent project application (CPA), or equivalent. Once a CPA (or equivalent) is completed, AEMO would expect that tendering processes would be complete and that the EISD would be known with far more certainty. In addition, the AER's Cost Benefit Analysis Guidelines require AEMO to have regard to re-testing all ISP projects identified as actionable in a previous ISP which have not had CPA costs approved[10]. By extension of this logic, AEMO would not expect to re-test EISDs once a CPA (or equivalent) is approved.

[10] AER. August 2020. *Cost benefit analysis guidelines – Guidelines to make the Integrated System Plan actionable*. Page 17. At https://www.aer.gov.au/system/files/AER%20-%20Cost%20benefit%20analysis%20guidelines%20-%2025%20August%202020.pdf.

Of course, AEMO would continue to receive updates from project proponents as transmission projects are delivered, and would incorporate the most up to date project advice in the ISP wherever possible.

Need for transparency, and project-by-project consideration

AEMO agrees with **Origin** and other stakeholders about the need for transparent, early communication of the process that would be used to amend any EISDs. AEMO has released the draft project lead times for application in the 2024 ISP, for consultation through the Draft 2023 *Transmission Expansion Options Report*[11]. At this stage, AEMO has not proposed to make any adjustments to project lead times, and the report reflects project lead times that have been prepared as the result of extensive joint planning with TNSPs and jurisdictional bodies. AEMO would endeavour to consult as early as possible on any adjustment to transmission project lead times.

AEMO agrees with **Hydro Tasmania** and the **CEC** that EISDs should only be adjusted (if at all) on a project-by-project treatment, rather than a "blanket delay to all EISDs". This treatment would allow careful consideration of the factors impacting a project lead time and would allow for appropriate recognition of the current status of a project through regulatory, design, procurement, stakeholder engagement and environmental approval stages. However, AEMO may consider blanket delays in sensitivity analysis.

Potential to reduce the urgency of transmission project delivery

AusNet and **ENA** raised the concern that extending transmission project lead times could reduce the urgency to deliver actionable ISP projects as soon as possible. The **CEC** cautioned against delaying projects without justification, and **Shell Energy** warned that extending project lead times could permit transmission projects to begin regulatory approval for transmission projects while large uncertainty still exists for major associated matters such as supply-side resource investment that would be associated with the transmission project. These submissions highlighted the complexity involved in deciding how and when to adjust a project lead time estimate for ISP modelling purposes, and the many factors that must be balanced.

AEMO notes these concerns relating to the urgency of transmission project delivery, and potential unintended consequences of an adjustment to an EISD. AEMO considers that the best way to address these concerns is to ensure that an adjustment to a project lead time is only made where information and evidence exists to indicate the need for the adjustment.

In response to **Shell Energy**'s request that AEMO introduce ongoing analysis to consider whether actionable ISP projects should remain in the ODP, AEMO notes that ongoing reviews of actionable ISP projects already occur during each specific project's RIT-T and in the ISP feedback loop. AEMO assesses actionable projects that have completed a RIT-T via the ISP feedback loop, and actively monitors for material changes affecting actionable projects that would require an ISP update. In addition, the 'actionable ISP project' status of all actionable projects is reconsidered in subsequent ISPs[12] unless those projects are categorised as committed or anticipated[13].

AEMO acknowledges **AusNet**'s view that further work is required to demonstrate whether the proposed update to the ISP Methodology is preferred to the status quo. AEMO considers that the change is appropriate to allow for a

[11] AEMO. May 2023. *Draft 2023 Transmission Expansion Options Report*. At https://aemo.com.au/consultations/current-and-closed-consultations/2023-transmission-expansion-options-report-consultation.

[12] As required on page 17 of the AER's Cost Benefit Analysis Guidelines.

[13] Committed transmission augmentation projects meet five criteria relating to planning consents, construction commencement, land acquisition, contracts for supply and construction of equipment, and necessary financing arrangements. Anticipated projects are in the process of meeting at least three of the criteria. Details about the criteria are provided in AEMO's Transmission Augmentation Information publication, at https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecastingand-planning-data/transmission-augmentation-information.

response to transmission project lead time uncertainty, with the caveat that appropriate information and evidence would be needed before an adjustment would be made.

AEMO's proposed option to introduce an 'actionable window'

AEMO thanks **Transgrid**, the **CEC** and **PIAC** for their comments about AEMO's proposed option to introduce an 'actionable window'. AEMO agrees with **Transgrid** that the actionable window option may prudently allow some projects to be identified as actionable sooner, "helping to address project lead time uncertainty".

Based on stakeholder feedback, AEMO has revised its position on the actionable window concept. AEMO now considers that an actionable window should be introduced into the ISP Methodology, to further ensure that transmission project lead time uncertainty can be appropriately accommodated through the ISP. Under this new consideration, an actionable window:

- Will allow the cost benefit analysis to reflect a reality that transmission projects on their critical path cannot be paused after two or more years of progress and subsequently resumed without affecting lead time (for example, due to restarting regulatory approvals, planning approvals and community engagement).
- Will not require pre-emptive or unwarranted adjustment of an EISD based on uncertain project delay factors, but will allow consideration of delaying a project (for example, by interrupting regulatory approvals, planning approvals and community engagement) to be appropriately incorporated in the decision about whether a project is determined as actionable.
- Will apply for projects that have previously been assessed as actionable, in one or more previous ISPs, but not for projects that have not previously been assessed as actionable. This reflects the fact that if a project is identified as actionable then a regulatory process is begun, including planning approvals, community engagement and more, and that a change to actionable status would likely mean repeating this work if the project is required at a later date.

Because regulatory approval for large transmission projects can take more than four years, the actionable window is used to assess whether a project that was previously actionable should retain its actionable status from one ISP to the next. AEMO has decided to introduce an actionable window as follows:

- An actionable ISP project will be identified where the cost benefit analysis for the ISP has concluded that the project should proceed at the EISD, or before EISD + an actionable window.
- The actionable window will be defined in accordance with Table 4 when AEMO undertakes the ISP cost benefit analysis to consider which projects may be determined as potential actionable or future ISP projects.

Table 4 Treatment of projects when assessing actionable and future ISP projects

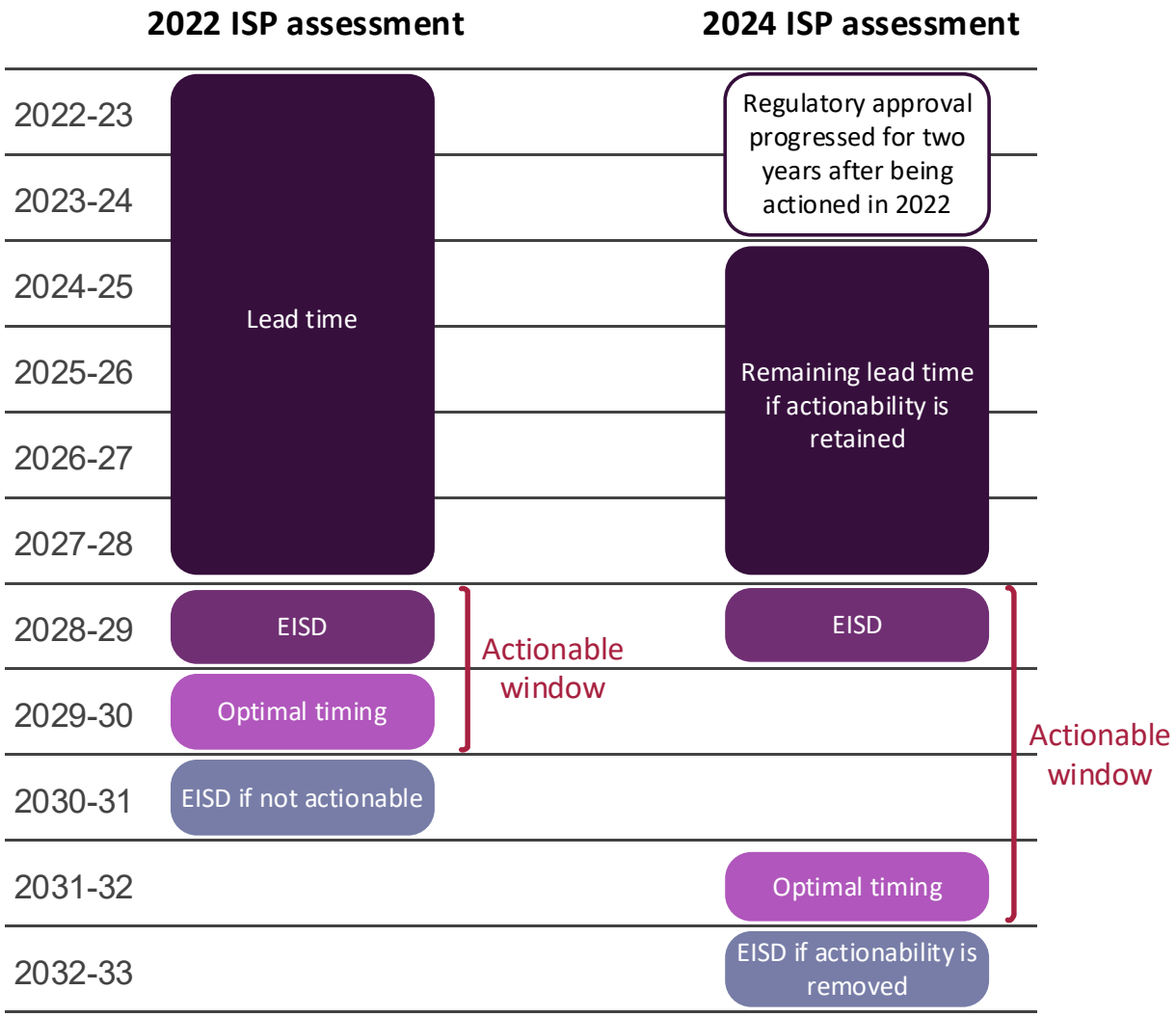
Methodology version	Project status	Optimal timing required for actionable status	Optimal timing for future project status
2022 ISP	Not previously actionable	EISD or (EISD + 1 year)	(EISD + 2 years) or later
	Actionable in most recent ISP		
	Actionable in last two ISPs		
2024 ISP	Not previously actionable	EISD or (EISD + 1 year)	(EISD + 2 years) or later
	Actionable in most recent ISP	EISD to (EISD + 3 years)	(EISD + 4 years) or later
	Actionable in last two ISPs	EISD to (EISD + 5 years)	(EISD + 6 years) or later

Figure 4 illustrates an example of the application of the actionable window.

On the left-hand side, a transmission augmentation project with a six-year lead time is identified as actionable in the 2022 ISP with optimal timing of EISD + 1 year (that is, 2029-30). The project proponent begins the streamlined RIT-T process, including community engagement, planning and environmental approvals processes, option consideration and more.

On the right-hand side, the same project is subsequently considered for the 2024 ISP. Two years of regulatory activities have been undertaken, and the project is two years progressed through its lead time. While the EISD has not changed since the 2022 ISP, other changes result in the 2024 ISP identifying the optimal timing at EISD + 3 years (that is, 2031-32). If the project's actionable status were to be removed, and the regulatory and engagement works stopped, the six-year lead time will need to be restarted after a future ISP re-declares it as actionable.

Figure 4 Possible impact of actionable window on EISD for a project that was actioned in the 2022 ISP and reassessed in the 2024 ISP



The implications of this actionable window are that:

- Extended regulatory approval timelines will be better accommodated. Although regulatory approval (the RIT-T, ISP feedback loop and contingent project application) can technically be completed within two years, there are multiple recent instances which have seen significantly longer completion times.
- The threshold for a project to be relegated from actionable to non-actionable between ISPs is higher than the threshold for making a project actionable if it has not previously been actionable. This position reflects the fact that the EISD for an actionable project is already based on stakeholder engagement, design, and regulatory and planning approvals that have been progressed over a two-year period. These activities and approvals cannot be paused for multiple years without affecting project lead time.

AEMO notes the concern raised by **PIAC** that an actionable window could lead to the inclusion of additional transmission projects as actionable ISP projects in the ODP than may otherwise have occurred. **PIAC** is concerned that this would be at the expense of potentially less costly non-network options. AEMO considers that the revised approach to actionable windows manages the risk raised by **PIAC** because it does not change the approach used in previous ISPs to action new projects (it only affects projects which are previously actionable). AEMO also considers that non-network options should be assessed through the RIT-T process, and that removing actionable status may interrupt the assessment of non-network options in the RIT-T.

Other matters relating to transmission project delays

AEMO notes **PIAC**'s comment regarding the ongoing need to consider social licence for transmission projects in the NEM. AEMO will undertake sensitivity analysis in the 2024 ISP to consider the impact of social licence-related matters.

AEMO acknowledges the **CEIG**'s important point that this ISP Methodology adjustment will not address the root cause of issues driving transmission project delays.

Supply chain constraints and generation project lead time

AEMO agrees with **Origin** that project lead times can vary for generation and storage projects, particularly for technologies such as pumped hydro which have extremely site-specific development lead times. AEMO already uses project lead time for generation and storage, as described in the IASR.

At present, AEMO is not proposing to amend the project lead times already published and consulted on through the IASR process, which include an eight-year lead time for pumped hydro projects. Although a longer lead time could capture the longer lead times for more complex or larger projects, it could mean assuming an unnecessarily long lead time for less complex or smaller projects. AEMO acknowledges that over time and with more evidence and data it may be prudent to change that assumption. In the interim, AEMO does conduct sensitivity studies in the ISP for particularly impactful variable changes, and this could include consideration of generation and/or storage project delays.

AEMO acknowledges **CEIG**'s view that renewable generation build out rates required in the 2022 ISP's *Strong Electrification* sensitivity and *Hydrogen Superpower* scenario were unrealistic.

AEMO's conclusion

AEMO has decided to proceed with amending the ISP Methodology to introduce an actionable window. AEMO considers that the actionable window approach will more accurately reflect the lead time of projects that were actionable in the previous ISP. Projects that were not previously actionable are not affected by this change.

AEMO has also decided to permit adjustment of the EISD for each transmission augmentation project in the ISP based on transparent stakeholder consultation. AEMO expects this adjustment to be unlikely given that AEMO undertakes extensive joint planning with TNSPs and jurisdictional bodies to understand the most up-to-date project status and lead time.

Both of these updates are made in the 'terminology' sub-section in Section 5.1 of the final ISP Methodology.

If the generation or transmission build in the draft or final ISP is observed to be lumpy, sensitivity analysis could be conducted to assess the impact of limiting infrastructure delivery based on a supply chain constraints. This could be modelled with annual limits on:

- **Transmission network** – a total length or cost of network build.
- **Generation** – a total capacity or cost of generation per year (potentially split into generation technologies)
- **Storage** – a total capacity, cost or amount of energy (potentially split into generation technologies)

This update is made in Section 2.4.4 of the final ISP Methodology.

2.2.2 Impact of fossil-fuelled generation on REZ transmission limits

Issue summary and submissions

AEMO proposed to better reflect the impact of retiring fossil-fuelled generation on REZ transmission limits by adding additional variables to existing REZ transmission limit equations. This approach means that when fossil-fuelled generation retires in ISP modelling, or is dispatched at lower than typical historical levels, the model will allow transmission network capacity previously assumed to be used by that generation to be automatically freed-up for potential use by additional variable renewable energy (VRE) generation (or any other additional generation). AEMO simultaneously proposed to update the formulation of REZ transmission limits to incorporate relevant impacts from nearby flow paths, for example the impact of a flow path augmentation on a REZ transmission limit.

Several submissions (**Powerlink**, **Transgrid**, **CEC**, **AusNet**, **QCC**, **PIAC**, **Hydro Tasmania**) supported the proposal to include fossil-fuelled generator terms in REZ transmission limit equations.

The **ISP Consumer Panel** agreed that REZ transmission limit formulations should be updated but did not support the proposed change. **Shell** also did not support the proposed update. Both stakeholders expressed concern that "*the proposed methodology could have the effect of reserving capacity in the shared network for both thermal generators and ISP projects when these interact with generation located in a REZ*". AEMO's understanding of this concern is that these stakeholders have interpreted the proposed update as placing fossil-fuelled generation terms in transmission limit equations in such a way that would lock-away transmission network capacity, until those generators retire in ISP modelling. AEMO acknowledges that the consultation paper could have described this process more clearly. The **ISP Consumer Panel** and **Shell** put forward that ISP modelling would be improved by using a "*more granular, but not necessarily a fully nodal transmission network model*". **Shell** further recommended that AEMO consult further with stakeholders on this matter.

Powerlink noted that the increased transfer capacity associated with a reduction in fossil-fuelled generation is not a one-to-one relationship, and that is it is impacted by the "*location, technical characteristics and expected future operation of these fossil-fuelled generators*". It is **Powerlink**'s view that constraint equations must approximate the impacts of these factors.

Transgrid also suggested that AEMO consider including specific terms in transmission limit equations for other terms, for example, storage, hydrogen electrolysers, or other large loads.

The **CEC** agreed that there is value in recognising that decreasing dispatch from fossil-fuelled generators will free up existing transmission network capacity for renewable generation, but raised concern that the proposed approach could give a false impression that more transmission network is available to support new renewable generation that would actually be available, and could lead to delays in REZ transmission network expansion.

QCC also recommended that AEMO create an annual publication on the indicative network capacity used by fossil-fuelled generators within a REZ for greater transparency.

AEMO's assessment

AEMO does not agree that the proposed methodology change will reserve capacity in the shared network for thermal generation, or indeed for any other generation type. Rather, the revised formulation of the equations allows more flexible consideration of REZ generation, fossil-fuelled generation and interconnector flows, and will be responsive to whatever amount of each type of generation is dispatched in the market model. These new variables will all be able to be optimised by the market model – that is, they will be left-hand side terms in the constraint equations, not right-hand side terms[14]. These variables will not be predetermined values and they will not reserve transmission capacity for use by one particular type of generation. AEMO acknowledges that the consultation paper could have described this process more clearly.

AEMO has designed the updates to the equations to overcome the risk of reserving capacity for particular generation types, and to instead allow the equations to accommodate access to transmission network in the model for all generation types. AEMO agrees with stakeholders that a more granular network representation would be preferable, and AEMO continues to track and investigate this as an option, but currently the complexity of the model is already limited to ensure the runtime for the model solution is feasible.

AEMO agrees with **Powerlink** regarding increased transfer capacity associated with a reduction in fossil-fuelled generation not being a one-to-one relationship, and will ensure appropriate coefficients are used to represent the relationship.

AEMO agrees with **Transgrid**'s recommendation to be able to include terms for hydrogen electrolysers or other large loads. AEMO notes that the equations already provide for inclusion of storage variables, and notes that any additional terms would have to be explicitly modelled and that this could extend runtime. As such, AEMO would include these additional terms on a case-by-case basis only.

AEMO also agrees with the **CEC** feedback regarding a need to ensure network capacity should not be over-estimated by the use of these equations. AEMO agrees that adjustment of REZ transmission limits to remove assumptions about capacity used by fossil-fuelled generation would need to be undertaken very carefully,

[14] More information about constraint equations used in the NEM Dispatch Engine (NEMDE) is available via https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/system-operations/congestion-information-resource/constraint-faq. The limit equations and constraint equations used in the ISP modelling process.

with appropriate consideration of nearby generation and interconnector flows as well as known operational limits of the power system.

AEMO notes **QCC**'s request for information-sharing about any use of REZ capacity by fossil-fuelled generators in the modelling process. AEMO does not consider this to be within the scope of the ISP Methodology.

AEMO's conclusion

AEMO has decided to proceed with amending the ISP Methodology to include fossil-fuelled generators and nearby flow path impacts as variables in the transmission limits applied for REZs in the ISP modelling. AEMO has also decided to include an optional variable for large loads, depending on availability of load information, on load treatment in the regional and sub-regional models, and on simulation complexity and solve time. These updates are shown in Section 2.3.4 of the final ISP Methodology.

2.2.3 Network losses for REZs and sub-regions

Issue summary and submissions

In the Draft 2023 IASR, AEMO proposed to create new sub-regions and associated sub-regional loss equations, to support better representation of network losses associated with sub-regions are in the ISP. AEMO proposed to reflect this enhanced treatment of network losses in the ISP Methodology by adding an option for inclusion of loss equations and marginal loss factor equations for intra-regional flow paths, in other words flow paths between sub-regions.

Several submissions (**Powerlink**, **Transgrid**, **QCC**, **CEIG**, **PIAC**, **Windlab**, **ISP Consumer Panel** and **Shell**) supported the proposal for improvement to calculation of network losses. There were no submissions that did not support an improvement to catering for losses. However, some submissions did recommend different approaches be considered in the loss calculation methods proposed (**CEIG**, **Windlab**, **Shell Energy**).

Powerlink supported the creation of new sub-regional loss equations but recommended that AEMO adjust its definition of the new sub-regions Central Queensland (CQ) and North Queensland (NQ). In **Powerlink**'s opinion, "*the flow path between the Central West zone and North zone is more informative for representing major flow paths*" than the flow path between the "North" and "Ross" zones. **Powerlink** proposed that:

- AEMO's CQ region should be defined as **Powerlink**'s Central West zone, and
- AEMO's NQ region should include **Powerlink**'s Far North, Ross and North zones.

Powerlink supported the option to include MLF equations for intra-regional flow paths "*in lieu of more granular representation of the network in the ISP modelling*". **Powerlink**'s agreement with AEMO's proposal is conditional on the approach being "*taken holistically to avoid penalising certain sub-regions*".

In **Transgrid**'s opinion, the creation of new sub-regions and the associated sub-regional loss equations will be more reflective of both network conditions and developer locational decision making for renewable generation projects.

QCC agreed that the impact of network losses for REZs and sub-regions is worth quantifying in the modelling. In **QCC**'s opinion, changes to loss factors caused by increasing renewable generation will be a material factor in determining the ODP. **QCC** suggested that "*Renewable Energy Industrial Precincts (REIPs) should be modelled parallel to REZ to guide development of industry geographically, particularly in a green energy export scenario*". In **QCC**'s view, this would have a significant impact on network losses.

PIAC supported the proposed update to enhance the treatment of network losses by adding an option for inclusion of loss equation and marginal loss factor equations for intra-regional flow paths.

The **ISP Consumer Panel** agreed that network losses for REZs and sub-regions are worth quantifying.

CEIG proposed an alternative method to the one proposed by AEMO. **CEIG** recommended replacing MLFs with average loss factors for determining settlement prices and argued that MLFs overstate the value of losses.

Windlab agreed that network losses for REZs and sub-regions are worth quantifying but noted that AEMO must ensure losses are not double-counted, and recommended MLFs relative to the new regional reference nodes should be utilised. Also, in **Windlab**'s opinion, the ISP should use average loss factors (ALFs) rather than MLFs as the use of MLFs overestimates losses by 100%, and referred to an example in an AEMO publication (Treatment of Loss Factors in the National Electricity Market, Section 5.3) where this occurred. Based on this, **Windlab** argued that use of MLFs in the ISP will lead to a sub-optimal generation mix in the ODP.

Shell supported the proposed update but noted that it is "*critical that marginal loss factors for individual generating units … are referenced to their respective sub-regional reference node and not the central regional reference node to prevent the application of a double marginal loss factor penalty to a remote regional generator*". **Shell** recommended "*that AEMO issue a draft report for consultation setting out the proposed sub-regions and their nominated sub-regional reference nodes*".

AEMO's assessment

When considering application of loss equations and factors in the ISP modelling process, it is important to distinguish treatment of generators and load scheduling from the treatment of physical network losses. In the NEM design, marginal losses are a market construct used to determine wholesale prices and scheduling, whereas average or total losses are used to determine physical losses that occur as electricity travels through the network.

AEMO does not agree with **CEIG** and **Windlab** that static average loss factors for should be used for modelling settlement prices and dispatch for generators and loads instead of MLFs. AEMO considers that MLFs should be used for assessing merit order and pricing for generators and loads, consistent with the design of the NEM. Using existing generator MLFs, as opposed to new generator MLFs relative to the sub-region reference nodes, will better reflect the actual dispatch merit order seen in the regional dispatch model currently used in the NEM. AEMO is not proposing to change the treatment of these factors for generators and loads in the ISP so as to stay consistent with the NEM pricing methodology applied in the dispatch process.

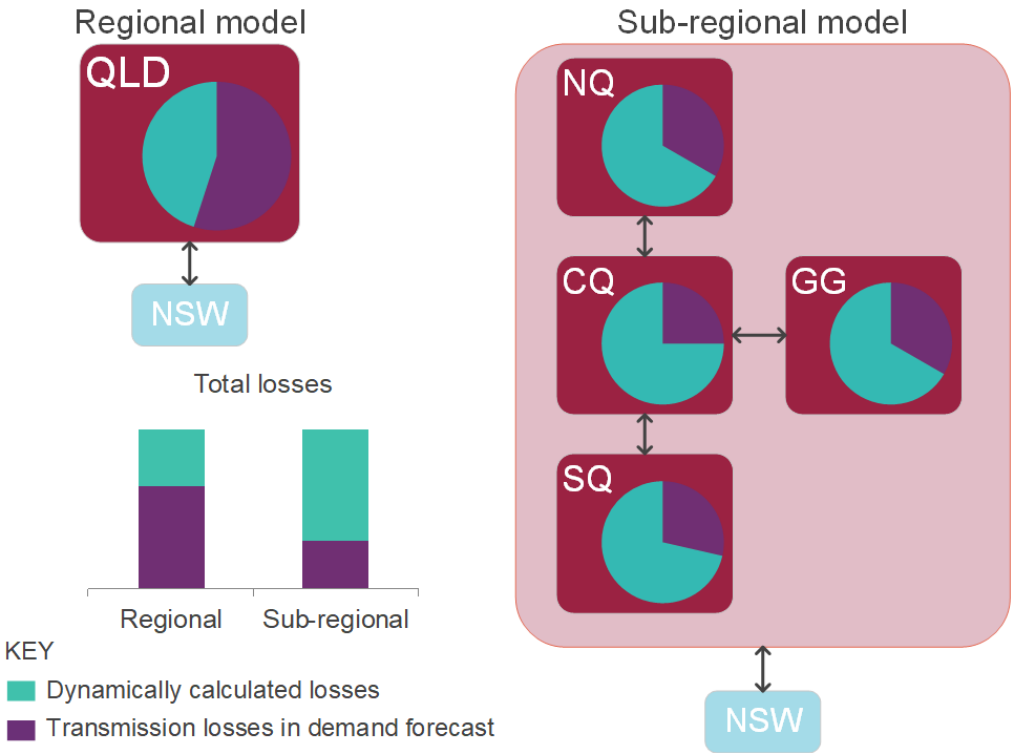
Separately, network losses are accounted for in planning and modelling processes in two ways:

1. **Network losses through the flow paths (transmission lines) that connect sub-regions to one another** – these are explicitly accounted for and calculated dynamically using loss equations. The updates proposed in the consultation paper were limited to the method for preparing these loss equations, for application to the modelled flow paths between the sub-regions.
2. **Network losses within the sub-regions** – these are associated with all other transmission elements that are not part of a flow path between sub-regions. This category of losses is already included in the modelling of sub-regional demand forecasts and are exclusive of flow path losses that are dynamically calculated using the loss equations.

Figure 5 displays the treatment of network losses for both regional and sub-regional models.

In relation to concerns that the additional inter-regional losses being calculated would apply a double penalty to existing generation if the regional generator MLFs are still utilised, it should be noted the purpose of modelling the generator MLFs is not to account for losses but to represent the marginal impact of losses on pricing. The accounting of losses occurs in the loss equations for the flow paths and in the sub-regional demand forecast.

Figure 5 Treatment of losses in the regional and sub-regional models



AEMO agrees with **QCC** in relation to being cognisant of development of local demand such as Renewable Energy Industrial Precincts, particularly in the *Green Energy Export* scenario. The inclusion of these demands into sub-regional demand forecasts, where possible, will support more accurate modelling of inter- and intra-regional flows.

AEMO notes **Powerlink**'s request for the definition of the new sub-regions in the Queensland region of the ISP models to be adjusted to align with **Powerlink**'s zones. AEMO agrees that ideally local TNSPs and AEMO should publish aligned boundaries for network modelling purposes to reduce confusion and facilitate transparency. In this case, AEMO is not presently proposing to adopt **Powerlink**'s zone boundaries because significant work would be needed to ensure alignment on all matters such as load data, generator data and network elements, and because the currently proposed sub-regions and REZs within those sub-regions have already been published for consultation as part of the Draft 2023 IASR (see Section 3.10.1, Table 34).

To ensure that key and impactful modelling parameters for the ISP are appropriately captured and kept aligned between AEMO and **Powerlink**, AEMO has consulted with **Powerlink** to ensure that the transmission limit equations defining the relationship between the Northern Queensland and Central Queensland sub-regions in the model will appropriately capture transmission augmentation project capacities and inter-relationship with nearby generation and storage projects. AEMO will continue to consult closely with **Powerlink** throughout the ISP delivery process to ensure that the ISP modelling approach adequately captures future power system

characteristics in northern Queensland, and may consider adjustment of sub-region boundaries in future IASR consultations.

AEMO's conclusion

AEMO has amended the ISP Methodology to use the loss equations to better represent power transfers between specific REZs and sub-regions. Existing static generator MLFs will be maintained in the modelling process, to remain consistent with the existing pricing methodology and merit order dispatch process for the NEM. The updates are shown in Section 2.3.6 of the ISP methodology.

AEMO will continue extensive joint planning with **Powerlink** to ensure that both AEMO and **Powerlink** network modelling exercises appropriately capture key power system parameters.

2.2.4 Assumed renewable energy resource quality

Issue summary and submissions

In the consultation paper, AEMO identified an opportunity to better align assumed renewable energy resource quality in REZs with historical performance by incorporating values consulted on with stakeholders through the Draft 2023 IASR consultation process. AEMO proposed two updates related to renewable energy resource quality:

- The first was to use a desktop assessment of land use data to provide an initial screen of sites which are unsuitable for development, considering a range of factors including environmental and ecological constraints, cultural heritage, land planning and proximity to restricted areas, such as airports.
- The second was to remove the wind resource quality percentile values from the ISP Methodology, and instead implement updated values through the 2023 IASR process.

Several submissions (**ISP Consumer Panel**, **Transgrid**, **Powerlink**, **Shell**, **QCC** and **PIAC**) supported both of AEMO's proposals regarding assumed renewable energy resource quality, but also made recommendations or suggestions. **CEIG** supported AEMO's proposal to screen sites via a desktop assessment of land use data but did not state agreement or disagreement with AEMO's proposal to adjust the percentiles used to delimit the wind resource tranches.

There were no submissions that did not support the proposed update. However, **Origin** stated that it could not evaluate whether the proposed update to wind resource quality tranches is appropriate, and requested more information on the process used to select the percentiles that delimit the wind resource quality tranches.

Regarding the use of land use data, the **ISP Consumer Panel** highlighted the importance of considering cultural heritage, particularly with reference to Indigenous sites, as a factor that should be better applied in considering VRE development locations.

Powerlink suggested AEMO publish an additional document to provide greater insight into any changes to the determined renewable energy availability and quality of a REZ that result from the proposed approach. It pointed to a case where AEMO had increased the capacity factor of wind resources in the Far North REZ, but had not proactively explained the change to stakeholders.

Transgrid encouraged AEMO to stress test its proposed approach.

PIAC suggested that an additional class of wind turbines is required to increase the granular accuracy of these metrics, noting that AEMO uses a single class of wind turbines and that this may lead to over- or under-estimation of generation. It suggested the model should assume "class A" and "class B" turbines are used in "grade 1" and "grade 2" locations respectively.

QCC stated its view that land use screening is "*extremely important*" for REZ modelling and recommended that this process must consider cultural and environmental value. In **QCC**'s opinion, past applications of a land use penalty have largely omitted the intrinsic value of cultural sites and threatened species habitat and have focussed mainly on land uses which can be bought. **QCC** highlighted its concern that current wind proposals in Central, North and Far North Queensland "*would remove more than 1000 hectares of habitat... of 12 threatened species*" and threaten "*nearly 8000 hectares of koala habitat*". **QCC** noted that there has been no assessment of cumulative impacts at a regional scale, or any consensus on whether this should qualify as an ecological constraint. **QCC** also noted that damage to environmental and cultural sites could erode the social licence afforded to REZ developments and advised AEMO to use the **Advisory Council on Social Licence**.

QCC supported a more conservative view of capacity factors for wind in Queensland and pointed to operational result from northern Queensland wind farms, and noted its preference for wind capacity factors to be based on more detailed land mapping and resource assessments, as well as on historical performance of existing wind farms.

Shell recommended that the methodology also be updated to include an obligation on AEMO to publish and consult on a report which lists the sites deemed unsuitable for development and details the reasoning for the choices.

Windlab agreed with the proposal to screen potential VRE sites with consistent use of land use data. However, it claimed the currently assumed capacity factors for the South West New South Wales REZ are too low, and stated a willingness to provide AEMO with measured wind speed and energy traces under a non-disclosure agreement to support this claim.

AEMO's assessment

REZ resource quality and capacity factor estimates are intended to represent the estimated performance of hypothetical new wind and solar generation developments in the REZs. The selection of the percentiles used for the two tranches of wind farms aims to result in capacity factors that realistically reflect the expected performance of new developments in the REZs. AEMO has adjusted the percentiles to better align with actual performance data from recently established wind farms, and will publish the updated values through the 2023 IASR process.

Wind resource is split into two tranches in order to capture the potential variability of wind resource within REZs. High wind tranche is developed first due to its better resource, while the medium tranche represents other areas that may be developed in later years after the high wind sites have been taken.

The capacity factors resulting from the application of the multi-criteria analysis (MCA) will be detailed in the final 2023 IASR[15].

The increase in capacity factors for some REZs is due to the ruling out of no-go zones with poorer wind resource. The updated capacity factors reflect the better resource quality of the remaining locations.

[15] Consultation materials for the 2023 IASR are available at https://aemo.com.au/en/consultations/current-and-closed-consultations/2023-inputs-assumptions-and-scenarios-consultation.

AEMO agrees that having different classes of turbines could improve the accuracy of the inputs and the modelling. However, much like traditional generation plants, turbines for wind farms are project-specific, and while there is a significant number of 'off-the-shelf' turbines in the market that could be used for resource modelling, picking the one that best represents the technology that will most likely be deployed deserves careful evaluation and study. Additionally, the cost trade-offs between those turbine designs have to be explored. AEMO is not in a position to implement that detailed assessment for the upcoming 2023 IASR or the 2024 ISP.

Due to data confidentiality requirements, AEMO is unable to publish all the land-use planning data used to determine locations within REZs that are modelled as candidates for renewable energy projects. Furthermore, the resolution of data could identify areas with small number of landowners who could easily misinterpret the intent of the data, which is conceptual. As such, AEMO does not consider there is merit in publishing precise individual locations where the ISP model plants renewable generation.

AEMO is actively looking for other sources of mesoscale and irradiation data to further enhance the IASR and ISP, but has so far only found one data set that is sufficiently large, and that it can use and publish.

AEMO has met with **Windlab** to discuss its submission and to make arrangements to receive confidential wind trace data. AEMO will continue to consult with **Windlab** and any other stakeholders that are able to provide relevant data to support enhanced renewable energy quality assumptions for AEMO planning publications. However, AEMO does not propose to make changes until sufficiently broad and robust data can be gathered and consulted on.

AEMO's conclusion

AEMO has adopted its original proposal to use multi-criteria analysis to exclude areas for the development of wind generation. The amendments are in Section 2.3.6 of the final ISP Methodology.

2.2.5 Potential inclusion of a value of carbon emissions

Issue summary and submissions

On 19 May 2023, Energy Ministers agreed to legislative amendments to incorporate an emissions reduction objective into the National Electricity Objective (NEO)[16]. These changes are intended to provide clarity to market institutions such as AEMO regarding how they consider emissions reduction in how they undertake their powers and functions.

In the consultation paper for the update to the ISP Methodology, AEMO considered that the most appropriate method to incorporate an emissions reduction objective in the NEO into the ISP would be to apply a value of carbon emissions in the ISP cost benefit analysis[17]. This would represent the value of investments that reduce carbon emissions beyond the existing ISP scenario parameters. AEMO noted that an additional class of market benefits, which estimates the value of emissions reductions beyond those required by policy or scenario settings, could be considered. This may require a rule change, an amendment to the AER's Cost Benefit Analysis Guidelines, or agreement from the AER.

[16] Australian Government. June 2023. 'Incorporating an emissions reduction objective into the national energy objectives'. At https://www.energy.gov.au/government-priorities/energy-and-climate-change-ministerial-council/working-groups/national-energy-transformation-partnership/incorporating-emissions-reduction-objective-national-energy-objectives.

[17] Although the consultation paper erroneously referred in one place to capacity outlook modelling rather than cost benefit analysis, the intent is for a value of carbon emissions to be applied in the cost benefit analysis stage of the ISP modelling.

Sixteen submissions (including the **ISP Consumer Panel**, **Transgrid**, **Powerlink**, and **CEIG**) supported AEMO's proposal to include an additional class of market benefit to estimate the value of emissions reductions, once there is clear direction provided by the AER. However, several of these submissions made recommendations or raised queries about the process that will be taken to derive the value of carbon emissions and suggested that the value used should be one that is consistent across industry.

The **ISP Consumer Panel** noted that the Consultation Paper does not outline how AEMO will obtain that value and raised two questions:

1. How will AEMO ensure consistency with the values used in other parts of the NEM?
2. How will AEMO avoid biasing the results with the chosen values?

The **ISP Consumer Panel** further noted that there is a need to avoid a situation where consumers pay for an emissions abatement multiple times. The example provided was that it may be included in the ISP cost benefit analysis, in a TNSP RIT-T, and in a distribution NSP (DNSP) regulatory test for distribution (RIT-D). Given these concerns and questions, the **ISP Consumer Panel** highlighted that "*transparency is crucial for customers*".

AusNet supported AEMO's proposed approach. However, **AusNet** noted its view that a carbon emissions value should be determined consistently by a single market body, "*such as the Australian Energy Regulator*", and be "*subject to robust industry consultation*". **AusNet** does not consider the ISP Methodology as the appropriate mechanism to derive this value. Further, **AusNet** recommended that "*any update to the ISP methodology should align with the intent of the Australian Government's proposal to capture all public commitments related to emissions reduction*".

Transgrid put forward a similar view regarding the need for a value of carbon emissions to be developed in a consultative manner, and stated that the value should be derived "*with a clear methodology aligned with international best practice*".

Powerlink noted its anticipation that AEMO or the AER will provide additional information for consultation on this matter.

IEEFA agreed with AEMO's proposed approach, but made the following recommendations:

- The value of carbon should reflect the economy-wide implied carbon price.
- The value of carbon emissions should be reported as a separate item so readers can see the specific cost of emissions abatement associated with particular investments.
- The use of a value of carbon in the ISP should not replace the currently used carbon budgets.
- The use of a value of carbon should not be used to justify the use of carbon offsets as an alternative to decarbonising the electricity system.

In the **CEC**'s view, the ISP methodology requires an explicit value of carbon emissions. The **CEC** stated concern that AEMO's proposal only states the possibility of including a value of carbon emissions within an additional class of market benefit. **CEC** recommended that "*emissions outcomes be considered equal, if not prioritised, in the ranking of CDPs*" and cited the "*potentially greater economic impacts from climate change*" that could result from candidate development paths (CDPs) with lower levels of carbon emissions abatement. Finally, the **CEC** recommended that AEMO call for a clear dollar-value of carbon emissions to be created by another party.

FFI did not state whether it agreed or disagreed with the proposed update. **FFI** noted that a value of carbon was not included in the 2023 Draft IASR and queried whether this would actually lead to emissions reductions.

Shell did not state whether it agreed or disagreed with the proposed update. In **Shell**'s opinion, the proposed update may result in the benefits of carbon emissions reductions associated with ISP projects being double counted. **Shell** recommended that, prior to implementing the change, AEMO consult on how it will ensure only the marginal benefit of carbon emissions reductions, above what is already included in the ISP modelling under the carbon budget constraint, will be included, in order to avoid "double-claiming" carbon emissions reductions benefits. **Shell** noted that AEMO provided no information on how the value of carbon emissions will be derived, and queried how AEMO will ensure consistency with values used across the NEM, and how AEMO will limit biasing the results via the chosen values.

AEMO's assessment

AEMO acknowledges stakeholders' calls for transparency about the application of a value of carbon emissions in the ISP. AEMO will be transparent on this matter throughout the ISP process.

AEMO has not identified what value of carbon emissions would be applied in the ISP. AEMO intends to use a value prepared by an authoritative body, should it be developed.

In response to the **ISP Consumer Panel**'s questions and comments on this matter, AEMO notes that where consistency with any other values used in other parts of the NEM is relevant, AEMO will take this into account. In addition, AEMO always seeks to select ISP inputs, assumptions and modelling techniques which accurately reflect energy sector policies and market trends without bias.

AEMO notes views from the **ISP Consumer Panel** and **Shell** that a value of carbon emissions should be applied such that there is no double-counting of emissions reduction, given that the ISP already incorporates carbon budgets to represent the pace of decarbonisation in different scenarios. AEMO considers that a value of carbon emissions (or value of emissions reduction) would complement a carbon budget without double-counting. In response to the **ISP Consumer Panel** example, AEMO notes that the ISP cost benefit analysis, TNSPs' RIT-Ts, and DNSPs' RIT-Ds are independent assessments. AEMO considers that benefits identified progressively through these processes are not cumulative and should not include double-counting.

AEMO's conclusion

AEMO has adopted its original proposal to reflect the anticipated emissions reduction objective in the NEO by applying a value of carbon emissions or value of emissions reduction in the ISP. The application of this method in the 2024 ISP is subject to a value being developed by an authoritative body. This amendment is in Section 5.2 of the final ISP Methodology.

2.2.6 Consumer risk preferences

Issue summary and submissions

In the consultation paper, AEMO proposed that it may use informed judgement to finalise the ODP with reference to consumer risk preferences by incorporating evidence-based consumer risk preference metrics where available. AEMO engaged a consultant to support the preparation of consumer risk preference metrics specifically relevant for the ISP, using data gained through focus groups and a survey. The development of these risk preference metrics is ongoing.

Transgrid and **CEIG** supported AEMO's proposal to potentially use evidence-based consumer risk preference metrics as part of applying professional judgement to finalise the selection of the ODP. Several submissions

pointed to a lack of information provided by AEMO, and many of these requested further opportunities for consultation.

In the **ISP Consumer Panel**'s opinion, incorporating consumer risk preferences using a replicable methodology is a priority for the 2024 ISP. The **ISP Consumer Panel** highlighted the importance of examining risk preference, not only risk neutrality and risk aversion. The **ISP Consumer Panel** also suggested several factors for AEMO's consideration:

- The extent of a customer's existing payments to reduce risk.
- State government policies that seek to reduce or eliminate consumer risk.
- That selecting an ODP with a more aggressive timetable does not guarantee that projects will be completed more rapidly, due to factors beyond AEMO's control.
- Recent and forthcoming large price rises.
- Cost-of-living pressures associated with the fall in real wages.

The **CEC** supported the proposal to incorporate consumer risk preference metrics. However, the **CEC** recommended that AEMO engage with the full range of consumer groups and cautioned AEMO to account for the potential occurrence of salience bias, in which consumers may focus on upfront costs ahead of long-term benefits. The **CEC** noted the asymmetrical levels of risk associated with transmission augmentations being built early versus late and stated its view that the ISP Methodology should actively consider the insurance value of transmission.

Nexa Advisory also suggested that AEMO should consider that the risks associated with delivering transmission too late exceed the risks associated with delivering transmission too early.

AusNet welcomed AEMO's investigation of evidence-based consumer risk preferences. **AusNet** suggested that AEMO "*consider whether consumers value bringing forward early works for a wider set of ISP projects*" and recommended that "*the draft update ISP Methodology document be updated to reflect the need to publicly consult consumers on draft metrics rather than rely solely on professional judgement*".

In **RE-Alliance**'s opinion, consumer risk preferences should be considered and AEMO should make the proposed approach transparent so that stakeholders can see how AEMO is weighting various risk profiles. **RE-Alliance** recommended that AEMO consult with a wide range of stakeholders, beyond the **ISP Consumer Panel**. **RE-Alliance** further recommended that AEMO employ social scientists to inform the development of evidence-based risk preference metrics.

ENA, **Shell**, **First Nations Clean Energy Network**, **Nexa Advisory**, and **QCC** all recommended or requested that AEMO provide opportunities for further consultation on the development and application of evidence-based risk metrics. In addition, **ENA** and **Shell** agreed with (or supported) the principle of considering evidence-based risk metrics but stated they were unable to adequately evaluate the proposed update due to a lack of information provided on the matter. **Shell Energy** implied its expectation that the questions asked to consumers, and their responses, as well as the consultant's report, will all be made publicly available.

Nexa Advisory and **First Nations Clean Energy Network** both agreed that it is important to consider consumer risk preferences but suggested that AEMO should also consider community risk preferences. **Nexa Advisory** further recommended that,

- AEMO consult more widely than the **ISP Consumer Panel**, and

- AEMO provide more information on the composition and selection of the **Advisory Council on Social Licence** and **ISP Consumer Panel** (so stakeholders are made aware of any biases within these groups).

PIAC did not state support for AEMO's proposed update, although it supported the principle of employing evidence-based metrics. **PIAC** noted that there is a lack of information on how these metrics are being developed. In **PIAC**'s view, an assessment of consumer risk preferences requires "*robust and meaningful engagement*". **PIAC** highlighted that a diverse set of consumer preferences should be accounted for in the model. **PIAC** cautioned AEMO to consider the impacts of the method used to aggregate risk preferences and noted that some approaches run the risk of "over-valuing" the benefits of more expensive CDPs. **PIAC** suggested that AEMO must be transparent with the level of risk aversion chosen and stated that "*assumptions concerning consumer preferences that increase the attractiveness of more expensive CDPs should be treated with extreme caution*".

QCC did not state support for the proposed update and commented that it cannot evaluate the consequences of incorporating evidence-based metrics based on the information provided by AEMO to date. **QCC** raised concern that the metrics being prepared will be too narrow. **QCC** expressed further concern that the process of developing these metrics may prioritise "*traditional consumers, such as on the **Consumer Panel***".

QCC and **Nexa Advisory** put forward similar opinions that:

- Metrics based on a willingness to pay or value of customer reliability framework will not completely capture consumer risk preferences.
- An understanding of consumer and community risk preferences must consider risk preferences regarding climate change, in addition to direct economic costs. (**Nexa Advisory** pointed to climate change being a key issue in recent federal and state elections).

Additionally, **Nexa Advisory** expressed its opinion that cost of living is a "top-of-mind" issue for consumers.

Flow Power recommended that AEMO needs to be clear regarding the types of consumer risk preferences incorporated in the ISP, and transparent in how these are translated into quantitative metrics. **Flow Power** highlighted that these metrics need to be well understood by stakeholders to allow them to interpret ISP results.

AEMO's assessment

AEMO appreciates the submissions on the consumer risk preferences. This project is novel, and AEMO appreciates stakeholders' advice on next steps with this work.

Lack of transparency

A number of submissions noted that there is a lack of transparency or information around the development of the risk metrics and advised that fuller feedback would be possible if more information were available. AEMO acknowledges this point, however the reason for the lack of information is that the consumer risk preference project is still in progress. The completion date for the project is expected to be after the final ISP Methodology publication.

AEMO will publish the conclusions of the consumer risk preferences work in December 2023, as part of the release of the Draft 2024 ISP. AEMO will welcome feedback during the consultation period following the release of the Draft ISP.

Consumer engagement

Several submissions referred to AEMO consulting with **ISP Consumer Panel** and AEMO's **Advisory Council on Social Licence** as the consumers for this project. AEMO notes that the **ISP Consumer Panel** is collaborating with AEMO on this project, including providing their expert views on the method for the project.

The project itself involves an external consultant conducting consumer research with a broad range of residential electricity customers to seek to qualitatively and quantitively derive a consumer risk metric for residential consumers in the NEM. This work will include focus groups with deliberative elements, and an online survey, including ensuring there is sufficient representativeness and segmentation in the demographics.

Consumer risk preferences methodology and metric

As noted above, the project is ongoing and has not been completed. At this stage of the project, it can be communicated that the methodology for deriving consumer risk preferences is not based on the value of customer reliability framework. The project is exploring consumers' risk appetite for price volatility.

AEMO has not yet decided the application of consumer risk preferences in the ISP. Any application of consumer risk preferences in the Draft ISP will transparent, and will be subject to stakeholder consultation between the draft and final ISP.

AEMO's conclusion

The development of evidence-based consumer risk preference metrics is a novel and innovative project. The results will be shared in the Draft 2024 ISP which will be published in December 2023. AEMO will welcome stakeholder feedback on this matter through the formal consultation period following the release of the Draft 2024 ISP and will ensure that, once the project is completed, there is transparency on the method and results.

AEMO has made some adjustments to the wording in the ISP Methodology. AEMO has decided to implement this update, as shown in Section 5.8 of the final ISP Methodology.

2.2.7 Dispatch behaviour of storage devices

Issue summary and submissions

To limit the perfect foresight inherent in AEMO's forecasting approach for the dispatch of storage devices, AEMO proposed in the consultation paper to limit storage capacity as follows:

- For devices with less than 2 hours of storage, reduce storage capacity by 50%.
- For devices with 2 to (less than) 4 hours of storage, reduce storage capacity by 25%.
- For devices with 4 to (less than) 8 hours of storage, reduce storage capacity by 10%.

AEMO received 18 submissions that discussed the proposed update to the way short-duration storage devices are modelled in the ISP.

Several submissions expressed support for the proposed update, while some others expressed support for the principle of accounting for perfect foresight but held that the proposed derating factors were too extreme, put forward alternative approaches, or raised queries as to how the proposed derating factors had been derived.

Nine of the submissions did not support the update (**Shell** recommended alternative derating values). These submissions raised several arguments, including that storage technology may improve over time and that historical storage behaviour may not reflect future behaviour.

The **ISP Consumer Panel** responded to AEMO's proposal with cautious support, accepted it as a first iteration of an approach to deal with perfect foresight, and recommended that the approach be committed for the 2024 ISP only. The **ISP Consumer Panel** raised concern regarding the application of the derating factor to virtual power plants (VPPs), which they view as becoming an increasingly important component of the NEM. The submission cited a report jointly published by AEMO and **ARENA**, and reasoned that if energy prices rise, financial incentives may result in higher penetration of behind-the-meter storage and rooftop photovoltaics (PV) (thereby increasing VPP penetration). The submission also cited **AGL**'s forecasts of the storage capacity (MWh) that may become available to the NEM through electric vehicle (EV) uptake.

The **ISP Consumer Panel** also stated its expectation that predictability of dispatch from VPPs will increase rapidly as the technology matures. The **ISP Consumer Panel** suggested an alternative approach to reduce the impact of perfect foresight on VPP dispatch behaviour. The suggested approach would involve considering the impact of consumer risk preferences on consumers' decisions to dispatch or save capacity in case it is needed in the next few hours.

Powerlink, **Transgrid**, **Hydro Tasmania** and **PIAC** expressed support for the proposed update. **Transgrid** and **Hydro Tasmania** commented that derating factors of up to 50%, depending on the duration of storage, are reflective of historical storage behaviour. **Hydro Tasmania** pointed to analysis it conducted on the impact of imperfect forecasting on arbitrage optimisation for storage devices with varying storage durations. **PIAC** reasoned that although the proposed derating factors are large, in its opinion, the risk of overbuilding storage is likely to be a non-regrettable error. **Powerlink** commented that the proposed approach is a "positive first step", but that further work is required to refine the solution to perfect foresight in the ISP.

Origin supported the proposal in principle but raised several queries regarding:

- How the derating limits where chosen,
- Why AEMO prefers derating capacity (MWh) rather than power output (MW), and
- Why VPPs would be derated in the same way as grid-scale storage.

Origin made two recommendations:

- First, that AEMO should analyse dispatch behaviour of short-duration storage and VPPs with regard to storage capacity (MWh) and release this analysis.
- Second, that AEMO should consider a hybrid approach of derating power output (MW) and capacity (MWh).

Origin also put forward several views:

- Short-duration batteries are likely to be able to discharge more than 50% of their capacity during major power system events.
- Storage is more likely to reserve some capacity during a smaller system event when prices are lower and dispatch all its capacity during a large system event, when prices are higher. Therefore, the derating factor shouldn't be the same across all power system events.
- Known existing constraints on storage units (such as participation in a System Integrity Protection Scheme) should be incorporated in the methodology.

- VPPs should be treated differently from grid-scale storage.

Flow Power agreed that it is important to consider storage capacity limitations to reflect imperfect foresight. However, in **Flow Power**'s opinion, AEMO's proposed level of derating will underestimate the level of battery capacity that is available during reliability events. **Flow Power** gave evidence that past reliability events have been anticipated at least six hours in advance, due to forecasts from AEMO, and noted that this provided battery operators with sufficient notice to preserve capacity for the forecast reliability event.

Origin, **QCC**, **Nexa Advisory**, **IEEFA** and **CANA** presented a view that it is not suitable to derate storage capacity of short-duration storage devices based on historical dispatch behaviour of such devices. **QCC**, **IEEFA** and **Nexa Advisory** said that a derating factor of 50% is too high. **Origin** argued that historical analysis of storage dispatch behaviour is limited, since "*significant power systems events are rare, and dispatch behaviour may change in the future as battery penetration increases*".

Nexa Advisory, **QCC** and **IEEFA** noted that a significant proportion of current short-duration storage devices are optimising for frequency control ancillary services (FCAS), rather than optimising for arbitrage, and that this may change as penetration of storage increases, leading to different dispatch behaviour. **QCC** further commented that short-duration storage is a "nascent" industry, and that its performance may improve over time. On this basis, **QCC** does not agree that a 50% derating factor should be applied across the whole modelling period. **Nexa Advisory** and **CANA** similarly argued that the application of a derating factor based on historical behaviour does not provide an allowance for potential improvements in short-duration storage technology.

QCC noted its view that derating storage capacity (MWh) is the most appropriate way to restrict the performance of short-term energy storage, as most batteries will be able to dispatch to full power, if not energy, when required.

Several submissions (**Greenpeace**, **ACF**, **CEIG** and **Nexa Advisory**) expressed a view that if storage device capacity (MWh) is derated to mitigate the impact of perfect foresight within ISP modelling, then other technology types should also be derated. These submissions held that the issue of perfect foresight applies equally to other technology types, and specifically referenced coal and gas generation. **Nexa Advisory** cited the 2022 market suspension as evidence that other technology types are energy-limited and are impacted by imperfect foresight and stated that "*imperfect forecasting at a gas plant led to load shedding in NSW in recent years*". **QCC** similarly requested that if storage device characteristics are derated, AEMO should also consider constraints to generation output from fossil-fuelled generation.

First Nations Clean Energy Network disagreed with AEMO's proposal to derate the capacity (MWh) of storage devices, and noted that First Nations communities are especially exposed to the benefits of decentralised, short-duration storage (and may therefore be exposed to poor outcomes if storage is underbuilt).

Windlab strongly disagreed that it is appropriate to derate storage device capacity (MWh) by up to 50% but stated that applying a minimal power output (MW) derating factor may be appropriate. In **Windlab**'s view, the problem of perfect foresight does not have a significant impact on the dispatch behaviour of devices with a short duration of storage. **Windlab** reasoned that it is reasonably likely that such shallow devices can be fully charged during "peak solar hours", despite the solar profile not being perfectly predictable.

In **Shell**'s opinion, based on its own analysis, a derating factor of no more than 30% should be applied to power output (MW), with no derating applied to storage capacity (MWh). **Shell** further recommended the following storage capacity derating factors be applied:

- 2-3 hours: 20%.
- 3-4 hours: 10%.

- 4 or more hours: 5%.

Shell noted that AEMO derates storage capacity available for storage devices to which network support contracts apply and recommended that AEMO only apply these deratings in the specific situations where those contracts would be active at dispatch.

AEMO's assessment

Storage capacity versus power

Considering stakeholder feedback, AEMO has recognised that the proposed storage limitations may materially affect the capability for shallow storage devices to operate to provide energy shifting or energy arbitrage functions. On reflection, AEMO considers that the proposed methodology may be appropriate for assessments that focus on reliability rather than broader investment objectives such as the ISP.

AEMO recognises that the ISP primarily optimises the mix of generation, storage and transmission investments to meet broader needs than required to maintain reliability. The broader ISP assessments should not place unnecessary constraints on shallow storage operation that may limit these assets from operating across the year in the manner intended – to shift daily energy surpluses to other times of the day, or to take advantage of energy arbitrage opportunities.

AEMO recognises that increased consideration for energy storage management, perfect foresight, and weather-induced intermittency are several modelling and real-world phenomena that will require extended consideration before broader adoption in investment planning frameworks such as the ISP. Until such analysis can be thoroughly developed, AEMO will use the iterative modelling approach between ST and DLT modelling in the ISP modelling approach to ensure sufficient consideration of reliability implications of shallow storage installations.

Further work required

AEMO agrees that further modelling refinements will be needed to improve this modelling approach for future ISPs.

AEMO thanks **Origin** for the detailed feedback, which has given AEMO much to consider. AEMO proposes to continue investigating the optimal implementation of storage modelling, which may be utilised in future ISPs or other forecasting publications. To respond to some specific concerns from **Origin**:

- The concern for short-duration batteries during power system events or lack of reserve (LOR) events is not that batteries are not flexible enough to respond to those events, but they may misjudge exactly when that event may occur, or the duration of the event. Such storage may have already discharged some of its capacity earlier in the day, and prices have been too high to recharge, so when the power system event occurs there is simply less than the full capacity of energy available to contribute.
- System Integrity Protection Scheme (SIPS) batteries are modelled as reserving the SIPS component of the storage, and only allowing the remainder of the battery storage/power to contribute to the energy market.
- VPPs will be further investigated to ensure optimum treatment in AEMO's market models.

AEMO's conclusion

AEMO has decided to not implement its proposed changes to storage duration for the 2024 ISP. However, AEMO has retained a note in Section 3.3.3 of the final ISP Methodology explaining that AEMO may in some cases apply limits to storage duration in the time-sequential modelling phase to validate the reliability and operability of CDPs. AEMO conducts reliability assessment periodically during the ISP development, and may refine the minimum reserve level to ensure a reliable system is achieved.

The feedback from this consultation has made it clear that further work must be done to determine the most appropriate implementation of reducing the perfect foresight for short-duration storage. AEMO will retain the option to apply the proposed approach for reliability forecasting purposes within the ISP, ensuring validations of market operability in detailed time-sequential modelling, but will not extend this to the broader capacity outlook modelling that underpins much of the generation development and transmission outcomes. For these purposes, AEMO agrees with stakeholders that more general storage behaviour throughout the rest of the year is needed when determining development needs, and that restricting storage capacity (or power output) for these broader purposes is not prudent for this ISP.

AEMO will review imperfect foresight considerations for storages in operability modelling to assess power system reliability and operability under a range of conditions. AEMO will then progress work to better understand the operation of existing battery storages and investigate potential future modelling improvements.

2.2.8 Duration of demand-side participation response

Issue summary and submissions

AEMO proposed to limit the daily energy contribution from the reliability response band of DSP to a maximum of two hours of continuous operation. This update was proposed to reflect that the conditions corresponding to the reliability response band typically do not exceed two hours in duration per event. AEMO did not propose to limit the demand response at lower price bands, on the understanding that DSP accessed through lower price bands is called upon more frequently and for longer durations than DSP accessed through the reliability-response band.

Powerlink, **Transgrid** and **PIAC** supported AEMO's approach to limit the duration of reliability response of DSP in line with market observations and expectations. Their submissions put forward that the proposed approach provides more realistic assumptions that better captures risk and resilience to the system. It will also materially improve the network, generation and storage needs forecasted by the ISP given the model cannot rely on DSP in modelled unserved energy events for unrealistically long durations.

QCC believes that the historical performance of DSP should not be used as the basis for future modelling. As electricity demand grows, so does the opportunity for DSP to create the most efficient and effective electricity system. Limiting the participation of DSP to its historical levels will not value this effectively. **QCC** supports a more detailed investigation of the value of DSP to the system as it grows, which may involve more iterative runs. This would be able to guide policy and technical innovation to make more energy available for DSP.

FFI believed that limiting demand response duration may be suitable for the current options in the NEM, however, over time new technologies are expected which may deliver much more capable demand response for example green hydrogen electrolysers.

IEEFA had not seen enough justification to show that a two-hour operation limit on DSP in the reliability-response band is the right course forward. It highlighted that further information and data are required to investigate the

right approach. Unserved energy events of the future high VRE NEM may look quite different to past USE events, so limiting DSP duration based on the duration of past USE events could be fraught. DSP could have a much larger role in the future, and policy and market design could change to encourage DSP to participate much more – in all price bands. The limit on DSP proposed appears to be due to current market settings and historical USE events rather than technical capability. This may prevent modelling of some of the potential benefits DSP could deliver.

Shell did not believe that there is sufficient historical analysis to suggest that limiting DSP events to 2 hours is reasonable. **Shell** recommended that AEMO undertake a survey of market customers for which DSP has been observed to determine if this proposed two-hour period is supported, or a longer duration is achievable. The recommendation reflected AEMO's statement in the consultation paper that "*lower price bands triggering DSP response have been observed to last upwards of 12 hours*". If observations of lower priced DSP events can last this length of time, **Shell** considered it would be premature to implement a change to the modelling for a reliability event where price outcomes would generally be significantly higher.

Flow Power agreed that the responsiveness of demand can be duration limited, but, based on its experience with commercial and industrial customers, believed that reliability response could be implemented with a range of durations. **Flow Power**'s recommendations for the 2024 ISP were:

- 40% at two hours, reflecting short-term load processes that need to be restarted after two hours offline.
- 40% at four hours, reflecting loads that can stay offline for longer periods of time or when load shifting has allowed a customer to pre-empt and/or manage load for a reliability event.
- 20% at eight hours, when processes are closed for the day or distributed generation is used for extended periods of time.

In the longer term, **Flow Power** recommended AEMO engage with customers, retailers and aggregators to better understand demand-side behaviour in response to different event types.

AEMO's assessment

Future DSP performance should not be limited to historical behaviour

AEMO agrees that in future further investigation and analysis of DSP behaviour is warranted. This will require a detailed understanding of how customer loads are willing to respond to requests for load reduction in future, and whether this is likely to extend continuously for many hours. Without this knowledge, AEMO will use recent history as its best guide as to DSP behaviour in the future.

Green hydrogen electrolysers were provided as an example of new technologies that may deliver a more capable demand response. AEMO notes that this specific technology is already modelled explicitly in AEMO's ISP models as a market exposed load that can be turned on or off depending on system requirements; loads such as this are expected to operate independently from any DSP program.

AEMO welcomes more engagement to better understand the potential response of new demand sectors to DSP in the future.

Two-hour duration for DSP response is insufficient

The two-hour time limit was based on historical USE events and the current willingness for consumers to participate in DSP programs. While it is reasonable to assume that willingness for customers to engage in DSP

may change in future, without an understanding of the details of those changes, it is impossible to model. AEMO considers that it is also impractical to retain the current ISP methodology of allowing unlimited duration of DSP for the reliability band – potentially leading to modelled outcomes of turning off customer load for days on end.

AEMO's proposal is to only limit the duration of the reliability-response band of DSP, not the entire availability of DSP. Lower price bands will still be modelled as available to be triggered for unlimited, continuous periods of time.

AEMO thanks **Flow Power** for providing an alternative set of DSP values to use, and will use this dataset as a basis for further data collection. AEMO will continue to monitor actual market data, engage with stakeholders, and investigate whether there is a more optimal implementation to capture future DSP behaviour.

AEMO's conclusion

For the 2024 ISP, AEMO proposes to retain the original proposal to limit the daily energy contribution from the reliability response band of DSP to two hours and allow the lower DSP bands to behave in a more dynamic and flexible manner.

AEMO will continue to monitor actual market data, engage with stakeholders, and investigate whether there is a more optimal implementation to capture future DSP behaviour for future ISPs.

2.2.9 Additional issues identified in submissions

A number of additional issues were raised in stakeholder submissions, or through AEMO's finalisation of the ISP Methodology. Table 5 provides AEMO's responses to the additional issues raised.

Table 5 AEMO's responses to additional issues raised

Issue raised	AEMO's response
Transgrid submitted there was a need to consider alternate transmission planning standards within the ISP Methodology to improve power system resilience in key parts of the power system, as the transmission system evolves to accommodate multiple large REZs and concentrated fossil fuel retirements. **Transgrid** proposed AEMO could plan the transmission network to a higher 'N-1 Secure' operational planning standard.	The ISP already considers both secure and satisfactory power system status as part of preparing the power transfer limits applied in the ISP, which may be considered as broadly equivalent to the 'n' and 'n-1' nomenclature. This approach is consistent with the planning standards in the NER, as well as relevant jurisdictional planning standards. AEMO agrees with Transgrid that the power system planning standards can be expected to evolve over time as the transformation of the NEM continues, and the ISP does already explore a range of power system challenges over the coming 20 years and beyond. However, AEMO must only declare actionable and future ISP projects consistent with the current power system planning standards, rather than potential future standards. The RIT-T framework (or equivalent, in some jurisdictions) provides opportunity for transmission augmentation project proponents to test the costs and benefits of various options, including potentially options which consider expanded power system reliability and reduced unserved energy values. AEMO recommends that this matter continue to be explored between AEMO, TNSPs and jurisdictional bodies through joint planning processes.
In the **CEC**'s opinion, it would be pertinent for the ISP to consider short- and medium-term transmission network congestion to account for and manage "*rapidly emerging congestion issues*". The **CEC** pointed to an example in New South Wales, where there "*has been a recent increase in congestion and curtailment on transmission lines 94T and 9R6 because of increased solar generation connecting to the lines*".	While AEMO agrees that network congestion is an important issue, AEMO does not consider that the ISP is the appropriate publication for considering short- and medium-term transmission network congestion in detail. These matters may be identified through AEMO's monthly constraint reports, and through TNSPs' ongoing consideration of where market benefits would occur through relieving transmission constraints. AEMO's annual Network Support and Control Ancillary Services (NSCAS) review also considers the top-binding recent constraints in each region, to consider whether there may be an opportunity for services to relieve those constraints.
FFI stated that "the *methodology remains suited to modelling, and therefore planning for, a system with*	The ISP modelling approach is designed to reflect the current NEM design. AEMO agrees that having 'energy at the right time' is important. AEMO publishes a system operability appendix with

Issue raised	AEMO's response
large amounts of fossil fuel generation that considers 'energy issues' as the primary challenge, rather than 'capacity' (i.e., energy at the right time)."	the ISP, which provides analysis considering the projected ability for supply to meet demand across the 20-year horizon and beyond.
Hydro Tasmania suggested that in the long-term model, AEMO should replace the eight three-hour blocks per day with 24 one-hour blocks. **Hydro Tasmania** argued this change would more accurately estimate the contributions of various generator types.	While having more granular settings in the modelling is preferred, the size of the optimisation problem being solved by AEMO's long-term market models becomes challenging to manage with increased resolution. AEMO has completed extensive testing of various model settings and is of the opinion that eight blocks per day is an optimal trade-off between accuracy and simulation time.
FFI noted that a broader review of the methodology is not planned until 2025, and put forward that this will likely not result in notable changes to the system until 2031 onwards. In **FFI**'s view, given the rapid energy transition, there is a more immediate need to comprehensively update the methodology.	AEMO agrees that a significant amount of change is required in the energy industry to deliver the electricity transformation. However, AEMO has not identified major policy or market changes that would necessitate a wholesale review or major changes to the ISP Methodology at this stage. AEMO notes the proposed Commonwealth Government and Australian Energy Market Commission reviews of the ISP. A future ISP Methodology update will incorporate any ISP review outcomes and any relevant changes in jurisdictional policies or market design.
FFI suggested that the current ISP Methodology will result in a transmission schedule that "*defers transmission development until well after it is first needed*".	AEMO agrees that in the ISP, projects will not be 'built' in the model as soon as the REZ transmission limit is initially exceeded. The modelling conversion from a continuous linear expansion of transmission network capacity to discreet increases in network capacity is complex, and is an attempt to reflect the reality that transmission network augmentation is by its nature 'lumpy'. AEMO considers that the current approach strikes the right balance between investing too early or too late, for the purposes of the ISP, with precise timing and implementation matters to be considered by TNSPs and jurisdictional bodies.
FFI stated that "*emissions from fossil fuels are underestimated by assuming the highest efficiency heat rates*".	Emissions production rates and efficiency heat rates are consulted on through a separate annual review process (the IASR consultation) rather than through the ISP Methodology.
FFI noted that in the 2022 ISP, the difference in market benefits associated with the top five CDPs was approximately $70 million or 0.2%. In **FFI**'s view, these differences are insignificant given the magnitude of uncertainty. On this basis, **FFI** stated that: • The plan that delivers the best outcomes against the NEO will likely have the fewest regrets, and • The CDP with larger and sooner transmission expansion will accelerate the transition to cleaner energy sources, and will lower prices for consumers, whilst maintaining acceptable reliability standards.	AEMO notes that the Cost Benefit Analysis Guidelines require the CDPs to be evaluated based on net market benefit. In the last ISP, other metrics, including Least Worst Weight Regret, Worst Regret, and Insurance Value, were also looked at to determine which of the front-runner CDPs should be the ODP.
FFI noted that the ISP methodology assumes distributed PV is fully available with the distribution network expanded to manage all flows. **FFI** stated that it assumes that EV charging is treated similarly in the ISP methodology. **FFI** noted that "*if this does not eventuate, then the planned system build out may be insufficient resulting in continued use of thermal generation*".	AEMO's scenario-based planning approach considers a range of CER uptake which is accompanied by appropriate distribution network upgrades. In a scenario with low CER, it is implicit that distribution network upgrades are relatively minimal. In contrast, a scenario with high CER assumed more distribution network upgrades. Given that decisions to install CER are made by consumers, and that distribution network upgrades are assessed based on consumer trends, AEMO considers that a scenario-based planning approach is appropriate. This approach accommodates uncertainty on CER uptake rather than attempting to dictate an optimal level of CER.

Issue raised	AEMO's response
FFI stated that the "*the benefits continue to be assessed against the cost of the system rather than acknowledging that scarcity rent costs consumers substantially*". **FFI** also provided that "*in 2021 around half the cost in the market was attributable to prices over $300MWh – theoretically around the short-run marginal cost of liquid fuels generators*" In **FFI**'s view, "*this is clear evidence of substantial scarcity rent impacting consumers*".	The ISP modelling must be undertaken consistent with the AER's cost benefit analysis guidelines which dictates the classes of costs and benefits that must be quantified for the determination of the ODP. The AER's cost benefit analysis guidelines also prescribe the general methodology, which is a cost optimisation approach, that must be followed when quantifying these costs and benefits.
FFI noted that in the ISP Methodology, the "*system is tested against a summer peak, not a peak imbalance*" and argued that this means the ISP underestimates the scale of the challenge of the energy transition. **FFI** further stated that "*increasingly, the energy gap will present at times of reduced renewable energy output, highlighting the capacity gap at increasingly varied times*".	AEMO considers that testing against a summer peak (or any other projected peak demand across the year) is a sufficiently appropriate test to apply for the ISP modelling. Although transmission and generation limits are aligned with seasonal peaks and typical levels, the ISP model considers a wide range of operating conditions. AEMO agrees that the NEM energy transformation is leading to a range of power system security and reliability issues. AEMO will continue to explore these through preparation of the ISP, the Engineering Framework, the 100% renewables roadmap, the annual system security assessments (system strength, inertia and NSCAS), and more.
IEEFA recommended that AEMO should: • "*Improve the balance of demand-side vs supply-side solutions in the ISP cost optimisation*", and • "*Provide greater clarity on the allocation of energy efficiency and electrification loads to half-hourly demand profiles*". **IEEFA** also requested that AEMO • Release half-hourly generation results in the 2024 ISP, and • Outline the level of government action that is required for specific scenarios to be realised. **IEFFA** also claimed that there are inconsistencies in gas generation forecasts between the 2022 ISP and the 2022 GSOO.	AEMO seeks to consult through the IASR and the ISP on appropriate solutions to meet electricity needs, both on the supply side and the demand side. AEMO's ISP preparation and cost benefit analysis must remain consistent with the AER's cost benefit analysis guidelines. AEMO publishes a range of demand forecasting data through the annual *Electricity Statement of Opportunities* (ESOO). AEMO will consider how best to provide further transparency on demand modelling outcomes for ISP purposes. AEMO already provides half-hourly generation results for some of the ISP results (that is, the solar and wind traces available via https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp). AEMO will consider how best to provide further transparency where practical while not breaching confidentiality requirements. Gas generation forecasts in the ISP are based on AEMO's capacity outlook model outcomes, while forecasts in the *Gas Statement of Opportunities* (GSOO) are based on the time-sequential model outcomes. The capacity outlook model considers the short run marginal cost of gas generators when minimising the cost of supply, while the time-sequential model deploys a bidding model that is calibrated on historical data. AEMO acknowledges that these models are designed for different purposes, and may diverge at times.
In **PIAC**'s view, the ISP does not consider the full breadth of the energy transition, including the take-up of EVs, CER, smart appliances, increasing thermal efficiency of buildings, and more energy efficiency of towns.	AEMO acknowledges the huge importance of EVs, CER, smart appliances, thermal efficiency of buildings and energy efficiency in general. AEMO endeavours to enhance its forecasting and planning practices over time, including through dedicated consultations such as the IASR consultation process. At this time, AEMO considers that these variables should be exogenous inputs to the ISP rather than variables that are optimised. It is AEMO's view that the ISP should enable consumer choice (for example, the amount of EV, CER or smart appliances) rather than determining an efficient scale of consumer investment.
The **ISP Consumer Panel** suggested that future ISPs should have a greater focus on consumer risk preferences and social licence. The Panel also referenced its submission to the Draft 2023 IASR, in which it argued for more focus on sensitivity analyses, and social licence. **PIAC** suggested that AEMO must be more proactive in its management of social licence, both broadly and within the ISP. **RE-Alliance** recommended that AEMO should clarify the role of the	AEMO agrees that consumer risk preferences and social licence are highly critical matters for all transmission, generation and storage planning and delivery organisations. As noted elsewhere in this report, AEMO has begun new work on understanding consumer risk preferences. AEMO will continue to proactively work with its **Advisory Council on Social Licence** to establish an agreed position on its role relating to the ISP. AEMO's role in social licence matters is an ongoing area of consideration, and AEMO will continue to consider this feedback alongside feedback received through the IASR and *Transmission Expansion Options Report* consultation processes. AEMO does not consider that a change to the ISP Methodology is required at this stage to incorporate feedback on social licence matters.

Issue raised	AEMO's response
Advisory Council on Social Licence in supporting the ISP. **RE-Alliance** further recommended that AEMO re-introduce interactive detail on a map so that communities can better understand how projects relate to their local area.	
Several submissions requested that AEMO model additional 1.5°C scenarios in the 2024 ISP. **Nexa Advisory**, **CANA**, **QCC**, **ACF**, and **The First Nations Clean Energy Network** requested that an additional round of consultation be provided by AEMO on the 2023 IASR.	Regarding requests for additional 1.5°C-aligned scenarios, AEMO notes that the same feedback was provided in submissions to the Draft 2023 IASR Consultation and that these requests are being responded to through that consultation process.
In its review process, AEMO identified that further clarity could be provided about the application of REZ resource limits and land use limits.	Further clarity is provided in Section 2.3.4.

3 Summary of changes to the ISP Methodology

The table below outlines the changes made to the ISP Methodology resulting from consultation.

Table 6 Summary of changes to the ISP Methodology

Topic	Change	Section(s) updated	Comparison with draft methodology
Transmission project lead time uncertainty, and the concept of an actionable window	Consistent with the Draft ISP Methodology, AEMO will develop the lead times for transmission projects through joint planning with TNSPs, and will consult on them via the *Transmission Expansion Options Report*. Like all inputs for the ISP, lead times are subject to finalisation through public stakeholder consultation. Based on feedback, AEMO has amended the ISP Methodology to apply an actionable window concept. This change reflects the need to repeat regulatory approvals and other work if the actionable status is removed and subsequently restored. This only impact projects that were actionable in the previous ISP.	Section 5.1	**Changes made – see Section 2.2.1.**
Supply chain limits	If the generation or transmission build in the draft or final ISP is observed to be lumpy, sensitivity analysis could be conducted to assess the impact of limiting infrastructure delivery based on a supply chain constraints.	Section 2.4.4	**Changes made –see Section 2.2.1.**
Impact of fossil-fuelled generation on REZ transmission limits	Consistent with the Draft ISP Methodology, AEMO has amended the ISP Methodology to include fossil-fuelled generators and nearby flow path impacts as variables in the transmission limits applied for REZs. Based on feedback to the Draft ISP Methodology, AEMO has now decided to include an optional variable for large loads, depending on availability of load information, simulation complexity and solve time.	Section 2.3.4	**Changes made – see Section 2.2.2.**
Network losses for REZs and sub-regions	Consistent with the Draft ISP Methodology, AEMO will use loss equations to better represent power transfers between specific REZs and sub-regions.	Section 2.3.6	*No changes compared to draft.*
Assumed renewable resource quality	Consistent with the Draft ISP Methodology, multi-criteria analysis is used to exclude non-go zones for the development of wind availability traces and its recalibration to existing wind performance.	Section 2.3.5	*No changes compared to draft.*
Potential inclusion of a value of carbon emissions	Consistent with the Draft ISP Methodology, AEMO has reflected the anticipated emissions reduction objective in the NEO by applying a value of carbon emissions or value of emissions reduction in the ISP.	Section 5.2	*No changes compared to draft.*
Consumer risk preferences	Consistent with the Draft ISP Methodology, AEMO will consider evidence-based risk preference metrics in its application of professional judgement when selecting the ODP.	Section 5.8	*No changes compared to draft.*
Dispatch behaviour of storage devices	Based on feedback, AEMO has not proceeded with the proposal in the Draft ISP Methodology to derate storage devices in the capacity outlook and time-sequential models. AEMO has noted in the final ISP Methodology that some tests may be undertaken in the time-sequential modelling to understand the impact of storage behaviour on candidate development pathways. AEMO conducts reliability assessment periodically during the ISP development, and may refine the minimum reserve level to ensure a reliable system is achieved.	Section 3.3.3	**Changes made – see Section 2.2.7.**
Duration of DSP response	Consistent with the Draft ISP Methodology, the duration of DSP will be limited to a maximum of two hours of continuous operation per day in the reliability response band.	Section 2.3.7	*No changes compared to draft.*

A1. Abbreviations

Acronym	Term
ACF	Australian Conservation Foundation
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ALF	average loss factor
AusNet	AusNet Services
BZE	Beyond Zero Emissions
CANA	Climate Action Network Australia
CDP	candidate development pathway
CEC	Clean Energy Council
CEIG	Clean Energy Investor Group
CER	consumer energy resources
CPA	contingent project application
DNSP	distribution network service provider
DSP	Demand-side participation
EISD	earliest in-service date
ENA	Energy Networks Australia
ESOO	*Electricity Statement of Opportunities*
EV	electric vehicle
FCAS	frequency control ancillary services
FFI	Fortescue Future Industries
Greenpeace	Greenpeace Australia Pacific
GSOO	*Gas Statement of Opportunities*
IASR	*Inputs, Assumptions and Scenarios Report*
IEEFA	Institute for Energy Economics and Financial Analysis
ISP	*Integrated System Plan*
MLF	marginal loss factor
MW	megawatt/s
MWh	megawatt hour/s
NEM	National Electricity Market
NEO	National Electricity Objective
NER	National Electricity Rules
NSCAS	Network Support and Control Ancillary Services
ODP	optimal development path
Origin	Origin Energy
PADR	Project Assessment Draft Report
PIAC	Public Interest Advocacy Centre
Powerlink	Powerlink Queensland
PV	photovoltaic

Acronym	Term
QCC	Queensland Conservation Council
REZ	renewable energy zone
RIT-D	regulatory investment test for distribution
RIT-T	regulatory investment test for transmission
Shell	Shell Energy
SIPS	System Integrity Protection Scheme
TNSP	transmission network service provider
VPP	virtual power plant
VRE	variable renewable energy