AEMO responses to Questions on Notice from Chair, Senator David Van

Senate Select Committee on Energy Planning & Regulation in Australia

28 November 2024

Question one

Once a project is deemed actionable it will pass through the RIT-T process and be approved at potentially any cost, providing AER are satisfied the costs are real, correct?

Answer

There are several protections to ensure that actionable Integrated System Plan (ISP) projects are only built if they provide value to consumers.

Following the RIT-T, the transmission network service provider (TNSP) must request AEMO to confirm whether the preferred option identified in the RIT-T (which is subject to consultation and dispute processes) continues to meet the identified need specified remains aligned with the optimal development path (ODP) in the most recent draft or final ISP, and whether its cost changes its status as an actionable ISP project: National Electricity Rules (NER) clause 5.16A.5(b). This is called a 'feedback loop' request.

AEMO must comply with the Australian Energy Regulator's (AER) Cost Benefit Analysis guidelines (section 3.5.3) in undertaking the feedback loop assessment. The feedback loop assessment by AEMO does not review the TNSP's RIT-T modelling, but checks the matters described above. Changes in the cost, timing, capacity or design are assessed against the ODP as part of AEMO's assessment following the TNSP request.

If AEMO provides feedback loop confirmation, the TNSP is eligible to submit a contingent project application to the AER for cost recovery for the project: NER clauses 5.16A.5 and 6A.8.2. The AER must comply with NER clause 6A.8.2 in consulting on the application and deciding whether to make a revenue determination for the TNSP. If the AER amends the TNSP's revenue determination to include the revenue required for the project, it must have regard to the expenditure that would be incurred by an efficient and prudent TNSP.

Question two

The ISP calls for the 'optimal mix of generation and storage e.g. "The optimal future generation, firming and transmission for the NEM form the ISP's optimal development path (ODP)" (page 41 of 2024 Integrated System Plan). Can AEMO articulate the optimal mix of generation, firming and storage including nameplate capacity, assumed capacity factor, location and timing of this mix for each year to 2050?

Answer

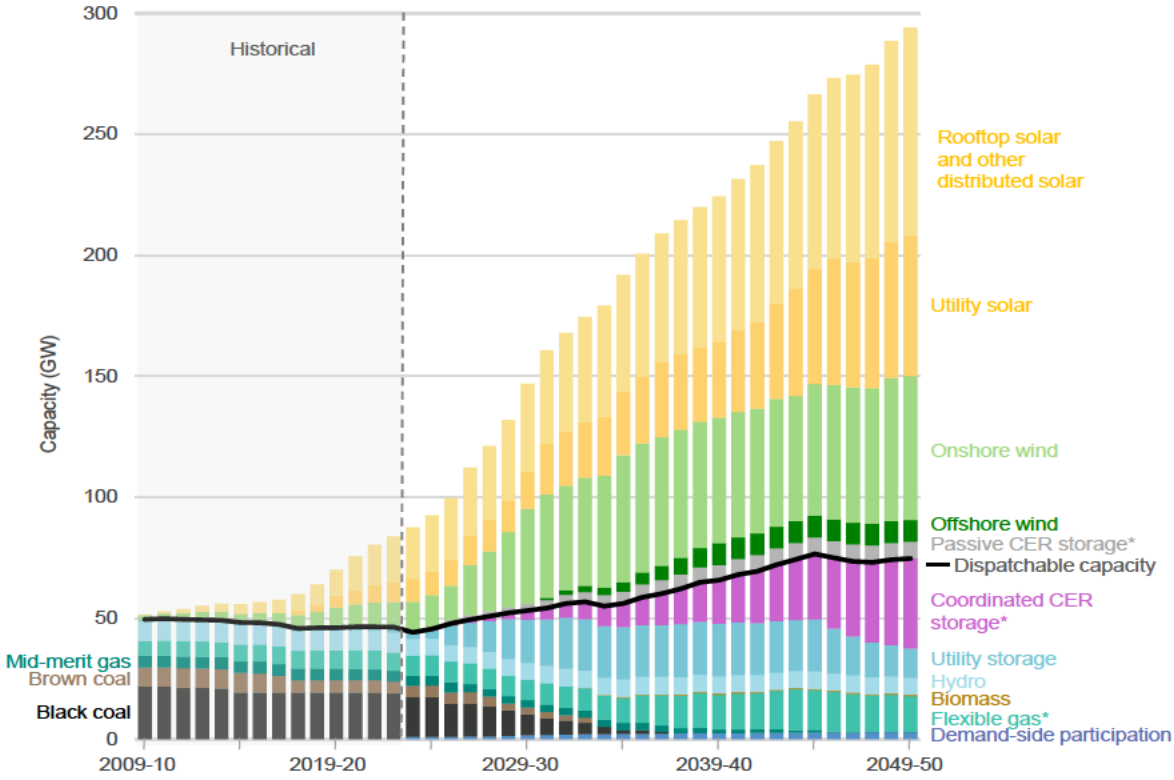
The ISP is a scenario-based plan that considers a wide range of plausible futures. The ODP sets out the needed generation, firming and transmission to transition to net zero by 2050 through current policy settings having considered all ISP scenarios developed by AEMO. The ODP aims to deliver reliable and affordable power to meet NEM needs for at least 20 years, fulfil the NEM's security and reliability requirements, contribute to achieving the national electricity objective, meet government policy settings, and manage risk through a complex transformation.

The 2024 ISP main report has a focus on the Step Change scenario, and gives a NEM-wide view on the capacity and energy requirements of generation and storage (see figure 2 from the 2024 ISP – shown below). Appendix 2 (Generation and Storage Development Opportunities) provides more granular information, often at a state level, and Appendix 3 (Renewable Energy Zones) provides information at a Renewable Energy Zone level.

Finally, for stakeholders seeking ISP data, AEMO publishes generation and storage outlook spread sheets for each scenario and each sensitivity conducted as part of the ISP. This data includes annual capacity (and duration for storage), annual generation and approximate location (i.e. renewable energy zone or sub-region) amongst many other metrics. The capacity factors can be calculated by dividing annual energy production (in GWh) by installed capacity (GW) and then further dividing by the number of hours in a given year (h).

- 2024 ISP generation and storage outlook
- Appendix 3 – Renewable Energy Zones

Figure 2 from the 2024 ISP – Capacity, NEM (GW, 2009-10 to 2049-50, *Step Change*)



Notes: "Flexible gas" includes gas-powered generation and potential hydrogen capacity.
"CER storage" means consumer energy resources such as batteries and electric vehicles.
Projections for "Rooftop solar and other distributed solar" and "CER storage" are forecast based on unit costs, consumer trends and assumptions about payments received to participate in the electricity market.

Question three

How do you generate and choose candidate development paths? What locational data of generation, storage and load is used to determine CDPs?

Answer

AEMO complies with the NER (including clauses 5.22.6 and 5.22.10) and the AER's Cost Benefit Analysis Guidelines to identify and assess development paths in the ISP.

AEMO develops a wide range of locational information that feeds into the methodological process for developing candidate development paths. The locational information includes:

1. Wind and solar capital costs and resource data – per Renewable Energy Zone (REZ)
2. Load information and forecasts – per ISP sub-region (e.g. New South Wales had four sub-regions in the 2024 ISP)
3. Storage development options – including battery storage and pumped hydro, which can be modelled in REZs or ISP sub-regions.
4. Gas development options, which can be built in ISP sub-regions.
5. Network limitations – with consideration of the geographical spread of load and existing generation.
6. Network augmentation options – between REZs and major flow paths (e.g. interconnectors).
7. Locational cost factors, which estimate the cost of building capital projects in different locations (e.g. due to remoteness from ports).

AEMO develops candidate development paths through the use of a capacity outlook model. This is the core process in the ISP that explores how the energy system would optimally develop in each ISP scenario. The capacity outlook modelling process seeks to minimise capital expenditure and generation production costs over the long-term outlook. In doing so, it must:

- Ensure there is sufficient supply to reliably meet demand at the current NEM reliability standard, allowing for inter-regional reserve sharing.
- Meet legislated and likely policy objectives (in accordance with the scenario definitions).
- Observe physical limitations of generation and transmission system.
- Account for any energy constraints on resources.

AEMO then tests the candidate development paths against a detailed market model which includes full network representation, and further tests results in a detailed power system model.

AEMO complies with the AER's Cost Benefit Analysis Guidelines in selecting which development paths are assessed in the ISP cost benefit analysis and the definition of the counterfactual development path, valuing the costs and market benefits of development paths, and selecting the ODP.

More information on the development of candidate development paths and the selection of the optimal development path is available in the 2023 ISP Methodology[1].

[1] AEMO. *2023 ISP Methodology*, at https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2023/isp-methodology-2023/isp-methodology_june-2023.pdf?la=en.

Question four

Please detail what transmission projects (including cost) are included in the forecast of $16b.

Answer

Please see below a table of transmission project costs. These costs are the present value annualised costs to 2050 for the relevant projects. They are in real July 2023 $ discounted to present value at 7%. As such they vary from headline project costs.

Project	Annualised Present value cost to 2050 ($million real 2023)
New England Transmission Link 1	$1,271
New England Transmission Link 2	$601
Sydney Ring North	$766
Sydney Ring South	$140
Gladstone Grid Reinforcement	$763
HumeLink	$2,969
Marinus Link 1	$1,951
Marinus Link 2	$729
Mid North SA	$222
New England REZ Expansion	$261
Hunter Central Coast REZ Expansion	$64
QNI Connect	$1,023
QLD SuperGrid South	$1,755
North West Tasmania REZ Expansion	$241
VNI West	$2,304
QLD SuperGrid North	$130
Other REZ Expansion Capex	$740
Payment schemes	$163
Total	**$16,093**

Question five

Gippsland REZ (ISP Step Change Generator capacity by REZ) shows that only 500 MW of solar and 2000 MW wind can be added by 2050. Please detail what limits or constraints are used to determine these amounts?

Answer

As outlined in section 3.9.3 of AEMO's 2023 Inputs, Assumptions and Scenarios Report (IASR), Renewable Energy Zone (REZ) resource limits reflect the total available land for renewable energy developments, expressed as installed capacity (MW). The availability is determined by existing land use (for example, agriculture) and environmental and cultural considerations (such as national parks), as well as the quality of wind or solar irradiance.

AEMO takes a consistent approach to assessing resource limits in REZs:

- For onshore wind, AEMO assessed land available that has a resource quality of high (in the top 10% of sites assessed), and medium (in the top 30% of sites assessed, excluding high quality sites), and assumed that only 20% of this land area would be able to be utilised for wind generation, considering competing land and social limitations.
- For solar generation, AEMO assessed typical land area requirements for solar PV. AEMO assumed that 0.25% of the approximate land area of the REZs would be able to be used for solar generation. This allocation is significantly lower than wind availability, as solar farms have a much larger impact on alternative land use than wind farms, which require reasonable distance between wind turbines.
- Over successive consultations, AEMO has made adjustments to these resource limits to reflect its understanding of current developer activity and through joint planning with the relevant jurisdictional bodies.

Having a smaller geographic area than many REZs, Gippsland naturally also has a lower resource limit.

AEMO consulted on REZ resource limits for the 2024 ISP via the 2023 IASR consultation. Section 3.9.3 of the 2023 IASR Consultation Summary Report responds to feedback that AEMO received in relation to REZ resource limits.

Question six

ISP claims large interconnectors are required to get more renewable generation into the NEM. Yet at same time CBA counts not building renewable generation as a benefit. They can't both be correct please explain the logical inconsistency with this?

Answer

The 2024 ISP identifies material benefits for interconnector projects — which are projects that expand transmission flow capabilities between market regions of the NEM.

As coal generation retires, new sources of renewable generation and storage will need to connect to ensure a reliable supply of electricity to consumers through current policy settings. Interconnectors support sharing surplus generation and storage between market regions, thereby minimising duplication of investments in firming capacity which would otherwise be needed in each market region to support coincident peaks in demand and/or troughs in generation availability. Without further interconnector investment, a higher total investment would be needed due to additional renewable generation, storage and gas-powered generation.

Based on the 2024 ISP, the most significant market benefits from interconnectors are comprised of:

- **Generator and storage capital deferral** – There is diversity in resources (e.g. wind generation) and electricity demand (e.g. due to variations in weather dependent consumption such as heating and cooling, and due to variations in time zones) across the NEM. Additional interconnector capacity allows generation and storage which is surplus to local requirements to be shared across the NEM, resulting in a lower requirement for capital investment overall in generation and storage to meet the reliability standard.

  While building new generation is generally a cost in the cost-benefit analysis, interconnector projects can expand the capability to connect renewable generation in areas of high-quality resources, and can allow surplus energy to be shared across market regions. Therefore, there is an efficiency recognised in the cost benefit analysis whereby developing interconnectors can lead to a reduction in the total capacity of renewable energy required across all market regions (and the total capital expenditure) to meet consumer and policy needs.

- **Fuel cost savings** – With additional interconnection, less fuel is required (e.g. coal and gas) because renewable generation and storage can be shared across market regions during times of surplus availability.

- **Operating and maintenance cost savings** – With a lower investment in generator and storage capital (discussed above), there are lower operating and maintenance costs due to the reduction in net generation and storage capacity.

- **Reduced need for other transmission investments** – Because interconnectors often pass through Renewable Energy Zones, the development of an interconnector can mean that less subsequent transmission is required to connect high quality renewable energy.

As an example, Project Marinus is a project to construct an interconnector to further link the Tasmanian and Victorian regions, which will support growing demands in the Tasmania region and in the mainland. Project Marinus Stage 1 and Project Marinus Stage 2 contribute roughly $571 million to the benefits of the Optimal Development Path (ODP).

The 2024 ISP assessed that developing Project Marinus avoids the investment and other costs associated with additional generation and storage in the mainland regions. This delivers benefits through avoided generator and storage capital costs, fuel costs, and fixed operating and maintenance costs. If Project Marinus did not proceed, additional capacity would be required to meet demand in the mainland. This includes higher levels of onshore wind (around 1.4 GW by 2032–33) and utility solar, mostly in Victoria and to a lesser extent in New South Wales. Project Marinus would instead allow additional Tasmanian renewable generation to support the mainland regions. In addition, without Marinus, nearly 500 MW of additional deep utility storage capacity would be required in Victoria by 2037–38, increasing to 760 MW by 2044-45.

Question seven

Following the ISP review completed early 2024, the ECMC provided a response, noting the review concluded that AEMO was very effective in meeting the role established for under the current ISP framework, but that there were opportunities for AEMO to provide further advice on several matters key to the energy transformation. The ECMC have agreed to a range of actions in response to the recommendations of the review. Could you provide some information on the actions taken to date in relation to all the actions agreed by the ECMC, and more specifically in relation to:

a. AEMO expanding its consideration of gas market conditions in the 2026 ISP;

b. AEMO developing additional targeted communications products and activities to support community groups and consumer to engage with the 2026 ISP planning process;

c. AEMO having consideration to community concerns or sensitive locations in the identification of the ODP for the 2026 ISP; and

d. AEMO taking advantage of existing and additional data to enhance the 2026 ISP (environmental and regional planning for energy infrastructure, workforce constraints, community sentiment etc.).

Answer

The agreed ISP Review recommendations have resulted in changes to the preparation and increased the scope of the Integrated System Plan, including:

- incorporating gas development projections into the ISP given plausible pathways for gas investments;
- requiring AEMO to collaborate with distribution networks on how we incorporate Consumer Energy Resources;
- distribution network opportunities and limitations into our forecasts and modelling;
- developing targeted communications to support consumers and community groups to engage with the ISP process; and
- having regard to available data on community sentiment in identifying the Optimal Development Path.

Integrating gas into the ISP

- AEMO is in the process of considering and implementing key changes to the 2025 IASR, ISP Methodology and 2026 ISP to implement the gas-related recommendations to the extent possible.
- The key change for the 2026 ISP will be to build on the infrastructure analysis prepared for the 2024 Gas Statement of Opportunities to assess the impacts of plausible gas demand and gas infrastructure availability outcomes on the efficient development of the power system. This will enable the ISP to improve its consideration of gas sector investments and their impact on gas powered generation needs to firm the electricity sector.

Enhanced demand forecasting and optimising for the demand-side

- AEMO is exploring distribution network interaction with Consumer Energy Resources (CER) operation, including through engagement with Distribution Network Service Providers (DNSP).
- Distribution network capabilities and opportunities for distributed resources are being assessed including analysis of how DNSP investments, programs and annual plans may impact CER and distributed resources development, and as a result, the ISP optimal development path.

- Preparation of new information about how the use of distribution networks can be maximised by CER and distribution network investment that may be required to realise the demand side assumptions made as part of the ISP inputs. This will support how the distribution system and potential investments, as well as the investments in consumer developments (such as energy efficiency and electrification) will contribute to the efficient development of the power system.

Targeted communication

- As part of preparation of the 2026 ISP, including the 2025 IASR, AEMO is developing simple, short supporting documentation to help consumers, community members and advocates better understand the ISP development and engagement process and choose how to engage or navigate to more information as needed. For example, this includes an 'explainer' that describes how AEMO uses scenarios in its planning and forecasting functions, released with the Draft 2025 Inputs Assumptions and Scenarios Report (IASR) Stage 1 release on 11 December 2024.

Community concerns and sensitive sites

- AEMO is exploring opportunities to further consider community sentiment in network planning, including through joint planning with TNSPs and jurisdictional bodies.

Additional data

- AEMO is in the process of assessing and incorporating new information into the 2025 IASR on energy infrastructure construction delays due to environmental approvals, planning approvals and global and domestic supply chain limitations.

The AEMC are progressing to final determinations on rules to support implementation of the ISP Review recommendations, and the AER is reviewing its relevant guidelines. AEMO is taking preparatory steps in anticipation of the amended rules and guidelines in development and will use reasonable endeavours to implement review recommendations for the 2026 ISP to the extent possible.

For more information about AEMO's consideration of all ISP Review recommendations, see the Draft 2025 IASR published 11 December 2024.