Challenges

Uncertainty
• Energy and climate policy
• Technology
• Consumer behaviour
• Location and type of generation & storage

Network Planning
• Generation & storage – how much is needed? Where? When?
• Interaction between transmission & distribution networks
• Contrasting delivery timelines for network & generation
• “No regrets” planning methodology
• Valuing resilience

System Operation
• Coordination of many distributed generation & storage resources
• Power system security, strength, inertia, voltage & frequency
• Dynamic power flow – real time data, protection & control systems
• Inverter technology – capabilities, standards
New transmission development that strengthens the NEM backbone is necessary to access benefits delivered from large-scale deep storages.

- Increased transfer capability between the Snowy area and Sydney (HumeLink) would maximise the reliability and resilience benefits from Snowy 2.0 at lowest cost for New South Wales consumers following the 2022 closure of the Liddell Power Station.

- Increasing transfer capability between the Snowy area and Melbourne (KerangLink) would maximise the reliability and resilience benefits from Snowy 2.0 at lowest cost for Victorian consumers in time for the next expected closure of brown coal-fired generation in Victoria.

- Increasing transfer capability between Tasmania and Victoria (Marinus Link) would allow additional renewable generation and storage capability to be exported to the mainland.
The preferred option identified in this PADR (and shown in Figure 1) is to install:

- Two 100 MVAr shunt reactors at Keilor Terminal Station in 2021 and 2022 respectively.
- One 330 kV +200/-100 MVAr synchronous condenser at South Morang Terminal Station in 2022.
- Two 220 kV 100 MVAr shunt reactors at Moorabool Terminal Station in 2023.

**BENEFITS:**

- Reduce market costs of dispatching generators during light load periods to maintain voltages
- Reduce market costs associated with dispatching generators to maintain system strength
- Increasing VIC-NSW export interconnector transient stability limit by 150MW and voltage stability limit by 30MW
The preferred option will support additional generation connections in the Western Victoria region, and includes the following major components:

- **Short term (present to 2021):**
  Minor transmission line augmentations, including wind monitoring and upgrading station limiting transmission plant, carried out for the:
  - Red Cliffs to Wemen to Kerang to Bendigo, and
  - Moorabool to Terang to Ballarat, 220 kilovolt (kV) transmission lines.

- **Medium term (2021 to 2025):**
  By 2024:
  A new North Ballarat terminal station (NBTS)
  New 220 kV double circuit transmission lines from North Ballarat to Bulgana (via Waubra).

  By 2025:
  New 500 kV double circuit transmission lines from Sydenham to North Ballarat connecting two new 1,000 megavolt amperes (MVA) 500/220 kV transformers at North Ballarat.
The proposed preferred option identified in this PADR is to implement the following augmentations by 2022-23:

- Install a second 500/330 kilovolt (kV) transformer at South Morang Terminal Station.
- Re-tension the 330 kV South Morang – Dederang transmission lines, as well as associated works (including uprating of series capacitors), to allow operation at thermal rating.
- Install modular power flow controllers on the 330 kV Upper Tumut – Canberra and Upper Tumut – Yass lines to balance power flows and increase transfer capability.

The proposed preferred option will increase export capability from Victoria to New South Wales by approximately 170 megawatts (MW), and has a capital cost of approximately $68 million (in present value terms). This option yields the highest net market benefits under all the future scenarios and sensitivities assessed.

The PADR analysis identifies that this option will deliver a net present economic benefit of approximately $286 million, by:

- Reducing dispatch costs, through more efficient dispatch of generation in Victoria and New South Wales.
- Reducing capital costs associated with new generation build in New South Wales.

This preferred option is consistent with the project identified as a Group 1 priority project in AEMO’s 2018 ISP.
Questions & Discussion