

Important notice

Purpose

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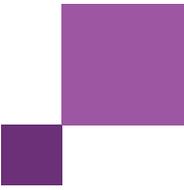
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Version control

Version	Release date	Changes
1.0	30/6/2022	Initial release.



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1 Background

The transmission network in the Sydney, Newcastle and Wollongong (SNW) area was originally designed for large coal-fired generation in the Hunter Valley to supply SNW load centres. With the impending retirement of coal-fired generators in the Newcastle area, the current network is unable to supply SNW load centres using generation external to the area. To reliably supply these load centres, additional transmission network augmentation that connects Central New South Wales (CNSW) to local generation and/or energy storage in the SNW area is needed.

Sydney Ring (Reinforcing Sydney, Newcastle and Wollongong supply) was identified as an actionable project in the Draft 2022 *Integrated System Plan* (ISP). AEMO therefore called for submissions on non-network options for this actionable project¹.

A non-network option is a solution or service that provides an alternative to investment in transmission system apparatus, such as transmission lines or substations. A non-network option may partially or wholly meet the identified need.

1.1 Requirements for assessment

Where the Draft ISP identifies an actionable project, the National Electricity Rules (NER) require AEMO to request submissions for non-network option proposals². AEMO must provide an assessment on each non-network proposal as to whether it meets or is reasonably likely to meet the relevant identified need. If the assessment concludes this is the case, the transmission network service provider (TNSP) must assess the non-network proposal in its Project Assessment Draft Report (PADR).

Since the release of the Draft ISP, in line with New South Wales Government announcements, Sydney Ring will progress under the *Electricity Infrastructure Investment Act 2020* (NSW)³ as an actionable NSW project rather than the ISP framework⁴.

1.2 Scope of assessment

Non-network option proposals are assessed on whether they are reasonably likely to meet the identified need. The non-network option could completely meet the identified need or may be part of a hybrid solution with reduced transmission network investment or additional market benefit.

¹ Call for Non-Network Options – Reinforcing Newcastle, Sydney and Wollongong Supply, at https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2021/non-network-options-supply-sydney-newcastle-wollongong/notice-of-consultation.pdf?la=en.

² National Electricity Rules, section 5.22.12, available at <https://www.aemc.gov.au/regulation/energy-rules/national-electricity-rules/current>

³ Available at <https://www.legislation.nsw.gov.au/view/html/inforce/current/act-2020-044>.

⁴ For more information, refer to the letter from the New South Wales Minister for Energy at <https://aemo.com.au/consultations/current-and-closed-consultations/2022-draft-isp-consultation>.

Identified need

The identified need is:

Deliver net market benefits for consumers by increasing the power system's capability to supply the Sydney, Newcastle and Wollongong load centres, replacing supply capacity that will be removed on the closure of coal-fired power stations in the Newcastle area.

Assessment methodology

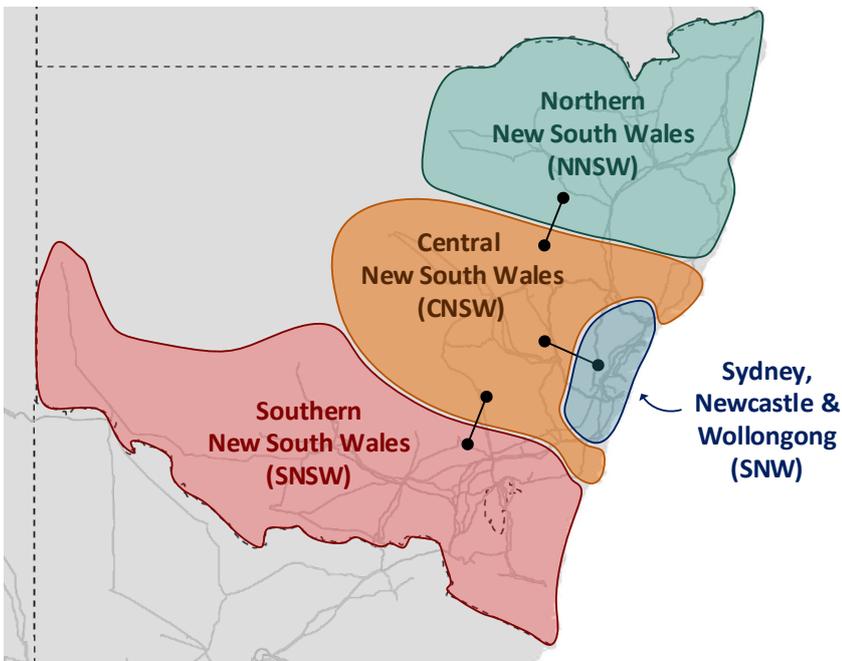
AEMO assessed each individual submission as to whether the proposal meets or is reasonably likely to meet the identified need. The purpose of this first stage of non-network proposal submissions is to obtain an early indication of the types and characteristics of the non-network option and provide a feasibility assessment of each submission in meeting the identified need.

The TNSP in New South Wales is Transgrid. AEMO, as part of joint planning, has sought input from Transgrid on the technology types (in Section 2 of this report) submitted to the call for non-network options.

1.3 Existing transmission network

The transmission network in the SNW area was designed in large part to connect large coal generators in the Hunter Valley to the SNW load centres. When these coal generators retire, the network has insufficient capability to supply SNW area from generators located outside of the Hunter Valley. The transfer capacity of transmission lines between CNSW and SNW zones is about 6,125 megawatts (MW). Figure 1 shows CNSW and SNW zones.

Figure 1 Intersection between ISP zones



1.4 Existing transfer limits

AEMO published the transfer limits from CNSW Zone to SNW Zone in the 2021 *Inputs, Assumptions and Scenarios Report*⁵.

Thermal limits

Following the retirement of large coal-fired generation in the Hunter Valley area, power flow on a number of transmission lines between CNSW and SNW zones and within SNW will increase. The location and amount of overloading will depend on the dispatch pattern of generators in SNW zone, Northern New South Wales (NNSW) zone, CNSW, Southern New South Wales (SSNW) zone, import from Queensland, Victoria and South Australia, and demand in SNW.

The network in SNW is shown in Figure 2. The following were identified as critical transmission lines:

- Bannaby – Sydney West 330 kilovolts (kV) line (this line can overload pre-contingent conditions as well).
- Marulan – Avon 330 kV line.
- Marulan – Dapto 330 kV line.
- Avon–Macarthur 330 kV line.
- Macarthur – Kemps Creek 330 kV line.
- Dapto – Sydney South 330 kV line.
- Sydney South – Liverpool 330 kV line.
- Sydney West – Sydney North 330 kV line.
- Wallerawang – Sydney South 330 kV line.
- Wallerawang – Ingleburn – Sydney South 330 kV line.
- Liddell – Tomago 330 kV line.
- Liddell – Newcastle 330 kV line.

⁵ Table 37, at <https://www.aemo.com.au/-/media/files/major-publications/isp/2021/2021-inputs-assumptions-and-scenarios-report.pdf?>

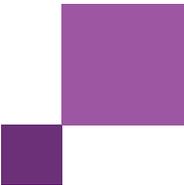
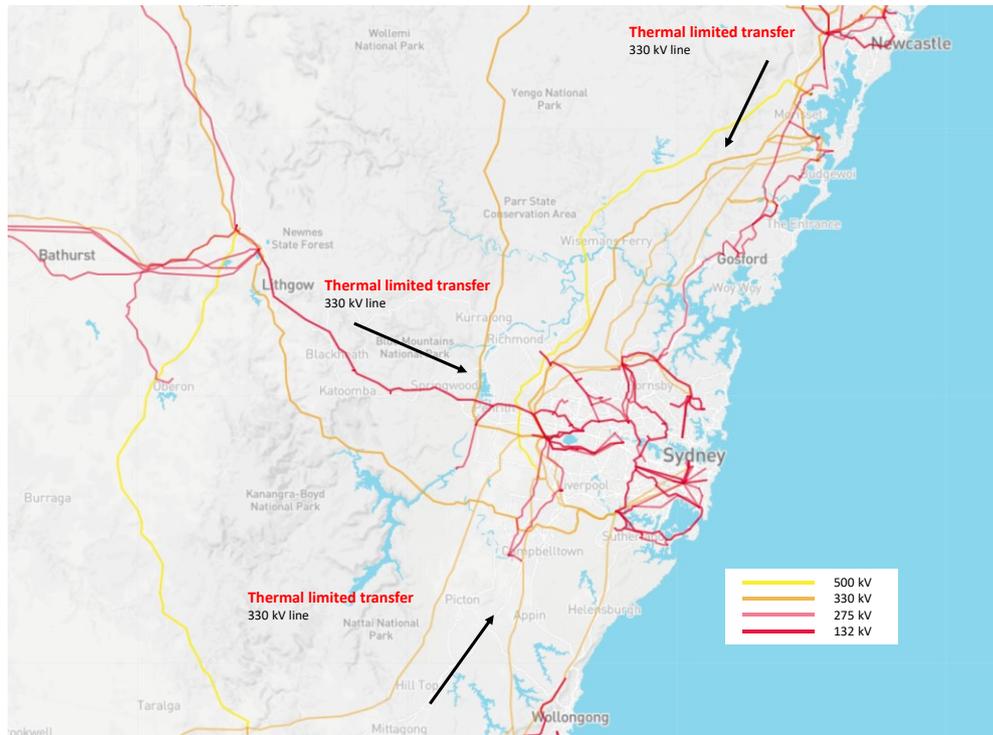


Figure 2 Thermal transfer limits in SNW area



2 Submissions

AEMO received several confidential submissions for non-network options to address the identified need. Many of the proponents have proven experience in delivering renewable energy projects in both Australia and across the world. Some submissions also stated their solution had already secured land and easements.

The submissions can be categorised into following technology types:

- Battery storage.
- Battery storage with automated control schemes.
- Power flow controllers.

2.1 Battery storage

Battery storage facilities are proposed to meet the supply shortfall within SNW and/or increase transfer capability to supply the SNW load centres with an automated control scheme. Also, battery storage can provide frequency control ancillary services (FCAS) and network support services.

The submissions had the following characteristics of proposed battery storage:

- Developed and commercially operational within two years.
- Proposed 15-year term of service, with the option to shorten or extend the contract.
- No requirement to access other resources, so can be installed in most locations.

- Low capital expenditure (CAPEX) compared to other technologies.
- Reduced environmental impact in comparison to the large footprint required by most transmission assets.

2.2 Battery storage with automated control schemes

Battery storage systems can also form part of automated control schemes, referred to as System Integrity Protection Schemes (SIPS). These options target increasing thermal limits by installing battery storage systems controlled by a SIPS at two ends of transmission lines. The operation of such schemes would mimic a 'virtual transmission line' following a transmission line contingency.

If the associated battery storage system and associated control scheme is owned and operated by a Network Service Provider, this would be considered to be a network option, as opposed to when a battery storage system is owned and operated by another participant, in which case it is considered to be a non-network option.

Virtual transmission line (VTL)

A virtual transmission concept involves a use of fast active power response at both ends of a transmission line which is likely to be a constraining element. Immediately following a contingency, the sending end reduces the power, and the receiving end increases the same amount of power minus the line losses, relieving any overload on remaining parallel transmission lines. This design is an alternative to upgrading, replacing or building new line.

2.3 Power flow controllers

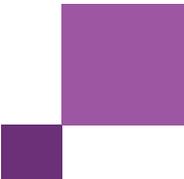
Power flow controllers can increase the system capability by balancing power flows to improve utilisation of existing networks and transmission assets, as well as new network augmentations. As power flow controllers are expected to be network assets, they are not considered to be a non-network option. They can be considered as part of other network options to increase the transfer capacity to supply the SNW load centres, and as such the details of the submitted proposals will be shared with the relevant Network Service Providers for further consideration in network option designs.

The designs in the submissions had the following characteristics:

- Modular design that can be installed incrementally.
- Real-time remote control to moderate levels of reactance as desired.
- Suitable for system voltages up to 550 kV.
- Typical supply time of 12 months.

3 Assessment

The purpose of this assessment is to determine whether each of the proposed non-network options meets, or is reasonably likely to meet, the identified need, either as a standalone non-network option or in conjunction with a network option as a hybrid solution.



Each submission has been assessed individually. Due to the confidential nature of some submissions, the assessment outcomes have been grouped by technology type and the services offered and outcomes of the assessments summarised

All proposed non-network solutions would have an effect on improving the network limits. By technology type and services offered:

- Battery storage - this will partially replace supply capacity that will be removed on the closure of coal-fired power stations in the Newcastle area, thereby meeting the identified need.
- Battery storage with automated control schemes – this could enable increases to post-contingency short-term rating of highly loaded lines within the SNW region. This would increase the power system’s capability to supply SNW load centres, thereby meeting the identified need. However, design of the automated control scheme and allowable short-term rating of existing transmission lines need to be reviewed and agreed with transmission plant asset owners.

4 Conclusion

AEMO concludes that:

- All submitted battery storage, with and without automated control schemes, non-network solutions are reasonably likely to assist with meeting the identified need at least partially.
- The power flow controller submission is not considered to be a non-network option. As a network option, they are reasonably likely to assist with meeting the identified need when considered with other network options.
- The large scale of the Sydney, Newcastle, and Wollongong area means that the non-network solutions on their own cannot fully provide the 5,000 MW network capacity increase. Instead, they could be part of a hybrid solution.

As an actionable NSW project, this project will now progress under the *Electricity Infrastructure Investment Act 2020* (NSW)⁶ rather than the ISP framework. As such, AEMO will now provide this preliminary assessment and the details of the non-network proposals to EnergyCo NSW for further consideration.

⁶ Available at <https://www.legislation.nsw.gov.au/view/html/inforce/current/act-2020-044>