New England REZ Transmission Link Non-Network Options Assessment

June 2022

Assessment of Submissions

Important notice

Purpose

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Version control

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

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1 Background

The New England Renewable Energy Zone (REZ) was formally declared under the *Electricity Infrastructure Investment Act 2020* (NSW)[1] on 17 December 2021.

The declaration also sets out that the REZ has an intended network capacity of 8,000 megawatts (MW)[2].

The New South Wales Government has stated in the Transmission Infrastructure Strategy that it will support the transmission upgrades for the New England REZ[3], and has also committed to financially support the development of the New England REZ.

As the New England REZ Transmission Link was identified as an actionable project in the Draft 2022 *Integrated System Plan* (ISP), AEMO therefore requested submissions on non-network options for the project[4].

A non-network option is a solution or service that does not involve investing 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 proposals[5]. 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, New England REZ Transmission Link will progress under the *Electricity Infrastructure Investment Act 2020* (NSW) as an actionable New South Wales project rather than under the ISP framework[6].

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

[2] New South Wales Government. Renewable Energy Zones, at https://www.energy.nsw.gov.au/renewables/renewable-energy-zones.

[3] New South Wales Government Transmission Infrastructure Strategy, at https://www.energy.nsw.gov.au/renewables/clean-energy-initiatives/transmission-infrastructure-strategy.

[4] Notice of consultation - Non-Network Options for New England REZ Transmission Link, at https://aemo.com.au/consultations/current-and-closed-consultations/2022-isp-consultation-non-network-options-new-england-rez-link.

[5] National Electricity Rules, section 5.22.12, available at https://www.aemc.gov.au/regulation/energy-rules/national-electricity-rules/current.

[6] New South Wales Government. *New England Renewable Energy Zone declaration*, at https://www.energy.nsw.gov.au/renewables/renewable-energy-zones/new-england-renewable-energy-zone-declaration.

Identified need

The New England REZ Transmission Link is as defined in the New South Wales Electricity Strategy[7]. The identified need is:

> *To increase the capability of the transmission network to enable the connection of expected generation in the New England REZ:*
>
> - *increasing the transfer capacity between expected generation in the New England REZ and the existing transmission network in the Hunter region, and*
> - *ensuring sufficient resilience to avoid material reductions in transfer capacity during an outage of a transmission element*
>
> *or as otherwise consistent with the NSW Government's Electricity Infrastructure Roadmap.*

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 existing network was designed to provide supply to load in northern New South Wales, and facilitate flow on the existing Queensland – New South Wales Interconnector (QNI).

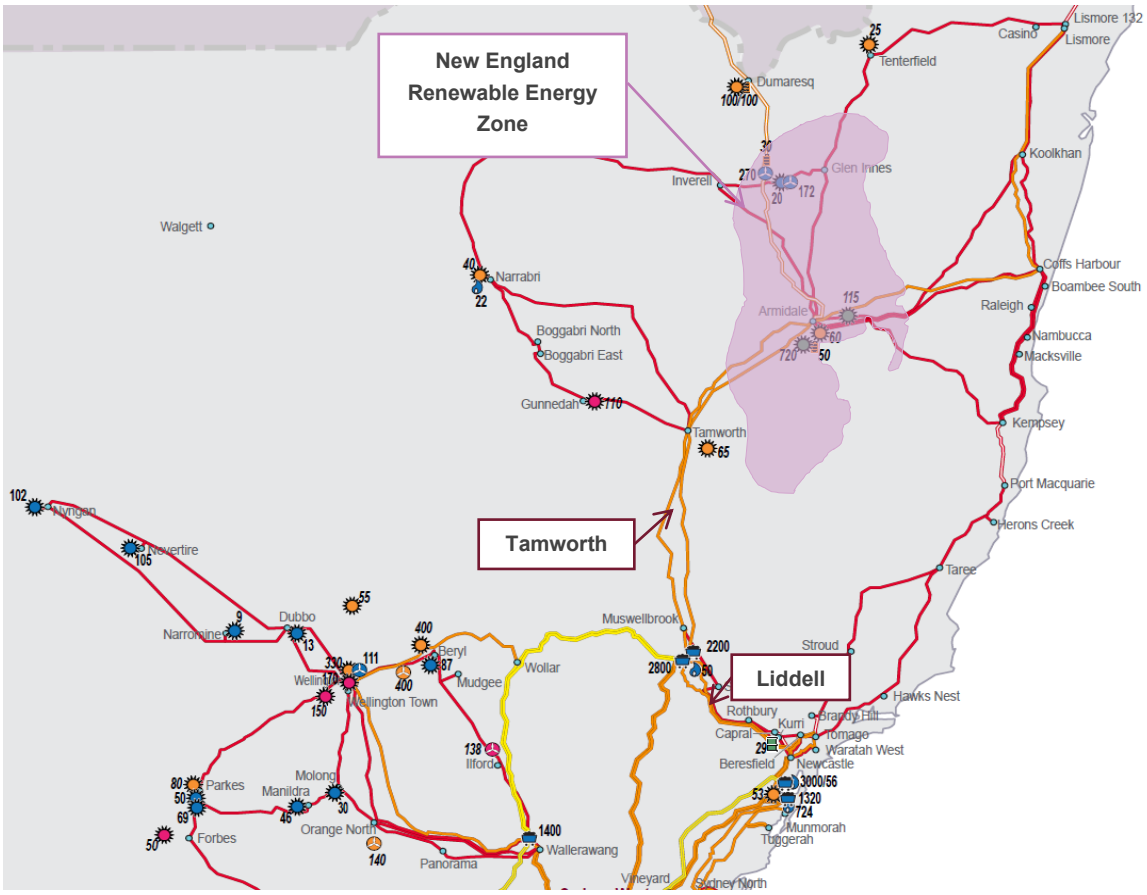
During periods of high southerly flows on QNI, capacity can be limited by thermal limits on the 330 kilovolts (kV) circuits between Armidale, Tamworth, Muswellbrook and Liddell[8], as shown in Figure 1. Due to the long line lengths for this part of the network, flows can also be limited due to voltage or transient stability limits.

The proposed New England REZ upgrade transmission options aim to allow for increased flows south from the New England REZ to the Hunter region, and still allow for high southerly flows south on QNI during peak demand periods.

[7] Available at https://www.energy.nsw.gov.au/sites/default/files/2019-11/NSW%20Electricity%20Strategy%20-%20Final%20detailed%20strategy_0.pdf

[8] 2022 Draft ISP Appendix 3 Renewable energy zones, Section A3.4 REZ scorecards page 20, at https://www.aemo.com.au/-/media/files/major-publications/isp/2022/appendix-3-renewable-energy-zones.pdf.

Figure 1 Current network map showing New England Renewable Energy Zone geographical area and thermal limited 330 kV transmission circuit to Hunter region



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 several technology types:

- Battery storage.
- Battery storage with automated controlled schemes.
- Pumped hydro.
- Power flow controller.

2.1 Battery storage

Battery storage is a very flexible technology, where the instantaneous power output (MW), and storage capacity (megawatt hour, or MWh) characteristics are highly customisable. The inverter and its associated control systems

can be customised to the exact needs of the network. Also, battery storage can provide frequency control ancillary services (FCAS) and network support services.

The designs in the submissions had the following characteristics:

- Between one and two years to develop and commission.
- Lifespan of 20 years or can be designed for more.
- Grid-forming inverters are used, potentially providing fast voltage control, virtual inertia, and limited levels of system strength.
- No requirement to access other resources, so can be installed in most locations.
- Low capital expenditure (CAPEX) compared to other technologies.

2.2 Battery storage with automated controlled schemes

Battery storage systems can also form part of automated control schemes. A virtual transmission concept involves the 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 uprating, replacing or building new line.

If the battery storage system and associated control schemes 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.

2.3 Pumped hydro

Pumped hydro systems can provide long-duration energy storage. The designs in the submissions had the following characteristics:

- Four years to build.
- Lifespan of 50 years.
- Use a synchronous machine, so can provide system strength when pumping or generating.

2.4 Power flow controller

A form of power flow controller is a static synchronous compensator placed in series with a conductor to produce a controllable reactance, in effect allowing power flow to be controlled on transmission lines. As power flow controllers are expected to be network assets, they are not considered to be a non-network option.

The designs in the submissions had the following characteristics:

- Modular design that can be installed incrementally.
- Remotely controllable in real-time to produce desired level of reactance.

- Suitable for system voltages up to 550 kV.
- Twelve-month supply time.

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 relevant 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.

3.1 Battery storage

The technical characteristics of battery storage give the potential for meeting the network need through several mechanisms, including demand shifting and improving stability limits. The required thermal network capacity to support the New England REZ could be reduced by placing batteries inside the REZ. They could act as local demand during periods of high local generation and when thermal constraints are binding and could then discharge later during periods of lower local generation. By firming and decongesting variable renewable energy (VRE) generation in the REZ, the battery systems can increase the utilisation of the transmission network.

3.2 Battery storage with automated controlled schemes

These systems can increase the capacity of the transmission network, thereby assisting in meeting the identified need, because they allow higher line flows by being able to rapidly increase or decrease output after contingency events and can also be integrated with other generator runback schemes. 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.

3.3 Pumped hydro

The technical characteristics of pumped hydro systems give the potential for meeting the network need through several mechanisms, including demand shifting and improving stability limits. Pumped hydro systems can assist with firming VRE generation in the REZ. This allows increased utilisation of the transmission network and increased transfer capacity from the REZ to the Hunter region during periods of low VRE, hence meeting the identified need. Additionally, pumped hydro systems typically have a high storage capacity (MWh) compared to present battery technologies. This would give the New England REZ greater flexibility to be effective during multi-day weather conditions. There is scope for pumped hydro to provide a wide range of system services. A synchronous pumped hydro system, when in operation, can provide fast voltage control and system strength, improving stability in the REZ and increasing limits. Therefore, it is likely that pumped hydro systems can address the identified need.

4 Conclusion

AEMO concludes that:

- All submitted battery storage, with and without automated control schemes, and pumped hydro non-network option submissions are reasonably likely to assist with meeting the identified need.
- 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 REZ means that the non-network solutions on their own cannot fully provide the 8,000 MW transmission capacity for the New England REZ. Instead, they could be part of a hybrid solution.

When the New England REZ was formally declared under the *Electricity Infrastructure Investment Act 2020* (NSW), EnergyCo NSW was appointed as the Infrastructure Planner to assess and recommend REZ network infrastructure. As an actionable NSW project, this project will now progress under the *Electricity Infrastructure Investment Act 2020* (NSW) 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.