Submission No 28

INQUIRY INTO FEASIBILITY OF UNDERGROUNDING THE TRANSMISSION INFRASTRUCTURE FOR RENEWABLE ENERGY PROJECTS

Organisation: National Parks Association of NSW

Date Received: 10 November 2023

NATIONAL PARKS ASSOCIATION OF NSW
protecting nature through community action

10 November 2023

Select Committee
Legislative Council, NSW Parliament
By email: https://www.parliament.nsw.gov.au/committees/inquiries/Pages/lodge-a-submission.aspx?pk=3002

Submission to Select Committee on the feasibility of undergrounding the transmission infrastructure for renewable energy projects

Dear Select Committee,

The National Parks Association of NSW's (NPA) mission is to protect nature through community action. Our strengths include State-wide reach, deep local knowledge, evidence-based input to policy and planning, and over 65 years' commitment to advancing the NSW Protected Area network and its professional management.

NPA welcomes this second Inquiry as an opportunity to highlight the environmental impacts of transmission connections, especially overhead lines. This submission is designed to be read in concert with our previous submission and appearance before the first inquiry.

NPA believes that NSW should adopt international best practice and mandate the use of underground transmission lines whenever passing through areas of high environmental, social, agricultural or economic value.

Overhead transmission lines are last century's technology. It was Government's preferred option in an era when the massive clearing of natural habitats and loss of prime agricultural lands, that are required for the construction and maintenance of overhead lines, were considered an acceptable burden on the community. In the 21st century, clearing the tens of thousands of hectares of additional lands will inflict a biodiversity, economic and social cost our State simply cannot afford.

The most effective means of reducing these impacts is to adopt underground cables whenever traversing lands of high conservation, agricultural or social value.

NPA notes that there are several well-proven methods for putting cables underground, including trenching, directional drilling and tunnels.

In NPA's view the claim that underground lines are 'too expensive' is a product of a failure to fully cost the large scale clearance that is required for overhead transmission. The true costs of selecting overhead transmission includes, but is not limited to:

- release of carbon from vegetation and soils during construction;
- loss of the carbon sequestration and sequestration potential of natural habitats;
- loss of biodiversity value;
- disruption of habitat connectivity and increase in 'edge effects' as they relate to invasive species and fire risk;

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- loss of agricultural productivity; and
- landscape disfigurement and visual blight.

The current preference for overhead transmission is effectively transferring the short term higher capital cost of underground to biodiversity, agricultural and social costs that will be inflicted on future generations.

Protected Areas

NPA has a strong interest in the routing and construction of the next generation of transmission connections in NSW. We are particularly interested in situations where connections are proposed across or near Protected Areas (National Parks, Nature Reserves, Regional Parks, and State Conservation Areas) and other lands of high conservation significance.

Most NSW Protected Areas are located along the Great Dividing Range and coast. The transmission connections between the generators in the Snowy Mountains, Hunter Valley and Lithgow traverse Protected Areas on their way to the major load centres of Sydney, Illawarra, and Newcastle. Most lines were constructed more than half a century ago, in many cases prior to the gazettal of the Protected Areas. They sit within easements where vegetation is treated by slashing or removal to maintain clearance and reduce the potential for arcing during bushfires. The effect on the ecological integrity of the Protected Areas is substantial, removing thousands of hectares of habitat and causing fragmentation and loss of connectivity at a massive scale.

The location of the new Renewable Energy Zones means that the Government will come under significant pressure to allow new transmission connections through Protected Areas.

NPA submits that transmission lines, overhead or underground, should never be permitted in Protected Areas.

This submission uses the example of the Snowy 2.0 transmission connection through Kosciuszko National Park to illustrate the severe environmental costs associated with overhead towers, lines, easements, and access tracks. The Snowy 2.0 transmission will be the first overhead line in a National Park for 50 years.

NPA advocates for a more serious consideration of undergrounding new transmission lines, rather than automatically proposing overhead lines for non-urban areas. Whilst overhead lines have a higher initial capital cost, underground cables have significant benefits that will in many cases more than offset the cost gap, particularly when environmental, social, agricultural and fire-fighting advantages are considered. This is well covered in a recent report by Amplitude Consultants.

Underground cables are also far more acceptable to local communities and landowners, resulting in substantial savings in time, litigation and human angst.

Underground cables have been used in NSW urban areas for decades. It is an inconsistent double standard to neglect their use in regional areas, especially those with significant environmental, Indigenous, agricultural, scenic and social value. It's time for NSW to catch

up with the rest of the developed world and apply underground cabling as the default technology for transmission.

Further detail on our contention that underground cables should be preferred over overhead transmission lines is provided in Attachment A.

Together with this submission we tender the following documents:

i) NPA Submission (No. 95) to "Inquiry into the feasibility of undergrounding the transmission infrastructure for renewable energy projects', 14 July 2023
ii) NPA Submission on HumeLink EIS, 10 October 2023, concluding that HumeLink needs a rethink
iii) NPA Paper on Snowy 2.0 Transmission Connection RTS/PIR, 31 March 2022, concluding that overhead transmission is not the best option
iv) NPA Submission on Snowy 2.0 Transmission Connection EIS, 2 April 2021, opposing overhead line transmission
v) Snowy 2.0 Underground Transmission Representation from Four Independent MPs, 11 February 2021 , calling for the transmission connection to be underground
vi) Open Letter to NSW Planning Minister and Environment and Energy Minister, 18 January 2021, from two dozen environmental groups and 50 experts, titled “Snowy 2.0 transmission must be underground”

NPA would welcome the opportunity to present on these issues to the Committee, and can be contacted at

Yours sincerely,

Gary Dunnett
Chief Executive
National Parks Association of NSW
protecting nature through community action

Attachments:
A Further comments on underground cables versus overhead transmission lines
B The Snowy 2.0 overhead line connection through Kosciuszko National Park
C Specific comments on HumeLink

Attachment A – Further comments on underground cables versus overhead transmission lines

1 Transmission lines should not be permitted within or directly adjacent to Protected Areas

As a matter of principle, Protected Areas (National Parks, Nature Reserves, Regional Parks, and State Conservation Areas) and other areas of intrinsic environmental significance and natural beauty should be no-go areas for new transmission lines and any other human infrastructure, full stop.

So little of NSW is set aside for its natural values, that we cannot afford to disfigure those precious areas with major infrastructure.

This principle is embodied in the Plans of Management for many National Parks, rightly so.

There also needs to be a buffer zone of at least one kilometre between the boundary of areas of natural significance and transmission lines. In some locations, such as lookout points, the distance from the boundary of natural significant areas should be much greater to reduce the visual impacts to acceptable levels.

Wherever a proposed transmission line passes near an area of natural significance the route should be subject to a comprehensive visual, landscape character and noise assessment.

2 Biodiversity offsets

The biodiversity offset cost for transmission lines can be enormous. For example, the offset cost for HumeLink is almost $1 billion,

Offsets are supposed to be a last resort according to the EPBC Act Offsets Policy:

> *"Offsets will not be considered until all reasonable avoidance and mitigation measures are considered, or acceptable reasons are provided as to why avoidance or mitigation of impacts is not reasonably achievable."* (Section 4.1 and Fig 1)

Clearly undergrounding is a 'reasonable' avoidance measure - by horizontal directional drilling - and a mitigation measure - by trenching - that must be assessed before offsets are considered.

Where it is not possible to avoid damaging important habitat, ecosystem offsets should be established as close as possible to the impact and located within the same IBRA subregion (Interim Biogeographic Regionalisation of Australia). Offset areas and management activities should aim to maintain or increase the actual local populations that are to be impacted, including populations of the many plant and animal species in endangered ecological communities, so they are not reduced or fragmented into unviable populations destined to be lost from the local area. In determining the suitability of possible offset areas, factors such as similar soil type, habitat qualities like shelter, and the dispersal abilities or requirements of species should be considered.

This principle goes beyond the legislative requirement, which is to establish ecosystem offsets within the same IBRA region and species offsets within the state. This will require a

proactive approach to landholders near to transmission line routes to encourage and enable them to establish Biodiversity Stewardship Agreements on their land to generate credits for the project. This will ensure that the offsets are close to where the impacts are and will generate additional income for affected landholders and neighbours. This could be developed in partnership with the Biodiversity Conservation Trust or the Credit Supply Taskforce.

Species offsets should be established close enough to the impact area that affected populations can move to the offset areas. The distance will depend on the dispersal ability of the affected species and may require the establishment of corridors or improved connectivity. For some fauna species, capture and release into offset areas should be considered and carefully monitored.

Management of offset stewardship areas should be consistent with the National Standards for the Practice of Ecological Restoration in Australia. This would be a means to achieve the specific offset outcomes through either passive or active management, or both.

3 Underground cabling is far preferable to overhead lines

Overhead transmission should no longer be the default design in rural NSW.

Much has been written on this subject over the past couple of years, with TransGrid (and AEMO) adamantly against undergrounding in non-urban areas, and against DC (direct current as opposed to alternating current).

We will not repeat the extensive information provided by others on the benefits of undergrounding (visual amenity, no exposure to lightning or other weather events, no noise, no bushfire sparking, no restrictions to firefighting, less environmental damage and loss of biodiversity, tourism unaffected, productive efficiency of agriculture etc) and of a DC backbone connection from Sydney to Melbourne.

TransGrid has long adopted underground transmission in urban areas and must extend undergrounding to non-urban areas of high value – environmental, agricultural, scenic and social. TransGrid will never obtain 'social licence' for overhead lines. The rest of the developed world has adopted underground cables and long-distance DC transmission.

Australian private entities are not even bothering proposing overhead lines and have adopted underground cables from the outset for their projects (e.g. Star of the South, Marinus Link (land sections) and wind and solar farms).

The rest of the developed world has adopted underground cables and long-distance DC transmission, why shouldn't NSW.

If TransGrid persists with proposing overhead lines it will be a protracted and fraught process. It is likely to be cheaper, faster and far less traumatic for all concerned, including TransGrid, to go underground.

3.1 Amplitude Report

'HumeLink Undergrounding - Review of Transgrid Report and Costing for HVDC Alternatives', Amplitude Consultants, 3 Oct 2023 provides a detailed comparison of overhead and underground construction of HumeLink.

It concludes that underground would be around 1.5 times the cost of overhead and could be completed by the end of this decade, aligning with Snowy 2.0's latest completion estimate and with the optimal timing identified the AEMO:

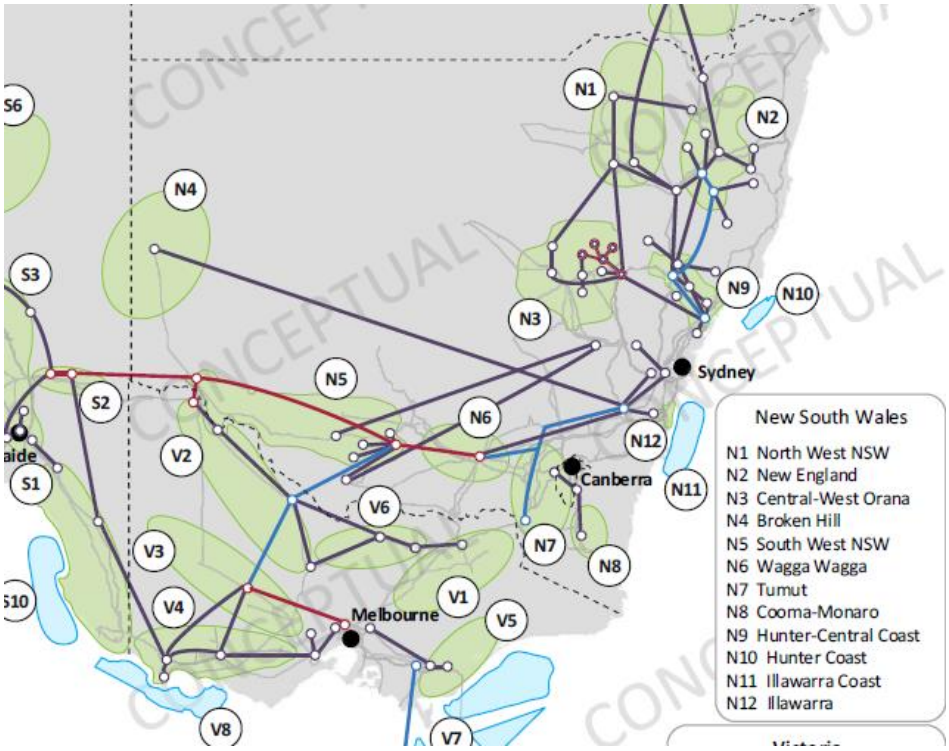
> *"Amplitude's estimates of the two options presented, based on our own estimates of HVDC converter station costs and bottom up of long distance HVDC underground cable cost and installation in Australia, has resulted in multiples (when compared to the latest reported cost of the HumeLink AC overhead line project) of 1.5 times the cost of the 2A-1 AC overhead line option and 1.37 times the cost of the escalated 1C-new AC overhead line option."*

When the advantages of undergrounding are taken into account this results in undergrounding being a superior option to overhead lines.

4 Piecemeal planning of transmission

AEMO's 2023 Transmission Expansion Options Report, 28 July 2023 outlines *"transmission expansion options to be evaluated in the 2024 ISP, including conceptual design, lead time, location and cost estimate*".

The main message from this Report is that the transmission expansion across NSW (and the rest of Australia) will be considerably more extensive than currently revealed.



Conceptual REZ expansion options and flow path augmentation options (AEMO Report)

As shown in the figure above there are a number of potential additional REZs and a significant number of additional transmission expansions across NSW (purple lines). It is appreciated that these additional projects are conceptual, but they provide AEMO's view of what is needed to continue the energy transition through to 2050.

Some of these additional lines are in areas where new transmission lines are already being progressed (e.g. HumeLink, Central-West REZ, New England REZ), some are in adjacent areas and some span new territory. Also, many of the additional lines would be terminated at existing substations, some of which are already being augmented, and will need to be further expanded to accommodate additional lines.

No doubt, the prospect of further transmission and substation expansions in those communities where augmentations are already underway will be a challenge. It would be a daunting task to return to communities with an additional transmission proposal just a couple of years after being through the process and possibly even before the first line was completed.

An example of additional transmission capacity to that currently being planned is the need for a second HumeLink – see Attachment C.

5 No evidence of consideration of upgrading existing lines or conversion to DC

Before proposing to build new lines, the first thing to consider is what further can be done with the existing network, such as:

- restringing existing circuits to increase capacity
- replacing existing single-circuit lines with double-circuits (will involve new, taller towers, but on the same or adjacent easement)
- replacing existing 330kV AC lines with DC
- 'adding' a DC circuit to an existing AC line (possibly involving new towers)

The recent German Ultranet Project is an example, replacing one of two circuits of an existing 380kV double-circuit AC line with a 2,000 MW DC circuit over 340 kilometres.

Such an arrangement could be possible for a Sydney to Melbourne DC connection, 'replacing' Sydney Ring South, HumeLink and VNI West.

6 Plan an underground DC backbone network now

An obvious planning option is the development of a DC backbone network across NSW and southeastern Australia. The best time to plan such a backbone is now, rather than in another decade or so when many of the benefits will have been forgone due to new AC lines being constructed in the meantime. A prime benefit of DC lines is that they are less obtrusive than overhead AC lines and can be undergrounded for much longer distances.

One opportunity for routing underground cables is to locate them within or near existing overhead line easements, providing numerous significant benefits:

- far less need for additional underground cable easement
- far less objections from landowners, no objections from neighbours or local

communities
- minimal additional environmental impact after construction
- minimal if any biodiversity offset and easement purchase costs. For HumeLink such costs are estimated to be well over $1 billion:
    - $930 million for biodiversity offsets
    - $90 million for easement purchase (likely to be understated)
    - $180 million for the additional payment of $200,000 per kilometre (though this payment may still be appropriate compensation for landowners)
- 'combined' maintenance savings, few additional access tracks

Of course, it would not be practical to install underground cables along some sections of line, but it would be for significant distances.

6.1 German example of priority for underground cables

Many overseas countries prioritise underground lines versus overhead lines, and there is no reason why NSW shouldn't follow suit.

For example Germany adopted a law in 2015 that required DC transmission lines to be planned and delivered as underground cables. Public opposition to overhead lines was but one consideration, as explained in the German Ministry explanation for the Act:

> *"Where major electricity highways are concerned (= new ultra-high voltage direct current transmission lines), the Act will give priority to underground cables as a principle in federal planning. Overhead cables will only be used exceptionally in certain cases, e.g. in order to protect the natural environment. To put it simply, this means that there will be an absolute ban [on] overheard cables being used wherever people live. So overhead cables can only be used in very strict exceptions."*

7 New generators should pay their fair share of new transmission infrastructure

TransGrid's submission to the First Inquiry stated (page 5):

> *"Transgrid is investing $16.5 billion in transmission infrastructure in NSW over the next decade. Our major projects will create an energy superhighway, connecting new renewable generation to a strong and flexible network"*

As well as TransGrid's projects there is an additional $5 billion or more for transmission to the Renewable Energy Zones (REZs) under the responsibility of EnergyCo, bringing the total proposed expenditure to around $25 billion over the next ten years.

TransGrid, EnergyCo, the AER and AEIC are assuming that the cost of this new transmission will be paid for entirely by electricity consumers, by adding the whole amount to the Regulatory Asset Base (RAB) of TransGrid or other operators – on which a regulated return is ultimately applied.

TransGrid's current RAB is approximately $7 billion, so the additional investments will approximately triple current transmission tariffs for electricity consumers.

The inequity of the current payment approach is epitomised by HumeLink, which is being built primarily to connect Snowy 2.0 to the grid, from a new substation at Maragle (near

Talbingo Reservoir) to Bannaby (near Goulburn) and Wagga Wagga. Were it not for Snowy 2.0 it is arguable whether HumeLink is needed, but certainly its route (involving a 100 kilometre dog-leg deviation to Maragle), size and timing would be very different, and much cheaper.

HumeLink's capacity of 2,200 MW is identical to the capacity of Snowy 2.0's pumps and generators. Snowy 2.0 is stranded without HumeLink.

So, in this example, as Snowy 2.0 is the major reason for and beneficiary of HumeLink, Snowy Hydro should be paying its fair share rather than leaving it to electricity consumers to bear the full cost.

Snowy Hydro is paying for the 9 kilometre connection of Snowy 2.0 to Maragle. But Snowy Hydro should also be paying for the new Maragle substation, contributing to the 360 kilometres of 500kV double-circuit lines to Bannaby and Wagga Wagga and their substation augmentations, and contributing to Sydney Ring South and VNI West to enable its output to reach Sydney and Melbourne.

This issue was discussed at the First Inquiry page 21:

> *Ms CATE FAEHRMANN: So the owner, the developer, Snowy 2.0—they don't pay for the connection [HumeLink] because of the regulatory environment, correct? JIM COX: The regulatory environment doesn't require them to pay, no.*
>
> *Ms CATE FAEHRMANN: It doesn't require them to pay; it requires consumers to pay, and only consumers?*
>
> *JIM COX: Only consumers, yes, is the way that things are at the moment. I suppose the other thing that's around and important is the Government has got ideas about concessional financing of these transmission links. Were that to go ahead, that would reduce the amount that consumers have to pay. So that's another possibility that's being considered at the moment.*
>
> *Ms CATE FAEHRMANN: I suppose it's a result of history that we have this regulatory environment that dictates that the consumer, and only the consumer, pays for this transmission infrastructure. Shouldn't we consider regulatory change to potentially split that between, say, the proponent, the developer, the Government and, yes, potentially the consumer?*
>
> *JIM COX: Let's see. The idea that generators should contribute is one that's around, and I think there are respectable arguments in that direction. I certainly wouldn't want to rule that out. It might be reasonable for such costs to be borne by all electricity consumers when it is not possible to distinguish any individual generator or load that is causing the need for additional transmission capacity. However, in many cases the need for the additional transmission can be directly linked to specific new generators or new loads.*

The only reason that 'this is the way things are at the moment' is because governments and energy industry regulators have taken the path of least resistance and allowed it to be so –

there are no specific rules requiring consumers to pay for additional transmission. However, as Mr Cox indicates, there are sound reasons to require contributions from new generators and new loads.

To put it simply, if Snowy Hydro decides to build a big battery in the middle of Kosciuszko National Park, it should pay for the transmission augmentations required to enable it to receive its pumping power and deliver its generation to the major load centres. Snowy Hydro should not expect someone else (consumers via TransGrid) to provide that infrastructure for free.

More generally, no developer should be allowed to build a new generator (or load) and then expect someone else to design and build the transmission connection and someone else (consumers) to pick up the tab. The new generators should be paying their fair share of the cost of connection.

Not only would this be the just outcome, but it would also send an important pricing signal to developers to optimise the location of their plant (generators, batteries, pumped hydro, loads etc) by taking into consideration the cost of transmission.

This is a fundamental issue for consideration by the Inquiry and the NSW Government.

The oft-quoted response that electricity consumers pay in the end anyway so why worry, is incorrect. Any extra costs to developers of new generation for the associated transmission infrastructure cannot be recovered by charging higher prices in a competitive National Electricity Market. Also, there is inherent value in attributing all related costs to individual projects to ensure the most efficient outcome.

Attachment B – The Snowy 2.0 overhead line connection through Kosciuszko National Park

Kosciuszko National Park is more affected by transmission connections than any other NSW Protected Area because it contains the Snowy Mountains Scheme, with hundreds of kilometres of overhead transmission lines in thousands of hectares of cleared easements.

The net impact on the ecological values of Kosciuszko is immense. In direct and measured response, the Park's statutory 2006 Plan of Management (POM) introduced several policies designed to mitigate those impacts.

One was a requirement for TransGrid and Snowy Hydro, wherever feasible, to rationalise and replace overhead transmission lines with underground connections. Another was an outright prohibition on the construction of any new overhead transmission lines. In simple terms, enough was enough.

The new underground power connection from Cabramurra to Mt Selwyn ski resort, replacing the overhead line burnt out by bushfires, is an example of the move to undergrounding.

The Snowy 2.0 underground pumping/power station will be located about 12kilometres from the western boundary of Kosciuszko National Park. Once the power cables emerge from the access tunnel there is another 8 kilometres to the edge of the Park.

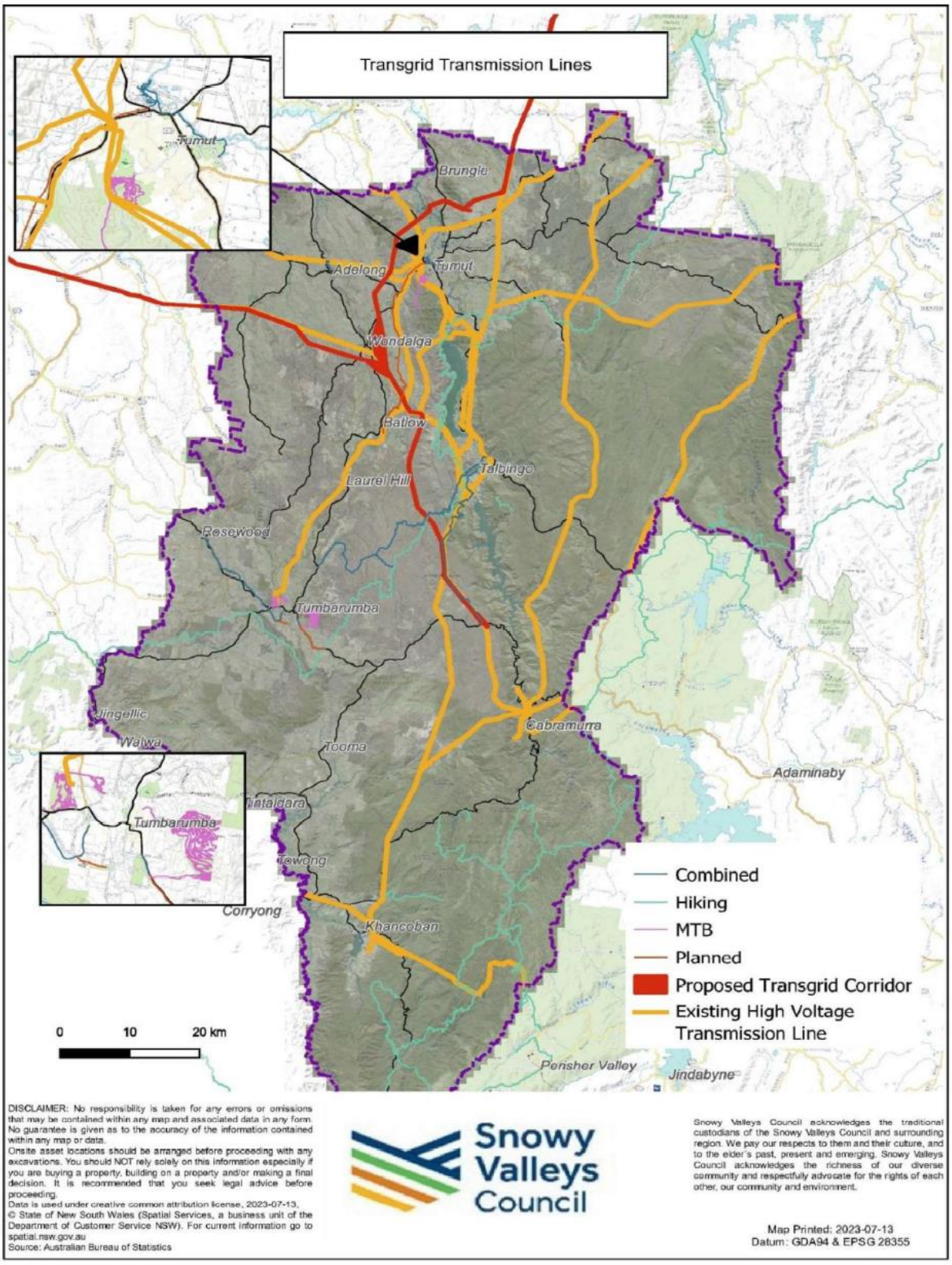
TransGrid proposed an overhead transmission connection across the Park despite the POM prohibition. It has emerged that TransGrid was assured by the National Parks and Wildlife Service that the POM would be amended to exempt Snowy 2.0 from the prohibition. The proposal was for four 330kV lines on two parallel sets of transmission towers within an easement swathe 120-140 metres wide. The total area of Park affected by the construction and easement exceeds 160 hectares while the 75 metre high towers will be visible over more than two hundred square kilometres.

NPA contested the Snowy 2.0 transmission proposal on environmental, technical, and economic grounds. We collaborated with energy, engineering, and environmental experts, made submissions to the regulatory documents, met with Ministers, their departments and TransGrid, and drew national media attention to the issue.

Apart from the devastating impact on Kosciuszko, our objections to the proposal were motivated by the precedent for further overhead transmission lines through Protected Areas. If allowed in an iconic park where new overhead lines were expressly prohibited, what was the likelihood that other proposals would be refused?

The Snowy 2.0 transmission will be the first overhead line in a National Park for 50 years.

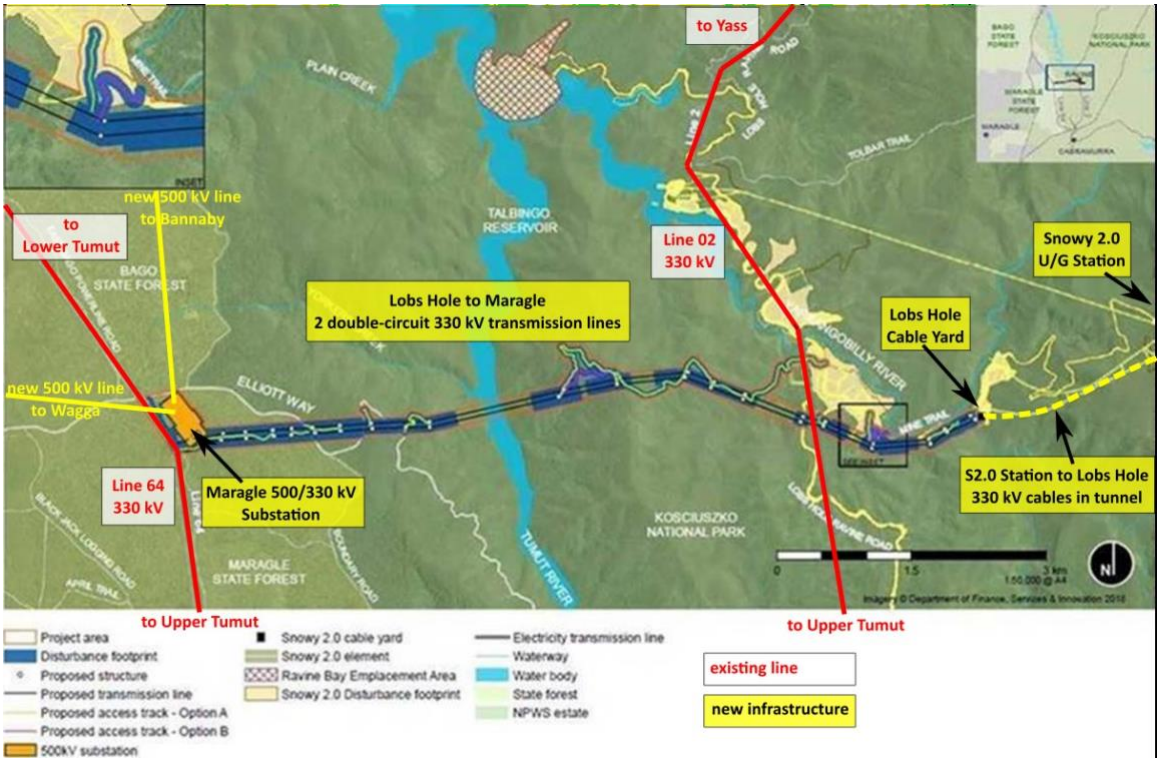
NPA has been campaigning on this issue for several years, and we are currently engaged in a judicial review of the previous Minister's decision to amend the Kosciuszko Plan of Management to exempt Snowy 2.0 from the requirement for underground cables.



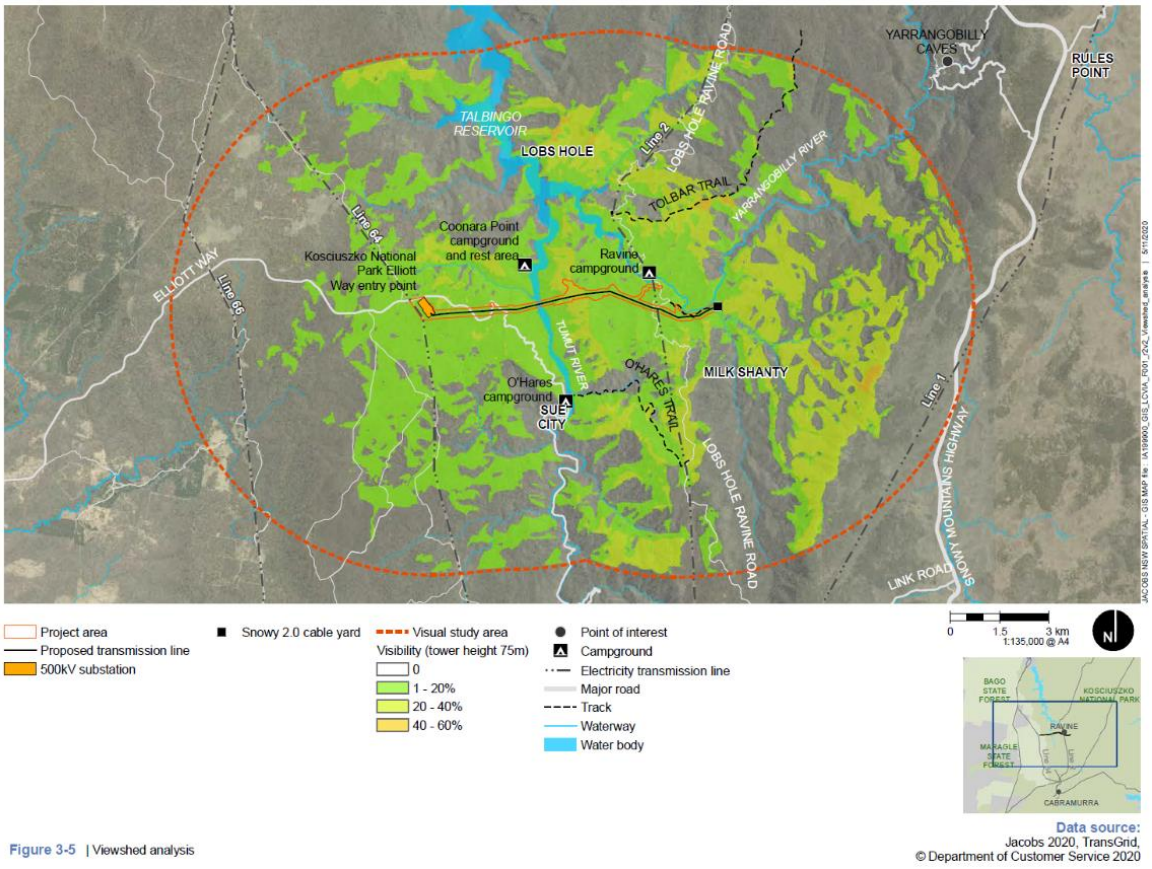
Existing and proposed overhead transmission lines in <u>Snowy Valleys Council</u>

Photomontage of proposed overhead transmission lines near Lobs Hole (TransGrid)

Photomontage - Lobs Hole (TransGrid)

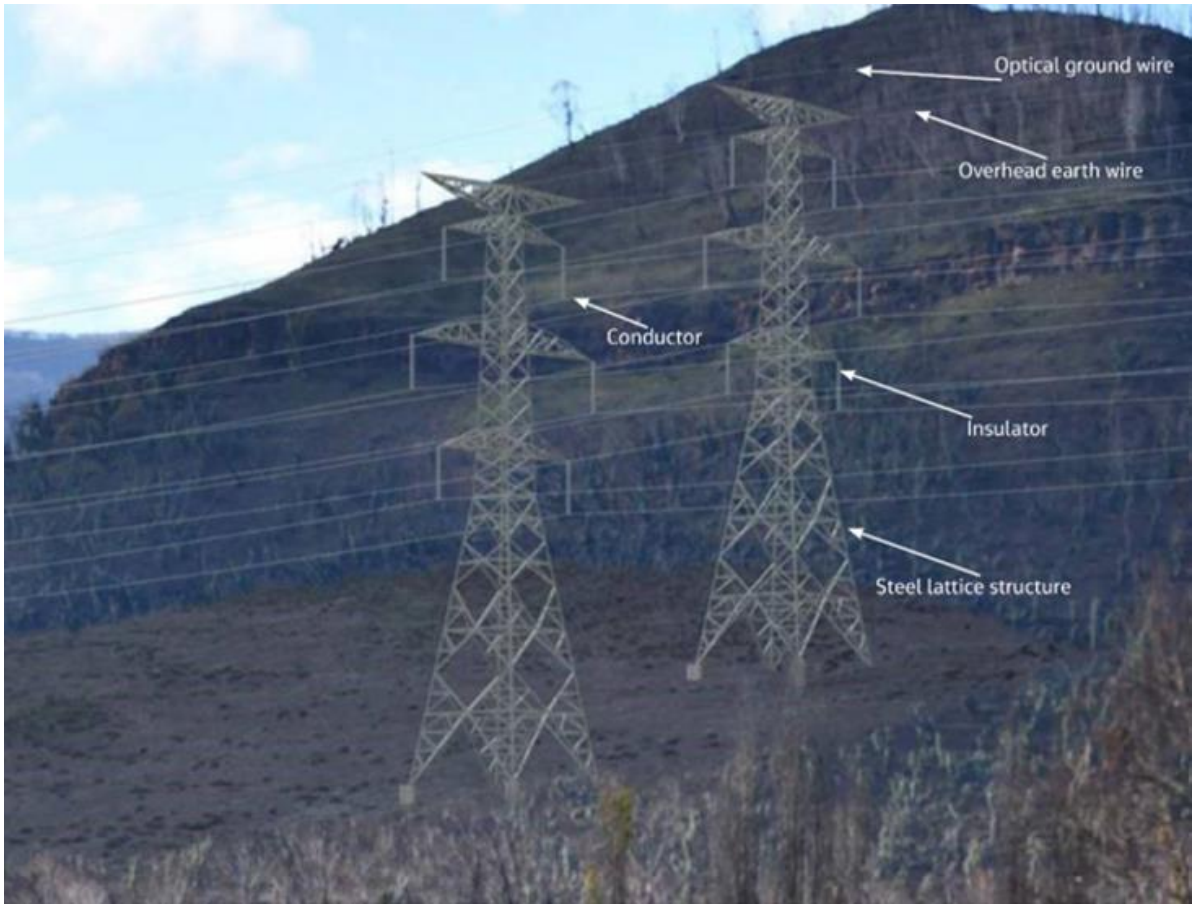


Route of transmission connection from Lobs Hole to Maragle Substation (TransGrid+ NPA captions)

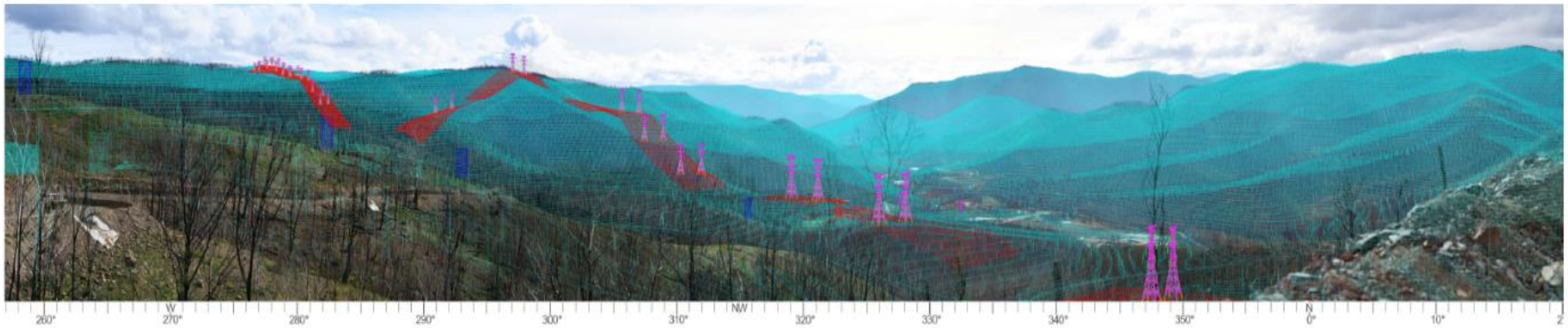


Lines will be visible over 200 square kilometres (TransGrid EIS)

Photomontage – Tumut River/Talbingo Reservoir Crossing (TransGrid)



Snowy 2.0 Transmission Line Design (TransGrid)



Wireframe view - Project

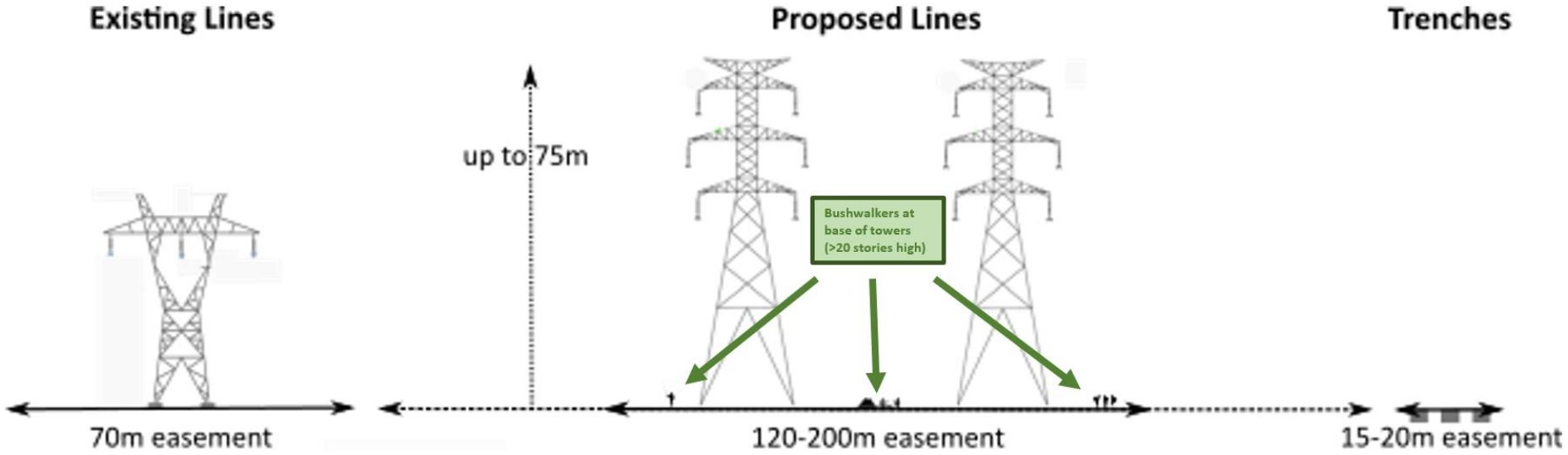
Photomontage - Lobs Hole to Maragle (TransGrid)

Photomontage - Lobs Hole (TransGrid)

Snowy 2.0 overhead lines will dominate Kosciuszko landscape

- 3 times the bulk of existing 330 kV lines in KNP
- easement for overhead lines will be 6-10 times width of underground cable trench
- no easement or access tracks required for tunnel (best U/G option)

- four 330,000 volt circuits
- 8 km through Kosciuszko National Park and 1 km through Bago State Forest
- 21 pairs of side-by-side steel lattice towers up to 75m tall - two circuits per tower
- 26 wires per tower (52 in total)
- cleared easement swathe 120m to 200m wide
- 10 km of access tracks



Comparison of Existing Kosciuszko NP Transmission Lines, Proposed Lines and Trench (NPA)

Attachment C – Specific comments on HumeLink

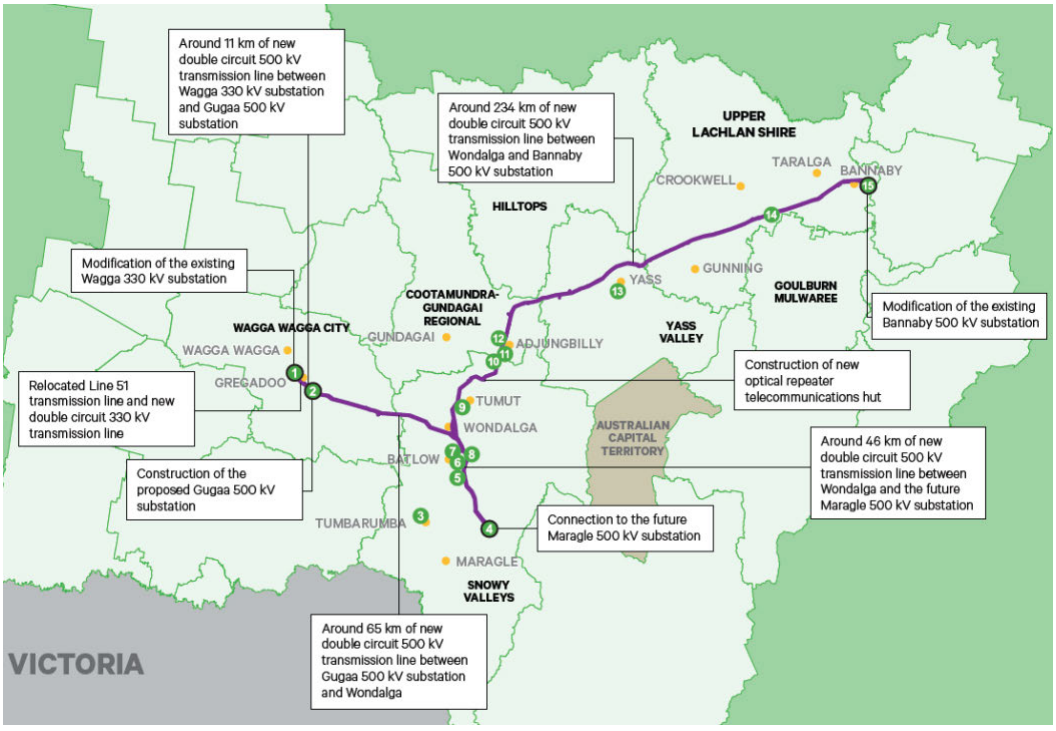
HumeLink needs a rethink.

HumeLink's recent capacity downgrade to 2,200 megawatt (MW) means it can only transmit Snowy 2.0's electricity when pumping and generating at full load. There is no spare capacity for new renewable generation or interstate transfers. A second HumeLink will be needed immediately Snowy 2.0 is commissioned. The full requirements for transmission from southern NSW to Sydney and the total environmental impacts must be considered once, and constructed once, not in a project-by-project manner.

HumeLink's latest estimated cost of $5 billion will significantly exceed its benefits, raising a fundamental question on its viability. As currently proposed, the total cost is to be borne by electricity consumers, increasing NSW transmission tariffs by more than 50%. It is inequitable for Snowy 2.0 and new generators that are triggering the need for HumeLink to not be required to pay their fair share. It's the equivalent of an electricity tax.

HumeLink will permanently scar 8,500 hectares. Its routing along the boundaries of six national parks and nature reserves is unacceptable. The biodiversity offset bill has previously been assessed as $1 billion, a staggering amount reflecting the enormity of the environmental damage.

Overhead transmission should no longer be the default design in rural NSW. With Snowy 2.0's continual delays there is sufficient time to redesign HumeLink (One and Two) to provide an all-up (partially or fully) underground solution with far less environmental damage, acceptable to local communities, and largely paid for by the electricity participants needing the transmission capacity.



Key components of HumeLink (EIS Summary Fig 3)

1 Unstated primary purpose is to connect Snowy 2.0

Throughout the EIS there is scant mention of the need for HumeLink to connect to Snowy 2.0, even though this is its primary purpose.

> *"The project would deliver a cheaper, more reliable and more sustainable grid by increasing the amount of renewable energy that can be delivered across the national electricity grid, helping to transition Australia to a low carbon future. It would achieve this by supporting the transfer of energy from existing renewable generation as well as facilitate development of new renewable generation in the declared South West Renewable Energy Zone (REZ) and candidate Wagga Wagga and Tumut REZs. The project would provide the required support for the network in southern NSW, allowing for the increase in transfer capacity between new renewable generation sources and the state's demand centres of Sydney, Newcastle and Wollongong. The project would also improve the efficiency and reliability of the current energy transfer in this part of the network."* ("quotes" are from the HumeLink EIS unless otherwise indicated)

HumeLink was initially called 'SnowyLink North":

> *"AEMO understands that a final decision to go ahead with the Snowy 2.0 project is likely before the end of 2018. SnowyLink can be delivered in two stages – a north component ("SnowyLink North") connecting Snowy 2.0 to Sydney, followed by a south component ("SnowyLink South") that enhances interconnection between Victoria and New South Wales."* (AEMO ISP 2018)

SnowyLink North has morphed into HumeLink (and Sydney Ring South) and SnowyLink South into VNI West. HumeLink is being constructed primarily to provide Snowy 2.0 with capacity to transmit electricity from its generators and to its pumps.

It is the need to connect Snowy 2.0 that has determined HumeLink's configuration, route, length, cost, timing, capacity, environmental footprint, and community impact. Without Snowy 2.0 HumeLink, if needed at all, would have been routed directly between Bannaby and Wagga Wagga, not have a 110 kilometre dog-leg deviation to Maragle, and be two-thirds the cost (saving $1.5 billion).

The capacities of HumeLink and Snowy 2.0 are now identical at 2,200 MW, so Snowy 2.0 takes up HumeLink's full capacity when pumping/generating at full load/output.

2 Enormous environmental impacts

HumeLink will have an enormous environmental impact over 360 kilometres, with a cleared easement at least 70 metres wide, together with access tracks. The project footprint is 8,500 hectares - 5,700 ha of native vegetation, 800 ha of non-native vegetation and 2,000 ha of Category 1 exempt land (land where native vegetation can be cleared without approval). The following extracts from the EIS give an idea of the enormity of the environmental loss:

"Based on several existing spatial datasets and field validation within accessible lands, the project footprint includes about 5,692.96 hectares of native vegetation, about 810.25 hectares of non-native vegetation and about 1,983.48 ha of Category 1 – exempt land."

"Five threatened ecological communities (TECs) listed under the BC Act were recorded within the project footprint during field surveys. Two of these TECs are also listed under the EPBC Act."

"Three candidate threatened flora species were recorded directly within the project footprint during surveys as part of the biodiversity assessment."

"Field surveys carried out for the project recorded 232 native fauna species comprising 13 frog, 136 bird, 45 mammal, 37 reptile and one fish species."

"The project could potentially directly impact about 670.21 hectares of native vegetation based on the indicative disturbance area (excluding Category 1 – exempt land)."

"Of the 58 threatened flora species that have potential to be directly impacted, 11species are listed as critically endangered under the BC Act and/or EPBC Act."

"Of the 47 candidate threatened fauna species, a total of 33 species (12 bird, 11 mammal (including three bat species), three reptile, five amphibian and two insect species) and two endangered fauna populations have the potential to be directly impacted by the project. The impacted threatened fauna species includes 15 species listed only under the BC Act with the remaining 18 species listed under both the BC Act and the EPBC Act."

While undergrounding would also have an environmental impact, it is a much narrower easement and the disturbed ground can be rehabilitated at least partially.

3 Too close to National Parks and Nature Reserves

According to the EIS:

"No nature conservation land use areas are mapped within the project footprint. However, the project footprint is located close to a number of national parks, nature reserves, and state conservation areas including (refer to Figure 11-3):

- *Minjary National Park – less than 10 metres west of the project footprint*
- *Mudjarn Nature Reserve – about 180 metres north of the project footprint*
- *Bango Nature Reserve – about 140 metres north of project footprint*
- *Back Arm Nature Reserve – about 70 metres north of the project footprint*
- *Tarlo River National Park – less than 10 metres south of the project footprint*
- *Kosciuszko National Park – about 90 metres east of the project footprint."*

While HumeLink will not traverse any areas of declared natural significance, it is less than 10 metres to 180 metres outside the boundary of six such areas. That is far too close for a massive transmission line - 500 kV double-circuit, 50 - 76 metre towers, 26 wires, 70 metre cleared easement.

Most of these declared areas are relatively small and make up a minor proportion of HumeLink's 360 kilometre length. They will be dominated by HumeLink's towers and lines on their boundaries.

The World Health Organisation states *'Existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low'*. The EIS predicts the noise levels of HumeLink during certain weather conditions would potentially exceed 35 dBA.

4 Significant impact on native State Forests

The State Forests to be traversed are Green Hills, Bago, Maragle, Red Hill and Tumut.

The HumeLink footprint encompasses 1,067 ha of native forests and 21.5 ha of plantation forests, constituting 12.5% and 0.2%, respectively, of the project. The native forests most impacted are those to the south of Tumut and Batlow for the dog-leg connection from Wondalga to Maragle and Snowy 2.0:

> *"State forests are managed by the FCNSW to balance environmental conservation, recreation, and timber production. The project footprint intersects about 1,087.5 hectares of State forest south of Batlow towards the future Maragle 500 kV substation which is mainly associated with Bago State Forest."*

Though the footprint for native forests will have increased with the recent announcement of a realignment from private property near Batlow to Green Hills State Forest, adding another 10 kilometres to the length of HumeLink and no doubt many tens of $millions.

5 Unprecedented biodiversity offsets

The biodiversity offset cost for HumeLink was assessed in the Project Assessment Conclusions Report (PACR), dated 29 July 2021, as almost $1 billion, a staggering amount reflecting the enormity of environmental damage.

> *"In accordance with the BAM, offset requirements are necessary to address any residual biodiversity impacts associated with the project. BAM calculations for both ecosystem and species credits have been determined by using the Biodiversity Assessment Method Credit Calculator (version 1.3.0.00) and includes:*
>
> - *10,997 ecosystem credits*
> - *134,578 species credits*
>
> *The offset requirements are based on the indicative disturbance area and include 17 species that were recorded during surveys for the biodiversity assessment and 78 species that were assumed present.*
>
> *As the project would not result in a net loss of KFH, or significant impacts on threatened aquatic species, offsets for aquatic species and key fish habitats are not proposed under the FM Act.*
>
> *As detailed in Section 8.6, the project has the potential for significant impacts on several MNES."*

TransGrid has not sufficiently considered undergrounding HumeLink as a "reasonable avoidance and mitigation measure.

6 Undergrounding dismissed without genuine assessment

> *"Based on the findings from the report, undergrounding HumeLink would not be consistent with the regulatory rules that require TransGrid to propose the most efficient option for consumers based on the capital cost of the solution, the ongoing operational costs, the market benefits, the expected reliability, and the costs associated with the impact on landowners, the community, and the environment."*

If TransGrid persists with overhead lines for HumeLink it will be a protracted and fraught process for all involved. It is likely to be cheaper, faster and far less traumatic for all concerned, including TransGrid, to go underground.

Why does TransGrid build underground transmission in urban areas but not in other areas with high environmental, agricultural, social and tourist value?

7 HumeLink cost exceeds its benefit - needs to be reviewed

HumeLink's PACR estimated a net benefit of $39 million:

> *"On a weighted-basis, Option 3C is the top-ranked option and is expected to deliver approximately $39 million in net benefits (excluding competition benefits)"*

This is a miniscule net benefit, just 1% of the cost. Also, many experts considered that figure to be overstated and that the costs actually exceeded the benefits - see 'A review of the HumeLink PACR', Victoria Energy Policy Centre, Sep 2021'.

Nevertheless, since then a number of adverse events have increased the costs and reduced the benefits:

Cost increases:

- HumeLink's cost has increased by $1,575m to $4,892m, 48% higher than the $3,317m estimate in the PACR (note the 2018 ISP estimate was $1.1bn)
- The extra 10 kilometre deviation through Green Hills State Forest will have added further tens of $millions
- Opex of only 0.5% was assumed, a figure far less than normal, hence understating the HumeLink's costs

Benefit reductions:

- HumeLink's capacity has decreased to 2,200 MW, 14% less than the 2,570 MW capacity in the PACR
- the Kurri Kurri and Tallawarra gas power stations are both being built, reducing the benefits of HumeLink by $180 million according to a sensitivity analysis in the PACR
- Snowy 2.0 was assumed to be operational in July 2025. It is now expected to be at least four years later, reducing the benefits of HumeLink
- the PACR assumed Snowy 2.0 had a capacity factor of 27%, which is unattainable and wildly overstated, hence exaggerating the benefits of HumeLink

The PACR cost estimate of $3.3bn came with a Class 4 classification of an accuracy range of -30% to +50%. That is, the cost was estimated to be somewhere between $2.3bn and $5bn. We now find that just two years later the cost has soared to the upper limit.

The latest estimate of $4.892bn has a Class 5 classification with an accuracy range of -50% to +50% (see Attachment A). That is, the cost lies somewhere between $2.5bn and $7.5bn, a range of $5bn! Given the five-fold increase in the estimated cost since 2018, it would seem to be highly optimistic to not expect further increases beyond $5bn.

Paradoxically, TransGrid executives claimed at the NSW Inquiry into undergrounding transmission lines that HumeLink's benefits had risen by more than its costs and that Snowy 2.0's delay has actually increased the net benefit and urgency for completion by the July 2026 target date. That all sounds highly questionable.

It is also inconsistent with the warning given by AEMO in its 2022 Draft ISP that the then estimated cost of $3.3 billion must be cut:

> *"Nonetheless, protection is needed against rising project costs. To ensure the benefits are robust, the project costs cannot materially increase from the current estimate of $3.3 billion. Further work to drive down costs should be undertaken urgently."*

Surely the subsequent adverse variations in cost and benefits result in a sizable negative net benefit now, constituting a 'material change in circumstance' and therefore prompting a review of HumeLink's regulatory approval.

But we seem to be in a paradoxical situation that the approval will only be reviewed if TransGrid advises the AER accordingly, as explained by Jim Cox at the first Inquiry (7 Aug, 2023 page 25):

> *JIM COX: Yes, I think the increase of cost is of concern to us. I think we are concerned that the initial cost estimates proved to be so far wide of the mark. I don't think that's a good situation. Obviously, as we learn more about how to construct these long transmission links, we would expect cost estimation to improve and we have suggested a number of measures to improve the accuracy of cost estimation. It is something that has received attention for us. We are concerned and we are taking action to improve the accuracy of cost measurement.*
>
> *Does this mean that HumeLink is still the right option? That requires a consideration of costs and benefits. I think Transgrid and perhaps AEMO would argue that the benefits are also increasing, given the rapid transition and that we are moving away from coal toward renewables and given concerns about Snowy 2.0, ironically enough. There we would say the benefits are increasing. Obviously, there would come a point where the costs are so great that perhaps some other option would be preferred. If an increase in cost is enough to cast doubt on the acceptability or whether the preferred option is still the preferred option, then the proponent has an obligation under the RIT test to reapply the test.*
>
> *The Hon. EMMA HURST: When would it come into play that they have to reapply the*

test?

JIM COX: I don't really think it's a precise number. The point is that the proponent has to be persuaded that the existing preferred option is still the preferred option, given that the costs have increased and bearing in mind that the benefits may also be increasing because we are moving more rapidly towards reliance on renewables than we might have expected a couple of years ago.

Ms CATE FAEHRMANN: I will build on that line of questioning, if I may. You said that it is up to the proponent—in this case, Transgrid—because of this quite extraordinary increase in the cost, which you acknowledge, to determine if there needs to be a new cost-benefit analysis. Does the regulator play any role in that?

JIM COX: No. I think it is up to Transgrid to determine that. It is their responsibility, yes.

Ms CATE FAEHRMANN: I'm not sure what the regulatory framework is for this but there is nothing that the regulator can look at and say, "Hey, this has increased a lot. I think your cost-benefit analysis that you provided may not be correct or may not still meet the regulatory investment test"? There's nothing within this regulatory framework that empowers the regulator to do anything?

JIM COX: We have no power. I think's it is the proponent's responsibility. Obviously, we do talk to them, so they'll be aware of our views.

Surely the current situation needs to be amended so that the AER can step in at any time if it considers that circumstances have changed sufficiently to warrant a review of a project.

It would seem that the questioning of the AER at the Inquiry may have had an impact as the AER wrote to TransGrid on 22 August asking if it thought there had been 'a material change of circumstances'.

It seems odd that it the Aer considers it is up to TransGrid to determine if it thinks the circumstances have sufficiently changed for it to seek a review of the AER's regulatory approval.

8 2026 target date is unrealistic and well before Snowy 2.0

The current target date for HumeLink's completion of July 2026 was set to coincide with a previous commissioning estimate for Snowy 2.0.

The recent Snowy 2.0 reset the date for first power in 2027 and full commercial operation in December 2028. These dates are totally unrealistic, as have been every previous Snowy 2.0 estimate (there have been six completion date estimates so far).

However, according to Brett Redman, TransGrid CEO, HumeLink is needed urgently:

> *"If HumeLink is not delivered on time in 2026, it will jeopardise network reliability"* Hansard inquiry 18 July 2023 page 26

There is no need to rush HumeLink. Snowy 2.0 is unlikely to be completed till sometime next decade and a 2026 target is impossible anyway, with so many transmission projects

vying for limited resources and the lack of social licence from local communities for overhead lines.

There is sufficient time to rethink HumeLink and build more appropriate transmission capacity to serve NSW for the remainder of this century. We need to get it right, not be rushed into sub-optimal projects.

9 Connecting to LTSS far better than Maragle

Connecting HumeLink to Maragle was proposed by Snowy Hydro to minimise its cost of connecting Snowy 2.0.

However, connecting Snowy 2.0 to HumeLink at the existing Lower Tumut Switching Station (LTSS) is a far superior option compared with connecting to a new substation at Maragle – it would be 20 kilometres shorter, $300 million cheaper and have less environmental impacts. This alternative was covered in numerous documents (including 'A review of the HumeLink PACR', VEPC, Sep 2021), and never genuinely considered by TransGrid.

Most importantly, connecting to LTSS significantly improves the transmission capacity of the existing Snowy Scheme and the resilience of the NSW network, whereas connecting to Maragle is effectively only connecting to Snowy 2.0 (other than a tie-in to an existing 330 kV line). Snowy 2.0 will be effectively separate from the existing Snowy network.

Connecting Snowy 2.0 to LTSS would involve a 23 kilometre tunnel, versus a 3 kilometre tunnel and 9 kilometre of overhead lines through Kosciuszko National Park to Maragle. Obviously more expensive for Snowy Hydro, but a far superior option electrically for the NEM and Snowy Hydro.

10 Snowy 2.0 should contribute to the cost of HumeLink

HumeLink's route, cost, capacity, and environmental footprint have been determined by Snowy Hydro's desire to connect Snowy 2.0 as cheaply as possible.

Whenever Snowy 2.0 is pumping and generating at full capacity (2,200 MW) it takes up all of HumeLink's capacity. HumeLink is effectively Snowy 2.0's 'Connection Asset[1]'.

Electricity consumers shouldn't have to bear the full $5 billion cost of HumeLink. If they do NSW transmission tariffs will increase by over 50% just to pay for Snowy 2.0's transmission connection.

If Snowy Hydro doesn't pay its fair share of HumeLink, then this is a transfer of wealth from NSW electricity consumers to the Commonwealth – equivalent to an electricity tax.

[1] A Connection Asset is used exclusively by a generator or load, whereas a Shared Asset is used by all market participants. The purpose of HumeLink is to connect Snowy 2.0 to the grid, even though once constructed it would form part of the grid and be used by other participants, but only when Snowy 2.0 is not operating at full capacity.

11 Plan now for HumeLink 2

The reduction in HumeLink's capacity from 2,570 MW (PACR) to 2,200 MW (AEMO 2023 Transmission Expansion Options Report), the same capacity as Snowy 2.0, has brought forward the prospect of further transmission capacity being required to connect the nascent Renewable Energy Zones (REZ) in southern NSW and Victoria.

AEMO's Report, sourced from TransGrid advice, includes three augmentation options additional to HumeLink to increase the transmission capacity between Bannaby and Wagga Wagga and beyond by up to 6,000 MW at a cost of up to $3 billion (±50%). See Appendix 1.

- Option 2: a 2000 MW overhead DC line from Bannaby to Wagga, 260 km, costing $2,450m
- Option 3: a 6,000 MW 500kV double-circuit line from Bannaby to Wagga to Dinawan, 481 km, costing $3,014m
- Option 4: a 3,000 MW 500kV single-circuit line from Bannaby to Wagga to Dinawan, 481 km, costing $2,370m

It would seem that, as HumeLink will have no spare capacity when Snowy 2.0 is operating at or near its full load, one of these augmentation options will be needed in the intermediate future to transmit from the REZ's in the South West and Wagga to Bannaby. For ease of reference this augmentation is called HumeLink 2.

It would also seem that the necessary timing for HumeLink 1 and HumeLink 2 will be similar as the latest commissioning date for Snowy 2.0 of 2029 is likely to be delayed further and this will coincide with, if not be later than, the development of the REZ's in southwest NSW.

If so, HumeLink 2 should be considered at the same time as HumeLink 1.

For example the routing is likely to be similar for much of the distance from Bannaby to Wagga and an additional easement will be necessary. It would be most inappropriate and inefficient if the HumeLink 1 route was determined and then almost immediately afterwards the route for HumeLink 2 was then sought.

It is also noted that the route for HumeLink 2 from Dinawan to Wagga parallels Project EnergyConnect. Even though the easement for EnergyConnect has been obtained and work is about to start, there may be some adjustments that are appropriate if a parallel line is to be required in the future. One obvious choke point will be accessing Wagga Wagga and (the new) Gugaa substations.

And Sydney Ring South ($1.5 billion) should be included in the mix as the generation from Snowy 2.0 does not complete its 'journey' till it reaches Sydney. All up, this brings the total expenditure for transmission from Wagga Wagga to Snowy 2.0 to Sydney to around $10 billion by the end of this decade.

Instead of taking a project-by-project piecemeal approach, the transmission requirements from Wagga Wagga to Sydney should be considered all at once (i.e. HumeLink + HumeLink 2 + Sydney Ring South). Such consideration needs to include the legitimate concerns of local communities and the full costs and benefits - financial, social, and environmental - of the

various alternatives.

The opportunity to adopt underground cables and DC as well as AC transmission must be seriously considered, not summarily dismissed as has been the case to date. Australia needs to catch up with the rest of the developed world and apply the latest and least impactful technologies for our future transmission network.

The prospect of TransGrid seeking to build HumeLink 2 in the near future doesn't bear thinking about for the affected communities and no doubt for TransGrid too.

It may well be that undergrounding the two HumeLink's as one project could cost less than two separate overhead projects, as well as being far less environmentally damaging.

12 Concluding remarks

We need to transition away from fossil fuels and we definitely need additional transmission.

But the transmission requirements from southern NSW to Sydney over the next two decades or so need to be considered together. Such consideration needs to include the legitimate concerns of local communities and the full costs and benefits - financial, social, and environmental - of the various alternatives, particularly undergrounding and use of DC.

Crucially, Snowy 2.0 and the new solar and wind generators in the REZs must be required to contribute their fair share to the cost of new transmission, not leave electricity consumers with the full bill.

Let's do HumeLink once and do it right. Whatever is built now will be with us for the rest of this century.

The never-ending delays in Snowy 2.0 provide sufficient time to get this $10+ billion investment right.

HumeLink needs a rethink.

Appendix 1 – Extract from AEMO's 2023 Transmission Expansion Options Report, 28 July 2023

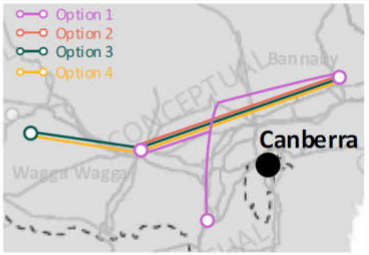
3.8 Southern New South Wales to Central New South Wales

Summary

The transmission network between Southern New South Wales (SNSW) and Central New South Wales (CNSW) provides access for the hydroelectric generation in the Snowy mountains, renewable generation in SNSW, and import from Victoria and South Australia to New South Wales major load centres.

HumeLink is a proposed transmission network augmentation that reinforces the New South Wales southern shared network to increase transfer capacity to New South Wales load centres. This was identified as an actionable ISP project in the 2022 ISP. Transgrid has completed the RIT-T process for this project and early works funding has been approved by the AER.

Subsequent to HumeLink, three options are proposed to increase the maximum network transfer capability between SNSW and CNSW to access increased import from Victoria and South Australia with increased generation in SNSW to NSW major load centres.



Existing network capability

The maximum transfer capability from SNSW to CNSW is 2,700 MW at peak demand and summer typical and 2,950 winter reference periods. The maximum transfer capability is limited by thermal capacity of Yass– Marulan or Crookwell-Bannaby 330 kV lines following a credible contingency.

The maximum transfer capability from CNSW to SNSW is 2,320 MW at peak demand and summer typical and, 2,590 MW at winter reference periods. The maximum transfer capability is limited by thermal capacity of Yass–Canberra or Marulan–Yass[62] or Gullen Range–Bannaby 330 kV lines following a credible contingency

Augmentation options

Description	Additional network capacity (MW)	Expected cost ($ million)	New easement length (km)	Lead time
Option 1 (HumeLink): • New Wagga Wagga 500/330 kV substation and 330 kV double-circuit connection to the existing Wagga Wagga 330 kV substation. • Three new 500 kV transmission lines: - Between Maragle and Bannaby 500 kV substations. - Between Maragle and new Wagga Wagga 500 kV substations. - Between new Wagga Wagga and Bannaby 500 kV substations. • Three 500/330 kV 1,500 MVA transformers at Maragle. • Two 500/330 kV 1,500 MVA transformers at new Wagga Wagga. • 500 kV Line shunt reactors at the ends of Maragle – Bannaby, Maragle – new Wagga Wagga and new Wagga Wagga – Bannaby 500 kV lines. *Provided by Transgrid – see Section 1.2.*	2,200[63] N6+N7: 2,200 (N6: 1,500), N5: 800	4,892[64] (June 2023 dollars) Class 5 (± 50%)	630	Short
Option 2: • A 2,000 MW bi-pole overhead transmission line from locality of Bannaby to locality of Wagga Wagga. • A new 2,000 MW bipole converter station in locality of Bannaby.	2,000 (both directions SNSW to CNSW) N6: 2,000	2,450 Class 5b (± 50%)	260	Long
• A new 2,000 MW bipole converter station in locality of Wagga Wagga. • AC network connection between new HVDC converter station in the locality of Bannaby and the existing Bannaby 500 kV substation. • AC network connection between HVDC converter station in the locality of Wagga Wagga and a future Wagga Wagga 500 kV substation. *Pre-requisite: HumeLink*				
Option 3: • An additional new 500 kV double-circuit line from Dinawan to Near Wagga Wagga. • An additional new 500 kV double-circuit line from Near Wagga Wagga to Bannaby. • 4 additional new 500/330/33 kV 1,500 MVA transformers at Dinawan. *Pre-requisite: HumeLink, VNI West, SNW Southern 500 kV loop.*	6,000 (both directions SNSW to CNSW) REZ N5+N6: 6,000	3,014 Class 5b (± 50%)	481	Long
Option 4: • An additional new 500 kV single-circuit line from Dinawan to Near Wagga Wagga. • An additional new 500 kV single-circuit line from Near Wagga Wagga to Bannaby. • 2 additional new 500/330/33 kV 1,500 MVA transformers at Dinawan. *Pre-requisite: HumeLink, VNI West, SNW Southern 500 kV loop.*	3,000 (both directions SNSW to CNSW) REZ N5+N6: 3,000	2,370 Class 5b (± 50%)	481	Long

Adjustment factors and risk

Option	Adjustment factors applied	Known and unknown risks applied
Option 1	• Cost estimate provided by Transgrid.	• Cost estimate provided by Transgrid.
Option 2	• Land Use: Developed area/Grazing • Jurisdiction: NSW – Southern • Project network element size: # of total Bays above 31/applicable for HVDC converter station project/Above 200 km • Location (regional/distance factors): Regional/Urban • Delivery timetable: Long	Known Risks: • Compulsory acquisition: High/BAU • Cultural heritage: High/BAU • Outage restrictions: High/BAU • Project complexity: Highly complex • Environmental offset risks: High • Others: BAU Unknown risks: class 5b
Option 3	As per Option 2 except: • Project network element size: # of total Bays 6 – 10/Above 200 km	As per Option 2 except: • Project complexity: BAU
Option 4	As per Option 2 except: • Project network element size: # of total Bays 1 – 5/Above 200 km	• As per Option 2 except: • Project complexity: BAU

[62] Uprating of Marulan – Yass and Marulan – Collector – Yass 330 kV transmission lines were included in limit assessment.

[63] Limit from Transgrid's Project Assessment Conclusions Report is 2,570 MW based on a lower Victoria to New South Wales transfer than that used in the ISP.

[64] Transgrid. At https://www.transgrid.com.au/media/rxancvmx/transgrid-humelink-pacr.pdf.