Supplementary Submission No 106a

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

Organisation: HumeLink Alliance Incorporated

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The Hon Emily Suvaal,
Committee Chair,
Standing Committee on State Development
Parliament House
6 Macquarie Street
SYDNEY NSW 2000

5 August 2023

Dear Standing Committee Members,

Supplementary submission to the Parliamentary Inquiry Feasibility of undergrounding the transmission infrastructure for renewable energy projects

Following the publication of submissions to the parliamentary inquiry into *Feasibility of undergrounding the transmission infrastructure for renewable energy projects* (the Inquiry) and the hearings of the Standing Committee to date, we have a number of comments and questions as follows:

1. Since the commencement of the Inquiry, the Australian Energy Market Operator (AEMO) last week released AEMO's 2023 Transmission Expansion Options Report, 28 July 2023 . This report provides information on the extent of new transmission options planned for NSW and up dated costs, and project specifications for the HumeLink project.

2. The cost of HumeLink is now estimated at $4.892 billion.

   This means that the cost of HumeLink has increase 48%, from $3.3 billion in the Project Assessment Conclusions Report (PACR) in July 2021, to $4.892 billion now. This presents as a material change in circumstance for the project.

   The net benefit (excluding competition benefits, and environmental and community costs) of the HumeLink project reported in the PACR was $39m. A $1.6 billion increase in capital cost, will undoubtedly mean that this project has a massive net cost, and fails the net benefit test.

   In the *Decision Reinforcing the NSW Southern Shared Network (Humelink) Determination on dispute - application of the regulatory investment test for transmission*, November 2021, the AER says:

   > *'A material change in circumstances could arise where updated estimated projects costs increase significantly from the costs estimated in the RIT-T as a result of finalising the route. We would expect TransGrid to consider its obligations under the NER in the event that*

updated estimated project costs, for example following route selection, significantly depart from those estimated in its PACR'.

Also as pointed out by the National Parks Association (NPA):

'AEMO's 2022 Draft Integrated System Plan (ISP) indicates (p65) that the current estimated cost of $3.3bn is already at the maximum level and the project could not be justified if there is a further increase:

"project costs cannot materially increase from the current estimate of $3.3 billion. Further work to drive down costs should be undertaken urgently … As part of any feedback loop between stage 1 and stage 2, net market benefits will be reassessed to confirm the project still remains part of the ODP [Optimal Development Path] in the latest ISP." ', (Quick Comments on the HumeLink PACR Addendum Ted Woodley (NPA Executive Member) 22 December 2021).

Question

2.1. Given the 48% ($1.6 billion) blow out in cost, will Transgrid be required to reapply the regulatory investment test for transmission (RIT-T) to the HumeLink project, as required with a material change in circumstance?

3. The extent of new transmission options being planned for regional NSW, in AEMO's *2023 Transmission expansion options report*, is of immense concern to regional communities. The cumulative negative impacts of these transmission lines will be excessive.

   The *Transmission expansion options report* outlines three transmission options, in southern NSW to central NSW, after HumeLink in Figure 3.8 below.

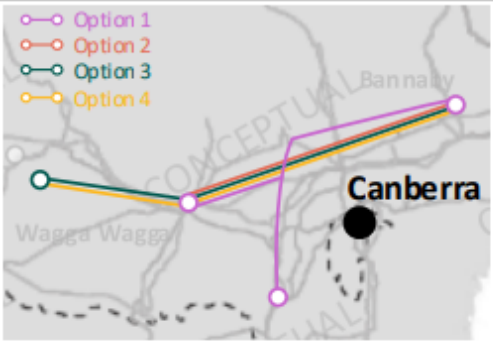
3.8 Southern New South Wales to Central New South Wales

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. • 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*	2,000 (both directions SNSW to CNSW) N6: 2,000	2,450 Class 5b (± 50%)	260	Long
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

Source: AEMO, *Transmission expansion options report*, July 2023, p61-62.

Therefore, it is critical to adopt international best practice for connecting renewables to the grid NOW, and require projects be delivered as HVDC underground cables, where ever possible.

Australia is a big country but south-eastern NSW is closely settled. There is a strong case for undergrounding transmission in south-eastern NSW. Also it might not be possible to underground all future transmission, but there is a compelling case for undergrounding 500kV lines - the biggest bulkiest and most imposing of all transmission lines in Australia, completely dominating the landscape for kilometres either side.

The problem with 500kV lines is the height of the towers relative to the trees in the landscape. The trees in the Upper Lachlan region are 15-20m tall, while the 500kV towers are up to 80m tall - four times the height of the trees, with devastating impacts on the rural landscape character.

Overseas studies have found that transmission lines have a major negative impact on the aesthetic quality of the landscape, and have established a link between the quality of landscapes and the wellbeing of the population (Berto, 2005; Hartig, Evans, Jamner, Davis & Garling, 2003; Mu˜noz, 2009; Ulrich, 1984; Ulrich et al., 1991; Velarde, Fry, & Tveit, 2007; Wells, 2000, Arriaza, Ca˜nas-Ortega, Ca˜nas-Madue˜no, & Ruiz-Aviles, 2004; Devine-Wright, 2012; Kaplan, TaskIn, & Önenc, 2006; Soini, Pouta, Salmiovirta, Uusitalo, & Kivinen, 2011; Tempesta, 2006; Tempesta & Thiene, 2007).

As such building overhead transmission lines rather than underground cables is condemning regional communities to a lower level of wellbeing for generations.

This is particularly unconscionable as the regions are already less well-off relative to people in city areas (Regional NSW demographic and economic snapshot, Briefing Paper No 01/2020). Taking something of value from regional communities – their landscapes where they live and work, will further eroding their wealth and so increase inequity in NSW. There is an important distributional equity argument for putting transmission lines underground in the regions.

Question

3.1. Given the massive investment in new transmission proposed, what National Electricity Market (NEM) Rule changes are being put in place by government so that all the costs of transmission (including environmental and community costs) are taken into account when planning new transmission, to ensure efficient outcomes in the electricity market, and equitable outcomes for the people of NSW?

4. The *Transmission expansion options report* also shows that the transfer capacity of HumeLink has been reduced from 2570MW to 2200MW. This means that almost all the capacity of HumeLink will be taken up by 2000 MW Snowy 2.0, contradicting claims that HumeLink, as a HVDC underground option, will restrict access to the grid for renewable energy zones (REZ) along the route.

Further Table 7 in the *Transmission expansion options report* (below) indicates the planning is only to connect REZ to 330kV or 220kV lines NOT 500kV lines like HumeLink.

Table 7 Connection costs for solar and wind generation technologies

REZ names	Region	REZ network voltage (kV)	Connection capacity (MVA)	Feeder length (km)	Total cost ($ million)	Cost ($/kW)
Far North Queensland	QLD	275	300	5	47	67.47
North Queensland Clean Energy Hub	QLD	275	300	10	33	112.60
Northern Queensland	QLD	275	300	5	31	67.47
Isaac	QLD	275	300	5	42	59.79
Barcaldine	QLD	275	300	10	31	97.24
Fitzroy	QLD	275	300	5	31	59.79
Wide Bay	QLD	275	300	5	31	59.79
Darling Downs	QLD	275	300	5	606	59.79
Banana	QLD	275	1,000	200	50	603.50
North West New South Wales	NSW	330	400	10	50	93.94
New England	NSW	330	400	10	50	93.94
Central-West Orana	NSW	330	400	10	41	93.94
Broken Hill	NSW	220	250	10	51	112.14
South West New South Wales	NSW	330	400	10	51	95.11
Wagga Wagga	NSW	330	400	10	37	95.11
Tumut	NSW	330	400	5	37	60.33
Cooma-Monaro	NSW	330	400	5	24	60.33
Hunter-Central Coast	NSW	330	400	5	NA*	60.33
Hunter Coast	NSW	NA*	NA*	NA*	NA*	NA*
Illawarra Coast	NSW	NA*	NA*	NA*	24	NA*
Illawarra	NSW	330	400	5	32	60.33

The claims that HumeLink as an underground HVDC option will constrain renewables connecting to the grid, is also inconsistent with the PACR, where there is no mention of renewables teeing-in along the HumeLink route.

Further, although the tee-in/tap-off constraint with HVDC underground cables was part of the scope of the GHD/Transgrid undergrounding study:

> *'Any issues associated with connecting in ("tapping in") to the HVDC system, and how these can be overcome',*

this was not raised as an issue for the HVDC underground options throughout the 12-month long undergrounding study.

The lower transfer capacity of HumeLink reported in the *Transmission expansion options report*, however, does make clear that to connect planned new South West NSW renewables to the grid (west of HumeLink - not along the HumeLink route), additional transmission lines paralleling HumeLink will be required, and will be required very soon.

In the case of the Marinus project, the onshore HVDC underground part of the project is being constructed to allow for additional capacity in the future.

Questions

4.1. Why isn't HumeLink being future proofed, and being constructed as a HVDC underground option with scope for additional transfer capacity like Marinus, given that additional transfer capacity is expected to be needed very soon?

4.2. Does the 2200MW transfer capacity of HumeLink, when the capacity of Snowy 2.0 is 2000MW, make it an ideal candidate for a HVDC underground solution, as a means to efficiently shunt power from Snowy 2.0 to the load centres?

4.3. Does the 2200 transfer capacity of HumeLink make it uneconomic for renewables along the route to tee-in?

4.4. Will the cost of a 500kV substation prevent renewables tee-ing into HumeLink as an AC overhead line? Will renewables along the route, rather tee-in to the existing 330kV AC lines, because of the expensive of teeing-in to 500kV HumeLink?

4.5. Why does the *2023 Transmission expansion options report* (Table 7, p140) only list REZ network voltage (kV) as 330kV or lower when reporting connection costs for solar and wind generation technologies? Does this mean that in the planning of the REZs, it is assumed REZs will only tee-in to 330kV lines or lower?

4.6. NSW has two exiting 500kV lines in the network. How long have they been operating and how many new generators/industries have tapped-in/tee-ed-off along the route since their construction?

5. Mr Jim Cox, Acting Chair, Board of Directors, Australian Energy Regulator, stated at the July 18, 2023, hearing of the Inquiry:

'*The AER's **purpose is to ensure that energy consumers are better off** now and in the future*'.

The National Electricity Market (NEM) is therefore making decisions about transmission projects based on what's best for consumers.

However, when projects are assessed by the NSW Department of Planning and Environment as part of the Environmental Impact Statement (EIS) the assessment, they are assessed on the basis of State benefit. The key economic 'test' in the State approval requirements for the HumeLink transmission project is "an assessment of **the benefits of the project for the region and the State as a whole**" (HumeLink transmission project, Planning Secretary's Environmental Assessment Requirements (Section 5.16 of the Environmental Planning and Assessment Act 1979), emphasis add, p2.

The preferred option for a transmission project needs to be established taking into account all the costs of a project – financial, environmental and community. Wrong decisions are being made about projects, early in the planning process, because projects aren't taking into account all the environmental and community costs and aren't being assessed on the basis of State benefit.

Questions

5.1. Why are projects planned on the basis of consumer benefit, ignoring significant impacts on the environment, but approved on the basis of State benefit?

5.2. How can the optimal transmission project options for the State be determined, if significant environmental and community costs are left out of the NEM planning process?

6. In their submission to the Inquiry Transgrid quoted the cost of undergrounding as:

'The costs of underground cables are approximately four to 25 times higher than overhead lines'.

The independent experts at the hearing in Tumut, July 26, 2023, corrected this saying undergrounding could be as low as two times the cost and '*DC cables are getting cheaper and cheaper all the time*'.

From September 4 to 7, 2023, the world CIGRE Symposium is being held in Cairns, Queensland. International underground cabling experts from around the world will be in Australia for the Symposium. Given the importance of the Inquiry and the need to make decisions on the basis of facts, it would be invaluable for the Standing Committee to:

- delay reporting on its finding (currently scheduled for August 31, 2023); and
- have a hearing with a number of the international underground cable experts in early September 2023.

Question

6.1. Is there scope for the Standing Committee to delay reporting its finding so it can hear from transmission cable experts from around the world who will be in Australia for the CIGRE Symposium September 4 to 7, 2023.

7. Transgrid also says in their submission to the Inquiry:

'Our responsibility is to operate and manage the transmission network safely, securely, and efficiently…'.

For the transmission network to operate efficiently all costs of projects need to be assessed in project planning. The current planning process currently ignores important indirect costs of transmission projects including:

- The visual pollution of landscapes of great natural beauty for generations;
- Reduced regional development from reduction in liveability, workability and beauty of regions;
- Reduced productive efficiency of farming properties neighbouring a transmission line;
- The increased risk of bushfires because of the lines themselves, and impediments to aerial and ground firefighting;
- Impacts on regional tourism industries; and
- Safety risks of Transgrid employees working at heights.

Questions

7.1. How is Transgrid fulfilling its responsibility to efficiently operate the transmission network, when not all transmission costs are included in project decisions?

7.2. Will ignoring all the costs of transmission mean that too much transmission is built, it is built in the wrong place and the wrong kind is built - overhead instead of underground?

7.3. Are there important system security and reliance benefits for the grid from undergrounding HumeLink, rather than paralleling existing overhead lines with another overhead line?

8. Further Transgrid also says in their submission:

'Transgrid's strategy is aligned with AEMO's roadmap to build the critical infrastructure which will reshape the National Electricity Market'.

As stated above, the net benefit (excluding competition benefits, and environmental and community costs) of the HumeLink project reported in the PACR was $39m. $39m is a tiny net benefit and was calculated when HumeLink was costing $3.3 billion, rather than $4.892 billion. Including all the environmental and community costs for the 360km route, as well as the current $4.892 billion cost, will mean that Humelink will have a massive net cost.

The net benefit modelling for HumeLink modelled assumed:

- Humelink was costing $3.3 billion (originally $1.35 billion (PADR)) – now $4.892 billion;
- Snowy 2.0 was included from July 1, 2025 – now delayed four-and-a-half years to December 2029, at the earliest;
- Opex 0.5% of Capex – when AEMO assumes Opex is 1% of Capex, and VNI West assumed Opex is 1% of Capex; and
- No Kurri Kurri Gas Power Station – a commitment has been made to build Kurri Kurri Gas Power Station.

Transgrid has said the net benefit of HumeLink without Snowy 2.0 was modelled in the Project Assessment Draft Report (PADR) as the Slow Change scenario. Including the biodiversity offsets costs that were omitted in the PADR, it appears HumeLink, Option 3C, has a **net cost** of around $555 million, **without Snowy 2.0**.

The '48% increase in cost' of HumeLink from $3.3 to $4.892 billion, as well as the 'four-and-a-half-year delay to Snowy 2.0' is considered a material change in circumstance for the project, meaning that the RIT-T should be reapplied.

Questions

8.1. How could HumeLink, a project with a net benefit (excluding competition benefits, and environmental and community costs) of $39m, be defined as critical?

8.2. Can Transgrid provide net benefit modelling of Humelink with the capital cost now $4.892 billion, Snowy 2.0 delayed (scenarios – Snowy 2.0 delayed, 5 years and 8 years), Opex 1% of capex, and Kurri Kurri going ahead?

8.3. Will Transgrid be required to reapply the RIT-T to the HumeLink project, as required with a material change in circumstance, given that: costs have increased 48%; Snowy 2.0 is delayed; Opex is underestimated; and Kurri Kurri is committed?

9. Brett Redman, Chief Executive Officer, Transgrid stated at the July 18, 2023, hearing of the Inquiry:

   '*we work hand in glove with the RFS*'

   But RFS captains and incident commanders have said that in the 2019 Dunns Road fire when the fire was 400ha, potentially controllable, and burning up the 051 330kV line at night, there was a call to turn off the 051 line. However the RFS on the ground couldn't get the line turned off. The fire burnt for two weeks with 147 homes lost and 386,000ha burnt, including 50,000ha of pine plantation and 20,000ha of hardwood forest, with a value for the timber alone estimated at more than $5 billion.

   Question

   9.1. How can Transgrid say they 'work hand in glove' with the RFS when RFS captains and incident commanders on the ground are saying that there have been numerous incidents of Transgrid failing to turn off lines when requested, with catastrophic consequences resulting in costs in the billions?

10. The Australian Energy Infrastructure Commissioner (AEIC) states in his submission the following:

    'We have also heard from landholders, with first-hand experience from being directly located on the proposed route for an HVDC underground transmission line, who are particularly concerned about the invasive impacts and destruction arising from the trenching and drilling required to place and locate the transmission cables underground'.

    This statement suggests concerns during construction of the underground option, but there will also be significant impacts during the construction of the overhead option – 280 tonne cranes, up to 18m deep tower footings, 17 truck loads of concrete per tower, etc.

    As the overhead option has a wider easement, and towers up to 80m tall for the next 80 years, undergrounding is established as the far a less intrusive long-term option.

    The evidence from international studies indicates that there are many, many more issues for landowners with overhead lines.

    A study by the International Council on Large Electrical Systems, or CIGRÉ, shows the environmental impacts of concern from overhead transmission lines and underground cables (see Figure 1 below).

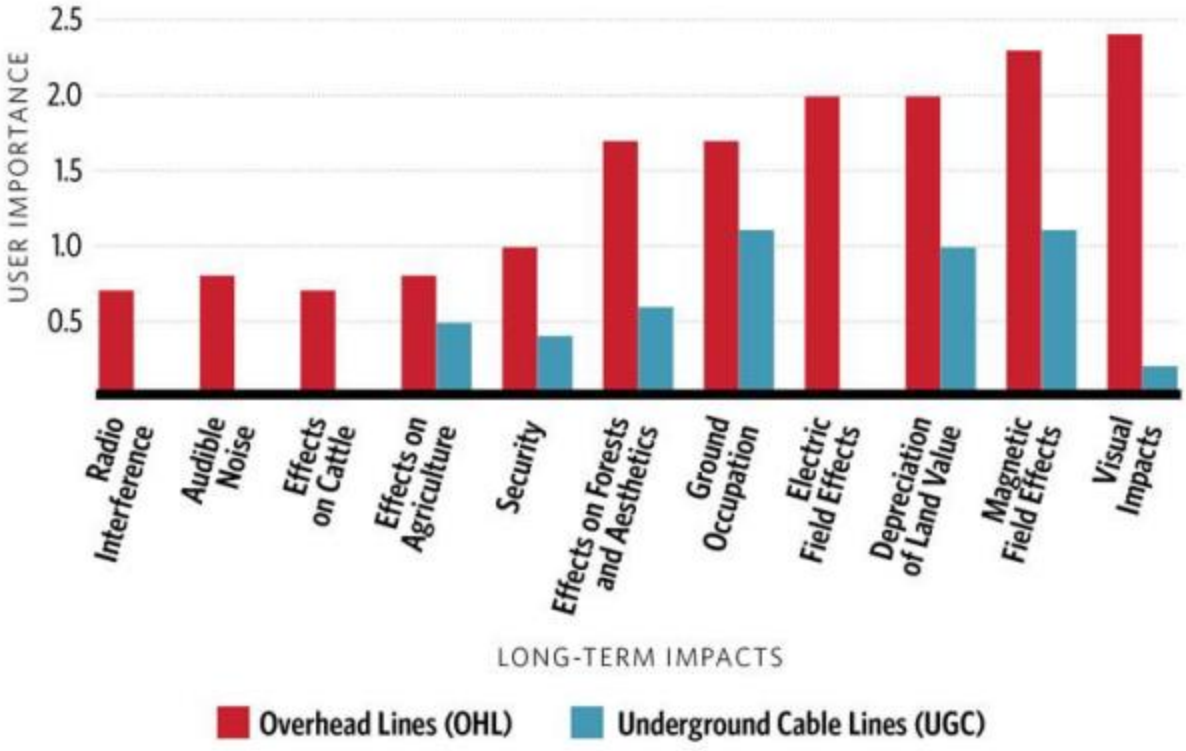


Figure 1: Source - CIGRÉ as referenced by HDR https://www.hdrinc.com/insights/top-5-reasons-use-underground-transmission-lines

In all cases overhead lines have greater negative impacts than underground cables. One factor not assessed for 'user importance', in the study above, is "bushfire risk", which is also a major concern in regional areas of Australia. Underground cables provide an important benefit of eliminating the risk with bushfires.

Further the GHD/Transgrid underground study, that compared impacts of overhead lines and underground cables, reported only positive Environmental Impacts for the underground option post construction.

Questions

10.1. What number of interactions has the office of the AEIC had with landowners concerned about overhead lines, compared to underground cables?

10.2. Did the Commissioner ask if the landholders, who he mentioned were concerned about underground cables, would prefer an overhead option rather than an underground option?

10.3. The AEIC implies that there are concerns for the environment and landowners with undergrounding transmission. How is this consistent with the Murraylink project, an HVDC underground project, winning a Case Earth Award in 2002?

We hope these comments and questions provide important additional information for the Inquiry.

Yours sincerely,

Andrea Strong
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