Supplementary Submission No 106b

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

Organisation: HumeLink Alliance Incorporated

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NSW Legislative Council Inquiry
Feasibility of undergrounding transmission for renewable energy projects

Questions following the Hearing on 7 August 2023

HumeLink Alliance Inc. – 9 August 2023

A. Efficiency of the national electricity market

Marie Jordan: *Transgrid is working with the Australian Energy Market Operator on the delivery of nation-critical energy projects identified in the 2022 Integrated System Plan, which is a whole-of-system plan that provides an integrated road map for the* ***efficient development of the national electricity market*** *over the next 20 years and beyond. Its primary objective is to optimise value to end customers by designing the lowest-cost secure and reliable energy system capable of meeting any emission targets determined by policymakers at an acceptable level of risk.*

For efficiency outcomes in the electricity market, all costs need to be taken into account – both direct and indirect costs, including all costs to communities and the environment.

Non-market costs of overhead lines (loss of visual amenity, reduced productive efficiency of agriculture, lost tourism, increased risk with bushfires and reduced biodiversity) are negative environmental externalities. They are a failure in the market[1]. There is a critical role for government with market failure. To ensure efficient outcomes in the electricity market, government must require these costs be taken into account.

By not taking these costs into account our landscapes and our environment (our natural assets) things of great value to us, and of great value to future generations, are left forever damaged.

Transmission lines are a visual pollution (plus increase bushfire risk and unnecessarily destroy habitat and so reduce biodiversity). These costs need to be taken into account to get the right balance between essential infrastructure and the environment.

By taking these costs into account, different project options will be optimal:

- More roof top solar;
- Offshore wind closer to load centres;
- Batteries close to load centres, rather than big water batteries remote from load centres; and
- The location of renewables where transmission already exists where coal fired power stations are shutting down.

[1] **Market failure**, failure of a market to deliver an optimal result. In particular, the economic theory of market failure seeks to account for inefficient outcomes in markets that otherwise conform to the assumptions about markets held by neoclassical economics (i.e., markets that feature perfect competition, symmetrical information, and completeness). When failure happens, less welfare is created than could be created given the available resources. The social [government] task then becomes to correct the failure. Market failure arises when the outcome of an economic transaction is not completely efficient, meaning that all costs and benefits related to the transaction are not limited to the buyer and the seller in the transaction https://www.britannica.com/money/topic/environmental-economics/Market-failure .

Questions

1. If the Integrated System Plan is for the ***efficient development of the national electricity market,*** why are critical costs to communities and the environment omitted from decisions about projects? Why are the costs of lost natural assets not being taken into account?
2. How can the best project option for NSW, as a whole has been chosen, if massive and enduring costs to communities and the environment are left out of transmission project planning??
3. How does Transgrid intend to keep transmission assets protected in the next bushfire? Reports from Transgrid show significant fire damage to their existing infrastructure and interruption to supply security with unplanned outages, from the Black Summer bushfires.

B. Bushfires

Marie Jordan: *'Our records indicate in relation to the Dunns Road fire, which burned within the Snowy Valley local government area from 28 December 2019 to 15 February 2020, our control centre received five separate requests to de-energise overhead lines and all of those requests were actioned'.*

This is contradicted by RFS Captains and incident controllers on the ground.

It is possible that in an emergency bushfire situation that requests to have lines switched off are not getting through to Transgrid. Although RFS Captains maintain calls were made and requests were denied.

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 at night, there was a call to turn off the 051 330kV line. But the RFS on the ground couldn't get the line turned off. The fire burnt for 2 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.

If Transgrid was required to pay the more than $5 billion in costs to the timber industry that occurred after RFS Captains and incident commanders were unable to get the lines switched off, then undergrounding, that eliminates the risk, would quickly become the least cost option.

In the *Overview of 2019-20 Bushfire Damage to TransGrid's Network Cost pass through application for 2019-20 Bushfire* Transgrid states:

> *'The summer of 2019/2020 was the scene of a historically destructive bushfire season in Australia and NSW with burnt areas greater than the burnt areas of the 2009 Black Saturday and 1983 Ash Wednesday combined. The final report of the NSW Bushfire Inquiry concluded that the 2019/20 bushfire season was 'extreme' and 'challenged conventional assumptions', however, the season could have been worse*

still. ***Over the next six years the risk will increase and return to or exceed pre-2019/20 levels****.*

Figure 9 – Line U3 Dropped conductor on ground

The bushfire season first impacted TransGrid's network on 6 September 2019 when the first network fault outage occurred and finished on 2 March 2020 when the NSW RFS declared that there were no longer any active fires. TransGrid assets were within the active fire zones until this day. No bushfires in the 2019/20 bushfire danger period were initiated by the TransGrid network. Key impacts of the 2019/20 bushfire season (August 2019 – March 2020) on TransGrid's network were:

> 999 km of transmission line route length (comprising 9,000km of conductor and earthwire), or 9% of TransGrid transmission line network, was within the bushfire-impacted zones.

> 2,681 transmission line structures were within the bushfire-impacted zones.

> 249 transmission line fault and forced outages caused by bushfires, 20 times higher than past seasons.

> 65% more fault outages than the 10-year average for the same period. This included 275 forced outages in January 2020, more than 200% higher than the January average over the last 10 years.

> Two NEM regional separation events, one involving the NSW to Victorian interconnection and the other involving the NSW to Queensland interconnection, compared to zero separation events in 2018/19.

Transmission line assets form the vast majority of damaged infrastructure given their proximity and exposure to bushfires across the state of NSW…..

The bushfires resulted in unprecedented damage to network assets due to the intensity of the fires.'

We note that this is an excerpt from a "cost pass through" application.

Section 3.3 of the *Overview of 2019-20 Bushfire Damage to TransGrid's Network Cost pass through application for 2019-20 Bushfire*, details the Southern NSW impact of the Black Summer bushfires as follows:

*'**3.3 Southern NSW/ Snowy Mountains** - In late December and Early January, the Snowy mountains fires took hold, resulting in 65 outages of 330 kV assets. Unfortunately on the 4th January, four of the 330 kV lines tripped within minutes of each other and caused the NEM regional separation of NSW from Victoria. This separation is the subject of a separate AEMO report.*

One of the four lines out of service was the most damaged line within TransGrid's 330 kV network, line 2. This line had sufficiently damaged insulators on multiple structures such that it was impossible to re-energise the line. This line took a number of weeks to repair due to both the significance of the damage and the difficulty in assessing and clearing the access tracks to the site. The nearby U3 line was also damaged. This line had melted and annealed conductor, with one phase found on the ground. A section of U3 had to be re-strung with new conductor taking approximately 3 months to procure and install'.

Some damage took three months to repair.

Brendan Nelson in his Bushfire Red Hat Review presentation said:

• *HumeLink is a nationally significant project and resilience against future bushfires is critical both from an operational perspective and from an RFS / community safety perspective.*

The community has been told that transmission lines will not be 'turned off' in a bushfire due to the length of time to do so, and the impacts on other consumers. Also, information from Transgrid experts suggests that 'de-energising' is not a safe option, as residual energy in the lines can still pose a risk to firefighters.

Questions

4. RFS Captains and incident controllers on the ground, contradict Transgrid's claims that lines are always de-energised when requested. Why?
5. Transgrid employed Brendan Nelson to do a Red Hat Review of bushfires. Can the community and the Standing Committee get a copy of the Bushfire Red Hat Review?
6. Does Transgrid, incur any non-recoverable costs from bushfires or are they all simply passed through to consumers?
7. Would bushfire damage to overhead transmission lines be prevented if the lines were underground?

8. Have losses incurred by landowners and forestry, as a result of not being able to get transmission lines turned off in a bushfire, ever been reimbursed by Transgrid?
9. Transgrid has stated that de-energised lines can still pose a threat to firefighters due to the residual energy that is retained in the line. Transgrid has also said if one transmission line parallels another line, that current can transfer from the live to the de-energise line. How long does it take to ensure there is no threat to human life when lines are de-energised?
10. Is undergrounding the safest option in a fire?
11. Is it possible to ensure firefighters are safe where two transmission lines parallel and only one line is turned off?
12. Who is liable for the property losses if live powerlines (or unsafe de-energised lines) prevent bushfire control?
13. If HumeLink is *a 'nationally significant project and resilience against future bushfires is critical' (- presentation Red Hat review)* why isn't undergrounding mandated given that it eliminates the risk of bushfire to the network?
14. In 2020 Transgrid stated that '***Over the next six years the risk will increase and return to or exceed pre-2019/20 levels'.*** Why therefore, isn't undergrounding being recommended now to reduce risks to communities, the environment and transmission infrastructure?
15. Does the government indemnify Transgrid for the risk of bushfire? Is that why Transgrid is not focussed on reducing the risk of bushfires.

C. The net benefit of HumeLink $39m

Marie Jordan: *'I just had my colleague whisper in my ear it was $491 million of market benefits for HumeLink at the PACR'*.

In the PACR, HumeLink was assessed as having a net benefit of $39m (excluding competition benefits). Including competition benefits, in the PACR, HumeLink had a net benefit of $491m. However, the Australian Energy Market Operator (AEMO) consulted with stakeholders on the inclusion of competition benefits in the 2022 Integrated System Plan (ISP) and has excluded competition benefits '*due to the significant uncertainty surrounding key assumptions*', (Draft 2022 Integrated System Plan, AEMO, December 2021, p83). To be consistent with AEMO's position, competition benefits need to be excluded from the net benefits of HumeLink in the PACR, meaning HumeLink has a net benefit of $39m.

This is a tiny net benefit for a $3.3 billion project (now a $4.892 billion project), before environmental and community costs. Further this net benefit was estimated assuming:

- Snowy 2.0 would be operating from July 2025, when it's now delayed until at least December 2029;
- Snowy 2.0 was a sunk cost, and so without cost;
- an overly optimistic capacity factor for Snowy 2.0;
- No Kurri Kurri or Tallawara gas fired power stations;
- Transfer capacity of HumeLink 2570MW rather than 2200MW; and
- a wrong per annum Opex assumption of 0.5% of Capex, when AEMO assumes 1% in the ISP and Transgrid's five-year average is 3.5%.

Correcting for these modelling errors, means HumeLink has a net cost, even before the environmental and community costs are added.

The reported $39m net benefit (excluding competition benefits, and environmental and community costs), speaks to the fact that HumeLink is not critical to the transition to net zero emissions. The modelling is saying that compared to the base case, where there is no HumeLink, electricity consumers are better off by only $39m with HumeLink. If HumeLink was critical, it would have a much bigger net benefit.

Question

16. Does the $39m benefit for HumeLink in the PACR justify:

- the increased risk of bushfires;
- visually polluted landscapes for the next 80-100 years;
- interruption to tourism and agriculture for the next 80-100 years;
- increase risk of childhood leukemia for the next 80-100 years;
- impacts on Matters of National Environmental Significance.

D. Reapplying the RIT-T to HumeLink

The Hon. EMMA HURST: When would it come into play that they have to reapply the test? J

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.

NSW Treasury's *Economic Appraisal Principles and Procedures Simplified* states

"International research on major infrastructure projects has found evidence of systemic bias in project appraisals, ...

> *The research suggests a tendency for the costs of major projects to be underestimated and for demand forecasts to be inflated. These conclusions are based on case studies of several hundred major infrastructure projects in over 20 nations and 5 continents.....*
>
> > *The most appropriate way of addressing the issue,... is to ensure that the cost and benefit assumptions and data used in the analysis are reasonable, when compared with actual data from broadly similar projects undertaken in the past, or similar projects completed inter State or overseas. The analysis should also incorporate adequate sensitivity analysis."*

Therefore, research has shown there is systemic bias in cost-benefit analysis of major infrastructure. Scratch the surface of the cost-benefit analysis of HumeLink, and the problem of costs being underestimated and benefits being overestimated, is plain to see.

There are serious problems with the oversight of the cost-benefit analysis of transmission infrastructure. The AER takes a very narrow review of their role – limited to enforcing the cost-benefit guidelines. Obvious mistakes in project evaluations are missed. There is an urgent need for all cost-benefit analysis of major infrastructure projects to be independently and expertly reviewed.

The AER states in relation to compelling Transgrid to reapply the RIT-T because of a material change in circumstance for the project: '*We have no power. I think's it is the proponent's responsibility…'.*

There is a serious conflict of interest with the decision to reapply the RIT-T being made by the proponent, when the proponent has an interest in the RIT-T not being reapplied.

If HumeLink goes ahead, Transgrid will profit massively (a government guaranteed rate of return on a billion-dollar investment). Despite it being in the public interest to reapply the RIT-T, to ensure the project still has a net benefit, further scrutiny of the HumeLink project, puts Transgrids expected massive profits at risk. It is in Transgrid's best interest to hold the position that, in their opinion, there has been no material change in circumstance for the HumeLink project.

Questions

17. How can a project costing billions of dollars, only be required to have the cost-benefit analysis reassessed if it's considered necessary by the proponent, where the proponent has a conflict of interest?
18. If the AER can't compel Transgrid to reapply the RIT-T, will **government** require Transgrid to redo the cost benefits analysis of HumeLink given the material change in circumstance for the project?

E. 'Criticality' of HumeLink

Marie Jordan: *'On the delivery of ISP projects to ensure energy security, I just need to reiterate the **criticality** of HumeLink project in the context of the energy transition, not just here in New South Wales but the entire eastern seaboard'.*

Although Transgrid argues HumeLink is critical it was found to have a net benefit (excluding competition benefits and environmental and community costs) of $39m, before the 48% increase in cost.

HumeLink isn't in the top ranked candidate development path (CDP) in the 2022 Draft ISP. It is in the second ranked CDP, but not again in a CDP, until the ninth ranked CDP. AEMO has defined the second ranked CDP as the optimal development path (ODP). If HumeLink was as critical, as AEMO argues, it would be in all of the top ranked CDPs.

Table 9 The candidate development paths (unchanged from the Draft ISP)

In these CDPs …		… these projects would be actionable					
		New England REZ Transmission Link	Sydney Ring	Marinus Link	VNI West	HumeLink	Gladstone Grid Reinforcement
Least-cost CDPs in each scenario							
1	Progressive Change least-cost	✓	✓				
2	Step Change least-cost	✓	✓	✓	✓		
3	Hydrogen Superpower least-cost	✓	✓	✓	✓	✓	✓
4	Slow Change least-cost	✓					
Testing variations to test timing of project delivery and/or event-driven scenarios							
5	CDP1, adding Marinus Link	✓	✓	✓			
6	CDP1, adding VNI West	✓	✓		✓		
7	CDP1, without New England		✓				
8	CDP2, adding HumeLink	✓	✓	✓	✓	✓	
9	No actionable projects						
Testing the staging projects with early works							
10	CDP5, with VNI West staged	✓	✓	✓	✓ Staged		
11	CDP8, with VNI West staged	✓	✓	✓	✓ Staged	✓	
12 (ODP)	CDP10, with HumeLink staged	✓	✓	✓	✓ Staged	✓ Staged	
13	CDP12, removing Marinus Link	✓	✓	✘ Never available	✓ Staged	✓ Staged	

Table 10 Weighted net market benefits of CDPs across scenarios for the Draft ISP ($ billion)

CDP	Description	*Slow Change*	*Progressive Change*	*Step Change*	*Hydrogen Superpower*	Weighted Net Market Benefits	Rank
	Scenario weighting	**4%**	**29%**	**50%**	**17%**		
10	CDP5, with VNI West staged*	3.52	16.35	25.59	70.01	29.58	1
12 (ODP)	CDP10, with HumeLink staged	3.35	16.20	25.59	70.20	29.56	2
2	Step Change least-cost	3.25	16.26	25.59	70.01	29.54	3
5	CDP1, adding Marinus Link	3.71	16.51	25.51	69.60	29.52	4
6	CDP1, adding VNI West	3.62	16.47	25.59	69.37	29.51	5
1	Progressive Change least-cost	4.17	16.72	25.50	68.95	29.49	6
7	CDP1, without New England	3.94	16.67	25.49	68.45	29.37	7

4	*Slow Change* least-cost	4.34	16.50	25.41	68.73	29.35	8

Source: AEMO, 2022 ISP, p81, 82.

Comparing Table 9 and 10 above, not only is HumeLink not in CDP 10, the top ranked CDP, it also isn't in CDPs ranked 3 to 8, that is CDPs 2, 5, 6, 1, 7 and 4.

Again, if HumeLink was critical for the transition to net zero, it would be expected to be in the top ranked CDPs.

Further the assumptions in the ISP, that are being used to model the cost and benefits of transmission projects, are highly questionable. For instance, even though electrical manufacturing costs have increased significantly in the last years (see Figure 1, above), the Step Change scenario, that AEMO describes as the most likely scenario, has the following assumptions:

Step Change – rapid consumer-led transformation of the energy sector and co-ordinated economy-wide action. Step Change moves much faster initially to fulfilling Australia's net zero policy commitments that would further help to limit global temperature rise to below 2°C compared to pre-industrial levels. Rather than building momentum as Progressive Change does, Step Change sees a consistently fast-paced transition from fossil fuel to renewable energy in the NEM. On top of the Progressive Change assumptions, there is also a step change in global policy commitments, ***supported by rapidly falling costs of energy production****, including consumer devices. Increased digitalisation helps both demand management and grid flexibility, and energy efficiency is as important as electrification. By 2050, most consumers rely on electricity for heating and transport, and the global manufacture of internal-combustion vehicles has all but ceased. Some domestic hydrogen production supports the transport sector and as a blended pipeline gas, with some industrial applications after 2040, (2022 ISP, AEMO, p31).*

The assumption of rapidly falling costs of energy production is contrary to what's happening in the real world.

The Step Change scenario, with the rapidly falling costs of energy production assumption, is associated with large net benefits of transmission projects ($1.3 billion net benefit of HumeLink (excluding competition benefits and community and environmental costs), inconsistent with the $39m HumeLink PACR net benefit), and is being used to push for a rapid build of transmission lines. Looking at what's actually happening on the ground, the more likely scenario is one that doesn't assume rapidly falling costs of energy production – possibly the Progressive Change scenario.

Question

19. How is HumeLink critical when it is only in the second ranked candidate development path – not the top ranked path or the third, fourth, fifth, sixth, seventh or eighth ranked path?

F. HumeLink more critical with Snowy 2.0 delayed

Jeremy Roberts: *So we've confirmed with the market operator, AEMO, that with the Snowy delays HumeLink is more critical to increase the resilience of the network. Without the Snowy*

coming on as soon as it was, that resilience requirement for the network is even more critical—especially that connection from Wagga through to Bannaby

The community asked Transgrid to model the net benefit of HumeLink with Snowy 2.0 delayed 3 years, 5 years, and 10 years. Transgrid responded saying the net benefit of HumeLink without Snowy 2.0 was modelled as the Slow Change scenario of the Project Assessment Draft Report (PADR). Looking at that document it can be estimated that HumeLink has a net COST without Snowy 2.0 of $555 million.

Question

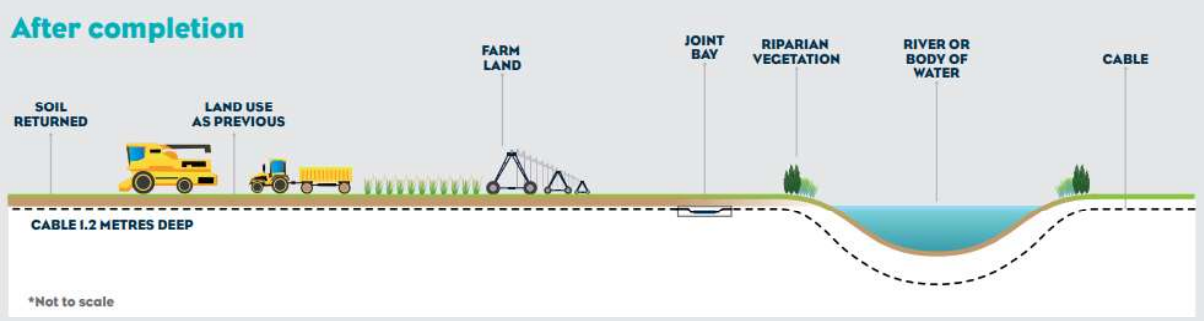
20. If you believe HumeLink is MORE critical with Snowy 2.0 delayed, can you please model the net benefits of HumeLink, with the RIT-T cost-benefit analysis, with Snowy 2.0 delayed 5 and 10 years? (The community is not confident with the AEMO modelling, as to determine the market benefits of projects in the ISP, involves a sequential modelling process. Initially an oversimplified model for the transmission network, with exaggerated transmission limits on the interstate transmission network, is assumed. When the outputs of this modelling are fed into the more detailed, hour by hour simulation modelling, it leads to overstated benefits of State interconnectors).

G. Impacts on agriculture

Marie Jordan: '*What you don't have the ability to do is to do any type of agricultural work that would require any kind of ploughing or disruption of the soil. There is a small layer of native soil a little bit deeper in a high-voltage HVDC line because there is a lower temperature on that. So the information we gave today is in response to the inquiry and the discussions around HVDC. All of the pictures shown are HVDC, and you can see that it's still a very expansive process as you dig a trench to put in 500 kV. I also heard part of the testimony where they discussed boring under trees and not disrupting. I'm in disagreement of that. I have not seen that done for this type of voltage. As I shared, I've got a lot of global experience with this type of work and I've yet to see somebody do a bore underneath trees for a 500 kV HVDC line'.*

These comments misrepresent the facts about underground cables and the impacts on agricultural land use. They are inconsistent with the GHD/Transgrid undergrounding study that provided a link to land use impacts of underground cables [Victorian-land-access-and-easement-acquisition-Marinus-Link-web.pdf (marinuslink.com.au)]

Figure 2: Land use impacts of undergrounding post laying underground cables



As shown in Figure 2 above, agriculture can be carried out unimpeded above underground cables.

Question

21. Why are Transgrid's comments on the impacts of underground cabling inconsistent with scientific studies, that show there is almost no reduction in cropping yield for agriculture with underground cables?
22. Does Transgrid have any technical competency in HVDC undergrounding?

H. Transgrid lacking HVDC specialists

Marie Jordan: *'we do not have a lot of HVDC specialists for construction as well as the equipment. So all of that is at a brand-new starting point. That will be very difficult if it has ended up in that direction'.*

Question

23. If Transgrid has no competency in HVDC undergrounding should the HumeLink project, that requires the assessment of an undergrounding option, be taken off Transgrid?