Submission
No 53

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

Name: Mr Les Brand

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Ms Cate Faehrmann MLC
Committee Chair,
Parliament of New South Wales

RE: Inquiry into the feasibility of undergrounding the transmission infrastructure for renewable energy projects

Dear Ms Faehrmann,

I thank you for the opportunity to present this submission to the Inquiry into the feasibility of undergrounding the transmission infrastructure for renewable energy projects, as detailed in the Terms of Reference which was adopted on 13 September 2023.

I refer the Committee to my submission to the previous Standing Committee on State Development inquiry into undergrounding transmission infrastructure, dated 14 July 2023.

This submission provides additional information and responses to some of the items raised during the previous Standing Committee. It is intended to be read in conjunction with and in addition to the 14 July 2023 submission and my verbal testimony presented on 26 July 2023.

I'd like to start by acknowledging that the transition to renewables in Australia will necessarily require a significant (unprecedented) level of construction of high voltage transmission to be completed to connect the (often) remote renewable energy sources to the major load and demand centres. In some cases, the use of AC or HVDC overhead transmission lines will be more appropriate, especially in cases where the benefits of spending the extra cost for undergrounding cannot be justified. There will however also be cases where the additional capital costs of using underground cable can be justified considering the benefits that could be realised at that particular location or for that particular project.

There may be technical reasons to prefer long distance HVDC over AC, particularly where the distances between renewable energy source and load/demand are so high that an HVDC overhead and/or underground solution may become the lower capital cost option.

What is important to me is that all options are assessed based on facts, which are established by those experienced in these areas, and that such an assessment is undertaken early enough in the project development process.

As a professional with over 24 years of experience in the construction, commissioning, operation and maintenance of HVDC and long distance underground/subsea cable projects in Australia and overseas (my profile is provided in my submission dated 14 July 2023), I am deeply concerned about the various statements that are being made (in the previous inquiry and the media) about HVDC transmission and underground cables that, in my experience, are not correct. The origins of these statements are unknown. What is clear to me though is that the technical assessment of AC vs HVDC and overhead versus underground must be undertaken in a balanced, fair and structured way by professionals with knowledge and experience in these areas and not rely upon one-line statements that through repetition and dissemination, have a habit of being treated as fact.

Capital Cost of HVDC Underground Equivalents

Amplitude was engaged by the Humelink Alliance to undertake a detailed review of the underground report published on Transgrid's website (performed by GHD) and to present a scope and cost estimate for two underground alternatives to Humelink (using HVDC technology). It is my understanding that the report dated 3 October 2023 has been submitted to the Committee by the Humelink Alliance in their submission.

Amplitude developed a high-level technical HVDC underground cable solution and capital cost estimate for two different options. One of these options is based on the option 2A-1 presented in the GHD report (but including the allowable loss of 700 MW in the event of a credible contingency, as stated in the same report). The other is based on option 1C- presented in the Addendum to the PACR for Humelink (a Maragle to Bannaby direct HVDC connection). The HVDC alternatives presented utilise multi-level modular, voltage source converter (VSC) technology in a bipole with metallic return configuration which would operate at a DC voltage of ±525 kV.

The concept design of the cable trench profile assumed that each set of power cables (three per bipole system) will be laid and buried in individual trenches with separation distances of a minimum of 0.5 metre between each cable in a system (a trench width of about two metres for each set of three cables) and a minimum of one metre between each cable trench to maintain thermal and current cable ratings. Practically, more than one metre between trenches may be required, however even assuming a five-metre separation will result in an overall corridor of no more than nine metres.

The results of the concept design show trench widths significantly (orders of magnitude) narrower than the "50-metre-wide trench" or "wide trench about the width of an Olympic swimming pool" which was stated during the inquiry hearings held on 18 July 2023.

The outcomes of the scoping and cost estimate exercise for these two options can be summarised as:

- Option 2A-1 with an allowable loss of 700 MW in the event of a credible contingency: the high-level cost estimate for this option is circa $7.3 billion. Based on the cost for the AC overhead Humelink option published in August 2023 of $4.89 billion, the "multiple" for the modified option 2A-1 is 1.5 times the cost of the AC overhead line option.
- Option 1-C: This is a Maragle to Bannaby direct HVDC connection. The high-level cost estimate for this option is circa $5.46 billion, which is estimated to be of the order of 1.37 times the cost of the AC overhead line project (based on an escalated value of the 2020/21 amounts presented in the Addendum Report by Transgrid dated December 2021).

The work presented in the report demonstrates clearly that even taking into account the cost of the HVDC converter stations (which have a higher capital cost than AC substations), there are viable HVDC underground alternatives to the AC overhead Humelink option, which are of the order of 1.4-1.5 times the published capital cost of that AC overhead option – not up to 10 times as was stated during the inquiry hearings conducted on 18 July 2023.

Statements Relating to What Can Grow Above the Cables

During the inquiry hearings conducted on 18 July 2023, there were a number of statements made in relation to what can grow above the cables and what cannot. I continue to hear comments such as there is a need to sterilise the ground above the cables after they are installed.

Firstly, as a matter of context, it is clear in the Amplitude report that for the HVDC cable options, the width of area that we are really talking about is only a two-metre strip for each trench (lets say two two-metres strips, approx. five metres apart).

Second, there are very few limits to what can be grown directly above the cables (i.e. within the two metre area, and a safety area either side, of each trench) to grow. Documents prepared by experienced professionals that are available publicly state simply “no deeply rooted trees”.

Australia has two long distance HVDC cable facilities, both of which have been in operation for over two decades now (Murraylink and Directlink). In my previous roles during the installation, operation and maintenance on both of these projects, I can say that there was no sterilisation of the vegetation above these cables occurring (or recommended) and the location of the cables are often so hard to see with the naked eye (due to the vegetation growing above it) that specialised electronic cable fault finding devices are required to actually find where the cable is. This could be verified by visiting these locations.

The following repeats for emphasis what I had presented in my previous submission dated 14 July 2023 on this topic.

There are also a number of references available in the public domain to support this. One example is a report by Europacable[1]. Quoting directly from this report:

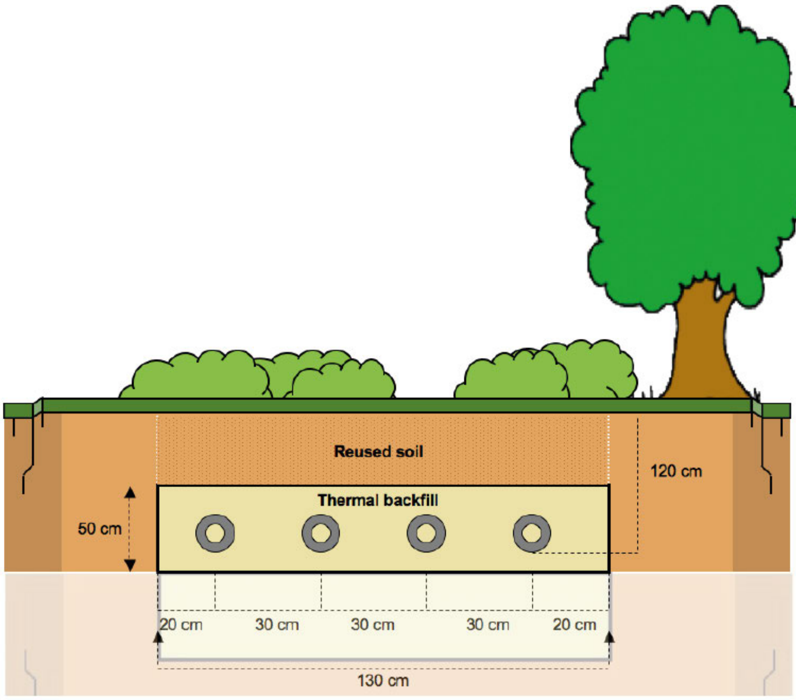
“*The only restriction on the use of land over an undergrounded section is that no deeply rooted trees may be planted within the corridor width plus a margin of about 2 meters to prevent root encroachment into the cable trench. Apart from that there are no limitations to cultivation, including agricultural farming*.”[2]

The report includes the diagram shown in Figure 1, repeated for convenience, which shows a 320 kV, 2 GW HVDC system.

[1] Europacable report, “An Introduction to High Voltage Direct Current (HVDC) Underground Cables”, October 2011 (https://europacable.eu/wp-content/uploads/2021/01/Introduction_to_HVDC_Underground_Cables_October_2011_.pdf)

[2] Ibid, Page 8.

Figure 1 – Cable Trench Profile Showing Limited Impact on Surface for 2 GW, 320 kV HVDC System[3]



In terms of environment, one benefit of the underground cables is the reduced easement requirements compared to extra high voltage AC overhead transmission lines. While AC overhead transmission lines need to be installed in straight lines between towers and will require more towers on non-linear routes, underground cables have the flexibility to be able to have the trench/route installed around bends, diverting around sensitive areas and can be installed below major obstacles using horizontal directional drilling. This provides some flexibility when selecting a route, making relatively narrow road reserves and corridors viable options for cable routing. In the case of Murraylink, we were able to install the cables within the firebreaks along fencing (on the road reserve side) for a significant length of the route and were able to bend the trench/route around trees to avoid cutting them down. This is why Murraylink won the Case Earth Award in 2002.

Another point to make is that much of what is said against underground cables in relation to environment is what happens during construction. The reality is that a cable construction front is only at one location for a few weeks (before moving on to the next section), and then immediately remediated. It can take up to 6 months to reinstate vegetation. After this, the land repairs quickly and for the rest of the life of the asset (40 years +) there is virtually no impact on the environment except to maintain access tracks in areas not accessible by existing roads.

Closing Remarks

I appreciate the opportunity to be able to present this submission.

[3] Europacable report, "An Introduction to High Voltage Direct Current (HVDC) Underground Cables", October 2011 (https://europacable.eu/wp-content/uploads/2021/01/Introduction_to_HVDC_Underground_Cables_October_2011_.pdf), Page 7.

As an expert in the field of HVDC transmission projects and as one of the few with direct experience in the installation, commissioning, operation and maintenance of such HVDC underground projects in Australia and overseas, I would appreciate the opportunity to make a presentation to the Inquiry on these matters.

Yours faithfully,

Mr Leslie Neil Brand
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Managing Director
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