10 November 2023

Members of the Select Committee on the Feasibility of Undergrounding the Transmission Infrastructure for Renewable Energy Projects

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

Energy Networks Australia (ENA) welcomes the opportunity to make this submission in response to the Inquiry into the Feasibility of Undergrounding the Transmission Infrastructure for Renewable Energy Projects.

ENA represents Australia's electricity transmission and distribution and gas distribution networks. Our members provide more than 16 million electricity and gas connections to almost every home and business across Australia. Our electricity transmission members, the transmission network service providers (TNSPs), are focused on delivering Integrated System Plan (ISP) and renewable energy zone (REZ) projects, which are urgently needed to facilitate the energy transformation that is central to Australia's carbon reduction commitments.

The select committee has been established to inquire into and report on the feasibility of undergrounding the transmission infrastructure for renewable energy projects and is due to report back by 31 March 2024.

In summary:

- Transmission is an essential enabler for the energy transition in NSW, including new renewable generation connections. Delays to Snowy 2.0 and REZ projects places even greater importance on the timely delivery of critical new transmission projects such as HumeLink and VNI West;
- The Energy Charter has commenced a collaborative process on transmission undergrounding. This project is seeking to improve the experience of landholders and communities by providing greater transparency on how the viability of undergrounding vs overhead designs are evaluated;
- Overhead transmission lines pose minimal fire start risk. It is electricity distribution lines that pose a greater risk of fire starts due to the larger coverage and proximity to the ground and trees;
- The merits of undergrounding and overhead transmission projects are necessarily considered on a case by case basis throughout the planning and regulatory investment

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processes, and this should occur with appropriate levels of engagement with stakeholders and communities. The potential value of undergrounding will be different depending on a range of factors, including for example, type of technology and transmission use case, geography and geology, land use in the vicinity, biodiversity risks and drainage and cultural heritage concerns;

- A recent Australian Energy Market Operator (AEMO) report has noted that the cost of undergrounding can be 4 to 20 times higher for undergrounding compared to overhead transmission lines. The exact number will depend on a range of factors such as those noted above.

The benefits of new transmission to connect lower cost renewables

Transmission is an essential enabler for the energy transition in NSW, including new renewable generation connections. It is important that low-cost renewables, storage and essential system services are available to ensure reliability and system security through the transition. This requires reconfiguration of the grid as new renewable generation is generally in different locations to the retiring NSW coal generation assets. New firming capacity from Snowy 2.0 and other projects will complement intermittent renewable generation. The deep storage provided by Snowy 2.0 is crucial for energy reliability in the future power system.

AEMO stated in the final 2022 Integrated System Plan (ISP)[1]

> "*The transmission projects within the ODP are forecast to deliver scenario-weighted net market benefits of $28 billion, returning around 2.2 times their cost of approximately $12.7 billion. They represent just 7% of the total investment in NEM generation, storage, and network to 2050; optimise benefits for all who produce, consume and transport electricity in the market; and provide both investment certainty and the flexibility to reduce emissions faster if needed*."

The draft 2024 ISP will be released in mid-December by AEMO for consultation, providing the next update on the electricity system plan, including an updated view on the overall costs and benefits of the plan.

The interconnectors outlined in the 2022 ISP are important for the diversity of supply into and out of NSW. These include *Project EnergyConnect* linking South Australia to NSW with an overhead transmission line, *Humelink* connecting latent generation capacity and the additional capacity from Snowy 2.0 to key NSW load centres and *VNI West* creating an additional connection between Victoria and NSW.

[1] AEMO 2022 Integrated System Plan, p15

The first part of *Project EnergyConnect* will commence commissioning in early 2024 and the second stage will follow a year later on the NSW side. The project will facilitate significant new renewable generation along its path.

Humelink is a crucial project for NSW. The NSW Government has noted that HumeLink should be fast tracked to unlock 1,200MW of existing capacity in Snowy Hydro, of which 500MW would be available during periods of peak demand[2]. This capacity is available to assist meeting reliability in NSW, despite delays to Snowy 2.0 and delays also being experienced with Central West Orana and New England REZs. Delays to Snowy 2.0 place even more importance on HumeLink to reinforce the southern network in NSW, linking renewable energy from SA, southern NSW and Victoria. If HumeLink did not proceed based on current design the project will be set back significantly and access to the existing capacity will be delayed, increasing the costs further to NSW electricity consumers. Snowy 2.0 will add 2,000MW of new reliable capacity on completion which will be available to meet reliability in NSW load centres (i.e. Sydney, Newcastle and Wollongong) and the NEM with HumeLink in place.

Completion of HumeLink provides much needed dispatchable energy to meet reliability standards as NSW coal generation retires. There will be days and potentially weeks where renewable output may be low due to cloud cover, smoke, storms and even a solar eclipse.[3] Where renewable output is low over several days it is likely that batteries will be fully discharged and not able to charge from renewables. Longer duration storage, increased interconnection and gas fired generation will be important components of the energy mix for days like these.

Delivering the transmission outlined in the ISP's optimal development path will aid a transition to net zero by 2050. Endgame Economics modelled the change in wholesale electricity costs that would arise due to any delay to transmission projects outlined in the ISP. The modelling indicated a 1-4 year delay could cost a NSW residential customer from $283 to $1,428 extra over the period FY2026 to 2040.[4]

Improving engagement and collaboration for the transition

TNSPs recognise the need for open and genuine community engagement early in the planning process to build social licence for these important projects. More broadly, TNSPs have been working proactively with Energy Charter, agricultural groups and farmers' federations to co-design a range of guidelines and continuously improve their community engagement. A number of examples are outlined below that have been completed or are in progress:

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[2] NSW Electricity Strategy Overview, 2019, p15
[3] 22 July 2028, total eclipse, lasting from 9.07am to 3.48pm https://www.timeanddate.com/eclipse/in/australia?iso=20280722
[4] Endgame Economics, Modelling Electricity Bill Impact of Transmission Project Delays, 7 June 2022, $ are in real 2022 AUD, incl GST

- **Energy Charter Landholder and Community Better Practice Engagement Guide** – This guideline was launched in September 2021 after collaboration between TNSPs and various farmers groups. The primary purpose of the Guideline is to encourage improved outcomes for landholders and communities across a range of different electricity and gas projects.
- **Energy Charter Better Practice Social Licence Guideline** – This Better Practice guideline was launched in May 2023 after a collaborative process with the Ag Energy Taskforce, AEIC, various farmers groups and TNSPs. The Guideline provides a checklist of actions and activities required to minimise the impact and meet landholder expectations to deliver shared value and build social licence. Actions cover planning to decommissioning.
- **Energy Charter Evaluating Transmission Undergrounding** – This work has commenced using a similar model as the Energy Charter adopted for the Better Practice Social Licence Guideline. It is seeking to improve the experience of landholders and communities by providing greater transparency on how the viability of undergrounding vs overhead designs are evaluated. This initiative is targeting completion in April/May 2024 and will take into account relevant matters from the NSW Undergrounding Inquiry and the Australian Energy Infrastructure Commissioner's community engagement review.

The Better Practice Social Licence Guideline recognised[5]:

> "*Many regional communities and landholders have also publicly suggested undergrounding transmission lines to avoid visual impacts. In some instances, where undergrounding has not been progressed, communities have expressed that this option was not fully investigated or given adequate consideration.*
>
> *It is also critical that open and transparent consultation occurs throughout the planning and construction of transmission. Engagement on undergrounding should include adequate consideration of all options to reduce or compensate for visual – and other – impacts. Undergrounding transmission infrastructure can be comparatively more expensive and in some instances may equally compromise productive land for landholders, due to vegetation clearing requirements for safety purposes. Undergrounding cables also reduces the expected technical service life of transmission infrastructure and cables can require longer repair times for unexpected electrical faults. The cumulative impact of land use, environmental, technical, operational and economic considerations can limit the viability of undergrounding as an option*.

[5] Energy Charter Better Practice Social Licence Guideline, May 2023, p16-17

Consideration and communication around undergrounding

Consider undergrounding when it is a viable option as part of community and landholder consultation. Investigation reports and supporting analysis, including the challenges, benefits and impacts of overhead compared to underground transmission designs from a landholder, community, environmental, technical and cost perspective should be completed and made publicly available. In some instances, it may be preferable for research to be conducted by an independent party with appropriate expertise. It is also important that this information be well circulated with communities, this could include through direct community and landholder engagement and project newsletters."

Energy Charter signatories agreed to report annually against the Better Practice Guidelines. The first report is expected by May 2024, accompanied with an independent audit report which will assess the level of compliance with the guideline in its first year of operation. We expect reporting will consider how signatories are engaging and communicating throughout the planning process on undergrounding decisions.

Further to this Better Practice Social Licence Guideline, the Energy Charter is well progressed with more detailed research on concerns of undergrounding vs overhead lines. A broad stakeholder group is co-designing this work, including farming and agricultural groups. An independent technical consultant is also participating in the project to develop the insights from overseas projects, consider the research findings and assist with the co-development of a document on undergrounding vs overhead to explain the considerations in the planning process. This work will consider the findings from this inquiry before the work is completed.

Transmission lines and bushfire concerns

Energy Safe Victoria (ESV) developed a Bushfire Management and Community Safety Report on Electricity Transmission lines which was published in March 2023.

The report states; [6]

> *"Transmission lines, when managed and maintained properly, pose a very low risk of starting a fire. This is due to factors such as the height clearance between the transmission lines and the ground, as well as the managed vegetation beneath the lines that runs for the length of the line. Energy Safe Victoria (ESV) ensures that those who design, construct, operate, and maintain the Victorian transmission network are aware of and understand their responsibilities and obligations to minimise the risk and impact of bushfires.*"

[6] https://www.esv.vic.gov.au/sites/default/files/2023-03/ETL-Bushfire-FINAL-March-2023.pdf, p4

In relation to fire risk the report notes that there are many more distribution lines over a larger geographic area, these are closer to the ground and trees. Ultimately this means that it is electricity distribution lines that pose a greater risk of fire starts, not transmission lines.

Furthermore the ESV notes – "*Transmission lines are remotely operated so that they can be shut down when required. If a fault occurs on the transmission network, the protection systems will detect and switch off the power in a very short period of time (between 80 and 120 milliseconds or 0.08 and 0.12 of a second) to prevent an electrical fire*."

ESV also highlights that TNSPs work with fire authorities to ensure aerial firefighting is possible in the vicinity of transmission lines and the Civil Aviation Safety Authority sets the regulations for safe flying distances.

Undergrounding considerations

There are many factors that need to be considered regarding whether all or part of a transmission project should be underground. This includes the technical appropriateness of undergrounding for the transmission use required, the costs and benefits for electricity customers based on an economic assessment, as well as the impact on landholders and communities.

The regulatory framework for transmission investment requires a rigorous cost and benefit analysis and consideration of the options to meet the needs identified in the AEMO Integrated System Plan. The preferred option is not necessarily the least cost option but one that maximises the net benefit for all electricity consumers, considering price, reliability and system security and achievement of emissions targets. The merits of undergrounding and overhead transmission projects are necessarily considered on a case by case basis throughout this process, and this should occur with appropriate levels of engagement with stakeholders and communities.

National Grid operate the Great Britain transmission system consisting in 2015 of 7,200km of overhead transmission lines and 1.400km of underground transmission cable. Great Britain is about the size of Victoria with a population of over 67 million, who use and pay for all transmission lines. In contrast the NEM envisages a build of 10,000km of new transmission funded by a population of around 22 million electricity users.

The National Grid indicate in the diagram below that 4 trenches each of 3 cables are required for a 400kV line and the extensive layout area required.

Figure 1 – Buried cable installation and indicative layout area[7]

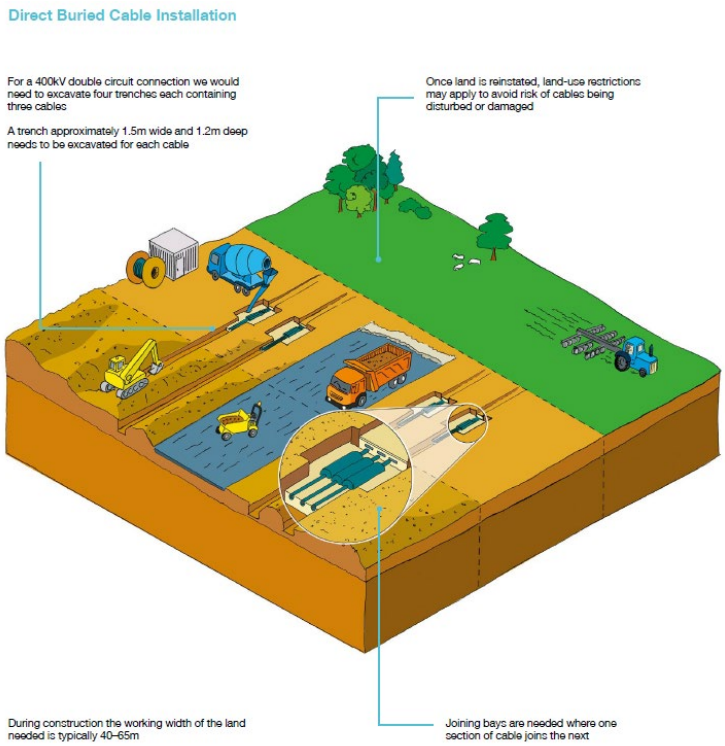
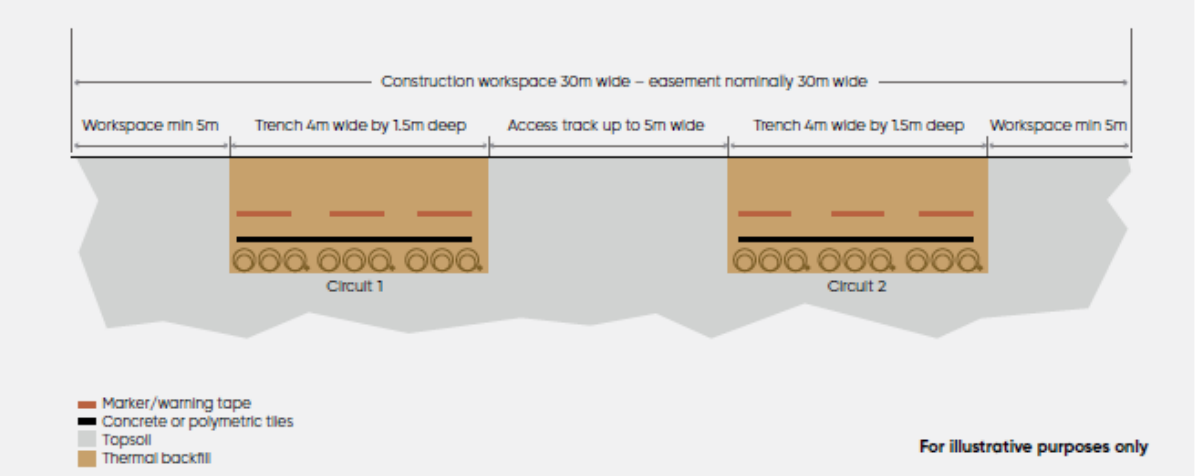


Figure 2 - Indicative 500kV HVAC underground diagram[8]

[7] NationalGrid, Undergrounding high voltage electricity transmission lines, The Technical Issues, Jan 2015
[8] AusNet/Mondo, Underground construction summary, Nov 21, p 6



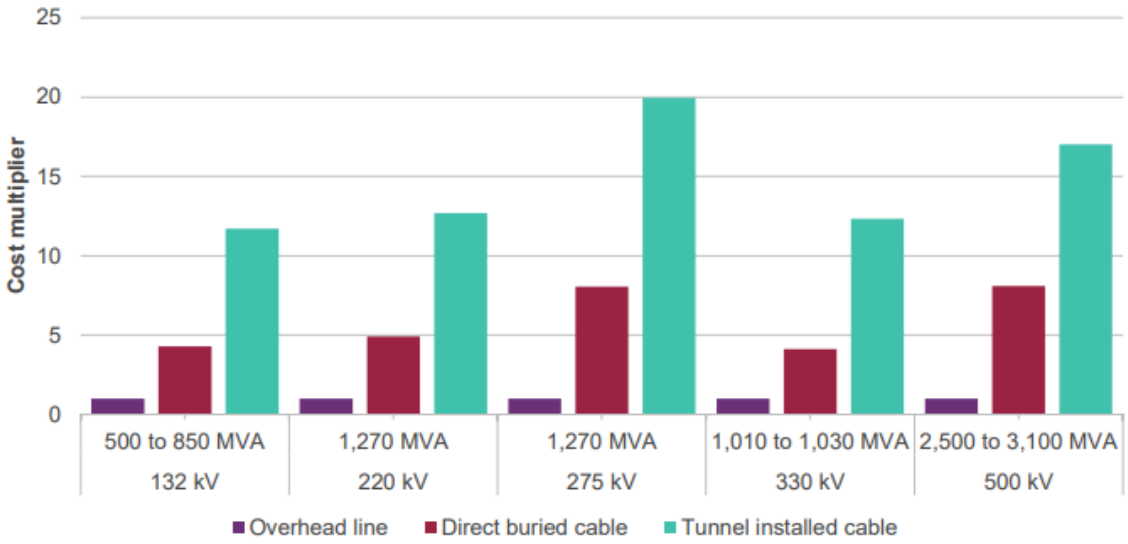
These diagrams indicate the extent of land impact, soil removal / thermal backfill and cartage. Land use in the vicinity, biodiversity risks and drainage will be impacted differently for underground cables compared to overhead. Cultural heritage issues could also be different with each option.

ENA is acutely aware of rising cost of living challenges for energy customers, including the impact of energy costs. The cost of undergrounding is substantially higher than overhead lines and is most often presented as being higher by a factor of multiples, not fractions. The exact additional costs would depend on a range of factors that are individual to the circumstances of a project. These include the type of technology deployed, line length and additional infrastructure required for undergrounding, as well as the local topology (whether it is hilly or flat) and geology (whether it is rocky or sandy etc.).

In preparation of the 2024 ISP, AEMO engaged a consultant, Mott McDonald, to update the underlying Transmission Cost database. In September 2023, AEMO released the 2023 Transmission Expansion Options Report which indicates the undergrounding can be 4 to 20 times higher in cost than overhead lines. Tunnel installed cables are higher cost than direct buried cables and both are higher than overhead lines. AEMO notes that these cost comparisons are indicative and will vary by project based on a range of factors including terrain, geotechnical constraints.

Figure 3 - Indicative unit cost multiplier from HVAC overhead to HVAC underground cables[9]

[9] AEMO 2023 transmission Expansion Options report, Sept 2023, p34



The draft 2024 ISP released in mid-December will consider the impacts of social licence in sensitivity cases. Higher transmission and generation costs, projects delays to transmission projects or amended land use assumptions will be modelled as sensitivities to better understand the impacts of social licence on the ISP.

Should you have any queries on this response please feel free to contact Verity Watson, vwatson@energynetworks.com.au.

Yours sincerely,

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