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7.

Case Studies

Comparing high voltage overhead and underground transmission infrastructure (up to 500 kV)

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Abbreviations and Acronyms

Abbreviation	Description
AC	Alternating Current
ACSR	Aluminium conductor steel-reinforced cable (or conductor)
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AVP	AEMO Victorian Planning
CBA	Cost Benefit Analysis
CIGRE	International Council on Large Energy Systems
DC	Direct Current
EHV	Extra High Voltage—consensus for AC Transmission lines is 345kV and above
EIS	Environmental Impact Assessment
EIR	Environmental Impact Review
EIS	Environmental Impact Statement
ELF	Extremely low frequency
EMF	Electromagnetic Fields
ENA	Electricity Networks Australia
EPR	Ethylene propylene cable
EPRI	Electrical Power Research Institute
GIL	Gas Insulated Line
GC	Gas cable
HDD	Horizontal Directional Drilling
HPOF	High-pressure oil-filled cable

Abbreviation	Description
HTLS	High Temperature Low Sag Conductors
HV	High Voltage
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
ICNIRP	International Commission on Non-ionizing Radiation Protection
ISP	AEMO's Integrated System Plan
NEM	National Electricity Market
OH	Overhead
OHTL	Overhead transmission line
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
REZ	Renewable Energy Zone
RIT-T	Regulatory Investment Test—Transmission
ROW	Right of Way (e.g. easement)
SCOF	Self-contained oil-filled cable
SLO	Social Licence to Operate
UG	Underground
UGC	Underground cable
UGTL	Underground transmission line
XLPE	Cross-linked polyethylene

1.

Introduction

This study aims to investigate the benefits and trade-offs between overhead and underground transmission line infrastructure, specifically focusing on issues associated with undergrounding new transmission infrastructure. It seeks to establish a clear and consistent approach to the evaluation of overhead lines and underground cable transmission, including the consideration of community concerns around the need for new transmission infrastructure to connect large renewable energy generation projects. It does this through systematic reviews of the literature as well as incorporating experiences of Transmission Network Service Providers (TNSPs) in Australia and overseas. The study has a particular focus on 500kV infrastructure which is expected to be the system voltage for high-capacity transmission lines in Australia going forward.

Historically, transmission networks in Australia developed from the need to transfer large amounts of power from large coal fired power stations, typically co-located near coal reserves, over long distances to

major cities and industrial load centres. In contrast, the proposed large scale renewable generation facilities, mainly solar and wind farms, require greater land areas and are largely being located in greenfield areas with little or no existing transmission network infrastructure. These new developments are naturally creating community interest and concerns around a range of potential impacts, including but not limited to: visual amenity; environment; Traditional Owner lands; agricultural land use; and social licence to operate concerns. This has led to questions surrounding when it is appropriate to underground transmission infrastructure and the likely implications of doing so.

This chapter provides a review of case studies, both Australian and international, in considering technical, cost, environmental, social and community information for transmission projects in the range of 330kV to 500kV.

2.

Review of Current Developments in the Australian NEM

2.1 Overview of NEM

The National Electricity Market (NEM) is comprised of five physically connected regions on the east coast of Australia: Queensland, New South Wales (which includes the ACT), Victoria, Tasmania, and South Australia. Western Australia and the Northern Territory are not connected to the NEM. They have their own electricity systems and separate regulatory arrangements, although the AEMC does have a role in the Northern Territory.

The Australian Energy Market Agreement sets out the legislative and regulatory framework for Australia's energy markets. It provides for national legislation that is implemented in each participating state and territory. There are four key market bodies governing the NEM:

- The Australian Energy Market Commission (AEMC) develops the rules by which the market must operate.
- The Australian Energy Market Operator (AEMO) handles the day-to-day operations of the electricity and gas markets.
- The Australian Energy Regulator (AER) enforces the national electricity market rules and makes judgements on the regulatory proposals of monopoly network operators.

While Energy Consumers Australia are the national voice for residential and small business energy consumers.

National Electricity Law, establishes obligations in the NEM, including transmission networks. The Law is supported by the National Electricity Rules. The requirements for planning and operation of transmission networks are set in the National Electricity rules and supported by guidelines and processes administered by the AER and AEMO. The objectives are to ensure the safe, reliable, and efficient operation of the transmission system. These requirements cover a wide range of issues including design and construction; maintenance and repair; environmental; and social impacts of the transmission lines.

2.2 NEM Transmission Network Planning and Approval Processes

Transmission Network Service Providers (TNSPs) must undertake the AER's Regulatory Investment Test for Transmission (RIT-T) when potential solutions to reinvest in network assets or increase the capacity of high voltage transmission network are over a \$7 million threshold—as defined in the National Electricity Rules.

The RIT-T is a consultation process which has 3 stages:

1. Project Specification Consultation Report (PSCR) is published. Stage 1 is not required for projects that have been identified as actionable under AEMO's Integrated System Plan (ISP).
2. Project Assessment Draft Report (PADR) is published.
3. Project Assessment Conclusions Report (PACR) is published.

State governments or their jurisdictional bodies also develop projects, including those related to renewable energy zones. These projects are not necessarily subject to the RIT-T process. The RIT-T is specifically designed to assess transmission investments proposed by TNSPs within the NEM in Australia.

There is coordination and collaboration between state government projects and the regulatory processes conducted by the AER and AEMO with its ISP. This collaboration ensures that the state projects align with the broader requirements of the NEM and consider system security and efficiency. However, the specific processes for state government projects differ from the formal RIT-T process that applies to TNSPs.

2.3 AEMO's Integrated System Plan (ISP)

AEMO developed the first ISP in 2018 to provide an actionable roadmap for eastern Australia's power system. The plan is updated every 2 years, with the current published plan being the 2022 ISP. Consultation for the 2024 ISP is currently in progress. The ISP has drawn on extensive stakeholder engagement and internal and external industry and power system expertise to develop a blueprint that maximises consumer benefits through a transition period of great complexity and uncertainty.

As part of the 2024 ISP consultation process, AEMO recently released the 2023 Transmission Expansion Options Report [1]. This report lists projects currently being assessed and reviewed for the 2024 ISP and summarised in Table 1, Table 2 and Table 3.

In addition to the projects listed above, the ISP provides an overview of network development options related to flow paths linking existing network and renewable energy zones (REZs). An overview is provided in the map in Figure 1.

Table 1. Committed and Anticipated Projects (from AEMO 2023 Transmission Expansion Options Report [1])

Project	Status	Responsible TNSP(s) or jurisdictional bodies
Central-West Orana REZ Transmission Link	Anticipated	EnergyCo
Eyre Peninsula Link	Committed	ElectraNet
VNI Minor (also named VNI East Upgrade)	Committed	AEMO (Victorian Planning), Transgrid
QNI Minor (Queensland—New South Wales Interconnector)	Committed	Transgrid
Northern QREZ	Committed	Powerlink
Project EnergyConnect—Stage 1	Committed	ElectraNet, Transgrid
Project EnergyConnect—Stage 2	Committed	ElectraNet, Transgrid
Murray River REZ and Western Victoria REZ minor augmentations	Committed	AEMO (Victorian Planning)
Victoria Central North REZ minor augmentations	Committed	AEMO (Victorian Planning)
Mortlake Turn-In	Committed	AEMO (Victorian Planning)
Waratah Super Battery Network Augmentations and SIPS Control	Committed	EnergyCo
Ararat synchronous condenser	Committed	AEMO (Victorian Planning)
Western Renewables Link	Anticipated	AEMO (Victorian Planning)

Table 2. RIT-T Projects in 2024 ISP (from AEMO 2023 Transmission Expansion Options Report [1])

Project	Responsible TNSP(s) or jurisdictional bodies
HumeLink	Transgrid
VNI West	Transgrid and AEMO (Victorian Planning)
Marinus Link	TasNetworks, Marinus Link

Table 3. Future ISP Projects with Preparatory (from AEMO 2023 Transmission Expansion Options Report [1])

Project	2022 ISP Timing	Responsible TNSP(s)
South East SA REZ expansion (Stage 1)	2025-26 to 2045-49	ElectraNet
Darling Downs REZ Expansion (Stage 1)	2025-26 to 2047-48	Powerlink
Mid-North SA REZ Expansion	≥ 2028-29	ElectraNet
QNI Connect (500 kV option)	2029-30 to 2036-37	Powerlink and Transgrid
QNI Connect (330 kV option – NSW scope)	2029-30 to 2036-37	Transgrid
South West Victoria REZ Expansion	≥ 2033-34	AEMO (Victorian Planning)

These projects are generally in planning phase by TNSP’s and State jurisdictional bodies. The Queensland Energy and Jobs Plan [2] provides details and an overview of the roadmap for Queensland’s proposed REZ expansion. Similar plans are available in the other states.

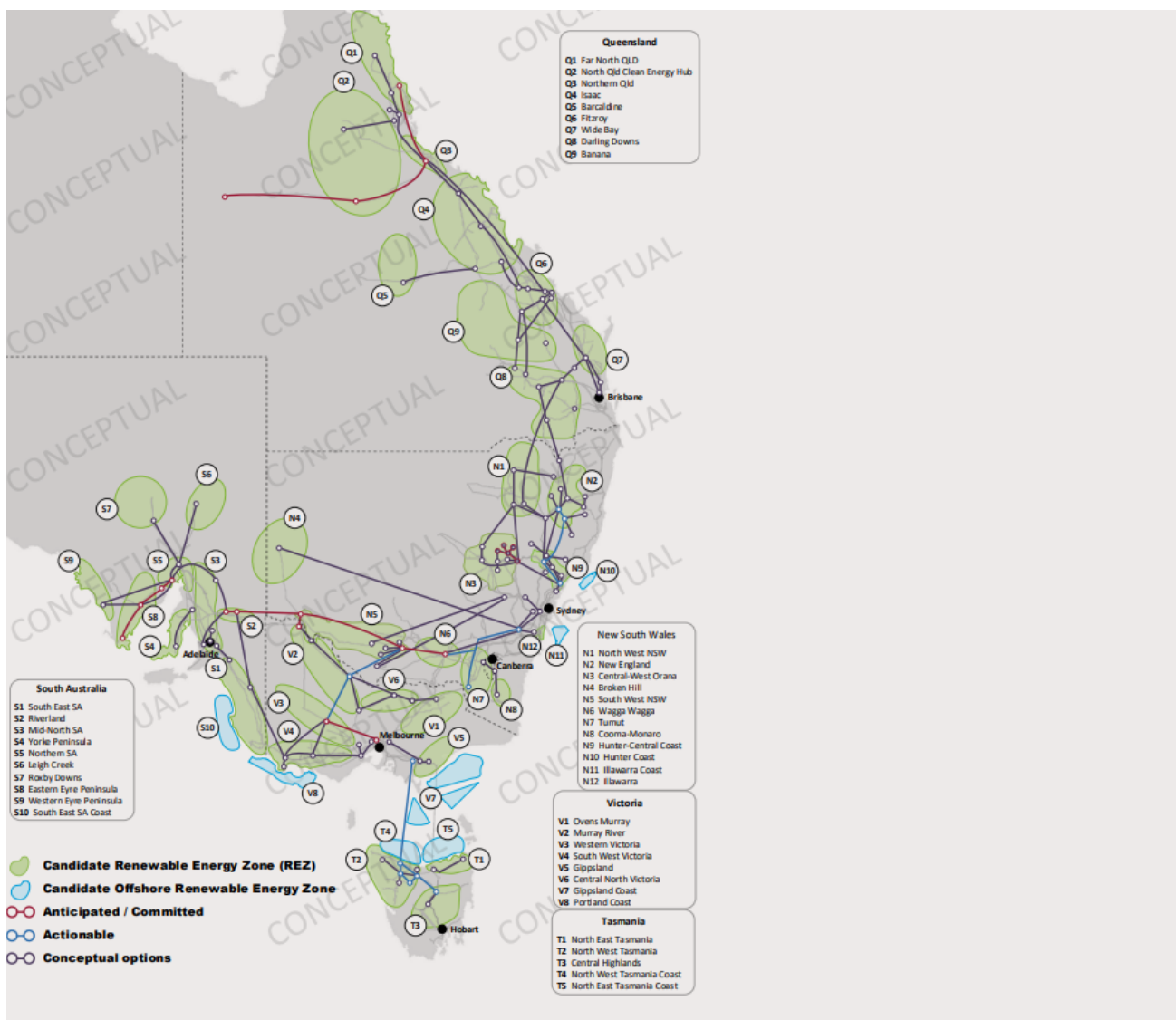


Figure 1. MAP of REZs and Flow Path Options (AEMO 2023 Transmission Expansion Options Report [1])

2.4 Current NEM Engagements involving Significant Transmission Line Projects

This section of the report focusses on three significant case studies where planning, consultation and engagement is in progress: (a) Humelink in NSW; (b) Western Renewables Link; (c) VNI West in Victoria. The review of these cases took place in July before the findings of the NSW Senate Inquiry in August, although the results are detailed in the chapter. However, we note the announcement of a subsequent Inquiry by a Select Committee in NSW in September, with the findings expected to be handed down in March 2024. While Powerlink Queensland is progressing the Borumba Pumped Hydro Connection and Copperstring 2032 projects, given the infancy of these projects they were not included as case studies for this research.

2.4.1 Humelink (NSW)

The HumeLink project involves a 500 kV transmission upgrade connecting Project EnergyConnect and the Snowy Mountains Hydroelectric Scheme to the existing Bannaby substation.

During stakeholder consultation for the HumeLink project, the community raised concerns regarding transparency and community engagement processes from Transgrid. They expressed dissatisfaction with a lack of clarity around what were negotiable and non-negotiable elements of the project, how decisions will be notified, and opportunities for community input. Notably, only landowners within the project corridor were consulted, while adjacent landowners felt excluded from the process. These landowners also reported feeling misunderstood, being treated disrespectfully, and believed that alternative options for the transmission corridor proposed were not given sufficient consideration.

In response to these concerns, Transgrid has initiated a series of measures aimed at improving community relations and delivering improved outcomes for impacted communities. This includes the establishment of Community Consultant Groups, which aim to involve a diverse range of stakeholders at every stage of the proposal, allowing them to provide valuable input and feedback. Transgrid has also actively sought expressions of interest from the community to assess the cultural significance of Aboriginal objects and places within the project area. HumeLink spans the lands of the Wiradjuri, Ngannawal, Ngarigo, and Gundungurra people. In collaboration with Registered Aboriginal Parties, cultural heritage surveys have been conducted, providing valuable insights for assessing impacts and implementing appropriate mitigation measures.

The community raised several concerns regarding the potential disturbances caused by the HumeLink project to farming operations. These concerns include impacts that limit the use of drones and GPS systems, which were deemed essential tools for modern

farming practices. Worries were also expressed around the risk of introducing and spreading weeds and pathogens from construction movements, which could have detrimental effects on agricultural productivity. Increased traffic associated with the project was also a concern, with its potential to disrupt road networks and lead to the deterioration of road conditions. Community members have also expressed concerns about air quality, particularly the dust generated by construction trucks, and its potential impact on human health and agricultural activities. Noise and vibration concerns have been raised, with landowners and livestock expected to experience disturbances from construction activities. Additionally, there are worries about the obstruction of natural landscapes and its potential impact on tourism in the area.

Through community consultation, environmental field studies and site assessments to identify regional constraints and investigate local considerations, Transgrid refined the route to minimise these impacts to the community. These included:

- **Tumut Area Route Refinement Decision:** Traverses a longer distance on private land and affects seven residences within a 500-meter radius (compared to 24 or 26 in other route options). However, the route has lower environmental and social impacts, and it passes a shorter distance through high to very high bushfire risk areas. Provides diversification in supply, improved network resilience, and reduced adverse effects on the community.
- **Bannaby Route Refinement Decision:** Prioritises lower environmental impact as a smaller area of impacted Plant Community Types and lower biodiversity offset costs. Shorter distance through high bushfire risk areas and better network resilience.
- **Green Hills Route Refinement Decision:** Despite having higher costs and poorer network resilience, the route reduces impact on private landowners by removing five residences within 500 meters of the line.
- **Pejar Dam Route Refinement Decision:** Considers amenity impact on Pejar Dam for recreational users. There are higher impacts on Plant Community Types and biodiversity offset costs along the alternate route, but it avoids crossing the middle of the recreational dam.

Throughout all stages of the project, the community has expressed a preference for undergrounding as a route option for the HumeLink project due to various concerns associated with overhead towers. These concerns include the potential for the towers to cause bushfires, hinder firefighting efforts, create electromagnetic fields with potential health impacts,

render farmland unusable, industrialise the landscape, decrease land and property values, destroy native habitats, and be susceptible to collapse during storms and high winds. However, an Undergrounding Report conducted by Transgrid found that the technical feasibility of the undergrounding being limited to 70km and the excessive cost of undergrounding the transmission lines was deemed unsustainable. The cost would ultimately be borne by commercial, industrial, and private electricity consumers, and it would also result in a significant project completion delay. Stakeholders criticised the Undergrounding Study for its focus on highlighting negative impacts while lacking representation of potential positive benefits. They also highlighted the discrepancies in cost estimates for underground cable components, technical inaccuracies in installation and operation, excessive commissioning schedules, and constraints based on studies focused on the overhead route. Transgrid maintain undergrounding is not a viable option.

2.4.2 Victoria to New South Wales Interconnector West (VNI West)

This project consists of a new high capacity 500kV double-circuit transmission line to connect Western Renewables Link located north of Ballarat with Project EnergyConnect at Dinawan via a new terminal station near Kerang.

Some members of the community have expressed dissatisfaction with the stakeholder engagement process, citing several issues. These include late communication to potentially impacted communities about project decisions, which limited their ability to prepare and provide informed submissions. It was felt that the six-week consultation period was insufficient time for the community to thoroughly understand the project details and make meaningful contributions. Additionally, there were concerns about the adequacy of information provided, as some community members and landowners found it challenging to comprehend the technical and complex project details.

The AEMO's Project Assessment Draft Report (PADR) has also caused community concerns regarding the project. Stakeholders have emphasised the need to consider various social license issues, including visual amenity, biodiversity, land use, culture, heritage, tourism, and bushfire risk. Of particular concern is the impact on regional agriculture, as the installation of transmission lines was felt to impede the use of large tractors, irrigation systems, and modern agricultural technologies such as GPS-enabled tractors, auto steer, and drones. Property access issues have also been raised, including inadequate notice, undisclosed chemical usage, weed spread, failures in gate closures, crop and machinery damage, and soil impacts. Mental health concerns have

been raised and attributed to the project, alongside worries about the potential impact of electromagnetic fields, including cancer and overall health risks for both humans and animals. Some stakeholders have suggested moving the corridor further west along a Bulgana to Kerang corridor, which offers lower density dwellings, increased wind resources to harness more renewable generation, larger agricultural properties, fewer constraints related to native vegetation and ecology, less sensitivity to cultural heritage, and reduced flood risk. Additionally, there have been questions regarding the accuracy of cost estimates and recorded benefits associated with VNI West's interaction with the Western Renewables Link and other projects within the NEM.

In response to the recommendations, AVP and Transgrid have taken the following actions:

- Considered five new options connecting VNI West to WRL further west, which they claim consider more factors that may impact social license than previous options.
- Extended the modelling horizon until 2049–50 as PADR submitters questioned the short duration of the NPV analysis, which ended in 2047–48. They noted that VNI West (via Kerang) has a longer economic life of 16 years, making the analysis period insufficient.
- Updated cost estimates for the New South Wales portion of investment based on the Strategic Benefits Payment Scheme as the estimated km length underpinning these payments has been updated.
- Improved alignment with RIT-T and AER's guidelines, aligning with the 2022 Integrated System Plan parameters.
- The market modelling undertaken for the PADR assumed that the Dinawan to Wagga Wagga portion of EnergyConnect is built to 500kV but operated at 330kV under both the base case and the option cases. Transgrid and AVP updated the modelling as being built and operated at 330kV under the base case to estimate the expected benefits of the project more accurately for consumers.
- Interaction with the Victorian Government's offshore wind policy was not included in the core scenarios for this cost benefit analysis, but due to increased stakeholder and government support for Victorian offshore wind, AVP and Transgrid expanded the sensitivity analysis to include assessing changes in transmission costs and the Victorian Government's offshore wind policy which assumes significant Victorian offshore wind development going forward.
- Increased transparency in cost estimates and terminal value calculation in their Project Assessment Consultation Report.

Transgrid published an additional Consultation Report in response to community feedback, identifying Option 5 (connects from Dinawan, via the new terminal station near Kerang, directly to WRL at a new terminal station near Bulgana) as the proposed preferred option for further development. However, stakeholders raised concerns about the study's lack of comprehensive engagement and accurate consideration of social constraints. They felt that agricultural impacts, mental health, and community opposition to Option 5 were not adequately addressed. The justification for Multi Criteria Analysis ratings was found lacking, with economic factors being prioritised over social, cultural, and environmental aspects, as is currently required by the RIT-T process. Regional plans and development directions were also not given sufficient consideration and it was suggested that the modelling overlooked impacts on land value, agriculture, tourism and lacked modelling disclosing the WRL and VNI West projects' carbon footprints.

In response to the concerns raised, Transgrid and AVP explored a variant of Option 5 called Option 5A, which involved selecting a different crossing point over the Murray River (north of Kerang rather than near Echuca) and allowing for higher hosting limits for renewable generation in the Murray River Renewable Energy Zone. Furthermore, Transgrid and AVP actively explored opportunities to increase the capacity for renewable generation within the VNI West project. To ensure accurate cost estimation that reflect the current market and labour trends, Transgrid and AVP updated their cost estimates to reflect latest market and labour trends. This update incorporated the latest information and insights from AEMO's 2023 Transmission Cost Database which highlights material and labour price inflation, as well as

the recently announced additional landholder payments by the Victorian Government. This involves payments to landowners for a typical area of transmission easement at a standard rate of \$8,000 per year per kilometre of transmission hosted for 25 years. The refined route option, considering stakeholder feedback, includes fewer environmental constraints and avoids intercepting the Patho Plains, an area of significant grassland habitat known to support the endangered Plains-wanderer bird. It also avoids passing near Ghow Swamp, a place of national cultural significance.

Undergrounding is once again a preferred transmission method advocated for by the community due to its perceived lower impact on flora, fauna, landscape, and visual aesthetics, reduced bushfire risk and lower impact on agricultural productivity including inability to operate tractors, drones, and airborne pesticide distribution. Specific requests were made for undergrounding in urbanised areas, areas of high landscape value, and around habitats of endangered species. AVP and Transgrid are considering partial undergrounding in areas where severe impacts cannot be avoided, but state that full undergrounding is not feasible because of the technical feasibility for undergrounding being limited to 70km. However, cost effective alternatives such as route diversion, screening, and line tower design will be prioritised.

2.4.3 Western Renewable Link Victoria (WRL)

The Western Renewables Link projects consists of a proposed 190km long transmission line extending from Bulgana near Stawell in Western Victoria to Sydenham in Melbourne's North-West via a new terminal station to the North of Ballarat.



Figure 2 Local farmers' protests of AusNet's Renewables West project

The community has expressed several concerns regarding the stakeholder engagement process. They have highlighted inadequate advertisement of community meetings, resulting in limited awareness and participation. Additionally, there is dissatisfaction with the limited notice provided for project updates (such as March 2021 session with announcement of the single corridor, scheduled for mid-year 2021), as well as long waiting times for community drop-in sessions that impede in-depth discussions on important matters. Stakeholders have also reported unsatisfactory or inadequate answers from AusNet representatives, leading to concerns about the effectiveness of the communication process. The community has expressed dissatisfaction with the phone services, noting that they were not effective in providing immediate assistance. Furthermore, there are concerns about the lack of empathy demonstrated by staff members during interactions. Stakeholders have felt that their concerns and feedback were not fully understood or addressed and levels of concern are illustrated in the signs of protest across various local farms (Figure 2).

The community has raised significant concerns regarding threats to biodiversity in relation to the proposed project. They have emphasised the importance of preserving habitat provided by hollow-bearing trees and riparian corridors along waterways. Observations of diverse fauna, including kangaroos, wombats, bats, brologas, and raptors, have highlighted the ecological value of the area.

Stakeholders have also highlighted the presence of rare species such as *Grevillea Steiglitziana* and Braid Moss, underscoring the need for conservation efforts. Concerns extend beyond terrestrial wildlife, with stakeholders identifying important nesting sites for some bird species. The presence of platypi and Rakali around Clunes has also been noted. In addition to biodiversity, stakeholders have expressed worries about visual amenity and the potential loss of land value. Landscape impacts on volcanic cones, tourist spots, and night sky views are significant concerns. Furthermore, stakeholders have raised issues regarding electromagnetic force and its potential health risks, particularly in relation to pacemakers. The possibility of lightning strikes and flashovers has also been mentioned.

There have been additional concerns regarding bushfires in relation to the project. These concerns include fears of fires starting due to project infrastructure, potential impacts on bushfire management activities such as planned burning and aerial firefighting, difficulties in escaping forest areas during a bushfire event, coupled with the worsening of fire weather conditions and fire risk due to climate change. The community has proposed undergrounding

as a potential solution to mitigate these concerns. However, AusNet has argued that while overhead transmission lines may cause less ground disturbance and provide cost-effective connections for renewable energy generators, they also meet the necessary requirements for electricity system availability and reliability. AusNet maintains that overhead construction is the most feasible option for the entire project.

The proposed route for AusNet's transmission line has been informed by community and stakeholder feedback, as well as technical studies, field surveys, and investigations. The key refinements for each area include:

- Bolwarrah: The new route minimises impacts on heavily vegetated areas while maximising the use of cleared land. It avoids a large cluster of endangered Brooker's gums but still impacts other clusters. The wetland adjacent to the Moorabool River West Branch, a potential habitat for growling grass frogs, is avoided. The route also maximises distance from houses in the Tooheys Close area and reduces visual impact through screening.
- Mt Steiglitz to Korjamnunnip Creek: The refinement increases the distance from houses and minimises land use impacts in this area.
- Myrning: The route reduces the visual scale of towers from the Myrning township by increasing the distance between the transmission line and the town. It is set against the backdrop of forested hills and ridges of the Lerderderg State Park, minimising visual impacts on adjacent houses. Efforts are made to minimise impacts on the area of cultural sensitivity associated with Myrning Creek.
- Darley military camp area: Refinements are made to further reduce impacts on the military camp site and Grey Box Grassy Woodlands.
- Merrimu Reservoir: The route avoids impacts on the significant ecological values of Long Forest and Aboriginal cultural heritage sites. It maximises distance from residential properties and avoids potential impacts on any future dam wall upgrade works. The route also minimises impacts on existing quarry operations.
- Melton — MacPherson Park: The route avoids threatened ecological communities and areas of Aboriginal cultural heritage sensitivity. It does not directly impact the sporting fields at MacPherson Park and follows property boundaries to minimise impacts on landholders. The current operations at Melton Aerodrome are also considered to minimise disruption.

A common theme observed across all three projects was the topic of undergrounding and its dismissal by project coordinators, as well as sentiments regarding

the long-term advantages of underground transmission. Stakeholders argued that the initial cost and time investment of undergrounding (and the technical limit to short distances) would be outweighed by the significant benefits it offers. These benefits include enhanced safety and reduced health risks associated with electromagnetic fields, preservation of visual amenity and landscapes, safeguarding property values, minimising biosecurity threats where concerns were raised in relation to construction risks, preserving productive farming operations, and mitigating the risks of bushfires. Stakeholders also highlighted the importance of meaningful community engagement throughout the decision-making process for all three projects. They highlighted the need for transparent and inclusive dialogue that considers the perspectives and concerns of all stakeholders. By fostering a collaborative approach, stakeholders believed that a more balanced and equitable outcome could be achieved, considering the interests of the community to achieve long-term sustainability in transmission projects.

2.4.4 New South Wales Undergrounding Inquiry

A NSW Parliamentary Inquiry was conducted into the feasibility of undergrounding the transmission infrastructure for renewable energy projects¹. The Committee inquired into (a) the costs and benefits of undergrounding; (b) existing case studies and current projects regarding similar undergrounding of transmission lines in both domestic and international contexts; (c) any impact on delivery timeframes of undergrounding; (d) any environmental impacts of undergrounding.

The inquiry's report was released in late August 2023. Its key findings and recommendations are:

Finding 1

That, in considering all the evidence, the current plan for constructing HumeLink as a 500 kV overhead transmission line is the correct approach especially given the applicable regulatory environment and the lack of any action to date in progressing the undergrounding option.

Recommendation 1

That the NSW Government consider the viability of changing the New South Wales planning framework to require:

- *a comprehensive cumulative impact study to be undertaken before any renewable energy zone (REZ) is declared; and*
- *community consultation on any proposed REZ to start at the scoping stage to allow adequate consideration of viable alternatives.*

Recommendation 2

That the NSW Government consider the creation of an independent ombudsman to oversee consultation upon, and rollout of, renewable energy projects and transmission infrastructure in New South Wales and to receive and handle complaints about these processes.

Based on a negative response to the findings and recommendations, with some politicians and community questioning the integrity of the first Parliamentary Inquiry, on September 13, a subsequent Select Committee Inquiry has been announced. The Term of Reference include:

"1. That a select committee be established to inquire into and report on the feasibility of undergrounding the transmission infrastructure for renewable energy projects, and in particular:

- (a) the costs, benefits and risks of underground versus overhead transmission lines, particularly with regard to bushfire and other weather-related events, ongoing environmental impacts, and community mental health and welfare*
- (b) existing case studies and current projects regarding similar undergrounding of transmission lines in both domestic and international contexts*
- (c) any impact on delivery timeframes of undergrounding with broad community consensus versus overhead transmission with large scale opposition*
- (d) any other related matters.*

*2. That the committee report by 31 March 2024."*²

¹ Feasibility of undergrounding the transmission infrastructure for renewable energy projects (nsw.gov.au).

² <https://www.parliament.nsw.gov.au/committees/listofcommittees/Pages/committee-details.aspx?pk=320#tab-termsreference>

3.

International Case Studies

3.1 Summary of Case Studies

Six case studies involving projects that have either recently been completed or have commenced design and construction phase were reviewed for this research considering technical, economic, environment and social aspects. The Powering Sydney's Future project was also included in these case studies as it provides a very recent example of a large underground transmission project. A summary of the projects is provided in Table 4 followed by a discussion on each case study.

Table 4. Case Studies for up to 500kV OHTL or UGTL Projects

Project Name	Year Completed or to be Completed	Location	Voltage (kV)	Capacity	Approximate Capital Costs	Features of Project
Southern California Edison	2016	California, USA	220 and 500 kV AC OHTL 500 kV AC UGTL	OHTL & UGTL 1732 MVA (normal) 3031 MVA (emergency)	Total project cost: \$2.7B USD (2019) UGTL Cost: \$224M USD (2013)	272 km OHTL (lattice tower design), 5.6 km UGTL (2 cables per phase with 2500 mm ² Cu cable in ducts)
West Coast Interconnector - Idomlund to German border	2022 to 2023	Denmark	400 kV AC OHTL and 400 kV AC UGTL	OHTL 2494 MVA (normal) 2771 MVA (maximum) UGTL 1663 MVA (continuous) 2494 MVA (40 hr short term rating)	Total project cost: €512M EUR (2023) UGTL Cost: €147M EUR (2023)	146 km OHTL (aesthetic low tubular tower design with triple bundles), 26 km UGTL (comprising 9 sections of XLPE 2500 mm ² AL cable)
Balen to Mapai	2021 to 2025	Sarawak Malaysia	500 kV AC OHTL	2200 MVA	Not Available	177 km OHTL (62 to 70 m lattice towers with quad bundled conductors) Comprehensive EIAS
Powering Sydney	2023	Sydney Australia	330 kV AC	2 x 750 MVA	\$235M AUD (2022)	20 km UGTL (2500 mm ² Cu cables - laid in trefoil in duct banks and on bridges)
Hinkley Point Connection— National Grid UK	2022 to 2026	United Kingdom	400 kV AC OHTL and UGTL	2 x 2404 MVA continuous rating	£655.7 UK (2022)	48.5 km OHTL (new T-Pylon structures replacing existing 132 kV) and 8.5 km UGTL (in area of ONB) Comprehensive PEIS
Suedlink DC3 and DC4 HVDC Transmission Link	2026	Germany	+ 525kV HVDC UGTL	2 x 2000 MW	€11B EUR (2022)	700km 4GW 525kV HVDC underground transmission link with VSC converter stations.

3.2 Case Study 1 - Tehachapi Renewable Transmission Project, California USA

Overview

The Tehachapi Renewable Transmission Project (TRTP) is a series of new and upgraded high-voltage electric transmission lines and substations capable of carrying 4,500 megawatts of electricity from renewable and other generators in Kern County south to San Bernardino County, California, USA.[3]

One of the main reasons for the project was the urgent need to decarbonise the SCE grid, mainly through connections to several large wind farms. The project comprises 278km of transmission lines which replaced many of Southern California Edison's (SCE's) existing 220-kV lines with 500kV. They were all overhead lines except for 5.6km where the line passed through the city of Chino Hills.

The undergrounding was a result of the California Public Utilities Commission (CPUC) granting a request by the City of Chino Hills to underground the 5.6km segment of the project. This was a reversal of an earlier decision in 2009 where they had approved the project in spite of public opposition (Nelson, Swanson & Cain, 2018). Their subsequent finding was that the design of the above ground line effectively ignored community values and placed an unfair and unreasonable burden on residents. The cost estimate of the undergrounding in Chino Hills was approximately \$224 million. This included an offset for Chino Hills' financial contribution of real property, which was valued at approximately \$17 million USD. [4] From a technical point of view, Bucco et al. (2017) have reported that as a consequence of the inclusion of underground cables it:

"...causes the line to draw significant charging current, resulting in severe overvoltage conditions when the line is open circuited or lightly loaded".

This case study focuses on the underground cable section and the public opposition and process that led to the undergrounding outcome, with the project being completed in 2016.

Project Details

A summary of the project technical details is provided in Table 5.

The inclusion of underground cable necessitated the installation of reactive compensation in the network at Mira-Loma substation. A single line diagram of the 500kV network containing the underground cable is shown in Figure 3.

Construction Aspects

A map showing the overall scope of Tehachapi Renewable Transmission Project is provided in Figure 4 and a map showing location of the underground cable section in Figure 5.

Table 5. Project details—Tehachapi Renewable Transmission Project

Project owner:		Southern California Edison (SCE)
Overhead Lines:		
Voltage	220kV and 500kV AC	
Circuit configuration	Double circuit and Single Circuit	
Construction type	Double circuit and single circuit steel poles and lattice towers	
Route length - overhead	272km	
Underground Cable:		
Voltage	500kV AC	
Circuit configuration	500-kV XLPE cable system consisting of one circuit with two cables per phase of 5000 kcmil (2500mm ²) copper conductor.	
Construction type	Cables in concrete duct, banks grounded at a single point.	
Route length - underground	5.6km	
Transfer Capacity	1732 MVA (2000A) normal operation 3031 MVA (3500A) emergency operation There are spare conduit provisions to install a third cable per phase.	
Cable manufacturer	Taihan Electric Wires (South Korea)	
Project Costs:		
Total Cost—Lines and substations	\$2.7B USD (2019) [5]	
Estimated cost - Underground	\$224M USD (2013) [4]	
Project Construction Duration:		
		Overall project: 2010 to 2016 Underground section: 2014 to 2016
Project status:		
		Completed 2016

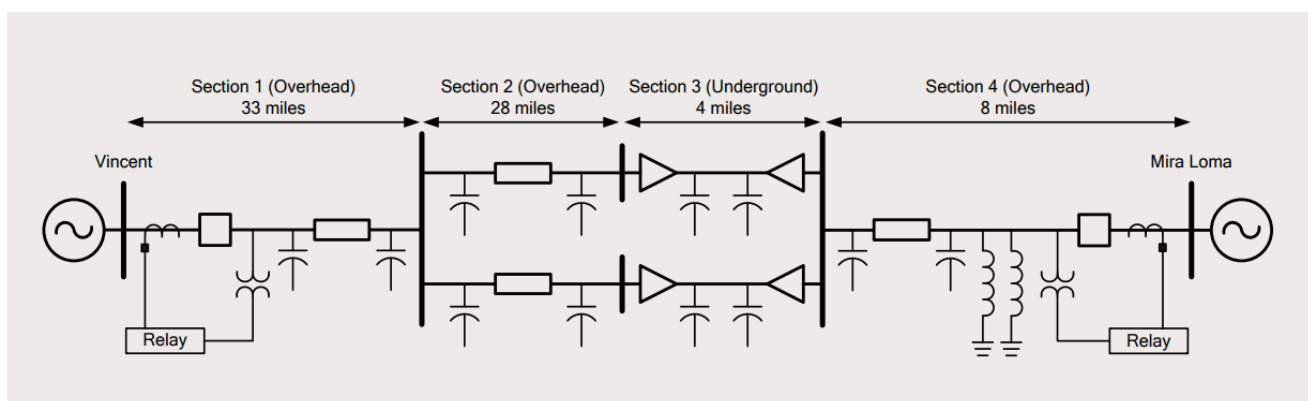


Figure 3. Single Line Diagram—500kV overhead and underground circuits (D. Bucco et al. [6])



Figure 4. Project Overview Map—Tehachapi Renewable Transmission Project (Southern California Edison)

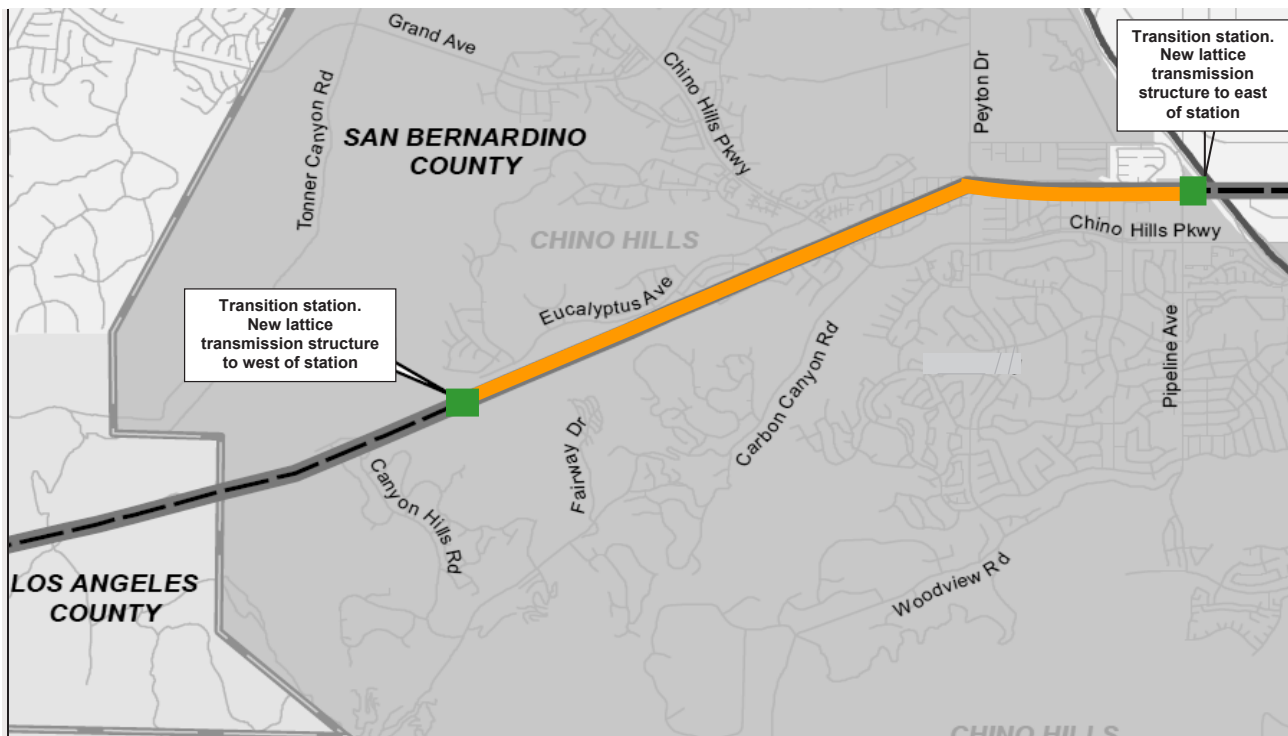


Figure 5. Undergrounding route map—Tehachapi Renewable Transmission Project (Southern California Edison)

Although the underground section of the project represented only 1.5% of the transmission line route it presented engineering and construction challenges because of the hilly terrain and location of transition stations. Figure 6 and Figure 7 illustrate the type of terrain [7].



Figure 6. 500kV Underground Cable Trench Installation at Chino Hills (T&D World)



Figure 7. Tehachapi 500kV Underground Cable Installation (dailybulletin.com)

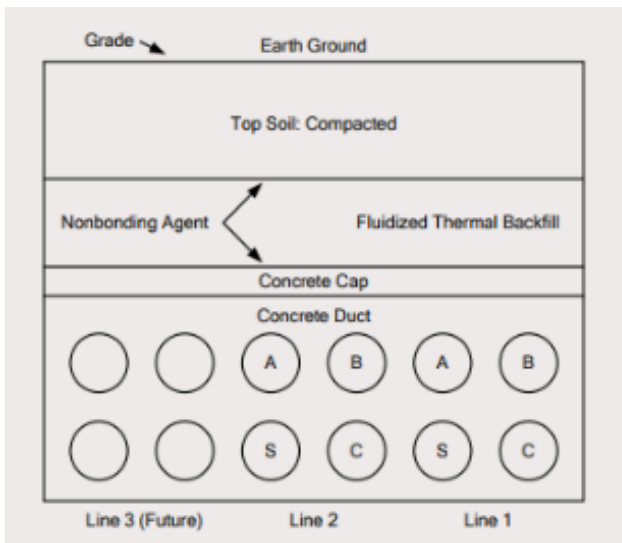


Figure 8. Underground Cable Trench Configuration (D. Bucco et al. [6])



Figure 9. 500kV Transition Station, Chino Hills (Southern California Edison)

The general configuration of the cable installation Trench is shown in Figure 8.

Restraining the cables along the route where they traversed steep hills also required special attention. Because of the flexible restraint systems in the vaults, the splices were not capable of restraining cables to fight gravity and prevent them from sliding downhill. Therefore, at six locations along the route, purposely built restraint vaults were designed to anchor the cables to prevent them from moving.

The two transition stations, each about 3 acres (1.2 hectares) in size, constituted major civil engineering work on their own. Because of the hilly terrain, the Western Transition Station required approximately 170,000 cubic yards (130,000 cubic m) of cut and 60,000 cubic yards (45,000 cubic m) of fill. The Eastern Transition Station involved the demolition of old buildings and hazardous contamination remediation. Key features of both stations are the cast-in-place concrete cable trenches, which were designed to relieve mechanical stress in the cable terminations by providing a space that would enable the cables to expand freely into the trenches.

Environmental Aspects

The California Public Utilities Commission was responsible for managing environmental impact assessment. Project configuration and route options were evaluated in an extensive EIS—Tehachapi Renewable Transmission Project Environmental Impact Report/Environmental Impact Statement. [8] The environment analysis in the report covered the following aspects:

- Aesthetics
- Agriculture
- Air Quality
- Biological Resources
- Cultural and Paleontological Resources
- Geology and Soils
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Mineral Resources
- Noise
- Population and Housing
- Public Services
- Public Utilities
- Traffic and Transportation
- Wilderness and Recreation

Social licence and impacts on landholders and communities

There was a large degree of public opposition to the project with a number of appeals through the courts. These caused multiple delays in the construction process and resulted in the undergrounding of the 5.6km segment through the built-up area. In short, the City of Chino Hills and their residents were not happy with the size of the transmission infrastructures being built, even though it was along an existing easement. In the protest document it was outlined that:

“...approximately 1046 homes will be located less than 500 feet from the proposed line. Currently these

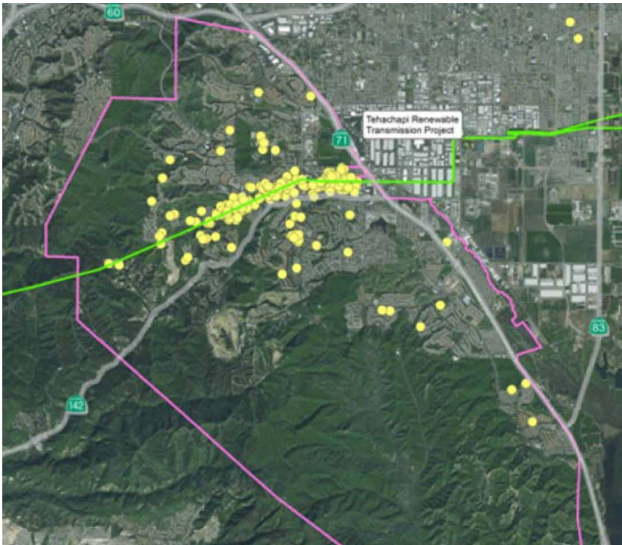


Figure 10. Aerial Image Showing image showing the boundary of Chino Hills, California (purple Line), the route of the power line project (green line), and location of Citizens who commented on the EIR (yellow dots).

(Esri, Digitalglobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AerGrid, IGN, and the GIS User Community)

neighbourhoods are dissected by a 150-foot-wide SCE easement on which there is a de-energized 220kV transmission line."

Figure 10 clearly shows location of those who commented on the Environmental Impact Review as well as the park areas nearby. Objections were around the size of the proposed towers "towering over the 'backyards'" and negatively impacting the "safety and welfare of the residents".

While considerable effort was spent investigating alternate routes. For example, at one point a proposed alternative involved the transmission line being re-routed through a state park. While a less populated area, the Recreation and Parks opposed the idea based on environmental and visual impacts. While the project progressed the City Council continued to lobby against the project with a renewed focus on undergrounding, which at the time had not really been done before in the US at that voltage [9]. With some controversy in its decision, in 2013 the CPUC overturned its original decision and moved the project towards undergrounding. The CPUC was responsible for regulatory approvals which included the environmental impact assessment phase.

In their 2007, protest application document, lawyers Day and Armstrong, on behalf of the City of Chino Hills, outlined pragmatic concerns about the SCE's planning process. They referred to the lack of effort by the SCE

to consider viable alternatives, based on various project objectives that had been set. For example, Objective 8: Selection of the shortest feasible route and Objective 9: Meeting project needs in a timely manner. However, as was witnessed these objectives ultimately delayed the overall project delivery and resulted in additional costs and delays being incurred. Concerns around the safety considerations of electromagnetic fields were also raised at the time by many as a reason to object to the large infrastructure.

Minimising environmental impact

Examining the objections that were documented, size of laydown areas and marshalling yards for assembly and storage of poles and equipment and uncertainty about the vehicle and construction machinery requirements (i.e. cranes) and movements were items of concern. Particularly, ground disturbance and visual impact of such large infrastructures. Bushfire potential was also cited as reasons for seeking alternative routes but also recognition that the route choice by SCE in some instances was justified because of bushfire potential in some areas. Finally, a number of geological concerns centred around the existence of active faults, the potential for landslides and some potential for liquefaction were all raised as further environmental and safety reasons for seeking alternative routes. Vegetation management plans were required to ensure biodiversity considerations we well managed as part of the process.

Community consultation and engagement

SCE, as the project owner, was responsible for the stakeholder communication during the construction phase. Their website contains example Questions and Answers which consolidate many of the concerns that have arisen in the literature. While extensive community and stakeholder engagement occurred throughout the project (with the types of communications materials also available on the website), it is clear, from this case study, that any concerns about such a project, will need to be overcome with fair and transparent processes, fact-based information and strong leadership by the project proponent and communities they are working with.

3.3 Case Study 2 - West Coast 400kV AC Interconnector, Idomlund Denmark to German border

Overview

The project [10] is the part of a 400kV AC interconnector between Idomlund to the German border in Denmark. The transmission line comprises two 400kV AC circuits of with 146km of overhead line with 9 short sections totalling 26km of underground cable through socially and environmentally sensitive areas.

German TenneT and Danish Energinet [11] are working together to plan and build this high-voltage transmission line connecting the German and the Danish electricity transmission systems. It is part of a so-called European “project of common interest” (PCI). To become a PCI, a project must have a significant impact on energy markets and market integration in at least two EU countries, boost competition on energy markets and help the EU’s energy security by diversifying sources and contribute to the EU’s climate and energy goals by integrating renewables.

The interconnection consists of a German section from a new-build substation in Klixbüll near Niebüll in Schleswig-Holstein to the Danish border, and a Danish section starting from the German border and ending at the Endrup substation near Esbjerg in Denmark.

The project is currently in progress and due for completion 2023.

Project Details

A summary of the project technical details is provided in Table 6.

Table 6. Project details—West Coast 400kV AC Interconnector, Idolum to German Border, Denmark

Project owner:	Energinet
Overhead Lines:	
Voltage	400kV AC
Circuit configuration	Double circuit
Construction type	The towers for the overhead line are in a new design called Thor-gi. It is a lattice tower with galvanised steel tubes. Because of the tubes instead of angle bars, the tower is more open with larger distance between the members. All phase conductors are placed in one level and there is only one crossarm. This means a relatively low tower. The phase conductors are 945 mm ² AAAC in a triple configuration.
Transfer capacity	2771 MVA (4000A) maximum 2494 MVA (3600A) normal operating
Underground Cable:	
Voltage	400kV AC
Circuit configuration	Double circuit - 400-kV XLPE cable system consisting of two circuits each with two cables per phase of 2500mm ² aluminium conductor. Cross bonded system.
Construction type	Cable installation method—direct buried into the soil. Backfill is sand with max thermal resistivity 0.8 Km/W. Under roads, streams etc. - horizontal directional drilling with one tube for each single phase cable.
Route length - underground	Total of 9 sections = 26 km
Transfer Capacity	1663 MVA (2400A) continuous 2494 MVA (3600A) 40-hour short term rating
Cable manufacturer	LS Cable (Korea) and Taihan Electric Wires (Korea)
Project Costs:	
Total Cost—Lines and substations	Endrup-Idomlund: €294M EUR (2023) Endrup-German border: €218M EUR (2023)
Estimated cost - Underground	€147M EUR (2023)
Project Construction Duration:	2022 to 2023
Project status:	In progress, expected commissioning in 2024

Undergrounding Investigation

An investigation and report on undergrounding options for the project was undertaken [12].

In December 2015, Energinet sought the permission of the Minister of Energy, Utilities and Climate to establish 400kV overhead lines between Endrup and Idomlund, and between Endrup and the Danish–German border.

In October 2017, the Minister approved the two projects, and Energinet notified the Danish Environmental Protection Agency of the projects in March 2018. The first public hearing phase of the EIA process ran from 9 April to 9 May 2018, and a series of public meetings

were held at which the projects were presented as was the political agreement from November 2016 which states that, in general, 400kV transmission lines are to be established as overhead lines.

Based on feedback from local residents in the affected areas along the route of the proposed transmission line, the Minister requested Energinet in June 2018, to prepare a technical report detailing, for example the share of underground cabling that can be utilised for the new transmission line. The aim is to find a solution that limits the environmental impact and alleviate any public concerns as much as possible. The Minister requested that Energinet discuss various undergrounding options.



Figure 11. Overview Map of West Coast 400kV AC Interconnector Idomlund Denmark to Germany (Energinet)



Figure 12. Existing 150kV OHTL (left) and Proposed 400kV Structures (right) (Energinet)

HVAC and HVDC options were investigated.

The report concluded:

The possibility of increased 400kV underground cabling has been examined for the defined alternatives A, B, C and D. The conclusion is that it is possible to underground up to 15% of the total distance, corresponding to alternative B. Further underground cabling will result in significant and unacceptable risks to the electricity grid due to system wide amplification of harmonics. Maintaining harmonic distortion within utilized planning levels is extremely important for asset lifetime and a compatible operation. Deviation from planning levels will eventually cause miss-operation to a level that may possibly compromise the security of supply.

Construction Aspects

A map showing the overall scope of the Transmission Project on the Denmark side is provided in Figure 11. The line is currently designed to have 9 sections of underground cable totalling 26km in route length.

The towers for the overhead line are in a new design called Thor-gi. It is a lattice tower with galvanised steel tubes. Because of the use of tubes instead of angle bars, the tower is more open with larger distance between the members. All phase conductors are placed in one level and there is only one crossarm. This results in a relatively low tower. There is one 400kV circuit on each side. Illustrations are provided in Figure 12, Figure 13 and Figure 14.

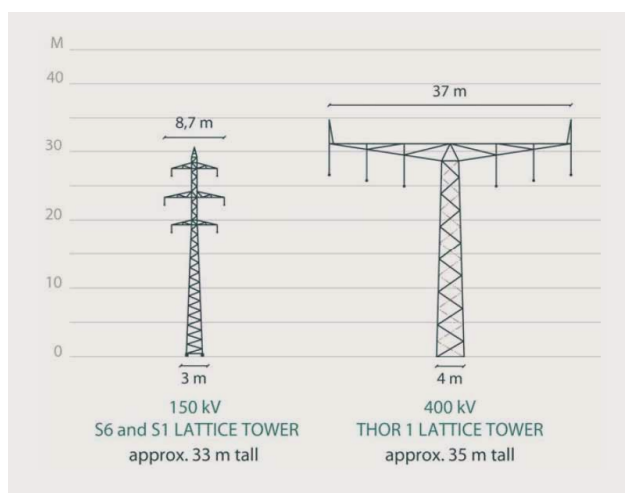


Figure 13. Dimensional Comparison of 150kV and 400kV Structures (Energinet)

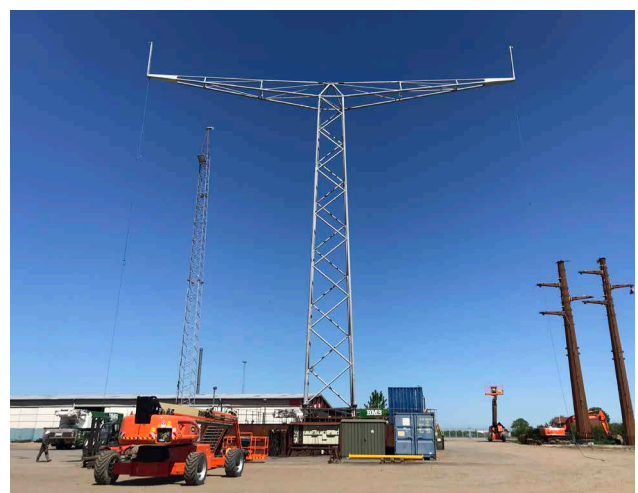


Figure 14. 400kV Double Circuit Thor-gi Tubular Steel Structures (Energinet)

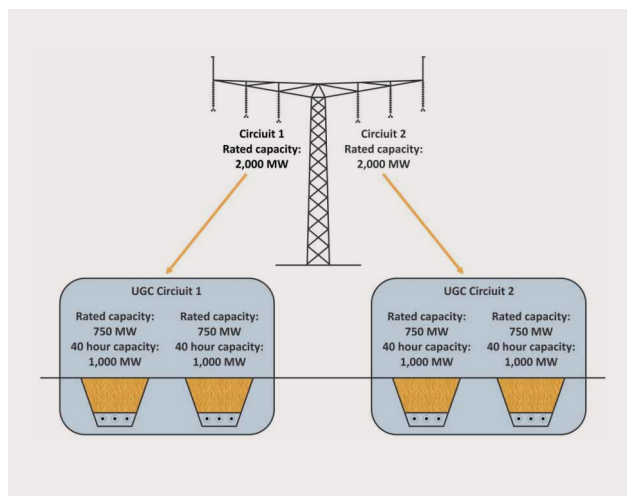


Figure 15. Comparison between Capacity of OHTL and UGTL (Energinet)

To match the rated capacity of a 400kV double circuit OHTL, 12 separate single core cables in four separate trenches are needed as depicted in Figure 15. This results in a work zone of up to 36 metres wide as indicated in Figure 16. UGTLs with a capacity requirement comparable to OHTLs will have significant environmental impacts and restrictions along the route. In this declaration area, the construction of buildings or roads or terrain changes is only permissible in exceptional circumstances. Compared to OHTLs, cables allow for minor adjustments of the right of way for mitigating local land problems.

The inclusion of underground cable sections in the transmission line requires reactive power compensation plant. For this project this will be achieved with variable reactors on the line—partly directly connected to the line in the substations and partly switchable in the substations.

Environmental Aspects

Energinet obtained overall permission from the Climate and Energy Ministry in October 2017 and started the Environmental Impact Assessment process in spring 2018. The first public hearing in April–May 2018 triggered much community concern. There was initially political support to expand the 400kV grid with overhead lines however Politicians became involved with the community concerns about overhead lines. This resulted in undergrounding investigation referred to above. The conclusion was that Energinet could underground up to 26km (route length) of the lines without causing unacceptable risk with respect to quality, reliability, and security of supply.

Environmental Assessments are published on Danish Environmental Protection Agency’s website [13]

The main factors influencing the decision to underground some sections of the line were:

- Short distance to towns or villages—visual impact, proximity to residential properties
- Protected nature and restricted areas because of birds
- Public access to beauty landscape and nature

Following negotiations between Energinet and the Environmental Protection Agency final approvals for the project were obtained in 2023.

Community and Stakeholder Engagement

Energinet commenced negotiations with the landowners and neighbouring property owners. In Denmark Energinet has reached an agreement with the farmers’ organisation on how to compensate farmers and landowners. When overhead lines or underground cables are on their property there are payments between 7700 and 11600 Euros for each

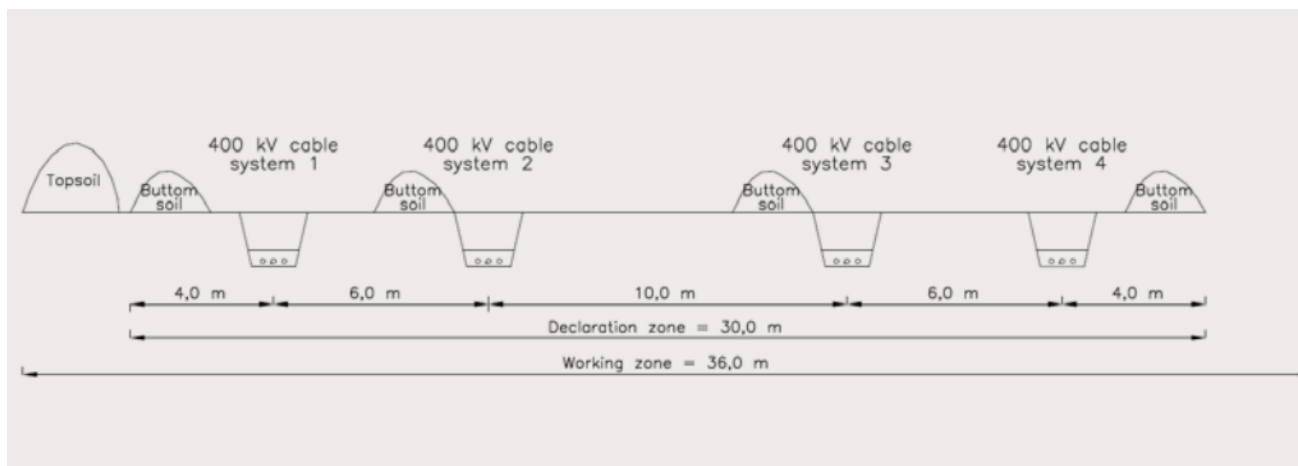


Figure 16. Typical Construction and Declaration Area with Two Cable Systems per OHTL System (Energinet)

400 kV tower and about 0.5 Euros/m² for the area subject to easement. If the overhead line is placed near a residence (living-house), the compensation is a percentage of the market value for the house. The percentage depends on the distance between the house and the overhead line. The graph below shows how this is calculated (Figure 17).

For example, at 80m from the line, the compensation will be 50% of the market value of the house. At 280 m or more there will be no compensation. If there is less than 80m between the overhead line (nearest part) and house (nearest part), Energinet may offer to buy the whole property. If the owner doesn't want to sell (and there is enough space for it), they can be compensated with 50% or more of the market value.

Energinet does not provide any form of community benefit funding for the project. The only compensation is as described above i.e., to the directly impacted landowners and to neighbouring property owners close to the overhead line.

Outside of the formal processes for community consultation and impact assessments cited in the report, the online research has found very little protests or concerns raised or reported on the Endrup - Idomlund Line. It is possible that as concerns about overhead transmission lines near towns and sensitive environmental areas during public consultation were addressed with the underground installations, that the public were satisfied with the process.

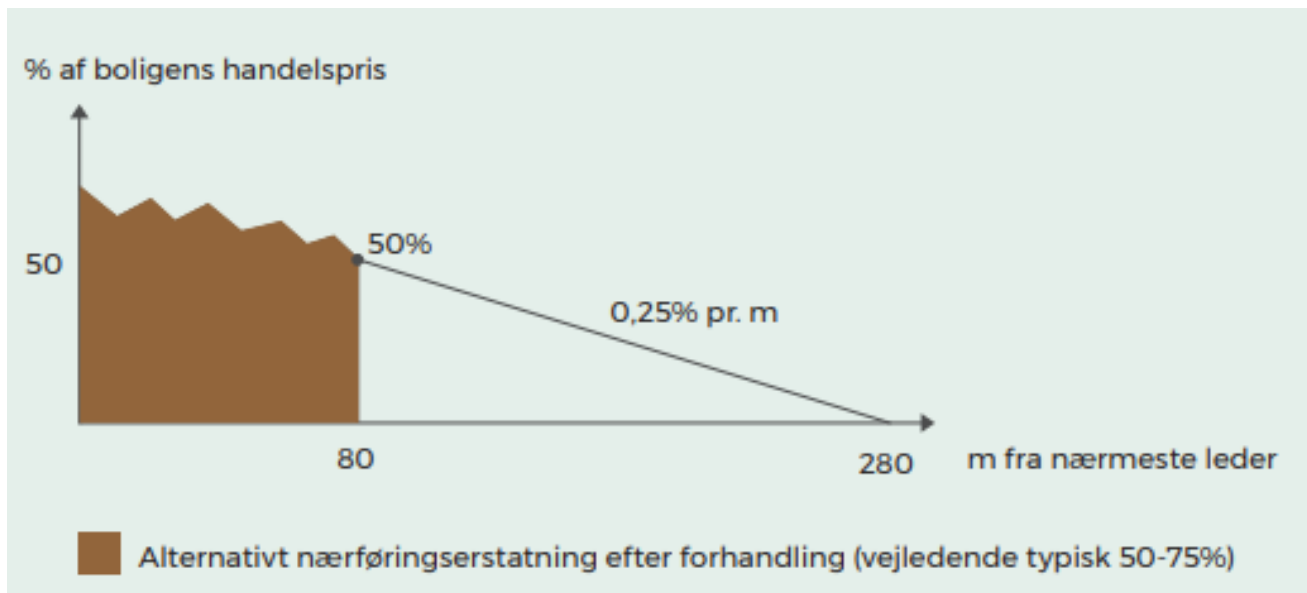


Figure 17. Compensation Values for Neighbouring Properties near Transmission Lines (Energinet)

Translations:

% af boligens handelspris = % of market price for the residence

m fra nærmeste leder = m from nearest conductor

Alternativt nærføringserstatning efter forhandling (vejledende typisk 50-75%) = Alternative compensation after negotiation (consultative typically 50-75%)

3.4 Case Study 3—Baleh–Mapai 500kV Transmission Line, Sarawak

Overview

Sarawak Energy Berhad (SEB) is establishing a 500kV overhead transmission line between 1285MW Baleh hydroelectric project (HEP) and Mapai substation in Sarawak [14].

The primary objective of the project is to contribute to the State of Sarawak’s agenda of sustainable development. The State aims to eliminate the use of diesel-powered electricity supply and allow the affected areas of the proposed project to benefit from hydropower development in Sarawak. The electricity evacuation is aligned with the State and Malaysian Government’s fuel diversification policy, which promotes greater use of renewable energy for power generation.

The main component of the project is a 177km, 2 x Quad conductor Drake 500kV transmission line. The line involves the construction of 413 towers in total—35 are angle towers and 378 are intermediate transmission towers.

The project is currently in progress and due for completion 2024.

Project Details

A summary of the project technical details is provided in Table 7.

Table 7. Project Details—Baleh–Mapai 500kV Overhead Transmission Line

Project owner:	Sarawak Energy
Overhead Lines:	
Voltage	500kV AC
Circuit configuration	Double circuit—2 x Quad conductor Drake 500 kV transmission line
Construction type	There are five types of lattice tower to be installed for this Project: 1. Heavy Suspension Towers (5HS) 2. Dead End-Tension Tower (5DE) / 5RA (Right Angle) 3. Light Angle-Tension Tower (5LA) 4. Medium Angle-Tension Tower (5MA) 5. 5T (Transposition Tower) Towers will be between 62 to 70 m high, depending on terrain and location. The tower platform footprint is approximated at 40m × 40m. 413 towers in total (35 AT and 378 intermediate)
Route length - overhead	177km
Transfer capacity	2200 MVA
Project Costs:	
Total Cost—Overhead Lines and substations	Not available
Estimated cost—Overhead line	Not available
Project Construction Duration:	2021 to 2025
Project status:	In progress, expected commissioning in 2025

Packages	Line Length	Commencement Date	Completion Date	Contract Duration
A	81 km	1 Nov 2021	30 Sept 2024	35 months
B	96 km	1 Nov 2021	30 Sept 2024	34 months

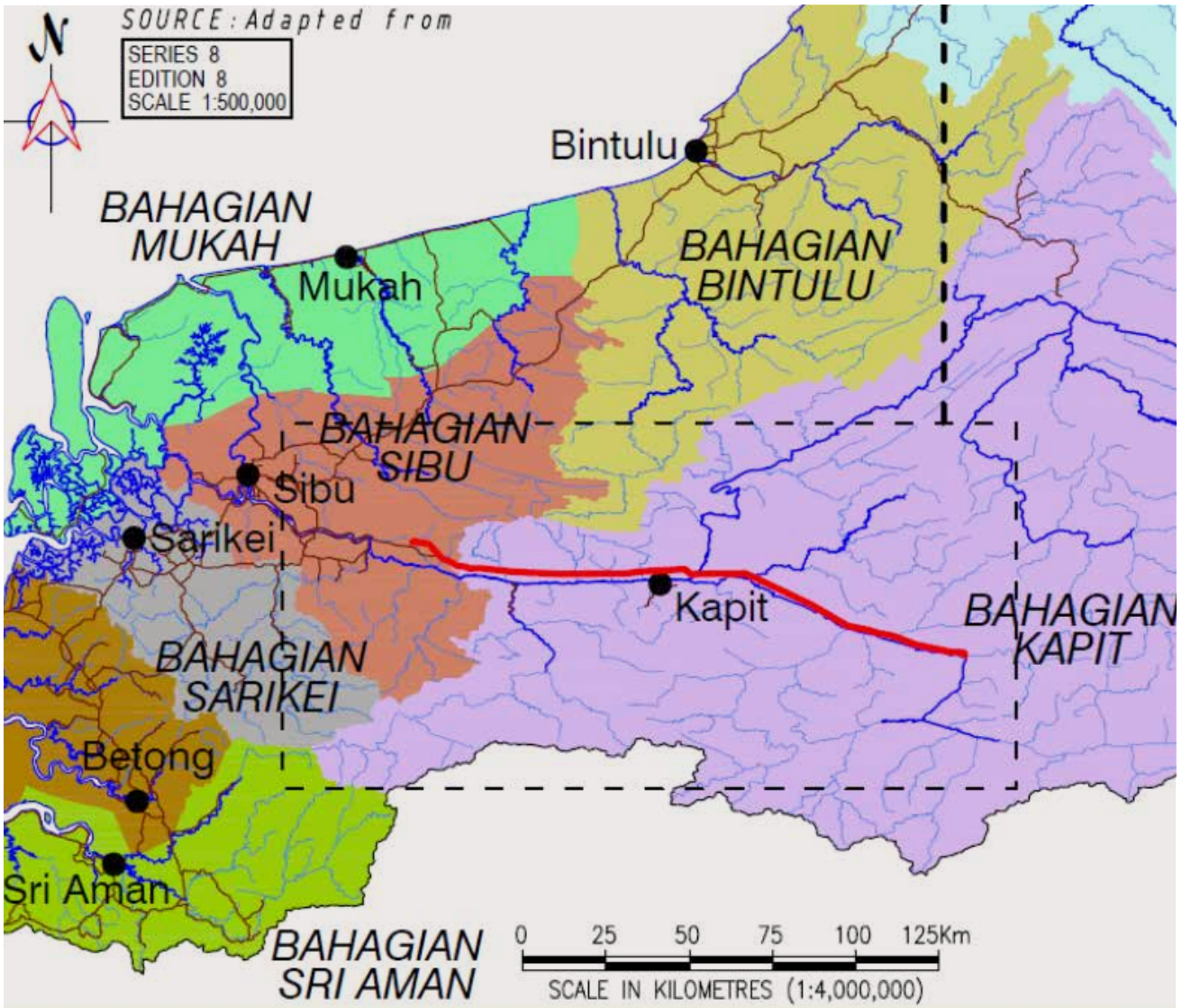


Figure 18. Baleh–Mapai 500KV Transmission Line Overview Map (Sarawak Energy)

Typical overhead line structures for the project are shown in Figure 19. The steel lattice towers shown are 70m and 93m high respectively.

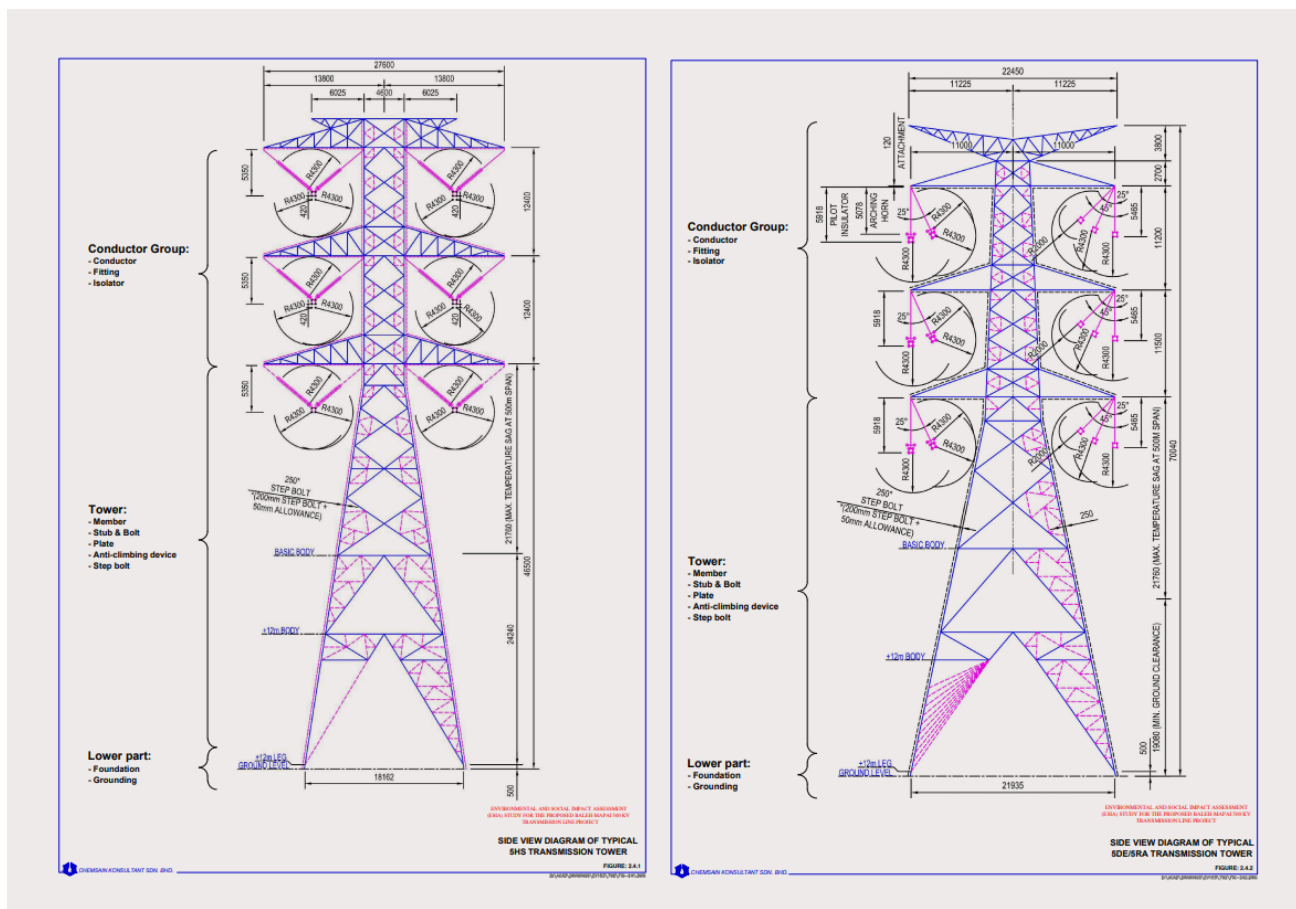


Figure 19. OHTL Structure for Baleh-Mapai 500kv Project (Sarawak Energy)

Table 8. Baleh-Mapai 500kV OHTL Project–Design Clearances (Sarawak Energy)

Table 2.4.4: Electrical Clearance for Lattice Tower 500 kV Transmission Line

Minimum Vertical Clearance to be Ensured from the Line Conductors at Maximum Sag to Ground or by Various Crossings	
To ground	12.0 m
To main road crossing (highway)	18.0 m
To roads, streets, alleys, parking lots, non-residential driveways and other areas subject to truck traffic, tracks and railroads	15.0 m
To water at maximum flood level except navigable rivers, to buildings or structure upon which people may regularly stand	12.0 m
Over major navigable river crossing to water at maximum high-water level including 5 m electrical clearance	50.0 m
Over non-navigable river crossing to water at maximum high-water level	29.0 m
To metal clad or roofed buildings or other structures upon which people may occasionally stand.	6.0 m
To overhead power or telecommunication lines (to cradle)	5.0 – 8.0 m
Minimum Horizontal Clearance to be Ensured between the Line Conductors at Maximum Sag and 45 degrees Swing Angle and Object Near to the Line	
Buildings	6.0 m
Danger trees zone	4.3 m
Minimum Clearance to be Ensured between the Line Conductors at Maximum Sag and 45 degrees Swing Angle and Object Near to the Line	
Side ground clearance	12.0 m

Source: Sarawak Energy Berhad, 2020

A right of way (ROW) with a width of 50m will be established for the Project. The design vertical and horizontal clearances to structures are documented in the ESIA study in Table 8.

Environmental and Social Aspects

The Environmental and Social Impact Analysis (ESIA) Study for the project is found on Sarawak Energy’s website [14]. The report considered impacts on several aspects:

- Land use
- Soil erosion
- Water quality
- Air quality
- Noise
- Wastes
- Greenhouse gases
- Traffic and transportation
- Biological resources
- Social resources
- Cultural Heritage
- Public health and Safety,
- Occupational health and safety

Major and moderate impacts identified in Construction Operation and Maintenance were:

- Loss of customary land, crops and livelihood
- Communicable disease (Covid 19)
- Influx and interaction with construction workforce (non local)
- Occupational safety and health

Employment opportunities and capacity building was identified as a positive impact.

Community and Stakeholder Engagement

Engagement and consultations on environmental issues with community members, institutional stakeholders, and potentially affected communities in the form of stakeholder meetings, focus group discussions, social and health surveys, public display of the Environmental and Social Impact Assessment terms of reference (online and physical), etc. were carried out since October 2020. The engagements process involved both formal and informal discussions. The feedback generated through these meetings has been incorporated as much as possible into the design of the project.

The government is compensating landowners impacted by this project and other nearby related projects [15] [16].

3.5 Case Study 4—Powering Sydney's Future—A 330kV Underground Transmission Line

Overview

TransGrid's Powering Sydney's Future project delivered a new 330kV AC underground electricity cable between Potts Hill and Alexandria, along with upgrades to three substations, to help meet the city's future energy needs. [17] The cable route length is approximately 20km. The 330kV cable also replaced 50-year-old cables, which were reaching the end of their serviceable life.

The cable was installed mostly along roads, with some work in parks. Construction involved cable bridges and under-bores (underground crossings) to cross rail corridors, rivers, main roads and underground services.

The project was completed in 2023.

Project Details

A summary of the project technical details is provided in Table 9.

The project was subject to the Australian Energy Regulators (AER) RIT-T approval. The Project Assessment Conclusions Report [19] submitted in November 2017.

Construction Aspects

A map showing the route of the underground cable transmission line is provided in Figure 20. The cable route traversed a very densely populated area of Sydney between Potts Hill and Alexandria. The 330kV underground cable has been installed in PVC duct-banks, mostly along roads, with some work in parks.

Cable bridges were constructed in places and horizontal direction drilling under the ground at some locations to cross rail corridors, rivers, main roads and major underground utility services.

The typical trench dimensions were 2m to 3m wide and 1.2m to 2m deep.

There are a total of 16 cable joint bays (see Figure 21) along the route. The joint bays are formed using pre-fabricated concrete sections with completed dimensions approximately 10m long, 3m wide and 2m deep.

Cable sections up to around 900m in length were installed between joint bays (see Figure 22 and Figure 23).

Table 9. Project Details—Powering Sydney’s Future 330kV Underground Transmission Line

Project owner:	Transgrid
Underground Cable:	
Voltage	330kV AC
Circuit configuration	330kV XLPE cable system consisting of one cable per phase of 2500mm ² copper conductor, smooth aluminium sheath.
Construction type	Standard configuration is trefoil, in a duct bank. Ducts were laid for two circuits but only circuit installed initially. The other set is for future use. One of the sets of trefoils is inverted. There are some locations such as bridges with flat formation, and some HDD locations both in flat and trefoil formation.
Route length - underground	20km
Transfer capacity	750MVA (1312A)
Cable manufacturer	Taihan Electric Wires (South Korea)
Project Costs:	
Total Cost	\$235M AUD (2017) [18] i.e. \$11.75M per km
Estimated cost—Overhead line	Not available
Project Construction Duration:	
	2021 to 2025
	Dec 2019 Contract award Jan 2020 Start of detailed design Feb 2020 Published EIS Submissions Reports May 2020 Project determination Jul 2020 Completion of detailed design Nov 2021 Main construction Mid 2023 Permanent Road restoration
Project status:	Completed 2023

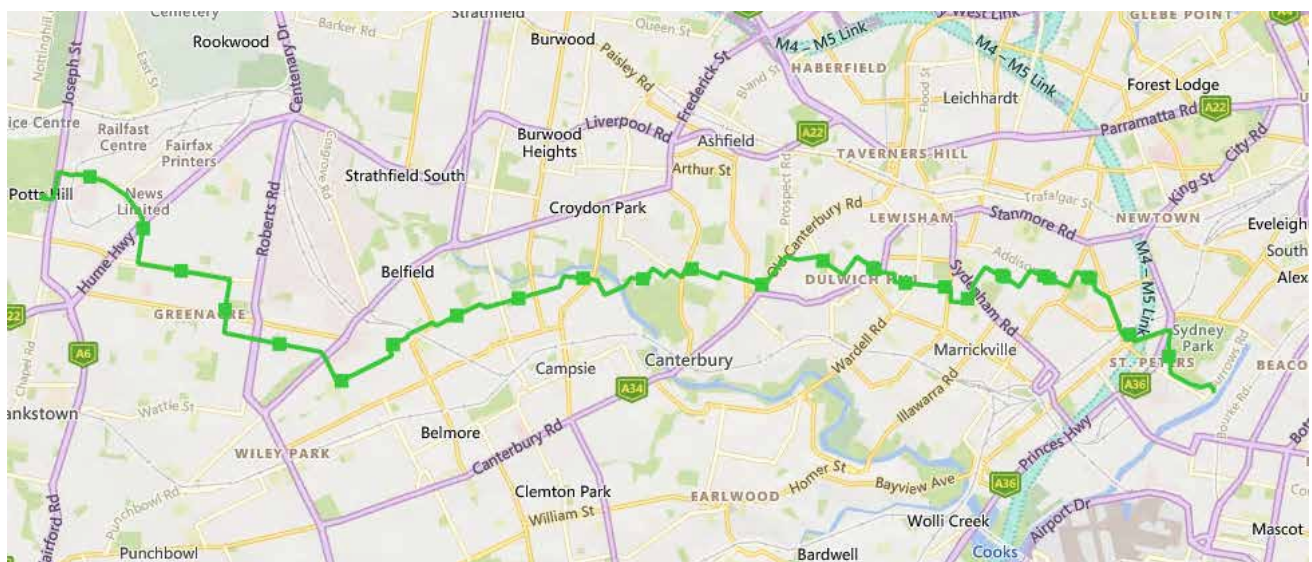


Figure 20 Powering Sydney Future 330kV Cable Route Showing Joint Locations (Transgrid)

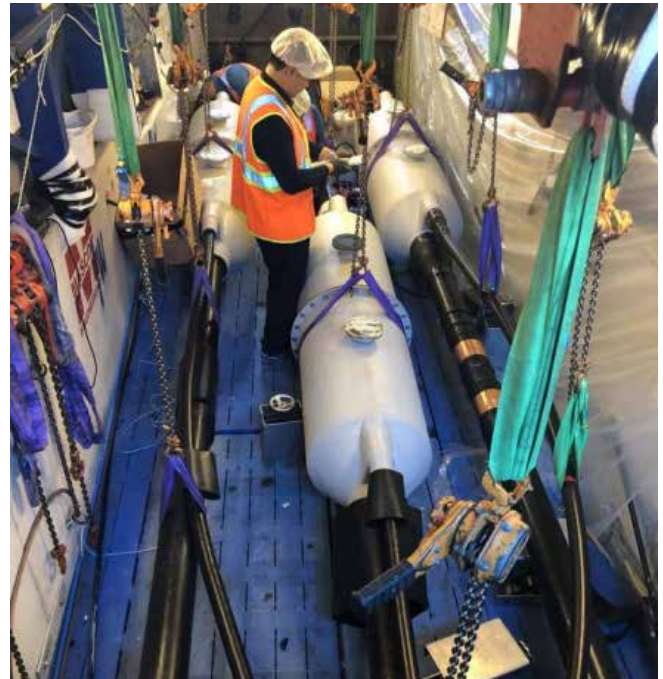


Figure 21. Powering Sydney’s Future—330kV Cable Joint Bay (Transgrid)

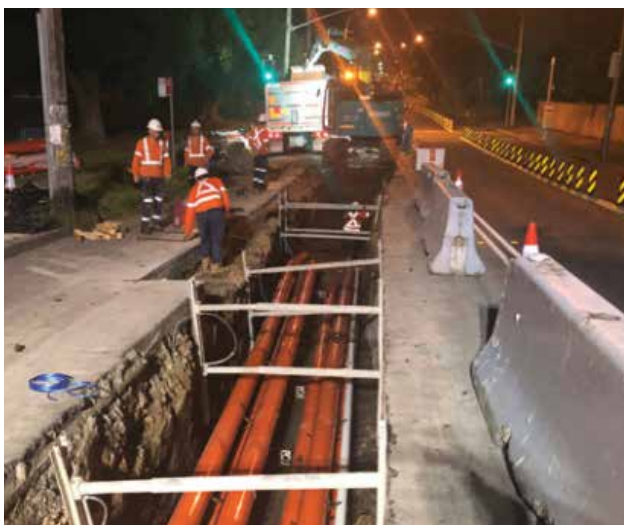


Figure 22. Powering Sydney’s Future 330kV Cable Trench and Conduit Installation (Transgrid)



Figure 23. Powering Sydney’s Future—330kV Cable Drum (Transgrid)

No new reactive compensation plant was required for the project. Existing plant at substations was considered adequate.

The project construction occurred over a period of approximately 18 months.

Environmental and Social Aspects

The Environmental Impact Statement [20] identified the key impacts as:

- traffic and transport;
- noise and vibration;
- air quality;
- electric and magnetic fields;
- landscape character and visual amenity;
- soils and contamination.

There were other relevant environmental aspects considered for the project including:

- surface water and flooding;
- groundwater;
- biodiversity;
- land use and property;
- Aboriginal heritage;
- non-Aboriginal heritage;
- social and economic;
- hazards and risks;
- waste management;
- cumulative impacts

Regulatory approvals following the EIS were completed in February 2020.

Community and Stakeholder Engagement

The following community and stakeholder groups were consulted during the planning and approval phases of the project.

- impacted stakeholders including schools, childcare centres, businesses, property/landowners, residents, healthcare providers, consumer groups, emergency services and religious institutions;
- Aboriginal stakeholders, including Local Aboriginal Land Councils;
- elected government officials and local government, including councils in the local government areas of Sydney, Canterbury-Bankstown, Inner West, and Strathfield;
- government authorities including Roads and Maritime Services, NSW Environment Protection

Authority, NSW Office of Environment and Heritage, Department of Industry—Water, Water NSW, Transport for NSW, Greater Sydney Commission, NSW CBD Coordination Office, Department of Education NSW;

- major development proponents/transport operators including Sydney Motorway Corporation, Sydney Metro, Sydney Light Rail, Sydney Trains, Australian Rail Track Corporation;
- utility providers including Ausgrid, Sydney Water, Telstra, Optus, Jemena, Viva Energy, Sydney Metropolitan Pipeline;
- special interest groups, including community, environmental, pedestrian and bicycle user groups;
- directly impacted communities (within 100 metres of the project area); and the broader community.

During the construction phase special consideration was made in relation to the engagement and communication with the culturally diverse communities along the route. Tailored communications to suit the specific needs of such multi-cultural groups were employed.

An overview of the community and stakeholder engagement is provided in Figure 24.

Transgrid also worked to provide meaningful support to local businesses directly impacted by construction on PSF by engaging Realise Business to implement a strategy to help businesses ride out building work with minimal disruption. During construction Transgrid also provided \$190,000 in community grants to support the work of local not-for-profit groups along the project route. The project is due for completion in mid-2023 with final road restoration works being the last activity.

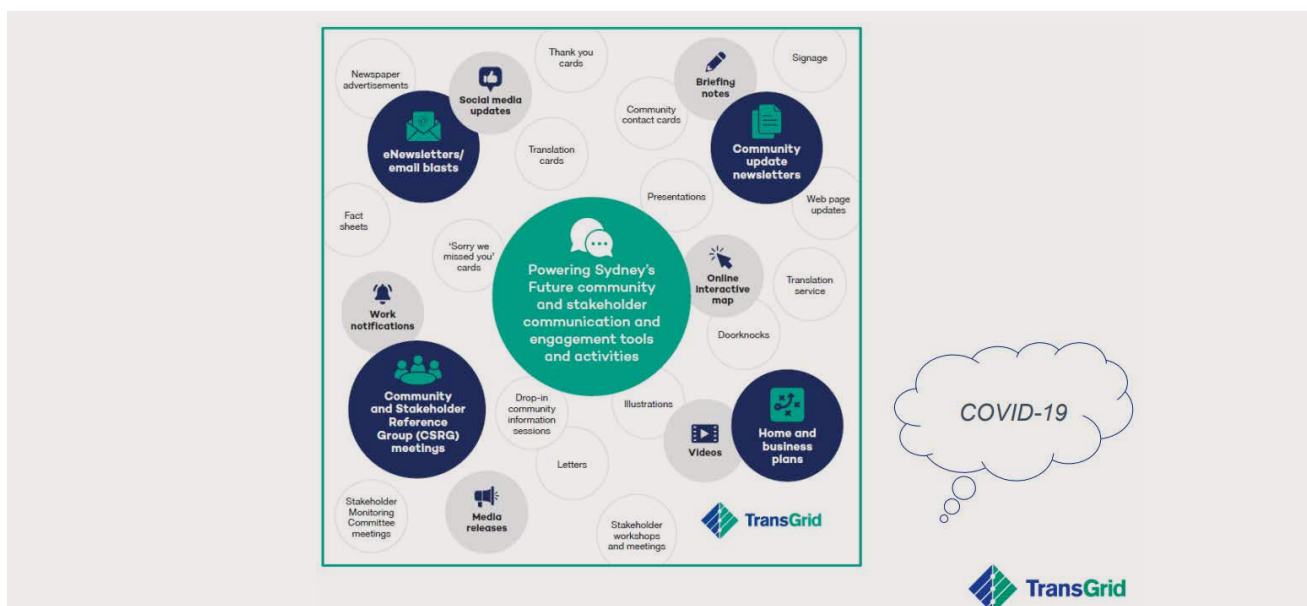


Figure 24. Powering Sydney's Future—Community and Stakeholder Engagement Strategy (Transgrid)

3.6 Case Study 5—Hinkley Point C Connection Project 400kV Transmission Line, UK

Overview

The Hinkley Connection Project [21] is a new high-voltage electricity connection between Bridgwater and Seabank near Avonmouth. It is a significant investment in the region's electricity network and will enable us to connect new sources of low-carbon energy to homes and businesses, including Hinkley Point C, EDF Energy's new power station in Somerset.

The new connection will be 57km long, consisting of 48.5 km of overhead line and 8.5km of underground cable through the Mendip Hills Area of Outstanding Natural Beauty (AONB).

National Grid (UK) constructing what will be the world's first operational T-pylons, and is also exploring different, more sustainable approaches to construction

that potentially reduce traffic and impact on the environment.

The project is currently in progress a series of work packages involving different sections of the route. Overall completion is expected in 2026.

Project Details

A summary of the project technical details is provided in Table 10.

Construction Aspects

A map showing the overall scope of the Transmission Project is provided in Figure 25. The 400kV line comprises 48.5km of overhead line and 8.5km of underground cable. There also associated 132kV transmission line works involving some underground sections.

Table 10. Project details—Hinkley Point C Connection Project, 400kV AC

Project owner:	National Grid (UK)
Overhead Lines:	
Voltage	400kV AC
Circuit configuration	Double circuit
Construction type	Lattice tower and T-Pylon (2x850mm ²)
Route length - overhead	48.5km
Transfer capacity	2820 MVA post fault rating at 900
Underground Cable:	
Voltage	400kV AC
Circuit configuration	Double circuit
Construction type	2 x 2500mm ² XLPE cables per circuit
Route length - underground	8.5km
Transfer Capacity	2404 MVA continuous rating per circuit
Cable manufacturer	
Project Costs:	
Total Cost—Lines and substations	£655.7M UK (2020) [22]
Estimated cost - overhead	Not available
Estimated cost - Underground	Not available
Project Construction Duration:	2022 to 2026
Project status:	In progress, expected commissioning in 2025



Figure 25. Overview Map—400kV AC Hinkley Point C Connection Project (National Grid)



Figure 26. Hinkley Point C Project - 400kV T-Pylon structures (National Grid)



Figure 27. Hinkley Point C Connection Project--400kV Underground Cable Works (National Grid)

The project involves the world’s first T-Pylons installed in between Bridgewater and Loxton I Somerset, completed in early 2023 [23]. The T-Pylons at 35m high and are around one third shorter than traditional steel lattice towers, but considerably wider and affects land use more.

The T-pylon design, the first major UK redesign since 1927, has a single pole and cross shaped arms, and is around one third shorter than traditional high-voltage pylon design with a smaller ground footprint. The new design was selected from over 250 designs entered into an international competition run in 2011, organised by the Royal Institute of British Architects and government (the then Department of Energy and Climate Change). With a need for new energy infrastructure to enable progress towards net zero, the competition sought a new design to reduce impact on the local environment and surroundings. A photograph of the structures is provided in Figure 26.

Along with offshore routes, underground cabling and continued use of traditional lattice pylons, the new T-pylon design is a potential technology choice for future projects. Each new transmission network project is assessed on a case-by-case basis, with the technology used by National Grid based on planning policy and regulations set by Ofgem as well as engineering, environmental and cost considerations.

400kV Underground cable installation works have commenced with a section at Mendip Hill completed. Photographs of the works in progress is shown in Figure 27.

Environmental, Community and Stakeholder Engagement

National Grid commenced planning on the Hinkley Connection Project in 2009. After detailed analysis, it was concluded that a new connection between Bridgwater and Seabank substations would be the most appropriate and cost-effective solution. Once connection points were identified, an independent environmental review of the area, otherwise known as the Hinkley Point C Connection Project Route Corridor Study (RCS) was undertaken—attending to consideration of corridor selection and land access.

Over the next five years (2009-2014), several stages of pre-application consultation occurred and in total received more than 11,000 pieces of feedback, which helped shape plans. Planning included attention to biodiversity, rights of way, waste management, construction traffic, and noise and vibration and therefore attended to issues regarding community consultation, social licence, and minimal environmental impact. Key issues were visual impact, ecology and perceived socio-economic effects on tourism.

Changes to the original design occurred because of pre-application public consultation including:

- choosing the route of an existing overhead line owned by Western Power Distribution (WPD) to *minimise the impact on the local landscape*.
- removing more than 67km of existing overhead line to make way for the new connection
- putting 9km of WPD's network underground between Nailsea and Portishead
- putting 8.5km of the new connection underground through the Mendips Hills Area of Outstanding Natural Beauty (AONB)
- using T-pylons for 81% of the overhead connection.

Many of these changes are related to minimising the impact on the local landscape.

The National Grid was required under the Planning Act 2008 to submit a Development Consent Order for nationally significant infrastructure projects, which includes overhead power lines 132,000 volts and above. Applications to the Planning Inspectorate had to accord with National Policy Statements (NPSs), issued by the Government. Six NPSs have been produced for the energy sector, including for electricity networks and nuclear power.

In May 2014 a Development Consent Order application was submitted to the Planning Inspectorate. On 19 October 2015, the planning inspectors made a recommendation to the Secretary of State. Permission was granted on 19 January 2016.

From a regulatory perspective National Grid have consulted on the Preliminary Environmental Impact Assessment (PEIR). This document sets out National Grid's preferred route and explains their methodology and identifies the likely impact on the proposals on the environment.

National Grid has developed practices around Visual Impact including undergrounding for new transmission line connections and undergrounding of existing overhead lines, as described in their presentation "National Grid Electricity Transmission Environment consultation July-August 2018 [21]. In this presentation they state that their approach to planning transmission line is:

"In principle...

- *The Government does not believe that development of overhead lines is generally incompatible with our statutory duty*

In practice...

- *New above ground electricity lines can create adverse landscape and/or visual impacts*
- *This is dependent upon their scale, location, degree of screening and the nature of the landscape and local environment*
- *These impacts can often, but not always, be mitigated"*

Further information on National's Grid approach is outlined in their public document "National Grid Our Approach to Consenting (April 2022)" (<https://www.nationalgrid.com/electricity-transmission/document/142336/download>).

Considerable *engagement with the community* was undertaken which included initiatives such as

- a) Working with schools through
 - a. Investing £250,000 UK into STEM in local schools- helping schools across the Hinkley Connection Project deliver an improved education experience through its Education Fund by providing activities and equipment that teachers would otherwise not be able to afford. In 2022/2023 this constituted supporting 103,950 children from 382 local schools, including 22,375 children from disadvantaged backgrounds. Since the start of construction in 2018, the NG supported 425,040 children, including 87,182 children from disadvantaged backgrounds. NG have made 1,240 grants with £1.1m used for Science, Technology, Engineering and Maths (STEM) activities and equipment. <https://www.nationalgrid.com/electricity-transmission/hinkley-connection-project-helps->

over-400000). In addition, archaeologists working on the Hinkley Connection Project ran an educational session and assembly for primary school students in Winscombe, North Somerset, helping to inspire the next generation of historians.

- b) *Working with communities* such as Somerset Councils, the Mendip Hills AONB (area of outstanding natural beauty) and other Statutory Consultees.
 - a. Attending to concerns regarding the *visual impact* of the Sealing End Compound, particularly the impact it will have on the view from Crook Peak out over the Somerset levels towards Brent Knoll. The removal of the existing 132KV power lines through the Lox Yeo valley was welcomed by the community.
 - b. Attending to details that need to be explained, for example, the locations of monitoring kiosks and details that show how the underground cables will negotiate the river crossings. This *helped ensure social license*
 - c. Protecting wintering birds and other wildlife, by scheduling construction activities within Portbury Wharf Nature Reserve to take place between March and September. Portbury Wharf Nature Reserve (<https://www.nationalgrid.com/electricity-transmission/portbury-wharf-nature-reserve-upcoming-works>) *reducing environmental impact*.

The National Grid worked with Copper, a communications agency, to help with *effective stakeholder engagement*. The collaboration commenced in 2009 and is currently ongoing allowing for engagement through the project from planning through to construction. The collaboration was stimulated by significant local opposition to the proposals throughout the planning and development stages which posed a risk to the project if the opposition was to continue into the construction stage. The National Grid needed to switch the communications approach from 'reactive' to 'proactive' and reposition the narrative to concentrate on the project's benefits. To minimise the risks of project delays, opposition and criticism National Grid with Copper aimed to:

1. Provide clear and timely information to stakeholders about the work in their area too, and quickly respond to any concerns. This was achieved through activities such as maintaining and regularly updating a project website, making it the 'go to' place for stakeholders to learn the latest information. In addition, should there be any concerns amongst the

public, a responsive 24-hour contact centre service enables the local community to get a swift response.

2. Devise procedures to inform and update local communities and other stakeholders about construction work and the steps National Grid and its contractors take to reduce local impact. This has established positive relationships with local community groups and parish councils and use these links to help spread information as widely as possible assisting with the gaining of social license. Copper has communication with more than 10,000 householders.
3. Put processes in place to monitor the mood of local communities, to identify and respond rapidly to any emerging issues."

The outcome from this is that³ *"despite the highly disruptive nature of the work, there is widespread public acceptance of the project." To date, "a minimal number of complaints have been received and no issues have been escalated by local residents or community stakeholders to the media or their elected members. These successes have given National Grid the confidence to reposition the project narrative going forward. In the future, communications and engagement will place an even greater emphasis on the positive impact and benefits National Grid will bring to the area over the next five years and beyond."*

In summary, the planning and consultation, the outcomes for this project were:

1. An overhead route of approximately 48.5km in which a the new 400kV line replaced existing 132kV lattice tower structures with mainly new aesthetic 400kV T-Pylon structures.
2. An 8km underground section was built through the Mendip Hills, which is described as an "Area of Natural Beauty" (AONB).

3.7 Case Study 6—Suedlink DC3 and DC4 HVDC Transmission Link Germany

Overview

With a length of around 700 kilometres and a transmission capacity of 4000MW, SuedLink is the largest infrastructure project in Germany's energy transition. In the future, SuedLink will connect hydroelectric power plants in Scandinavia, wind farms in the north and solar parks in southern Germany. The connection makes it possible to flexibly network fluctuating renewable energy sources, thus ensuring a stable and secure power supply.

³ <https://copperconsultancy.com/our-work/hs2-national-grid-hinkley-point-c-connection-project/>

The project is currently reported to be the longest underground transmission project in the world. Project cost is currently estimated at €11B EUR. The project has commenced with completion expected in late 2026.

SuedLink consists of two high-voltage direct current transmission links from Wilster and Brunsbüttel in Schleswig-Holstein to Bergrheinfeld/West in Bavaria and Großgartach/Leingarten in Baden-Württemberg. The two connections each have a transmission capacity of 2000MW and are laid as underground cables. The SuedLink output is equivalent to about four nuclear power plants and can supply around ten million households with electricity. Along with the underground cables, commercial fibre optic cables are laid along the entire route. These offer municipalities in rural areas in particular a great opportunity to benefit from high-speed Internet. Both underground cable connections are listed as independent projects referred to as DC3 and DC4. Both lines run side by side over a long stretch, the so-called main stretch.

Suedlink is a joint project involving Transmission system operators TenneT as the owner of the northern section, and TransnetBW as owner of the southern section. In their project information the benefits of HVDC are described as [24]:

- *Lower transmission losses when transporting electricity over long distances.*
- *In contrast to AC cables (AC = “alternating current”, i.e. three-phase current), HVDC underground cables can also be used over long distances (several hundred kilometers). With AC cables, the length of the sections is limited by technical and economic parameters.*
- *High transmission capacity Flexibility and system stability of the power grid are increased.*

The German Federal Government has put the policies in place for expanding the grid more quickly and gaining public acceptance for it⁴. Following the agreement within the governing coalition in July 2015, the cabinet gave the go-ahead in October 2015 for an increased use of underground DC cables. On 3 December 2015, the Bundestag adopted the draft legislation, as amended by the coalition party groups, and the bill passed the Bundesrat on 18 December 2015. The new rules entered into force at the turn of the year 2015/2016. The Suedlink project has therefore been progressed as a HVDC underground project.

Even with the adoption of underground transmission for the project, there were many concerns raised by communities, landowners and farmers which are being considered by the project developers TenneT and Transnet BW in the regulatory approval processes. Location of large AC/DC converter stations is one such concern.

Project Details

A summary of the project technical details is provided in Table 11.

A map showing the overall scope of Suedlink HVDC Transmission Project is provided in Figure 28.

⁴ <https://www.cleanenergywire.org/news/germany-passes-laws-grid-chp-keep-energie-wende-going>

Table 11. Project details—Suedlink HVDC Transmission Line, Germany

Project owner:	TenneT and Transnet BW
Overhead Lines:	
Voltage	-
Circuit configuration	-
Construction type	-
Route length - overhead	-
Underground Cable:	
Voltage	+ 525 kV DC
Circuit configuration	2 x 2000MW HVDC circuits 4 x VSC converter stations, Rigid Bipole system ⁵ with metallic return cable
Construction type	525kV DC 3000mm ² copper conductor XLPE cable. Direct buried cables, ducts, HDD and special installations
Route length - underground	700 km
Transfer Capacity	4000 MW
Cable manufacturer	Prysm
Project Costs:	
Total Cost—Lines and substations	€11B EUR (2022)
Project Construction Duration:	Construction 2021 to 2026
Project status:	Commenced, expected completion 2026

⁵ HVDC Light® Reference list (ABB Group)

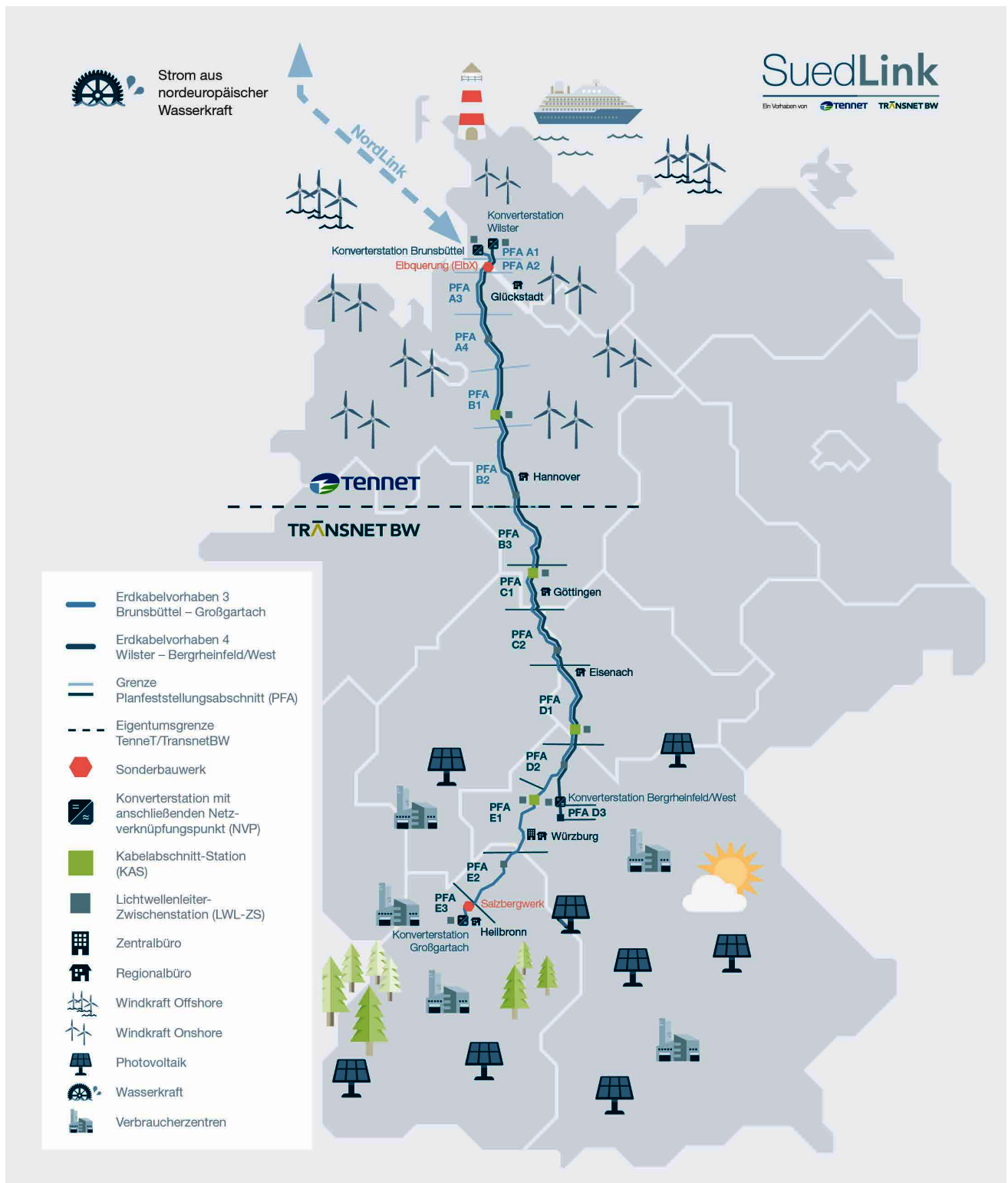


Figure 28 Project Overview Map—Suedlink HVDC Project (TenneT, TransnetBW [25])

Cable Installation

The two 2000MW underground circuits of SuedLink will comprise XLPE-insulated 525kV cables as shown in Figure 29. The total cable length of the transmission system over a route length of 700km.

The cables will be laid in four parallel trenches with about 10m from each other in the central trunk of the transmission system. The trenches will be excavated up to 2m-deep beneath the ground. An example of the trench profile for one circuit is shown in Figure 30.

Examples of direct buried HVDC cable installation are provided in Figure 31.

Although most of the cable route is proposed to be direct buried cable installation, alternative methods will be required in some sections e.g.:

- Cables installed in buried ducts.
- Direction Drilling sections under waterways and highways.



Figure 29. Suedlink HVDC XLPE Cable (Prysiam Group [26]).

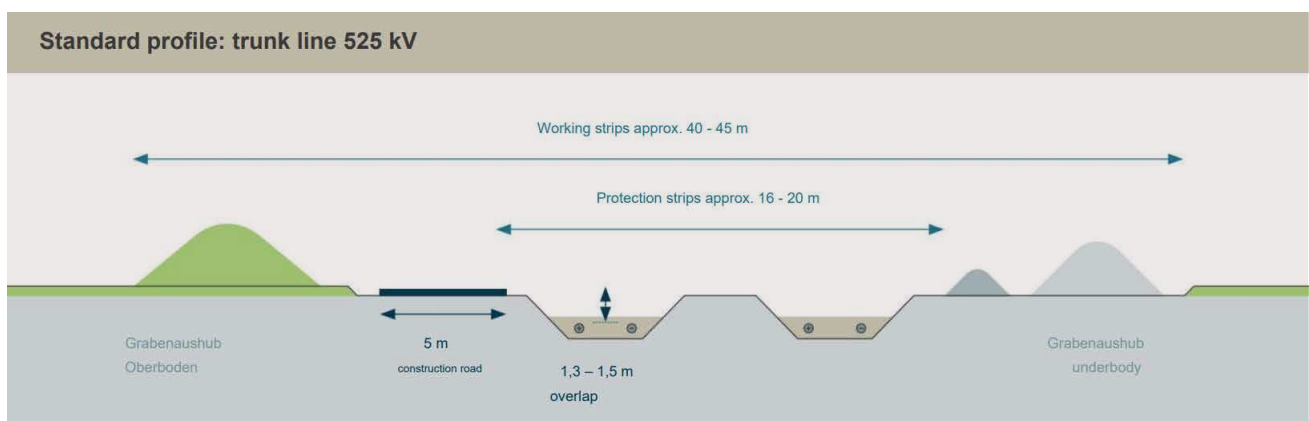


Figure 30. Suedlink—Typical Cable Installation for One HVDC Circuit (Tennet, Transnetbw [24]).

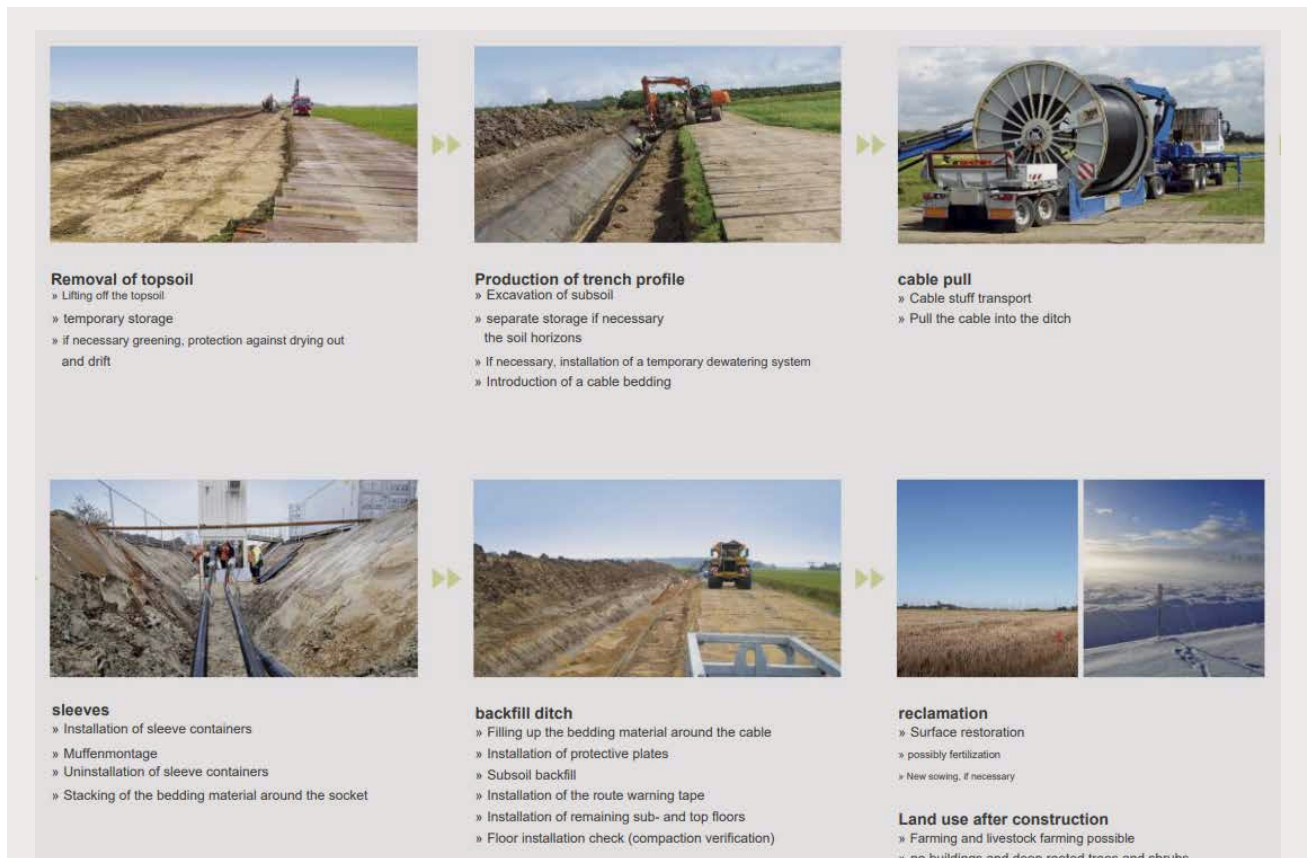


Figure 31. Suedlink—Example of Direct Buried Cable Installation Phases (Tennet, TrasnetBW)

Converter Stations

The converter stations in Schleswig-Holstein, Bavaria, and Baden-Württemberg for the SuedLink transmission system will be designed to operate both as rectifier and inverter depending on the direction of the flow of electricity transmission. Hitachi energy has been awarded a contract for the DC4 project converter stations. An image of proposed stations is shown in Figure 32.

TenneT is responsible for the operation of the converters in Schleswig-Holstein and Bavaria, while TransnetBW is responsible for the converter in Baden-Württemberg.

Regulatory Approvals

The Federal Government has decided on the need for SuedLink and laid it down in the Federal Requirements Plan Act. The law also stipulates that direct current connections should primarily be planned as underground cables. SuedLink is identified as projects 3 and 4 in the *Federal Requirements Plan Act*.

SuedLink is approved by the Federal Network Agency (BNetzA) in accordance with the Network Expansion Acceleration Act (NABEG) as part of a public and multi-



Figure 32. HVDC Converter Station (Hitachi Energy [27])

stage process. At the end of this process, a concrete line route is determined. SuedLink is currently in the planning approval process, i.e. in the last stage of the approval process. Individual sections were defined for the planning approval process. A final decision on the route of the cables was made in 2021, with cable production and background infrastructure starting in 2022. Cable laying has commenced as of March 2023.⁶

SuedLink is divided into 15 sections. The manageable size of each section facilitates planning, approval, and later construction. In addition, the “short line” between all stakeholder groups on site enables direct and more personal participation in the project.

Environmental Aspects and Concerns

Key aspects of environmental planning and assessment for the project include [28]:

- Mapping of flora and fauna
- Subsoil investigations
- Archaeological investigations
- Further ground investigations (e.g. explosive ordinance, soil mapping, thermal conductivity measurements)

Preliminary investigations in the approval process included extensive research in order to avoid large spatial obstacles such as settlements, roads. Considerations in corridor selection included:

- Where exactly will the SuedLink cables run?
- Which method and which devices do we use when laying the underground cable?
- How can we best reconcile the needs of people, nature and the environment?

Soil preservation is a particular focus for agricultural impacts. Soil performs numerous services and functions for nature and society. In addition, the soil is the production basis for agriculture and forestry. In addition to other functions, the ground is also a transport medium for power transmission. The common goal of soil protection is therefore the sustainable preservation of soil functions. That is why protecting the soil is also a special concern for us at SuedLink in all project phases.

Communication and engagement

Consultation and engagement on the Suedlink project and proposed corridors commenced around 2014. Many of the original concerns citizens had relating to the



Figure 33. Protestors at a Suedlink rally in central Germany in 2019 (DW [29])

impact of overhead transmission lines were addressed by the 2015 decision of the German Government to place them underground.

Concerns raised by citizens regarding the impacts of underground transmission on the environment have tended to be regarding local issues. At a rally in central Germany in 2019, farmers “suggested the cable would heat and disrupt the soil, making it less fertile for growing crops” [29]. Residents in a village in Northern Bavaria were concerned that the planned substation will soon “encircle them with routes”; and that a popular piece of forest could possibly disappear [30]. Kiel and colleagues [31] noted in interviews with citizens that the “deterioration of the landscape” was an issue of concern. However no specific issues mentioned.

Social Aspects and Concerns

When focusing on social issues surrounding placement of underground transmission lines, it is evident that in areas in Northern Bavaria (Lower Franconia) and nearby parts of Central Germany, the strong local cultural and social identities of these areas have framed their concerns with the Suedlink. Objections have been raised by citizens in these areas to the notion of “outsiders” coming in taking over things in their local area. A particular regional community lower Franconia which was proposed as the site for one of the terminal converter stations, felt that the companies have no interest in the local areas or communities, and that money from the region is being taken out by these entities and nothing reciprocated [32]. A participant in a rally in 2019 commented that they dislike being told what to do by these outsiders [29].

⁶ <https://www.energyprojectstechnology.com/first-dc-underground-cables-reach-interim-storage-facility/>

Economic Aspects and Concerns

Concerns raised by communities also focus on economic issues. Some of these were local relating to the loss of employment and the knock-on effect on the local economy due the fact that local power suppliers (nuclear power plants for example) would be closed down and the energy supplied from elsewhere [32].

Original farmers' concerns about the loss of revenue due to the construction work and ongoing presence of the underground lines on their land [32], have tried to be addressed by the offer and acceptance of compensation by farmer associations across a number of regions in Germany in 2022. [33].

TenneT advises on their website⁷ what forms of compensation are available for impacted parties:

- *“For owners: Compensation for the permanent use of the property (protective strips, access routes if necessary) and associated payments*
- *For owners: Compensation for the temporary use of the parcel*
- *For those who cultivate agricultural land: Compensation for growth damage*
- *For those who cultivate agricultural land: Compensation for consequential damage*
- *For those who cultivate agricultural land: Compensation for disadvantages in subsidy programs and bonuses*
- *For those who cultivate agricultural land: flat-rate expenses*
- *For those who cultivate agricultural land: Compensation for economic difficulties”*

There is also a broader economic concern raised by citizens' action groups in recent years about the “multi-billion euro costs of the project” and that “it had not been thought through properly” [29]. They indicated a preference for smaller decentralized power sites using power produced near where it is used and have proposed an alternative plan to divide Germany up into 80 areas which would each produce electricity for the end user” [29] [30]. A protest in 2022 stated “Instead of building a monster line from north to south, Germany should rather focus on decentralized energy supply with photovoltaics, wind energy and hydrogen. In the future, the company will no longer be as dependent on suppliers as it has been in the past. Even the war in Ukraine has not changed the fact that the power line is unnecessary” [34].

In 2023, one media source noted that “activists don't just want to move the route projects to other places, they want to prevent them as a whole. They see the projects as too expensive and unnecessary and that the routes could also transport nuclear power from abroad” and that, “there is no need for dinosaur lines if the energy transition is implemented decentrally and locally”, and that they do not trust that the lines will use energy only from renewable sources [30].

Summary

The move by the German Government to make Suedlink an entirely underground project continues to raise environmental objections from areas specifically impacted by the laying of cable or the presence of substations. However, more notable in recent years are the importance of local social issues and economic criticisms raised by citizens groups in the affected areas.

⁷ <https://www.tennet.eu/de/suedlink-entschaedigung-und-schadensregulierung>.

4.

Conclusions

4.1 Current Australian Projects

The related themes necessary for achieving social license and project acceptance uncovered during the systematic literature review were highlighted and reinforced in the current Australian 500kV projects: Humelink (NSW), VNI West (Vic) and Western Renewables Link (Vic). A key finding from all three is the importance of recognising the context, both historical and current, in which the project is occurring. Noting that project proposals and announcements, technology type, levels of communication and engagement, host individual and communities' knowledge and awareness of the technology, will influence the context and how the project is perceived. There were multiple findings from across the three projects. Key findings include:

- The need to have clear justification for route selection, why the decision was made and to provide enough time for community members to understand the implications of the proposal.
- A sentiment by host communities in all three projects was that project coordinators were quite dismissive of the topic of undergrounding, including their sentiment regarding the long-term advantages of underground transmission. Many in host communities argued that the initial cost and time investment of undergrounding would be far outweighed by the significant benefits it offers.
- Community Consultant Groups were established to improve the dialogue between project proponents and local stakeholders.
- A lack of leadership at the local level, in some instances, meant that decisions were delayed and without clear communication, led to misinformation being introduced into the community.
- Indigenous groups raised concerns around construction ground disturbance directly disturbing and destroying archaeological artifacts and structures, along with vegetation clearance removing the protective cover and concealment of archaeological sites that could impede the ability to effectively protect the site during a fire.
- The proponents, sought expressions of interest for cultural heritage surveys which have now been conducted in collaboration with Registered Aboriginal Parties, providing valuable insights for assessing impacts and implementing appropriate mitigation measures.
- Impacts on health and safety included concerns about increased mental health and wellbeing - coupled to this were examples of engagement fatigue where people were being asked to engage in multiple processes, not only for transmission line projects but also renewable energy projects.
- The potential for increased bushfire risks was also raised as both a health and safety and environmental concern, in particular transmission lines hindering effective bushfire responses therefore increasing their risk of exposure in the case of a fire.
- There were significant concerns raised around the impacts on land use and property values including increased traffic on local roads, decreased tourism in some areas, impacts on farming operations and access.
- Alternative transmission technologies such as HVDC or hybrid HVAC and HVDC networks are being promoted by some stakeholder and advocacy organisations
- Following the findings from the NSW Parliamentary Inquiry into the feasibility of undergrounding the transmission infrastructure for renewable energy projects there has been a new Select Committee Inquiry announced that will hand down their findings in March, 2024.

4.2 International Case Studies

The six case studies from Australian and international projects, involve projects which have been completed or are in the design phase and include 400 and 500 kV HVAC overhead and underground, 330kV HVAC underground and one HVDC transmission project.

- Key findings include the importance of extensive community and stakeholder consultation, with on-going engagement undertaken to gain approval and minimise the risk of project delays and opposition. For example, the National Grid UK's document - the Preliminary Environmental Impact Assessment (PEIA) set out the preferred route, explained their methodology and identified the likely impact of the proposals on the environment from the beginning.

This transparent approach was deemed by the proponent to help minimise opposition to the project.

- Other factors that were considered to influence project success included the use of aesthetic overhead transmission line structures combined in some cases with the need for underground sections to be installed. The downside of these structures, however, is the greater width of the structures and larger easement requirements and land-use restrictions.
- The Hinkley Point Connection Project (UK) involved the replacement of an existing 132 kV lattice steel tower line with new aesthetic 400kV T-Pylon structures. The community had become used to the existing transmission line and the new structures were designed to be more aesthetically pleasing. Additionally, the proponents were prepared to underground 8.5 km of the route in an area, because it was recognised as an area of natural beauty.
- In the case of the UK T-Pylons and in the Danish case, Thor-gi tubular steel structures were used; which are more compact with a lower height compared to traditional steel lattice towers for the same system voltage. The downside of these structures, however, is the greater width of the structures and larger easement requirements and land-use restrictions.
- Case studies from Denmark (400kV) and California (500kV) also demonstrated the need for underground sections; ranging from 5.6km to 26km respectively. The rationale for underground sections were in response to community concerns, or political / regulatory interventions.
- Appropriate compensation was also deemed a critical facilitator, particularly to farmers and landholders. For example, in Denmark the company, Energinet, established an agreement with the farmers' organisation on how to compensate farmers and landowners if overhead lines or underground cables are on their property. Landowners adjacent to line were also eligible for compensation based on a proximity distance criteria scale.
- The Powering Sydney project is a 20km long 330kV underground cable transmission line, linking major substations in a heavily populated urban environment. The case study provides perspectives on managing a project that has significant impacts during the construction phase, affecting many diverse communities, major roads and local businesses.
- The case study of the Baleh-Mapai 500kV transmission line in Sarawak involves a double circuit overhead line traversing 177km of mainly rural and remnant forest areas. The case study provides an overview of the project's detailed Environmental and Social Impact Assessment and stakeholder engagements with affected communities.

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Appendix A:

Review of Current NEM Projects: Humelink, VNI West & Western Renewables Link

1. HumeLink

The HumeLink project involves a 500 kV transmission upgrade connecting Project EnergyConnect and the Snowy Mountains Hydroelectric Scheme to the existing Bannaby substation [1].

1.1 Community and Stakeholder Engagement

One landowner and community advocate, presented a review of HumeLink's engagement process with landowners and the community [2]. The findings of the review relate to the experience of the landowners impacted by the consultation process. Accordingly, they suggested that the community engagement was not transparent as there was no clarity on who is responsible in project decision making, how/when decisions will be notified, which decisions are negotiable and how/when community input will be sought. Only landowners within the project corridor were found to be included in the process, and not

landowners adjacent to the corridor. Landowners were not always treated with respect, and it was felt that their anxieties about the projects were misunderstood. The review examined the maps, letters, fact sheets, landowner packages and web pages involving the project and found they were not always appropriate, up to date and user friendly. It was also felt that any alternative options or feedback proposed by landowners were not seriously explored. Rod Stowe listed twenty recommendations for Transgrid to improve their community engagement.

Transgrid has committed to reapproach their community and stakeholder engagement by adopting all twenty recommendations from the Landowner Advocate Report. As highlighted in the Implementation of the Landowner Advocate's Recommendations on HumeLink Report [3], the recommendations of Stowe as well as the actions taken by Transgrid are listed as follows:

Table 1 Recommendations by a Landholder and Actions Taken by Transgrid

Recommendation	Actions Taken
<p>1. “Re-set” landowner and community consultation by holding a meeting with all potentially impacted parties to:</p> <ul style="list-style-type: none"> a. examine all proposed transmission route options (including those proposed by landowners) with detailed advice as to feasibility and reasons for exclusion; b. have experts available to discuss all aspects of the project; c. provide advice on how Transgrid is using international best practice infrastructure technology in transmission line project; and d. provide advice on the remaining steps in the consultation process and how they will be conducted. 	<p>Place Managers (individuals responsible for overseeing and managing a specific location, ensuring its efficient operation and maintenance) have reached out to meet with all landowners within the study corridor to:</p> <ul style="list-style-type: none"> Outline the Engagement Reset and confirm our commitment to improve to the quality of engagement; Discuss the project generally, including the decision making process, the route options, infrastructure and technology that is being considered, the project’s timeline and next steps in the process; Seek feedback on the consultation process, particularly understanding the best way to engage with landowners; and Communicated the channels that Transgrid will engage regularly, including through regular check-ins and newsletters. Place Managers schedule and hold face-to-face meetings and regular phone check-ins. Community engagement improvements were also discussed through the CCGs, webinars and meetings with landowner action groups. Key Transgrid subject matter experts and industry experts have provided advice and participated in key meetings, including the Australian Energy Infrastructure Commissioner (AEIC), Andrew Dyer, and the undergrounding expert, Amplitude, as the independent consultant for the community advising on the undergrounding study. All feedback received from landowners, stakeholder groups and the community are registered in our consultation management process and considered as part of the project planning process. Landowners and other stakeholders have been provided with detailed information on how their feedback has been considered. We have considered alternative route options based on feedback provided by landowners, stakeholders and the community and provided detailed information on how these options have been considered and if not progressed, why this is the case. Additional advice and discussions held during meetings and briefings with stakeholder groups have been documented into FAQs [4] and published alongside other materials on the HumeLink website to be available to all parties.
<p>2. Review the mid-year time frame for disclosure of the proposed transmission route and advise landowners.</p>	<p>During the start of the Engagement Reset, the mid-2021 time frame was updated to the end of 2021 to allow time to genuinely engage with landowners and the community. This was communicated to landowners by Place Managers through direct engagement and mentioned in the August newsletter.</p> <p>The timeframe to provide formal notification of the narrowing of the corridor to 200m was subsequently extended until early 2022. This was to balance providing certainty for some landowners, providing time for landowners that were newly included in the study corridor and to assess community provided corridor alternatives.</p>

Recommendation	Actions Taken
<p>3. Conduct a general information session with each regional group along the corridor prior to the commencement of each new stage of the consultation process, such as the commencement of on-site visits. This should explain the process, what it aims to achieve, how it will be conducted and what will be required of them. This should be supported by a fact sheet on the website at the same time.</p>	<p>Key information on the stages of the consultation process, the upcoming proposed field activities, their timing and what to expect have been discussed in webinars, the Landowner Brochure, newsletters, and periodic meetings with landowners and CCGs.</p> <p>Each stage of the consultation process has information available on the Humelink website. For example, the Route Selection Fact Sheet provides information on how Transgrid conducts the route selection process, whilst the Ecology Survey Fact Sheet and the Cultural Heritage Fact Sheet provides details on the process and what to expect during the field surveying activities within private property.</p>
<p>4. Review the number of staff required to conduct the consultation on this major project using a best practice model.</p>	<p>Transgrid has used the advice from industry experts and lessons learned from other Transgrid major projects to gauge the level of full-time staff needed for the engagement program.</p> <p>The Engagement Team has been resourced accordingly and consists of the Community Engagement Lead, a Strategic Lead, a Team Lead, three Place Managers, a Communications Officer, a Systems and Support Officer, and support staff. All of these team members work with other teams within the Humelink project team to deliver engagement activities.</p>
<p>5. Review the list of landowners it is consulting with to ensure that all appropriate landowners are included</p>	<p>The list of landowners has been updated based on looking through all properties within each route area and discussions with landowners, the community, and stakeholders.</p> <p>Place Managers have reviewed the list to ensure it is comprehensive.</p> <p>The list continues to be updated as the consultation process progresses, including other interested parties who sign up to the newsletter.</p>
<p>6. Review the capacity, skills and suitability of staff and contractors involved in landowner and community engagement activities.</p>	<p>Industry experts have been used to assess the Engagement Team, and the wider project team (particularly those with external facing roles), and resources uplifted as needed.</p> <p>All members of the Engagement Team were assessed on their capabilities based on their skills, previous experience, and qualifications (e.g. all members of the Engagement Team have IAP2 certification or equivalent industry experience). This was done by both the Community Engagement Lead within the Project team and other senior members within Transgrid's operations and human resources teams.</p>
<p>7. Provide appropriate training to all engagement staff focusing on empathy and customer centrality in business operations.</p>	<p>A set of minimum training requirements was developed for each team member who would engage with external stakeholders, including those outside of the Engagement Team such as the Project Director, the Land Access and Acquisition Team and other roles that provide ad-hoc support to engagement activities.</p> <p>The training requirements include the IAP2 certification which provides the fundamentals of community engagement and best practice guidelines, and also training on developing empathy and dealing with challenging situations.</p> <p>All members of the Engagement Team and the Land Access and Acquisition Team were assessed against the training requirements, particularly on empathy and customer centrality. Training was issued where there were gaps in their capability.</p>

Recommendation	Actions Taken
<p>8. All Transgrid staff involved in landowner engagement activities be required to:</p> <ol style="list-style-type: none"> comply with Transgrid guidelines for property visits i.e. provide accurate information about the identity and number of staff/consultants attending the property. Any variation to the originally agreed arrangements should be renegotiated with the property owner; generally, ensure the number of Transgrid staff/consultants attending a property does not significantly exceed the number of owners present at the property. (e.g. a ratio of five Transgrid staff to one property owner would normally not be considered desirable.); and ensure that all landowner feedback/communication is responded to in a timely manner and comply with commitments to provide advice by a specific timeframe. 	<p>The HumeLink guideline on accessing and visiting properties was updated and enforced for all staff to follow.</p> <p>Overseen by the Community Engagement Lead, all property visits are conducted in pairs of one Place Manager with one Land Access Officer.</p> <p>Place Managers and Land Access Officers worked with landowners to receive and update property access agreements in the form of Consent to Enter forms. These forms are in the process of being updated with clearer messaging.</p> <p>The process on receiving, acknowledging, considering and responding to enquiries, complaints and feedback was reviewed and updated. This is documented and tracked within Transgrid’s consultation management platform.</p>
<p>9. Re-examine how it represents key features on the maps it provides to landowners so as to explain how data is sourced.</p>	<p>All base maps were reviewed and updated against feedback collected to date.</p> <p>The interactive map was relaunched on HumeLink’s website after a comprehensive review and update with the ability to highlight comments and the sources of information for particular features, and for users to provide comments and feedback.</p> <p>The maps are checked on a regular basis and linked to the interactive map.</p>
<p>10. Review its consultation documents to remove excessive irrelevant images and marketing material and to provide a less clinical and impersonal tone</p>	<p>A comprehensive review of all collateral and consultation documents was conducted to ensure they are appropriate and provide a less clinical and impersonal tone.</p> <p>The Landowner Advocate was included in the document review process prior to distributing and/or publishing online on the HumeLink website.</p> <p>The AEIC Andrew Dyer has and will continue to provide feedback on materials.</p> <p>Training on tone of voice and writing in plain English is included in the minimum requirements for the team members involved in engagement activities</p>
<p>11. Utilise its website more to provide a ‘source of truth’ for responses to questions that arise and to share presentations that are given to one group of landowners with all the affected landowners so that all are aware of the same information.</p>	<p>The HumeLink website was relaunched in a format where it is easy to access key documents, as well as a section dedicated to landowner resources.</p> <p>The following items are published on the website to ensure all landowners, the community and stakeholders have access to the same information:</p> <ul style="list-style-type: none"> • CCG presentations and associated meeting minutes (with details on the Q&A section) and list of participants; • Webinars/information sessions summaries; • Newsletters that have been distributed; • Relevant fact sheets; and • Regulatory documents, such as the Project Scoping Conclusions Report, Project Assessment Draft Report and Project Assessment Conclusions Report.

Recommendation	Actions Taken
<p>12. Consider the use of a newsletter to provide progress reports on the consultation process.</p>	<p>Regular newsletter issues have been planned in alignment with project phases and milestones to provide timely information to landowners. For example:</p> <ul style="list-style-type: none"> • The August issue introduced the Engagement Reset, reaffirmed Transgrid’s commitment to improving the quality of engagement, introduced the CCGs and provided other information on the project; • The September issue introduced the Place Managers, provided information on the updated study corridors (where some of the previously scoped corridors are no longer required for HumeLink, other corridors were narrowed and new study corridors emerged), introduced the field investigations and surveys (including the Ecological Survey and the Cultural Heritage Survey), and promoted the Landowner Assistance Program and the Community Partnerships Program; and o The upcoming February issue will focus primarily on introducing the narrowed corridor. <p>These are all published on the HumeLink website. The team continues to actively seek suggestions from landowners on what they want to see in the next newsletters.</p>
<p>13. Revised project maps, reflecting appropriate information provided by landowners, be uploaded at relevant intervals.</p>	<p>All maps were assessed against previous feedback gained from landowners, stakeholders and the community prior to relaunching the interactive map on the HumeLink website</p> <p>The team updated and implemented a new process to review feedback and comments on the online interactive map (i.e. review and post all comments unless they are specified to be private).</p> <p>Land Access Officers and Place Managers have met and will continue to meet with each landowner on the narrowed corridor with up-to-date maps with all information from previous interactions with the landowner and relevant info from the online interactive map.</p>
<p>14. Q and A be prepared on the question “Why doesn’t the information I provided about my property and/or surrounds not appear on the map?”</p>	<p>FAQs are published on the HumeLink website, which provide a response to the question.</p> <p>The team have discussed map features specific to landowners at CCGs and Action Group meetings.</p>
<p>15. In individual discussions with potentially impacted landowners, Transgrid staff have regard to feedback received about the specific property and explain why landowner requests can/cannot be acceded to.</p>	<p>The process for receiving, addressing, considering and responding to feedback from landowners has been updated and is embedded in the team as a business as usual process. For example, we have considered alternative route options based on feedback provided by landowners, stakeholders and the community and provided detailed information on how these options have been considered and if not progressed, why this is the case.</p> <p>Land Access Officers and Place Managers have met and will continue to meet with each landowner to discuss concerns regarding their property, including the use of maps that accurately reflect their property, how their property will be impacted and the next steps in the process.</p> <p>A list of negotiables and non-negotiables has been developed for the Engagement Team to use when corresponding with landowners, stakeholders and the community.</p>
<p>16. Formally respond to the matters raised by Kyeamba landowners at the meeting of 31 March 2021</p>	<p>The team formally responded to Kyeamba queries in July 2021, and we continue to engage with Kyeamba landowners as part of the consultation.</p>

Recommendation	Actions Taken
<p>17. Advise affected landowners of its intended response to the Advocate’s recommendations.</p>	<p>Our commitment to achieve the Advocate’s recommendations was discussed and outlined with all landowners and stakeholder groups through check-ins, meetings and letters at the beginning and continuously throughout the six-month period.</p> <p>It is also publicly stated on HumeLink website and through various media releases</p>
<p>18. Consider making a limited EAPS like service available to potentially impacted landowners who might be experiencing anxiety during the route selection process.</p>	<p>The Landowner Assistance Program (through Assure) was introduced and continues to be offered to all landowners through property visits and phone calls.</p> <p>Information on the Program is available via the HumeLink and Transgrid website and printed in newsletters (which are also available on the website).</p> <p>Affected landowners and community members have free access to the program.</p>
<p>19. Consider the use of a landowner from a previous project to speak with the landowners who are potentially affected by HumeLink.</p>	<p>The team has discussed and explored internally within Transgrid the appropriate platform and medium to potentially use landowners from other projects. We have found that there is a lack of willingness for this to occur.</p> <p>We are actively looking at other options to achieve similar outcomes.</p>
<p>20. Consider the establishment of one or more reference groups to provide input into the consultation process for the HumeLink project.</p>	<p>CCGs were established where members can engage in the project planning process and on issues of key community concern.</p> <p>Bespoke reference groups will be established where possible. The steering committee for the independent undergrounding study provides the model for this.</p>

1.2 Community Consultative Groups

Recommendation 20 emphasised the requirement for establishing reference groups for the HumeLink project. As a direct response to this recommendation, the project successfully established Community Consultative Groups (CCGs) to involve a diverse range of stakeholders at every stage of the proposal to provide valuable input and feedback. The initiative seeks to foster effective communication and collaboration among various stakeholders involved in the HumeLink project, including Transgrid, local community groups, landowners, and councils. Its primary objective is to create a platform for two-way communication, allowing Transgrid to provide updates on the project and address any concerns or queries raised by the community [5]. Similarly, it offers an opportunity for community members, stakeholders, and local councils to seek information from Transgrid and provide valuable input to refine the project corridor and contribute to the subsequent Environmental Assessment process.

As highlighted in the CCG Code of Conduct [6] (Attachment A), to facilitate a comprehensive representation of stakeholders, each group within the

initiative consists of a maximum of 15 members. This includes three representatives from Transgrid, one member from each council and one from each land council, and one representative from each established landowner group within the CCG area. The remaining members are drawn from recognised community groups, with preference given to groups, and individuals who have expressed their interest in participating. As of writing, the CCGs have had meetings in the following months:

- 2021: October, November,
- 2022: February, April, July, September, October, November, December,
- 2023: February, March, May

The Code of Conduct also highlights how the CCGs should strive for equitable gender representation and include diverse age groups. Coverage along the project corridor is crucial for comprehensive representation. Invitations were extended to Chambers of Commerce, Progress or Resident Associations, Indigenous groups, Local Environmental Groups, Landcare/Bushcare organisations, Tourism Associations, and industry associations such as Forestry Groups and NSW

Farmers. The CCGs selection process considered specific expertise, skills, and a broad range of local organisations to foster inclusive dialogue and effective decision-making. As of April 2022, the three groups across five Local Government Areas (LGAs) of CCGs were formed [7].

1.3 Summary of Stakeholder Engagement and Interest

The following table is sourced from the HumeLink Scoping Report [8] and highlights how Transgrid has engaged with stakeholders as well as their key interests:

Table 2 Summary of Stakeholder Engagement and Interest

Stakeholder	Engagement	Topics of Interest
Community	HumeLink newsletter and fact sheets Website and Interactive Map 1800 number and HumeLink email CCGs Webinars, information sessions and public displays Support services, such as independent counselling	Local employment opportunities Environmental and social concerns Cumulative impacts Community sponsorship opportunities Community benefits Opportunities for improved communication and consultation Opportunities to collaborate for better regional outcomes Impact to local businesses
Landowners	One on one meetings and site visits HumeLink newsletter and fact sheets Targeted notifications Website and Interactive Map 1800 number and HumeLink email CCGs Webinars, information sessions and public displays Support services, such as independent counselling	Impact to local farm businesses and landowners Easement guidelines Compensation Opportunities for improved communication and consultation Environmental and social concerns
Government (political representatives) Local State Members	Briefings / presentations Briefing Notes HumeLink newsletter and fact sheets	Community sentiment/issues arising Constituent concerns Media interest Regulatory considerations
Local Government (elected officials and Executive staff)/Councils	Councillor briefings Council presentations Emails / phone calls HumeLink newsletter and fact sheets	Community sentiment / issues arising Constituent concerns Local impacts Media interest Local opportunities and constraints, such as considerations around Tumut airport Use of public vs private land

Stakeholder	Engagement	Topics of Interest
Government (Departmental and Agency) Heritage NSW DPE (NSW) (including Biodiversity Conservation Division) DAWE (Fed) Department of Primary Industries (NSW) Forestry Corporation of NSW Centre for Property Acquisition (NSW) Transport for NSW Rural Fire Service	Briefings / presentations Technical meetings Interface meetings Emails / phone calls HumeLink newsletter and fact sheets	Field survey requirements Hunting restrictions Impact of proposed routes on firefighting and fuel reduction burns Impact on operations Compensation Opportunities to share lessons and to collaborate for better regional outcomes
Traditional Owners and other Aboriginal representative groups/Land Councils	Briefings / presentations Emails / phone calls HumeLink newsletter and fact sheets CCGs Website and Interactive Map Community sponsorship program	Culturally significant sites Cultural heritage survey requirements and findings Opportunities for improved communication and consultation Community sponsorship opportunities Opportunities to collaborate for better regional outcomes
Community groups Community organisations Service groups (Rotary etc) Issue-specific interest groups (e.g. environment, health) Local business PIAC, EUAA, ECA, St Vincent de Paul, Tesla, AiGroup	Briefings / presentations HumeLink newsletter and fact sheets Website and Interactive Map CCGs Community sponsorship program Support services, such as independent counselling	Local employment opportunities Community sponsorship opportunities Opportunities for improved communication and consultation Opportunities to collaborate for better regional outcomes
Industry representative groups NSW Farmers Association	Briefings / presentations HumeLink newsletter and fact sheets Website and Interactive Map Community Consultative Groups Support services, such as independent counselling	Impact to local farm businesses and landowners Easement guidelines Local employment opportunities Community sponsorship opportunities Opportunities to collaborate for better regional outcomes Opportunities for improved communication and consultation Compensation
Major development proponents and renewable generators (e.g. Snowy Hydro, CWP Renewables, Tilt Renewables, Spark Renewables)	Briefings / presentations HumeLink newsletter and fact sheets Website and Interactive Map Technical meetings Interface meetings Emails / phone calls	Workforce capacity Cumulative impacts Interface management Constraints and opportunities Opportunities to share lessons and to collaborate for better regional outcomes

Transgrid's engagement with landowners and stakeholders within the corridor resulted in feedback across a range of themes. The following table from the Humelink Scoping Report [8] highlights these themes received up to November 2021:

Table 3 Feedback Themes

Theme	Number of times topic was raised	Focus of feedback
Proposed alignment	364	<ul style="list-style-type: none"> Location of route Preferences for alignment Concerns about the alignment Proposed alternative alignments Timeframes for route refinement Level of influence on alignment Consultation timings and process What it means to live with a powerline Easement guidelines Route selection process Compensation process Known and unknown constraints Use of public versus private land
Impacts on land use and property	220	<ul style="list-style-type: none"> Protection of productive agricultural land Current and future land-use plans Existing farming infrastructure Impact to farming operations Property access Gates and livestock Biosecurity Easement guidelines Construction impacts Consent to enter protocols
Impacts of tower	97	<ul style="list-style-type: none"> Tower locations Size and shape of the towers Impact to visual amenity Impact to property value Impact to farming operations Level of influence on tower placement Easement guidelines and exclusion zones Design safety features
Impact on the environment	48	<ul style="list-style-type: none"> Protecting Landcare plantings Clearing requirements Construction impacts Easement guidelines Identification and protection of heritage items Undergrounding the line Use of public vs private land
Impacts on health	37	<ul style="list-style-type: none"> Concerns about effects of electric and magnetic fields (EMF) on people and animals

1.4 Biosecurity

The proposal's preliminary impacts include changes in land tenure, potential disturbance to dwellings and infrastructure, land parcel fragmentation, and disruptions to existing land uses [9]. Agricultural activities, horticulture operations, forestry operations, and other land uses within the project corridor are susceptible to these impacts. As a result, there may be interruptions to seasonal cropping and harvesting, biosecurity risks due to construction movements, and temporary restrictions on accessing and using nearby properties during the construction phase [8].

Themes involving biosecurity have been received by Transgrid 220 times as seen in Table 3. Potential impacts on terrestrial ecology highlighted by Transgrid [8] include the direct loss of vegetation and habitats, which can disrupt the delicate balance of ecosystems. Additionally, the damage to habitats, vegetation, and foraging areas poses a threat to the survival of various species. The injury or mortality of fauna can also further exacerbate the negative ecological impact. The disturbance caused by noise, vibration, movement, and human presence can disrupt natural behaviours and stress wildlife. Lastly, there is a risk of unintentional introduction or spread of weeds and pathogens, which can harm native plant species and potentially impact the entire ecosystem.

Following a meeting with the CCGs in March 2023 [10], it was apparent that some members expressed concerns regarding the effectiveness of the protocols implemented by contractors in addressing biosecurity issues during the construction phase. These individuals raised concerns about the possibility of the protocols not being strictly adhered to, resulting in the persistence of biosecurity problems. It was emphasised that the existing measures might only serve to reduce the risk rather than eliminate the potential threats. Furthermore, there were concerns that the current Property Management Plan (PMP) might not sufficiently address or account for potential future risks that could arise from the construction activities. These latent impacts could emerge over time, potentially affecting the terrestrial ecology beyond the project's completion.

A representative for Resist HumeLink has raised concerns surrounding overhead transmission infrastructure conflicts with agriculture [11]. They referenced the Managing Farm-Related Land Use Conflicts in NSW research report by the Australian Farm Institute [12] which highlights how all levels of government need to protect agricultural assets to secure the future of the industry. They claimed the project does not consider modern farming practices such as drones and GPS which cannot be utilised in proximity to overhead transmission lines.

1.5 Cultural and Heritage Sites

The HumeLink project extends across the lands of the Wiradjuri, Ngunnawal, Ngarigo and Gundungurra people [8]. Construction ground disturbance, which includes activities such as excavation and grading, can directly disturb and destroy archaeological artifacts and structures as highlighted in the Scoping Report [8]. Vegetation clearance can remove the protective cover and concealment of archaeological sites, exposing them to further risk of damage or destruction. The removal of vegetation can also result in the loss of important contextual information that helps archaeologists interpret and understand the significance of the site. Within the designated heritage study area, which encompasses a one-kilometre-wide corridor on either side of the proposal corridor, a total of 291 Aboriginal heritage items/recordings have been documented and included in the Department of Premier and Cabinet Aboriginal Heritage Information Management System (AHIMS).

One of the thirteen FAQs present of Transgrid's website discussing HumeLink questions what engagement practices has been considered and performed to Indigenous groups and people [13]. In April 2021, the HumeLink project team actively engaged with Aboriginal stakeholders and invited expressions of interest from the community to determine the cultural significance of Aboriginal objects and places within the project area. Registered Aboriginal Parties (RAPs) were involved in cultural heritage surveys and provided valuable insights for assessing impacts and implementing mitigation measures.

During a meeting with the CCGs in March 2023 [10], a member expressed concern regarding the placement of powerlines over culturally significant sites. The member commented that if a fire were to occur in the vicinity of the site, the presence of the powerline infrastructure could impede the ability to effectively protect the site. According to Transgrid, the risk of unintended accidents would be reduced by following established Transgrid procedures (like designating restricted areas around recognised Aboriginal cultural sites) [8].

A discussion with Snowy Valley CCG members in February 2023 [14] highlighted an important perspective regarding the concept of heritage and its significance to local communities. It was emphasised that while Transgrid may not consider trees planted by farmers as heritage, for the farmers themselves, these trees hold great value as they represent a legacy and contribute to the creation of heritage. The term "heritage" was deemed to be disconnected from its intrinsic value. Members expressed concern about Transgrid's plan to remove hundreds of trees that hold significance for future generations. They stressed the importance of city personnel involved in this project understanding

the perspectives of country people and recognising how they perceive and value different aspects of their land and heritage. Transgrid representatives suggested raising these concerns with the Land Access Officers, highlighting the need for open dialogue and the inclusion of local community voices in decision-making processes.

1.6 Economy

Residences which are within the corridor of the project will receive compensation payments. This includes Strategic Benefits Payments of \$200,000 per kilometre of transmission, paid in instalments over 20 years once the project is energised [15]. Easement Payments are assessed by the Land Acquisition (Just Terms Compensation) Act 1991 [16] and are paid to landowners in addition to compensation payments. Additionally, Transgrid offer a Community Partnership Program which offers up to \$5000 grants for non-profit organisations local to the Transgrid assets or construction [17].

From the minutes of a CCG meeting held in March 2023, a CCG member commented they will not accept a \$5000 grant from Transgrid as they 'do not endorse what Transgrid is doing' [10].

In the same meeting, it is clear CCG members are unhappy with Transgrid and the AEMO. They requested a copy of the 2022 Integrated System Plan (ISP) [1], but it was received months after the request. CCG members also requested to meet with the AEMO in the CCG meeting a month prior, however no meeting was scheduled. The CCG members want to be 'involved in conversations with key decision-makers' and are concerned Transgrid are 'not representing concerns of the community'. They submitted an additional request to meet with a representative from AEMO or the government, which has been taken on notice by Transgrid project member attendees.

The ISP suggests that net market benefits would be \$3 million more if HumeLink were scheduled to be delivered in 2028-29 in Step Change (sudden transformation that occurs in a relatively short period) and 2033-34 in Progressive Change (gradual and continuous development). A CCG member questioned the timeframe for completing the project and requested the project to be slowed down in order to deliver a better outcome for impacted communities.

A representative for Resist HumeLink sent a letter to the AEMO, highlighting the omission of costs to communities in transmission infrastructure evaluation [11]. They raised concerns regarding property devaluing of homes in proximity to overhead transmission lines. The Land Acquisition Act 1991 only covers residences which have transmission line infrastructure on the property. The representative highlighted how neighbouring properties suffer from the decrease in valuation, but do not receive this compensation.

They also highlighted how the Regulatory Investment Test for Transmission (RIT-T) aims to select the transmission investment option which maximises net economic benefits. However, RIT-T does not consider the cost of the environment and is insensitive to environmental impacts.

The representative, is deeply concerned about the negative impact of overhead transmission on the lifestyle of farmers, as how it significantly affects the desirability of the landscape for farming. Consequently, this detrimental effect on agriculture poses a threat to local businesses, leading to a substantial "loss of economic stimulus for rural areas".

They also claimed tourism of NSW is also impacted due to the obstruction of natural landscapes due to transmission towers. She highlighted how NSW visitation increased 41% from 2014 to 2019 and expenditure of \$14.3 billion in 2019, as well as how regional Australia is a visitor attraction due to its natural landscape.

1.7 Undergrounding

In late 2021, Transgrid received requests from the community and landowners to investigate the possibility of constructing the HumeLink project using underground cables instead of overhead transmission lines. However, an underground feasibility study scope of works presented in April 2022 by Transgrid [18] presented four concept design as well as design variants for consideration which can be summarised:

Table 4 Undergrounding Design Concepts Summary

Options	CAPEX	Schedule
Overhead line	\$3.3 Billion	4-5 years
Design 1A	\$17.1 Billion	≈ 11 Years
Design 2A-1	\$11.5 Billion	≈ 7 Years
Design 2B-1	\$9.0 Billion	≈ 7 Years
Design 3A-3	\$9.6 Billion	≈ 6 Years
Design 3B-3	\$7.5 Billion	≈ 6 Years
Design 4A-5	\$11.5 Billion	≈ 6 Years
Design 4B-5	\$9.1 Billion	≈ 6 Years
Design 4C-2	\$10.4 Billion	≈ 6 Years

The cost of burying the HumeLink transmission lines amounts to at least an estimated \$17.1 billion, which is five times greater than the current cost of the overhead line project, standing at \$3.3 billion. This excessive cost was deemed not sustainable since it would ultimately be borne by commercial, industrial, and private electricity consumers. Opting for underground transmission lines would also result in a significant project completion delay of up to six years which compromises later works for renewable energy and interstate connections to the grid.

1.7.1 CCG Response to Undergrounding Study

CCG representatives from Snowy Valleys CCG, Wagga Wagga, Cootamundra, Gundagai CCG, and Upper Lachlan, Yass Valley CCG submitted the CCG Representatives' Position on HumeLink Undergrounding Study Report [19] in response to Transgrid, expressing their concerns. They found the Undergrounding Study report to be heavily focused on the negative impacts of undergrounding while neglecting to represent any of the potential positive benefits. Additionally, the CCG representatives suggested that the cost estimates for the underground cable components were significantly higher than other estimates available in the AEMO Transmission Cost Database and from reputable Australian-based high voltage cable experts. The representatives claimed that there were technical inaccuracies regarding AC and HVDC underground

cable installation and operation in the report, which seemed biased towards highlighting the negative aspects of undergrounding. To illustrate their point, they provided an example wherein the consultant based their assumptions on the Transgrid EHV Cable Design and Installation Manual, which primarily addresses the installation of long-distance AC and HVDC cables in rural and non-built-up areas. However, the consultant applied techniques for the installation of relatively shorter distances of AC underground cables in built-up areas, leading to inconsistencies and potential inaccuracies in their findings.

The CCG representatives have expressed dissatisfaction with the methodology used for the cost estimates related to undergrounding and have specifically requested clarification on how scaling factors have influenced these estimates. They have voiced their concerns regarding responses that rely solely on "engineering judgement based on experience and understanding of the HVDC market" as the basis for the cost estimates. According to the representatives, they find the consultants' inability to justify how they have adjusted historical values to account for market changes to be problematic. This lack of transparency raises concerns about the accuracy and reliability of the estimates provided.

Additionally, the CCG representatives highlighted the consultants' failure to provide MW/MWh values used in

determining the operational expenditure (OPEX) costs associated with undergrounding. The representatives argued that a fair comparison between the underground and overhead options cannot be made until the calculations and assessments of losses and costs have been presented and thoroughly reviewed. The representatives asserted that it is crucial to consider the total electrical losses in the comparison. They believed that the underground option should demonstrate lower losses than those incurred by AC overhead lines.

The CCG representatives expressed dissatisfaction with the proposed alternative route assessments for undergrounding and raised concerns regarding the constraints highlighted in the report. They argued that the inconvenience caused during a short construction period should not be the sole determining factor for the project's location, as they found it unconvincing. Furthermore, the representatives disagreed with the inclusion of unlicensed airstrips and bushfire-prone land within the designated kilometre corridor as constraints for undergrounding. They believed that these factors should not be considered limitations for the underground option. They also asserted that the constraints presented in the report were derived from land studies conducted for overhead routes, making them unreliable for assessing the feasibility of undergrounding. The representatives highlighted inconsistencies in the definitions of bushfire-prone areas between the NSW Rural Fire Service and Transgrid. They suggested that certain properties in the area, marked as bushfire-prone on the Rural Fire Service maps, had not been officially designated as such by Transgrid. This discrepancy raised concerns about the accuracy and consistency of the constraints used in the report's assessment.

Lastly, according to the CCG's consultant, the commissioning schedule mentioned in the report is deemed excessive and should not exceed a maximum of two to three months. By implementing this adjustment, the schedule for certain options would be reduced to less than 6 years, making it more comparable to the AC overhead line's timeline.

1.7.2 Response from Transgrid

This letter prompted a response from the Major Project Delivery Director of Transgrid [20] to the Community Consultative Groups' representatives, who found the original report to be consistent with other national and international experiences and benchmark studies. The Director highlighted how Transgrid operates under the National Electricity Law (NEL) and therefore must present the most efficient route for transmission that adheres to the long-term interests of consumers of electricity with respect to price, quality, safety, reliability and security of supply of electricity.

Transgrid claimed their assessment of options involved a detailed examination of the relevant costs and benefits associated with the electricity supply to consumers. They stated their evaluation considered various factors, including the capital cost of the proposed solution, ongoing operational costs, market benefits, expected reliability, and the impacts on landowners, the community, and the environment. Based their analysis of the report's findings, it became evident that undergrounding HumeLink did not align with these criteria.

The letter acknowledged that the original report thoroughly evaluates the visual impact advantages of undergrounding, along with its implications for wildlife, bushfires, and reliability. However, it was found the cost of undergrounding HumeLink will surpass that of an overhead line. Furthermore, the additional time required to implement an undergrounding solution further enhances the project's costs. Considering these factors, it became apparent that undergrounding HumeLink was not a viable option.

1.7.3 CCG Meeting

During a meeting between CCG members and Transgrid representatives [10], the topic of undergrounding was further discussed. In this meeting, a CCG member raised a question regarding the potential reconsideration of undergrounding if Transgrid encountered significant cost increases for the towers due to unfavourable ground conditions. In response to this query, Transgrid stated that the cost comparisons already considered the risk of increased costs resulting from changes in ground conditions.

During the discussion, the issue of safety in relation to bushfires was extensively debated, with a focus on how the implementation of undergrounding could enhance protection and eliminate risks for communities. Concerns were raised regarding the potential danger posed by keeping overhead lines energised during fires, as it could jeopardise the health and well-being of residents. CCG members emphasised the need for equitable treatment of people in communities, urging that their safety should be prioritised as much as those in cities. Transgrid responded by highlighting their collaboration with the Rural Fire Service to develop appropriate protocols addressing these concerns. However, these assurances were met with continued apprehension from CCG members. One member expressed their belief that if Transgrid genuinely cared about the impacts of bushfires, they would prioritise undergrounding the line as a proactive measure.

During the discussion, a member cited the Australian Energy Infrastructure Commissioner's criticism of the suitability of the RIT-T in restricting undergrounding

considerations. Another member emphasised the need to account for ongoing social and environmental costs alongside financial considerations. Another member requested Transgrid to estimate the cost of building a small underground portion, to which Transgrid responded by highlighting collaboration with international companies to inform their cost estimates.

Members raised concerns about the cost comparisons of undergrounding and whether maintenance costs were adequately considered. One member specifically mentioned their awareness of an underground gas pipeline that was efficiently laid 32km over 8 weeks. In response, Transgrid highlighted that the challenging terrain along the HumeLink route was a crucial factor contributing to the difficulties and complexities associated with undergrounding.

During the discussion, there was a question raised about the potential reduction in road traffic with the implementation of undergrounding. However, it became apparent that such a comparison had only been conducted for overhead lines, with no assessment made specifically for the underground option. A CCG member pointed out this discrepancy, highlighting that Transgrid's lack of planning and consideration regarding traffic for the undergrounding option suggested a lack of seriousness in considering undergrounding as a viable alternative. This comment expresses the concern that Transgrid may not be giving sufficient attention to exploring the potential benefits and implications of undergrounding.

A CCG member inquired whether there would be a comparison between the visual impacts of undergrounding and those of overhead transmission lines. Another CCG member expressed the view that Transgrid should approach the HumeLink project through a co-design process involving the community, farmers, Rural Fire Service, security experts, environmentalists, and council members. They highlighted the importance of engaging with these stakeholders and working collaboratively to ensure that decisions are not imposed upon the community.

1.7.4 HumeLink Alliance Inc.

HumeLink Alliance Inc. started an independent ecological campaign against the HumeLink project, advocating to put the project underground to prevent disfigurement of the landscape and community damage [21]. They claim the proposed towers have the potential to cause bushfires, hinder firefighting efforts, create electromagnetic fields with health impacts, render farmland unusable, industrialise the landscape, decrease land and property values, destroy native habitats, disrupt aerial and drone activity, interfere with GPS signals, threaten animal habitats, create constant

noise, and be prone to collapse in storms and high winds.

They claim underground options instead offer advantages as the lowest impact solution. The risk of underground cables causing bushfires is minimal as power transmission is unlikely to be interrupted during bushfires or severe weather events, eliminating the need to shut off power and facilitating firefighting efforts. Access for emergency services and aviation operations remains largely unaffected. Once construction is completed, there is minimal impact on private land or existing land use, as the easement can be designed to fit within road reserves. The possible location of the cables along roadways significantly reduces the impact on flora and fauna. Furthermore, the underground cables result in no visual impact, and the converter station occupies a comparable area to a typical AC terminal station with much of the equipment housed indoors, minimising visual and land-use impact. Along the transmission line, there is no audible noise, and the option presents little to no electromagnetic field impacts.

However, they state communities have been advised Transgrid's towers are the only solution and are pleading with State and Federal Government to consider these alternatives.

1.7.5 Resist HumeLink

An article for Resist HumeLink [11] discusses the detrimental effects of visual pollution caused by transmission towers and raises a valid question regarding the lack of undergrounding initiatives in New South Wales, as opposed to other countries that have recognised the visual amenity and environmental benefits associated with underground transmission systems. The author also highlights the ongoing projects of companies such as Star of the South and Marinus, which are advocating for the undergrounding of transmission lines in the National Electricity Market. They claim undergrounding not only improves the aesthetic appeal of the surrounding landscape but also minimises potential negative impacts on the environment.

1.8 Traffic and Transport

Transgrid released a Traffic and Transport Impact Statement [22], highlighting temporary increases in traffic on local roads, adversely affecting the performance of the road network. Furthermore, both the construction and operation of the project will lead to temporary road closures and the deterioration of road conditions. Specifically, the construction interacts with 14 roads in Wagga Wagga, 18 roads in Snowy Valleys, 5 roads in Cootamundra-Gundagai Regional, 13 roads in Yass Valley, and 26 roads in Upper Lachlan Shire.

During a CCG meeting conducted on May 2023 [23], a CCG chair raised concerns regarding road safety and dust. A Transgrid project member highlighted mitigation for dust from trucks does not include wetting down of council roads but only access tracks. They suggested there will be other mitigation measures such as ensuring loads are covered when transporting dust generating materials. CCG members were concerned that when a truck moves along the road it throws up dust and this will not be mitigated by covering the load. High volumes of truck and vehicle traffic will further damage already poor roads. The CCG members felt that Transgrid should be required to bring the roads back to better condition.

1.9 Noise and Vibration

As a method to engage with community and stakeholders, Transgrid hosted Community Information Webinars. A webinar in May 2023 [24] highlighted possible sources of noise and vibration. This included site establishment work, vegetation clearing, civil works for access tracks or compounds, and laydown areas. They also noted that noise issues can arise from the construction of transmission lines, involving the use of plant and equipment, concrete batching, and the erection of steel components. Similarly, noise is generated during the construction of new substations and modifications to existing substations, including civil works and the erection of new buildings and steel structures. There are also vibration impacts from construction equipment and noise from construction traffic.

During a CCG meeting conducted in May 2023 [23], a member emphasised the importance of conducting a Property Condition Survey before construction begins due to the specific requirements for tower concrete footings. However, in response, a Transgrid project representative explained that the vibration assessment would examine vibration levels near structures to determine if a dilapidation report was necessary. They mentioned that the EIS assessment did not identify any buildings affected by vibration, but once the final tower locations were determined, Transgrid would assess whether further evaluations were required before construction.

Another CCG member inquired about the number of sites designated for noise monitoring. The project representative confirmed that there were only nine sites for monitoring noise in the EIS. However, they mentioned that contractors would be responsible for monitoring noise during construction. A CCG member raised another question concerning noise monitoring for houses adjacent to power lines. Transgrid clarified that noise levels would be monitored during construction, and if noise levels were expected to exceed the

acceptable limits for a certain period, Transgrid would engage in discussions with landowners to minimise impacts.

The topic of noise generated by the transmission lines after construction was discussed. The project representative responded that the humming effect (corona noise) from the lines occurred only under specific weather conditions, such as in light rain or when mist is present. The assessment determined that during these conditions, the noise could be heard up to 300 meters away and up to 400 meters away when two lines ran parallel. However, A CCG member mentioned that they could hear constant humming from the existing 330kV transmission lines, not just during specific weather conditions.

Another CCG member inquired about the assessment of agricultural impacts, particularly on livestock and animal well-being, regarding noise and vibration. The Transgrid project representative explained that noise and vibration requirements for the EIS did not cover livestock impacts. The representative added that Transgrid had conducted a literature review on the topic but found limited research on the impacts of transmission lines on livestock.

1.10 Bushfire Management

During the discussions, community CCG members raised concerns related to the impact of transmission lines on bushfire incidents [25]. One member shared their personal experience, stating that their farm was severely affected by fires in 2020, highlighting how the presence of transmission lines hindered their ability to combat the fire effectively. Another member expressed the widespread risk of bushfires and noted that several CCG members and observers had previously experienced fire damage. They questioned procedures in the event of a bushfire and how landowners are expected to manage such situations. Furthermore, a member criticised the fact sheets provided, stating that they focused primarily on minimising the risk of bushfires, which they felt was insufficient information for local landowners. These concerns highlight the need for comprehensive guidance and support in managing bushfire risks in relation to transmission lines for affected landowners. During a separate meeting, a CCG member highlighted that in the previous major bushfire incident, there were 60 outages, emphasising that undergrounding the route would eliminate this risk [26]. They expressed concern about property owners facing significant risks when transmission infrastructure is located on their land during a fire event.

Transgrid claim they are having ongoing meetings with NSW Rural Fire Service, working to identify how HumeLink can further support firefighting efforts as

well as targeted learning sessions with local RFS crews and bushfire workshops with the community [8]. They claim their practices meet Electricity Network Safety Management System standards for bushfire management. They state they perform regular vegetation management, regular reviews and inspections of assets to ensure they are fit for purpose, and inspection and management of the easement that supports the infrastructure. Transgrid will implement the Bushfire Risk Assessment (BFRA) which involves identifying and assessing specific bushfire survey areas within the project footprint. Field investigations and desktop mapping are conducted to analyse vegetation, slope, and access, as well as to model bushfire indicators. Mitigation measures are recommended based on the findings, considering local feedback from landowners and the community.

1.11 Route Refinement Decisions

Transgrid conducted community consultation, environmental field studies, and site assessments to evaluate regional constraints and local considerations. This process enabled the refinement of route options to minimise the potential impacts on the community.

As highlighted in the Tumut Area Route Refinement Decision [27], although the route would traverse a longer distance on private land compared to other options, it was deemed to have significantly lower environmental and social impacts. This route affects seven residences within a 500-meter radius and passes through a shorter distance through areas with a high to very high risk of bushfires. This route provides diversification in supply, improved network resilience, and reduced adverse effects on the community.

As discussed in the Bannaby Route Refinement Decision [28], Transgrid prioritised lower environmental impact. They opted for a route that resulted in a smaller area of impacted Plant Community Types and materially lower biodiversity offset costs. This route traverses a shorter distance through areas with a high bushfire risk, having better network resilience than other considered options.

In the Green Hills Route Refinement Decision [29], Transgrid considered an alternative route through the Green Hills State Forest. This option, despite being associated with higher costs and poorer network resilience, reduced the impact on private landowners. Transgrid weighed the benefits to landowners and the removal of five residences within 500 meters of the line against the negative aspects and determined that the alternative route was the preferred option.

As highlighted in the Pejar Dam Route Refinement Decision [30], Transgrid took into account the amenity impact on Pejar Dam for recreational users. While the alternative route has higher impacts on Plant Community Types, including threatened ecological communities, and incurred higher biodiversity offset costs, it avoided crossing over the middle of the recreational dam. This allows for the route to parallel an existing line at the northern end of the dam, providing greater opportunities for paralleling.

2. Victoria to New South Wales Interconnector West (VNI West)

This project consists of a new high capacity 500 kV double-circuit transmission line to connect Western Renewables Link (north of Ballarat) with Project EnergyConnect (at Dinawan) via Kerang [1].

2.1 Project Assessment Draft Report (PADR)

As a response to the PADR [31], twenty-two non-confidential stakeholder submissions were received [32] and the themes of their responses are detailed below.

2.1.1 Support for Increased Interconnection Between Victoria and NSW

Several stakeholders supported the swift advancement of the VNI West project. CVGA highlighted the urgent need for transmission network upgrades to enhance renewable energy generation opportunities in the region for cheaper and cleaner renewable energy and to provide opportunities for regional development [34]. This is further supported by Pacific Hydro who stressed the requirements of reinforcing the power system to enable larger interstate flow [35], and ENGIE highlighted the regions good quality solar and wind resources and potential for wider renewable generation deployment [36].

On the 20th of February 2023, the Victorian Minister for Energy and Resources issued an Order under NEVA, allowing early works for VNI West and the evaluation of alternative connections to WRL [37]. This NEVA Order aims to facilitate earlier project delivery by enabling AEMO to commence early works while completing the RIT-T. The Order also grants AVP functions, including the assessment of alternative project options to accelerate development and delivery of both projects. By considering alternative options for VNI West, this Order reduces delays and ensures reasonable costs for consumers. This enhances the consideration of social, cultural, and environmental factors, expediting project delivery. It aligns with community feedback on the importance of earlier and broader community engagement.

QUEN and PIAC expressed concerns regarding the project's unrealistic timeframe, citing challenges in securing land, easements, environmental approvals, and potential supply chain constraints [38] [39]. However, AVP and Transgrid defend their time estimates based on previous projects and are taking proactive measures to address these concerns [32]. They are engaging with suppliers at an earlier stage and utilising suppliers with multiple supply and production options to mitigate any potential delivery constraints.

2.1.2 Social Licence Issues

Multiple stakeholders emphasised the importance of considering social license issues, which encompass various factors such as the impact on visual amenity, biodiversity, land use, culture, heritage, tourism, and bushfire risk. QUEN states "the stakeholder engagement strategy currently employed by AEMO on the VNI West Project is certainly not the template for landowner and community engagement" [39]. In response, AVP and Transgrid assured the community they commit to the Energy Charter Better Practice Guide to Landholder and Community Engagement Guidelines [40] to mitigate conflicts developed by the co-existence between transmission infrastructure and communities [32].

The Hepburn Shire Council emphasised the impact of the project on the landscape, highlighting the need to address the "specialness" of the landscape and its impact on the future aspirations of the community [41]. The VFF discussed the impacts of the project on regional agriculture, highlighting transmission lines will impact the use of large tractors and irrigation while also rendering digital agriculture incompatible, such as GPS enabled tractors, auto steer and drones [42]. This impact on agriculture production is said to threaten regional jobs in manufacturing and there were concerns that it would also lead to the introduction of biosecurity risks due to the spread of invasive species between properties from construction vehicles.

The VFF and Hepburn Shire Council also discussed the area's vulnerability to bushfires. Hepburn Shire Council discussed the grass and canopy fire risk already present in the region, which is increasing due to climate change. They state the "community simply will not tolerate increased fire risk" and how aerial firefighting is limited near transmission lines, further increasing the dangers [43]. Their submission referenced the collapse of six transmission towers during the Cressy 500 kV Tower Incident in January 2020 due to a convective downburst caused by a severe weather event of high winds [44]. They also mentioned the Kincadee Californian fires, which were found to have been caused by failed Pacific Gas & Electric (PG&E) transmission infrastructure which destroyed 374 residential and commercial structures [45]. In response, PG&E implemented undergrounding plans to high fire threat areas for fire risk mitigation [46], prompting Hepburn Shire Council to question the need for overhead lines highlighting their desire to keep communities safe. VFF highlighted the potential delays of fire response due to the prohibition of access of fire trucks under transmission lines according to the Country Fire Authority's Standard Operating Procedures [42]. They state permission is also required from the transmission line owners for aerial helitankers to fly above transmission lines, which can also significantly delay responses which will further endanger communities.

Swan Hill Rural City Council highlighted the importance of benefit sharing with local communities, ensuring that investment in new transmission infrastructure will improve the reliability of local power supplies, particularly in communities that will be hosting infrastructure [47]. The City of Greater Bendigo further emphasised the requirement for community benefit sharing models that extend beyond directly affected landholders and can contribute to the local economy. This includes utilising local suppliers, creating opportunities for community investment structures, establishing opportunities for local training and employment and maximising opportunities for development of complementary industries in the region [48]. CVGA proposed training for future employment in the renewable energy sector, grant programs, and local energy projects investments to reduce power bills, enhance reliability, address local energy needs, and strengthen community resilience [32].

City of Greater Bendigo [48], another individual [49], VFF [42], and Hepburn Shire Council [41] also suggested that the potential negative impacts of transmission infrastructure could be mitigated by co-locating it with existing infrastructure or constructing it underground. Hepburn Shire Council insists undergrounding is more reliable, efficient and has a reduced impact to social and environmental factors. They state there is:

- Little to no risk of underground cables causing fire or being affected by severe weather events
- Little to no impact to access e.g., for emergency services and aviation operations
- Power will not need to be switched off to aid firefighting, and the power transmission is highly unlikely to be disrupted due to smoke causing flashovers and potentially tripping breakers
- Minimal impact to private land or current land use once construction is completed as the easement could be designed to fit within existing road reserves
- Significantly reduced impact to flora and fauna due to the possible location of the cable along roadways
- No visual impact concerning the transmission line as the cables are buried underground
- Equivalent or reduced visual and land-use impact from the converter station as it would be expected to occupy a relatively similar area as a typical AC terminal station with much of the equipment being housed indoors,
- No audible noise along the transmission line
- Little to no electromagnetic field impacts

It was also suggested the cost of undergrounding is overestimated. For example, questioning the claim that underground cables are 17 times more expensive than overhead [49]. Hepburn Shire Council suggest

AusNet's estimation that undergrounding the HVAC transmission line along their proposed routes would cost approximately 16 times more is based on inaccurate information and has been challenged by Amplitude on behalf of Moorabool Shire [41]. Amplitude Consultants estimate the cost of underground HVDC to range between 3.15 and 5.7 times the cost of an overhead HVAC solution [50]. Snowy Hydro commented on the estimated costs and duration of the HumeLink project (see Section 1.8) and highlighted how this excessive cost is not sustainable [51]. AVP and Transgrid maintain that the cost of undergrounding VNI West would be higher compared to using overhead lines and that undergrounding would introduce significant delays to the construction timetable [32]. AVP and Transgrid do not consider undergrounding VNI West a realistic option.

2.1.3 Transparency and Meaningful Consultation with Stakeholders

Mount Alexander Shire Council noted extensive engagement with both the Council and the community is crucial in order to thoroughly comprehend the proposed measures aimed at mitigating any potential adverse effects on local amenities, cultural values, and the environment [52]. Swan Hill Rural City Council also encouraged the AEMO to collaborate with local government authorities in placing new transmission infrastructure away from farmland and built-up areas to support renewable energy generation [47]. Hepburn Shire Council commented on the need for Traditional Owner engagement throughout all stages of the process [41]. These submissions had important themes involving being transparent on what are negotiable and non-negotiable aspects of the project which can be influenced by the community.

Concerns were also raised regarding the transparency of the RIT-T. AiGroup highlighted the need for the transparency of the RIT-T cost benefit analysis process to gain consumer support [32]. AusNet recommends adopting VTIF's approach to enhance "early and meaningful" engagement via thorough consideration of social, cultural, and environmental factors through a multicriteria analysis and strategic land use assessment, as well as outline how local communities are likely to benefit from the development [53]. As a response, AVP and Transgrid provided more information regarding how benefits are estimated, market modelling constraints, cost estimates, the projects interaction with the WRL, and the consistency with government policies relating to emissions and renewable generation. AVP and Transgrid assure they will receive confirmation from the AEMO that the project remains on the ISP optimal development path and delivers positive market benefits to provide confidence to stakeholders that the project will still provide a net positive benefit to consumers [32].

**2.1.4 Support Alternative Interconnection
Corridors, Further West in Victoria**

This includes consultation of the route alignment options, as proposed by AusNet, Moorabool and Central Highlands Power Alliance and Hepburn Shire Council, which originally traversed the area between Bendigo and Ballarat. RWE and Hepburn Shire Council suggested the corridor should be moved further west along a Bulgana to Kerang corridor. As highlighted by RWE [54] this route offers lower density dwellings, increased wind resources, larger agriculture properties, less native vegetation and ecological constraints, fewer regions of cultural heritage sensitivity, and reduced

flood risk. GNET note that a route situated further west will not impact constructability and will ‘open up increased renewables generation, with greater social acceptance’ [55]. This is further supported by the Hepburn Shire Council, who suggests this route is likely to impact fewer properties, communities and valuable natural resources than the proposed link via Bendigo [43]. As a response to the stakeholder feedback, AVP and Transgrid considered five new options that connect VNI West to WRL further west than originally proposed, which account for more factors which impair social licence. These include [32]:

Table 5 VNI West Route Options

Option	Description
Option 1 (to north of Ballarat)	Connects from Dinawan, via the new terminal station near Kerang, to WRL at the proposed terminal station north of Ballarat, and routes via Bendigo.
Option 1A (to north of Ballarat with spur uprate to 500 kV)	Additional spur involving uprate of WRL from the proposed terminal station north of Ballarat to Bulgana from 220 kV to 500 kV following the same WRL route for much of the length except for a slight variation around Waubra
Option 2 (to north of Ballarat plus non-network)	Same as Option 1 but with a virtual transmission line involving batteries at South Morang and Sydney West commissioned in 2026-27.
Option 3 (to Waubra/Lexton)	Connects from Dinawan, via the new terminal station near Kerang, to WRL at a new terminal station in the Waubra /Lexton area (Djaara Country), and routes via Bendigo. This option requires relocation of the WRL proposed terminal station north of Ballarat to near Waubra/Lexton and uprate of the proposed WRL transmission line from north of Ballarat to Waubra/Lexton from 220 kV to 500 kV
Option 3A (to Waubra/Lexton with spur uprate to 500kV)	Additional spur involving uprate of WRL from the proposed terminal station in Waubra/Lexton (Djaara Country) to Bulgana (Wotjobaluk Country) from 220 kV to 500 kV following the same WRL route for much of the length except for a slight variation around Waubra
Option 4 (to Bulgana via Bendigo)	Connects from Dinawan, via the new terminal station near Kerang, to WRL at a new terminal station near Bulgana (Wotjobaluk Country), and routes via Bendigo. This option requires relocation of the WRL proposed terminal station from north of Ballarat to Bulgana (Wotjobaluk Country) and the uprate of the proposed WRL transmission line from north of Ballarat to Bulgana from 220 kV to 500 kV.
Option 5 (to Bulgana)	Connects from Dinawan, via the new terminal station near Kerang, directly to WRL at a new terminal station near Bulgana (Wotjobaluk Country). This option requires relocation of the WRL proposed terminal station from north of Ballarat to Bulgana and the uprate of the proposed WRL transmission line from north of Ballarat to Bulgana from 220 kV to 500 kV following the same WRL route for much of the length except for a slight variation around Waubra

2.1.5 Interaction with the Western Renewables Link

Several submissions queried whether the modelling underlying the PADR treated the interaction between VNI West and the WRL appropriately when determining both the costs and benefits of VNI West. The EGA highlighted how the WRL is treated as an anticipated project as the proponent has not obtained all required consents, approvals, and licenses [56]. Should the WRL not proceed, they claimed this will significantly impact the benefits claimed in the PADR. EGA suggests the RIT-T should consider a counterfactual where the WRL does not exist.

Moorabool and Central Highlands Power Alliance highlighted the inadequacy of the VNI West project's component costs as the components of the WRL are only being built to facilitate VNI West and is claimed as difference in timing of transmission benefits from VNI West [57].

VEPC raised concerns, stating that a significant portion of its costs has been excluded and not evaluated elsewhere [58]. They argued that the expenses related to the North Ballarat Terminal Station and the North Ballarat to Sydenham 500 kV uprate should be considered in the assessment of VNI West for the RIT-T.

In response, AVP and Transgrid constructed an alternative base case that excludes not only the VNI West investment but also the WRL project [32].

2.1.6 Interaction with other major NEM projects

The EUAA raised several points regarding the assessment of VNI West in the PADR [59]. They sought clarification on the assumed timing of EnergyConnect and HumeLink, as well as requested sensitivity testing to evaluate the impact of any delays in these projects. They also highlighted the benefits derived from connecting HumeLink to EnergyConnect and questioned the impact of the EnergyConnect and VNI West connection at Dinawan on the claimed benefits for VNI West. Additionally, they expressed concern about the assumed commissioning date of Snowy 2.0, and the timing of other major transmission augmentations mentioned in the PADR, such as EnergyConnect and HumeLink.

AVP and Transgrid assure the delays in EnergyConnect and HumeLink projects, which are commissioned between three to twelve years before VNI West, will still result in their commission prior to the VNI West project and any impacts arisen from the delay is assumed to be minimal [32]. They state deferred capital investment will not affect investment decisions as this is a major source of market benefits which investors have already considered. They claim delays are expected to not impact benefits such as fuel cost savings from the VNI West commission, and therefore AVP and Transgrid

have not included a sensitivity test in relation to any such delay. Similarly, they claim delays in Snowy 2.0 is not anticipated to significantly impact the modelled benefits of VNI West. They suggest there is no double-counting of the expected benefits between VNI West and other major projects in the NEM. RIT-T modelling includes other major network projects in both the counterfactual base and the option cases and no other project benefits have been captured as part of this RIT-T

2.1.7 Consistency of the Assessment with Government Policies Relating to Emissions and Renewable Generation.

There have been raised concerns about how the RIT-T modelling incorporates government policies concerning renewable energy generation and carbon emissions levels. AusNet has expressed the need for clarification regarding the inclusion of the Victorian Government's offshore wind targets, REZ Development Plan, and the VTIF as inputs in the RIT-T analysis [53]. They are seeking information on how these factors are considered to affect the costs and benefits of VNI West. In addition, EPGA has raised inquiries about the inclusion and the potential impact of future Gippsland offshore wind generation within the modelling process [56].

AVP and Transgrid acknowledge that the modelling for the PADR initially did not incorporate the Victorian Government's offshore wind target, as it had not been officially legislated at that time [32]. In response to stakeholder feedback, it has now been included as an explicit sensitivity in the Consultation Report. The Victorian Government's REZ Development Plan and VTIF are not explicitly taken into consideration in the RIT-T analysis, and it is claimed that including them as scenario input assumptions would not significantly impact the forecast outcomes.

2.1.8 The Accuracy of the Cost Estimates Used

EUAA expressed concerns about the comprehensiveness and accuracy of the costs incorporated in the cost-benefit analysis [60]. They also requested additional information about the methodologies that were utilised in conducting the analysis such as the meaning of Class 4 estimates, whether cost estimates utilised cost data from EnergyConnect and HumeLink and whether the potential to achieve efficiencies across ISP projects is captured in Transgrid's cost estimates. AVP and Transgrid note that the cost estimates used are considered to have an accuracy of +/-30% and that the estimate class is determined by the level of maturity of the project definition deliverables [32].

The VFF expressed concerns regarding the precision of the costs incorporated in the PADR analysis and

indicated that the final cost of the approved project is anticipated to surpass the projected costs envisioned during this planning phase of the project. [42]. Similarly, it was highlighted the PADR indicates that benefits from VNI West are expected to start accruing in 2023-24, even before formal project approval [61]. During the three years preceding approval, it was claimed the projected benefits amount to a substantial \$726 million, accounting for approximately 25% of the total forecast benefits over the 25-year modelling period. It was questioned how the potential approval of VNI West contributes significantly to these early benefits. Considering that the project is set to commence in four years and will take another nine years to complete, there were concerns in anticipation of additional cost escalations. AVP and Transgrid have confirmed that the assessment is conducted in 'real terms', meaning that only real cost increases would be applicable, and they have conducted tests using alternate assumed network capital costs, suggesting that the main findings remain reliable despite realistic future cost increases [32].

VEPC claim AVP and Transgrid has defined VNI West in a way that excludes a large amount of its costs and these costs are not assessed elsewhere [58]. For example, they suggest the analysis conducted does not factor in the time value of emissions. Benefits projected to occur after 2049, when the power system is assumed to be fully decarbonised, have been included despite the likelihood of such benefits not materialising. Additionally, the costs associated with the North Ballarat substation and the North Ballarat to Sydenham 500 kV upgrade have been excluded from the analysis starting from the commissioning of VNI West. Likewise, the VFF expressed concerns about the unaccounted costs of the project, which encompass the loss of amenity, adverse social and environmental impacts, as well as the potential cost to agriculture and tourism [42]. AVP and Transgrid acknowledged that although the RIT-T assessment cannot directly capture these costs, the current assessment reveals that two alternative options, designed to minimise such impacts, are more advantageous for consumers when compared to the proposed preferred option in the PADR [32]. They emphasised that these factors will be further considered, and efforts will be made to mitigate them through the environmental and stakeholder consultation process that follows the RIT-T assessment.

2.1.9 Comments on the Wholesale Market Modelling

EUAA emphasised the advantages of delaying or avoiding generation and storage costs that would occur before the commissioning phase in 2031-32. They suggested that these benefits would start to materialise as early as 2023-24 under the step change scenario. AVP and Transgrid state the wholesale market modelling in the PADR assumes perfect

foresight, allowing parties to adjust their investment and operational decisions in anticipation of VNI West's commissioning [32]. The change in modelling the carbon budget to discrete windows better reflects real-world observations in the NEM, where renewable development and operation of storage plants have been observed in anticipation of interconnector projects and policy changes. AVP and Transgrid note that there was an apparent misinterpretation of these PADR results and have revised the presentation of these charts to present these benefits on an annualised basis.

EGA raised concerns about potential omissions in the existing regulatory cost-benefit analysis and its application [56]. They suggested that the net benefit of the investment should be determined by considering not only the transmission investment cost but also all future costs associated with generation, storage, and transmission resulting from that investment. This should be compared against the cost of alternative investments that would be necessary if the transmission project were not constructed.

2.1.10 Queries Regarding the Methodologies Applied for the NPV Modelling and Terminal Value

According to the Summary of PADR Consultation [32], PIAC suggested the Hydrogen Superpower scenario should be excluded from the PADR as the 18% weighting in the estimated market benefits has no credibility. AVP and Transgrid note that RIT-T assessment is required to implement the weightings which are applied as part of this occurs as part of the development of the Inputs Assumptions and Scenarios Consultation (IASR) [62] under the ISP framework and the weighting is 18% [32].

EUAA questioned the assumptions of fuel cost savings beyond 2047-48 and queried on how cost of gas is going to be avoided [59]. Woodley claims avoided fuel costs are incorrectly assumed after the 25 year modelling period as there are no fuel costs to avoid by 2050 due to the absence of fossil fuel generation [61]. AVP and Transgrid state the relevance of any benefits beyond the end of the assessment period is reduced since the investment has already recovered more benefits than it has costs by the end of the assessment period [32]. EUAA question the assumptions regarding 'stranded asset risks' defining the value of capital costs at after 16 years of operation. AVP and Transgrid claim this risk is not considered to be significant as costs are expected to be paid back before the end of the assessment period.

EUAA also question the appropriateness of the 5.5% commercial discount rate and its credibility [59]. AVP and Transgrid specify the percentage is taken from the most recent ISP parameters in undertaking its cost benefit assessment [32].

Another questioned the sixteen year length of the assessment period, highlighting the absence of explanation as to why this period ends three years earlier than the ISP and before the 2050 zero emissions target [61]. He claims this length is too short considering the predicted economic life of fifty years and an even longer technical life. This inquiry was also highlighted by EUAA [59]. In response, AVP and Transgrid extended the market modelling period by two years to 2049-50 [32].

2.1.11 AVP and Transgrid Response to Stakeholder Feedback

As stated in the VNI West Consultation Report: Options Assessment [33], AVP and Transgrid updated the assessment in response to recommendations in consultation to the Project Assessment Draft Report (PADR). These include:

- Considering five new options that connect VNI West to WRL further west than originally proposed, and taking account of a wider range of factors that may impair social licence.
- Extending the modelling horizon until 2049-50 in response to stakeholder feedback.
- Updating the option costs for the New South Wales portion of investment to reflect the New South Wales Government Strategic Benefits Payment Scheme for landowners announced in October 2022
- Improving alignment to the RIT-T instrument and the Australian Energy Regulator's (AER's) cost benefit analysis (CBA) guidelines through better alignment with the 2022 Integrated System Plan (ISP) parameters in a number of ways including:

- Applying coal retirement outcomes in the same manner across the base case and all VNI West options updated with the most recent retirement announcements including Loy Yang A retirement in 2035 and Torrens Island B Power Station retirement in 2026.
- Representing carbon budgets better matched to the 2022 ISP, progressively tightening the carbon budgets over time to avoid trading emissions between the early years and later years of study period.
- Modelling the Dinawan to Wagga Wagga portion of EnergyConnect as being built and operated at 330 kV under the base case (as opposed to being built to 500 kV but initially operated at 330 kV, as in the PADR).
- Expanding the scope of the sensitivity analysis and boundary testing conducted, including assessing the impact of changes in transmission costs, and the Victorian Government's announced (but not yet legislated) offshore wind policy
- Increasing the transparency regarding cost estimates and approach to calculating terminal value.

2.2 Additional Consultation Report Submissions

Over 500 submissions were received from landholders and organisations providing their views on the outcome of the assessment presented in the Additional Consultation Report [33]. Approximately 96% of the submission originated from Victoria or are related to Victorian components of the project [63].

The primary concerns raised by individual submissions opposed to the proposed route option include:

Table 6 Response Themes

Theme	Number of Responses
Socio-Economic	416
Land uses	411
Alignment	401
Consultation – Planning/EIS	327
Cumulative impacts	273
Bushfire	266
Easement – Rights	257
Impact to property value	255
Undergrounding	223
Biosecurity	201
Gates/Livestock	200

The main themes present in the stakeholder feedback as highlighted in the Additional Consultation Report Submissions report [63] include:

2.2.1 Stakeholder engagement

'Many' submissions expressed significant concerns regarding stakeholder consultation. This includes the lack of awareness among potentially affected communities about project changes with an insufficient six-week consultation period for potentially impacted stakeholders to make informed submissions. Additionally, the inadequate level of information provided which hindered stakeholder's ability to offer well-founded feedback. There were also concerns regarding the complexity of the information presented which made it challenging for communities to comprehend. Engagement prior to the NEVA order also fell short of best practices, particularly in terms of engagement timeframes. In response, Transmission Company Victoria (TCV) and Transgrid state they will commit to:

- Regionally focused engagement with communities, Traditional Owners, and stakeholders, to understand inherent values, opportunities, and constraints as inputs to a corridor definition process.
- Establishing Community Reference Group/s, to collaborate with the project teams, providing local information and insights to further develop and refine the study corridor.
- Undertaking direct engagement with potentially affected landholders, with dedicated landholder liaisons, to identify the best route alignment and optimise the route based on localised property constraints.
- Engaging with landholders to agree on access arrangements that minimise disruption prior to commencing field studies to inform the environmental assessment.

2.2.2 Agricultural Impacts

Of the 534 submissions, numerous raised concerns regarding limitations on farming operations. This included inability to use machinery, drones, autonomous vehicles or irrigate under transmission lines, decreased land value, insurance considerations, division of paddocks and financial implications of securing work permits. These submissions included the Loddon Shire Council [64] as well as The Victorian Farming Federation who highlight it is the agricultural industry that is forced to bear costs of transmission infrastructure [65]. There were also complaints of property land access such as failure to provide notice of entry or use of chemicals, the spread of weeds, damage to crops and soil due to heavy machinery, failure to close gates and materials

left on site causing damage to machinery. AVP and Transgrid assure all they will comply with the consent to enter under conditions such as appropriate access processes for their property, including biosecurity management, gate management, timing, livestock or crop awareness and repairing any damage that might unintentionally be caused.

2.2.3 Bushfire and Weather Risks

Numerous submissions also highlighted risks such as towers falling from severe weather conditions and causing fires, and the inability of firefighters to operate equipment under the transmission lines or use helicopters above. A community member from Blampied Victoria highlighted the Cressy collapse which passed \$25.04 million onto energy consumers [66, p. 3]. Another member from Bacchus Marsh highlighted the Bushfire Royal Commission recommendation to have powerlines undergrounded to avoid risks associated with bushfires [67, p. 59]. A submission from the Northern Grampian Shire Council questioned which safety controls are in place and highlighted instances of dust and moisture creating a conductive layer, allowing for electrical tracking or leakage currents [68]. Snowy Hydro commented on the importance of bushfire management to enhance social licence [69]. Mountain and Bartlett discussed the increased likelihood of severe weather from climate change such as lightning, severe winds and bushfires while also commenting on terrorism and military attacks [70]. AVP and Transgrid maintain these risks are considered in infrastructure design to ensure vegetation clearance is maintained, can withstand weather conditions and implement Safety in Design processes. They state they will be constructed with relevant safety management plans, hot work procedures, appropriate staff training and coordination with local Metropolitan Fire Service and Country Fire Service. They claim they will conduct routine maintenance to identify faults, as well as ground, aerial, weather and vegetation inspections and monitoring.

2.2.4 Health and Safety

Approximately 20% of submissions raised concerns about mental health effects such as anxiety during all stages of the VNI West project. A community member from Kanya Victoria referenced the National Farmers Wellbeing Report [71] and commented on how close to half of Australian farmers have had thoughts of self-harm or suicide, while close to a third have attempted self-harm or suicide [72, p. 68]. There were also multiple submissions questioning the risks associated with cancer and electromagnetic fields, referencing the World Health Organisation classification of EMFs as 'possibly carcinogenic to humans', and how transmission lines have links to childhood leukemia [72, p. 90] [66] [73, p. 99]. AVP and Transgrid referenced the Australian

Radiological Protection and Nuclear Safety Advisory (ARPANSA) statement [74] that there is no scientific evidence to establish that exposure to electromagnetic causes health effects. Precautionary action such as monitoring electric field intensity and constructing transmission lines at least 300 meters away from residences was said to be implemented by AVP and Transgrid.

2.2.5 Regional Benefit Sharing and Social Licence

The Pyrenee Shire Council suggests revenue from the VNI West project is owed back to affected communities, not just the landowners which host transmission infrastructure [75]. The Moorabool Shire Council highlighted that their region's social licence will improve if renewable energy potential is harnessed to benefit local specialisations, agricultural industries, environmental assets and residential amenity [76]. The EGA however question AVP and Transgrid assumption that wind and solar generation will boost social licence for communities, and suggest this assumption is "prudent" [77]. AVP and Transgrid claim identifying existing and new opportunities for benefit sharing for landholders and communities and is an important part of the ongoing consultation and engagement. The assumption that social licence will increase due to the ability for new generation is claimed to be based on received proposals such as the Victorian Annual Planning Review which shows currently approximately 4,400 MW of generation applications or enquiries in the Western Victoria REZ, and approximately 2,550 MW in the Murray River REZ.

2.2.6 Undergrounding

A large volume of submissions highlighted the mitigation of impacts on flora, fauna, the landscape/visual amenity, reduce bushfire risk through the implementation of undergrounding. While this option will cost more, it is believed by the Pyrenee Shire Council it will provide community benefits and enhance social licence [75]. The Hepburn Shire Council suggested at least implementing undergrounding in areas with high landscape value or home to endangered species should be considered [78]. The Northern Grampians Shire Council claim there is insufficient explanation as to why undergrounding is not technically feasible by AEMO and Transgrid [68]. AVP and Transgrid are considering partial undergrounding in areas where severe impacts cannot be avoided, but state that full undergrounding is not feasible. However, cost effective alternatives such as route diversion, screening, and line tower design will be prioritised.

2.2.7 Cost Inaccuracies

Simon Bartlett (previously a member of the National Electricity Market's Reliability Panel, a Professor of

Electrical Engineering and Chief Operating Officer of Powerlink) and Professor Bruce Mountain (Director of the Victoria Energy Policy Centre at Victoria University) submitted a detailed critique of AEMO's Consultation Report [70]. They conclude that AVP has greatly underestimated the cost of combining VNI-West with the Western Renewables Link (WRL-VNI), supplying the following cost estimates:

- AVP have understated the build cost of its preferred option by \$1,220m (38%) and understated the operating cost of its preferred option by \$5.1bn over 50 years, or \$1,012m stated as a present value (PV) in 2020/21.
- AVP's calculation of gross benefits of its preferred option of \$3,921m PV is not plausible, and has been overstated by \$5,185m PV, giving a (gross) detriment of \$3,921m - \$5,185m = - \$1,264m PV. For the avoidance of doubt this disbenefit is before deducting the cost of WRL-VNI. The additional detriment (separate to the cost of WRL-VNI) will be expressed in electricity markets in the form of electricity prices that will be higher than they otherwise would be.
- After accounting for the Victorian share of the cost of WRL-VNI, a total net detriment of WRL-VNI of \$6,778m stated as a PV in 2020/21.

Additionally, they listed the following impacts:

- Increase the exposure of Victoria's power system to natural disasters and terrorism risk.
- Recovering the capital outlay for the project will increase transmission charges in Victoria by at least 70%. The ongoing operation and maintenance charge will increase transmission charges by a further 25%. In round numbers, will therefore double transmission charges in Victoria.
- Affect the efficiency of the Victorian power system by wasting existing transmission capacity (the extensive 500 kV and 220 kV network from the Latrobe Valley to Melbourne) and forcing the development of renewable electricity in locations that are further away from Victoria's main load centre and will have a large part of their renewable energy wasted by spillage due to severe congestion on VNI West. This too will push prices up relative to what they otherwise would be.
- Will delay the transition to renewable electricity in Victoria by forcing new renewable entry to wait on the completion of this massive transmission augmentation (which is likely to take eight years to complete). It also undermines the development of onshore renewable generation in Gippsland and adjacent areas and thus wastes the capacity of Victoria's most valuable electrical transmission

infrastructure connecting the Latrobe Valley to Melbourne.

- WRL-VNI lays the foundations for massive additional 500 kV transmission developments in west, central and northern Victoria. This is likely to involve additional expenditure at least as big as WRL-VNI to follow in the decade after WRL-VNI is completed.
- VNI-W was christened “Snowylink South”, and its rationale was claimed to be making the capacity of the promised Snowy 2.0 pumped hydro station available to Victoria. But WRL-VNI, according to AVP, makes no perceptible difference to the dispatch of Snowy 2.0 and in reality, Snowy 2.0 will become choked by the congestion on VNI West and HumeLink. Instead, of any gain from Snowy 2.0, AVP’s analysis contends that the bulk (75%) of the benefit of WRL-VNI lies in the substitution of pumped hydro generation in Victoria by batteries in NSW.

2.2.8 AVP and Transgrid Response to Stakeholder Recommendations

AVP and Transgrid updated their preferred route in the Identifying the Preferred Option for VNI West Report [79] in response to recommendations in consultation to the Additional Consultation Report Submission. These include:

- Exploring a variant of Option 5 that is electrically similar, but with a different Murray River crossing point and higher hosting limits for renewable generation in the Murray River Renewable Energy Zone (REZ) (V2) – Option 5A.
- Exploring opportunities for VNI West to harness more renewable generation.
- Updating cost estimates to reflect latest market and labour trends as identified in AEMO’s 2023 Transmission Cost Database, and the Victorian Government’s recently announced additional landholder payments.

And therefore, the refined route recommended by the AVP has the following features based on stakeholder feedback:

- Option 5A presents fewer environmental constraints and avoids intercepting the Patho Plains, an area of significant grassland habitat known to support the endangered Plains-wanderer.
- Option 5A avoids passing near Ghow Swamp, a place of national cultural significance.
- Option 5A is expected to harness more renewable generation in Victorian renewable energy zones (REZs).

2.3 Compensation

The Labor Government announced additional payments for properties which host electricity transmission infrastructure at a rate of \$8,000 per year per kilometre of transmission hosted, for 25 years [80]. The CVGA brings attention to the unfairness of this payment system, which puts smaller landowners at a disadvantage due to the disproportionate effects of transmission towers on their properties [34]. They state “fair payment to landholders is essential but not sufficient to secure social license for transmission projects” and highlight how the mitigation of community impact and seeking mutual value outcomes will gain social licence. The Loddon Shire Council also highlight how the infrastructure will be present for 50-100 years, impacting productive agriculture and land values, and therefore the 25 year payment period is insufficient [64].

3. Western Renewables Link (WRL)

The WRL is a new 190km long transmission line extending from Bulgana near Stawell in Western Victoria to Sydenham in Melbourne's North-West via a new terminal station to the North of Ballarat. As published in the Western Renewables Link Consultation Plan [81], the stakeholders defined in this project include:

Table 7 Key Stakeholder Members

Stakeholder group	Key members	
Host landholders and surrounding landholders	Landholders who have a proposed easement on their property	Residents with line-of-sight of transmission infrastructure (Surrounding Landholders)
Broader community members	Local community within the project Area of Interest	Victoria-wide community
Consumer representatives	Australian Energy Regulator Consumer Challenge Panel Energy Consumers Australia	Major energy users Public Interest Advisory Centre
Industry and market participants	Property developers Renewable energy stakeholders Retailers Transmission Network Service Providers (TNSPs)	Renewable energy generator developers Victorian Network businesses Energy generators
Local councils in Area of Interest	City of Ballarat* Hepburn Shire Council* City of Melton* Moorabool Shire Council*	Northern Grampians Shire Council* Pyrenees Shire Council* *Local government area that the proposed route traverses through
Members of Parliament	State Member for Sydenham State Member for Koroit State Member for Melton State Member for Buninyong State Member for Macedon State Member for Wendouree State Member for Ripon State Members for western Victoria	State Members for Western Metropolitan Federal Member for Gorton Federal Member for Ballarat Federal Member for Wannon Federal Member for Mallee

Stakeholder group	Key members	
State (Department and Ministers)	Premier Minister for Planning Minister for Energy, Environment and Climate Change Attorney General Valuer-General Minister for Jobs, Innovation and Trade Minister for Economic Development Minister for Regional Development Minister for Local Government Minister for Industrial Relations Minister for Aboriginal Affairs Minister for Water Shadow Minister for Planning and Heritage Shadow Minister for Energy and Renewables Shadow Minister for Environment and Climate Change Department of Environment, Land, Water and Planning Department of Health and Human Services Department of Jobs, Precincts and Regions Department of Transport Department of Treasury and Finance Department of Premier and Cabinet Regional Development Victoria Central Highlands Regional Partnership	Wimmera Southern Mallee Regional Partnership Victorian Planning Authority VicTrack Invest Victoria Heritage Victoria First Peoples State Relations Department of Transport and Regional Roads Victoria Agriculture Victoria Parks Victoria Corangamite Catchment Management Authority North Central Catchment Management Authority Port Phillip and Westernport Catchment Management Authority Glenelg Hopkins Catchment Management Authority Wimmera Catchment Management Authority Melbourne Water Western Water City West Water Southern Rural Water Fire Services Victoria Country Fire Authority Emergency Management Victoria Electrical Safety Commission Energy Safety Victoria Forest Fire Management Victoria Environment Protection Authority Victoria Municipal Association of Victoria
Commonwealth	Minister for the Environment Minister for Energy and Emissions Reduction Shadow Minister for the Environment and Water Shadow Minister for Climate Change and Energy Department of Agriculture, Water and the Environment Australian Energy Infrastructure Commissioner	Civil Aviation Safety Authority Grampians Regional Development Australia Melbourne Regional Development Australia The Australian Radiation Protection and Nuclear Safety Agency Melbourne Airport
Regulators and policymakers	Australian Energy Regulator Australian Energy Market Commission	Essential Services Commission
Industry Bodies and Associations	Australian Energy Council Clean Energy Council Energy Networks Australia	Central Victorian Greenhouse Alliance Highlands Potatoes and Ag Inc

Stakeholder group	Key members	
Special interest groups	<p>Grampians New Energy Taskforce Grow West Loddon Mallee New Energy Taskforce Murray River Group of Councils Wimmera Development Association Australian Wind Alliance National Trust (Victoria) Victorian Farmers Federation Victorian National Parks Association Goldfields Track Association Great Dividing Trail Association</p> <p>Bushwalking Victoria Eureka Orienteers Yes to Renewables Project Platypus Birdlife Australia Australian Conservation Foundation Friends of the Earth Environmental Justice Australia Federation University Bacchus Marsh, Fiskville and Melton Airfields Melbourne and Ballarat Airports.</p>	
Community groups	<p>Key local environmental and interest groups (listed below according to LGA) Environment Victoria Western Victoria Transmission Network Project Rippon Association</p> <p>Ballarat Ballarat Environment Network Miners Rest Landcare Group Regional Sustainability Alliance Ballarat Ballarat Renewable Energy and Zero Emissions (BREAZE) Ballarat Climate Action Network Ballarat Bushwalking and Outdoor Club Ballarat Field Naturalists Club Bird Life Ballarat</p> <p>Hepburn Hepburn Wind (Hepburn Community Wind Park Co-Operative Ltd) Sustainable Hepburn Association Creswick and District Historical Society Transitions Creswick Mollonghip community energy Wattle Glen Landcare Group</p> <p>Melton Melton Environment Group Western Plains North Green Wedge Coalition Group Pinkerton Landcare and Environment group Toolern Landcare Group to Melton</p> <p>Moorabool Moorabool Environment and Sustainability Advisory Committee (Council advisory committee) Moorabool Landcare Network Moorabool Environment Group Friends of the Lerderderg Bunanyung Landscape Alliance Bacchus Marsh Community Coalition Lal Lal EPA Moorabool and Central Highlands Power Alliance Friends of Werribee Gorge and Long Forest Mallee Pentland Hills Landcare Group Coimadai Landcare Group Rowsley Landcare Group Moorabool Catchment Landcare Group Northern Grampians Wimmera Mallee Sustainability Alliance Friends of the Grampians</p> <p>Pyrenees Waubra Wind Farm Community Fund Inc. Waubra Community Foundation Other local community and action groups</p>	
Traditional Owner and Aboriginal Groups	<p>Registered Aboriginal Parties and Traditional Owner Groups: Barengi Gadjin Land Council Aboriginal Corporation Dja Dja Wurrung Clans Aboriginal Corporation Eastern Maar Aboriginal Corporation</p> <p>Wadawurrung Traditional Owners Aboriginal Corporation Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation Boon Wurrung Foundation Bunurong Land Council Aboriginal Corporation</p>	

The Consultation Plan also highlights key stakeholder interests and engagement techniques highlighted below:

Table 8 Stakeholder Interests and Engagement Methods

Stakeholder group	Likely engagement interests and needs	Stakeholder approach
<p>Landholders with a proposed easement on their land; and/ or their land is proposed to be used temporarily for construction e.g. laydown</p>	<p>Impacts to property during construction and operation (land use, business, amenity, and environmental impacts) Access to properties for environmental investigations to inform the EES Health and safety concerns including fire risk. How feedback has been considered and/or influenced project or design decisions</p>	<p>Targeted approach including one-on-one meetings Community engagement sessions Webinars Mail outs Community Consultation Group (CCG) Dedicated project hotline and email Consistent point of contact with the project</p>
<p>Surrounding landholders Landholders who live in the vicinity of the proposed route (no specific distance) but do not have a proposed easement</p>	<p>Impacts to property during construction and operation (land use, business, amenity and environmental impacts) Health and safety concerns including fire risk and management Locally specific information about the project, its progression and impacts Social and economic impacts and benefits Community impacts and benefits How feedback has been considered and/or influenced project or design decisions</p>	<p>Community engagement sessions Webinars Mail outs Community Consultation Group (CCG) Dedicated project hotline and email Consistent point of contact with the project</p>
<p>Other community members</p>	<p>Locally specific information about the project, its progression and impacts Social and economic benefits Community impacts Amenity and environmental impacts Potential impacts to sites and areas with cultural heritage significance Local community benefits (and their equitable distribution) Economic impacts Disruptions from construction Reliability and security of network supply Input into preferred consultation approach How feedback has been considered and/or influenced project or design decisions</p>	<p>Up-to-date and broad project information in an accessible format Online engagement and interactive portals Virtual information and interactive information session Face to face sessions Fact sheets/printed materials Advertising Project updates Community Consultation Group (CCG)</p>
<p>Consumer representatives</p>	<p>Environmental, social and economic impacts including local benefits To be informed of approvals processes and opportunities for input Input into preferred consultation approach</p>	<p>Targeted meetings Project updates Fact sheets/printed communication materials</p>
<p>Industry and market participants</p>	<p>Economic and technical aspects of the project Relevant social, economic and environmental impacts Future connection opportunities Interface activities with other transmission network service providers Input into preferred consultation approach</p>	<p>Targeted meetings Project updates Printed communication materials</p>

Stakeholder group	Likely engagement interests and needs	Stakeholder approach
Local councils across western Victoria	<p>Social and economic impacts to local residents and businesses including agriculture</p> <p>Environmental impacts including impacts on landscape and visual amenity</p> <p>Potential impacts to sites and areas with cultural heritage significance</p> <p>Local community impacts and local jobs creation</p> <p>Relevant permits and approvals processes including program and coordination</p> <p>Opportunities for communities and stakeholders to be involved in planning and approval processes</p> <p>Cumulative impacts of other projects occurring in the area</p> <p>Access to public areas for environmental investigations to inform the EES</p> <p>Input into preferred consultation approach</p> <p>How feedback has been considered and/or influenced project or design decisions</p>	<p>Targeted project updates</p> <p>Council Advisory Group</p> <p>Technical Reference Group meetings</p> <p>Targeted meetings</p>
Members of Parliament	<p>Social and economic impacts and community benefits</p> <p>Environment and amenity impacts</p> <p>Potential impacts to sites and areas with cultural heritage significance</p> <p>Measures to avoid, minimise and manage impacts and enhance community benefit</p>	<p>Targeted project updates</p> <p>Targeted meetings</p>
State (Department and Ministers)	<p>Environmental assessment and planning approvals processes</p> <p>Social, economic and environmental impacts</p> <p>Measures to avoid, minimise and manage impacts and enhance community benefit</p> <p>Access to public/crown land for environmental investigations to inform the EES</p>	<p>Targeted project updates</p> <p>Targeted meetings</p> <p>Technical Reference Group meetings</p>
Commonwealth	<p>Environmental assessment and approval</p> <p>Social, economic and environmental impacts</p>	<p>Targeted project updates</p> <p>Targeted meetings</p>
Regulators and policymakers	<p>Environmental assessment and approval</p> <p>Economic and technical aspects</p> <p>Delivery and compliance with necessary approvals/standards</p>	<p>Targeted project updates</p> <p>Targeted meetings</p> <p>Technical Reference Group meetings</p>
Industry Bodies/ Associations	<p>Network and economic impacts</p> <p>Social, economic and environmental impacts</p> <p>Input into preferred consultation approach</p> <p>How feedback has been considered and/or influenced project or design decisions</p>	<p>Targeted meetings</p> <p>Project updates</p> <p>Printed communication materials</p>
Special interest groups	<p>Environmental, social and economic impacts</p> <p>Potential impacts to sites and areas with cultural heritage significance</p> <p>Approvals processes and opportunities for input</p> <p>Input into preferred consultation approach</p> <p>How feedback has been considered and/or influenced project or design decisions</p>	<p>Up-to-date and broad project information in an accessible format</p> <p>Online engagement and interactive portals</p> <p>Virtual information and interactive information session</p> <p>Face to face sessions</p> <p>Project updates</p> <p>Factsheets/printed materials</p>

Stakeholder group	Likely engagement interests and needs	Stakeholder approach
Community groups	Environmental, social and economic impacts Potential impacts to sites and areas with tangible and intangible cultural heritage significance Approvals process and opportunities for input Input into preferred consultation approach How feedback has been considered and/or influenced project or design decisions	Up-to-date and broad project information in an accessible format Online engagement hub and interactive portals Virtual information and interactive information session Face to face sessions Project updates Community Consultation Group (CCG) Factsheets/printed materials
Registered Aboriginal Parties / Traditional Owner Groups	Potential impacts to sites and areas with cultural heritage significance Social and environmental impacts Economic and social benefits, particularly in relation to Aboriginal participation and employment opportunities Land management issues for Crown land subject to (or under negotiation for) Land use Activity Agreement Input into preferred consultation approach How feedback has been considered and/or influenced project or design decisions	Targeted project updates Targeted meetings

AusNet Services has established the CCG with the aim of enhancing community understanding and engagement with the project as highlighted in the Community Reference Group’s Terms of Reference [82]. These groups comprise of up to 20 community representatives selected from Northern Grampians Shire Council, Pyrenees Shire Council, City of Ballarat, Hepburn Shire Council, Moorabool Shire Council, and Melton City Council. The CCG have set objectives that include creating a transparent and accessible forum for discussing community-related project issues, capturing community feedback to aid decision-making, increasing community awareness about the project, advising on effective responses to concerns, and recommending benefit sharing initiatives. CCG members serve as channels for wider community issues, represent community perspectives on local impacts and benefits, receive project progress briefings, and share project information with other community members.

3.1 Undergrounding

Community concerns were raised about the limited consideration of social and environmental impacts in the RIT-T assessment, focusing primarily on economic factors as highlighted in the Role of RIT-T Report [83]. They found there was insufficient detail provided regarding undergrounding and partial undergrounding options. The community seeks more information on alternative options considered in the RIT-T process, aiming for transparency, and understanding.

Concerns were expressed that the undergrounding option was dismissed without a comprehensive cost-benefit analysis considering social and environmental impacts. The report suggested high-level assessment showed that underground transmission cables would be significantly more expensive, up to ten times the cost per kilometre compared to overhead lines. Given the cost difference without additional economic benefits, undergrounding options were not justified under the RIT-T regulations.

Inquiries were made about the consideration of High Voltage Direct Current (HVDC) in the RIT-T process. HVDC equipment was considered but deemed economically infeasible due to higher overall costs compared to High Voltage Alternate Current (HVAC) solutions. HVDC offers technical advantages but requires additional infrastructure to link with the existing HVAC network.

Concerns were also raised about the possibility of passing on additional costs associated with undergrounding to consumers through increased electricity prices. The community noted that the RIT-T does not account for such options. However, AusNet claims its primary purpose is to identify the most efficient option that minimises consumer costs for electricity.

During an April 2021 CCG meeting, the participants engaged in a discussion regarding the various

possibilities related to undergrounding. A representative from AusNet services emphasised that undergrounding is not currently being recommended under the RIT, and its consideration is limited to the EES process, specifically addressing alternative options scoping requirements [84]. Consequently, it was concluded that undergrounding would not be included in the delivery contract.

AusNet's Underground construction summary [85] explores various possibilities for minimising impacts along the route. These options, including different designs, structures, and sections of underground construction, will be further examined as part of the Environment Effects Statement. Partial underground alternatives need to be assessed to determine their feasibility and effectiveness in mitigating identified high-impact areas. However, AusNet claims while overhead

transmission lines cause less ground disturbance and offer more cost-effective connections for renewable energy generators, they also meet the requirements for electricity system availability and reliability. Overhead transmission lines are a proven solution for projects of this scale and distance. The report claims preliminary estimates suggest that using HVAC technology for underground construction of the Western Renewables Link would cost at least 16 times more than an equivalent overhead transmission line. Therefore, AusNet states overhead construction is most feasible for the full length of the project.

3.2 Compensation

As outlined in the Option for Easement Process and Compensation Guide [86], a summary of payments and compensation includes:

Table 9 Summary of Payment Options

Payment	Amount	Description
Landholder Participation Fee	\$10,000 (excl. GST)	Payable to landholders upon completing the Property Specific Details Form and signing the Land Access Consent
Landholder Professional Fees payment	\$10,000 (excl. GST)	Eligible if receive the Option for Easement proposal.
Additional legal and professional fees	As agreed	Upon request, we may agree to reimburse further reasonable out of pocket legal costs and professional service provider fees that exceed the Landholder Professional Fees payment
Option Fee	\$20,000 (excl. GST)	Payable after the Option for Easement is signed by both parties, as set out in the Option for Easement.
Option Extension Fee	\$15,000 (excl. GST)	Payable to extend the initial option period of the Option for Easement by one year
Compensation for Easement Amount	Property specific	The Compensation for Easement Amount is a market value assessment of the easement
Other Compensable Amount	Property specific	A percentage of the Compensation for Easement Amount (excl. GST) payable to landholders to allow for other compensation requirements.
Option Exercise Disturbance Fee	Property specific	Includes Production Loss Fee, which is an agreed amount for the value of lost crops and/or other disturbance due to construction activities, and Construction Licence Fee, amount equal to one year.
Construction Licence Fee	Property specific	Compensation for any loss, impact or interference with land use as a result of required construction activities payable annually
Land Rehabilitation Offset Payment	Property specific	Compensation for any residual impact on land use in the 12 months following the completion of construction. Covers a period of 12 months after the completion of construction and is equal to the previous year's Construction Licence Fee
Reimbursement of reasonable legal fees and disbursements associated with registration of the easement	Up to \$2,500 (excl. GST)	reimbursed for the reasonable legal costs related to the registration of the easement and any reasonable disbursements made for the purposes of registering the easement

Payment	Amount	Description
Reimbursement of mortgagee or other third-party consent fees	Up to \$1,000 (excl. GST) per consent required	If any mortgagee or other third-party holds an interest in a landowner's property, they will need to obtain their written consent for the Option for Easement. AusNet will reimburse reasonable costs of, and incidental to, securing these consents.
Additional landholder payments	Payment of \$8,000 per year per kilometre of new transmission easement hosted, for 25 years	In addition to the compensation and payments as required under the Land Acquisition and Compensation Act 1986 (Vic)
Community Benefit Fund	Waiting on approval within AusNet to total funding amount	Enabling local not-for-profit groups, organisations, and projects to make a positive long-term contribution to the communities within the project area.

In the renewable energy sector, wind developers offer payments to community members based on the distance between their residences and the turbines, as well as the number of turbines within that distance. A CCG member highlighted that although these payments are not mandated by law, it is important for AusNet to recognise the significance of negotiating compensation based on proximity to the infrastructure for ensuring best planning practices and obtaining social licence for the project [87].

A CCG member highlighted the importance to differentiate the Community Benefit Fund (CBF) from compensation as the CBF is not intended to address visual impacts, and it may be seen as unfair that the community as a whole receives benefits while individuals bear the negative impacts [87]. Another member highlighted how these benefits should be granted to impacted communities, not to energy start-ups or for-profit groups [88]. There were also speculations that AusNet are providing these funds as they are 'wanting to buy influence'.

Another member highlighted the Land Acquisition and Compensation Act does not apply to neighbours of easements and does not allow for compensation [87]. They highlight how these community members bear the consequences of the transmission line implementation but are not compensated for it.

3.3 Bushfires

The community have voiced their worries regarding bushfires, which include concerns regarding [89]:

- Fires starting due to project infrastructure.
- Effects on bushfire management, such as planned burning to decrease fuel, ground-based and aerial fire response, and back-burning.
- Difficulties in escaping forest areas during a bushfire event.

- The worsening of fire weather conditions and fire risk due to climate change.
- The impact on Coimadai Primary School, which is identified as at risk in the Bushfire Register.

During a community webinar [90], it was brought to attention that AusNet faced a class action due to its involvement in the 2009 Black Saturday bushfires. The infrastructure was found to have contributed to the fires, leading to concerns about similar sparking incidents within the WRL easement. The Royal Commission investigating the bushfires recommended exploring the feasibility of underground power lines for future installations to reduce the risk of sparking and subsequent fire incidents caused by infrastructure failure, enhancing safety and resilience [91, p. 29]. AusNet noted that the Royal Commission acknowledged that the AusNet transmission network had not caused any fires. The recommendations for undergrounding transmission lines primarily apply to lower voltage lines in the distribution network, not the higher voltage lines (220 kV and 500 kV) in the current transmission network project.

There were also concerns raised regarding operations of firebombing over transmission lines in another webinar session [92]. An AusNet member confirmed they do operate firebombing on powerlines, highlighting its use in East Gippsland. In the event of water bombing operations on power lines, AusNet claim there are protection systems in place to respond accordingly. While such operations may cause some damage, the primary concern is cleaning the insulators before restoring power. The insulators may accumulate residue or retire due to water exposure, necessitating cleaning before reactivation.

During a community webinar [89], an AusNet member highlighted a review conducted by the Victorian Auditor General, in which the average number of fire

ignitions from various sources over a 30-year period was examined using data from the Department of Environment, Land, Water, and Planning (DELWP). The main causes of fires in the landscape were campfires, lightning, deliberate lighting, and unknown sources [93, p. 21]. Notably, there were no records of bushfire ignitions associated with transmission networks. However, an average of seven fires per year were started by distribution powerline networks, which consist of smaller, lower voltage poles and wires, differing significantly from the infrastructure discussed in this project.

In the same webinar, there were concerns regarding increased fire risk due to climate change. The AusNet member highlighted climate change under a high emissions scenario can have significant implications for the project's 50-year lifespan. He stated projections for 2070 show reduced winter and spring rain in Victoria, leading to drier fuel conditions and increased fire risk. Higher temperatures, extreme heat, and slightly reduced humidity contribute to these changes. This results in fewer days in the low to moderate fire danger range, with an increase in severe fire danger. To mitigate the potential for fire ignition and enhance fire management, the AusNet member suggested several measures which can be taken. These include managing human causes of ignition and implementing practices to contain fires more effectively. This may involve cultural burning practices, fuel reduction burning, and allocating resources to agencies for improved fire detection and response capabilities. The focus is on preventing ignition and promptly addressing fires to minimise their impact.

3.4 Landscape and Visual Amenity

During a webinar [94], a participant expressed concerns on behalf of landowners residing in AusNet's area of interest. The participant mentioned that these landowners have deliberately chosen to live in the community due to the picturesque views of rolling green hills, which provide a source of solace and relaxation, instantly alleviating the stress of the day. According to the participant, the proposed project has the potential to strip away this cherished landscape, impacting the well-being and enjoyment of thousands of individuals. In response, AusNet addressed the issue by stating that they are actively assessing old heritage sites, considering tourist routes and significant landscapes throughout the region. They aim to strategically position the infrastructure to mitigate these effects and to minimise these impacts, and they will leverage topography and other natural barriers present in the landscape. Another AusNet member claimed they aim to avoid placing the lines on top of hills and instead explore routes around hills to utilise the natural terrain for concealing the transmission lines to some extent.

In certain areas, AusNet may consider using smaller towers or splitting the line to reduce the visual impact, even if it requires expanding the easement width in specific locations. They are also exploring options such as non-reflective coating for the structures to make them less prominent in the landscape.

The community provided feedback on the importance of landscapes such as volcanic cones, tourist spots, and night sky views [95]. Concerns were raised about the accuracy of images and how AusNet addresses the perception gap between photos and reality [96]. AusNet then claimed to focus on important community locations and use a 60-70mm lens for depth and scale. They layer the imagery as a 3D model, test it in the field, and ensure its accuracy. AusNet considers night-time impacts and follows Australian Standards to control obtrusive lighting effects, taking existing lighting into account. A CCG member expressed concerns over a heritage bridge that has well-established vegetation. AusNet assures that the impacts on cultural values, indigenous cultural heritage, flora, and fauna are being studied. The assessment will be conducted by the appropriate technical experts to address these concerns.

In a community webinar [92], there were concerns raised regarding loss of property value due to transmission infrastructure. An AusNet member highlighted that compensation is provided to these landowners to ensure they are not financially worse off. The compensation calculation considers various factors, including the property's existing use, market value, expected depreciation, disturbance to farming activities, and special value. Further concerns were raised questioning compensation for landowners with affected visual amenity but who do not host any infrastructure. Compensation for landowners is directly related to the acquisition of the easement. The AusNet member reiterated that compensation serves as a baseline and aims to mitigate the impacts caused by the project. Efforts are made to minimise the visual impact of the infrastructure by carefully selecting its location. While complete mitigation may not be possible, steps are taken to reduce the overall impacts in affected areas. Another AusNet member highlighted that, in line with AusNet's intention to give back to the community, a multimillion-dollar benefit community fund has been established. This fund will be allocated based on the requirements, inputs, feedback, and contributions from the community. The aim is to ensure that the community benefits from the project and has a say in how the funds are distributed.

3.5 Health and Safety

During a community webinar session [92], viewers raised concerns regarding associations between EMF and leukemia. In another community webinar session

[90], according to a representative from AusNet, transmission lines will not be constructed in close proximity to existing dwellings. The representative suggested that a corridor of approximately 80 to 100 meters would be required for a 500 kV line, guaranteeing that there is no overlap with residential areas. Furthermore, the representative stated that existing peer-reviewed studies have not found any conclusive evidence of health effects from living within a safe distance from transmission lines. However, they emphasised the need to consider factors such as field strength, proximity, and duration of exposure. To address proximity concerns, AusNet adheres to strict design guidelines and maintains clearances defined by the Australian Radiation Protection and Nuclear Safety Agency. Additionally, tower heights are designed to accommodate the lowest point of the conductor, ensuring a minimum clearance of 15 to 20 meters.

There were also concerns regarding lightning strikes and flashovers [97]. AusNet claimed there are protection systems in place which can detect when electricity is trying to flash over between the conductor through to the Earth's structure, and it will operate within milliseconds. Regarding lightning, AusNet stated all of their towers are equipped with grounding systems. They have an aerial earth that attracts lightning before it reaches the conductors. In the event that lightning does hit the conductors, AusNet claim their protection systems will detect the overcurrent caused by the strike and promptly trip off to prevent further risks.

Concerns raised regarding the collapse of six Cressy AusNet towers in February 2020 [44] highlight how the incident does not instil confidence in the community [94]. AusNet acknowledges this incident and are actively investigating the matter. They claim feedback and analysis from this investigation will play a significant role in designing the transmission towers for the current project. They claim the collapse occurred under extreme weather conditions in Western Victoria, which are rare occurrences.

3.6 Cultural and Heritage Sites

The topic of impacts to culturally significant sights in a community webinar was discussed [97]. An AusNet member assured a comprehensive Aboriginal Cultural Heritage Assessment will be conducted to understand the landscape and both tangible and intangible Aboriginal values in the project area. Collaboration with registered Aboriginal parties will be established to ensure proper management and protection of these values. Cultural Heritage Management Plans will be developed in consultation with the representatives to address any potential impact, including the possibility of overhead line infrastructure crossing important sites. The member claims AusNet's goal is to work closely

with the Aboriginal community to identify their priorities and implement measures that effectively manage and preserve Aboriginal cultural heritage values.

Several considerations have been identified in the Historic Heritage Information Sheet [98] for further investigation and management in the historic heritage impact assessment by AusNet. These considerations include assessing the potential impact of construction works on historic heritage places, evaluating the visual impacts of the infrastructure on the landscape's heritage values, identifying the presence of unlisted heritage and archaeological sites, and ensuring compliance with necessary heritage approvals and consent applications. Additionally, the assessment will consider the proposed nomination of the Central Victorian Goldfields for inclusion on the UNESCO World Heritage List. Additionally, the Geology And Contaminated Land Impact Assessment [99] will address various considerations, including the potential for land erosion, disturbance of contaminated soils, impacts on geological sites, encounter of historic mining waste, and potential contamination from landfill sites, agriculture, and a water treatment plant. The assessment will also evaluate the long-term impacts of soil chemistry on project infrastructure.

3.7 Land Access

In addressing concerns regarding access to the towers once they are installed on a property, including the installation of gates for road access, availability across the entire farm, and potential changes to fence lines and plantations, AusNet provides an explanation of their regular patrol and inspection protocols [94]. They confirm that their transmission lines are patrolled at least twice a year, which involves visual assessments of vegetation and the transmission line itself using drones and helicopters. Additionally, every six years, a climbing assessment is performed to thoroughly check the condition of the bolts and conduct an overall inspection of each tower.

In a CCG meeting [100], feedback received regarding land access raised several concerns. Firstly, the provision of vouchers to incentivise landowners to sign land access agreements created confusion and led to the perception that accepting the vouchers compromised land rights. Additionally, there were complaints about the lack of clarity in the messages conveyed through land access agreements and notices. Some landowners felt that the agreements imposed significant obligations beyond a one-time visit. Issues were also raised regarding the distribution of letters in February/March 2020 and February 2021, as not all landowners received them. Some landowners later received letters stating they were no longer in the area of interest/corridor, causing confusion about

the selection process for sending letters. The letters themselves were criticised for lacking personalisation, resembling flyers rather than official correspondence, and not being placed in envelopes. Concerns were expressed that the use of postcodes for letter distribution may not accurately capture all landowners within a community. CCG members requested prior notification of letters to landowners to enable them to follow up with their communities, and AusNet clarified that this could be done at the time of letter distribution, but not before the official announcement. The credibility of AusNet land agents was questioned, particularly their lack of agricultural expertise and understanding of terminology. Lastly, confusion arose about the availability of maps, as some landowners were shown maps while others were informed that maps could not be provided.

3.8 Stakeholder Engagement

The community drop-in sessions generated several concerns among participants of a CCG Meeting [100]. Firstly, the initial round of sessions in 2020 suffered from inadequate advertisement, resulting in some community members being unaware of their occurrence. However, the second round held in 2021 showed improvement, with more effective promotion and helpful staff. Nevertheless, attendees expressed dissatisfaction with the limited notice of project changes provided and the long waiting times at certain drop-in sessions, which restricted their ability to discuss important issues thoroughly. Suggestions were made to implement a booking system and consider offering sessions at later times or on weekends to accommodate commuters from Melbourne. There were also reports of AusNet representatives being unable to provide satisfactory answers to questions, leading to doubts about the effectiveness of the sessions. Furthermore, community members expressed concern about the short time gap between the March 2021 sessions and the planned announcement of the single corridor, scheduled for mid-year 2021. Lastly, some participants are still awaiting responses to their feedback and questions submitted during the March sessions.

In the same meeting, feedback highlighted concerns about the effectiveness of the project phone service. Community members expressed a preference for immediate assistance rather than receiving a call back after a week. Suggestions were made to use a toll-free 1800/1300 number to eliminate call charges for callers. Additionally, there was a request for a “case management” approach, where one designated person would handle all inquiries and provide comprehensive support.

A suggestion was also made in the CCG meeting to organise a town hall meeting where community members could ask questions to a panel consisting of

MPs, local government representatives, and AusNet representatives. However, concerns were raised about the perception that all panel members may be aligned in interests and views, despite potentially differing perspectives at this stage of the project. AusNet expressed a preference for smaller group format sessions that allow for a wider range of participation, discussion, and questions. It was recommended that staff involved in interactions with landowners undergo empathy training, as some interactions were perceived as unsympathetic. The group emphasised that the consultation process thus far lacked empathy and caused distress to the entire community, not just landowners.

3.9 Biodiversity

According to the Biodiversity EES Information Sheet [101], the community has shared concerns regarding the existing conditions in the project area. This includes the presence of habitat offered by hollow-bearing trees, riparian corridors along waterways, observations of diverse fauna such as kangaroos, wombats, bats, broilgas, and raptors, and the existence of rare species like *Grevillea Steiglitziana* and Braid Moss. They have also highlighted areas prone to landslides and important nesting sites for Yellow-tailed Black Cockatoos, as well as sightings of Little Eagles and other bird species, and the presence of platypus and Rakali around Clunes.

In response, a range of considerations have been identified by AusNet for further investigation and management in the biodiversity impact assessment. These include the potential impacts of construction and easement management on threatened flora and fauna species and communities, loss of native vegetation and habitat fragmentation due to clearing, disturbance of native fauna during construction, interference with waterways and wetlands, collision threats to threatened bird or bat species, potential disturbance caused by operating transmission lines, the transmission lines acting as vantage points for predators, and the risk of spreading weeds, pests, or other biosecurity concerns during construction.

3.10 Electromagnetic Fields

During a webinar addressing safety concerns [102], an AusNet spokesperson highlighted the extensive biological studies conducted over the past 40 to 50 years. He suggested these studies consistently found no adverse human health impacts resulting from extremely low-frequency EMFs. The concerns raised by the community regarding the potential impacts of EMFs on livestock have also been thoroughly studied. For instance, he referenced a comprehensive study in Ohio which examined dairy cattle behaviour and production on 18 farms located directly under a 765 kV high-voltage line, with no reported impacts. Similarly, he cited a study

in Canada involving various animals near high-voltage lines, including sheep, pigs, horses, and beef cattle, which found no observed health effects.

He stated ARPANSA, the Australian Radiation Protection and Nuclear Safety Agency, recognises the ICNIRP guidelines as international best practice for safeguarding against the potential effects of EMFs [74]. These guidelines establish reference levels for public exposure to EMFs, with limits of 5 kV per meter for electric fields and 200 micro-tesla for magnetic fields. He emphasises measured EMF levels in common household settings and near power lines are considerably lower than these reference levels.

A viewer questioned the safety of pacemakers around electromagnetic interference. Pacemakers and other active implantable medical devices can be sensitive to electromagnetic interference (EMI) generated by high fields around transmission line conductors. The AusNet spokesperson stated manufacturers design these devices to be immune to magnetic fields within reference levels (around 200 micro-tesla). He indicated pacemakers have fail-safe mechanisms that switch to a fixed pacing mode in case of EMI, which is uncomfortable but not medically significant.

A viewer asked if EMI would impact GPS systems. While heavy rain can have some effect on electromagnetic interference from transmission lines, the AusNet spokesperson stated the emissions in question are generally in a frequency range of about 500 kilohertz to 1.5 megahertz, which primarily impacts AM radio. He stated GPS systems, on the other hand, operate at much higher frequencies that are well above this range. Therefore, the transmission line emissions are unlikely to interfere with GPS devices, and there should be no significant impact on GPS functionality.

3.11 Route Refinement Decisions

As presented in AusNet's Updated Proposed Route Overview [103], community and stakeholder feedback, combined with the findings of technical studies, field surveys and investigations, have informed the selection of AusNet's proposed route.

In Bolwarrah, the new route aims to minimise impacts on heavily vegetated areas and potential Aboriginal cultural heritage, while maximising the use of cleared land. Although some clusters of endangered Brooker's gums may still be impacted, efforts are made to avoid a large cluster. The route also takes into consideration the protection of native vegetation and potential habitat for endangered species such as greater gliders, powerful owls, and other threatened and native species. Additionally, it avoids a wetland adjacent to the Moorabool River West Branch, which serves as potential habitat for growling grass frogs, and maximises the

distance to houses in the Tooheys Close area, reducing visual impact through screening.

For the section from Mt Steiglitz to Korjamnunnip Creek, the proposed route increases the distance from houses and minimises land use impacts.

In Myrniong, the transmission line route aims to reduce the visual scale of the towers from the township by increasing the distance between the line and the town. It is located in an area where it can be screened or filtered from views along Mt Blackwood Road. The route also increases the distance to some houses on farming land and is set against the backdrop of forested hills and ridges of the Lerderberg State Park, reducing visual impacts on adjacent houses. Efforts are made to minimise impacts on the area of cultural sensitivity associated with Myrniong Creek and its potential for Aboriginal cultural heritage.

In the Darley military camp area, further refinements are proposed to reduce impacts on the military camp site and Grey Box Grassy Woodlands.

Regarding the Merrimu Reservoir, the route has been planned to avoid impacts on the significant ecological values of Long Forest and Aboriginal cultural heritage sites. It maximises the distance to residential properties south of the Diggers Rest–Coimadai Road, as well as the Symington Road and Moonah Drive areas. To preserve the Coimadai Avenue of Honour and mitigate potential social impacts, the route crosses the Diggers Rest–Coimadai Road east of this community asset. It traverses disturbed areas with little tree cover and avoids potential impacts on any future Merrimu Reservoir dam wall upgrade works. The route also minimises impacts on Southern Rural Water's existing quarry operations.

In the Melton-MacPherson Park section, efforts are made to avoid threatened ecological communities and bulokes on properties east of MacPherson Park. A Seasonal Herbaceous Wetland ecological community, listed as threatened, is also avoided to the north-west of MacPherson Park, along with areas of Aboriginal cultural heritage sensitivity. The route does not directly impact the sporting fields at MacPherson Park and follows the boundaries of properties to minimise impacts on landholders. Furthermore, it minimises the impact on the current operations at Melton Aerodrome.

4. Summary of Stakeholder Concerns

Table 10 Summary of Stakeholder concerns

Key Themes	HumeLink	Victoria to New South Wales Interconnector West	Western Renewables Link
Stakeholder Engagement	<p>Stakeholder engagement: Community engagement lacked transparency, with unclear decision-making responsibilities, notification procedures, and opportunities for community input. Only landowners within the project corridor were involved, excluding adjacent landowners. Landowners felt their concerns were misunderstood and were treated disrespectfully. Project materials lacked currency and user-friendliness. Alternative options and landowner feedback were not given sufficient consideration.</p> <p>Compensation: Neighbouring properties suffer from the decrease in property evaluation, but do not receive compensation</p>	<p>Stakeholder engagement: Late communication to potentially impacted communities, insufficient time for informed submissions, inadequate information provided, and difficulties in understanding the project details for communities and landowners.</p> <p>Social licence: Offering opportunities for local renewable energy projects would increase acceptance of hosting transmission lines. It was recommended that the project consider the effects on communities early on, considering land uses, local government perspectives, and landscape considerations. Additionally, questions were raised regarding the assumption of social acceptance for wind and solar energy projects.</p>	<p>Stakeholder engagement: Inadequate advertisement of community meetings, dissatisfaction of notice of project changes, long wait times for community drop-in sessions, unsatisfactory answers to questions, doubts of effectiveness of sessions.</p> <p>Compensation: Some landowners felt benefits should be granted to impacted communities, not to energy start-ups or for-profit groups. Some compensation does not apply to neighbours of easements. Speculations that funds are serving to buy community influence. the provision of vouchers to incentivise landowners to sign land access agreements created confusion and led to the perception that accepting the vouchers compromised land rights.</p>
Proposed alignment	<p>RIT-T: Does not consider the cost of the environment and is insensitive to environmental impacts.</p>	<p>Multi-Criteria Analysis: The study lacked comprehensive engagement and failed to consider social constraints accurately. Agricultural impacts, mental health, and community opposition was not adequately considered. The MCA ratings lacked justification, and economic factors were prioritised over social, cultural, and environmental aspects. Regional plans and development directions were not adequately considered. Modelling overlooked land value impacts, carbon footprints, and the effects on agriculture and tourism.</p> <p>Errors in cost: accuracy of line length calculations, missing cost components, understated easements and easement taxes, low-cost estimates for power flow controllers, understated OPEX costs, and the exclusion of future network investment</p>	<p>RIT-T: Focused primarily on economic factors with insufficient detail provided regarding undergrounding and partial undergrounding options.</p>
Impacts on land use and property	<p>Tourism: Impacted due to the obstruction of natural landscapes due to transmission towers</p> <p>Traffic and roads: Temporary increases in traffic on local roads affects performance of the road network, construction may cause deterioration of road conditions, air quality affected due to construction trucks causing dust.</p> <p>Noise and Vibration: Lack of noise monitoring for landowners who claim they can hear constant humming, noise and vibration can affect the mental health of livestock</p>	<p>Impact to farming operations: Inability to use machinery, irrigation, and GPS technologies under power lines. Paddock division, financial implications, decreased land value, and loss of productivity are further concerns.</p> <p>Property access: Lack of notice given to landowners, undisclosed chemical usage affecting vendor declarations, weed spread, failure to close gates, crop damage, machinery damage from materials left on-site, and soil impacts due to heavy machinery use.</p>	<p>Landscape and visual amenity: Landowners intentionally reside in the community because of the scenic landscape, which will be affected by the transmission lines, leading to a decline in property value. The significance of landscapes, including volcanic cones, tourist attractions, and unspoiled night sky views, is overlooked.</p>

Key Themes	HumeLink	Victoria to New South Wales Interconnector West	Western Renewables Link
Impact on the environment	<p>Undergrounding: Proposed overhead towers have numerous negative impacts, including increased bushfire risk, hindered firefighting efforts, health concerns from electromagnetic fields, unusable farmland, industrialised landscapes, decreased property values, habitat destruction, disruptions to aerial and drone activities, interference with GPS signals, threats to animal habitats, constant noise, and vulnerability to storms. The Undergrounding Study report faced criticism for focusing on negatives and neglecting positive aspects. Concerns were raised about cost discrepancies, technical inaccuracies, extended commissioning schedules, and limitations based on overhead route studies. Undergrounding is seen as a solution to eliminate fire risks and promote protection.</p>	<p>Undergrounding: Lower impact on flora, fauna, landscape, and visual aesthetics, reduced bushfire risk, lower impact on agricultural productivity, and increased community support. While acknowledging potential cost implications, undergrounding was seen to minimise impacts on communities. Specific requests were made for underground technology in urbanised areas, important agricultural regions, areas of high landscape value, and habitats of endangered species.</p>	<p>Undergrounding: Was not considered appropriately as positive aspects were overlooked.</p> <p>Biodiversity: Impacts to presence of habitat offered by hollow-bearing trees, riparian corridors along waterways, observations of diverse fauna such as kangaroos, wombats, bats, brolgas, and raptors, and the existence of rare species like Grevillea Steiglitziana and Braid Moss</p>
Impacts on health and safety	<p>Bushfire risks: Transmission lines hinder effective fire response for landowners. The provided factsheets lack comprehensive information, only emphasising risk minimisation. Undergrounding the route would eliminate this risk.</p>	<p>Bushfire risks: Firefighters face limitations near power lines and falling lines can cause fires. The Bushfire Royal Commission recommends underground power lines. Incident costs, like the Cressy collapse, are passed on to consumers. Increased bushfire risk and route through flood-prone areas are additional concerns.</p> <p>Mental health: Anxiety caused to landowners and community members.</p> <p>Electromagnetic fields: Concerns regarding cancer and health risks on people and animals</p>	<p>Bushfire risks: Concerns including fires originating from project infrastructure, which can affect bushfire management strategies like planned burning, ground-based and aerial fire response, and back-burning. Forest areas pose challenges for evacuation during bushfire events. Climate change exacerbates fire weather conditions and fire risk. Coimadai Primary School, identified as at risk in the Bushfire Register, is also impacted.</p> <p>Mental health: The proposed project has the potential to strip away this cherished landscape, impacting the well-being and enjoyment of individuals.</p> <p>Electromagnetic fields: Concerns regarding cancer and health risks on people and animals</p>
Cultural and Heritage Sites	<p>Aboriginal heritage: Concern construction ground disturbance will directly disturb and destroy archaeological artifacts and structures. Vegetation clearance can remove the protective cover and concealment of archaeological sites. Placement of power lines over culturally significant sites impede the ability to effectively protect the site during a fire.</p> <p>Heritage sites: Farmers hold differing perspective of heritage and its significance to the community such as the removal of hundreds of trees that hold significance for future generations.</p>		<p>Aboriginal heritage: Concern regarding how transmission infrastructure will impact culturally significant sites.</p>

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Attachment A:

CCG Code of Conduct

HumeLink Community Consultative Group Code of Conduct [6]:

HumeLink Community Consultative Group

Terms of Reference and Code of Conduct

TERMS OF REFERENCE

Background and purpose

TransGrid has committed to reset our community and stakeholder engagement approach and adopt all twenty recommendations from the Landowner Advocate Report. The establishment of Community Consultative Groups (CCGs) for the HumeLink project is one of these recommendations. The groups will initially run through the planning stages of the project.

Three groups are proposed to cover the following local government areas:

- Upper Lachlan and Yass
- Cootamundra Gundagai, Wagga Wagga
- Snowy Valleys

The CCGs purpose are to:

- Bring together TransGrid, local community groups, landowners and councils, to provide an opportunity for two-way communication about the HumeLink project
- Provide a forum for TransGrid to keep the community informed about the project, seek community views and respond to matters raised by the community
- Provide a forum for community members, stakeholders and local councils to seek information from TransGrid and provide input to inform Corridor refinement and the subsequent Environmental Assessment process
- Suggest ideas for community benefits/ project legacy contributions along the corridor
- To provide feedback and guidance to TransGrid about their community engagement approach.

The CCGs will be one of many means by which TransGrid will engage with communities and stakeholders along the study corridor. The CCGs will be a forum for consultation rather than a decision-making body. Where possible, specific recommendations or actions arising from discussions will be agreed through consensus. Where this is not possible, different views and opinions will be noted.

TransGrid has engaged Brendan Blakeley as the inaugural independent chair of the CCGs with secretariat services to be provided by WSP.

Membership of the CCG

Each group will have a maximum 15 members comprising:

- 3 proponent representatives
- 1 member from each council
- 1 member from each land council
- 1 representative from each of the established landowner groups within the CCG area
- Remainder drawn from recognised community groups (first preference), then individuals who have nominated.

Participants must be:

- A member or representative of the local community
- Willing to commit to attending meetings regularly (alternative attendees are permitted if the CCG Chair/secretariat is advised prior to the meeting). The use of alternative attendees should be kept to a minimum. The Chair may request the replacement of any member who fails to attend three consecutive CCG meetings
- Willing to gather input from the community/stakeholder group represented and bring forward any queries or concerns raised in relation to the project
- Able to disseminate information received during the meetings back to the property owners/neighbours/community/stakeholder group
- Able to demonstrate why they have an interest in this project and their key areas of interest.

Selection criteria

- The CCGs should comprise an equitable mix of gender and preferably age groups
- The group should provide for coverage of locations along the corridor
- Members of recognised groups may be given preference over self-nominated individuals, this includes landowner groups
- While landowners are key stakeholders the CCGs should not solely be a forum for directly impacted landowners
- Other groups to be invited to nominate include:
 - Chambers of Commerce
 - Progress or Resident Associations
 - Indigenous groups
 - Local Environmental Groups
 - Landcare / Bushcare
 - Tourism Associations
 - Industry associations such as Forestry Groups, NSW Farmers
- Particular expertise or skills sets
- Breadth of local organisations represented.

Assessment of applications and selection of members will be undertaken by the independent chair of the CCGs and the independent landowner advocate.

Meeting minutes and presentations will be published on TransGrid's website, along with the list of CCG members.

CCG Chair

The independent chairperson must be:

- A convenor, facilitator, mediator and advisor for the CCGs
- Independent and impartial
- The key contact (with assistance from support secretariat) between the CCGs and TransGrid.

The Chair will oversee the preparation and publication of the minutes of the CCG meetings and the Chair's standard fees (and secretariat support) will be paid by TransGrid.

Meeting frequency

The CCGs will meet once every 3 - 6 weeks for the first 3 months. This timing is to maximise the two-way sharing of information during the initial refinement of the corridor and in advance of more detailed planning commencing. Meeting frequency will be reviewed in early 2023.

CODE OF CONDUCT

Working together

The principles underpinning the CCGs that all members and project team representatives must agree to are to:

- Work collaboratively in an open and honest fashion
- Be respectful of all members and their opinions
- Refrain from any form of conduct that may cause a reasonable person unwarranted offence or embarrassment
- Undertake to fairly present the information provided at the CCGs, to their local communities
- Not misrepresent the views of other members of the group outside meetings.

Code of conduct

All members, including the independent chairperson and alternative members, must agree and sign the following code of conduct at the first meeting. Breaches of this code of conduct can be reported to the independent facilitator, who will raise the issue with the member. This may take the form of:

- A verbal warning before or during the meeting (which will be formally recorded in the meeting)
- A written warning after the meeting.

Following three warnings, the independent chairperson may ask the member to leave the group. This position will then be replaced by the independent chairperson.

Members of the CCGs will be expected to:

- Attend meetings, at dates and times agreed by the group
- Advise the independent chairperson in advance if they are unable to attend and who their alternative member will be
- Respectfully engage with other members of the CCGs
- Contribute to an atmosphere of open and constructive participation
- Openly communicate relevant concerns, interests and ideas and make reasons for any disagreement clear in a constructive and thoughtful manner
- Put forward views but also remain committed to open and shared dialogue
- Actively work with the members of the group to try and resolve any issues that may arise during the CCGs work

- Ensure they do not discuss or share information about matters that are identified as confidential during meetings
- Not interrupt when another member is speaking
- Not speak publicly, for example to the media, on behalf of the CCGs
- Not misrepresent the views of other members of the CCGs
- Immediately advise the independent chairperson during meetings of any potential or actual conflict of interest relating to matters under discussion
- Abide by the reasonable directions of the independent facilitator as to the conduct of the meetings.

Operating protocols

The following operating protocols will govern the CCGs:

- Meetings will be held approximately every 3 - 6 weeks for the first three months and then every 2-3 months thereafter
- Conduct of meetings will be informed by social distancing guidelines and health advice
- The meetings may be held in various convenient locations within a CCG area to ensure any travel load is shared equitably amongst members. In the event of COVID restrictions meetings may be held online.
- Meetings will generally run up to 2 hours
- To ensure safe travel meetings will occur during the day and early evenings, suitable times for meetings will be established with members
- A call for agenda items will be issued by the chair two weeks before a meeting, with the agenda then being determined by the chair and distributed one week prior to the meetings
- Technical advisors or specialists will attend as required
- All information provided should be accurate and timely
- Any pecuniary/conflict of interest should be declared by members
- Notes of the meeting will be provided electronically to CCG members within five working days of the meeting, with any comments to be provided within five working days of that time. In the event of any disagreement about the minutes the independent chair will have final say. A final set of minutes will be uploaded to the HumeLink website within 3 weeks of the meeting date
- Recording of the meetings by an electronic device is not permitted without prior agreement of the independent chair and all CCG members
- TransGrid may choose to reimburse reasonable travel expenses incurred by members.

Members may ask the independent chairperson to invite non-CCG members to attend meetings, either as observers or to provide advice to the committee. This may include:

- Representatives of government agencies
- Technical experts or consultants
- Members of the general public.

The independent chairperson is to consult with the other members of the group before issuing the invitation. If there is any disagreement between the members about the invitation, the independent chairperson will

have the final say on the matter. Non-CCG members cannot participate in the business of a meeting unless they are invited to do so by the independent chairperson.

Media/social media protocols

To encourage open discussion at the meetings, we require members of the CCGs to adhere to the following media/social media protocols:

- Members of the CCGs are not authorised to provide written or verbal statements to the media/social media purporting to represent the views of the CCG
- The minutes are the authoritative record of the meeting
- CCG members are entitled to utilise media/social media on project matters in a personal capacity, and in doing so must ensure that their views are understood to be personal views and not the views of other CCG members or the project team.

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