North West Transmission Developments

Why overhead transmission has been selected

This fact sheet provides information on the proposed High Voltage Alternating Current (HVAC) overhead North West Transmission Developments (NWTD) and the proposed High Voltage Direct Current (HVDC) undersea and underground Marinus Link connection to further link Tasmania and Victoria. This fact sheet also outlines why the NWTD project is using overhead transmission.

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TasNetworks | Powering a Bright Future

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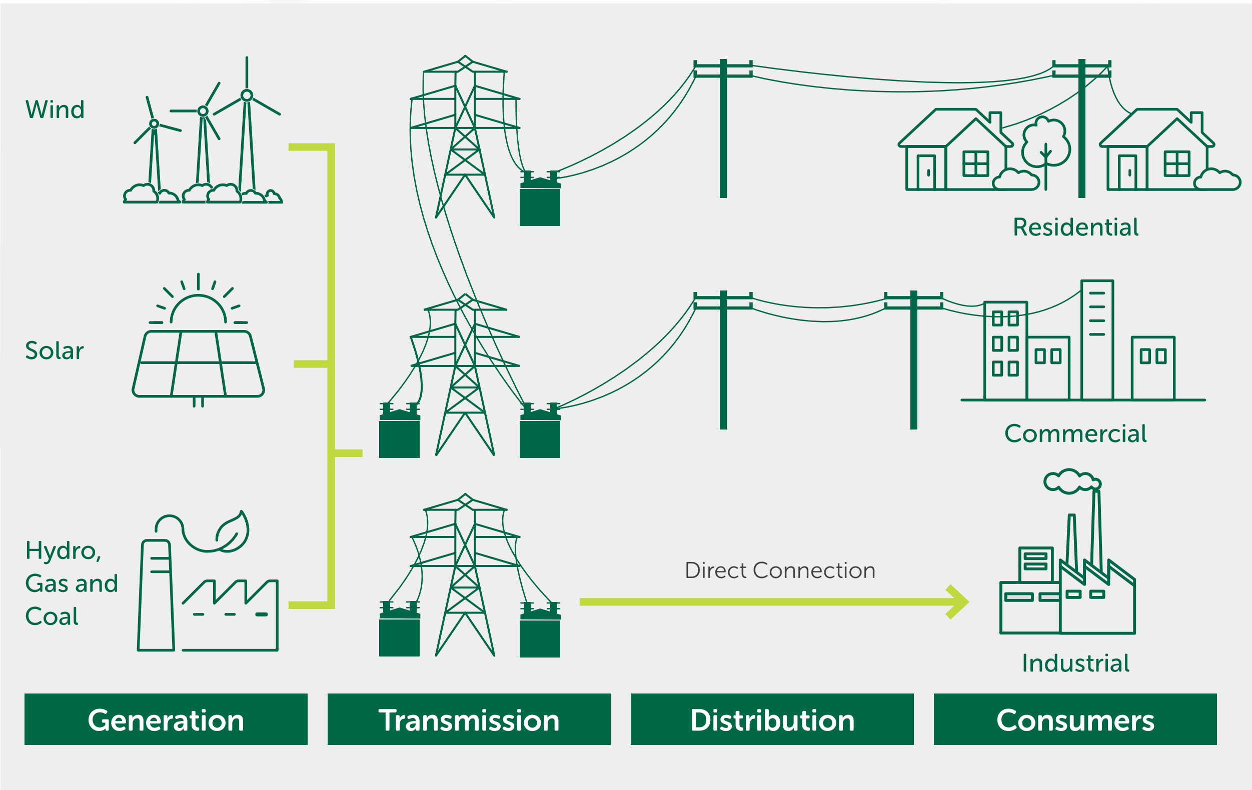
What is High Voltage Alternating Current (HVAC)?

Voltage is the force from an electrical power source that pushes electric charge through a conductor, resulting in a current. The power in your home is known as Alternating Current or AC power. It can be generated by different types of power generators and transmitted to your home via the transmission and distribution networks. HVAC power forms the backbone of transmission and distribution networks in Tasmania, Australia and around the world. Typically, this technology uses overhead transmission infrastructure but can also be placed underground.

HVAC electrical power provides various advantages:

- The voltage levels can be changed in a simple, proven and cost-effective manner with the use of transformers and substations.
- AC networks are easily expanded and upgraded.
- Three-phase and single-phase systems allow for effective connection of consumers with variable consumption needs.

Figure 1: AC Network



What is High Voltage Direct Current (HVDC)?

Direct Current or DC power is the flow of electric charge that maintains a single direction flow. HVDC is used for bulk transmission of high voltage electricity where the connection requirement is usually between two points only.

HVDC electrical power provides various advantages:

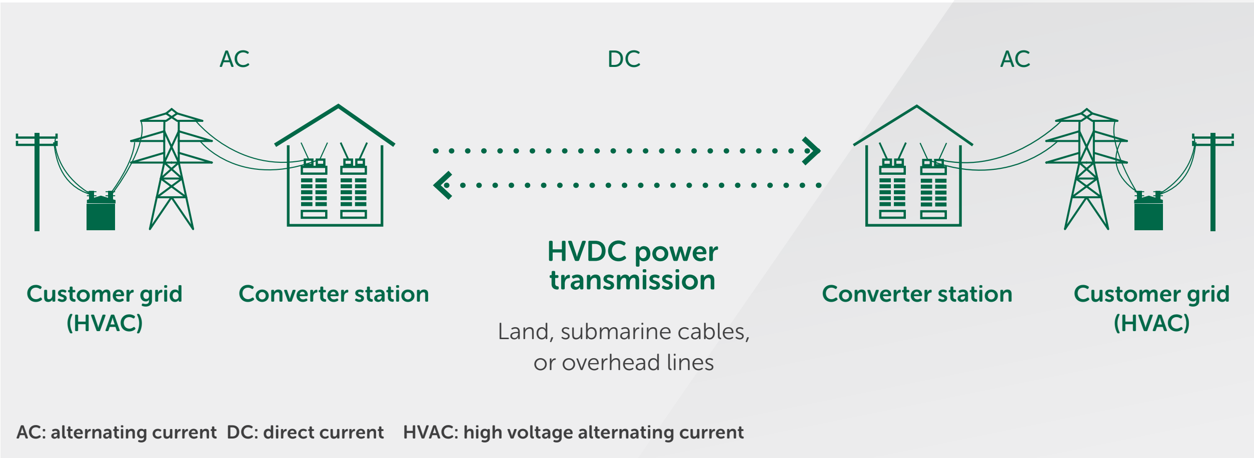
- HVDC is more efficient to transmit over long distances
- HVDC can transport about twice the amount of voltage in an HVDC power system in comparison to a high voltage AC power system.

HVDC needs converter stations

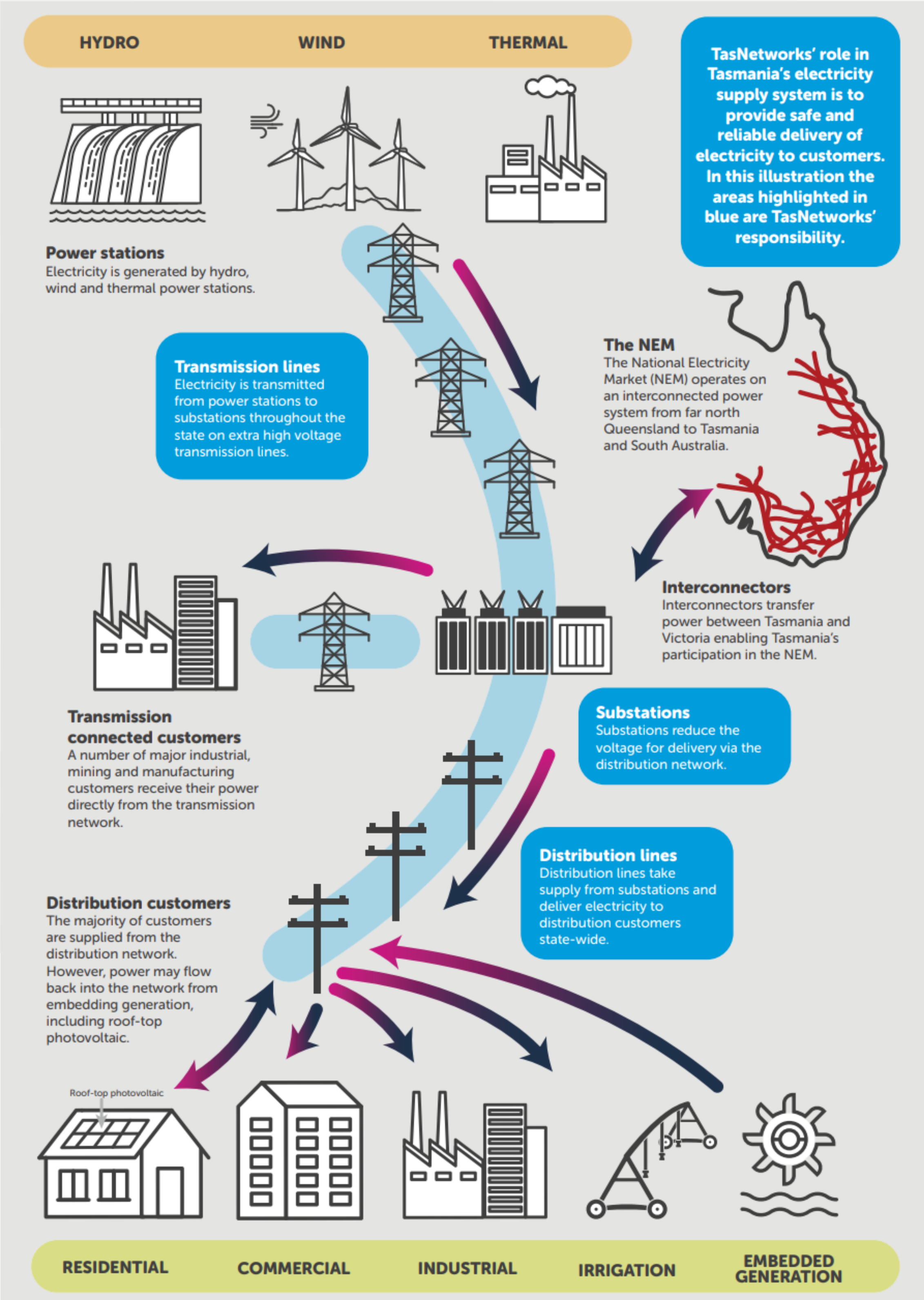
With the existing shared transmission and distribution networks across Australia being predominantly Alternating Current (AC) networks, HVDC needs to be converted to AC before it can be used in homes and businesses. Converter stations (large and technically complex systems) need to be placed at each end of the line to connect back into the HVAC network.

Figure 2: HVDC Transmission System

An HVDC transmission system interconnects two customer grids, which can operate independently of one another and can even have different frequencies.



Tasmania's Power System



Why is TasNetworks upgrading the electricity transmission infrastructure in the North West of Tasmania?

As Tasmania's electricity network planner, TasNetworks is working to ensure that the network will be capable and ready to support future renewable energy developments.

TasNetworks owns, operates and maintains the electricity transmission and distribution network in Tasmania, delivering safe, cost-effective and reliable electricity supply to more than 295,000 homes and businesses.

TasNetworks is designing the North West Transmission Developments project to meet Tasmania's future energy needs while ensuring this is the most efficient and affordable upgrade for Tasmanians.

What are the North West Transmission Developments (NWTD)?

The proposed North West Transmission Developments project will include 240km of new and upgraded HVAC overhead transmission lines and other energy infrastructure.

The developments will allow Tasmania's power system to remain strong and stable while providing the increased capacity needed to accommodate new and existing renewable energy developments in the region, including Marinus Link.

Why is the NWTD project using HVAC and not HVDC technology?

The NWTD will strengthen the existing transmission system in Tasmania which consists of highly connected overhead HVAC electricity infrastructure. HVDC is typically used to transmit power efficiently from point to point over a long distance. HVDC is less flexible when it comes to facilitating multiple connections along the route.

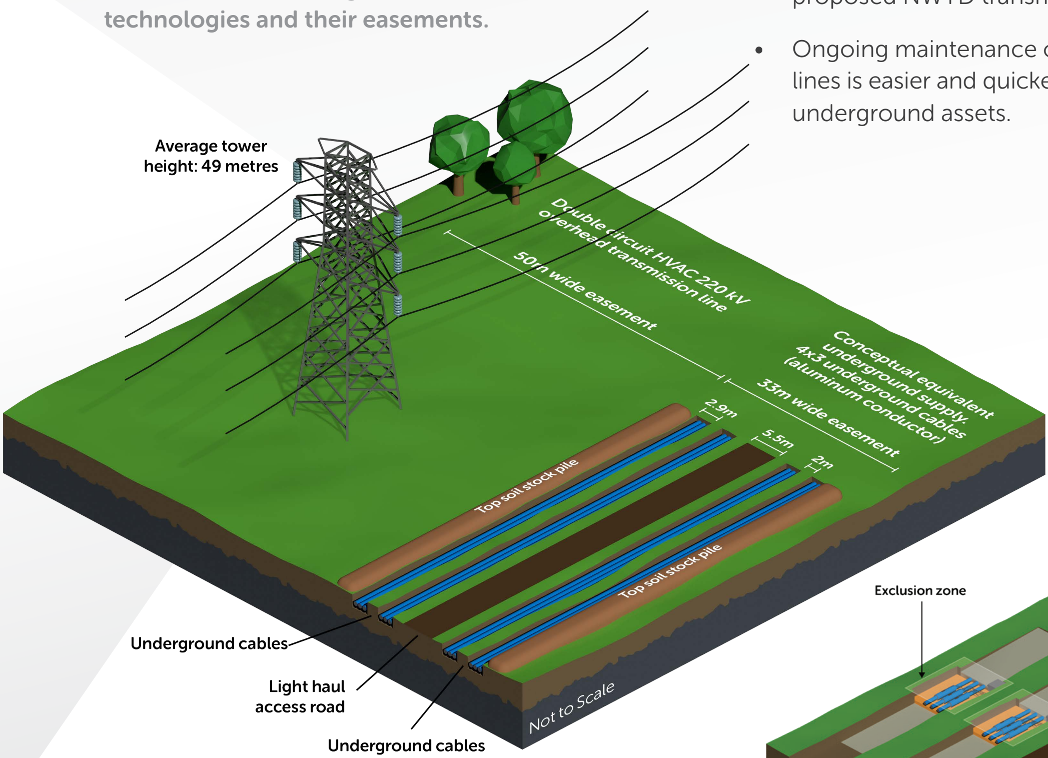
Converter stations are required at each end to convert electric power from AC to DC and vice versa. These would make future integration of additional renewable energy connections along the route much more complex and expensive. HVDC technology is not considered feasible for the existing interconnected network in Tasmania.

Why is the NWTD project using overhead transmission?

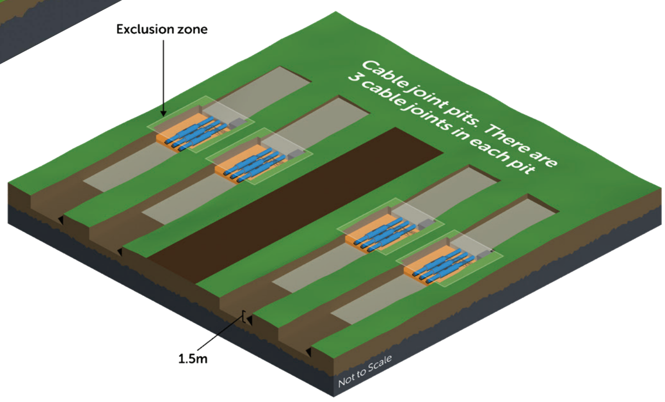
HVAC overhead transmission has been selected as the preferred method to transport electricity for the NWTD. This technology has been chosen because:

- Overhead HVAC lines will ensure Tasmania has the necessary energy transmission compatibility and capacity needed at an appropriate cost.
- HVAC underground cables pose technical limitations over long distances. Underground HVAC is typically only considered, for example, in a relatively short route length (approximately 50km) and in densely populated city areas where space is premium.
- HVAC overhead transmission lines will be constructed in a way that reduces impacts to landholders as much as practical.
- Overhead lines accommodate rugged terrain and landslip prone areas, which are features of the proposed NWTD transmission line corridors.
- Ongoing maintenance of overhead transmission lines is easier and quicker to repair than underground assets.

Figure 3: Conceptual diagram showing comparison between HVAC underground and overhead technologies and their easements.



If a cable with an aluminium conductor is chosen, four trenches with three cables in each are required. If a cable with a copper conductor is chosen, 3 trenches with 3 cables are required. This is because copper is more conductive than aluminium.



Cable joints are required every 1km.
This is because standard HVAC cable drums hold a maximum of 1km in cable length.

Cost

Cost is an important factor when planning electricity infrastructure, as projects have an impact on power bills for all electricity customers.

Underground HVAC cables are significantly more expensive than overhead HVAC transmission lines (up to 7-8 times depending on power rating and terrain). This is because:

- Underground construction is more labour-intensive and takes longer with trenching and the installation of cable joints and joint pits at regular intervals along the line.
- Additional aboveground infrastructure is required.
- Maintenance of underground infrastructure is more expensive.

All these additional costs are ultimately paid for by Tasmanians in their power bills.

While more costly, there may be instances where undergrounding is selected as the best solution. Project engineers will always complete a detailed analysis of the project requirements and constraints when determining the best option. Cost is an important consideration that is weighed against other factors in making these decisions.

Customer connections

HVAC technology is required to connect new generation and loads, and to make these connections to underground assets is costly and increases technical constraints/risk. The North West Transmission Developments need to service an increasing number of large generation and load customers that want to connect to the grid, including wind and solar farms, data centres and hydrogen plants.

Palmerston to Sheffield Case Study

In 2021, following concerns raised by landholders and to further inform the NWTD project, a feasibility study was commissioned by TasNetworks and conducted by JMME (Jacobs Group Australia).

The study focused on the Palmerston to Sheffield section of the proposed NWTD route. This section of the route is approximately 80km long and crosses through rural farmland, consisting of terrain that is relatively flat, with favourable geotechnical conditions including soft soils with few rocky outcrops and good access compared to other hillier and/or remote sections of the NWTD.

Overall, findings of the study noted that undergrounding this section of the route would be "more than seven (7) times more expensive than the overhead transmission line option" and substantially increases the levels of technical complexity and time taken to construct.

The full *Memorandum JMME Memo Palmerston to Sheffield Under Ground options* explaining the conclusions in detail can be found on our website: www.tasnetworks.com.au/resources

The key findings of the JMME study that undergrounding takes significantly longer to construct and costs the public substantially more to fund, align with the advice of independent studies into undergrounding energy infrastructure in other states, including a 2024 report from a New South Wales Parliamentary Inquiry into the Feasibility of Undergrounding Transmission Infrastructure for Renewable Energy Projects.

What are the impacts to land use for HVAC overhead and underground transmission?

Overhead HVAC transmission

Visual impact

- Overhead transmission lines have a high visual impact due to visible infrastructure.

Biodiversity

- Overhead transmission allows for ground clearance that can avoid some vegetation removal (e.g. in sensitive riparian areas, grassland areas and valley environments etc.).

Cultural Heritage

- Overhead transmission lines are less likely to disturb cultural heritage sites due to less ground disturbance.

Agricultural activities within easements

- Normal agricultural activities can generally take place with overhead transmission lines, however this is subject to restrictions on the height of mobile plant and equipment (such as pivot irrigators).

Other activities within easements

- Most recreational activities can be undertaken within overhead transmission line easements, with exceptions such as flying kites and model aircraft.
- Gardens can be planted within overhead transmission line easements if trees and shrubs are below three (3) metres when fully grown.
- Minor structures can be erected within overhead transmission line easements provided they are less than two (2) metres tall and metallic parts are earthed.

Underground HVAC transmission

Visual impact

- There is less perceived visual impact with underground transmission infrastructure. However, underground HVAC would still require a 30m wide construction easement throughout, together with significant trenching (3-4 trenches) to house 9-12 large cables (depending on conductor type) and aboveground infrastructure such as joint bay access points and compensation station compounds along the route.

Biodiversity

- Undergrounding HVAC would require longer construction time (2-3 times longer), increasing impacts and disruptions to landholders.
- Undergrounding HVAC can have greater environmental impacts, as easements need to be fully cleared.
- There are greater biosecurity risks due to the larger quantities of soil disturbance and vehicle movement required for construction of underground transmission lines compared to overhead line construction. The access roads also need to accommodate the significant weight of the underground cable and soil removal.

Agricultural activities within easements

- Certain farming and cropping will be restricted on the easement of an underground cable as the root systems of larger plants can damage the cable, and access to underground transmission lines is always required.
- There have been noted cases in Germany where farmers indicated that crops are affected by heating from underground transmission lines[1].

Other activities within easements

- There are significant restrictions in the way land can be used for buildings, farming, dams and tree planting.
- No excavation, deep ploughing or heavy machinery can be used.

1. Select Committee on the Feasibility of Undergrounding the Transmission Infrastructure for Renewable Energy Projects (March 2024) – page 45.

MARINUS LINK

Marinus Link is a proposed undersea and underground electricity and data interconnector between North West Tasmania and the Latrobe Valley in Victoria.

The project includes high voltage direct current (HVDC) cables, fibre optic cables, a communications station, and converter stations at each end. The converter stations will connect Marinus Link directly into the AC transmission networks in both Tasmania and Victoria.

With Marinus Link, Tasmania can import low-cost renewable energy, such as surplus solar, while reserving hydropower and storing the extra energy. Green hydropower can then be exported to the mainland grid when it is needed most.

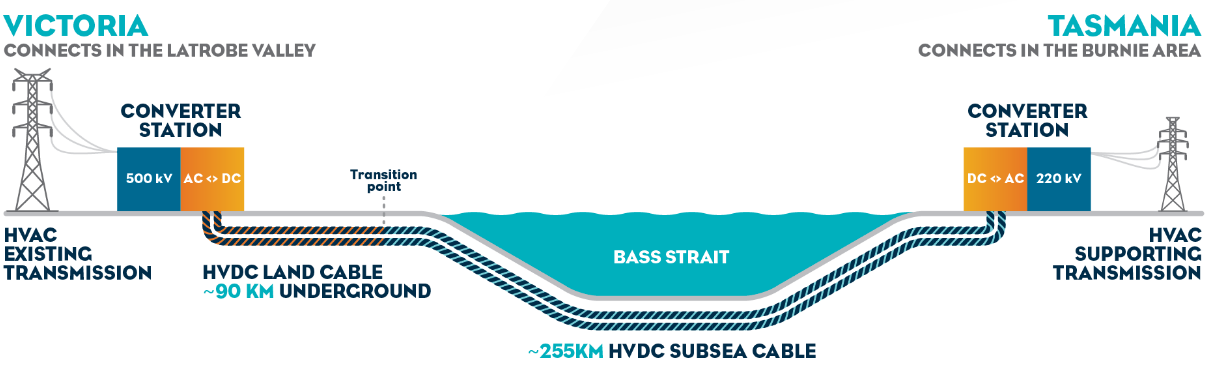
Why is Marinus Link going underground?

Marinus Link is a point-to-point connection across Bass Strait with a total length of 345km. HVAC underground cables pose technical limitations over long distances, and so HVDC is the only technology available to cross Bass Strait.

HVDC has been selected as the preferred method to transport electricity through Marinus Link because:

- HVDC is the most efficient and effective way to transfer bulk energy across long distances. Marinus Link has a 255km Bass Strait marine crossing from Burnie in North West Tasmania to Waratah Bay in Victoria, with a further 90km on land from Waratah Bay to the Latrobe Valley in Victoria.
- Marinus Link is a direct transmission line and is not connecting into any other projects along the route.
- HVDC requires fewer cables (three compared to up-to twelve for HVAC) to transfer the same amount of energy. This means fewer trenches, cable joints and lower material and labour costs, a shorter construction time and smaller easement width.
- Once built, Marinus Link won't be visible, except for the converter stations at each end of the route. The cables will be buried beneath the seabed across Bass Strait and will run underground through South Gippsland, to the Latrobe Valley in Victoria, with minimal above ground infrastructure required to support the alignment.

For further information about Marinus Link, please visit **www.marinuslink.com.au**



Want to know more or stay informed?

Visit tasnetworks.com.au/nwtd

Email NWTD@tasnetworks.com.au

Call 1300 127 777

The information in this fact sheet is based on expert technical advice provided by Jacobs / JMME. The full Memorandum "JMME Memo Palmerston to Sheffield Underground options" is available at www.tasnetworks.com.au/resources.

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