Delivering a new 500kV transmission network for Queensland

About this brochure

It makes good social, environmental and economic sense to use land wisely. That's why we're set to deliver a new voltage level in Queensland to enable variable renewable generation and storage to reliably meet our future energy needs. We're delivering new transmission lines capable of carrying the same amount of electricity as two 'traditional' transmission lines. This makes the best use of land and easements for developing electricity infrastructure and minimises potential impacts for landholders, the community and other stakeholders as much as possible.

Upgrading the transmission network

Upgrading the transmission backbone across Queensland will enable the efficient transfer of large volumes of renewable and stored energy to meet Queensland's transforming energy needs and provide a flexible platform to allow for future expansion as new loads emerge. It is expected Powerlink will be building around 2,000km of new transmission lines in the next decade to support the energy transformation.

The Queensland Energy and Jobs Plan (QEJP) sets out the direction for the future energy system, including developing renewable energy projects and long-duration storage to ensure the continued safe, reliable and affordable supply of energy for the future. Importantly, the QEJP outlines a strategy to develop a high-capacity transmission network, a SuperGrid, that connects areas throughout Queensland with a high renewable energy potential. The QEJP also identifies locations with long-duration storage capacity to store the renewable energy when it is produced and deliver it when Queenslanders require it.

A new voltage level for Queensland

With the transformation to variable renewable generation underway, there is a fundamental change occurring in how energy flows across the transmission network. Traditionally, Powerlink's network has transported power from large coal-fired generators to major load centres up and down the Queensland coast.

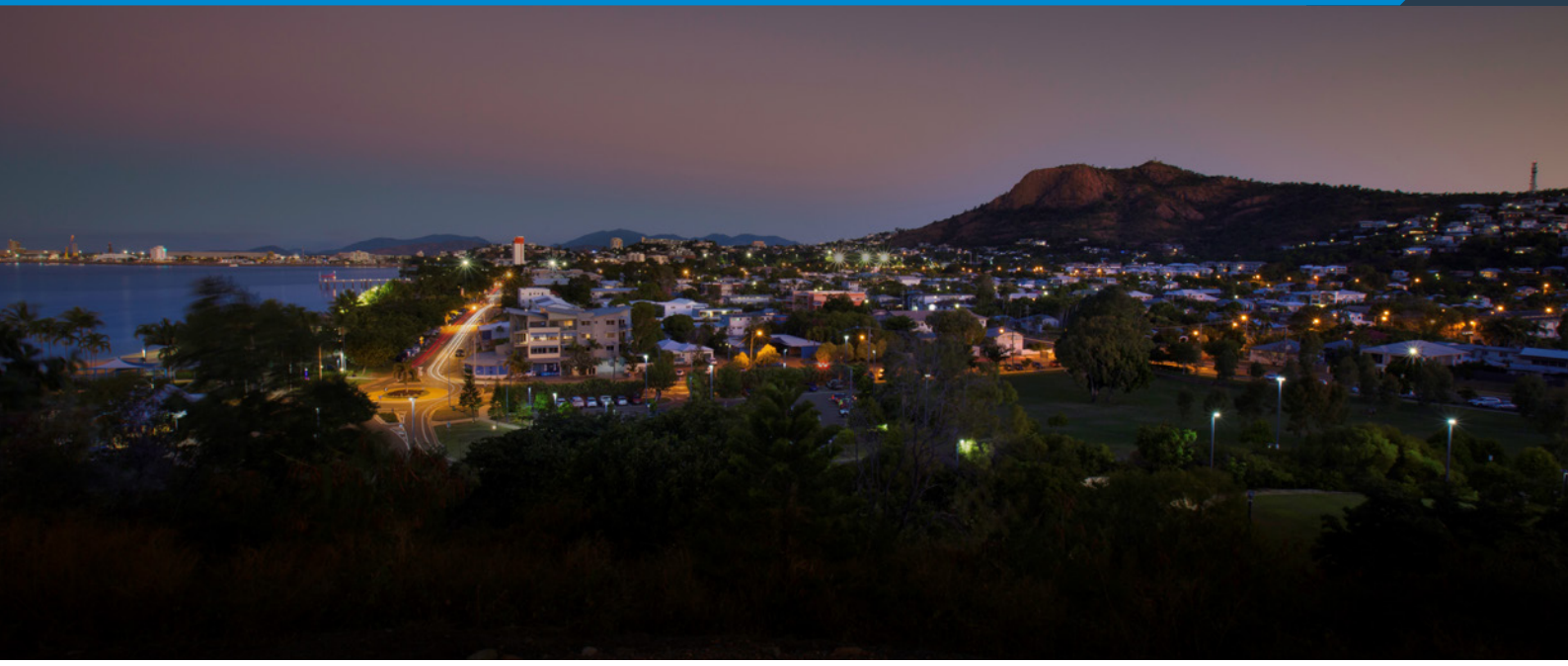
The existing transmission system has been developed to deal with the known energy loads and the operation of coal generation. Due to its intermittent nature (the sun isn't always shining and the wind isn't always blowing), achieving the same energy delivery from renewable generation sources requires approximately three times more generation capacity in the power system.

Times of high generation output will result in much greater power flows than currently experienced, which changes the scale, function and operation requirements of the transmission network. In the future, there will be significant daytime power flows from renewable generation to large load centres and pumped hydro energy storage facilities. At night, peak electricity demand will be supplied by a mix of pumped hydro, wind and other dispatchable generation sources which can adjust their power output to the electricity grid as required.

An upgraded high-capacity transmission backbone will act like major highways – a road network to facilitate the efficient transfer of large volumes of renewable and stored energy, and provide flexibility as the energy system continues to evolve. Given the capacity requirements, longer distances and future use, a new voltage of 500kV will be needed in Queensland's transmission network. This will enable generation to be dispersed more widely across Queensland as well as unlocking a greater diversity of renewable energy sources.

We will continue to plan our network carefully. Not all sections of the network are expected to require the high transfer capacity that 500kV provides. In parts of the network with lower load transfer requirements, lower voltages such as 275kV and 132kV, will continue to be most economic and appropriate.

While the introduction of 500kV transmission lines will be new to Queensland, in other states the 500kV transmission network has been in operation for many years. For example, the 500kV network in Victoria was developed more than 50 years ago and the New South Wales 500kV network has been in operation for nearly 40 years. The requirements on the transmission network now call for Queensland to integrate this higher voltage level into its network planning and delivery.



What will the new 500kV transmission lines look like?

500kV transmission lines will look similar to the existing high voltage lines in Queensland. The key difference is that the steel lattice transmission towers will be taller, at around 60 metres, and they will have a wider base and hold more conductors (wires). This height is necessary to enable the towers to support the 500kV conductors and meet safety clearance requirements. The height of individual towers will be dependent on the topography, environment and land use along the easement. Powerlink will discuss proposed tower heights and locations with individual landholders along transmission line routes as the need arises.

Like all transmission line developments, we will work closely with landholders, the community and other stakeholders to avoid, mitigate and manage any potential impacts of 500kV transmission lines and towers. From a visual amenity perspective, mitigation strategies can include using vegetation to provide visual screening from key viewing areas, and careful consideration of the placement of towers on properties and within the broader landscape. Powerlink will consider undergrounding where we cannot avoid social or environmental impacts, but this must be economically viable and technically feasible.

What about electric and magnetic fields?

We recognise that some members of the community may have an interest in electric and magnetic fields (EMF). There is no significant difference between EMF levels for 500kV and 275kV transmission lines. EMF is produced wherever electricity or electrical equipment is in use and decreases rapidly as the distance from the source increases.

At the edge of an easement for both a 275kV and 500kV transmission line, EMF levels are similar to those present in a standard home – and significantly below the relevant national and international guidelines. At about 200 metres from a transmission line (either 275kV or 500kV), the EMF is so small it cannot be easily measured and differentiated from magnetic fields from other closer sources found in and around the home or workplace.

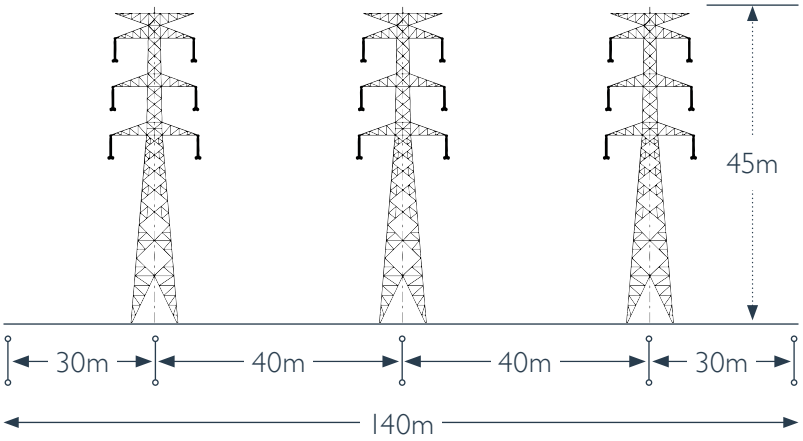
All future 500kV transmission lines in Queensland are being designed and built to meet national and international guidelines in relation to EMF. For further information on EMF please refer to Powerlink's website **www.powerlink.com.au/electric-magnetic-fields.**

Benefits of 500kV

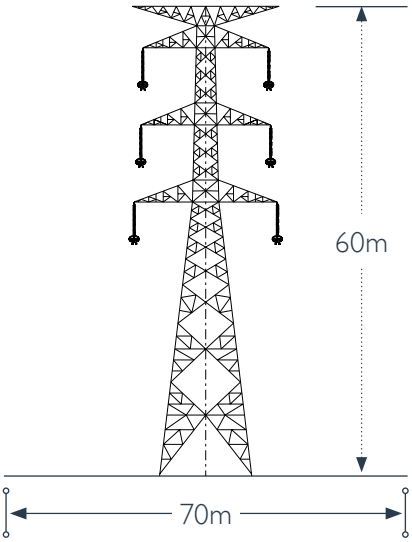
Higher power transfer capacity – A 500kV transmission line transmits up to three times more power per circuit than 275kV. The secure transfer level of one 500kV double circuit line would require a minimum of two parallel 275kV double circuit lines. In some instances at longer distances, three 275kV double circuit lines may be required to meet the equivalent 500kV power transfers to effectively manage stability.

Less corridor required – A 500kV double circuit line requires a smaller easement than multiple 275kV double circuit lines sharing the same right of way. For example, one 500kV double circuit line is expected to need an easement half as wide as three 275kV double circuit lines. This helps to streamline and minimise impacts on landholders' properties and the wider community by reducing the footprint of our infrastructure.

Easement for 275kV lines



Easement for 500kV lines



Lower transmission losses – Power transferred at higher voltages incurs lower network losses. Four parallel 275kV double circuit lines would be required to match the network loss performance of one 500kV double circuit line for the same power transfer.

Higher cost efficiency – The capital cost of one 500kV double circuit line is estimated to be more cost-efficient than two to three 275kV double circuit lines that would be required to achieve the same power transfer capacity. The ongoing operational and maintenance costs scale with the number of towers and lines and so would be greater for a larger number of 275kV double circuit lines compared to one 500kV double circuit line.

More streamlined coordination of projects – Delivering 500kV projects in a coordinated manner will facilitate strategic and targeted development that minimises impacts for landholders, the community and other stakeholders. This approach to optimising network design and implementation will take into consideration existing land uses and in turn reducing the footprint of transmission lines and environmental impacts.

More expandable for future development – A 500kV network provides Queensland with a greater ability to meet increased capacity for new and large electrification loads. A second 500kV double circuit line would increase the power transfer capability by up to 4,500MW. (For context, 4,500MW is roughly two-thirds of Queensland's current average daily electricity requirements.) This compares to an increase of approximately 1,500MW from adding another 275kV double circuit line in the future.

More timely constructability – A 500kV design involves constructing around 1,500km of new transmission by 2035 to deliver the backbone capacity in the QEJP. Achieving the same power transfer capacity with multiple 275kV lines would require two to three times more kilometres of transmission line to be constructed with longer delivery timeframes.

Contact Us

For further information, visit **www.powerlink.com.au** or scan the QR code

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