Our transmission network

About this brochure

This brochure explains the various elements of the transmission network in Queensland, including details on infrastructure such as lines, substations and structures.

Explaining our network

Our network extends 1,700kms from north of Cairns to the New South Wales border, delivering electricity to more than five million Queenslanders and 253,000 businesses. Our network also transports bulk electricity from generators, which includes large-scale wind and solar farms, hydro and battery energy storage, as well as traditional generators of electricity such as coal-fired power stations.

We build, operate and maintain a safe, reliable and cost-effective network, and are focused on working respectfully with landholders, other stakeholders and communities who co-exist with our infrastructure.

Electricity supply chain

Generators ····► Generate electricity.

Transmission lines ····► Carry high voltage electricity from generators to the local network.
Powerlink

Distribution lines ····► Supply electricity to homes and business.
Ergon Energy and Energex

Electricity retailers ····► Purchase electricity from generators, pay network costs and bill end users.

Customer

Easements

What is an easement?

Powerlink does not own the land the majority of our transmission network is located on. Our transmission lines are generally built on easements over the land. An easement gives us the legal right to access the land to carry out work to build, operate and maintain our transmission network.

The easement is registered on the property title and the landholder retains ownership and responsibility for the land. The rights of the landholder and Powerlink are explained in the registered easement terms and conditions.

For the safety of people living and working near electricity infrastructure, and to ensure its safe operation, there are some restrictions on activities on or near an easement. Many activities can continue as normal, but others are not permitted for electrical safety reasons.

How wide is an easement?

The width of a Powerlink easement depends on the local terrain and design of the line. The line design considers the operating voltage, structure types, and the length of conductor (wire) span between structures. A wider easement is needed to accommodate more than one transmission line. Typical easement widths are shown in Diagram 1.

Powerlink's Calliope River Substation

Substations

What is a substation?

Substations manage the flow and voltage levels of electricity around the transmission network and help keep the network stable to provide a reliable electricity supply. Electricity enters and leaves the substation via transmission lines – electricity is not generated at a substation. Powerlink's substations typically convert electricity from high voltages to lower voltages so it can be delivered to the distribution networks operated by Energex and Ergon Energy for delivery to residential customers and businesses. Substations also convert electricity to higher voltages to be efficiently transported across large distances. Generators or large industrial customers can link to the transmission network by connecting to a substation.

Substation equipment

A substation contains electrical equipment as well as buildings to house equipment for monitoring and control of the network. Equipment includes:

- transformers to convert electricity to a higher or lower voltage
- switches to interrupt the flow of electricity or disconnect parts of the substation for safe maintenance work
- instruments to measure the flow of electricity for metering and to protect equipment
- busbars to move electricity around the substation.

Substation sites

Substation sites can vary in size depending on the equipment to be housed. The typical footprint of a substation ranges from one hectare to five hectares, generally with a buffer zone outside the substation fence. To protect everyone's safety, perimeter fencing forms a physical barrier around our substations and signs warn against unauthorised access.

Powerlink usually purchases land parcels when building a substation.

Transmission lines

What is a transmission line?

A transmission line is a powerline capable of carrying bulk electricity at high voltages. In Queensland, transmission lines generally carry electricity at 132 kilovolts, 275 kilovolts or 330 kilovolts (kV). The option of 500kV transmission lines has also been considered in our planning in the past, and will factor into our forward planning to meet the state's future energy needs.

Our transmission lines consist of a series of conductors (metal wires) supported by transmission structures.

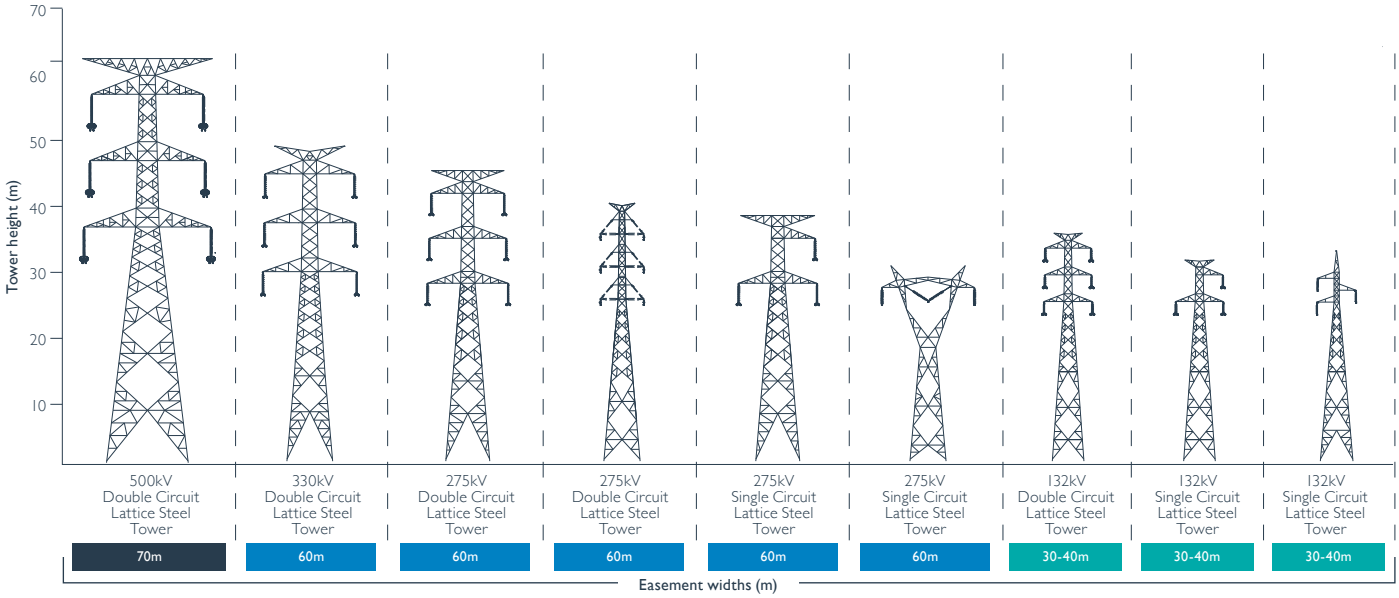
Transmission structures

Transmission structures support the conductors (metal wires) above the ground. The structures may be self-supporting lattice steel towers, or poles made of steel or concrete, or guyed steel structures (includes guy lines or wires attached to the ground for stability). The distance between structures, structure height, footprint and design vary to accommodate the number of conductors, voltage carried, and the local topography, land use and environment.

Powerlink uses a range of structures to maintain a safe electrical clearance between the conductors and the ground below.

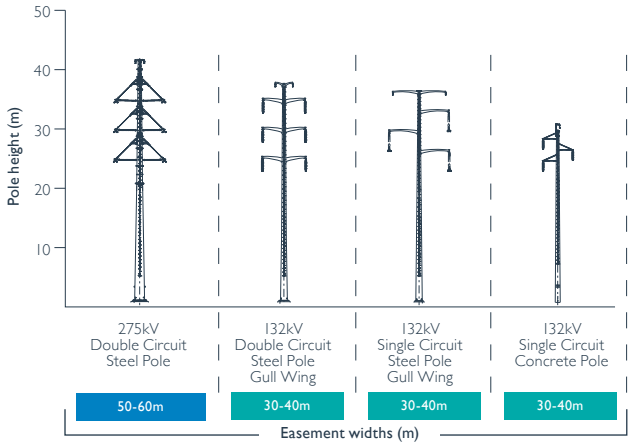
Tower heights shown are the starting point for all designs, irrespective of the terrain it will traverse. When topography is considered it directly influences the tower height i.e. either increasing or decreasing depending on network requirements for a specific area. The final tower height will vary based on this and a number of other factors. For example, some transmission towers in sensitive wet tropics areas in Far North Queensland are up to 85 metres in height to sit above the rainforest canopy.

Diagram 1: Typical structures, heights and easement widths



Typical pole types

In some cases, we will use a pole instead of a tower. This can be for technical reasons, but can also be the chosen option based on engagement with landholders who co-exist with the infrastructure.



Are underground cables used?

The majority of our transmission network uses overhead lines. Only a very small portion of our existing network is underground cable. Undergrounding is generally used in circumstances where overhead lines are not possible, usually due to terrain or land constraints. The cost of undergrounding circuits is also more expensive when compared with overhead lines.

What's on a typical tower?

Earth wires
One or two earth wires are attached to the top of each structure to shield the conductors from direct lightning strikes. Some earth wires may contain optic fibre for communications purposes, enabling Powerlink to remotely monitor, control and protect the transmission network.

Insulators
Strings of insulators support the conductors and create an insulated safe distance between the high voltage electricity and the structure. Insulators are generally made of porcelain, glass or polymer materials.

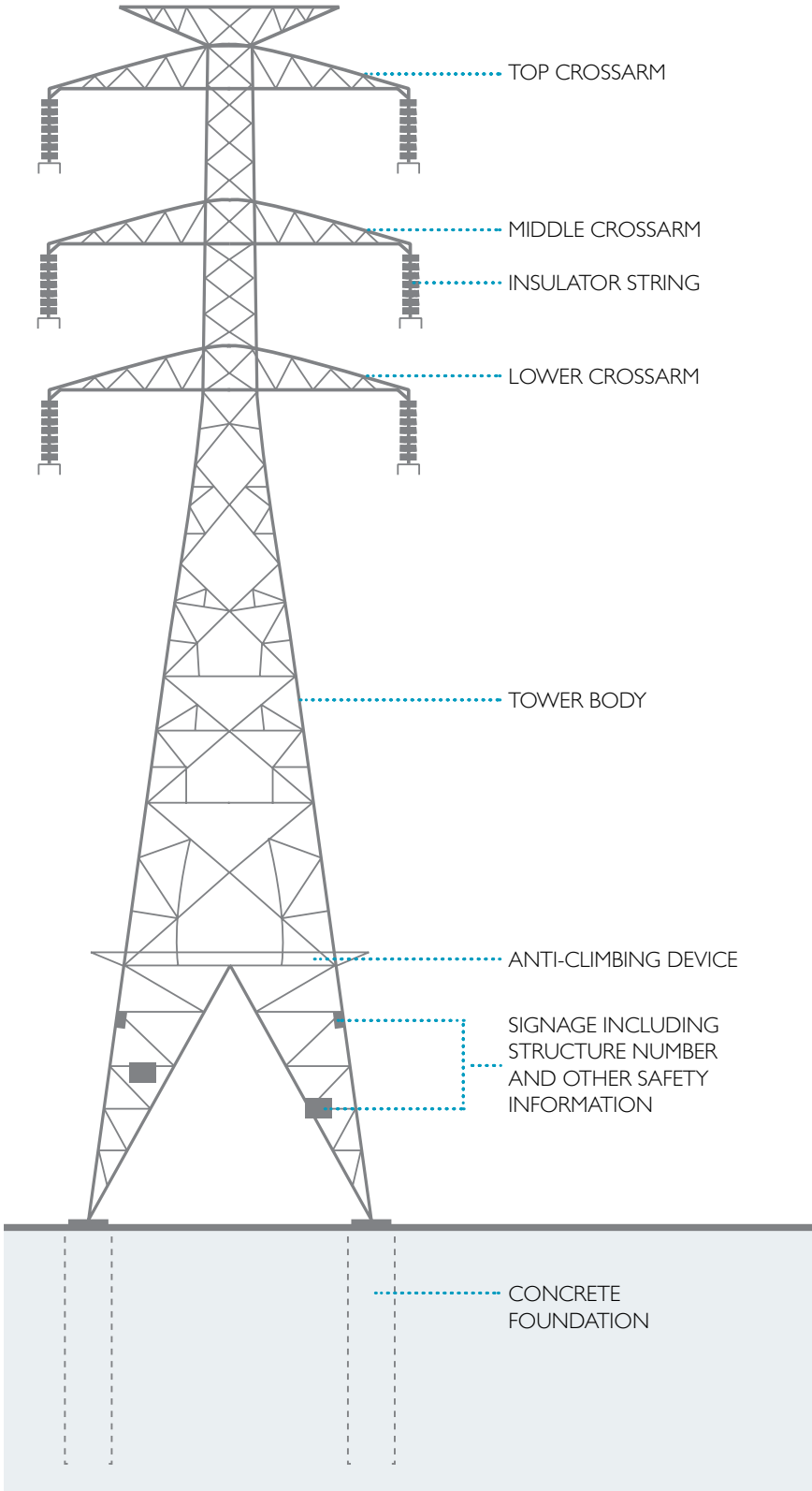
Conductors
Conductors are the wires that carry electricity. They are made of aluminium alloy or steel-reinforced aluminium and are installed at a height to allow for safe electrical clearance between the conductor and the ground.

Circuits
Powerlink's transmission lines are either single or double circuit. A circuit consists of three electrical phases, where each phase is transmitted via a single conductor or a bundle of conductors. Conductors are spaced at a distance to maintain safe electrical spacing and avoid flashovers.

Anti-climbing devices and signs
To ensure public safety, Powerlink installs warning signs and anti-climbing features as a physical barrier on all transmission structures.

Foundations
A foundation is the mechanism that anchors the pole or tower leg into the ground. It is usually several metres deep to provide structural stability. The foundation type used is dependent on the soil properties.

Individual foundations will support the four legs of a lattice type tower. In the case of a pole, a large single foundation is used. Guyed structures sit on one small central foundation and are typically supported by four guy wires, each with its own foundation.



Contact Us

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

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