Powercor AUSTRALIA

AUGMENTATION

FIBRE CAPACITY IMPROVEMENTS

PAL BUS 3.06 – PUBLIC

2026–31 REGULATORY PROPOSAL

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1. Overview

We maintain an optical fibre network that facilitates data transfer and communication between assets, which broadly allows us to efficiently operate and manage our network. Across our network, key uses for optical fibre cables include:

- power system protection circuits including sub transmission protection, runback and inter-trip systems, which protect our assets from surges to avoid asset damage and resulting outages
- centralised monitoring and remote control of network equipment to manage faults and asset switching to limit the impact of faults
- remote communication between sites and field crews providing safety, operational and emergency response benefits
- delivering remote visibility of our network to the Australian Energy Market Operator so they can manage the Victorian electricity system safely and reliably.

In the 2026–31 regulatory period, the capacity of our optical fibre cables to support demand for bandwidth will be constrained by the high utilisation of our existing fibre network. Today, 296 kilometres of this cable network has already exceeded critical utilisation of 80 per cent. It is unable to support new connections that exceed available capacity without upgrade or augmentation with third party fibre optic networks.

Technologies to monitor and control our network, in addition to new customer connections such as generators and data centres, require high speed data transfers to operate. The 1,000 megabytes per second (mbps) we provide is operating with little headroom to accommodate connections requiring high data speeds.

Several network switches and routers that enable digital traffic communication between zone substations will also exceed their useful life and have been declared obsolete by the manufacturer. Ongoing functionality of our network switches is critical to our capability to monitor and remotely control assets, including regaining supply when faults occur.

Our analysis of options to improve the capacity of our optical fibre network considered the availability of technologies to absorb the current functions of our network switch infrastructure.

Forecast capital expenditure for our preferred option is shown below in table 1.

TABLE 1 PREFERRED OPTION EXPENDITURE ($M, 2026)

PROJECT	FY27	FY28	FY29	FY30	FY31	TOTAL
Install MPLS routers on highly utilised optical fibre network	1.3	1.3	1.3	-	-	3.9

2. Background

Optical fibre networks are key components of the telecommunications network that underpin our ability to centrally and remotely monitor, control and communicate across our network. The optical fibre network supports secure, robust data transport services with effective quality of service management to ensure it is not over subscribed.

Our ability to remotely control our network through our Supervisory Control and Data Acquisition (SCADA) and protection systems is critical to maximising the useful life of our electrical assets and reducing network outage times through automated, remote resolutions. The optical fibre network is also integral to supporting communications between field staff and information sharing from our central control room.

Today, large sections of our optical fibre network are operating with little headroom to support new connections. The 24-fibre core cable that was laid as part of a modernisation program in the early 2000s was designed for a distribution network with low data transfer requirements, with low data throughput and lower latency.

Our optical fibre network supports the operation of network switches that enable us to automate the fault identification and resolution process. When a fault occurs, network switches automate the process of switching power to a functioning feeder. The network switch technology we deploy has been discontinued by the manufacturer, and 39 switches are forecast to exceed their serviceable life in the 2026–31 regulatory period.

3. Identified need

The identified need of this business case is to:

- maintain compliance with our obligations to deliver appropriate protection systems and operate within fault clearance times
- mitigate the reliability risk posed by our aging, obsolete fleet of network switches
- support demand for bandwidth from new customer connections, assets and technologies to facilitate the energy transition

3.1 Maintaining compliance

We are obligated to ensure our optical fibre network is compliant with the S5.1 of the National Electricity Rules (NER).

We are also obligated to maintain appropriate protection systems to detect and isolate faults promptly and maintain equipment to handle stresses on our network imposed by faults.[1] We are also obligated to operate within maximum allowable fault clearance times and ensure fault isolation without unnecessary outages.[2] Our Fault Detection, Isolation and Recovery (FDIR) is used to meet these obligations, and is dependent on the availability of our optical fibre network to maintain compliance with obligations.

We must also enable the Australian Energy Market Operator (AEMO) to remotely monitor the performance of our network via Inter-Control Centre Communications Protocol (ICCP) links that allow data exchange to provide AEMO with visibility of power flows, which are critical to system stability.[3]

3.1.1 Remote equipment outage requirements

Most of our substations and the energy generators connected to our network are considered as both Remote Monitoring Equipment and Remote-Control Equipment (RCE). Under AEMO's Power System Data Communication Standard, RCE's are required to have less than 24 hours of outages in 12 months, which equates to 99.73% availability.[4]

3.2 Aging communications infrastructure poses risks for maintaining reliability

Our optical fibre network is critical to maintaining a reliable supply of electricity for customers. It enables our FDIR systems to detect and isolate faults and restore power via our SCADA network. The SCADA system automates the monitoring and control of our distribution assets via our optical fibre network.

The network also allows our control centre to monitor and protect our assets. Remote Terminal Units send alarms to our control centre via our optical fibre network when key metrics, such as oil levels, exceed operating thresholds. The optical fibre network is also used by the control centre to understand load on existing feeders when shifting load during faults to avoid overheating.

1 National Electricity Rules, Clause 5.1.2
2 National Electricity Rules, Clause 5.1.9
3 National Electricity Rules, Section 4.11
4 AEMO, Power System Data Communication Standard, 2017, p. 9-10.

Each zone substation on our network contains a network switch to enable data communications along our optical fibre network between sites. When network switches fail, it leads to a communications outage on impacted equipment. Following a switch failure, we are unable to automatically and remotely switch power to functioning feeders, which can lead to sustained outage response times for customers

3.2.1 Switches are approaching their end of life

Most switches on our network were installed between 2008 to 2011. All switches used on our network are industrial grade Hirschmann MS30 switches, which are designed for a 15-year service life and a 20-year useful life.

Given they are aging technologies that have been replaced with modern day equivalents that have improved functionality by manufacturers, the manufacturer has declared these switches obsolete.

Today, newer technologies can perform the functions of our aging network switch fleet, in addition to enhancing the capacity of our optical fibre network.

As our switches continue to age, we expect to experience a higher rate of failure and subsequent outages. Many of our existing switches have shown early signs of failure and we have replaced them accordingly.

While we would typically retain an adequate number of spares to replace switches upon failure, they have been discontinued by the manufacturer and it is not possible to source additional spares.

Our asset management plans consider these assets at high risk of failure if:

- the manufacturer has discontinued the asset due to component availability, obsolescence and demand
- the asset exceeds its serviceable life, which significantly elevates the risk of product defects and failure
- no or limited availability of spare parts.

Our switches meet all three of these criteria.

3.3 Supporting the energy transition and renewable energy

Each large connection to our network has compliance obligations to use the fibre cables that we own and operate to ensure they can communicate with AEMO and safely operate.[5]

Without sufficient capacity available in our fibre network, we are unable to facilitate new connections to our network, which could delay the transition to renewable energy across Victoria.

3.3.1 Large sections of the network are highly utilised and reaching capacity

Our optical fibre network is deployed in large rings to minimise the required distance to be covered by fibre cable. A single ring on our network can support between 10 and 20 zone substations, all of which compete for bandwidth on the network, which is approximately 1,000 mbps.

296 kilometres of our optical fibre network are operating at our above 80 per cent capacity today, which is considered highly utilised. To support new customer connections that exceed available

5 National Electricity Rules, clause S5.2.6.2

bandwidth, fibre cable must be upgraded to support additional connections while maintaining current operations.

In addition to supporting renewable generation connections, fibre capacity is also utilised by several of our own systems. Protection circuits require 10 of the 24 fibre cores contained within an optical fibre cable to operate. This means that 42 per cent of the capacity of our optical fibre rings is utilised before other use cases are accounted for.

Allocating capacity in this manner provided acceptable headroom when the network was deployed. However, today it is constraining the available bandwidth for critical systems with high data speed requirements, including:

- FDIR systems
- Rapid Earth Fault Current Limiters (REFCLs)
- back up communications at substations
- corporate data traffic
- renewable energy generation runback protection schemes
- asset and system monitoring equipment
- high-definition video surveillance.

For example, high-definition video surveillance requires approximately 80 mbps per zone substation.

3.3.2 High utilisation poses additional reliability risk

In addition to increasing risk of failure as our switches continue to age, the high utilisation of our current fibre capacity network presents risk to reliability in the event of a fault in our optical fibre network.

Data traffic can be shifted to spare fibre cores on a cable in the event that other cores are damaged, such as when the outer sheath of a cable is impacted by vegetation, rodent damage or construction work. However, shifting cannot be undertaken when the cable is highly or completely utilised due to lack of available capacity.

4. Options analysis

We have considered several options to address the identified need to improve the capacity of our optical fibre network, support demand for bandwidth from new customer and asset connections, and facilitate technology developments.

Several options were considered relative to a base case. Consideration was given to options that can upgrade the capacity of the network through replacement of cable, in addition to options that can enhance the current capability of the network, while replacing the functions of the network switches.

A summary of the options we have considered and their associated expenditure are described in table 2.

TABLE 2 OPTIONS SUMMARY ($M, 2026)

OPTION		EXPENDITURE
1	Base case	-
2	Upgrade all constrained fibre rings to 144 fibre cores	33.3
3	Deploy multiprotocol label switching routers on constrained fibre optical rings	3.9
4	Upgrade constrained sections of fibre optical rings to 144 fibre cores	19.9
5	Augment with 3rd party dark fibre	8.2

4.1 Option one: base case – status quo

Under option one, we continue to support data traffic with our 24 fibre core optical fibre network, and replace network switches with spares upon failure.

The following events would likely occur:

- network switches would be run to failure where they would be replaced with available spares. This would result in a two day communications outage that inhibits our FDIR system's ability to detect and automate power restoration in the event of a fault
- highly utilised sections of the network could not support new connections that require the availability of high-speed data transfer without upgrade or augmentation
- partial fibre faults will require whole sections of optical fibre to be replaced in the event of a lack of available spares.

In the event of a widespread outage driven by faults along our optical fibre network or multiple failed network switches, we are at risk of breaching compliance with our obligations under the NER to maintain appropriate protection system.

Given the risk of non-compliance, inability to replace aging infrastructure with like-for-like and inability to connect new customers, we consider this option is not credible.

4.2 Option two: upgrade all constrained fibre rings to 144 fibre cores

Under option two, all optical fibre rings operating above 80 percent capacity would be entirely upgraded to optical fibre cable with 144 fibre cores. This would see 298 kilometres of optical fibre cable upgraded.

Investment under option two would future proof the network through providing ample headroom for bandwidth demand from digital traffic, including new connections and technology upgrades at existing connections. It would also reliability for customers.

However, deploying upgraded optical fibre cores does not address bandwidth constraints for technologies that require high data speeds. Each fibre core provides a portion of bandwidth but must be complemented by network management systems to allocate bandwidth and traffic efficiently along the path.

Our existing network switches are limited in their capacity to allocate bandwidth efficiently. Under option two, switches and routers are replaced with existing spares upon failure.

The expenditure required to deliver option two is presented in table 3 below.

TABLE 3 OPTION TWO: EXPENDITURE ($M, 2026)

OPTION	EXPENDITURE
Upgrade all constrained fibre rings to 144 fibre cores	33.3

4.3 Option three: deploy multiprotocol label switching routers on constrained fibre optical rings

Under option three, all fibre rings with optical fibre core utilisation in excess of 80% will have MPLS routers deployed through the 2026–31 regulatory period, in order of most heavily utilised. MPLS routers carry out the same function as the network switches, mitigating risk associated with the age and obsolescence risk associated with our current fleet of switches.

Protection circuits would also be progressively moved from utilising fibre optical cable, to utilising MPLS, freeing up capacity on fibre optical cores to facilitate more customer connections.

MPLS routers can also address bandwidth constraints as they create bandwidth of 10 gigabytes per second, which is sufficient to meet future requirements. MPLS systems are also upgradeable to allow for more bandwidth if needed.

This option would also improve reliability outcomes for customers because we would be minimising the risk of asset failure due to replacing aging assets with newer technologies. This option would also support the connection of new renewable generators.

Upgrading optical fibre rings experiencing the highest constraints would occur over three years from the start of the 2026–31 regulatory period.

The expenditure required to deliver option three is presented in table 4 below.

TABLE 4 OPTION THREE: EXPENDITURE ($M, 2026)

OPTION	EXPENDITURE
Deploy multiprotocol label switching routers on constrained fibre optical rings	3.9

4.4 Option four: upgrade constrained sections of fibre optical rings to 144 fibre cores

Under option four, sections of our optical fibre network that are assessed as constrained will be upgraded to 144 fibre cores in the 2026–31 regulatory period. In total, this would involve upgrading 296 kilometres of the fibre optic network.

However, deploying upgraded optical fibre cores does not address bandwidth constraints for technologies that require high data speeds. Each fibre core provides a portion of bandwidth but must be complemented by network management systems to allocate bandwidth and traffic efficiently along the path.

Our existing network switches are limited in their capacity to allocate bandwidth efficiently. Under option two, switches and routers are replaced with existing spares upon failure.

Work would begin in 2026–27 on sections of optical fibre ring experiencing the highest constraints and continue through the regulatory period until completion in 2030-31.

The expenditure required to deliver option three is presented in table 5 below.

TABLE 5 OPTION FOUR: EXPENDITURE ($M, 2026)

OPTION	EXPENDITURE
Upgrade constrained sections of fibre optical rings to 144 fibre cores	19.9

4.5 Option five: augment with 3rd party dark fibre

Under option five, optical fibre would be leased from telecommunications companies with available capacity that is not being utilised by any other party, known as dark fibre.

To do this, we would need to augment our distribution assets with optical fibre ‘tails’ to connect our sites to the dark fibre network. Fibre tails must span the distance of a zone substation to a population centre, where the dark fibre network runs.

This option would improve reliability for customers as telecommunications companies have newer fibre optic cables with a lower risk of failure.

Work to build optical fibre tails will be undertaken in the first year of the regulatory period to provide headroom on constrained sections of the optical fibre network.

The expenditure required to deliver option three is presented in table 6 below.

TABLE 6 OPTION FIVE: EXPENDITURE ($M, 2026)

OPTION	EXPENDITURE
Augment with 3rd party dark fibre	8.2

5. Preferred option

The preferred option for the 2026–31 regulatory period is option three, augmenting all optical fibre rings exceeding 80 percent utilisation with MPLS technology. This option is preferred because it addresses all three components of the identified need at the lowest overall cost for customers.

The benefits of this option include:

- capacity increases of the existing optical fibre network to support new customer connections
- bandwidth increases of the existing network to support new or upgraded connections that require high speed data
- absorbing the functions of our aging and obsolete network switch infrastructure, allowing us to retire the infrastructure and mitigate ongoing risk to reliability
- lower costs for customers compared with other credible options.

A summary of the capital expenditure required to deliver the preferred option is described in table 7 below.

TABLE 7 PREFERRED OPTION CAPITAL EXPENDITURE FORECAST ($M, 2026)

PROJECT	FY27	FY28	FY29	FY30	FY31	TOTAL
Capital expenditure	1.3	1.3	1.3	-	-	3.9

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