Directlink Transmission Annual Planning Report 2026

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Executive Summary

TAPR provides key asset planning information for Directlink, a high voltage direct current (HVDC) interconnector that connects the Queensland and New South Wales regional electricity transmission networks.

Directlink is owned by Energy Infrastructure Investments (EII) and operated by APA. Directlink Transmission Company Pty Ltd is wholly owned by EII and is a registered Transmission Network Service Provider (TNSP) in the National Electricity Market (NEM) as prescribed by the National Electricity Rules (NER). Under the Management, Operations, Maintenance and Commercial Service Agreement (MOMSCA), APA has prepared this Transmission Annual Planning Report (TAPR) on behalf of EII in accordance with the requirements of section 5.12 of the NER.

This report outlines the factors influencing Directlink's ability to provide a reliable and secure HVDC transmission service. It summarises the current capital and operational initiatives underway to maintain asset performance, reliability and security of supply, consistent with the EII Asset Management Plan and National Electricity Rules (NER) requirements. In addition, it examines the asset's future role, and the future investment requirements.

Directlink continues to perform an important role in the National Electricity Market, facilitating electricity transfer between Queensland and New South Wales and supporting resource sharing, peak demand, network controllability, outage management and voltage management. This role is expected to remain relevant as the NEM transitions and the proportion of variable renewable energy increases. Directlink transferred 434 GWh during FY2025–26, demonstrating its continued utilisation within the interconnected network. Maintaining the capability and reliability of Directlink therefore remains a key focus of asset management and investment planning over the planning horizon.

1. Introduction

1.1. Purpose of this Transmission Annual Planning Report

This TAPR is prepared in accordance with the requirements of the National Electricity Rules (NER). Given the nature of the asset and the absence of any directly connected customers, this report covers those aspects of the prescribed TAPR content required by the NER where specific comment is possible.

This TAPR has been prepared aligned with the requirements of rule 5.12 of the NER[1] and the applicable TAPR Guidelines[2]. Directlink's position as an HVDC interconnector, including the absence of directly connected customers or generators, means that certain prescribed information may not arise or may have limited application.

The purpose of this report is to present key factors impacting the future safety and reliability of the Directlink high voltage direct current (HVDC) transmission asset. It describes the associated asset planning needs and the capital investment being considered by EII to address asset objectives.

This report looks to identify the need and opportunity for improvements in efficiency, reliability, general functionality and potential capacity expansion of the asset in efficiently delivering required services. It considers the forecast asset and network investment requirements over the asset lifecycle, with greater certainty applied to near-term investments and indicative requirements identified over the longer term.

This TAPR seeks to provide broader stakeholders with an overview of the planning processes and future investment applied to this asset. The aim is to provide information that helps stakeholders understand Directlink’s role and capability within the National Electricity Market and contribute to the future development of the transmission network, where the net benefit is warranted.

1.2. APA Group and Related Entities

Directlink is a registered TNSP and is owned by Energy Infrastructure Investments (EII), with Marubeni holding a 49.9% interest, Osaka Gas holding a 30.2% interest and APA Group holding the remaining 19.9% interest.

The asset is operated and maintained by APA Group under a Management, Operations, Maintenance and Commercial Services Agreement (MOMSCA). The Directlink transmission asset provides transmission services to the NEM as prescribed by the NER.

The NER sets out the required processes for developing networks as well as minimum performance requirements of the network, which subjects the interconnector to the application of the Australian Energy Regulator’s (AER’s) Regulatory Investment Test for Transmission (RIT-T), where required.

1.3. Disclaimer

This TAPR has been prepared by EII for information and planning purposes only and reflects information, forecasts and assumptions available at the date of publication. These may change over time.

Information sourced from AEMO, Network Service Providers and other third parties has been sourced in good faith. Readers should undertake their own assessment and seek appropriate advice before relying on this report.

To the extent permitted by law, EII accepts no liability for loss or damage arising from reliance on this report. Interested parties are encouraged to contact APA directly for more information.

2. Acronym and Definitions

2.1. Acronyms

Table 1: Acronyms

Acronym	Meaning
AC	Alternating Current
AEMO	Australian Energy Market Operator
ALARP	As low as reasonably practicable
APA	APA Group company and operator of Directlink
DC	Direct Current
DL	Directlink
EII	Energy Infrastructure Investments
HSEH	Health, safety, environment and heritage
HVDC	High Voltage Direct Current
IGBT	Insulated Gate Bipolar Transistor
ISP	Integrated System Plan
MOMSCA	Management, Operations, Maintenance and Commercial Services Agreement
NEM	National Electricity Market

NER	National Electricity Rules
NSP	Network Service Provider
NSW	New South Wales
OEM	Original Equipment Manufacturer
QLD	Queensland
QNI	Queensland-New South Wales Interconnector
REZ	Renewable Energy Zone
RIT-T	Regulatory Investment Test for Transmission
TNSP	Transmission Network Service Provider
VCU	Valve Control Unit
VSC	Voltage Source Converter

2.2. Definitions

For the purposes of this report, the terms below have the meanings set out in the following table.

Table 2: Definitions

Term	Definition
Bungalora Converter Station	The Directlink converter station located on Terranora Road, Bungalora NSW, comprising one Directlink converter station.
Converter	Equipment used to convert electricity between AC and DC using power electronic devices and associated electrical and auxiliary equipment.
Converter Building	Structure housing the converter and associated electrical and auxiliary equipment, including the control room, cooling rooms, valve enclosures, reactor room, indoor AC yard and indoor DC yard.
Converter Station	Site where the converters and associated high-voltage switchgear are installed.
Directlink	The HVDC transmission system connecting the high-voltage transmission networks at Mullumbimby and Terranora via HVDC cables.
Hitachi	Company and supplier of the asset HVDC equipment (originally ABB) - main Contractor and OEM for this asset

Mullumbimby Converter Station	The Directlink converter station located on Wilsons Creek Road, Mullumbimby NSW, comprising one Directlink converter station.
Site	Either or both the Bungalora Converter Station and Mullumbimby Converter Station.
VSC Technology	Voltage Source Converter technology used by Directlink to convert electricity between AC and DC systems.

3. Asset Overview

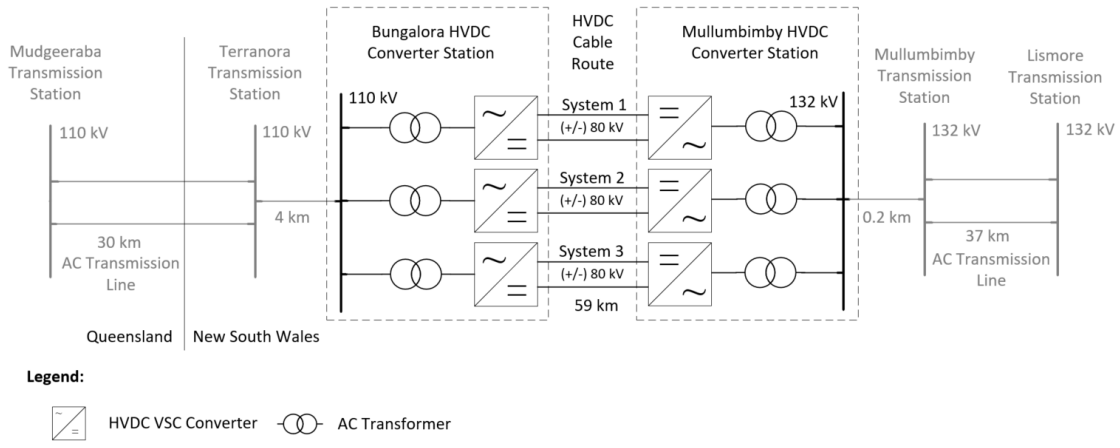
Directlink is a high voltage direct current (HVDC) transmission system in New South Wales (NSW) between Bungalora and Mullumbimby. Commissioned in 1999, it transfers up to 180 MW of bi-directional power between the Queensland (QLD) and NSW transmission networks.

The asset consists of three 59km independent DC transmission lines each consisting of a pair of high voltage DC cables, buried in some areas and in others installed in steel troughs. Each cable pair is connected to a single converter station at both Bungalora and Mullumbimby.

The alternating current (AC) is converted to direct current (DC) using voltage source converter (VSC) HVDC technology.

A simplified single line diagram for Directlink is shown in Figure 1.

Figure 1: Directlink Simplified Single Line Diagram



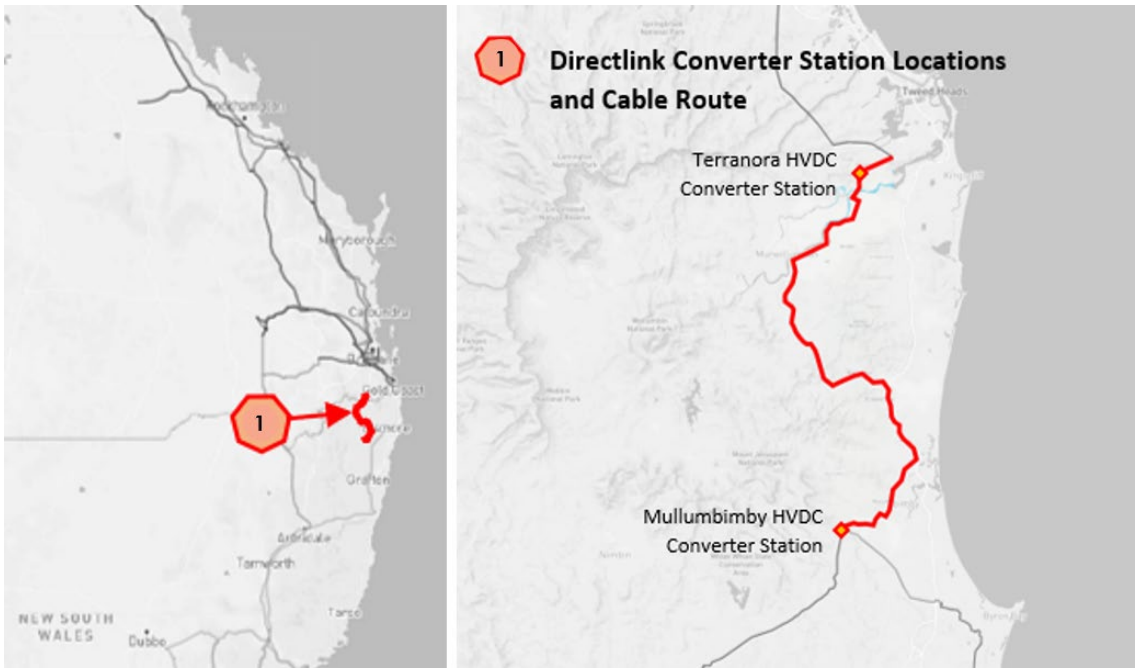
There are three independently operable 60 MW HVDC systems, with power transfer distributed across the available systems under the current control configuration. Individual systems can be taken out of service for planned or unplanned outages while the remaining available systems continue to operate, enabling Directlink to retain partial transfer capability. The current master control arrangement does not provide for an operating strategy whereby individual systems are independently loaded and

sequentially utilised as a means of managing system life. This operating characteristic is relevant to the assessment of future lifecycle and retirement options.

Power transfers across the interconnector are scheduled and dispatched by AEMO as part of the National Electricity Market's central dispatch process.

The approximate converter station locations and cable routes are shown in Figure 2.

Figure 1: Directlink Cable Routes and Converter Station Locations



3.1. Scope of the Asset

The converter stations interface to the existing high voltage AC transmission systems via relatively short lengths of underground, high voltage AC cable at Bungalora (110kV) and overhead high voltage AC cable at Mullumbimby (132kV).

The scope of Directlink includes:

- Two HVDC converter stations located at Bungalora and Mullumbimby.
- The DC transmission line consists of three independent HVDC transmission circuits comprising six DC cables over a route length of approximately 59 km.
- Associated AC connection assets, including:
    - 110 kV underground AC cables connecting the Bungalora converter station to the Queensland transmission network.
    - 132 kV overhead AC connection assets linking the Mullumbimby converter station to the New South Wales transmission network.

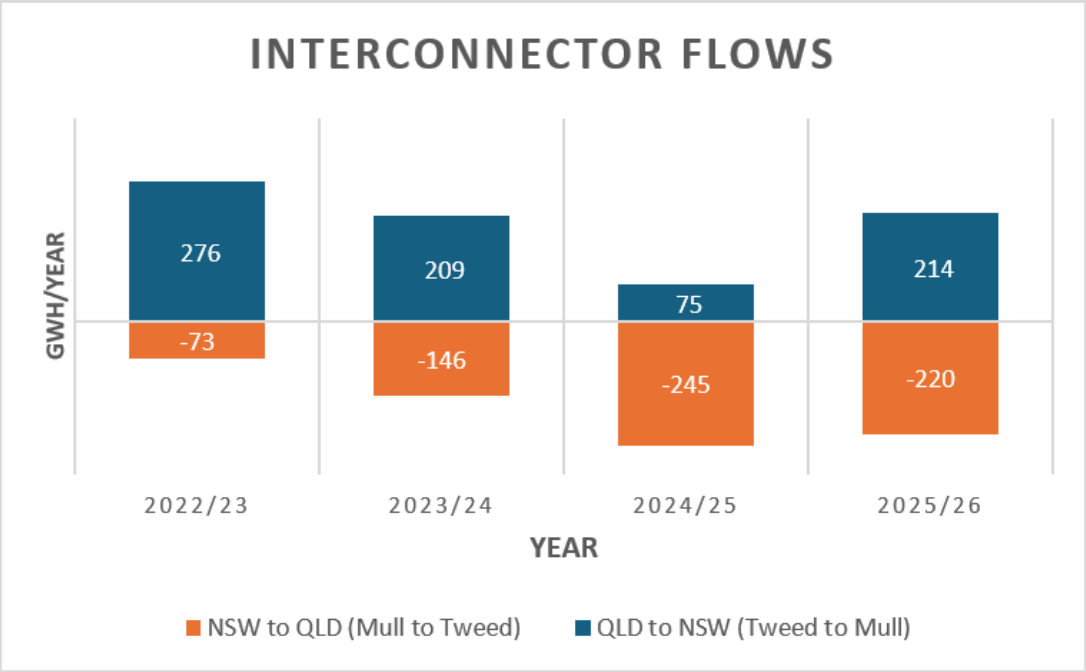
- Associated control, protection, telecommunications, auxiliary systems, easements and supporting infrastructure required for the operation of the interconnector.

3.2. Asset Utilisation

The demand for Directlink's services arises from the need for energy to be supplied to customers in the North Coast NSW area as well as supporting dispatch between the QLD and NSW regions through the Directlink interconnector.

The historical flows across the interconnector are presented in Figure 3, which shows the bi-directional electricity flow changing patterns to meet optimal dispatch outcome over time.

Figure 3: Directlink Historical Utilisation



Approximately 434 GWh of electricity flowed across both directions of DL during the 2025/26 financial year.

Electricity flows across the interconnector are driven by price variation between regions or to address network constraints.

4. The Changing Energy Landscape

AEMO's ISP (2026) [3] signifies the most important developments around Northern NSW, QLD-NSW Interconnector (QNI) and Southern Queensland. These changes have updated assumptions from AEMO's 2024 draft ISP where more recent

developments around Queensland coal-generator flexibility and newly committed batteries have pushed previously TNSP project timings back almost a decade.

APA continues to monitor whether Directlink's utilisation and market benefits change progressively as future ISP projects such as the New England REZ, Southern Queensland reinforcement and eventually QNI Connect (2041-42) enter service.

APA continues to engage with AEMO, Transgrid and Essential Energy to understand the implications of emerging network developments for Directlink. To date, these discussions have not identified a material change to Directlink's current planning requirements.

Further need for investment in the transmission network is anticipated in the future to support the development and connection of the projected portfolio of geographically dispersed renewable generation, battery uptake and changing demand load profiles with the increasing installation of data centres. APA is also monitoring QNI2.0 and the New England Renewable Energy Zone (REZ) to anticipate the changing strategic context in the area.

The Queensland Government in its Energy Roadmap (2025) indicates the state's plan for self-reliance, while also acting as a critical energy exporter to underpin reliability across the broader NEM. It also supports the need for Network Service Providers to manage requirements for an increasingly complex system.

The ISP has identified that increasing the interconnection of the grid will provide various benefits including flexibility and security as well as being able to take full advantage of the new and existing generation throughout the NEM.

Interconnectors provide a range of benefits, in particular:

- Enabling the lowest cost generation in the NEM to reach more consumers;
- Mitigating the risk of supply shortfall through imports from other regions;
- Sharing system stability support services, such as frequency and voltage control; and
- Improving system resilience to high impact, low probability events (such as interconnector failures) through a more interconnected NEM.

APA's asset management process does not forecast any new asset de-ratings, constraints or inability to meet network performance requirements over the next five years.

4.1. Role of the Directlink Interconnector

Directlink's primary role in the National Electricity Market is enabling the transfer of electricity between Queensland and New South Wales. Additionally, the characteristics of Directlink being an HVDC interconnector means that it provides greater flexibility in operation than traditional AC systems.

As advised by AEMO [4], there is an important and ongoing need to maintain the Directlink interconnector, for the reasons stated below:

- **Resource firming** – As the proportion of variable renewable energy (VRE) increases across the NEM, Directlink will play a role in sharing firm generation and surplus resources between regions. Throughout the duration of our modelling horizon to 2050, including following a potential major upgrade to the Queensland to New South Wales interconnector (QNI), we project that the full capacity of Directlink will generally be utilised in every year.
- **Supporting peak demand** – At times of peak demand, our modelling shows that Directlink improves the capability to deliver a reliable supply of electricity to consumers. This role is particularly clear during periods of high demand, low VRE, network outages or generator outages, and continues following a potential QNI upgrade. Without Directlink, additional capital investment (e.g. battery storage) may be required to meet the NEM reliability standard.
- **Network controllability** – The dispatchability of Directlink is projected to improve network utilisation and reduce congestion by actively controlling flows parallel to QNI. Directlink can actively follow a precise dispatch target, which helps to balance flows on the network between Queensland and New South Wales.
- **Outage management** – During both planned and unplanned outages of other assets in this area of the NEM, Directlink improves the capability of the grid to provide consumers with reliable and secure electricity supply. Importantly, the presence of Directlink is expected to increase the duration of outage windows that are critically needed to maintain the surrounding network.
- **Voltage management** – The reactive plant at both ends of Directlink improve voltage management at Mullumbimby and Terranora. This improves the resilience of the grid in these areas.

Regionally, Directlink provides a critical interconnection between QLD and NSW, supporting the security and reliability of electricity supply to the Northern Rivers and Lismore area, particularly during transmission network outages and contingency events. Furthermore, with anticipated load growth in Lismore and Terranora, APA is working with Essential Energy to explore Directlink's potential role in managing network contingencies.

5. Asset Management

The EII asset management planning process is a structured framework for managing asset condition, performance and risk throughout the asset lifecycle. The process supports the sustainable delivery of services by balancing reliability, safety, risk, compliance and value outcomes, while ensuring assets continue to meet current and future operational requirements.

The asset management planning process:

- Provides a comprehensive assessment of asset condition, performance, utilisation and management practices;
- Identifies asset management strategies and recommendations to support future operational requirements;
- Supports the development, prioritisation and approval of maintenance, replacement and capital work programs; and
- Identifies asset-specific risks, issues and opportunities, together with proposed remediation activities for consideration through planning and budgeting processes.

The objective of the asset management planning process is to maintain the safety, reliability and availability of the Directlink interconnector. Asset management activities are undertaken in accordance with APA's approved policies, standards and procedures, ensuring a consistent and integrated approach to the operation, maintenance and renewal of the asset.

Comprehensive health, safety, environment and heritage (HSEH) management systems are in place to support the safe and effective operation of all APA operated assets. These ensure the risks relating to the operation of all APA assets are effectively managed to keep risks as low as reasonably practicable (ALARP). APA's HSEH management system, *Safeguard*, provides the framework by which the processes relating to APA's HSEH activities are developed, implemented, communicated, managed and continually improved. The management system is subject to periodic review to ensure ongoing compliance with regulatory obligations and alignment with organisational objectives.

Functionally, Directlink's equipment can be broadly categorised into two groups:

- **Primary equipment** – this includes main circuit equipment such as power transformers, phase reactors, IGBTs, filtering equipment and underground cables. These generally have a standard design life of 40 years or more with some of these now beyond the midpoint of their useful service lives; and
- **Secondary equipment** – this includes ancillary equipment necessary for the operation of the converters, notably uninterruptable power supplies, building ventilation, air conditioning, cooling water pumping and treatment systems and control and protection systems. Ancillary equipment generally has shorter service lives (between 15 and 25 years) with elements of the equipment currently at various stages in their service life.

The principal challenges associated with the interconnector relate to maintaining the electrical installation, with its many components, to meet high reliability and availability standards. Even so, components need to be replaced or refurbished when:

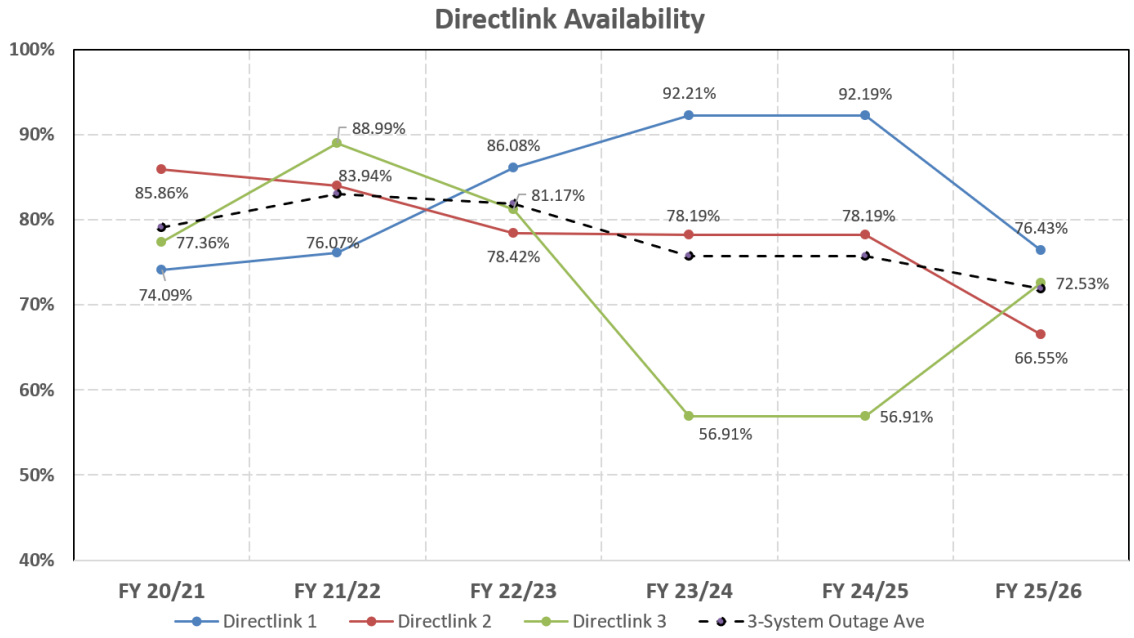
- Asset condition or service performance deteriorates, to the point where it may adversely impact the reliability, availability or operational risk;

- Increasing maintenance requirements or lifecycle costs make refurbishment or replacement the most cost-effective option; or
- Obsolescence of equipment or supporting systems introduces risks associated with limited technical support, spare parts availability or long-term maintainability.

5.1. Asset Performance

The annual availability across Directlink's three systems over the past six financial years of operation are shown in Figure 4.

Figure 4: Directlink Availability



Unplanned outages account for 62% of total outage hours since July 2020. DC cable faults are the predominant contributor of unplanned outage hours at 65% of all outage hours (or 41% of outage hours overall). The investment response is focused on improving resilience to cable failures through reducing the likelihood/risk associated with a known failure mechanism at underground / overground transition points and strengthening fault response and restoration capability, recognising in most instances, the underlying cable failure mechanisms may not be readily eliminated.

AC switchyard equipment and auxiliary power systems are the other leading contributors to outage frequency and time offline, with investment prioritised against identified reliability and asset condition risks

6. Current 2025-30 Regulatory Period

To ensure Directlink operates in a reliable and secure state, the capital works program is focused on addressing key asset risks through targeted asset replacement, major

maintenance and critical spares initiatives. Priority is being placed on improving resilience against high-consequence failure scenarios, particularly those that could result in a multiple system outage caused by failures in the AC switchyards. As a result, Bungalora's AC yard has been the highest priority area for investment in FY27, with a focus on critical sparing and obsolescence risk across both sites to follow in FY28.

In parallel, reviews of major maintenance requirements and critical spare holdings are underway, with a further procurement strategy planned for execution in FY28. Investment in safety and protection systems, asset condition monitoring and risk-based renewal initiatives is being progressively delivered through the current capital works program to address identified asset risks and support prudent lifecycle management.

The AER's 2025–30 final determination[5] includes a capital expenditure allowance for Directlink over the regulatory control period. This allowance does not constitute approval of individual projects. Individual investments remain subject to Directlink's asset management, capital expenditure framework governance and applicable regulatory processes, with expenditure prioritised in response to asset condition, performance, risk and lifecycle requirements.

7. Future Asset Requirements

Future capital investment will focus on preserving asset condition and performance through a proactive asset preservation approach that prioritises preventative maintenance wherever practicable. This strategy aims to sustain asset integrity, manage lifecycle risk and minimise corrective interventions. Where asset deterioration exceeds acceptable maintenance thresholds, refurbishment or replacement will be considered to maintain the safety, reliability and availability of the asset.

7.1. Future Investments Proposed

The approach to strategic spares management is continually reviewed to ensure appropriate mitigation of asset criticality and obsolescence risks. In determining optimal spare holdings, consideration is given to asset condition, failure consequences, supplier support arrangements, replacement lead times and overall lifecycle risk. A current priority is the replacement of Valve Control Units (VCUs), where legacy units of VCUs have become obsolete and are no longer supported by the Original Equipment Manufacturer (OEM). While this initiative is likely to fall below the RIT-T threshold, the design and specification, front-end engineering, procurement and extended lead times associated with sourcing replacement equipment necessitates proactive planning and early investment.

The management of spare AC and DC cable inventories also remains an ongoing focus area. AC and DC cable is being monitored to monitor cable failure trends, forecast future stock requirements, evaluate supply chain conditions and manage the

significant lead times associated with the manufacture and delivery of replacement cable.

The cable route has increasingly become threatened from environmental disasters, such as floods and more recently cyclones. Extreme weather events are becoming more common in the area, with APA monitoring types of unforeseen events and investigating mitigating controls to protect the asset and the public from weather related hazards.

Future capital investment will also focus on preserving asset condition and extending asset life, with particular attention given to buildings and structures exposed to corrosive environmental conditions. Ongoing exposure to a salt-laden marine atmosphere at Bungalora is accelerating corrosion of metallic components and deterioration of protective coatings, increasing the requirement for preventative maintenance and asset remediation. The condition and future requirements of the converter buildings will therefore continue to be assessed through the asset lifecycle planning process.

The asset lifecycle planning process incorporates a structured quarterly review of strategic spares and future investment requirements. These reviews are informed by asset condition assessments, OEM recommendations, industry benchmarking and specialist third-party advice. Proposed investments are assessed using a risk-based approach that considers asset criticality, probability of failure, equipment obsolescence, supply chain constraints, market availability of specialised equipment and lifecycle cost considerations. This process ensures capital expenditure is prioritised towards initiatives that deliver the greatest benefit in maintaining the long-term reliability, availability and resilience of the Directlink interconnector.

8. Asset Outlook

AEMO's assessment indicates an ongoing role for Directlink over its modelling horizon to 2050, including the continued utilisation of its transfer capability. This long-term network need informs Directlink's asset planning, although does not reflect the engineering life. Accordingly, the lifecycle scenarios discussed in this section should be regarded as preliminary planning scenarios rather than an adopted retirement strategy. They intend to identify and assess potential pathways sufficiently early to support informed future decision-making while maintaining the capability required of Directlink.

The current Control and Protection system is forecast end-of-life circa 2035-40, with future possibilities exploring a 3-system staggered system retirement. This has the possibility to free-up spare parts, with a staged retirement or reconfiguration of existing systems, where there are market and commercial benefits in doing so.

Any material change to Directlink's operating configuration, available transfer capability or long-term service would be subject to further technical, network, regulatory and economic assessment, together with the applicable consultation and approval processes, before implementation.

Options are under investigation for future augmentation works to enlarge the system or increase its capacity. Further continual external engagement seeks to understand and reinforce Directlink's role in the NEM.

APA continues to work with its investors in securing Australia's energy future by being the partner of choice in delivering infrastructure solutions for the energy transition. This includes maintaining relevancy in the region where network developments may affect Directlink's future role. This could extend to opportunities to retain least-cost ways to supply a resilient second source of electricity into the Northern Rivers or similar infrastructure development to support the energy transition.

APA will continue to monitor future developments, whilst sustaining and maintaining a safe and reliable service and continue to demonstrate prudent and efficient use of its capital program.

References

[1] Australian Energy Market Commission, *National Electricity Rules*, Rule 5.12 – Transmission annual planning process.

[2] Australian Energy [Regulator, *Transmission Annual Planning Report Guidelines*, December 2018.

[3] AEMO, *Integrated System Plan*, AEMO, 2026.

[4] AEMO Communication, *The future role of DL in the NEM - December 2023,* AEMO, 2023.

[5] Australian Energy Regulator, *Final Decision – Directlink 2025–30 Transmission Determination*, April 2025