Murraylink RIT-T for IGBTs

Stakeholder Meeting #1

5 June 2026

Energy Infrastructure Investments

Acknowledgement of Country

We acknowledge the Traditional Owners and Custodians of the lands on which we live and work throughout Australia.

We acknowledge their connections to land, sea and community.

We pay our respects to their Elders past and present, and commit to ensuring APA operates in a fair and ethical manner that respects First Nations peoples' rights and interests.

Welcome and purpose

01

Objective: To set the scene for the meeting

Energy Infrastructure Investments

Agenda

01	Welcome and purpose Mark Allen, Senior Regulatory Manager	**5 mins**
02	Why a RIT-T and the RIT-T process Mark Allen, Senior Regulatory Manager	**10 mins**
03	About Murraylink and the problem statement Zahra Jabiri, Head of Power Operations On Grid	**25 mins**
04	The options identified Zahra Jabiri, Head of Power Operations On Grid Mark Allen, Senior Regulatory Manager	**40 mins**
05	Wrap up and next steps Mark Allen, Senior Regulatory Manager	**5 mins**

Why a RIT-T and the RIT-T process

02

Objective: To ensure a common understanding of the purpose of the RIT-T and the likely process

Why a RIT-T?

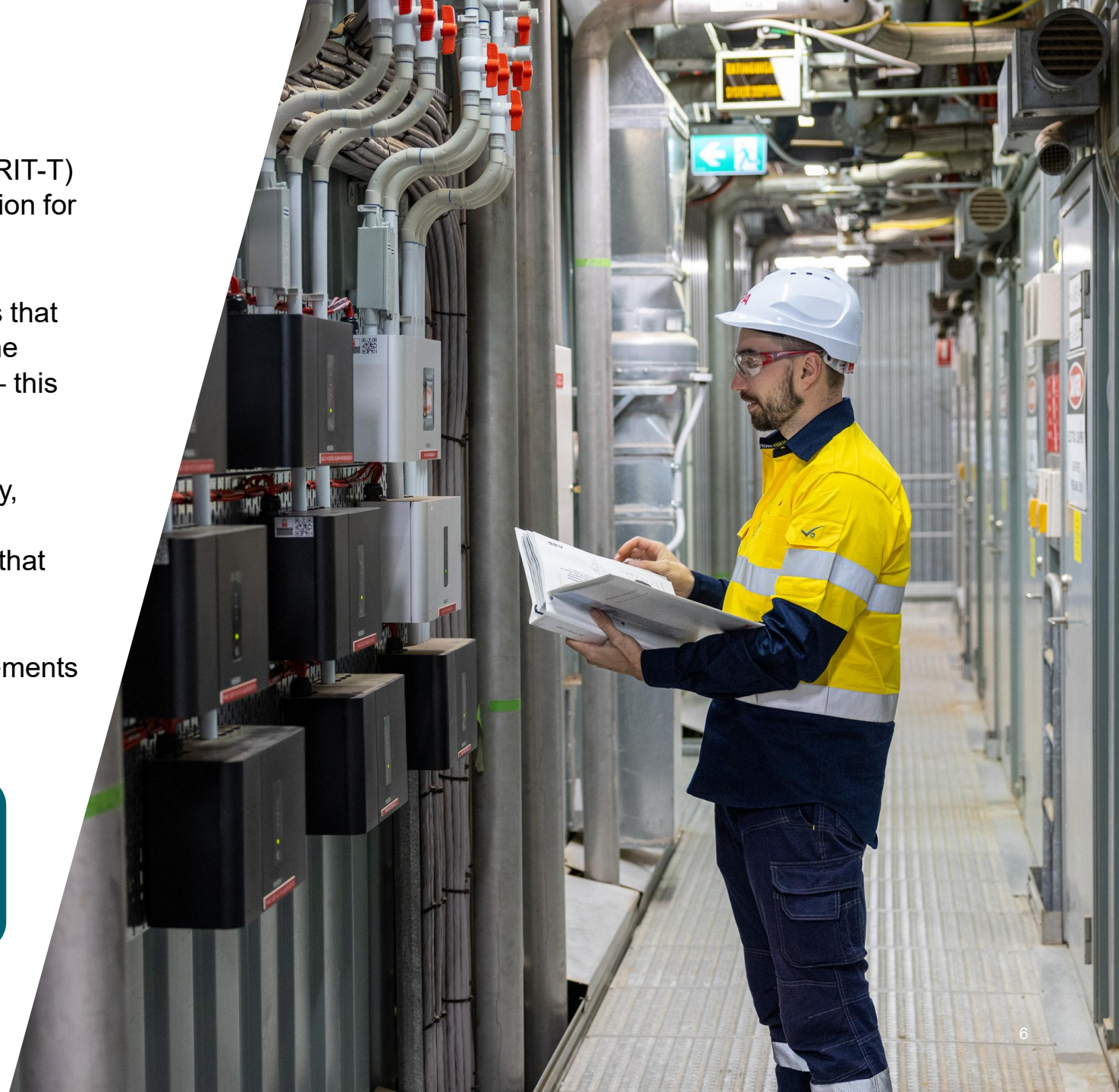
A Regulatory Investment Test for Transmission (RIT-T) is required to be undertaken when a credible option for network investment exceeds $8 million

The proponent must consider all credible options that could meet the network need, before selecting the option that maximises the net economic benefit – this includes non-network alternatives

The process aims to promote greater consistency, transparency and predictability in transmission investment decision-making and reduce the risk that consumers pay for inefficient investments

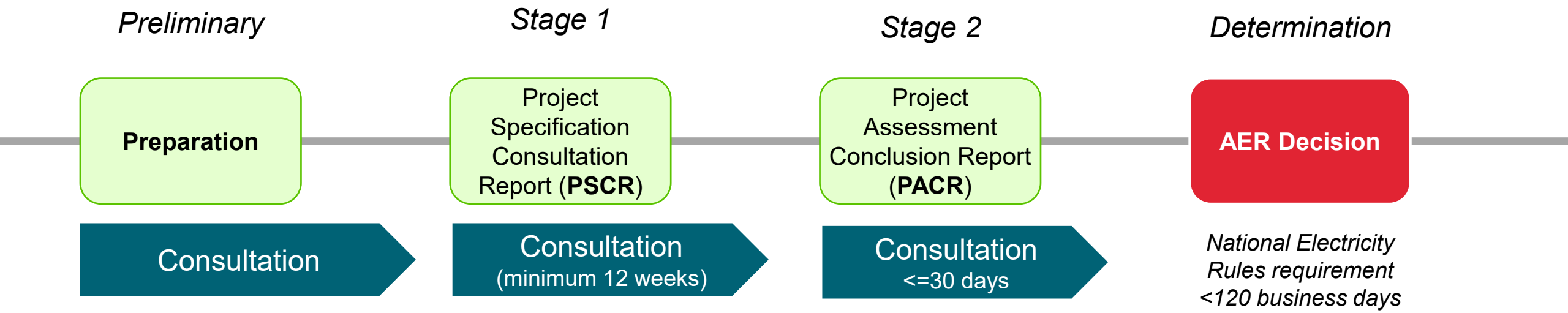
Imposes transparency and accountability requirements on major transmission investment decisions

Any approved RIT-T expenditure that falls between 1 July 2028 and 30 June 2033 will be included in our 2028–33 Regulatory Proposal



RIT-T process

As the project is <$54 million, **we intend to adopt the expedited process** for non-Integrated System Plan projects



The **expedited process** removes the need for a Project Assessment Draft Report (that would otherwise sit between the PSCR and the PACR)

What is in a PSCR

High level information about the:

Identified need for the investment

Assumptions used in identifying the need - for a reliability corrective action, must include reasons why this action is necessary

Technical characteristics of the identified need that a non-network option would be required to deliver and ideally information to assist non-network proponents in proposing alternative credible options, and

A description of all credible options that would address the need, including

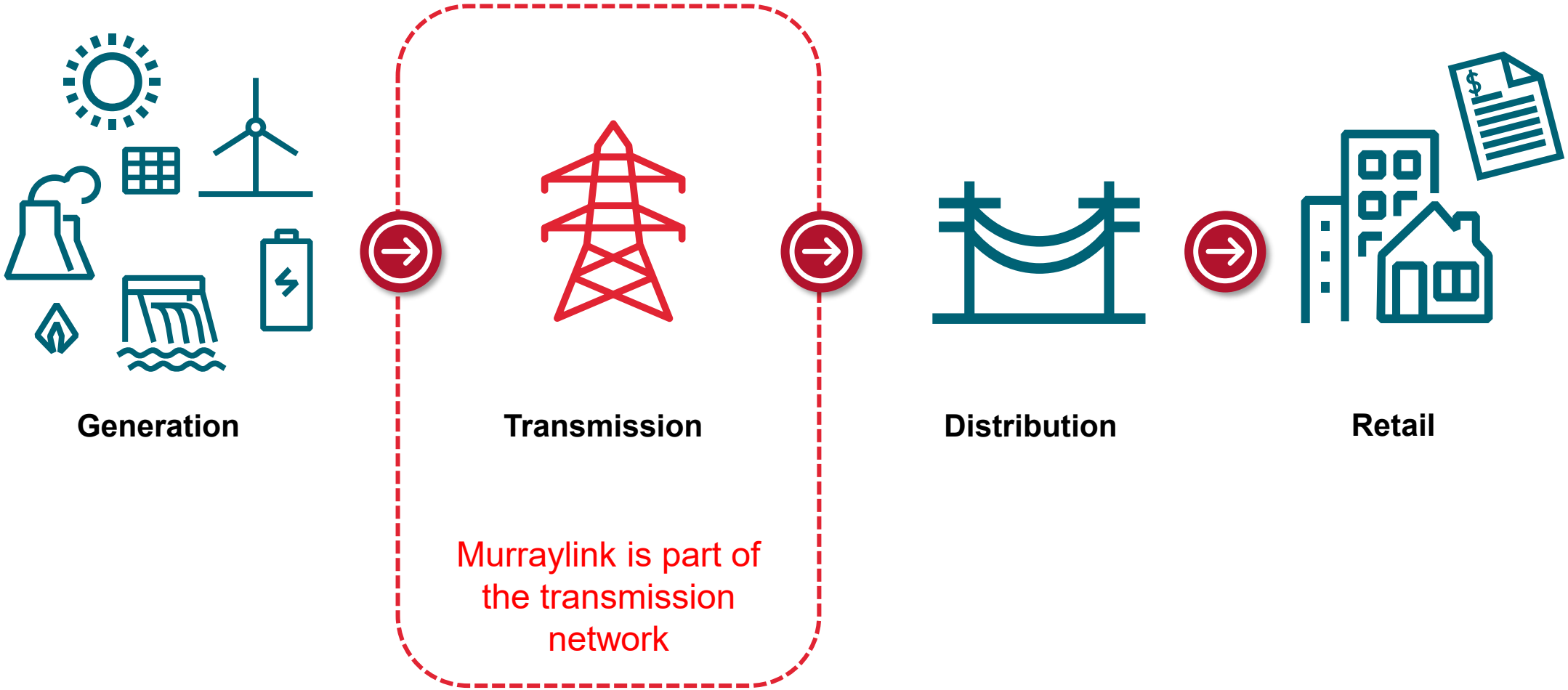
- the technical characteristics of the credible option
- whether the credible option is likely to have a material inter-regional impact
- the classes of market benefits that the RIT-T proponent considers are unlikely to be material and reasons why they are unlikely to be material
- the estimated construction timetable and commissioning date
- to the extent practicable, the total indicative capital and maintenance costs.

About Murraylink and the problem statement

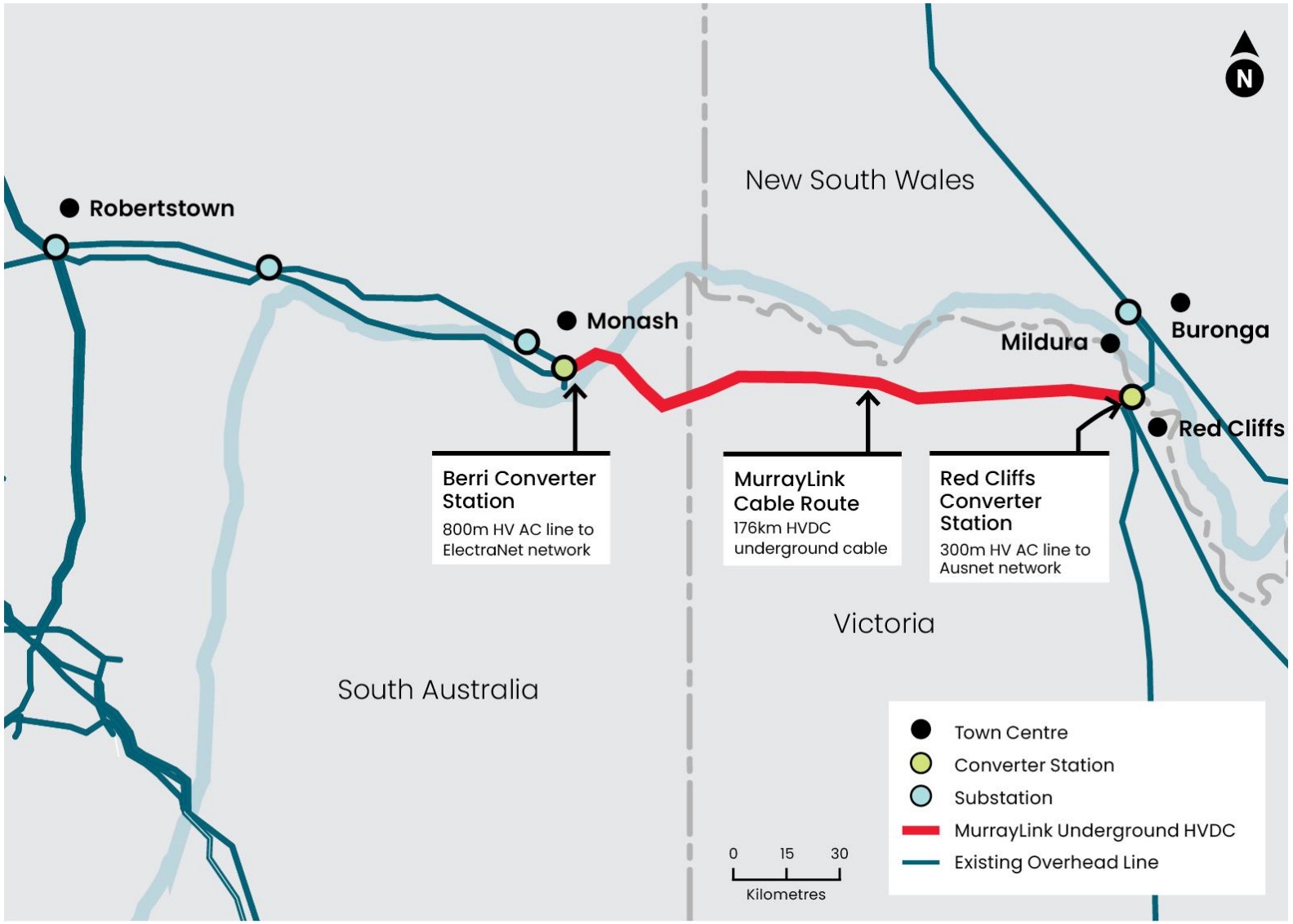
03

Objective: To ensure a common understanding of the problem and the need for investment

Electricity supply chain



Murraylink location and infrastructure



Red Cliffs Converter station

Largely dry, inland location

Runs through the Lyrup Wetlands (environmentally sensitive area)

Berri Converter station

Murraylink underground high voltage direct current (HVDC) electricity interconnector

Crosses the Murray River and forms a crucial energy bridge between South Australia and Victoria

2002

commissioned using leading edge technology for the time

Interconnector

sends electricity between South Australia (**SA**) and Victoria (**VIC**)

176 km length

Single high voltage direct current (**HVDC**) transmission line

220 MW capacity

to both SA and VIC

2

converter stations - Berri (SA) and Red Cliffs (VIC)

Owned By EII

MM Midstream Investment (49.9%)

Osaka Gas (30.2%)

APA (19.8%)

~$17.5M

average annual revenue

Supports local businesses

in the region

Estimated Murraylink portion of a residential customer's total electricity bill

Victoria

South Australia

The role of Insulated Gate Bipolar Transistors (IGBTs)

Deliver precise switching

- Multiple IGBT series are designed to open and close at precisely the same time
- Each valve switches in and out 150 kV at 1,350 times per second (Hz)

Essential for reliability & safety

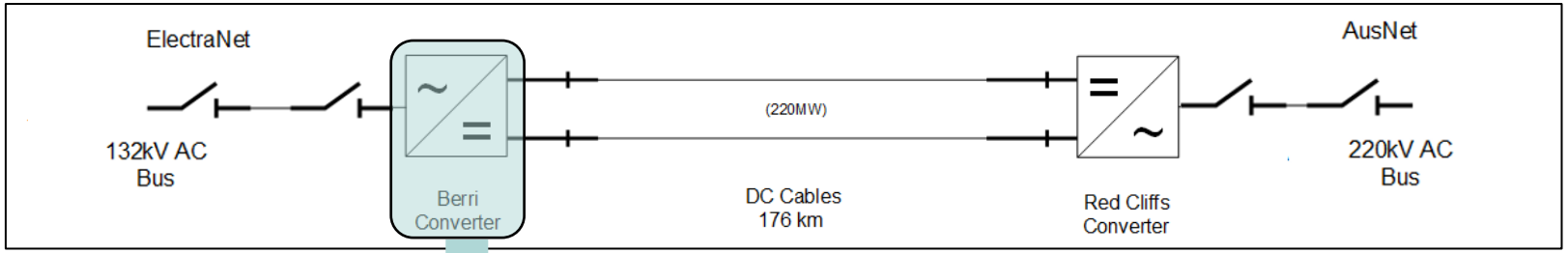
- Essential to converting HVAC to HVDC
- Allow electricity to flow between South Australia and Victoria
- Ensure integration with the AC grids in both states

Key IGBT statistics

- Murraylink has 5,832 IGBTs
- These are installed across three phases at each converter station
- Each converter station has 18 valves - each valve can have up to 5 IGBTs fail and continue to operate

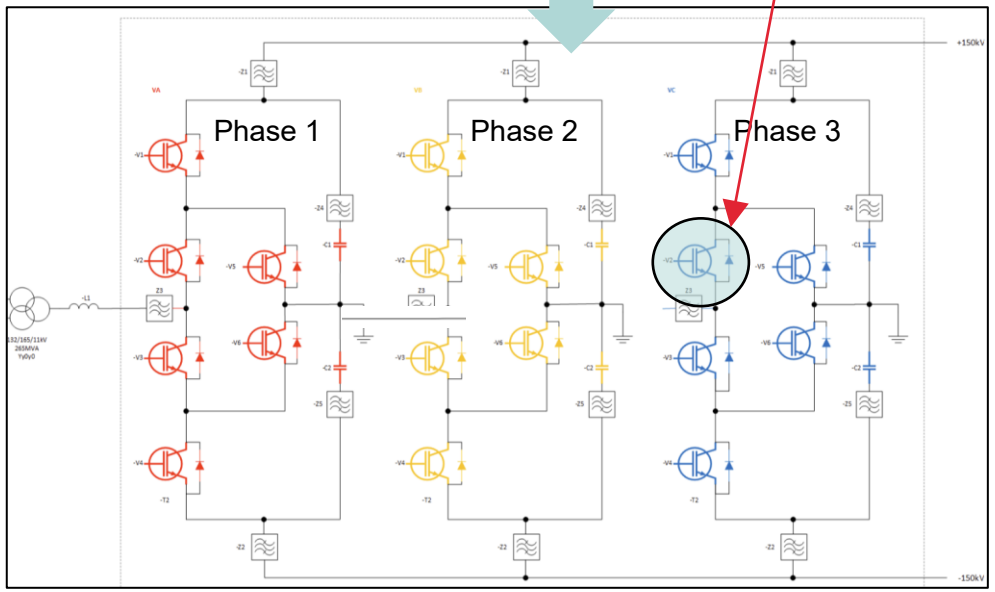
Do you have any questions about IGBTs?

Murraylink Configuration



Berri Converter Station

Each converter station has 18 valves installed across three phases



Valve

Valve room

Each valve has 162 IGBTs. The boxes inside the stack are the IGBTs.

The problem statement

Regular failure & replacement

- Due to the high level of switching, regular failure and replacement of IGBTs is expected

Old & limited technology

- Early form of Voltage Source Converter technology using IGBTs
- Only a handful of such systems in the world

Obsolescence issue

- Gen 2 IGBTs no longer supported by Hitachi and spares are no longer available for purchase

Spares are limited

- ~5 years of spares on hand
- At current failure rates, we expect to run out in May 2031

Do you have any questions about the problem statement?

The options identified

04

Objective: To ensure a common understanding of the options considered and those that are deemed to be credible to solve the problem

The options explored

We are exploring three potential network options

1. Upgrade just one phase

- Upgrade IGBTs from one phase at one converter station from Gen 2 to Gen 3
- Releases 972 spares for use in the other 5 phases
- Would undertake additional RIT-Ts to upgrade successive phases based on IGBT failure rate and sparing threshold

Estimated costs:

- Capital cost $30-40 million
- On-going operating expenditure to replace remaining IGBTs that fail – may escalate with age

Estimated completion date:

2030

Customer impact

50 day outage

Potential escalation of annual outages as existing IGBTs continue to fail

2. Change technology at one converter station

- Upgrade one station from Voltage Source Converter technology to today's technology (Modular Multi-level Converter)
- Releases 2,916 spare IGBTs for use at the other converter station or potential sale

Estimated costs:

- Capital cost approx. $70 million
- On-going operating expenditure to replace remaining IGBTs that fail – may escalate with age

Estimated completion date:

2031

Customer impact

150 day outage

Potential escalation of annual outages as existing IGBTs continue to fail

3. Change technology at both converter stations

- Upgrade both stations to Modular Multi-level Converter technology

Estimated costs:

- Capital cost approx. $140 million
- Savings in on-going operating expenditure from reduced work replacing failed IGBTs

Estimated completion date:

2031

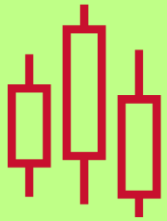
Customer impact

150 day outage

We have not identified a credible non-network option

Replacement of the obsolete IGBTs keeps Murraylink in operation –
A non-network option must be capable of delivering the capability of Murraylink

220 MW of electricity transfer capability



Frequency control

Voltage control

We are not aware of any non-network solution that could meet these requirements – are you?

The analysis of options

The RIT-T will focus on costs

- Market benefits do not vary materially with the different potential solutions
- This means the best option is the one which delivers the lowest long-term cost to customers

While further analysis of the options is required, the equivalent analysis on Directlink indicated that the lowest cost approach is to replace the generation 1 IGBTs with Generation 3 IGBTs valve room by valve room

Market benefits comprise

- variable operating costs (specifically, changes in fuel consumption arising through different patterns of generation dispatch)
- voluntary load curtailment
- involuntary load shedding
- costs to other parties
- timing of transmission investment
- network losses
- ancillary services costs
- changes in Australia's greenhouse gas emissions
- competition benefits
- option value
- costs associated with social licence activities

Potential IGBT upgrade program delivery

	2026–27	2027–28	2028–29	2029–30
Contract signature, slot booking and kick-off meeting, pre-engineering commencement	Jan 2027			
Pre-engineering completion		Jun 2027		
Engineering completion, drawings, and engineering approval before production release			Dec 2028	
Procurement of material			Dec 2028	
Completion of Factory Acceptance Testing				Sep 2029
Material ready for shipment				Oct 2029
Material delivered at site				Jan 2030
Final completion				Jan 2030

Wrap-up and next steps

05

Objective: To thank participants and explain next steps

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Indicative timeline

We will also publish the RIT-T reports on our Murraylink webpage along with the closing date and requirements for submissions

We are here

Interested parties can make submissions to Murraylink on the PSCR

No less than Time T + 12 weeks

Within 30 days a party may provide a notice to the AER to dispute the RIT-T application

5 June 2026

Stakeholder meeting #1

Objective: To gather stakeholder views on the proposed RIT-T and identify all credible options ahead of submitting PSCR

End of June 2026

Murraylink submits PSCR and summary to AEMO

Objective: To formally start the RIT-T process

Time T

AEMO publishes summary of the PSCR on website

On request, Murraylink will share the PSCR with interested parties within 3 business days

TBC ~Time T + 14 weeks

Stakeholder meeting #2

Objective: To share feedback received and demonstrate how it has influenced the proposal and preferred option

TBC ~Time T + 18 weeks

Murraylink submits PACR and summary to AEMO

Objective: To commence finalisation of the RIT-T process

Time TT

AEMO publishes summary of the PACR on website

Murraylink will share the PACR with registered participants and, on request, share the PACR with new interested parties within 3 business days

PSCR: Project Specification Consultation Report
PACR: Project Assessment Conclusion Report

Do you have any questions about the RIT-T process?

Thank you and next steps

Stakeholders to:

- Complete anonymous evaluation survey for today's meeting
- Reach out with any questions

APA to:

- Weave feedback from today's session into the PSCR
- Lodge the PSCR with AEMO
- Plan a second engagement meeting to discuss submissions to the PSCR and inform the Project Assessment Conclusion Report

For further information:

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