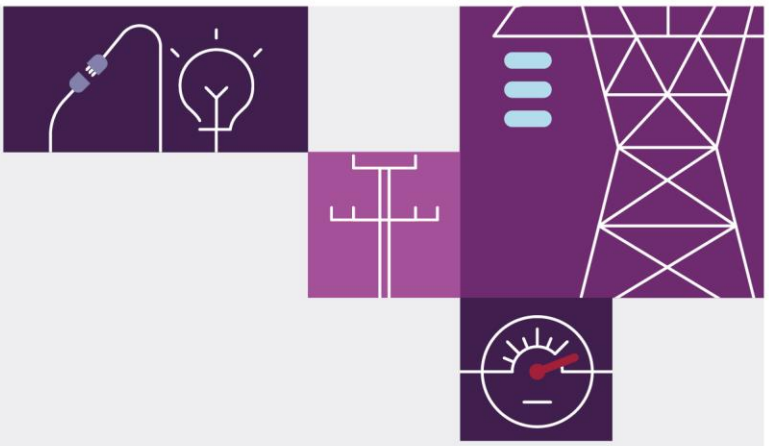
Western Renewables Link Project

Analysis for the purposes of clause 5.16.4(z3) of the National Electricity Rules

November 2022



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Contents

Glossary

Term	Definition
AER	Australian Energy Regulator
Alliance	Moorabool & Central Highlands Power Alliance Inc
AusNet	AusNet Transmission Group Pty Ltd
DSP	demand side participation
EES	Environment Effects Statement
FOM	fixed operating and maintenance
IASR	The *Inputs Assumptions and Scenarios Report* for a particular ISP published by AEMO pursuant to clause 5.22.8(a) of the NER. The IASR for the 2022 ISP can be found at https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp/current-inputs-assumptions-and-scenarios.
IDC	interest during construction
ISP	The *Integrated System Plan*. The 2022 ISP can be found at https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp.
ISP Methodology	The *ISP methodology* for a particular ISP published by AEMO pursuant to clause 5.22.8(d) of the NER. The ISP Methodology for the 2022 ISP can be found at https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp/isp-methodology.
Murray River REZ	The Murray River renewable energy zone (described as 'V2 – Murray River') identified in the 2022 ISP
NEL	National Electricity Law
NEM	National Electricity Market
NER	National Electricity Rules
Option B3	The second ranked *credible option* for the WRL Project as identified in the WRL PACR
Option C2	The *preferred option* for the WRL Project identified in the WRL PACR
PACR	*project assessment conclusions report*
PADR	*project assessment draft report*
PV	photovoltaic
REZ	A renewable energy zones is a high-quality resource area where clusters of large-scale renewable energy projects can be developed using economies of scale.
PSCR	*project specification consultation report*
RIT-T	*regulatory investment test for transmission*
RIT-T Application Guidelines	The AER regulatory investment test for transmission application guidelines
RIT-T Instrument	The *regulatory investment test for transmission* as published from time to time by the AER in accordance with clause 5.15A.1(a) of the NER. The current RIT-T Instrument can be found at AER - Regulatory investment test for transmission - 25 August 2020.
RIT- T Rules	The rules that relate to the *regulatory investment test for transmission,* particularly those set out in Part D of Chapter 5 of the NER
Step Change scenario	Is described in Section 4.4.2.
TCD	The Transmission Code Database which is the database of cost estimate inputs and cost estimating tool produced and utilised by AEMO in response to stakeholder feedback on the 2020 ISP.
TOA	Transmission Operations Australia
USE	unserved energy
VBB	Victorian Big Battery
VNI	Victoria to New South Wales Interconnector
VNI West Project or VNI West	The Victoria to New South Wales Interconnector West Project which was identified as an *actionable ISP Project* in the 2022 ISP.

Term	Definition
VOM	variable operating and maintenance
VRE	variable renewable energy
WACC	weighted average cost of capital
Western Victoria REZ	The Western Victoria renewable energy zone (described as 'V3 – Western Victoria') identified in the 2022 ISP
WRL RIT-T	The Western Renewable Integration Regulatory Investment Test for Transmission process
WRL PACR	The *project assessment conclusion report* for the WRL Project
WRL Project	The Western Renewables Link Project (formerly known as the Western Victoria Transmission Network Project) being the *RIT-T Project* to address the *identified need* that was the subject of the WRL RIT-T

A term printed in *italics* in this document will have the meaning given to that term in clause 5.10.2 of the National Electricity Rules (**NER**) or Chapter 10 of the NER (as applicable). Note that dollar amounts referred to in this document are in June 2021 dollars unless otherwise stated and have been rounded to the nearest million dollar amount.

1 Executive summary

In Victoria, AEMO has '*declared network functions*' that relate to the planning and *augmentation* of the Victorian *transmission system* and is classified as a *Network Service Provider* in relation to the Victorian *declared shared network* for various purposes under the NER. In this capacity, between 2017 and 2019 AEMO undertook a *regulatory investment test for transmission* (or **RIT-T**) in relation to the Western Renewables Link Project (**WRL Project**), and has now prepared this document regarding that project.

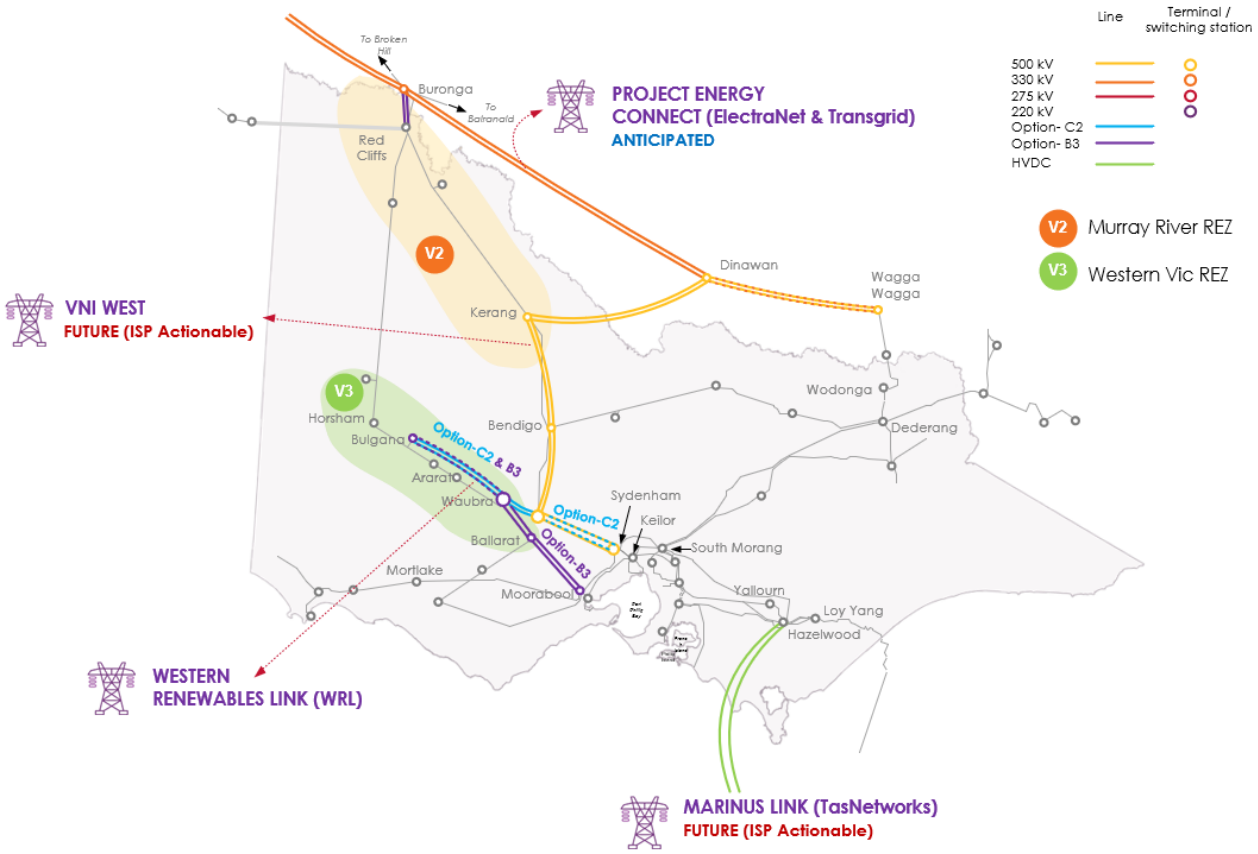
In the *project assessment conclusions report* (or **PACR**) published in July 2019, one of the *credible options* assessed was chosen as the *preferred option* for addressing the *identified need* for the WRL Project. Under the RIT-T Rules, the *preferred option* is the *credible option* that maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the *market*. That option is known as Option C2 and is referred to as such in this analysis. A brief description of Option C2 is set out in Table 1 below.

AEMO identified following the release of the 2022 *Integrated System Plan* (**ISP**) and the preparation of the *project assessment draft report (***PADR**) for the proposed VNI West Project that modelling may be required to reassess the market benefits for the WRL Project in light of the latest Step Change scenario assumptions set out in the 2022 ISP. AEMO commenced initial steps to undertake that assessment in July 2022. AEMO monitors changes in relevant circumstances as part of its broader national transmission planner function and had identified that various changes in circumstances had occurred which could impact upon the assessment of market benefits for the WRL Project.

Separately, the Moorabool & Central Highlands Power Alliance Inc (**Alliance**) wrote to AEMO in late August 2022 outlining a number of changes in circumstances that the Alliance considered to be "material changes in circumstances" for the purposes of the application of clause 5.16.4(z3)(3) of the National Electricity Rules (**NER**) to the WRL Project, and requesting that AEMO undertake the analysis required by clause 5.16.4(z3). Whilst AEMO has continued to hold the opinion that Option C2 was the *preferred option* in relation to the WRL Project, the release and publication of the 2022 ISP, the changes in relevant circumstances that AEMO had become aware of when developing the 2022 ISP, together with the receipt of the Alliance's request emphasised the need to undertake this analysis taking into account all of these matters.

Figure 1 shows the two highest ranked *credible options* for the WRL Project considered in the WRL PACR (Option C2 and Option B3) and the interaction with other projects, including the proposed VNI West Project. The proposed 500 kilovolt (**kV**) lines are shown in yellow, Option C2 is shown in blue, and Option B3 in purple.

Figure 1 Western Renewable Link credible options[1]



Note: This map only shows key terminal stations. Augmentation routes are illustrative only. Not to Scale

AEMO accepts that, since the WRL PACR was published, there have been numerous material changes in circumstances. However, the critical question for the purposes of clause 5.16.4(z3) of the NER is whether there has been a material change in circumstances that, in AEMO's opinion, means that Option C2 is no longer the *preferred option*. In order to form this opinion for the purposes of this analysis, AEMO has:

- reassessed the estimated costs, and forecast gross market benefits under the Step Change scenario, for the two highest ranked *credible options* in the WRL PACR (being Option C2 and Option B3) to determine the net market benefit for Option C2 and Option B3; and
- determined whether Option C2 still has the greater net market benefit of the two *credible options*.

This analysis found that market changes since the publication of the WRL PACR have resulted in:

- **Lower fuel cost savings attributable to the WRL Project**: with coal generation retiring earlier and being replaced by renewable generation and storage, fuel costs associated with generation in the next decade are likely to be lower than in the earlier assessment, and fuel cost savings are therefore less.

[1] The lines on the map are for illustrative purposes only. They do not represent the precise routes. For the VNI West Project, a route between the WRL Project and Project EnergyConnect in New South Wales has not yet been selected.

- **An increased need for renewable generation and storage to help maintain reliability as these coal plants retire:** the WRL Project increases access to existing renewable generation in the Western Victoria Renewable Energy Zone (**REZ**) that would otherwise be constrained and essentially "spilled" in the sense it would be wasted. It also harnesses over 500 megawatts (**MW**) of additional new renewable generation in the Western Victoria REZ. Without the WRL Project, more capital investment is required (in both transmission and generation) to harness the same amount of renewable generation.
- **Increased cost of transmission:** this increases the value of transmission options that can harness renewable generation while minimising the total cost of transmission. The difference in value between Option C2 and Option B3 is greater now, given that Option C2 leads to a lower combined cost of the WRL Project and VNI West Project than Option B3 for a similar level of benefit.

AEMO's analysis in this document shows that Option C2 has net market benefits of $186 million as compared to Option B3 which has net market benefits of $61 million.

In AEMO's opinion, Option C2 remains the *preferred option*.

This document represents AEMO's response to the Alliance's request, and takes into account the relevant changes in circumstances that have occurred since the WRL PACR was published in July 2019, inclusive of those raised by the Alliance.

It is in the above context, and in the spirit of transparency, that AEMO has also decided to publish its reasons for forming this conclusion, for the information of all interested parties.

2 Regulatory background — RIT-T process

2.1 Overview of RIT-T process

The RIT-T is a regulatory economic cost-benefit test for assessing investment in electricity transmission infrastructure. The purpose of the RIT-T is to identify the *credible option*:

- that addresses an *identified need*; and
- which maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the *market*,

(known as the *preferred option*).

2.2 Overview of regulatory instruments guiding the RIT-T process

The procedures applying to a RIT-T for *RIT-T projects*, which are not *actionable ISP projects*, are set out in rule 5.15A and rule 5.16 of the NER and the RIT-T Instrument published by the Australian Energy Regulator (**AER**) under clause 5.15A.1 of the NER.

The WRL Project is not an *actionable ISP project*.

As outlined in clause 5.16.4 of the NER, the RIT-T process for *RIT-T projects* which are not *actionable ISP projects*, involves the publication of three reports. Those three reports are the *project specification consultation report* (**PSCR**), the PADR and the PACR. As part of the PADR and the PACR, the *RIT-T proponent* must present the results of its RIT-T analysis. This analysis is based on the quantification of various categories of costs and benefits arising to all those that produce, consume, and transport electricity in the *market*.

In accordance with clause 5.16.2 of the NER, the AER has published RIT-T Application Guidelines which provide guidance on how *RIT–T proponents* are to apply the RIT-T (including the processes that *RIT-T proponents* must follow) and how the AER will address and resolve RIT-T disputes. The RIT-T Application Guidelines also provide guidance concerning how to account for the ISP, including the use of assumptions from the ISP and how to treat *ISP projects*.

The RIT-T Application Guidelines provide that:

> *'Each version of these RIT–T application guidelines will be effective from its effective date of issue, and RIT-T proponents should apply it as soon as practical. However, for compliance purposes concerning a RIT-T application, we will only have regard to the guidance that was in effect when a RIT-T proponent initiated the RIT-T in question. In this context, initiated means from the publication of a PSCR.'*

Consistent with the AER's comments, AEMO applies the most recent version of the RIT-T Application Guidelines when undertaking a RIT-T.

Whilst the analysis set out in this document is not itself a RIT-T, it does involve an analysis of whether the outcome of a previous RIT-T — the *preferred option* — remains the *preferred option*. As noted above, the definition of that term requires consideration of the net market benefits from the *credible options* that were

considered in the PACR. For that reason, AEMO has had regard to version 4 of the RIT-T Application Guidelines (released by the AER on 25 August 2020) when undertaking this analysis.

The RIT-T Rules, RIT-T Instrument and RIT-T Application Guidelines set out the classes of costs and market benefits that can be considered in a RIT-T (including what impacts should be treated as externalities[2] and therefore excluded from consideration in a RIT-T). These regulatory instruments make clear that only certain types of 'allowable' costs and benefits can be taken into account for the purposes of a RIT-T assessment.

[2] Section 3.11 of the RIT-T Application Guidelines provides that externalities are economic impacts that accrue to parties other than those who produce, consume and transport electricity in the *market* and sets out some examples of positive and negative externalities.

3 Background to the WRL Project

3.1 The WRL RIT-T process

AEMO operates and administers the National Electricity Market (**NEM**) and system and is the national transmission planner. In Victoria, AEMO also has '*declared network functions*' that relate to the planning and *augmentation* of the Victorian *transmission system*[3]. In this latter capacity, AEMO started the WRL RIT-T process in 2017 to assess the technical feasibility and economic benefits of addressing limitations in the Western Victoria *transmission network*. AEMO prepared and published a number of reports during the WRL RIT-T process, as required by rule 5.16 of the NER[4].

The first report - the *project specification consultation report* or PSCR - was published in April 2017 and described:

- the need for investment in the Western Victoria power system to increase its capability and reduce constraints on projected new generation in that region; and
- the potential investment options to address this need.

AEMO investigated the recommendations in the PSCR in its July 2018 ISP. The July 2018 ISP highlighted transmission investment in Western Victoria as a 'priority Group 1 project' due to Western Victoria's high-quality wind resources and high interest from potential generators[5].

The second report - the *project assessment draft report* or PADR - was published in December 2018. It:

- identified six *credible options*[6] to improve transmission capacity in Western Victoria;
- identified the *preferred option*[7] (that is, Option C2) based on the initial assessment outlined in the PADR; and
- sought feedback about the *preferred option*.

The top two *credible options* from the PADR, being Option B3 and Option C2, were assessed in detail during the third stage, being the preparation of the WRL *project assessment conclusions report* or PACR. The four other *credible options*, which ranked lower than Option B3 and Option C2 under all scenarios and sensitivities, were not assessed in the same detail during the WRL PACR stage because it was determined that their net market benefits would not exceed the net market benefits from Option C2 or Option B3.

In July 2019, after extensive modelling and stakeholder consultation, AEMO released the WRL PACR as the third and final report of the WRL RIT-T process. The WRL PACR confirmed that Option C2 remained the *preferred option* because it was the *credible option* which generated the greatest net economic benefit.

[3] For this purpose, AEMO is classified as a *Network Service Provider* in relation to the Victorian *declared shared network* for various provisions under the NER.

[4] AEMO published all the RIT-T reports and project updates on its website, at https://www.aemo.com.au/initiatives/major-programs/western-victorian-regulatory-investment-test-for-transmission/reports-and-project-updates.

[5] See https://www.aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2018-integrated-system-plan-isp.

[6] "*Credible option*" is defined in clause 5.15.2 of the NER. A *credible option* is an option that addresses the *identified need* in time and is commercially and technically feasible.

[7] "*Preferred option*" is defined in clause 5.15A.1(c) of the NER and is the *credible option* that maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the *market*.

3.2 Summary of the WRL PACR conclusions

3.2.1 Summary of Option C2 and Option B3

A summary of Option C2 and Option B3 as considered in the WRL PACR is set out below in Table 1.

Table 1 Option C2 and Option B2 descriptions from the WRL PACR

Credible option	Description
Option C2	• Minor augmentation for Red Cliffs to Wemen to Kerang to Bendigo, and Moorabool to Terang to Ballarat, 220 kilovolt (**kV**) transmission lines. • Construction of an anticipated new North Ballarat Terminal Station, with 2 x 1,000 megavolt amperes (**MVA**) 500/220 kV transformers. • Connect anticipated new North Ballarat Terminal Station to existing Ballarat to Bendigo 220 kV single circuit transmission line. • Construction of new 500 kV double circuit transmission line from Sydenham to anticipated new North Ballarat Terminal Station, with 50 megavolt amperes reactive (MVAr reactors) on each end of each circuit. • Construction of new 220 kV double circuit transmission line from anticipated new North Ballarat Terminal Station to Bulgana. • Connect one of the new 220 kV transmission circuits from anticipated new North Ballarat Terminal Station to Bulgana to the existing Waubra Terminal Station. • Disconnect existing Waubra Terminal Station from existing Ballarat to Waubra to Ararat 220 kV transmission line. • Cut in Ballarat to Moorabool 220 kV circuit No. 2 at Elaine Terminal Station.
Option B3	• Minor augmentation for Red Cliffs to Wemen to Kerang to Bendigo, and Moorabool to Terang to Ballarat, 220 kV transmission lines. • Construction of new 220 kV double circuit transmission line from Moorabool to Elaine to Ballarat to Bulgana. • Retire Ballarat to Moorabool 220 kV circuit No. 1 and cut in Ballarat to Moorabool circuit No. 2 at Elaine.

3.2.2 Net market benefit assessment for Option C2 and Option B3 in the WRL PACR

In the WRL PACR, Option C2 and Option B3 (including the minor augmentations referenced in Table 1) were estimated to have the capital costs, present value costs, gross market benefits and net market benefits set out in Table 2 below.

Table 2 WRL PACR credible options costs and benefits - $million 2019

Credible Option	Capital Cost	Present value cost	Gross market benefits	Net market benefits
Option C2	479	370	671	301
Option B3	340	287	534	247

The market benefits for Option C2 outlined in the WRL PACR were projected to be achieved through:

- significant reductions in the capital and dispatch cost of generation;
- facilitation of future *transmission network* expansion; and
- improvements to the Victoria to New South Wales interconnector (**VNI**) transfer limit.

3.2.3 Overview of procurement process for the WRL Project

Following the publication of the WRL PACR, AEMO conducted a procurement process for the WRL Project in accordance with its obligations under the NEL and NER. In December 2019, AusNet Transmission Group Pty Ltd (**AusNet**) was selected to plan, design, construct, own, operate and maintain the contestable portion of Option C2. AusNet, together with Transmission Operations Australia (**TOA**), was also contracted to design, construct, own, operate and maintain the "non-contestable" portions of Option C2. These assets would in turn be used to provide network services to AEMO which would benefit all Victorian consumers of electricity.

As is usual for a project of this nature, the terms of the contracts are commercial in confidence. AEMO is subject to confidentiality obligations, both under the terms of the contracts and under provisions of the NEL that require AEMO to maintain the confidentiality of information. Public disclosure of the terms of these contracts would contravene these obligations of confidence and has the potential to adversely impact future competitive procurement processes for *network augmentations* (as required by the NER). AEMO has therefore only referred to the WRL Project contracts in a general way throughout this document.

Option C2 is now being progressed through the WRL Project, and an Environment Effects Statement (**EES**) is being prepared by AusNet for submission. The EES will be exhibited for public comment, allowing the public to provide submissions on the WRL Project that will inform the planning authority's recommendations to the Minister for Planning. Construction is currently planned to commence in mid-2024 and to be completed in 2026[8].

[8] See https://www.westernrenewableslink.com.au/about/.

4 The present analysis

4.1 Application of clause 5.16.4(z3) to WRL Project

AEMO is the *RIT-T proponent* for the *RIT-T project* described in the WRL PACR (that is, the WRL Project).

Clause 5.16.4(z3) of the NER provides that:

'If:

(1) a *RIT-T proponent* [in this case, AEMO] has published a *project assessment conclusions report* in respect of a *RIT-T project* (in this case, the WRL PACR in respect of the WRL Project);

(2) a *Network Service Provider* still wishes to undertake the RIT-T project to address the *identified need*; and

(3) there has been a material change in circumstances which, in the reasonable opinion of the *RIT-T proponent* means that the *preferred option* identified in the *project assessment conclusions report* is no longer the *preferred option*,

then the *RIT-T proponent* must reapply the *regulatory investment test for transmission* to the *RIT-T project*, unless otherwise determined by the *AER*.'

The first two conditions, listed in sub-paragraphs (1) and (2) above, are satisfied in relation to the WRL Project. The satisfaction of the third condition with respect to the WRL Project depends upon the occurrence of a material change in circumstances which, in the reasonable opinion of AEMO, means that the *preferred option* identified in the WRL PACR is no longer the *preferred option*.

4.2 Initiation of this clause 5.16.4(z3) analysis

AEMO identified, following the release of the 2022 ISP and the preparation of the PADR for the VNI West Project, that modelling may be required to reassess the market benefits of the WRL Project in light of the latest Step Change scenario assumptions set out in the 2022 ISP. AEMO commenced initial steps to undertake that assessment in early July 2022. AEMO monitors changes in relevant circumstances as part of its broader national transmission planner function and had identified that various changes in circumstances had occurred which could impact upon the assessment of market benefits for the WRL Project.

Separately, the Alliance wrote to AEMO in late August 2022 outlining a number of changes in circumstances that the Alliance considered to be “material changes in circumstances” for the purposes of the application of clause 5.16.4(z3)(3) of the NER to the WRL Project, and requesting that AEMO undertake the analysis required by clause 5.16.4(z3).

Whilst AEMO has continued to hold the opinion that Option C2 was the *preferred option* in relation to the WRL Project, the release and publication of the 2022 ISP, the changes in relevant circumstances that AEMO had become aware of when developing the 2022 ISP, together with the receipt of the Alliance's request, emphasised the need to undertake this analysis in relation to the current costs and market benefits for both Option C2 and Option B3, taking into account all of these matters.

This document represents AEMO's response to the Alliance's request, and takes into account relevant changes in circumstances that have occurred since the WRL PACR was published in July 2019, inclusive of those raised by the Alliance.

AEMO accepts that since the WRL PACR was published, there have been numerous material changes in circumstances. However, the critical question for the purposes of clause 5.16.4(z3) of the NER is whether there has been a material change in circumstances that, in AEMO's opinion, means that Option C2 is no longer the *preferred option*.

In order to form this opinion for the purposes of this analysis, AEMO has:

- reassessed the estimated costs and forecast gross market benefits under the Step Change scenario for Option C2 and Option B3 to determine the net market benefit for Option C2 and Option B3; and
- determined whether Option C2 still has the greater net market benefit.

This analysis of the current costs and forecast gross market benefits for Option C2 and Option B3 has taken into account relevant present circumstances including the material changes identified in Section 5.2 below. Assessing forecast gross market benefits involves a process of modelling energy market simulations based on inputs and assumptions. That process of modelling adopting the Step Change scenario is described in Section 4.4.2 below.

AEMO has limited its analysis to Option C2 and Option B3 because:

- these were the *credible options* that were assessed in detail in the WRL PACR (and the *preferred option* is that which is preferred of those *credible options*); and
- AEMO remains of the view that the net market benefits of Option C2 and Option B3 will continue to exceed those of the other *credible options* identified in the WRL PACR, after taking into account the changes in circumstances that have been considered under this analysis.

4.3 Structure of analysis

Section 5 considers **changes in circumstances** of which AEMO is aware, including those raised by the Alliance. That section considers whether the changes are "material", for the purposes of clause 5.16.4(z3) of the NER.

Section 6 outlines the **methodology** used to determine the estimated cost and market benefits for Option C2 and Option B3. It also explains how the methodology is consistent with the RIT-T Rules, RIT-T Instrument, RIT-T Application Guidelines, and how it has been guided by the ISP Methodology and the *Inputs Assumptions and Scenarios Report* (**IASR**).

Section 7 explains the process AEMO has followed to estimate the **costs** for Option C2 and Option B3.

Section 8 outlines AEMO's analysis of the gross market **benefits** for Option C2 and Option B3 using (amongst other things) the Step Change scenario, which captures current market conditions and other relevant circumstances (including those market conditions and other circumstances raised by the Alliance) that could impact on the market benefits for Option C2 and Option B3.

Section 9 sets out **AEMO's conclusions** about the relative net market benefits of Option C2 and Option B3.

4.4 Summary of key concepts

Set out in this Section 4.4 is a brief explanation concerning three key concepts that are referred to in this document.

4.4.1 VNI West Project

Background

The 2018 ISP[9] identified the need for a large capacity VNI upgrade ahead of, and in preparation for, retirement of existing coal-fired generation in the mid-2030s. The 2018 ISP assessed seven different options for a major VNI augmentation and selected the "Snowylink South" option (from Sydenham to Ballarat to Kerang to Darlington Point in New South Wales) as the option that provided the highest net market benefits.

AEMO's "ISP Insights: Building power system resilience with pumped hydro energy storage"[10], released in July 2019, further assessed the benefits and timing of building additional interconnection between Victoria and New South Wales. This analysis found that an augmentation to increase transfer capability between the Snowy area and Melbourne (referred to as "KerangLink"), in time for the next expected closure of brown coal-fired generation in Victoria, would maximise the reliability and resilience benefits from Snowy 2.0 at lowest cost for Victorian consumers.

The 2020 ISP[11] identified VNI West as an *actionable ISP project* with decision rules, a project critical to address cost, security and reliability issues, and recommended that this project be progressed for completion as soon as practicable.

It should be noted that "Snowylink South", "KerangLink" and "VNI West" are referring to developments which connect the 500kV *network* in Victoria with the 500kV *network* in New South Wales and are different names used at different times for addressing the same *identified need*.

The 2022 ISP identified VNI West as an *actionable ISP project* to be progressed urgently. AEMO and TransGrid are jointly undertaking the VNI West RIT-T assessment, with the VNI West PADR released in July 2022.

The '*identified need*' for the VNI West project – as detailed in the 2020 ISP, 2022 ISP and the VNI West PADR – is to increase transfer capacity between New South Wales and Victoria to realise net market benefits by:

- Efficiently maintaining supply reliability in Victoria following the closure of further coal-fired generation and the decline in ageing generator reliability – including mitigation of the risk that existing plant closes earlier than expected.
- Facilitating efficient development and dispatch of generation in areas with high quality renewable resources in Victoria and southern New South Wales through improved network capacity and access to demand centres.
- Enabling more efficient sharing of resources between NEM regions.

The VNI West project in the 2022 ISP and the 2022 VNI West PADR assumed that the WRL Project (specifically Option C2) was committed[12] (that is, it was assumed to proceed) and hence it was no longer necessary for VNI

[9] See https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2018-integrated-system-plan-isp.

[10] See https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2019/ISP-Insights---Building-power-system-resilience-with-pumped-hydro-energy-storage.pdf.

[11] See https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2020-integrated-system-plan-isp.

[12] The RIT-Instrument defines 'committed project' and provides that a committed project is a project that meets 5 specific criteria.

West to connect all the way to Sydenham, requiring a shorter and less expensive option than would be the case without the WRL Project.

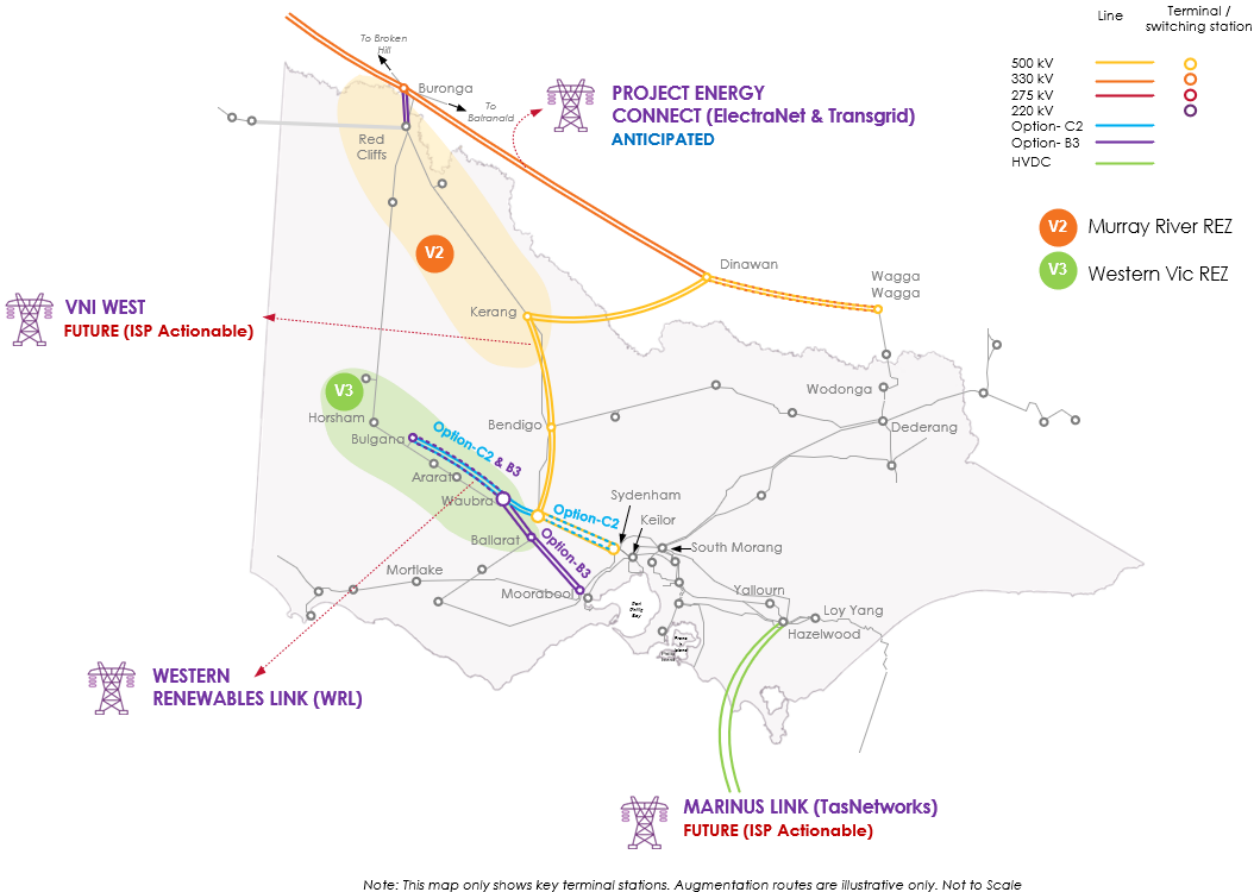
Interaction

Figure 2 below shows Option C2 and Option B3 in relation to the WRL Project and VNI West, and their interaction.

The proposed 500 kilovolt (**kV**) lines are shown in yellow, Option C2 is shown in blue, and Option B3 in purple.

As noted above, the length of VNI West will need to be longer in the absence of Option C2, as the interconnector is still required to connect renewable generation in the Murray River REZ and Western Victoria REZ to the 500 kV shared network in New South Wales and Victoria in order to reach the load centres, thereby addressing and meeting the *identified need*.

Figure 2 Interaction of Western Renewable Link options with VNI West[13]



Note: This map only shows key terminal stations. Augmentation routes are illustrative only. Not to Scale

The WRL RIT-T, and this analysis, assumed that:

[13] The lines on the map are for illustrative purposes only. They do not represent the precise routes. For VNI West, a route between the WRL Project and Project EnergyConnect in New South Wales has not yet been selected.

- Under Option C2, VNI West connects into the WRL Project at a proposed terminal station north of Ballarat.
- Without Option C2, VNI West would connect into Sydenham terminal station.
- With Option B3 it is not possible to share the 220 kV lines from Ballarat to Moorabool without reducing the capacity (and market benefits) of VNI West significantly, and therefore VNI West would need to connect into Sydenham terminal station.

This means that less overall transmission build is required to facilitate a WRL Project using Option C2 and VNI West, than would be needed to facilitate a WRL Project using Option B3 and VNI West. As the cost of transmission has increased, the benefit to Victorian electricity consumers from optimising transmission build has also increased.

The RIT-T for VNI West is currently progressing, and it assumes the WRL Project (specifically, Option C2) is committed (in line with the 2022 ISP). Under the original WRL RIT-T, and consistent with the RIT-T Application Guidelines applying at that time, the counterfactual base case assumed that VNI West would become committed consistent with the 2018 ISP's recommended timing in all reasonable scenarios apart from the 'No Interconnector Development' scenario[14]. In the remaining reasonable scenarios, Option C2 delivered market benefits compared to the base case due, in part, to the ability to share the 500 kV components to Sydenham with VNI West, reducing the cost to deliver VNI West compared to the base case without Option C2. Option B3 did not deliver these market benefits because the cost of delivering VNI West was the same with Option B3 included, as in the base case (there were no shared components).

4.4.2 Step Change scenario

The Step Change scenario is described in the 2022 ISP.

The purpose of an ISP is to determine an optimal development path which identifies investments that meet the future needs of the NEM. The ISP takes a balanced risk-based approach to the NEM's future development, considering a range of scenarios and risks.

The draft 2022 ISP considered four different scenarios for the pace of energy transformation on the path to reach net zero by 2050. Through the consultation process, stakeholders identified the most likely path to be the Step Change scenario, which has a relatively fast transition with renewables generating 83% of NEM energy by 2030-31.

In between publishing the draft 2022 ISP and the final 2022 ISP, momentum towards decarbonisation accelerated, which confirmed the Step Change scenario as a solid foundation for planning future NEM investment. The momentum towards decarbonisation has further accelerated since the publication of the final 2022 ISP with further announcements being made relating to the earlier expected timing for retirement of brown coal-fired and black coal-fired generation.

The Step Change scenario is characterised by rapid consumer-led transformation of the energy sector and co-ordinated economy-wide action towards decarbonisation and forecasts that in such a future:

- the renewable share of total annual generation would rise from approximately 28% in 2020-21 to 83% in 2030-31 (consistent with the Commonwealth Government's policy), to 96% by 2040, and 98% by 2050.

[14] The 'No Interconnector Development' scenario is not required under the current RIT-T Application Guidelines to be considered for the purpose of this analysis.

- 69 gigawatts (**GW**) of distributed solar photovoltaic (**PV**) would deliver about one-third of renewable capacity by 2050, with 54 GW of new capacity increasing the current 15 GW capacity nearly five-fold.
- 141 GW of variable renewable energy (**VRE**) would deliver two-thirds of renewable capacity by 2050, with over 125 GW of new capacity, increasing the current 16 GW capacity almost nine-fold.
- the VRE capacity is best developed in REZs that coordinate network and renewable investment and foster a more holistic approach to regional employment, economic opportunity and community participation.

The inputs and assumptions making up the Step Change scenario are monitored on a regular basis and updated quarterly to include all committed announcements. For example, this analysis has used the most recently available data concerning the proposed timing for retirement of coal generation in the NEM. In particular, the Step Change scenario includes all the changes in market circumstances referred to in Section 5.2.

For modelling purposes, the Step Change scenario characterisation of 'rapid consumer-led transformation of the energy sector and co-ordinated economy-wide action' is translated into a collection of inputs and assumptions that are used to populate AEMO's energy market models. Inputs include:

- Scenario-specific economy-wide emission reduction initiatives to meet Australia's net-zero target.
- Projections of future gas and coal prices.
- Projections of build costs for various generation and storage technologies.
- Forecasts of future demand for electricity.
- Existing power system characteristics.
- Market announced timings of new committed developments or power station retirements.

The inputs associated with the Step Change scenario used in both the 2022 ISP modelling and this analysis are detailed in the 2021 IASR and the Inputs, Assumptions and scenarios workbook published in June 2022.

Once populated with a scenario-specific set of inputs, AEMO's energy market models are run on PLEXOS, a sophisticated, globally accepted, proprietary energy market simulation platform, to determine the optimal infrastructure development, generation dispatch and associated total system costs for each state of the world[15]. These model outcomes are then used to calculate the market benefits as discussed in Sections 6 and 8. The ISP Methodology provides greater detail on AEMO's energy market modelling process and this analysis has been undertaken in a manner consistent with that methodology.

Since the publication of the WRL PACR, the transformation of the NEM has outpaced expectations, with the 2022 ISP highlighting that:

- 40% more VRE is now committed or anticipated to be connected to the *national electricity grid* by 2023-24 than was forecast in the 2020 ISP[16].

[15] The RIT-T Instrument provides that "state of the world" means a reasonable and mutually consistent description of all of the relevant market supply and demand characteristics and conditions that may affect the calculation of market benefits over the period of the assessment. For each reasonable scenario considered, a separate, internally consistent, state of the world must be developed for each *credible option*, and for the base case with no option in place.

[16] AEMO, 2022 ISP, June 2022, p 26, at https://www.aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp.

- 8.4 GW of coal generation plant will retire by 2030, based on announcements by plant owners. This compares to 1.8 GW of coal generation retirements announced to 2030 in the 2019 Electricity Statement of Opportunities[17].
- The Western Victoria REZ has good to excellent quality wind resources, with over 1 GW of existing and committed wind generation. It also noted that the current network is constrained west of Ballarat and unable to support any further connection of renewable generation without transmission augmentation[18].

4.4.3 Renewable energy zones

REZs (in the Victorian context) are areas in Victoria with the greatest potential for renewable energy, such as wind, sunshine, rain, tides, waves and geothermal heat.

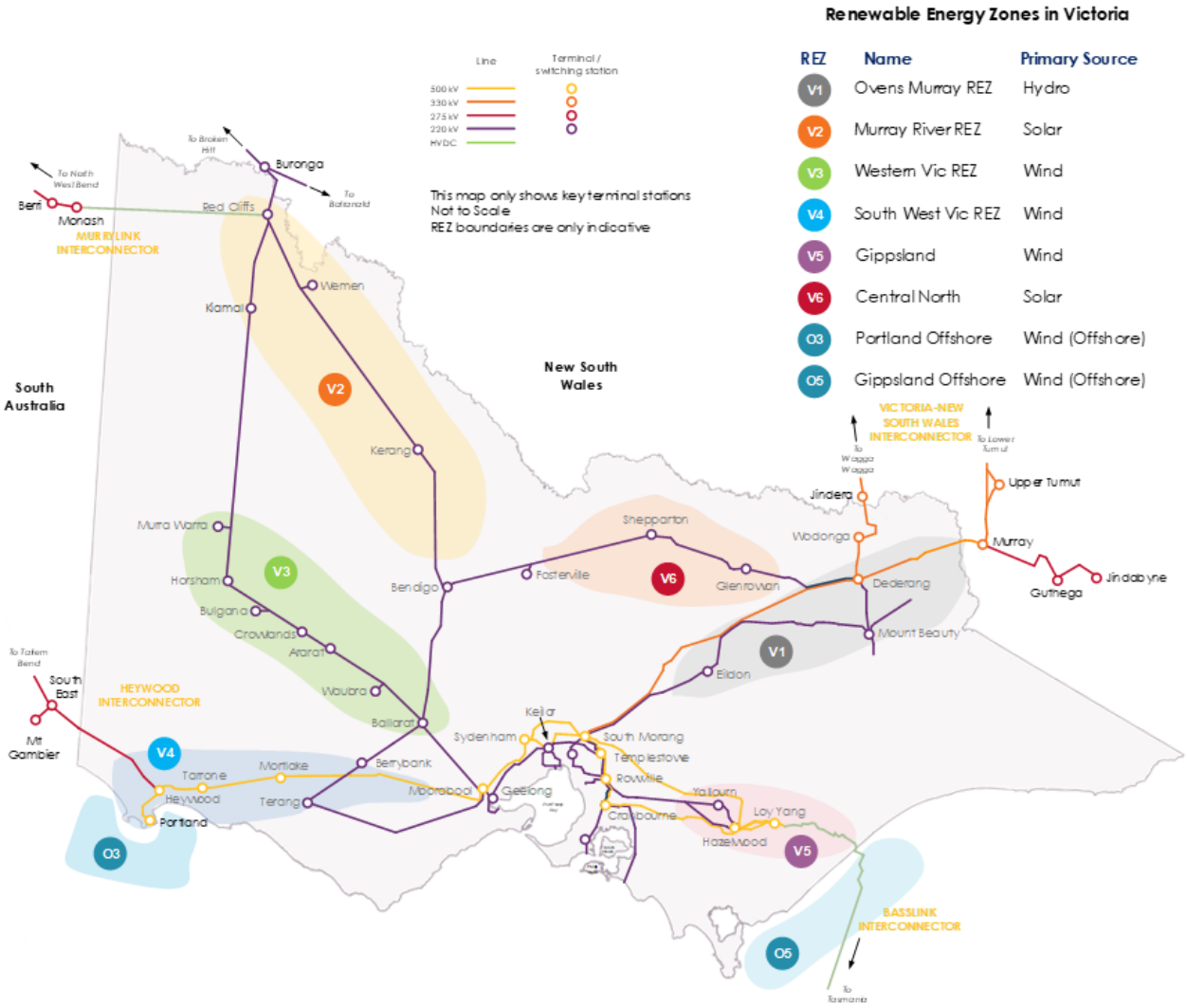
Each NEM *participating jurisdiction* has adopted REZs in various forms with a view to driving the efficient development of renewable generation in high quality wind and solar locations supported by transmission infrastructure that is capable of efficiently delivering this renewable electricity to load centres.

The current Victorian REZs are set out in Figure 3 including the Western Victoria REZ and the Murray River REZ.

[17] See https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/nem_esoo/2019/2019-electricity-statement-of-opportunities.pdf?la=en

[18] AEMO, 2022 ISP Appendix 3, Renewable Energy Zones, June 2022, p 84. Each REZ in the NEM is given an identifying code in the ISP – relevant to this analysis, V3 refers to Western Victoria REZ and V2 is Murray River REZ.

Figure 3 Victorian REZs



5 Material change in circumstances

5.1 Clause 5.16.4(z3)

As set out above, clause 5.16.4(z3) of the NER would require AEMO to re-apply the RIT-T to the WRL Project where (amongst other things) there has been a material change in circumstances which, in AEMO's reasonable opinion, means that the *preferred option* identified in the WRL PACR is no longer the *preferred option*.

5.2 Changes in circumstances

There have been a number of changes in relation to the regulatory landscape and market conditions since the publication of the WRL PACR in 2019. In undertaking this analysis, AEMO has considered these changes, including in particular, the changes in circumstances referred to in Sections 5.2.1 to 5.2.15.

AEMO accepts that each of the issues in Sections 5.2.1 to 5.2.15 are material in the sense they are not trivial matters and they could bear upon whether Option C2 remains the *preferred option*. Consequently, each of these matters have been taken into account in this analysis. As noted, many of the matters identified are assumed by the Step Change scenario which is described in the 2022 ISP and explained in more detail in Section 4.4.2.

5.2.1 Increases in costs compared to the estimates set out in the WRL PACR

The estimated costs of Option C2 and Option B3 have increased by more than 30% as compared to the estimated costs in the WRL PACR and an increase in costs of that magnitude has the potential to affect AEMO's opinion as to whether Option C2 remains the *preferred option.* AEMO has therefore estimated costs for Option C2 and Option B3 as explained in Section 6.2 and Section 1 and has taken those estimated costs for Option C2 and Option B3, into account when determining the net market benefits for Option C2 and Option B3. In respect of Option C2, AEMO has also undertaken a confidential analysis based on the present value costs to Victoria electricity consumers under the contracts with AusNet and TOA.

5.2.2 Changes in the proposed timing for retirement of coal generation in the NEM

There have been changes in the likely timing of coal fired powers station retirements since the WRL PACR was published in July 2019 and these changes have the potential to affect the analysis of the market benefits arising from Option C2 and Option B3. For example, earlier coal closure accelerates the need for additional renewable generation and storage to maintain reliability, and may increase reliance on existing gas generation during the transition.

The accelerated closure of coal fired generation is considered under the Step Change scenario described in Section 4.4.2 above. The current *expected closure years* and *closure dates* are set as the latest dates that AEMO's energy market model could select to close the power stations. In some cases, to meet emission reduction objectives, the model may withdraw them even earlier. By utilising the Step Change scenario (as updated to reflect recently announced dates for the retirement of coal fired generation) when undertaking the energy market modelling, the current *expected closure years* have been factored into the analysis of the forecast gross market benefits for Option C2 and Option B3.

5.2.3 Brown coal generation will substitute for black coal generation

As highlighted above, both brown and black coal power stations are now expected to close earlier than assumed in the WRL PACR. Under the Step Change scenario, all brown coal is forecast to withdraw by 2032. The period of time over which brown coal generation could substitute for black coal generation has therefore shortened considerably compared to that assumed in the WRL PACR and it is reasonable to expect that the benefits associated with brown coal generation substituting for black coal generation would also have reduced considerably. The accelerated closure of coal fired generation is considered under the Step Change scenario and by utilising the Step Change scenario (as updated to reflect recently announced dates for the retirement of coal fired generation) when undertaking the energy market modelling, any reduction in fuel cost savings associated with brown coal generation substituting for black coal generation would be reflected in the analysis of the forecast gross market benefits for both Option C2 and Option B3.

5.2.4 Announcement of NSW Electricity Infrastructure Roadmap in November 2020

The announcement of the NSW Electricity Infrastructure Roadmap by the New South Wales Government in November 2020 has the potential to change the market benefits arising from Option C2 and Option B3 as the development of more transmission, generation, storage and firming infrastructure in New South Wales could reduce the need to import generation from neighbouring regions such as Victoria to maintain reliable supply in New South Wales. The infrastructure planned for New South Wales under the NSW Roadmap is included in the Step Change scenario and by utilising the Step Change scenario when undertaking the energy market modelling, the impact of these developments has been factored into the analysis of the forecast gross market benefits for Option C2 and Option B3.

5.2.5 Commissioning of the Victorian Big Battery in Geelong in December 2021

The Victorian Big Battery (**VBB**) increases the import capacity to Victoria of the VNI by up to 250 MW during peak demand periods. The VBB was commissioned in December 2021 and is therefore now included in all AEMO energy market modelling. As such, the impact of the VBB on VNI import capacity has been factored into the analysis of the forecast gross market benefits for Option C2 and Option B3.

5.2.6 2021 announcement by EnergyAustralia concerning its commitment to building Australia's first four-hour utility scale battery of 350 MW capacity in the Latrobe Valley

EnergyAustralia's Wooreen Energy Storage System is currently an anticipated project[19], as reported in AEMO's 2022 Electricity Statement of Opportunities[20], as it has not yet met all of AEMO's commitment criteria[21]. In accordance with the ISP Methodology, all anticipated projects are assumed to be committed for the purpose of the cost benefit analysis. The Wooreen Energy Storage System is therefore included in the modelling in all 'states of the world', both with and without *credible options*, and its impact has been factored into the analysis of the forecast gross market benefits for Option C2 and Option B3.

[19] 'Anticipated' developments are projects which meet some of AEMO's commitment criteria, but not enough criteria to be considered committed

[20] See https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-reliability/nem-electricity-statement-of-opportunities-esoo

[21] 'Committed' projects meet all five commitment criteria listed under Background Information on AEMO's Generation Information updates, at https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-planning-data/generation-information.

5.2.7 Commencement of Project EnergyConnect

Project EnergyConnect (which involves the construction of a new high voltage electricity interconnector between South Australia and New South Wales with an added connection to Victoria) is currently an anticipated project as it has not yet met all of AEMO's commitment criteria. In accordance with the ISP Methodology, all anticipated projects are assumed to be committed for the purpose of cost benefit analysis. Project EnergyConnect is therefore included in the modelling in all states of the world, both with and without *credible options*, and its impact has been factored into the analysis of the forecast gross market benefits for Option C2 and Option B3.

5.2.8 The consumer led transformation of the NEM

As discussed in Section 4.4.2, the Step Change scenario is specified in the 2022 ISP as a scenario with rapid consumer-led transformation of the energy sector and co-ordinated economy-wide action. It includes:

- a step change in global policy commitments relating to decarbonisation.
- increased digitalisation to help both demand management and grid flexibility.
- an assumption that energy efficiency is as important as electrification.

By utilising the Step Change scenario in this analysis, the impact of a consumer-led transformation on the forecast gross market benefits of both Option C2 and Option B3 has been taken into account.

5.2.9 Changes to overarching government policy assumptions set out in the WRL PACR

There have been significant changes in government policy since the publication of the WRL PACR, including the Commonwealth Government's Net Zero Commitment in Australia's Long Term Emissions Reduction Plan, Powering Australia Plan and the *Climate Change Act 2022.* These policy changes are designed to increase the speed at which the carbon intensity of electricity generation approaches zero and may drive further early coal plant retirements in advance of current announcements. These policy changes also lead to greater electrification as other sectors of the economy seek to decarbonise. Stronger growth in electricity demand, coupled with accelerated closure of coal generation increases the need for significant investment in renewable generation and storage, and the need for transmission to help deliver this supply to the load centres.

The emission policies are closely aligned with the Step Change scenario, which assumes net zero emissions in the NEM well before 2050. By utilising the Step Change scenario in this energy market modelling, the impact of these recent government policies has been factored into the analysis of the forecast gross market benefits of both Option C2 and Option B3.

5.2.10 Benefits for 2034 will extend to the end of asset life, being 2074/75

Under this analysis, the modelling horizon is extended to 2050-51 meaning that the market benefits of both Option C2 and Option B3 are explicitly modelled over that period (in contrast to the approach adopted in the WRL PACR). This has the result that it is not necessary to make assumptions regarding the market benefits of the *credible options* between 2034 and 2050-51.

As noted in the ISP Methodology (that has been adopted and applied for this analysis and the 2022 ISP), beyond the modelling horizon there is an inherent assumption that costs and market benefits are neutral for the remaining economic lives of the *credible options*. Given that the annual market benefits of Option C2 and Option B3 are expected to increase over time, the assumption that costs and market benefits are neutral beyond 2050-51 is

considered as conservative. This also reflects the approach referenced in the current RIT-T Application Guidelines.

5.2.11 VNI-West will proceed

AEMO has assumed in its energy market modelling for this analysis that VNI-West will proceed. This is consistent with the RIT-T Application Guidelines that require a *RIT-T proponent* (in this case AEMO) to include *actionable ISP projects* in all states of the world, consistent with the treatment of committed projects. VNI West is identified as an *actionable ISP project* in the 2022 ISP and is therefore included in this analysis in all states of the world, both with and without the *credible options*.

5.2.12 Options C2 and B3 generation capex benefits are large and identical

The size of the generation capex benefits was an outcome of the modelling, not an assumption, and highlights the avoided or deferred capital costs associated with both Option C2 and Option C3. The harnessing of high quality renewable generation in the Western Victoria REZ is likely to reduce the capital needed to be invested in other forms of generation and storage to meet the same level of supply reliability in the absence of the WRL Project.

In the WRL PACR it was necessary to make a simplifying assumption that the same capital investment in generation and storage would be made irrespective of whether Option C2 or Option B3 became the *preferred option*, as the modelling tools used did not discriminate between the two *credible options* when assessing the generation capacity outlook. The energy market modelling tools have evolved since the WRL PACR, and in this analysis, the generation capex benefits are modelled explicitly for both options and therefore no such assumption is necessary.

5.2.13 Interconnection between states is necessary and a priority

AEMO has, for several years now, reiterated that new interconnection between states is necessary and a priority to maintain reliable and cost-effective supply for Australian electricity consumers during the transition to net zero. This was most recently confirmed in the 2022 ISP, the 2022 Electricity Statement of Opportunities and the 2022 Victorian Annual Planning Report [22].

However, this view is an output of AEMO's modelling, not an assumption, and had no bearing on the WRL PACR calculations except to the extent that VNI West is assumed to be proceeding (as already discussed above).

5.2.14 Fuel cost savings

Fuel cost savings are an output of the modelling, not an input. As already discussed, some of the changes in the market (such as the earlier retirement of coal fired generation and the NSW Roadmap) have the potential to change the quantum of fuel cost savings arising from Option C2 and Option B3. The quantum of fuel costs savings identified by this analysis is the result of the energy market modelling which assumes the Step Change scenario (as updated to reflect recently announced dates for the retirement of coal fired generation).

5.2.15 Change of scenario in ISP

The Step Change scenario reflect a different NEM future than was envisioned in some of the scenarios used for the WRL PACR. It represents a faster transition to net zero than even imagined in the WRL PACR Fast Change

[22] At https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/victorian-planning/victorian-annual-planning-report.

scenario. AEMO's adoption of the Step Change scenario in the 2022 ISP as the most likely scenario to play out was the result of extensive consultation with energy market stakeholders. By using the Step Change scenario in this analysis, AEMO is taking into account relevant market changes that have occurred since the WRL PACR was published.

5.3 Other matters

In respect of the matters listed in this Section 5.3, AEMO does not consider they are material changes for the purposes of this analysis pursuant to clause 5.16.4(z3) of the NER.

5.3.1 Treatment of costs of VNI West Components

The estimated cost of Option C2 in the WRL PACR and under this analysis includes all Option C2 project costs, including costs associated with infrastructure that VNI West may subsequently utilise. This is the correct approach under the RIT-T Instrument and this approach has not changed since the publication of the WRL PACR.

While it is true that, in the absence of VNI West, there would be no benefit in:

- building the overhead line from Sydenham to north of Ballarat at 500kV.
- adding a new terminal station north of Ballarat,

this is not a state of the world considered in either the WRL PACR or this analysis.

As an *actionable ISP project,* VNI West must be included in all states of the world[23]. When calculating the market benefits of any WRL Project *credible option* against a counterfactual that still builds VNI West in the future, any *credible option* that leads to a reduction in the subsequent cost of VNI West would deliver benefits for electricity consumers. These benefits, uniquely arising from Option C2, are identified in both the WRL PACR and this document.

5.3.2 Victorian Government Offshore Wind Policy does not yet satisfy NER clause 5.22.3(b)

The Offshore Wind Policy signalled in the Victorian Government's Offshore Wind Policy Directions Paper[24] released in March 2022, was not modelled in the 2022 ISP (except as a sensitivity) or for the purposes of this analysis. As detailed in the 2021 IASR, AEMO applies the 'public policy clause' set out in clause 5.22.3(b) of the NER when determining whether a policy is included in scenarios.

Clause 5.22.3(b) of the NER states that in determining *power system needs*, as it relates to a *NEM participating jurisdiction*, AEMO may consider a current environmental or energy policy of that *participating jurisdiction* where that policy has been sufficiently developed to enable AEMO to identify the impacts of it on the *power system* and at least one of the following is satisfied:

- a commitment has been made in an intergovernmental agreement to implement that policy.
- that policy has been enacted in legislation.

[23] The RIT-T Instrument provides that an *actionable ISP project* must form part of all states of the world unless (a) the *actionable ISP project* is for the RIT–T being undertaken and must be excluded from each 'base case' state of the world or (b) the RIT–T is for a project other than an *actionable ISP project* and the level of analysis required to include the *actionable ISP project* is disproportionate to the scale and likely impact of each of the *credible options* being considered.

[24] Victorian Government. Victorian Offshore Wind Policy Directions Paper, at https:\\www.energy.vic.gov.au\renewable-energy\offshore\wind.

- there is a *regulatory obligation* in relation to that policy.
- there is material funding allocated to that policy in a budget of the relevant *participating jurisdiction*.
- the Energy Ministers Meeting[25] has advised AEMO to incorporate the policy.

At this stage, none of the criteria listed in clause 5.22.3(b) of the NER have been satisfied in relation to the Victorian Government's Offshore Wind Policy and therefore the policy is not regarded as a material change and has not been modelled for the purposes of this analysis.

5.3.3 No redefinition of VNI West has occurred

The Alliance has asserted that AEMO has redefined the proposed transmission link comprising a Victoria – New South Wales Interconnector (via Kerang) also referred to as KerangLink and which is now known as VNI West. This is not correct.

In the VNI West PADR, the VNI West option is assumed to connect to the WRL Project at the anticipated new terminal station north of Ballarat. From there it shares the same 500 kV double circuit transmission lines from Sydenham to North Ballarat that the WRL Project will use to connect to the existing high voltage lines in the Victorian network (see Figure 2).

While VNI West is included in all states of the world, VNI West is assumed to connect into a terminal station north of Ballarat in the state of the world with Option C2 and into Sydenham terminal station in all other states of the world. This change in connection point in different states of the world is necessary to ensure that VNI West can connect into the Victorian 500kV network and deliver to major load centres in Victoria in all states of the world, thereby meeting the VNI West *identified need*. AEMO considers that this approach is appropriate to ensure that all states of the world are reasonable and internally consistent[26] and does not consider this approach to be a redefinition of VNI West.

This sharing of the 500 kV double circuit transmission lines from Sydenham to North Ballarat is not a change in scope. It is in fact the basis for the “Differences in the timing of transmission investment” benefit captured in the *preferred option* (Option C2) in the original WRL PACR.

The SnowyLink South Project from the 2018 ISP (shown in Figure 42 of the 2018 ISP) is well-aligned with the latest design of VNI West. The project was renamed between the 2018 ISP and 2020 ISP but remains the same project.

[25] Formerly known as the Ministerial Council on Energy.

[26] The AER RIT-T Application Guidelines state that a state of the world should be internally consistent in that all aspects of the state of the world could reasonably coexist (see page 31)

6 Analysis methodology

6.1 Overview of cost benefit analysis

As explained in Section 5, AEMO has concluded that there have been material changes in circumstances for the purposes of clause 5.16.4(z3) of the NER. Therefore, it falls to be considered whether those changes, in AEMO's opinion, mean that Option C2 is no longer the *preferred option*.

The *preferred option* is the *credible option* that maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the *market*. Therefore AEMO needs to consider whether the changes outlined in Section 5, in AEMO's opinion, mean that Option C2 is no longer the *credible option* that maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the *market*.

In considering this question, AEMO has undertaken a cost-benefit analysis that takes into consideration all of the material changes that have occurred since the WRL PACR was published. The methodology of that analysis is explained in this section.

6.2 Cost analysis methodology

6.2.1 Overview

To assess the relative estimated costs of Option C2 and Option B3, AEMO:

- estimated the capital cost for Option B3 utilising the Transmission Cost Database (**TCD**) cost estimation mechanisms (the intended purpose and operation of the TCD is explained in more detail in Section 6.2.2).
- used the TCD cost estimation mechanisms to also determine, on a consistent basis and using the same base cost data and assumptions, an estimated capital cost for Option C2 for the purposes of this analysis (given that the terms of the AusNet and TOA contracts are confidential and cannot be disclosed in this document).
- determined the present value cost using the TCD cost estimates for Option C2 and Option B3 and the 'build-up process' described in Section 7.4.
- undertook a sensitivity analysis using the Alliance's own TCD capital cost estimates and what was described as 'industry benchmark' costings for both Option C2 and Option B3 and applying the same 'build-up' process as is described in Section 7.4.
- undertook a confidential analysis in relation to Option C2 using the actual present value costs to Victorian electricity consumers of the AusNet and TOA contracts, which is essentially the same as the present value of the combined capital cost and operating cost estimates derived from the build-up process described in Section 7.5.

6.2.2 Transmission Cost Database

The TCD was developed by AEMO as part of the new ISP framework that came into effect with the commencement of the *National Electricity Amendment (Integrated System Planning) Rule 2020* on 1 July 2020.

The TCD was developed to address stakeholder recommendations relating to the accuracy and transparency of transmission costs within the ISP and to establish a framework to provide a transparent and standardised approach to generate early-stage cost estimates for electricity transmission network infrastructure major projects.

AEMO engaged GHD as an expert independent consultant to create the TCD, and collaborated with industry stakeholders, TNSPs and the AER during its design and construction[27].

The TCD is comprised of a Cost and Risk Data workbook containing the fundamental components used to compile a project cost estimate, and a cost estimation tool with an interactive 'Dashboard' containing algorithms that process the user inputs and selection choices.

The TCD generates Class 5b/5a estimates, using the Association for Advancement of Cost Engineering international classification system to define the level of accuracy of a cost estimate.

AEMO considers that the TCD is the most appropriate available method to determine the estimated capital cost for Option B3 given the level of detail concerning the scope of works for Option B3 that was included in the WRL PACR (i.e. the same level of detail concerning the scope of works for Option B3 included in the WRL PACR applies to this analysis because the scope of works for Option B3 has not been further developed since Option C2 was identified as the *preferred option* in the WRL PACR).

6.3 Market benefit methodology

6.3.1 Summary of principles

The analysis has been undertaken using the principles set out in the current 2020 RIT-T Instrument and RIT-T Application Guidelines. Amongst other things, the analysis used:

- inputs and assumptions from the 2022 ISP and the most recent IASR based on the 2022 ISP Step Change scenario.
- a market modelling approach based on the ISP Methodology and undertaken for the period from 2024 to 2051.
- the calculation of discounted total system costs of each state of the world to calculate the net market benefits of the *credible options* consistent with the 2020 RIT-T Application Guidelines and using the same discount rate as used in the 2022 ISP.

These factors are explained further below.

6.3.2 Inputs and assumptions based on the 2022 ISP Step Change

The analysis has been undertaken using the Step Change scenario described in the 2022 ISP and the 2021 IASR.

As noted in Section 4.4.2, the 2022 ISP Step Change scenario represents rapid consumer-led transformation of the energy sector, and co-ordinated economy-wide action that efficiently and effectively tackles the challenge of rapidly lowering emissions.

It includes all of the changes in market circumstances referred to in Section 5.2 and the inputs and assumptions in relation to the Step Change scenario are monitored and updated on a regular basis. The modelling data inputs

[27] See https://aemo.com.au/en/consultations/current-and-closed-consultations/transmission-costs-for-the-2022-integrated-system-plan.

used in this analysis are detailed in the Inputs and Assumptions Workbook released with the 2022 ISP[28] and the August 2022 Generation Information page[29].

6.3.3 Market modelling approach based on the ISP Methodology

The ISP Methodology details the approach used for the cost benefit analysis which underpins the development of the 'optimal development path' that promotes the efficient development of the power system, based on a quantitative assessment of the costs and benefits of various options across a range of scenarios.

The August 2020 RIT-T Instrument[30] allows *RIT-T proponents* to adopt market development modelling from the ISP, insofar as practicable. If a RIT-T application is not exploring an *actionable ISP project* it does not need to undertake this level of market modelling. However, the RIT-T Instrument encourages the use of AEMO's market modelling approaches documented in the AEMO ISP Methodology when assessing the market benefits of *credible options*. AEMO has used this market modelling approach for the purpose of this analysis.

Under the August 2020 RIT-T Instrument, the market benefits of a *credible option* (in this case Option C2 and Option B3) are the present value benefits calculated by comparing, for each relevant scenario, the state of the world with the *credible option* in place versus the state of the world (in the '**counterfactual base case'**) without any *credible option* in place.

The capacity outlook model described in the ISP Methodology[31] was used to develop projected *generation* expansion, *transmission* expansion and *generation* retirement (in combination, the '**expansion plan**'), and *dispatch* outcomes in:

- the state of the world in the counterfactual (i.e. without either WRL PACR *credible option*).
- the state of the world with Option C2 included.
- the state of the world with Option B3 included.

Take-one-out-at-a-time (TooT) analysis approach

This analysis also used the 'take-one-out-at-a-time' analysis approach detailed in the ISP Methodology and as summarised below.

Starting with the 2022 ISP Step Change scenario optimal development path, the capability of the *transmission network* to transfer power from REZs to load centres was adjusted based on:

- The WRL PACR *credible options* (either Option C2 or Option B3) and for the state of the world without either *credible option* (ie the counterfactual base case).
- For REZs not affected by the WRL PACR *credible options* or VNI West, the REZ network development was optimised as normal (that is, REZ transmission limits for the remaining REZs in Victoria and the rest of the NEM can be increased when it is found economically optimal under the modelling).

[28] See https://aemo.com.au/-/media/files/major-publications/isp/2022/2022-documents/inputs-assumptions-and-scenarios-workbook.xlsx?la=en.

[29] See https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/generation_information/2022/nem-generation-information-august-2022.xlsx?la=en.

[30] See https://www.aer.gov.au/system/files/AER%20-%20Regulatory%20investment%20test%20for%20transmission%20-%2025%20August%202020.pdf.

[31] This model is a 'least cost model' that seeks to minimise capital expenditure and operational costs over the long-term outlook while achieving the objectives (social, political, and economic) detailed under the scenario assumptions (in this case the 2022 ISP Step Change scenario).

- All other major *transmission augmentations* (whether committed, anticipated, *actionable ISP projects* or *future ISP projects*) such as interconnector developments remain as stated by the 2022 ISP Step Change optimal development path in all states of the world
- No other non-ISP *transmission* developments were introduced.
- The energy market model was then used to identify the expansion plan and calculate the total system cost (net present value) for:
  - the 'base case' with no WRL PACR *credible option* (A); and
  - the state of the world with a WRL PACR *credible option* in place (B).

In line with the actionable ISP framework, this analysis included the actionable VNI West Project in all states of the world (in the base case and in the state of the world with the WRL PACR *credible options* assessed). However, to continue to meet the *identified need* of VNI West, it was necessary to modify the *connection point* for this project into the Victorian *declared shared network* in states of the world without Option C2 so that generation connecting into VNI West can access the major Victorian load centres (see Section 4.4.1 for more detail).

6.3.4 Calculation of discounted total system costs

The calculation of the net market benefit first requires the calculation of the present value of total system cost in each state of the world, that is, the direct costs associated with building and operating generation, storage and transmission (excluding the transmission element the subject of the RIT-T) across the NEM between 2023-24 and 2050-51.

As detailed in the ISP Methodology, capital investment in generation, storage and transmission infrastructure is converted into an equivalent annual annuity which represents the value of the investment as a series of equal cash flows over the lifespan of the investment. This allows like-for-like comparison on assets with different economic lives and different commissioning dates.

The total system cost of a state of the world development path represents the present value of annual costs accrued in the NEM during the modelling horizon, where the year on year annual cost is the sum of all generation, storage and transmission-equivalent annual annuities, variable and fixed operating and maintenance costs, and fuel costs associated with generating electricity.

The economic life of generation, storage, and transmission assets, their weighted average cost of capital (**WACC**) and the discount rate assumptions used to determine the equivalent annual annuity and the present value in this analysis, have been based on the 2022 ISP assumptions.

Classes of market benefits that can be considered

The allowable classes of market benefits as described in the RIT-T Rules, RIT-T Instrument and RIT-T Application Guidelines (see Section 2.2) and included in this analysis were:

- Benefits related to the development and operating costs of generation and storage assets, that is:
  - Changes in fuel consumption arising through different patterns of generation dispatch or different mixes of generation and storage.
  - Changes in capital costs due to differences in timing of new generation and storage.

  - Differences in variable operating and maintenance (**VOM**) costs and fixed operating and maintenance (**FOM**) costs.

- Benefits related to the deferral or avoidance of development and operating costs of transmission assets resulting from differences in the timing of transmission related expenditure, including:
  - other infrastructure not addressing the WRL Project *identified need*[32], such as VNI West.
  - Victorian and/or other State REZ developments (that is, where, in the absence of the WRL Project, the transmission infrastructure servicing locations other than the Western Victoria REZ needs to be expanded because the generation from the Western Victoria REZ does not eventuate due to the lack of *transmission network power transfer capability* within and from the Western Victoria REZ to load centres).
- Costs associated with demand reduction:
  - Changes in voluntary load curtailment through demand side participation (**DSP**).
  - Changes in involuntary load shedding costs, through "unserved energy" **(USE),** valued at the value of customer reliability.

For each WRL PACR *credible option*, these classes of market benefits have been calculated as the difference between the present value of the relevant cost in the state of the world which includes the *credible option* and the state of the world in the counterfactual base case which does not include either *credible option*.

6.3.5 Calculation of gross and net market benefits

The gross market benefits of each *credible option* were calculated by comparing the present value of total system costs in the state of the world with and without the *credible option*. The net market benefits of each *credible option* were calculated by deducting the present value costs of the *credible option* from the gross market benefits.

[32] In accordance with Appendix A.5 Timing of transmission investment, August 2020 RIT-T Application Guidelines, this is an appropriate class of benefit to take into account

7 Analysis of costs of each option

7.1 Introduction

This section sets out the estimated costs for both Option C2 and Option B3, determined by AEMO using the TCD and the alternative cost estimates provided by the Alliance. As noted in Section 5.2.1, the estimated costs of both Option C2 and Option B3 determined by AEMO using the TCD cost estimation mechanisms have increased by more than 30% as compared to the estimated costs in the WRL PACR. However, that level of cost increase does not by itself lead to a conclusion that Option C2 is no longer the *preferred option*.

7.2 AEMO determined costs for Option C2 and Option B3

The TCD cost outputs for Option C2 and Option B3 as determined by AEMO are shown in Table 3 below. The TCD cost outputs reflect the scope of Option C2 and Option B3 detailed in the WRL PACR, excluding the minor augmentations described in the WRL PACR (and in Table 1) which were completed in 2021 and are now sunk costs.

Table 3 TCD outputs for Option C2 and Option B3 – $ million (2021)

	Option C2	Option B3
1. Baseline Cost	532	364
2. Adjusted Baseline Cost	556	380
3. Known Risk Allowance	29	16
4. Unknown Risk Allowance	98	68
5. Total Indirect Cost	55	46
6. Total Expected Project Capital Cost	737	510

Set out below is an explanation for each row of Table 3:

- The Baseline Cost is based on the building block costs in the TCD (e.g. transformer cost).
- The Adjusted Baseline Cost are the Baseline Costs adjusted based on the specific characteristics or attributes of the network elements as selected by the user of the TCD (e.g. jurisdiction, land use, terrain).
- The Known Risk Allowance (where risks are identified but the ultimate value of the risk is not known) is added to the Adjusted Baseline Cost to match the project risk exposure as considered by the user for each network element (e.g. project complexity, outage restrictions).
- The Unknown Risk Allowance (where the risk has not been identified but industry experience shows that in the course of major projects these can occur) is added to the Adjusted Baseline Cost to adjust for the accuracy offset commensurate with early stage costs recently observed in NEM transmission project estimates (e.g. productivity and labour cost risks).
- Indirect Costs are added to the sum of all network element cost estimates (inclusive of their respective project attribute and risk adjustment factors). Indirect costs represent the internal costs to identify the need for the

project, preliminary investigations, option analysis, project development, procurement, contract management, administration and insurance.

- Total Expected Project Capital Cost = Adjusted Baseline Cost + Known Risk Allowance + Unknown Risk Allowance + Total Indirect Cost.

AEMO has assumed for the purpose of this TCD cost calculation that Option B3 has some components that could be considered to fall within the brownfield classification and some components that fall within the greenfield classification. AEMO's technical assessment is that some widening of existing easements and the acquisition of some additional easements would be required for Option B3. In addition, construction of Option B3 would require significant outages to the existing infrastructure which will result in additional costs.

All of these factors have been taken into account in determining the AEMO TCD cost estimate for Option B3.

The 'minor augmentations' referenced in Table 1 above form part of both Option C2 and Option B3 in the WRL PACR. Both the Option C2 and Option B3 costs in the WRL PACR included the estimated capital cost and present value costs for the 'minor augmentations'. The minor augmentations were completed in 2021 and are now sunk costs. Therefore, these costs have not been included within the TCD estimated costs for Option C2 or Option B3. The impact of the completion of the minor works has also been taken into account when assessing the market benefits for both Option C2 and Option B3.

For Option C2, the 500 kV overhead lines are recognised as a higher complexity in the 'project complexity' Known Risk Allowance referred to in Table 3 above, compared to 'business as usual' risk for the 220 kV overhead lines in Option B3.

The outputs accord with AEMO's experience over the last 3 years that the cost of transmission works generally (including 220kV works and 500kV works) have increased

7.3 Alliance derived TCD cost output and industry benchmark costs

The Alliance has also nominated TCD cost estimates for Option C2 and Option B3 and what was described as 'industry benchmark' costs for Option C2 and Option B3. The Alliance's cost estimates for Option C2 and Option B3 are set out in Table 4 below.

Table 4 Alliance estimated capital costs – $ million (2020)

Source	Option C2	Option B3
Alliance TCD cost (2020$)	745	453
Alliance 'industry benchmark' cost (2020$)	648	322

The TCD costs stated by the Alliance do not contain any detail concerning the derivation of those costs using the TCD. In particular, the Alliance TCD costs have not been broken down into the various components that make up the 'Total Expected Project Capital Costs' referenced in Table 3 above. It appears that the minor augmentation sunk costs have been deducted from the Alliance's estimated TCD costs for both Option C2 and Option B3.

AEMO requested further information concerning the manner in which both the Alliance TCD costs and 'industry benchmark' costs were derived, but as at the date of this document no further information has been provided.

The Alliance TCD cost estimate for Option C2 is broadly consistent with the AEMO TCD cost estimate. However, the Alliance TCD cost estimate for Option B3 is more than $50 million lower than the AEMO TCD cost estimate for Option B3. The Alliances' 'industry benchmark' estimate for Option B3 is considered unrealistic given that it is approximately $12 million less than the estimate for Option B3 in the WRL PACR, in circumstances where market costs for transmission infrastructure projects have materially increased since the estimated capital cost for Option B3 was determined for the WRL PACR. As the Alliance has not provided any details regarding the basis of this estimate, AEMO is not able to comment more specifically on how it was arrived at.

7.4 Resultant costs used in the net market benefit analysis

The starting point for the capital cost estimates for Option C2 and Option B3 is the AEMO TCD cost estimates shown in Table 5. However, the TCD costs does not include financing costs. To be consistent with the usual outcome under the Victorian procurement model for transmission augmentations (where annual transmission charges do not commence to be paid until practical completion), AEMO has added an estimate of the interest during construction (**IDC**) to the TCD cost estimates for Option C2 and Option B3. The combination, including IDC, is the 'capital cost' for the purposes of this analysis.

Finally, the AEMO TCD capital cost estimate for Option C2 has been reduced by an amount equal to the estimated cost of the works relating to Option C2 that have already been completed (that is, the Option C2 sunk costs). Due to the commercial in confidence nature of the contracted works, the estimation of sunk costs was developed based on the estimated spend profile of early works (that is, project initiation, stakeholder engagement, land-use planning, detailed engineering design and cost estimation) for similar projects. These sunk costs would now need to be paid in all states of the world and therefore no longer influence the selection of the *preferred option*. Deducting these sunk costs from Option C2, reflects the future costs consumers would need to pay if this option were to remain the *preferred option* following a reapplication of the RIT-T. This reflects usual accounting practice.

The resultant capital costs were then converted to an equivalent annual annuity, to compare with the annual market benefits over the modelling period from 2023-24 to 2050-51, using a WACC of 5.5% (real pre-tax) and an asset life of 50 years, consistent with the most recent IASR.

The current RIT-T Instrument requires that the *RIT-T proponent* must adopt the discount rate from the most recent ISP unless it provides demonstrable reasons why a variation is necessary. If the discount rate is varied from the ISP, then the *RIT-T proponent* must still use a commercial discount rate appropriate for the analysis of a private enterprise investment in the electricity sector.

The operating costs of Option C2 and Option B3 were calculated as 1% of the underlying capital cost (that is, the TCD cost prior to adding interest during construction or deducting sunk costs) per annum, as per the latest IASR.

The present value cost is the present value of the annualised capital cost (including the IDC but less the Option C2 sunk costs in the case of the Option C2) and the annual operating cost discounted over the modelling period from 2023-24 and 2050-51, using the discount rate of 5.5% (real pre-tax).

Table 5 below sets out the various cost components for Option C2 and Option B3.

Table 5 Option C2 and Option B3 cost estimates (2021$)

Option	TCD cost estimate ($million)	Capital cost with IDC ($million)	Capital cost with IDC and less sunk costs ($million)	Equivalent annuity ($million/year)	Operating costs $million/year	Present value costs ($million) – 25-year modelling period
Option C2	737	789	742	44	7	525
Option B3	510	546	546	32	5	356

7.5 Alliance present value cost for sensitivity analysis

The Alliance cost estimates for Option C2 and Option B3 are listed in Table 4 above. These were both noted to be in 2020 dollars.

The resultant present value costs used in the sensitivity analysis were developed using the same approach and assumptions as have been applied to the AEMO TCD cost estimates in this analysis, with an additional step of first escalating to 2021 dollars. That is:

- The capital costs have been escalated to 2021 dollars.
- The IDC has been added to both sets of estimates, and the Option C2 sunk costs removed from the Option C2 estimates.
- The resultant costs were converted to an equivalent annual annuity using a discount rate of 5.5% (real pre-tax), and an asset life of 50 years.
- The operating costs were calculated as 1% of the 2021 capital cost referred to in the first point.

The present value cost for Option C2 and Option B3 using the Alliance cost estimates and the associated build up referred to above is shown in Table 6 below.

Table 6 Alliance cost estimate details ($2021)

Option	Base cost estimate ($million) - $2021	Capital cost escalated and with IDC ($million)	Capital cost with IDC and less sunk costs ($million)	Equivalent annuity ($million/year)	Operating costs $million/year	Present value costs ($million) – 25-year modelling period
Option C2 - Alliance TCD	773	827	780	46	8	552
Option C2 – Alliance 'industry benchmark'	673	720	673	40	7	477
Option B3 - Alliance TCD	470	503	503	30	5	328
Option B3 – Alliance 'industry benchmark'	335	358	358	21	3	234

7.6 Use of TCD to derive cost estimate for additional components of VNI West

The TCD was also used to develop cost estimates for the additional components of VNI West required in states of the world without Option C2. Under a state of the world without Option C2, VNI West would need to connect into Sydenham in order to meet the VNI West *identified need* (as described in Section 4.4.1).

Table 7 describes these additional components and shows the estimated additional costs for these components. The costs are in addition to the $3.265 billion estimated cost of VNI West detailed in the VNI West PADR and would only be incurred if Option C2 was not built.

Table 7 VNI West without Option C2 – TCD cost estimates

VNI West	Additional components	TCD additional cost estimate ($ million 2021)
VNI West additional cost (in all states of the world without Option C2)	• Construction of new North Ballarat Terminal Station, with 2 x 1,000 MVA 500/220 kV transformers. • Connect North Ballarat Terminal Station to existing Ballarat to Bendigo 220 kV single circuit transmission line. • Construction of new 500 kV double circuit transmission line from Sydenham to North Ballarat, with 50 MVAr reactors on each end of each circuit.	473

8 Analysis of market benefits

8.1 Changes in circumstances impacting market benefits

As discussed in Section 5, there have been numerous changes in circumstances in relation to the NEM since the publication of the WRL PACR in July 2019. This analysis has taken into account these changes in circumstances including by using the Step Change scenario described in the 2022 ISP and the 2021 IASR (updated where appropriate to reflect latest industry commitments) for the purpose of modelling the market benefits for both Option C2 and Option B3. Key changes in circumstances and the manner in which these changes in circumstances are reflected in the Step Change scenario are explained in Section 5.2.

8.2 REZ transmission limits

REZ transmission limits represent the maximum generation that can be dispatched at any point in time within a REZ, reflecting the transfer capability of the shared transmission network and taking into account any local load.

The REZ transmission limits determined in the case of Option B3 and Option C2 for each relevant Victorian REZ are a key input driving the benefits of those options, because that input indicates how much additional renewable generation can be harnessed through the development of each option.

AEMO completed network studies using PSS®E (a globally accepted power transmission simulation and analysis tool) to assess the impact of the options on REZ transmission limits.

Table 8 below shows the estimated increases in REZ transmission limits for each of Option C2 and Option B3 and for VNI West that are inputs to the energy market model. The REZ transmission limit increases for VNI West are in addition to those shown for Option C2 or Option B3.

Table 8 REZ transmission limit increases (MW)

Option	Western Victoria REZ	Murray River REZ
Option B3	520	0
Option C2	600	0
VNI West	550*	1,600

* The 550 MW increase in the Western Victoria REZ transmission limits in the case of VNI West is in addition to the 520 MW increase under option B3, or the 600 MW increase under option C2.

8.3 Identified need remains

The *identified need* underpinning the WRL Project is unchanged, because:

- the Western Victorian REZ continues to be classified as a high-quality wind resource location.
- the need for VRE investment in Victoria continues to increase.
- generation continues to be constrained in the Western Victorian REZ, without the WRL Project.

AEMO's 2022 Victorian Annual Planning Report, published on 28 October 2022, further confirms that thermal constraints continue to bind in the Western Vic REZ, as demonstrated in Table 9 below.

Table 9 Thermal constraints binding in Western Victorian REZ

Network constraint	Binding hours 2019-20	Binding hours 2020-21	Binding hours 2021-22
Waubra – Ballarat 220 kV thermal constraint	94	203	197
Ararat – Waubra 220 kV thermal constraint	-	148	234

Option C2 has been modelled as commissioned from 1 July 2026, which is consistent with the latest public advice from AusNet. Option B3 has been modelled as commissioned from 1 July 2027. The additional year delay for Option B3 reflects the minimum additional time that would be required to re-start the project process at this point.

8.4 Gross market benefits of the credible options

The breakdown of the Option C2 and Option B3 gross market benefits is shown in Table 10. These represent the gross market benefits (total system cost savings) attributed to the WRL Project alone, assuming that VNI West is committed in the base case:

- With Option B3 (and in the base case), VNI West connects at the Sydenham terminal station (so includes the cost of the Sydenham to North Ballarat component).
- With Option C2, VNI West connects at North Ballarat and is therefore lower cost, as the component from Sydenham to North Ballarat is included as part of Option C2.

Table 10 Option C2 and Option B3 gross market benefit details – net present value of annual benefits to 2050-51 ($ million)

Class of market benefit (all present value)	Option C2	Option B3
Generator and storage capital deferral	140	121
FOM cost savings	93	87
Fuel cost savings	22	20
VOM cost savings	5	5
USE + DSP reductions	55	46
Network investment – REZ	154	138
Other network investment cost savings	242	0
Gross market benefits	712	418

The analysis shows that Option C2 is estimated to deliver gross market benefits of $712 million (in present value terms) under the Step Change scenario, with:

- The largest source of gross market benefits arising from reduced network investment costs relating to the reduced cost of developing VNI West by July 2031 after Option C2 is built. This makes up 34% of the gross market benefits.
- Avoided and deferred capital investment in generation and storage (including FOM costs) being the next largest source of benefits, together making up 33% of the gross market benefits:

  - These benefits arise from the deferral of additional capital investment in wind in New South Wales (in excess of amounts required to meet New South Wales policy objectives) and South Australia up to the late 2030s.
  - From the mid-2030s, there is also deferral of solar generation, mainly in New South Wales and Victoria (Central North Victoria REZ and Gippsland REZ), and large-scale storage, mainly in Queensland and South Australia.
  - Renewable generation can be harnessed more efficiently and from higher quality resources with Option C2 developed, and transported more efficiently to Victorian load centres.

- Avoided and deferred capital investment in REZ network augmentation required to harness renewable generation in these alternate REZs being the third largest source of benefits, making up 22% of the gross market benefits.
- Fuel costs, VOM and USE and DSP savings being relatively minor at 12%.

The analysis shows that Option B3 will deliver gross market benefits of $418 million (in present value terms) under the Step Change scenario with:

- Avoided and deferred capital investment in generation and storage (including FOM costs) the largest source of benefits, together making up 50% of the gross market benefits.
- Avoided and deferred capital investment in REZ network augmentation being the next largest source of benefits, making up 33% of the gross market benefits.
- Fuel costs, VOM and USE and DSP savings being relatively minor.

9 Conclusion from analysis

9.1 Option C2 continues to deliver the greatest net market benefits

For each of Option C2 and Option B3, the net market benefits are calculated as the gross market benefits less the present value costs of the *credible option*. Table 11 shows the net market benefits for Option C2 and Option B3 under the 2022 ISP Step Change scenario.

Table 11 Summary net market benefits – net present value of annual costs and benefits to 2050-51 ($million)

	Gross market benefits	Present value cost	Net market benefits
Option C2	712	525	186
Option B3	418	356	61

This analysis confirms that Option C2 continues to be the *preferred option* as compared to Option B3.

Option C2 is estimated to deliver net market benefits of approximately $186 million (in present value terms), by relieving constraints on existing and committed generation in the Western Victoria REZ, reducing the need for additional generation elsewhere in the NEM and reducing the need for the associated transmission to facilitate that generation.

As discussed in Section 7.6 and 8.4, Option C2 also reduces the combined cost of the WRL Project and VNI West.

9.2 Changes in net market benefits compared to the original RIT-T

The forecast gross and net market benefits from the WRL PACR (excluding costs and benefits of the minor augmentations), as compared with the forecast gross and net market benefits determined under this analysis, are set out in Table 12. For the purpose of comparison, the benefits and costs reported in the WRL PACR have been escalated from $2019 dollars to $2021 dollars.

Table 12 Comparison of WRL PACR and updated market benefits – NPV $ million

Class of market benefit	Option C2			Option B3		
	WRL PACR 2019 $	WRL PACR 2021 $	This analysis 2021 $	WRL PACR 2019 $	WRL PACR 2021$	This analysis 2021 $
Capital + FOM	284	330	234	284	330	209
Fuel + VOM	289	336	27	244	284	25
USE + DSP	0	0	55	0	0	46
Network investment - REZ	0	0	154	0	0	138
Other Network Investment	92	107	242	0	0	0
Gross market benefits	665	773	712	528	614	418
Option cost (present value)	364	422	525	282	326	356
Net market benefits	301	351	186	247	288	61

Overall, the gross market benefits are lower under this analysis (when compared on the same $2021 basis with the gross market benefits under the WRL PACR), but the difference between the net market benefits for Option C2 and Option B3 has increased.

- The base case without Options C2 or Option B3 now takes into account the impact of the minor augmentations considered as part of the *preferred option* in the WRL PACR. The power system benefits of these augmentations have been greater than estimated in the WRL PACR. This means that the current base case has more access to Western Victoria REZ generation than projected in the WRL PACR base case, reducing the incremental benefits of both *credible options*.
- Fuel cost savings have significantly decreased with the earlier retirement of coal generation and more low cost renewable generation in the base case.
- For the same reason, deferred REZ network investment costs have increased (from zero in the WRL PACR) because there is significantly more renewable generation needing to be built to replace the retired coal generation, and this requires expansion of existing REZ's across the NEM to facilitate that generation. Access to Western Victorian REZ wind resource enables deferral of generation build and associated REZ transmission build in other REZs. This increase in REZ transmission capacity has been accelerated by the ongoing and rapid increase in renewable generation developments as well as the need for renewable generation developments resulting from the earlier than expected retirement of coal fired generation.
- The savings in network investment associated with Option C2 have increased with the expected increase in the cost of the network elements between Sydenham and North Ballarat that would otherwise need to be built to meet the VNI West *identified need*.

9.3 Option C2 internal analysis using details from contracts

AEMO's internal analysis using the present value of the actual forecast costs to Victorian electricity consumers under the contracts for the WRL Project results in a present value cost for Option C2 which is broadly consistent with the present value cost for Option C2 determined using the TCD cost estimation mechanism and the associated build up process referred to in Section 7.4. AEMO's confidential analysis of the present value of the actual forecast costs to Victorian electricity consumers under the contracts for the WRL Project produces an assessment of net market benefits which is not materially different to AEMO's conclusion, utilising the TCD cost estimate, that Option C2 for the WRL Project has a net market benefit of $186 million. It follows that the outcome from this analysis, being that Option C2 continues to be the *preferred option,* is the same if the present value of the actual forecast costs to Victorian electricity consumers under the contracts is used to determine the net market benefit.

9.4 Cost sensitivities

AEMO has also undertaken an analysis of how low the capital cost (including IDC) of Option B3 would need to be in order for Option C2 to no longer be the *preferred option*. With an AEMO TCD cost estimate (including IDC) for Option C2 of $789 million and after deducting the estimated sunk costs for the early works already undertaken in relation to progressing Option C2 from this $789 million amount, the Option B3 capital cost (including IDC) would need to be less than $354 million for it to be the *preferred option* given the gross market benefits for Option C2

and Option B3 that have been determined under this analysis. This would increase the net market benefits of Option B3 by $125 million which is the difference between the forecast net market benefits of Option C2 and Option B3.

This outcome is summarised in Table 13 below.

Table 13 Option B3 – capital cost threshold to be preferred option

Option	TCD cost estimate ($million)	Capital cost with IDC ($million)	Equivalent annuity ($million/year)	Operating costs $million/year	Present value costs ($million) – 25-year modelling period
TCD estimate Option B3	510	546	32	5	356
Threshold estimate Option B3	331	**354**	21	3	231
Difference	179	192	11	2	**125**

In addition, AEMO has assessed the net market benefits for Option C2 and Option B3 that would apply if the Alliance cost estimates were used rather than the AEMO TCD cost estimates. Whilst AEMO believes that its TCD cost estimates are reasonable and have been determined in a manner which is consistent with the intended purpose and operation of the TCD, even if the Alliance cost estimates were used, Option C2 is still the *preferred option* as compared to Option B3. Table 14 below sets out the present value costs and the net market benefits that would be determined if the Alliance costs estimates were used for this analysis. This demonstrates that the ranking of Option C2 and Option B3 does not change if the Alliance's cost estimates are used, as compared to the AEMO TCD cost estimates.

Table 14 Summary net market benefits – net present value of annual costs and benefits to 2050-51 ($ million) – Alliance cost estimates

Cost estimate base	Option C2			Option B3		
	Gross market benefits*	Present value cost	Net market benefits	Gross market benefits*	Present value cost	Net market benefits
Alliance TCD	712	552	160	418	328	89
Alliance 'industry benchmark'	712	477	235	418	234	184

* Note that the gross market benefits are unchanged in the above table and have been replicated in the table for completeness.

9.5 Conclusion

Based on the analysis in this document, AEMO is of the opinion that Option C2 remains the *preferred option* with higher net market benefits than Option B3.

10 Scope of analysis

As identified above, this analysis has been undertaken for the purposes of clause 5.16.4(z3) of the NER and in particular to allow AEMO to consider whether, in its opinion, Option C2 remains the *preferred option* for the WRL Project. It only considers matters relating to the methodology and assessment contained in the WRL RIT-T to the extent that is relevant to this analysis.