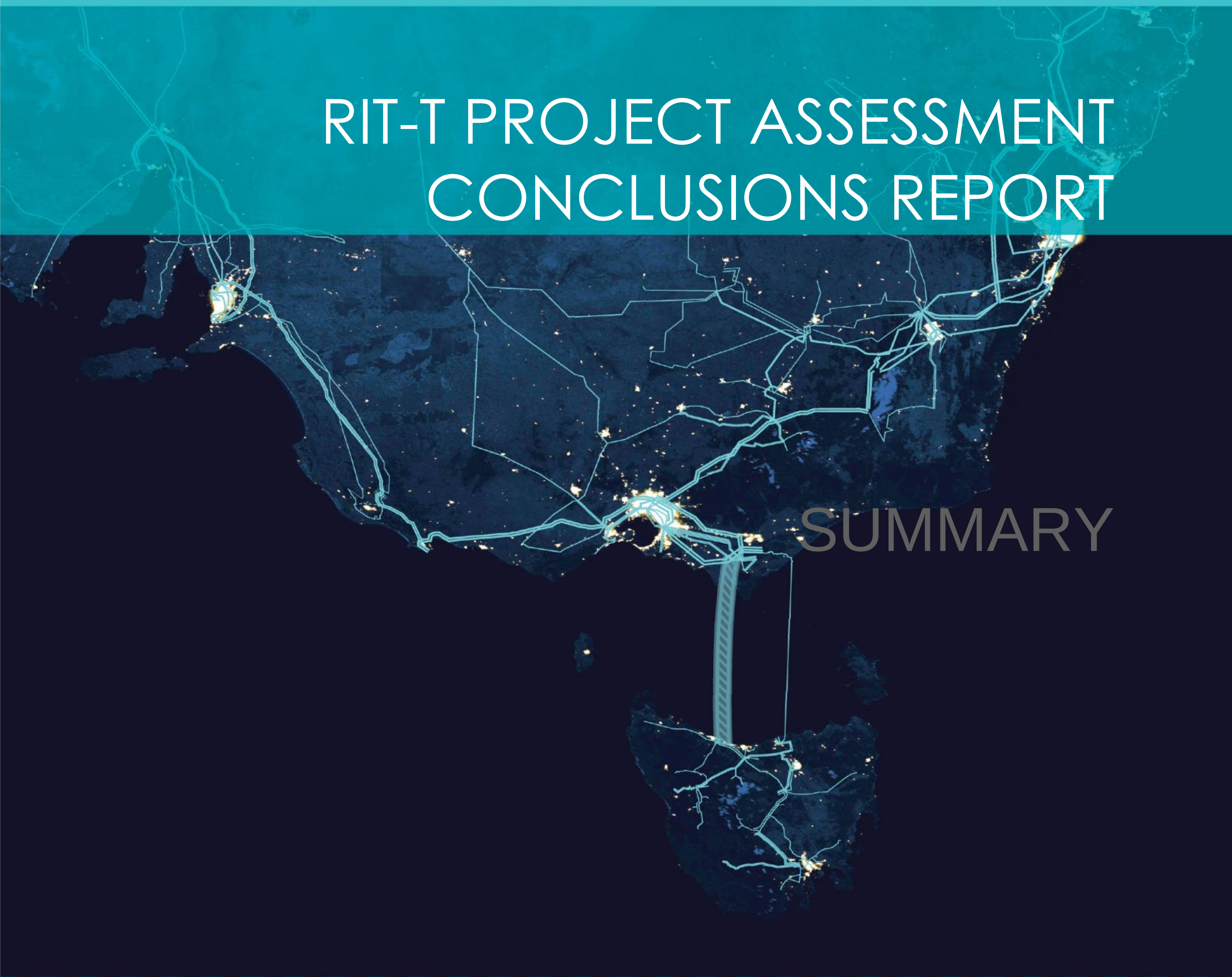
MARINUS LINK

# RIT-T PROJECT ASSESSMENT CONCLUSIONS REPORT



## SUMMARY

TasNetworks
Delivering your power

This document has been produced by Tasmanian Networks Pty Ltd, ABN 24 167 357 299 (hereafter referred to as "TasNetworks").

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# 1. Introduction

Electricity markets around the world are changing rapidly as economies decarbonise in response to global warming and technological change. In Australia, the rapid growth in renewable generation and distributed energy resources (**DER**), combined with the closure of coal plant, are creating significant challenges for market participants, network companies, and customers.

The pace of change appears to be accelerating. Previously held preconceptions regarding the limitations of renewable generation to meet our future energy needs are being challenged, as Renewable Energy Zones (**REZs**) and large scale storage projects obtain support from investors and state government policies. The rapid pace of change is driving the need for network investment to accommodate radically different generation and load flows across the NEM.

In its role as the national transmission planner, the Australian Energy Market Operator (**AEMO**) is responsible for publishing an Integrated System Plan (**ISP**). The purpose of the ISP is to coordinate transmission and generation planning to provide for the efficient development of the power system over a planning horizon of at least 20 years. The ISP is a whole-of-system plan that reflects the long-term interests of electricity customers by meeting their needs at the lowest total cost.

In the 2020 ISP, AEMO identified 'actionable ISP projects'. These projects are major transmission investments (or non-network options)[1] that are required to address an identified need and which form part of AEMO's optimal development path. In other words, actionable ISP projects are needed to deliver the lowest cost solution that meets customers' electricity needs. In its 2020 ISP, AEMO identified Project Marinus as an actionable ISP project, as described below:[2]

> "Marinus Link is a multi-staged actionable ISP project to be completed from 2028-29, with early works recommended to start as soon as possible, and with further stages to proceed if their respective decision rules are satisfied."[3]

This document provides a summary[4] of the Project Assessment Conclusions Report (**PACR**). The PACR tests AEMO's findings in its 2020 ISP by completing the Regulatory Investment Test for transmission (**RIT-T**) in accordance with the new regulatory arrangements for actionable ISP projects, which were introduced in July 2020.

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1 In accordance with the definition of 'actionable ISP project' in the National Electricity Rules.

2 AEMO, *2020 Integrated System Plan*, July 2020, page 82.

3 *2020 Integrated System Plan collectively referred to the HVDC interconnector and North West Transmission Developments as Marinus Link*

4 In accordance with clause 5.16.4(w) of the National Electricity Rules.

**Throughout this summary, 'Project Marinus' refers to the HVDC interconnector assets and the supporting transmission investment in Tasmania, which is the North West Transmission Developments. These investments together constitute the RIT-T project, which is the subject of the PACR.**

# 2. Inputs, assumptions and scenarios for the market modelling

Our market benefit modelling for Project Marinus, conducted in accordance with the RIT-T, was undertaken principally by Ernst & Young, with GHD being engaged to model the costs of ancillary services. Ernst & Young's modelling approach is closely aligned with AEMO's ISP modelling, as it identifies the lowest cost combination of generation, storage, demand side response, and transmission developments, without any preference for particular types of investment solutions or technologies.

To identify the net economic benefit from Project Marinus, Ernst & Young's modelling examines the total costs of meeting customers' future electricity needs 'with' and 'without' Project Marinus, under the 5 scenarios that AEMO adopted for the 2020 ISP. For the PACR, we have ensured that our inputs and assumptions are aligned with AEMO's current views,[5] as required by the RIT-T.[6]

A key consideration in the ISP and our RIT-T is the treatment of government policy announcements, which include state-based renewable energy targets and, in some instances, contracting arrangements to support these targets. In Tasmania, the Tasmanian Renewable Energy Target (**TRET**) has now been legislated, meeting one of the three decision rules specified in the 2020 ISP related to progressing stage 1 of Project Marinus to an actionable status.

To ensure that our approach in the PACR is objective, we adopted AEMO's treatment of government policies as set out in its most recent draft Inputs, Assumptions and Scenarios Report (**IASR**). In taking this approach, we note that concerns that some stakeholders have raised in relation to achievement of the TRET[7] could

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5 Specifically, we have adopted most of the inputs and assumptions in AEMO's draft 2021 Inputs, Assumptions and Scenarios Report (Draft 2021 IASR). However, we have retained the 2020 ISP scenarios for the purpose of the PACR.

6 National Electricity Rules, clause 5.15A.3(b)(7)(iv).

7 For example, submissions made by Bob Brown Foundation and Tasmanian Renewable Energy Alliance (TREA) to the Project Marinus Supplementary Analysis Report.

equally be made in relation to other government policies, which may implicitly assume that particular transmission or generation projects proceed, or outcomes eventuate.

To provide stakeholders with an insight into the impact of state government policies on the economic case for Project Marinus, we have conducted sensitivity modelling to examine the effect of replacing state government policies with a NEM-wide emission target. This approach removes distortions that may arise from state government policies that promote projects in particular regions in preference to an optimal NEM-wide solution. This sensitivity analysis shows that Project Marinus would be economically efficient if a Commonwealth 'carbon budget'[8] were adopted and state based policies removed. The analysis should further reassure stakeholders that we have tested Project Marinus against a range of plausible inputs and assumptions in assessing the economic case for the project.

# 3. Listening to customers and stakeholders

Customer and stakeholder engagement is an important part of our process and we welcome the feedback we have received. The modelling and analysis undertaken for the PACR takes into account the feedback received from customers and stakeholders over the past three years.

TasNetworks received a total of 40 formal written submissions throughout this RIT-T process. We conducted a total of seven industry forums across three capital cities and held a webinar during the course of this RIT-T assessment. In addition, we held in excess of 50 targeted stakeholder briefings for those consumers and stakeholders who sought further clarification about the economic and technical aspects of the project.

We have extended our consultation process beyond the requirements of the RIT-T, including engagement on our Initial Feasibility Report, which we published in February 2019. The Initial Feasibility Report provided indicative information on the likely costs and benefits of Project Marinus. The feedback we received helped guide our modelling approach and input assumptions, which were reflected in our Project Assessment Draft Report (**PADR**), published in December 2019.

We welcome the significant level of engagement from stakeholders and the feedback received in relation to our PADR. We listened to the feedback from stakeholders that they wanted our analysis to be aligned with the 2020 ISP. To address this issue effectively, we decided to undertake further modelling and to publish the results in our Supplementary Analysis Report in November 2020. The Supplementary Analysis Report also

8 The carbon budget represents a Representative Concentration Pathway (RCP) of 2.6. An RCP of 2.6 requires that carbon dioxide ($CO_2$) emissions start declining by 2020 and achieve a net zero status between 2080 and 2100. RCP 2.6 is likely to keep global temperature rises below 2°C by 2100. In comparison, an economy-wide net zero target by 2050 achieves the Paris Agreement's aspirational target to limit global warming to below 1.5 °C. This pathway is typically referred to as RCP 1.9.

responded to stakeholder feedback received on our PADR and adopted the 2020 ISP's updated scenarios, inputs and assumptions.

We also engaged with stakeholders and invited feedback on our Supplementary Analysis Report through a further round of consultation and submissions. By extending the engagement process, we provided stakeholders with an opportunity to review the updated modelling results prior to the publication of the PACR. In preparing the PACR, we have taken account of stakeholder feedback we received on our Supplementary Analysis Report, in addition to the feedback on our PADR. The feedback we have received has been invaluable in identifying specific issues and concerns that we have addressed in the PACR, particularly in the material presented in Chapters 8 and 9, and the accompanying appendices and attachments.

# 4. 1500 MW Project Marinus is the preferred option[9]

On the basis of the modelling undertaken for the PACR, a 1500 MW Project Marinus is the preferred option. This conclusion was reached following the assessment of four credible options for increased interconnection capacity between Tasmania and Victoria:

- **Option A**: A 600 MW symmetrical monopole HVDC interconnector, including associated AC transmission network augmentation and connection assets.
- **Option B**: A 750 MW symmetrical monopole HVDC interconnector, including associated AC transmission network augmentation and connection assets.
- **Option C**: A 1200 MW HVDC interconnector, comprising two 600 MW symmetrical monopole HVDC interconnectors, plus associated AC network upgrades.
- **Option D**: A 1500 MW HVDC interconnector, comprising two 750 MW symmetrical monopole HVDC interconnectors, plus associated AC network upgrades.

The cost-benefit analysis in the PACR shows that each credible option delivers a positive net economic benefit across every scenario. Furthermore, Option D delivers the highest net economic benefit compared to the other credible options. This conclusion is unchanged whether:

- An equal weighting is attributed to each scenario, as shown in the figure below; or

9 All values presented in this summary are 1 July 2020 real dollars unless stated otherwise. Net Present Value (NPV) outcomes are also discounted back to 1 July 2020 based on the Weighted Average Cost of Capital (WACC) of 4.8% for all scenarios, except Slow Change (WACC of 3.8%). The totals in the tables may not sum precisely due to rounding of the underlying values throughout the report.

- Whether a one-third Step change scenario, and two-third Central scenario weighting is adopted in accordance with the 2020 ISP, as shown in the figure and table below.

The results below are reported for the earliest commissioning dates of 2027[10] for the first 750 MW stage and 2029 for the second 750 MW stage. The question of optimal timing is addressed in the next section.

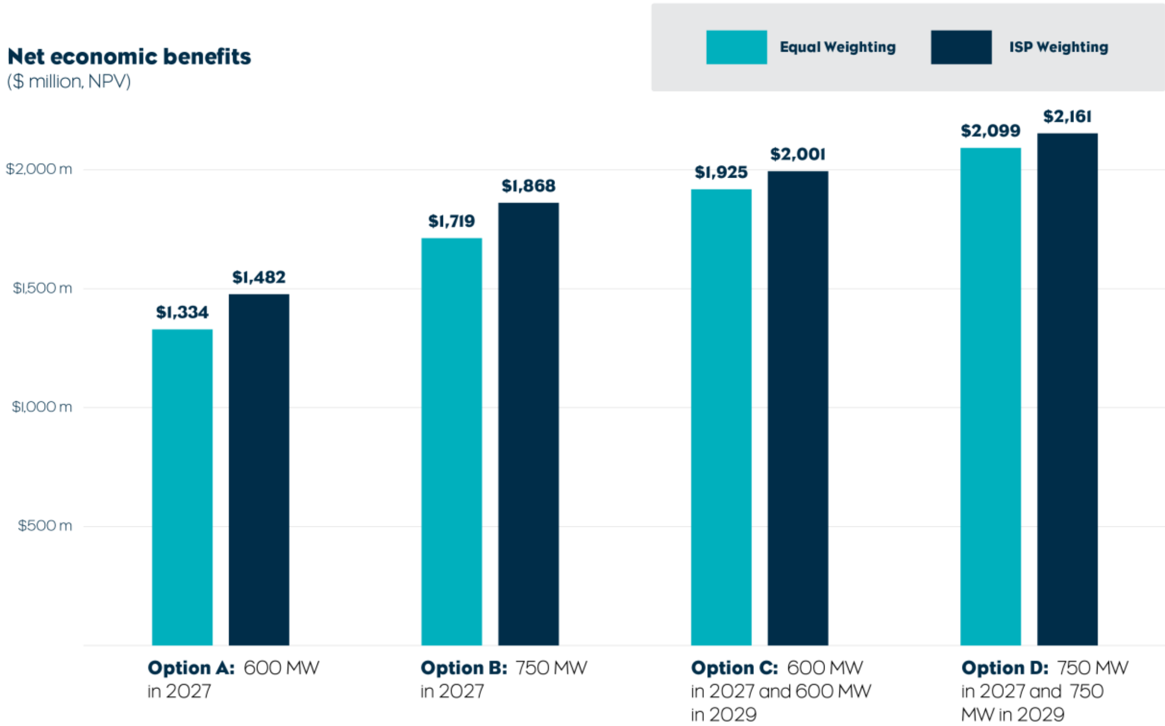


**Figure 1: Net economic benefit for all credible options – ISP weighting and averaged across scenarios**

10 All dates in this summary are on a financial year basis. The year represents the start of the financial year. For instance, 2027 represents the financial year commencing from 1 July 2027 to 30 June 2028. Unless otherwise stated, all interconnector and capacity expansion occurs at the beginning of the financial year whereas unit retirements occur at the end of the financial year.

**Table 1: Net economic benefit for each credible option, using ISP scenario weightings – Project Marinus timing of 2027 (link 1) and 2029 (link 2) ($ million, NPV)**

| Credible Options | Net economic benefit | | |
|---|---|---|---|
| | Central Scenario | Step Change Scenario | 2020 ISP weighting (67% - Central & 33% - Step Change) |
| **600 MW** | 1,056 | 2,332 | 1,482 |
| **750 MW** | 1,367 | 2,870 | 1,868 |
| **1200 MW** | 1,353 | 3,297 | 2,001 |
| **1500 MW** | 1,416 | 3,650 | 2,161 |

**In accordance with the RIT-T, the preferred option is a 1500 MW HVDC interconnector, comprising two 750 MW HVDC interconnector stages, plus associated AC network upgrades for each stage.**

# 5. The pace of NEM transition and project timing

Since the commencement of the Project Marinus RIT-T in July 2018, the pace of NEM transition has been steadily increasing. Our modelling indicates that the pace of transition away from coal fired generation to variable renewable energy, supported by dispatchable storage and strategic interconnection, is likely to gather significant momentum this decade (Figure 2) with up to 6,500 MW of additional coal-fired power stations expected to retire by 2030, over and above the currently announced retirement schedule outlined in the 2021 Draft IASR.

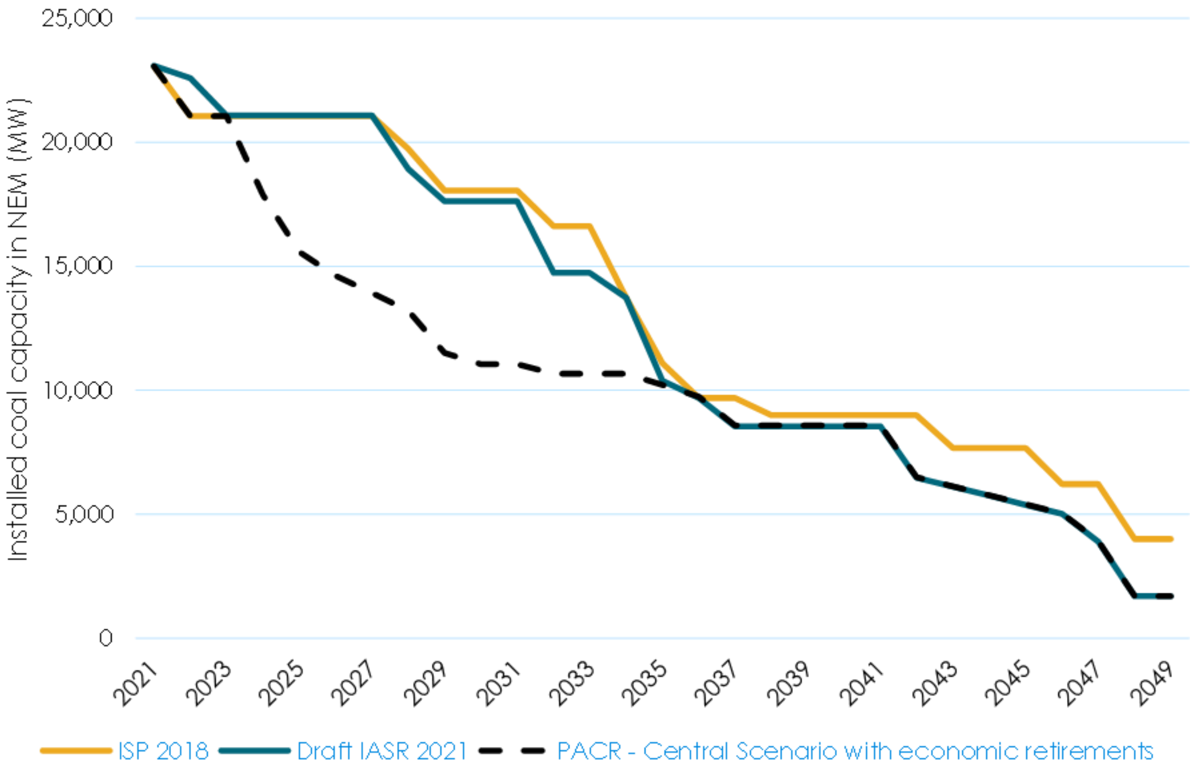


**Figure 2: Pace of coal retirement from 2018 ISP, Draft IASR 2021 and Project Marinus PACR (Central scenario with economic retirements)**

It is evident from recent company announcements that economic conditions are driving coal fired generation closures. In particular, since the publication of the Draft IASR 2021 in December 2020, the following announcements indicate the increasing pace of change in response to market conditions:

- In March 2021, Yallourn Power Station's (1,480 MW)[11] retirement was advanced by four years to 2028;
- In May 2021, Eraring Power Station (2,880 MW) announced that it would commence closure from 2030[12]. Origin Energy, the operators of Eraring, have indicated that the first of the four units will switch off two years earlier than previously planned; and
- In March 2021, AGL Energy undertook significant asset impairments and restructure plans, including indications that thermal generation units could be mothballed.[13]

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11 EnergyAustralia powers ahead with energy transition, Energy Australia, 10 March 2021.

12 NSW's Biggest coal plant, Origin's Eraring, starts closure from 2030, The Australian, 18 May 2021.

13 Slide 29, AGL Energy Investor Day, 30 March 2021.

In addition to these recent announcements, our assessment is that there is mounting evidence that the NEM's current trajectory is consistent with, or exceeding the Step Change scenario as outlined in the 2020 ISP. In particular, we note:

- Policy initiatives and legislation have been proposed or implemented by various state governments to advance renewable development to prepare for the retirement of the ageing thermal generation fleet. The objectives of these initiatives are aligned with, or exceed the Step Change scenario;
- The chair of the Energy Security Board has expressed views that the power system is already exceeding the Step Change scenario forecast in the Integrated System Plan (ISP) in 2020[14] and that the Step Change scenario could now be considered a conservative Central scenario given the ongoing pace of change[15];
- Increased generation from renewables is likely to exert increasing commercial pressure on coal fired generators as operational inefficiencies arise as output is continually varied to accommodate lower cost renewable generation in the supply stack;
- Sustained pressure from institutional investors and customers on the owners of coal-fired generators to align their business plans with the goals of the Paris Agreement could also lead to early retirement of assets due to environmental considerations.[16] Most recently this was highlighted by the owners of Loy Yang B power station when they flagged the challenges associated with refinancing debt for emission intensive generation assets[17];
- Recent announcements made by the Prime Minister and the Federal Treasurer regarding Australia's ambitions to reach net zero emissions as soon as possible, and preferably by 2050; and
- AEMO has indicated that one of its two Central scenarios for its 2022 ISP may reflect economy-wide net zero emissions by 2050.

In relation to project timing, our analysis confirms the findings in our PADR and Supplementary Analysis Report that the optimal timing of the preferred option depends on the future development of the NEM, which is subject to ongoing unprecedented change. In this context of NEM transition, Project Marinus has the potential to provide significant option value and ensure that wholesale power price increases owing to unexpected coal closure or unplanned maintenance is minimised. TasNetworks has considered the optimal timing based on the scenarios in the 2020 ISP, noting these scenarios are subject to change as AEMO prepares its 2022 ISP.

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14 Post 2025 options paper, ESB, 30 April 2021

15 ESB's Kerry Schott at Energy and Investment Conference, Sydney 24 March 2021

16 The inputs and assumptions in the Step Change scenarios best capture the electricity market outcomes required to achieve the targets of the Paris climate change agreement.

17 Alinta calls for Canberra to step in as banks retreat, The Sydney Morning Herald, 11 June 2021

At this stage, it is appropriate to describe the optimal timing for Stage 1 and Stage 2 of the preferred option as falling within a window, as shown in the table below.

**Table 2: Optimal timing window for commissioning 1500 MW Project Marinus**

| Stage (750 MW each) | Optimal commissioning range across scenarios |
|---|---|
| Link 1 | Between 2027 and 2031 |
| Link 2 | Between 2029 and 2034 |

We note that the new National Electricity Rules (Rules)[18] and accompanying guidelines[19] cater for this type of variability in the optimal project timing for a multi-staged actionable ISP project such as Project Marinus. In particular, AEMO may establish 'decision rules' in its ISP to guide optimal project timing. In addition, the Rules provide for a 'feedback loop' to verify that the project proponent's preferred option accords with AEMO's optimal development path.

In most instances, the lead time to withdraw dispatchable capacity from the NEM is much shorter than the timeframe for delivering large transmission projects. Given this observation, and the rapid pace of change in the generation sector, there is a compelling case to proceed on the basis that Project Marinus may be required at the earliest commissioning timeline of 2027 for Stage 1 and 2029 for Stage 2. Nevertheless, AEMO's 2022 ISP will be an important milestone in the context of Project Marinus to determine the optimal timing of the project in light of the latest available information and updated scenarios.

We also note that the significant benefits that Project Marinus will provide to the NEM have been recognised by the Australian and the Tasmanian governments through the execution of the Bilateral Energy and Emissions Reduction Agreement Memorandum of Understanding (**MOU**). This MOU provides funding of Project Marinus through the design and approvals phase to a final investment decision.

18 Clause 5.16A.

19 AER, Cost benefit analysis guidelines: Guidelines to make the Integrated System Plan actionable, August 2020.

**In relation to project timing, TasNetworks will proceed with the early works required for Project Marinus to be able to achieve a final investment decision in 2023-24 and subsequent commissioning of Stage 1 from as early as 2027 and Stage 2 by 2029. The actual timing of each stage will be determined by the 2022 and subsequent ISPs and AEMO's assessment of the proposed project in accordance with the feedback loop (as required by clause 5.16A.5(b) of the Rules) and its optimal development path at that time.**

# 6. Project cost estimates

We recognise the concerns raised by stakeholders that the costs of major infrastructure projects can increase substantially from initial estimates. To address these concerns, we engaged engineering consultants, Jacobs, to conduct an independent review of our project cost estimates. Jacobs' report is provided as an attachment to the PACR and should provide stakeholders with confidence that our project cost estimates reflect the best available information and assessment at this time. The expected project cost estimate is sourced from the Jacobs report, with the figure calculated on the basis of expected cost of the option under a range of different reasonable cost assumptions.[20]

The Jacobs cost review was conducted on a probabilistic estimation basis that identifies each of the significant cost components, determines the likely range based on prior projects and associated probability distribution of each component and undertakes a sampling process to generate a probability distribution of project costs. The Association for the Advancement of Cost Engineering (AACE) recommends utilising the probabilistic estimation basis for all projects over $200 million in value.

Each possible outcome value of the total project cost can be given a P value which indicates its likelihood of occurrence. For instance, a P10 cost is the project cost with sufficient contingency to provide 10 per cent likelihood that this cost would not be exceeded. A P90 cost is the project cost with sufficient contingency to provide 90 per cent likelihood that this cost would not be exceeded. The contingency included in the expected project cost is the median output from a probabilistic analysis of possible outcomes.

The Jacobs report provides an expected project cost for the delivery of Project Marinus of $3,481 million ($2020).[21] This estimate is inclusive of contingency allowance based on a median probabilistic scenario.[22] The

[20] Uncertainty regarding costs, RIT-T application guidelines, August 2020

[21] The Jacobs cost estimate is in June 2021 dollars. The modelling undertaken for this PACR is in $2020. Therefore, the Jacobs cost estimate was de-escalated by 1.11 per cent to account for inflation (March 2020 – March 2021, Australian Bureau of Statistics), addition of interest during construction charge and subtraction of $50 million in grant funding received by TasNetworks.

[22] Refer to Project Marinus Cost Estimate Report prepared by Jacobs, released as Attachment 3 with this report.

report also provides an overall range for the total project estimate of $3.1 billion to $3.8 billion ($2020). This range is based on P10 and P90 views of the total project contingency allowance. Our sensitivity analysis confirms that the preferred option is expected to deliver a strongly positive net economic benefit, even if the upper cost range estimated by Jacobs eventuates.

Figure 3 shows a comparison of the likely range of costs assumed at the PADR stage, in the 2020 ISP and now, at the PACR stage. The cost estimate for the PADR was based on a “neat” estimate ($2.8 billion, $2020), which excluded accuracy/growth allowances and contingencies, whereas the cost estimate for the 2020 ISP included an accuracy allowance (commonly referred to as the “base estimate”). The 2020 ISP subsequently applied a 30 per cent deterministic contingency on the base estimate of $3.2 billion ($2020).

It can be seen that whilst the underlying cost estimate (i.e. the “neat” estimate before allowances and contingencies) has increased by 10 per cent since the PADR, the contingency amount has reduced such that the expected total project cost is comparable to the PADR. This is explained by the more advanced status of the scope definition, engineering, route alignment and other matters, leading to more certainty.

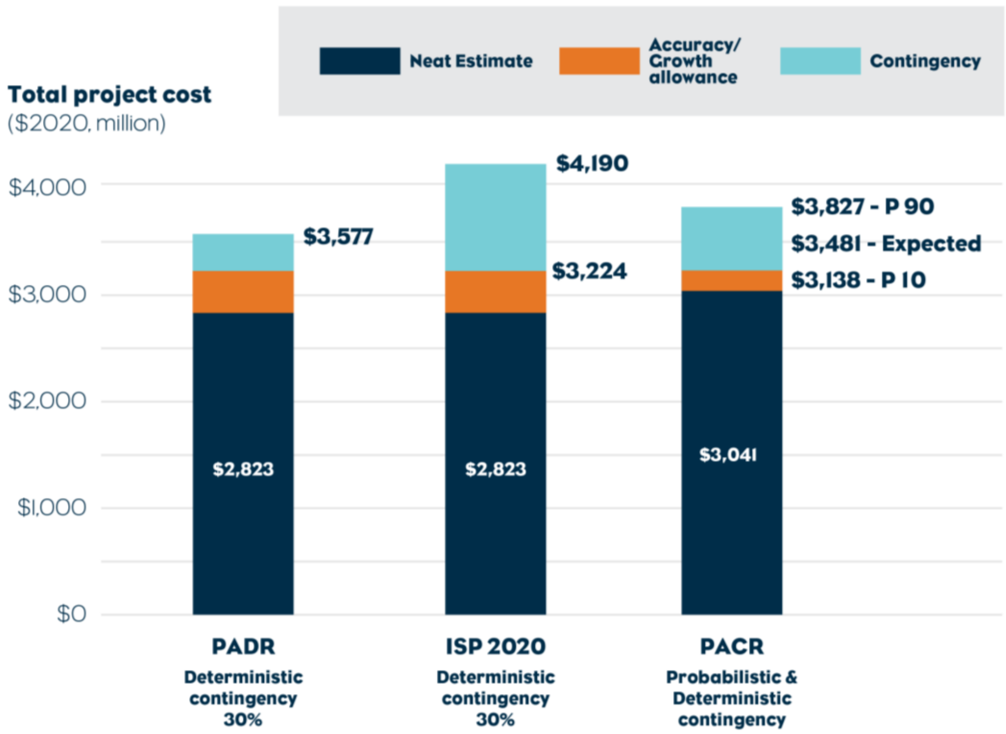


**Figure 3: Range of total project cost outcomes comparison ($ million)[23]**

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[23] The PADR and ISP costs have been escalated from their original 2019 basis to 2020 prices. Inflation rate of 2.2% based on ABS data for March 2019 to March 2020.

If Project Marinus is completed in two stages spaced no more than 2 to 3 years apart, $600 million in total project cost savings can be achieved compared to two standalone 750 MW links. The savings are derived from streamlining environmental approvals, civil works, horizontal direct drilling and procuring volume discounts from suppliers for cable and converter stations. In addition to ensuring that our project cost estimates are robust, we have developed competitive tendering and procurement processes that are designed to obtain the best value for money from our contractors and equipment suppliers to achieve the lowest total cost of construction. Our robust project governance arrangements will also ensure that project costs are subject to ongoing management and review.

# 7. How does Project Marinus deliver benefits?

It is evident from the feedback we have received from stakeholders that our PACR should go beyond the requirements of the RIT-T to explain the sources of benefits that Project Marinus would unlock. As part of this explanation, stakeholders specifically want to understand why Project Marinus is preferred to solely increasing battery capacity on the mainland and how Project Marinus interacts with the various policy and project announcements in other NEM regions.

In broad terms, Stage 1 of Project Marinus enables customers in the NEM to benefit from cost-effective wind resources, together with the spare capacity that already exists in Tasmania's hydro system. Stage 2 is expected to be in service at least two years after Stage 1, at which time our modelling shows that Australian mainland NEM regions would otherwise require additional peaking gas-fired generation and/or storage. By staging Project Marinus, investment in lower cost storage capacity and wind generation in Tasmania will provide savings to the mainland NEM by displacing more expensive alternatives.

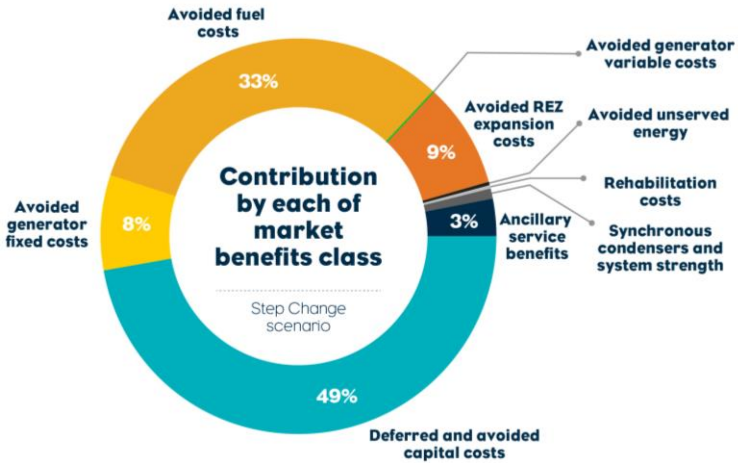


**Figure 4: Market benefits provided by Project Marinus, Step Change scenario, 2027 and 2029**[24]

[24] Data values for market benefit classes with minimal contribution have not been displayed but included in the analysis.

Our findings indicate that strategic transmission investment and long-duration energy storage have a key role to play in addressing the risk associated with ‘drought’ in Variable Renewable Energy (**VRE**). Our analysis also indicates that the benefits of interconnection are underestimated, owing to the computationally intensive nature of system analysis, such that that high-level, simplifying assumptions are made to support timely and cost-effective modelling. This means that the complexity of the NEM is understated, including through conducting system studies based on expected outcomes and perfect foresight, undertaking analysis at hourly granularity and utilising separate models for capacity expansion and long-term energy assessment. As explained in the PACR, these simplifications understate the benefits of interconnection and deep storage to manage variability and VRE drought.

# 8. Pricing impact

TasNetworks has received extensive feedback from customers regarding the transmission network pricing impact of Project Marinus, particularly in Tasmania. In principle, the most equitable and efficient pricing arrangement would allocate the costs of Project Marinus in a manner that reflects the beneficiaries. In practice, however, the beneficiaries cannot be determined precisely and will likely change over time. As a consequence, a pragmatic way forward needs to be developed.

To progress the discussion, TasNetworks has commissioned analysis by internationally respected consultants, FTI Consulting (FTI), to examine how customers in different NEM regions will benefit if Project Marinus proceeds. FTI’s analysis demonstrates the following:

- Project Marinus can exert downward pressure on electricity prices across the NEM;
- Project Marinus provides significant benefits to the end-customer;
- The current pricing framework is not consistent with the ‘beneficiaries pay’ principle; i.e. the principle that end-customers should pay according to the benefits they receive; and
- All customers are better off if Project Marinus proceeds and costs are shared fairly across the NEM.

The ability of Project Marinus to exert downward pressure on power prices in regions not physically connected by the interconnector may not be intuitive to some readers. However, the interconnected nature of NEM and the ability of an asset to exert pricing impacts across all regions was highlighted by the recent event in Queensland with the unexpected outage at the Callide power station.[25] This incident led to a doubling of wholesale energy prices compared to the previous year across most of the NEM[26] as the finely balanced

[25] Update on incident at Callide power station, CS Energy, 25 May 2021

[26] Callide outage feeds power price surge, Australian Financial Review, June 2021

supply and demand balance was disrupted. Similar to a power station outage impacting the wholesale energy prices across all jurisdictions, Project Marinus has the ability to put downward pressure on energy prices by introducing additional dispatchable capacity and bringing further diversity to the VRE portfolio in the NEM.

The pricing issue is being progressed by the National Cabinet Energy Reform Committee, building on work undertaken by the Energy Security Board (ESB) and the Australian Energy Market Commission (AEMC). We are continuing to work with the Commonwealth and state governments to deliver a fair pricing outcome.

# 9. Next Steps

The publication of the PACR concludes the RIT-T process. From a regulatory perspective, the next stage of the process is to work with the Australian Energy Regulator (**AER**) and AEMO on the revenue setting arrangements for the project. These arrangements will need to address the two project components, Marinus Link (i.e. the HVDC interconnector) and the North West Transmission Developments. We will continue to consult with customers and stakeholders on these arrangements as further information becomes available and these processes commence.