TasNetworks
Delivering your power

MARINUS LINK

Enabling low cost, secure and reliable, clean energy

RIT-T Supplementary Analysis Report

Presentation to:

Online public consultation forum

25 November 2020

Purpose of today

- Provide insights from the Marinus Link RIT-T Supplementary Analysis Report published on 5 November 2020.
- Seek feedback from stakeholders.
- Encourage submissions to the Marinus Link RIT-T Supplementary report, due **7 December 2020**.
- *Please note the following:*
  - *Today's session is recorded for the benefit of stakeholders that cannot attend this session.*
  - *Please type in your questions into the Q&A box.*

Regulatory Investment Test – Transmission (RIT-T)

AGENDA

Topic	Objective	Presenter
Welcome	Welcome & introduction	Benjamin White (TasNetworks)
Project summary and update	Project overview and stakeholder feedback	Bess Clark (TasNetworks) (15 min)
Findings from the 2020 ISP	2020 ISP outcomes related to Marinus Link	Eli Pack (AEMO) (15 min)
Supplementary report outcomes	Net market benefits and sensitivity outcomes	Stephen Clark (TasNetworks) (15 min)
Market modelling and insights	Benefits of Marinus Link and interaction between short and long duration storage	Clare Giacomantonio (Ernst & Young) (20 min)
Panel discussion and Q & A	Discussion and questions from the audience	Bess/Clare/Eli/Stephen (25 min)
Close		Benjamin White

Project Summary

Bess Clark – General Manager
Project Marinus, TasNetworks

Big year in the industry already including…

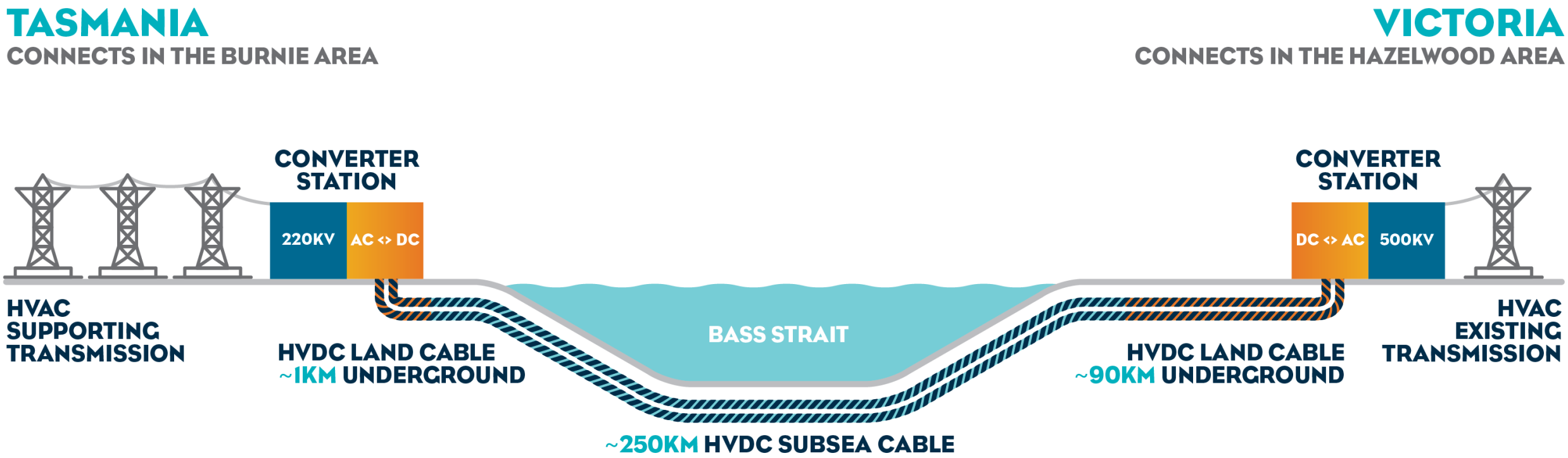
- Australia is in the midst of one of the fastest energy transitions in the world, while working through the impacts of Covid-19
- TasNetworks has continued to progress Marinus Link and supporting Tasmanian North West Transmission Developments through early Design and Approvals works, funded through a $56 million Commonwealth Government Grant
- Our Prime Minister has included Project Marinus as one of 15 key infrastructure projects to support Australia's economic recovery, including by implementing a streamlined environmental assessment process
- AEMO's 2020 ISP included Marinus Link as an Actionable Project with decision rules
- The Prime Minister announced a $250 million interconnector fund to support timely progress on Project Energy Connect, VNI West and Marinus Link
- National and state energy policy frameworks progressed, including Tasmania legislating a 200% Tasmanian Renewable Energy Target

Updating our RIT-T analysis

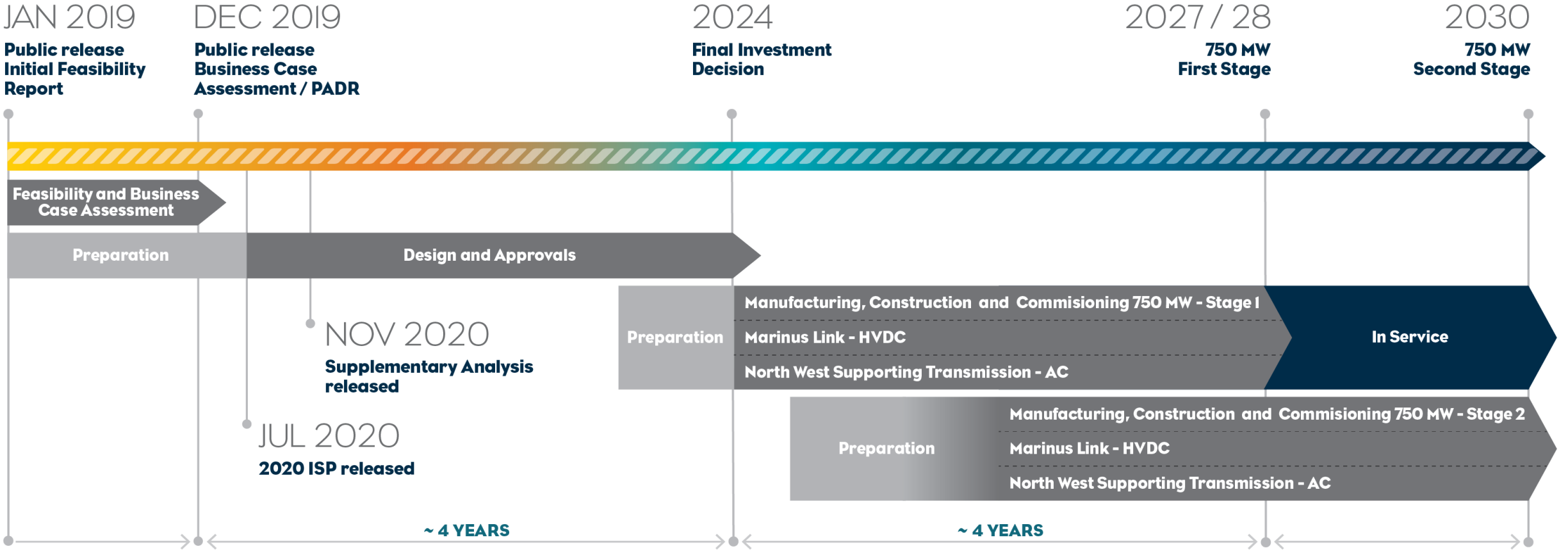
- The Marinus Link Supplementary Analysis Report **updates our regulatory investment test for transmission** (RIT-T) analysis, providing further information about the net benefits of the project to the national energy market (NEM).
- The Report **responds to stakeholder feedback** received on the RIT-T Project Assessment Draft Report (PADR) released in December 2019, including taking into account AEMO's 2020 Integrated System Plan (ISP).
- The Report highlights that a 1500 MW **Marinus Link**, together with the supporting Tasmanian North West Transmission Developments, **provides net market benefits across a range of future outlooks**.
- It is proposed to **apply the Actionable ISP Rules**, with one RIT-T for whole project scope, then progress **Marinus Link as a staged project**, with revenue to be triggered once AEMO Feedback Loop for each project phase has been satisfied.
- We welcome **submissions** from stakeholders on this report by **7 December 2020,** to inform our Project Assessment Conclusions Report (PACR).

Project Marinus – HVDC and supporting HVAC developments

- Project description is consistent between Marinus Link RIT-T and ISP, with some changed staging detail for supporting transmission



Project Marinus – potential delivery schedule



Marinus Link Project Assessment Draft Report (PADR) – Submissions and key themes

- Ensure alignment by updating modelling with the inputs, assumptions and scenarios from 2020 ISP
- Further consideration needs to be given to uncertainty, including COVID-19
- Some stakeholders support a staged approach to Marinus Link
- Consideration of non-network solutions
- Ensure allocation of project costs proportionate to beneficiaries

Industry segment	Submissions
Generators/retailers and affiliates	6
Market operator, other asset owners, and individuals	4
Energy users and affiliates	5
Total	15

Note: 2 submissions were confidential. Remaining PADR submissions published on our website (https://www.marinuslink.com.au/rit-t-process/)

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Working out who pays remains a key question

- Need a fair and reasonable cost allocation:
  - Current pricing frameworks based on physical asset location = Vic and Tas customers pay
  - Benefits are broader than for Vic and Tas customers, across the whole of the NEM
- Issue recognised by Energy Security Board (**ESB**) and the COAG Energy Council asked ESB to provide advice on a fair cost allocation methodology for interconnectors
- TasNetworks has engaged market consultants to assess delivered energy benefits of Marinus Link to whole of NEM, report released in coming months
- Work continues under auspices of Energy National Cabinet Reform Committee

Integrated System Plan (ISP)

Marinus Link Supplementary Analysis Report – Online Forum

Eli Pack, Manager Integrated System Planning, AEMO

25 November 2020

The ISP describes Australia's future least cost energy transition

- Whole-of-system plan
- Maximises value to end consumers
- Utilises the opportunities provided from existing technologies and anticipated innovations
- Aims to coordinate investments by informing policy makers, investors, consumers, researchers and other energy stakeholders

ISP consultation, considerations and expected changes to 2040

Consultation

200+ stakeholders consulted

8 workshops held

85 written submissions provided

4 webinars hosted

Considerations

- Grid technologies and services
- Consumer investment in DER
- Emissions reductions
- Market reforms
- Economic growth
- Government policies

Changes to 2040

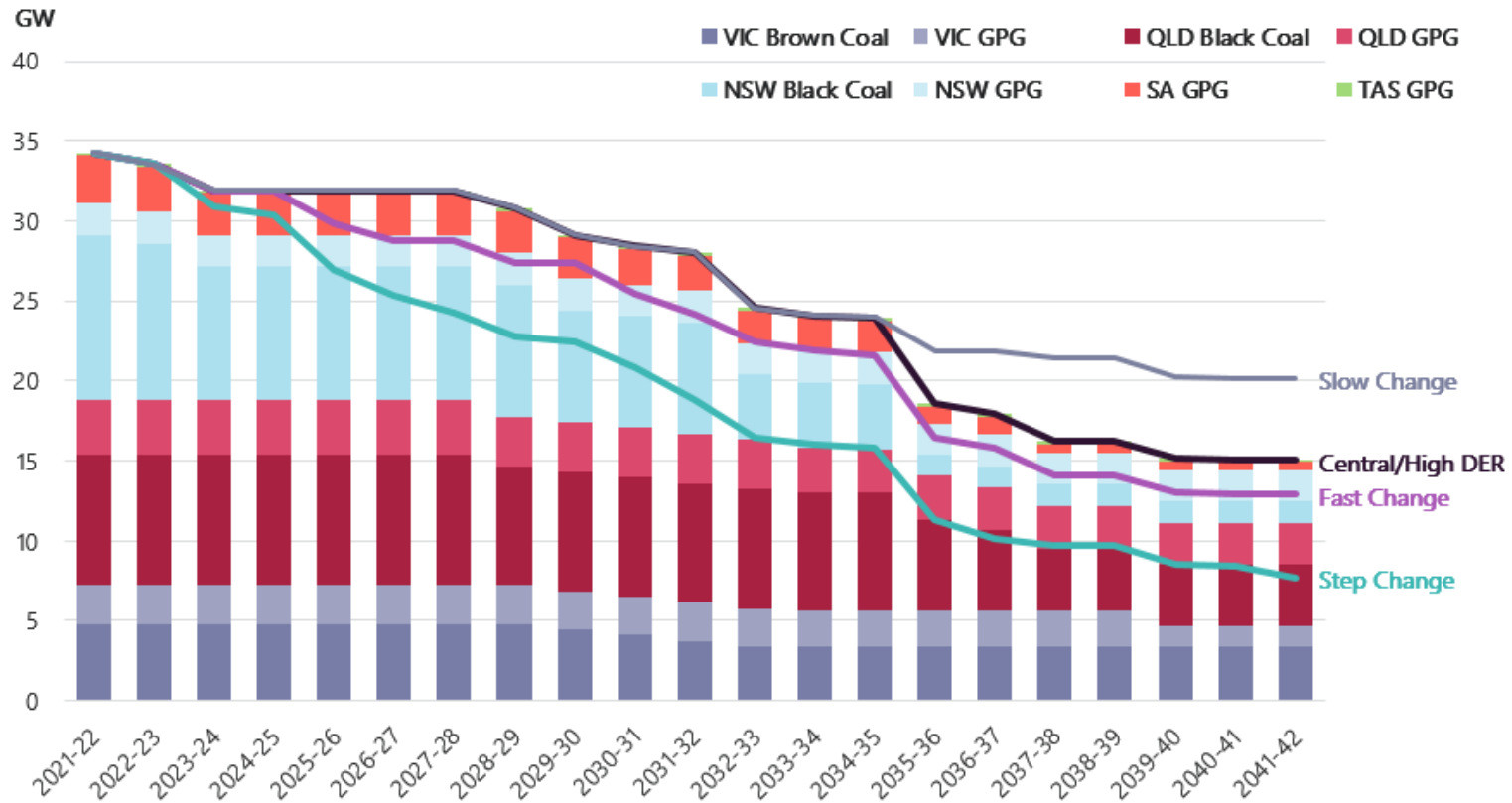
Coal generation retirements
15 GW
or 63% of coal-fired generators

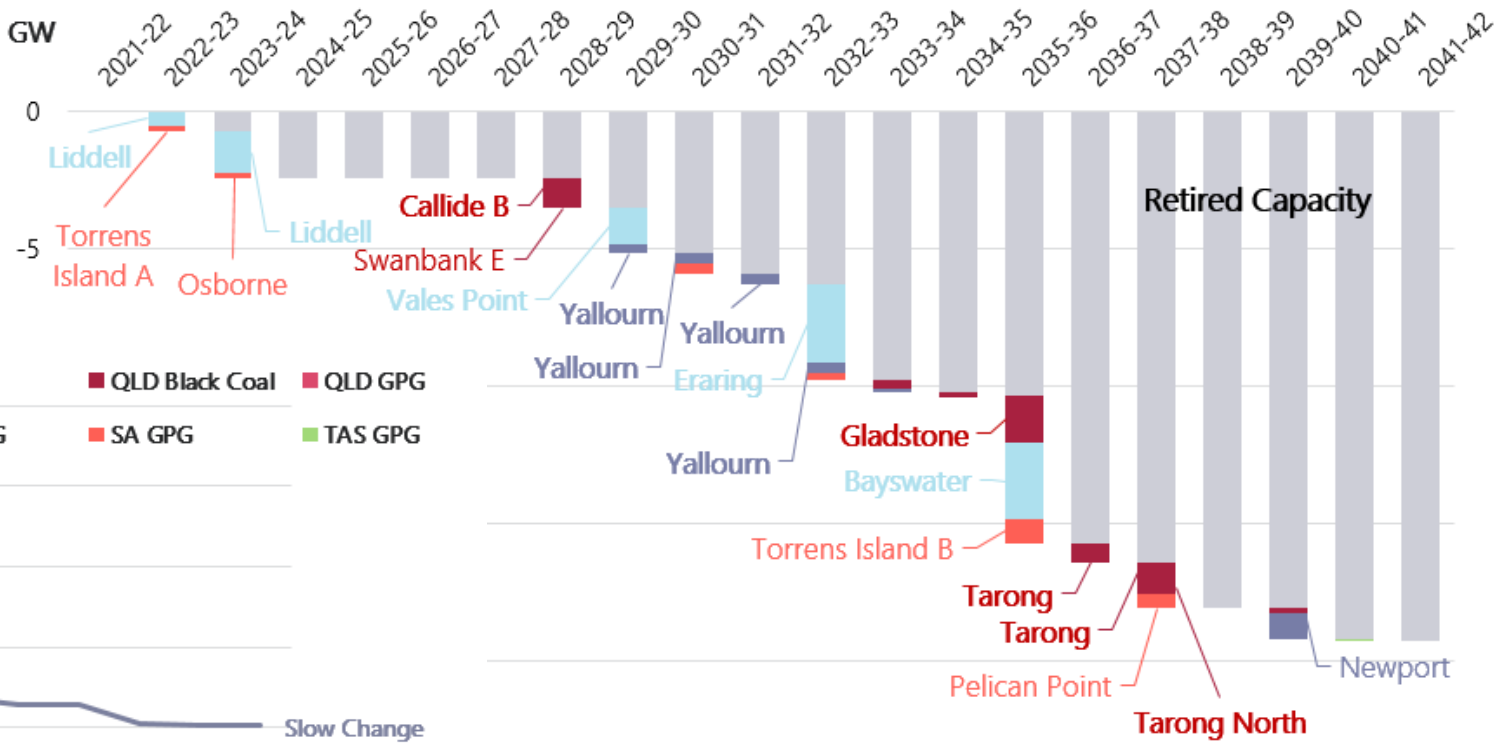
DER
+200%
supplying from 7% to 13–22% of total consumption

New VRE
26 GW
(grid-scale wind and solar)

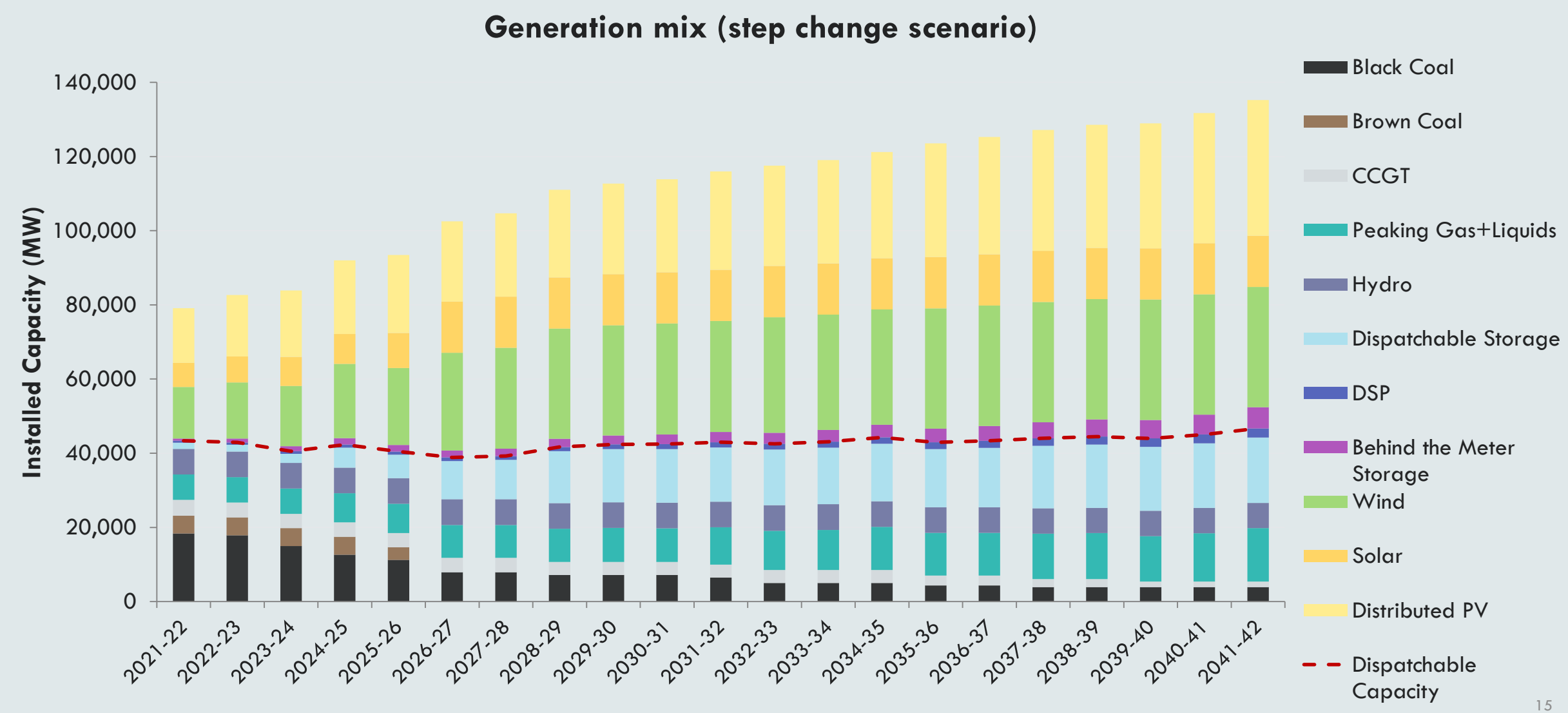
New dispatchable resources
6–19 GW
(pumped hydro, batteries, gas)

Power station closures



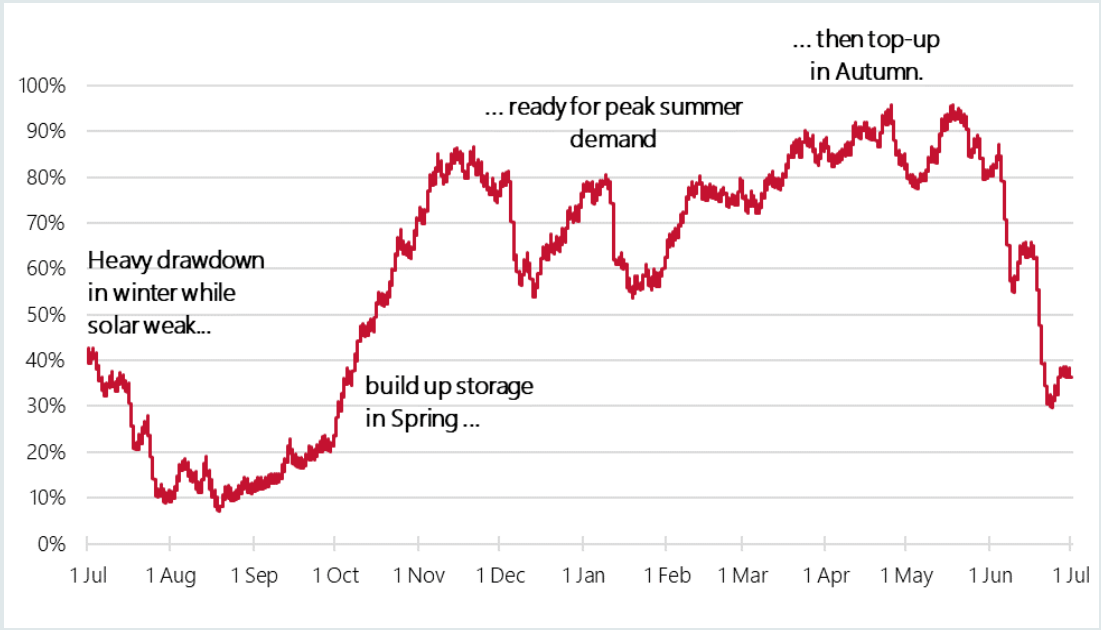


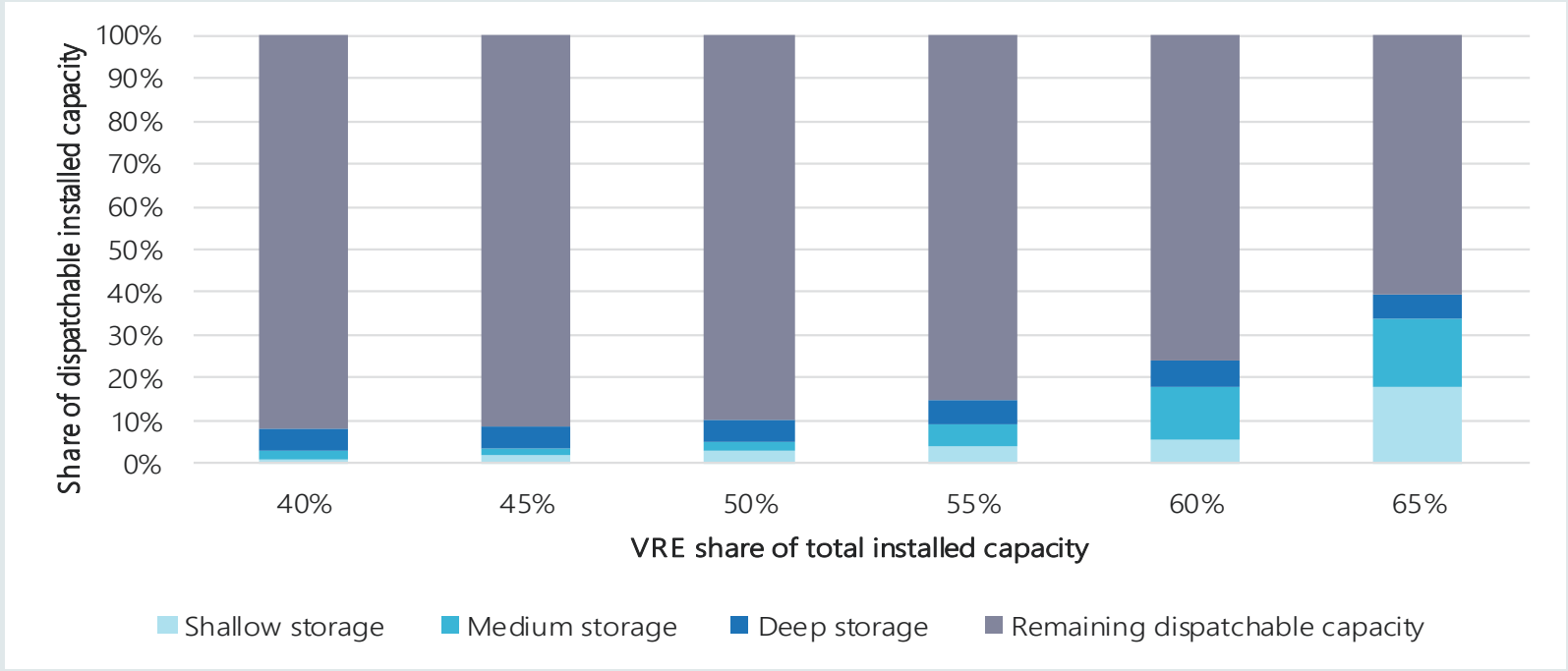
....replaced by distributed and large-scale renewables....



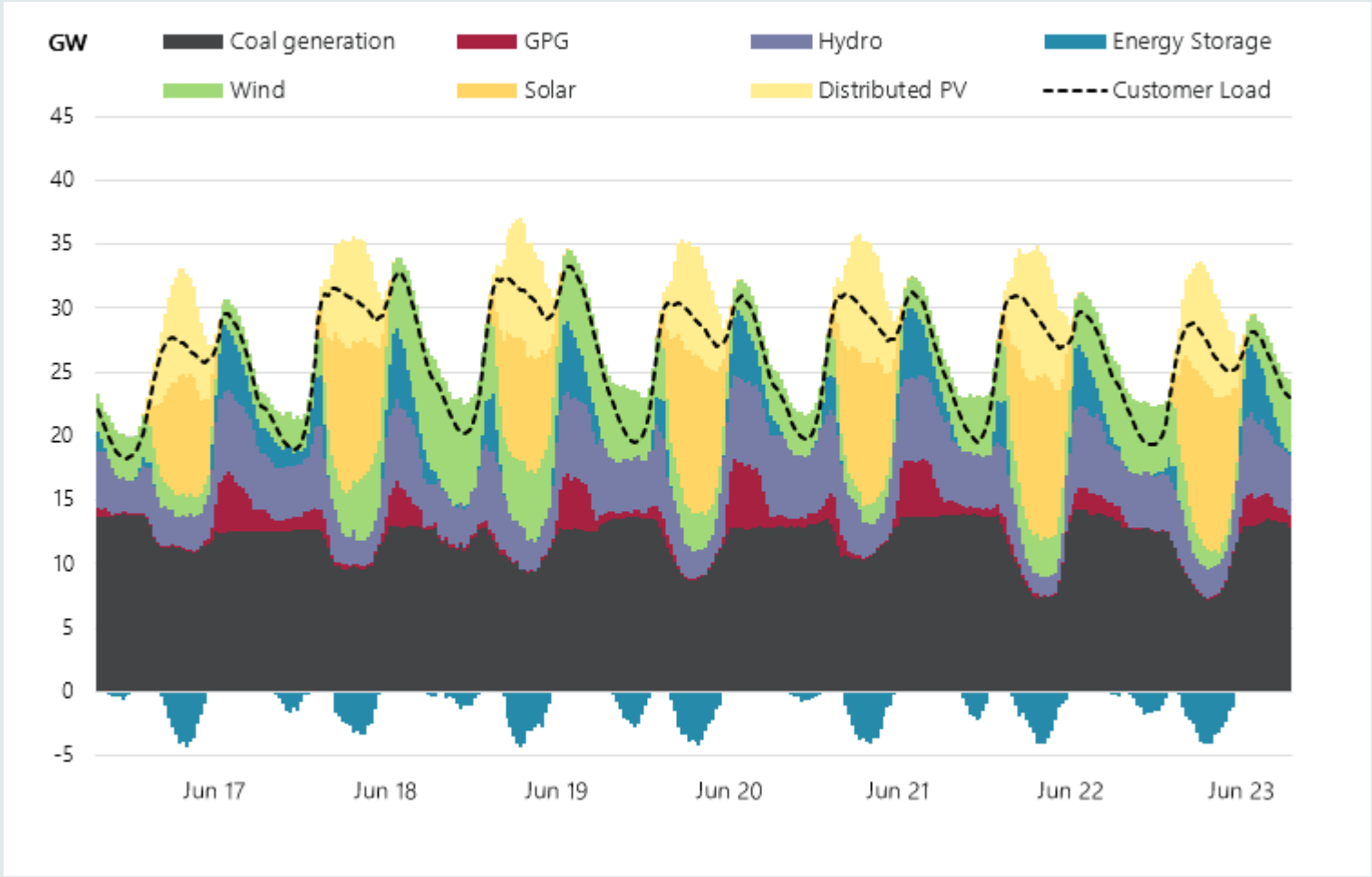
…complemented by a portfolio of storages of all depths across the NEM…

The value of deep pumped hydro storages becomes more obvious when utilisation is looked at seasonally.





...with gas generation helping to meet peak demand and firm dispatch....



…enabled by an optimal development path for transmission…

Classification	Project	Indicative timing
Committed	SA System Strength Remediation	2021–22
	QNI Minor	2021–22
	Western Victoria Transmission Network Project	2025–26
Actionable[1]	VNI Minor	2022–23
	Project EnergyConnect	2024–25
	HumeLink	2025–26
	Central-West Orana REZ Transmission Link	Mid-2020s
	VNI West[2]	2027–28
	Marinus Link[2] – Cable 1 – Cable 2	 2028–29 to 2031–32 2031–32 to 2035–36
Preparatory Activities Required	QNI Medium & Large	2030s
	Central to Southern QLD	Early–2030s
	Reinforcing Sydney, Newcastle and Wollongong Supply	2026–27 to 2032–33
	Gladstone Grid Reinforcement	2030s
	New England REZ Network Expansion[3]	2030s
	North West NSW Network Expansion[4]	2030s
Future ISP Projects	Far North QLD REZ	2030s
	South East SA REZ	2030s
	Mid North SA REZ	2030s

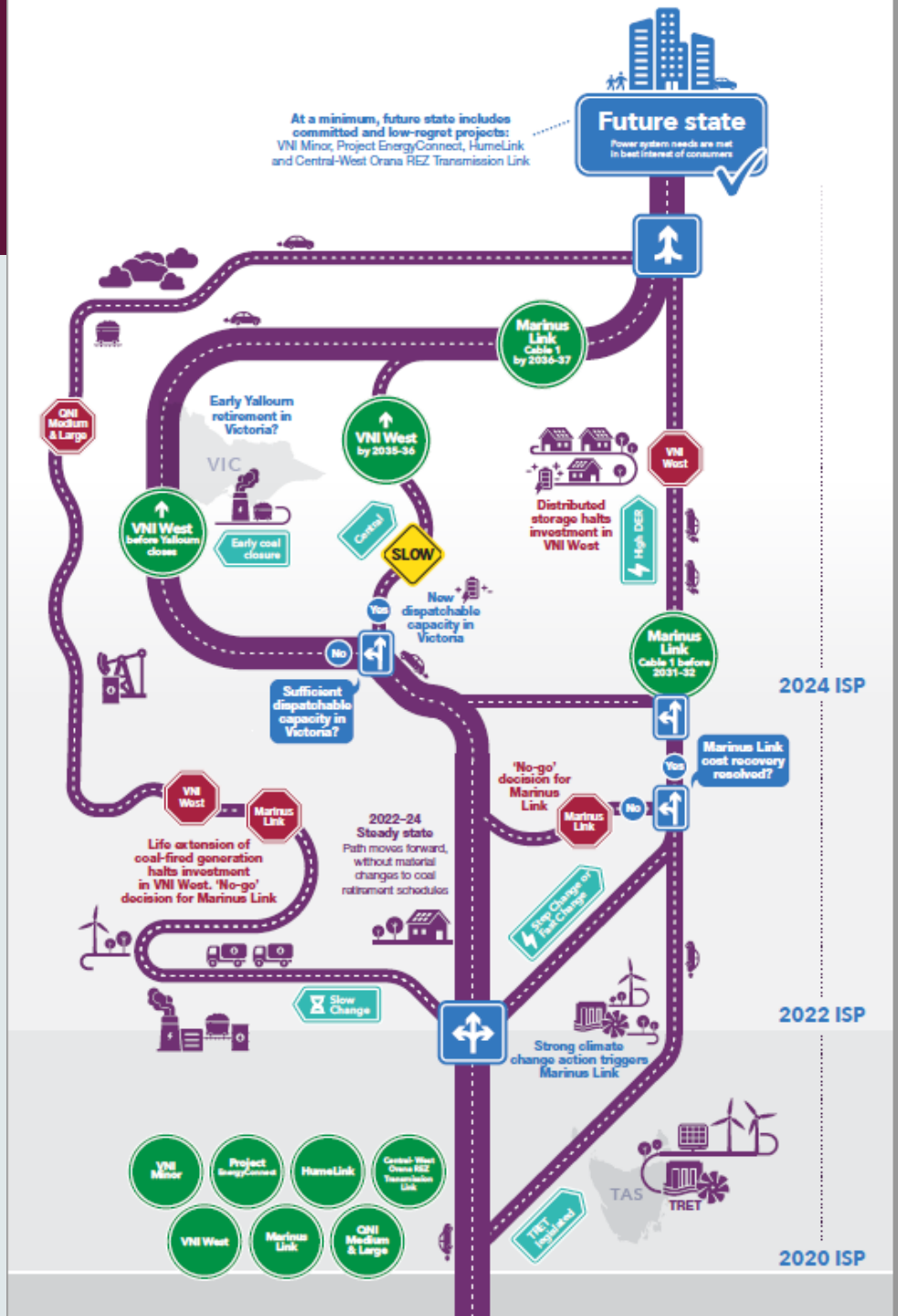
2020

2040

1 Estimated practical completion including any subsequent testing – projects may be delivered earlier
2 Decision rules may affect timing
3 May be accelerated by government initiatives
4 Not shown on map. AEMO requires that preliminary engineering designs be completed by 30 June 2021

…bound by prudent decision rules.

- **Progress VNI West by 2027-28, with early works as soon as possible; and defer to 2035-36 or pause if:**
  - *Transmission costs, including any 3rd party contribution, exceed $2.5 billion, or*
  - *There is evidence that sufficient new market-based dispatchable capacity will be in place in Victoria head the next brown coal closure in Victoria, or*
  - *There is evidence that the Slow Change scenario is unfolding, which includes life extensions of existing coal fired generation.*
- **Progress Marinus Link, with early works as soon as possible, as follows:**
  - ***Stage 1 in 2028-29*** *- if TRET is legislated; and there is successful resolution as to how the costs of Marinus Link project how the costs will be recovered from consumers, and Slow Change scenario is not unfolding.*
  - ***Stage 2 in 2031-32*** *– if TRET implementation is on track, or the Step Change scenario is materialising (to be re-assessed and refined in the 2022 ISP)*

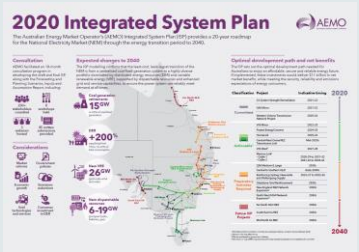


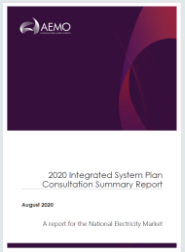
Where do I find…?

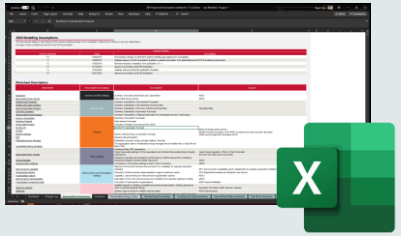
The ISP web page:

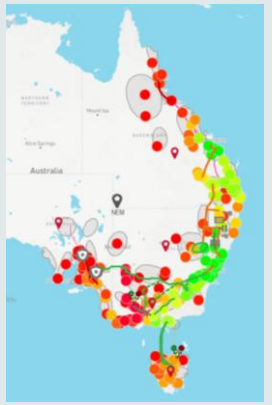
https://www.aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2020-integrated-system-plan-isp

- 2020 ISP – Main Report, Appendices & Supplementary Reports
- Interactive map
- ISP Inputs and assumptions
- ISP database - traces
- Consultation information
- Chart data
- Data files – generation and transmission outlook









How to get involved in the 2022 ISP

Please register for ISP notices: ISP@aemo.com.au

Thankyou !

Economic Analysis

Stephen Clark – Marinus Link, Project Director
Project Marinus, TasNetworks

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RIT-T Supplementary Report - Overview

- Stakeholders requested TasNetworks to **align the Marinus Link RIT-T analysis with the updated inputs, assumptions and scenarios of the 2020 Integrated System Plan** (**ISP**).
- TasNetworks produced this **Supplementary Analysis Report** to undertake a further round of engagement and consultation before concluding the RIT-T process with the publication of our Project Assessment Conclusions Report (**PACR**).
- The 2020 ISP recommended **conducting a single RIT-T for the entire project** with **decision rules for each stage** determining the optimal commissioning year.
- Report signals **adoption of the Actionable ISP Rules**. These new Rules **support staging** and in the 2020 ISP AEMO recommends staging for Marinus Link:
    - **early works are actionable without decision rules**
    - decision rules outlined for stage 1
    - stage 2 decision rules to be outlined in the next ISP

Our findings broadly align with 2020 ISP outcomes

- The outcomes in this report are aligned with the 2020 ISP findings for Marinus Link, including:
  - Early works[1] for both stages should be completed by 2023-24;
  - Stage 1 would be needed at the earliest possible timing if the Step Change scenario eventuates; and
  - Stage 1 of the project should proceed no later than 2031, under other scenarios or with legislation of TRET.
  - The decision rules to construct the second cable will be specified in the 2022 ISP.
- The report is modelled with 2020 ISP total project cost of **$3.15 billion** ($2019).
- While the project may need to be reconsidered in a Slow Change scenario, our modelling demonstrates that Marinus Link still provides a net market benefit from 2031 in this scenario.

Net market benefits (NPV, $ million)

	Commissioning Years			
Scenarios	2027 & 2030	2028 & 2031	2031 & 2034	2034 & 2037
Central	$639	$731	$871	$776
Fast Change	$790	$838	$906	$828
High DER	$612	$701	$857	$758
Slow Change	-$214	-$109	$107	$204
Step Change	$1,599	$1,615	$1,582	$1,309
Average (All Scenarios)	$685	$756	$864	$775
Average (no Slow Change)	$910	$972	$1,054	$918

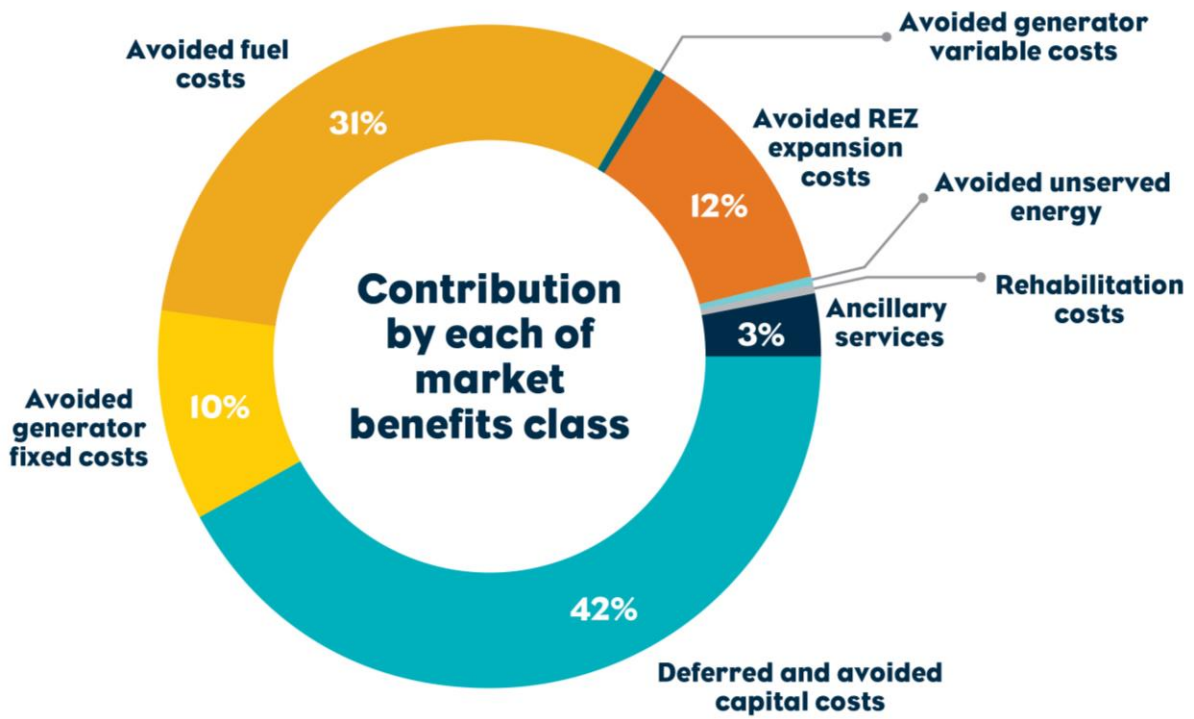
The supplementary report notes the marginally higher difference of net market benefits in 2028 & 2031 under the Step Change scenario but advocates for earliest timing for insurance value consideration.

1. For Project Marinus, early works covers the activities required to reach a Final Investment Decision.

Source of benefits for Marinus Link

- The **first 750 MW stage provides** access to:
  - **Existing and repurposed Tasmanian hydro capacity** thereby reducing the need to invest in pumped hydro and gas generation.
  - A further development of over 900 MW of on-island wind.
- The **second 750 MW stage enables** access to:
  - Development of **long duration pumped hydro** in Tasmania that reduces the need for additional gas-powered generation, thereby providing fuel cost savings.
  - **Further development of** some of the **best wind resources** in the country (total installed capacity of over 2,500 MW).

Contribution by benefit classes (%), Step Change scenario, Marinus Link in 2027 & 2030



How Marinus Link stacks up to changes in key input variables (sensitivity analysis)

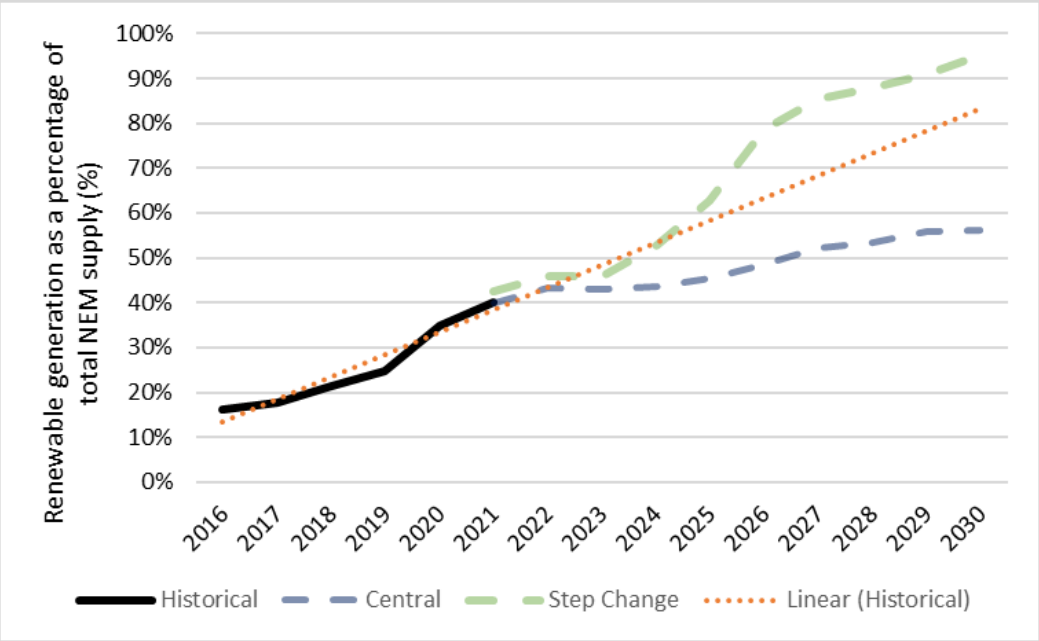
Sensitivity	Net market impact ($ million, NPV)	Revised net market benefit with sensitivity ($ million, NPV)	Relevant scenario
Hydrogen Load Growth (500 MW by 2035 & 1,000 MW by 2040)	-$554	$1,045	Step Change
Sustained Low Gas Price ($8/GJ – flat)	-$163	$654	Central
Economic retirements not allowed in Central scenario	-$59	$812	Central
750 MW committed pumped hydro in Tasmania	$573	$2,136	Step Change
Battery costs higher by 30% (ISP costs)	$51	$835	Central
Battery costs lower by 30% (ISP costs)	-$40	$796	Central
Project cost – upper bound ISP estimate ($4.1 billion)	-$206	$848[1]	Scenario weighted average

1. Preferred optimal timing on a scenario weighted basis is unchanged from 2031 & 2034.

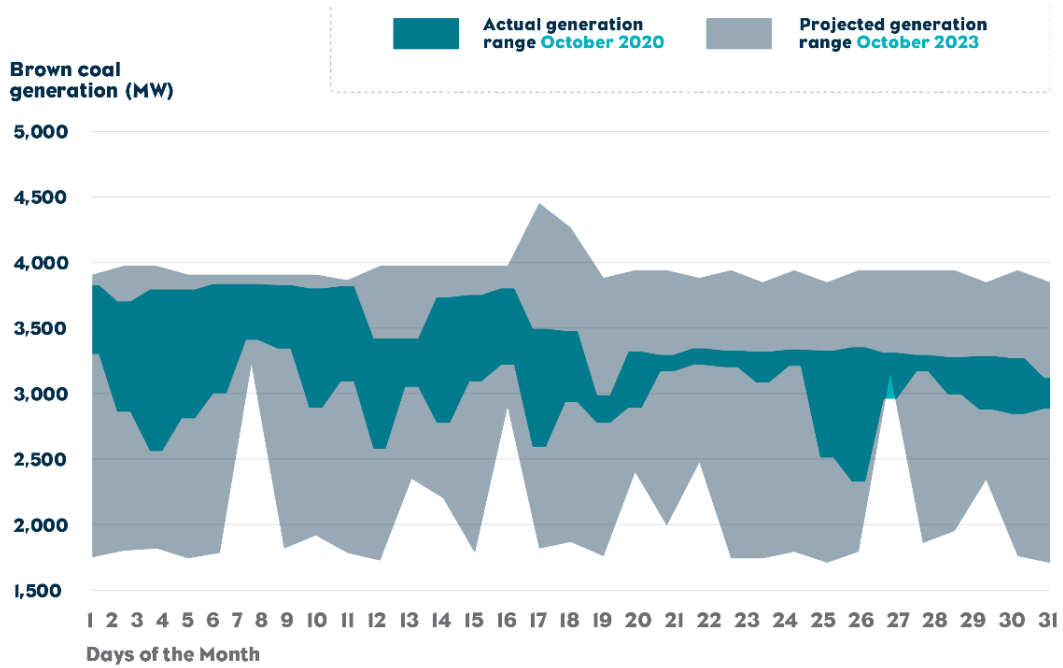
Are we in Step Change?

- The report makes a case to **prepare for the Step Change scenario** based on the following:
  - **NEM added 6.3 GW of additional renewable generation** (up to 6% of additional supply) in the most recent financial year.
  - This **exerts further economic and operational strain on ageing thermal generators** which could lead to some of them retiring earlier than initially planned.
- Lead time associated with **withdrawing dispatchable capacity** is much shorter than **commissioning large infrastructure projects**.

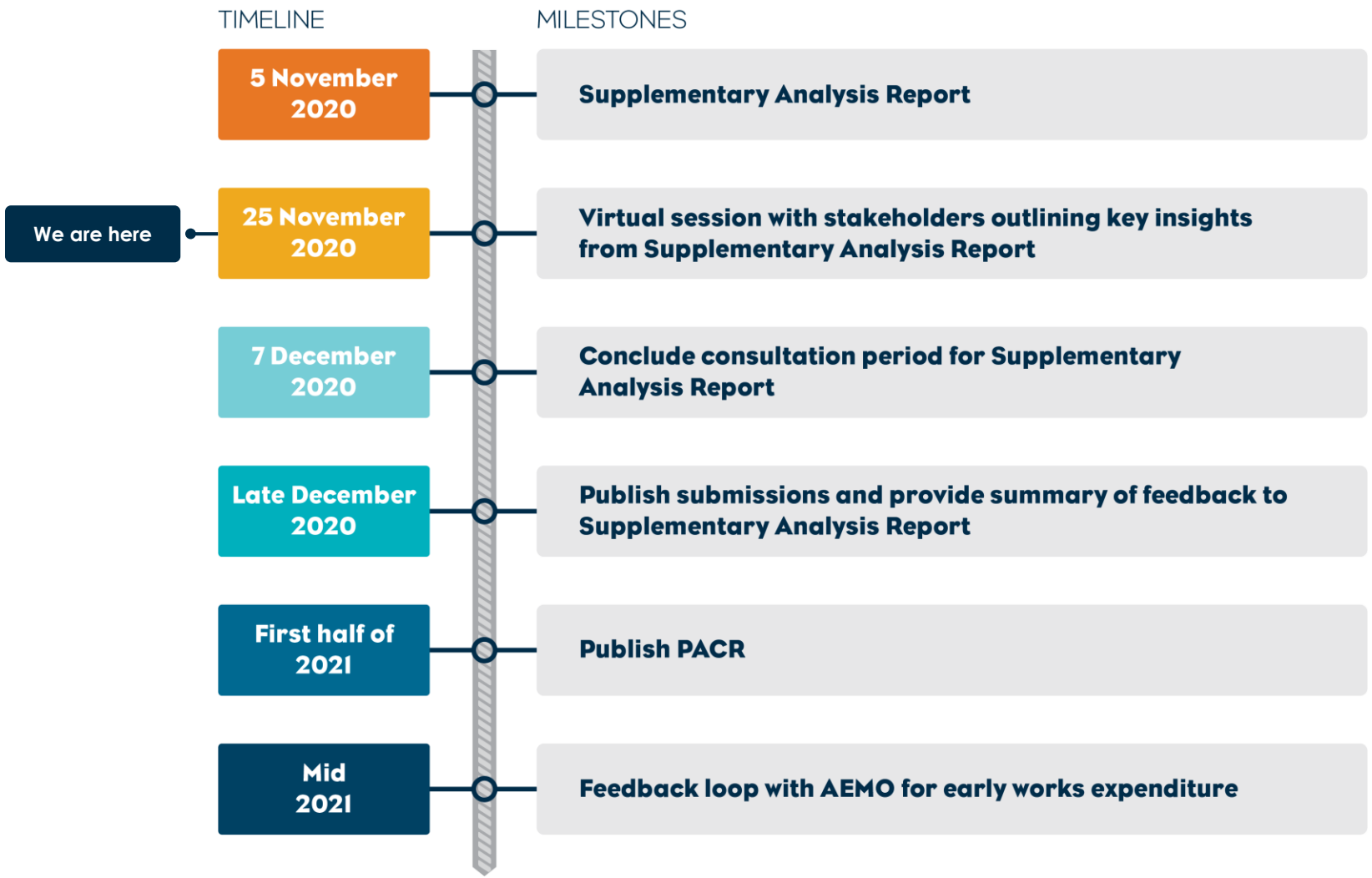
Renewable generation as a percentage of total NEM supply



Maximum and minimum daily generation range for October (Actuals for 2020 and modelled for October 2023 under Central scenario)



Next Steps


TIMELINE
MILESTONES
5 November 2020
Supplementary Analysis Report
We are here
25 November 2020
Virtual session with stakeholders outlining key insights from Supplementary Analysis Report
7 December 2020
Conclude consultation period for Supplementary Analysis Report
Late December 2020
Publish submissions and provide summary of feedback to Supplementary Analysis Report
First half of 2021
Publish PACR
Mid 2021
Feedback loop with AEMO for early works expenditure

Appendix to the TasNetworks Supplementary Analysis Report for Marinus Link

EY Market Modelling

25 November 2020

Presented by

Clare Giacomantonio
Director | Strategy and Transactions

Building a better working world

Notice

Ernst & Young ("we" or "EY") was engaged on the instructions of Tasmanian Networks Pty Ltd ("TasNetworks" or "Client") to provide market modelling in relation to the proposed Marinus Link interconnector ("Project"), in accordance with the contract dated 14 June 2018.

The results of EY's work, including the assumptions and qualifications made in preparing this presentation are set out in EY's report dated 27 November 2019 ("Report") and an addendum to the Report dated 9 November 2020 ("Addendum"). The addendum has been prepared at the specific request of the Client to update the scenarios and various input assumptions to align with more recent data. This presentation must be read in conjunction with the Report and Addendum to understand the full context and details of the model used to compute the long-term least-cost generation development plan and gross market benefits of Marinus Link. The Report and Addendum should be read in their entirety including this notice, the applicable scope of the work and any limitations. A reference to the Report includes any part of the Report and Addendum. No further work has been undertaken by EY since the date of the Report or the Addendum to update them. Except as described in this Addendum, no further work has been undertaken by EY since the date of the Report to update its contents.

EY has prepared the Report and Addendum under the directions of the Client and as per the guidance included in the RIT-T and followed the process outlined therein. EY has not been engaged to act, and has not acted, as advisor to any other party. Accordingly, EY makes no representations as to the appropriateness, accuracy or completeness of the Report and Addendum for any other party's purposes.

No reliance may be placed upon the Report and Addendum or any of its contents by any party other than the Client ("Third Parties"). Any Third Party receiving a copy of the Report and Addendum must make and rely on their own enquiries in relation to the issues to which the Report and Addendum relates, the contents of the Report and Addendum and all matters arising from or relating to or in any way connected with the Report and Addendum or their contents.

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Our work commenced on 6 January 2020 and was completed on 21 October 2020. Therefore, our Report and Addendum does not take account of events or circumstances arising after 21 October 2020 and we have no responsibility to update the Report or Addendum for such events or circumstances.

In preparing the Report and this Addendum we have considered and relied upon information from a range of sources believed to be reliable and accurate. We do not imply, and it should not be construed, that we have verified any of the information provided to us, or that our enquiries could have identified any matter that a more extensive examination might disclose.

The work performed as part of our scope considers information provided to us and a number of combinations of input assumptions relating to future conditions, which may not necessarily represent actual or most likely future conditions. Additionally, modelling work performed as part of our scope inherently requires assumptions about future behaviours and market interactions, which may result in forecasts that deviate from future conditions. There will usually be differences between estimated and actual results, because events and circumstances frequently do not occur as expected, and those differences may be material. We take no responsibility that the projected outcomes will be achieved, if any.

We highlight that our analysis, Report and Addendum do not constitute investment advice or a recommendation to you on a future course of action. We provide no assurance that the scenarios we have modelled will be accepted by any relevant authority or third party.

Our conclusions are based, in part, on the assumptions stated and on information provided by the Client and other information sources used during the course of the engagement. The modelled outcomes are contingent on the collection of assumptions as agreed with the Client and no consideration of other market events, announcements or other changing circumstances are reflected in the Report or this Addendum. Neither EY nor any member or employee thereof undertakes responsibility in any way whatsoever to any person in respect of errors in this Report arising from incorrect information provided by the Client or other information sources used.

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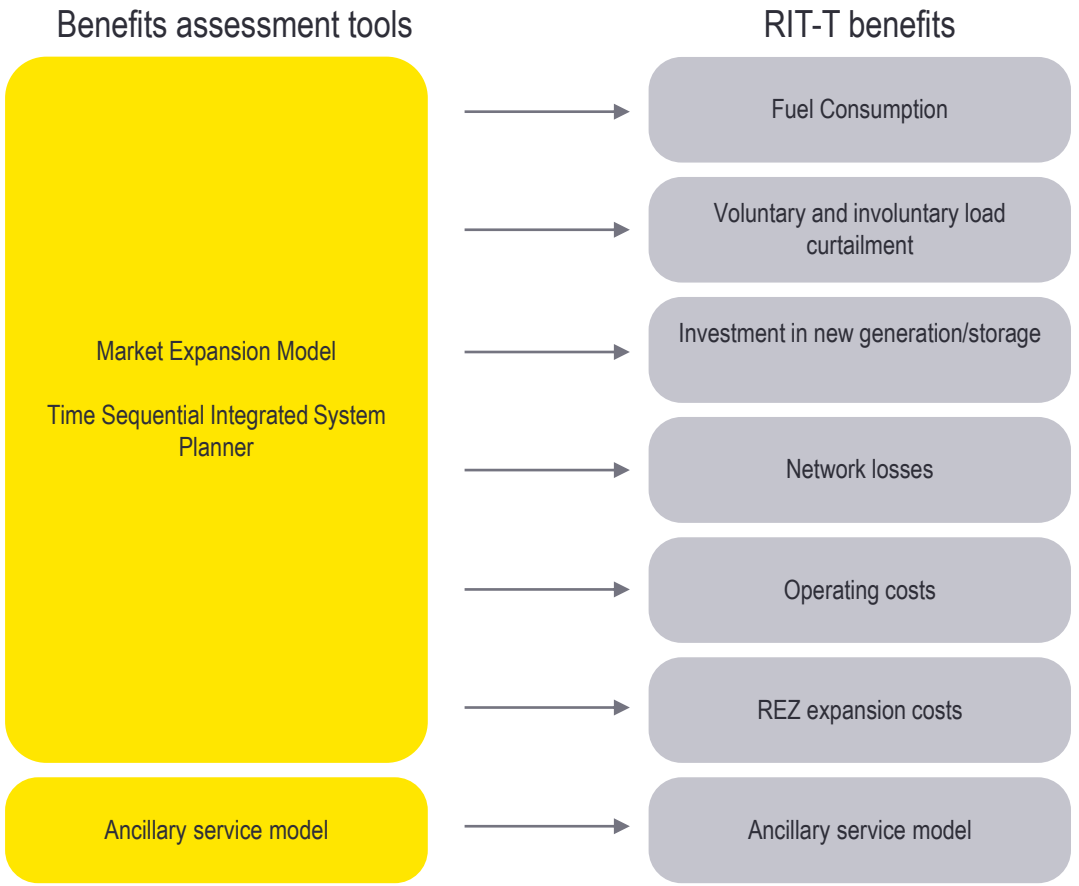
EY's liability is limited by a scheme approved under Professional Standards Legislation.

Modelling overview

- Least-cost NEM generation expansion model in accordance with AER RIT-T guidelines.
- Modelling conducted at hourly time-sequential granularity utilising a least-cost planning model that solves dispatch intervals for 21 years (FY2021-22 to FY2041-42) simultaneously.
- Least cost solution minimises cost of supply to meet demand and other constraints:
  - Generation of each plant and charging and discharging of storage.
  - Commissioning new plant installed 'linearly'.
  - Retiring existing plant to reduce FOM, fuel cost and VOM.
  - Other constraints include minimum loads, generator availability, emissions constraints etc.
- Model utilises 9 year historical trace for hydro inflows, wind and solar availability and demand shape. These traces include concurrent wind and hydro drought years.
- General alignment with AEMO 2020 Integrated System Plan (ISP).



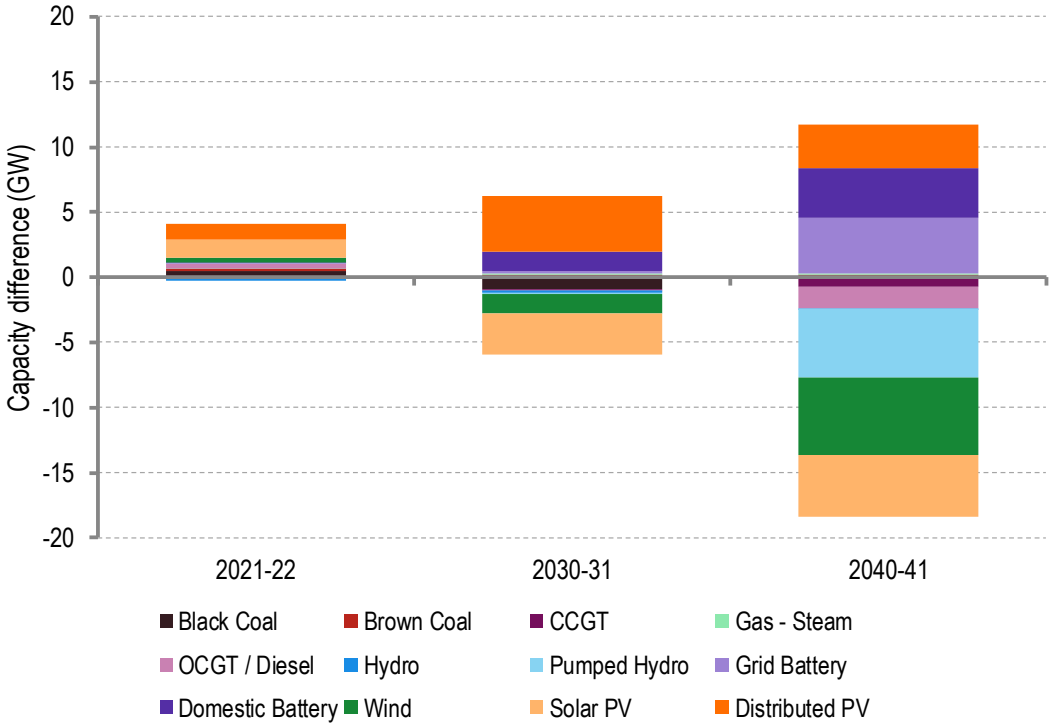
Overview of changes since PADR to align with 2020 ISP

- The modelling was undertaken to closer align with the AEMO 2020 ISP input assumptions and their five scenarios.
- Assumptions such as demand and the inclusion of TRET, which passed both Houses of Parliament last week, were updated to reflect more recent information.
- During the modelling process EY benchmarked our modelling against the ISP when assumptions such as demand and TRET were aligned with the ISP. Under these conditions our model outcomes for Marinus Link were broadly aligned with AEMO's timing across all scenarios.

	TasNetworks PADR	AEMO 2020 ISP	TasNetworks Supplementary Report
Demand Forecast	2018 ESOO demand	2019-20 ISP demand (lower than the 2018 ESOO)	2020 ESOO demand (lower than the 2019-20 ISP)
Final year of study period	2049-50	2041-42	
Renewable and pump hydro storage build limits	February 2019 ISP assumptions	2020 ISP assumptions (higher resource limits than Feb 2019 ISP)	
Capex trajectory	February 2019 ISP assumptions	2020 ISP assumptions (lower cost for battery storage) (higher cost for pumped storage hydro)	
TRET	Not included	Included in High DER and Step Change scenarios	Included in all scenarios

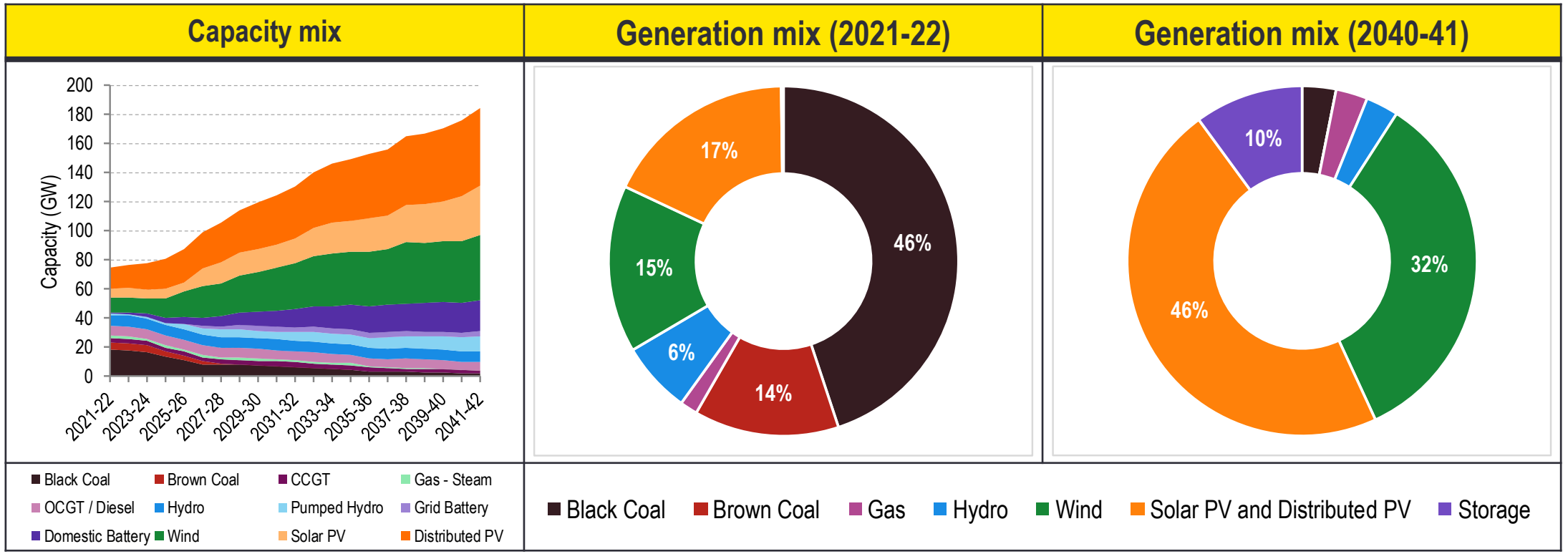
Changes in forecast capacity expansion since the PADR

- 2021-22:
  - More existing and committed renewable and storage projects along with minor thermal generation upgrades.
- 2030-31:
  - Minor changes to coal generation retirement schedule (e.g. Gladstone assumed to retire after 2030-31 and Callide B retirement brought forward prior to this date).
  - Higher assumed uptake of DER and lower operational demand (22 TWh lower annually throughout the NEM) results in 5 GW less large scale renewable capacity.
- 2040-41:
  - Operational demand assumed to be 23 TWh lower than previous PADR modelling results in less new entrant gas and renewables needing to be commissioned.
  - Lower capital cost of large scale batteries are able to offset some of the need for PSH in meeting peak demand and completely offset the need for new gas capacity.



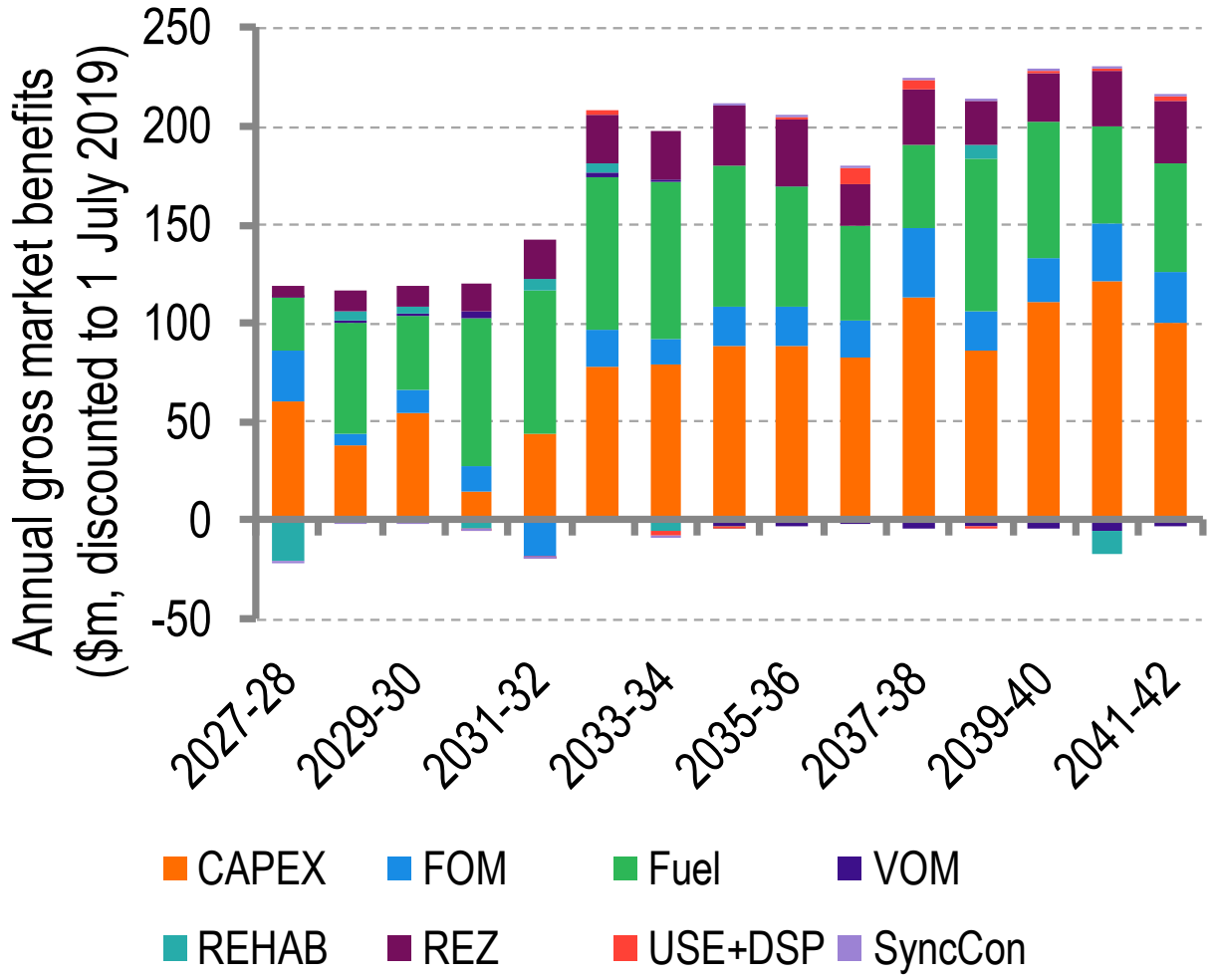
Forecast capacity and generation expansion for Step Change scenario with Marinus Link

- Fastest transition to renewables throughout the NEM for the Step Change scenario.
- In the Step Change scenario, there is less than 25 GW of thermal capacity by 2026-27.
- Wind and solar account for the majority of generation by 2040-41, with storage and interconnection used to shift energy when and where its needed.



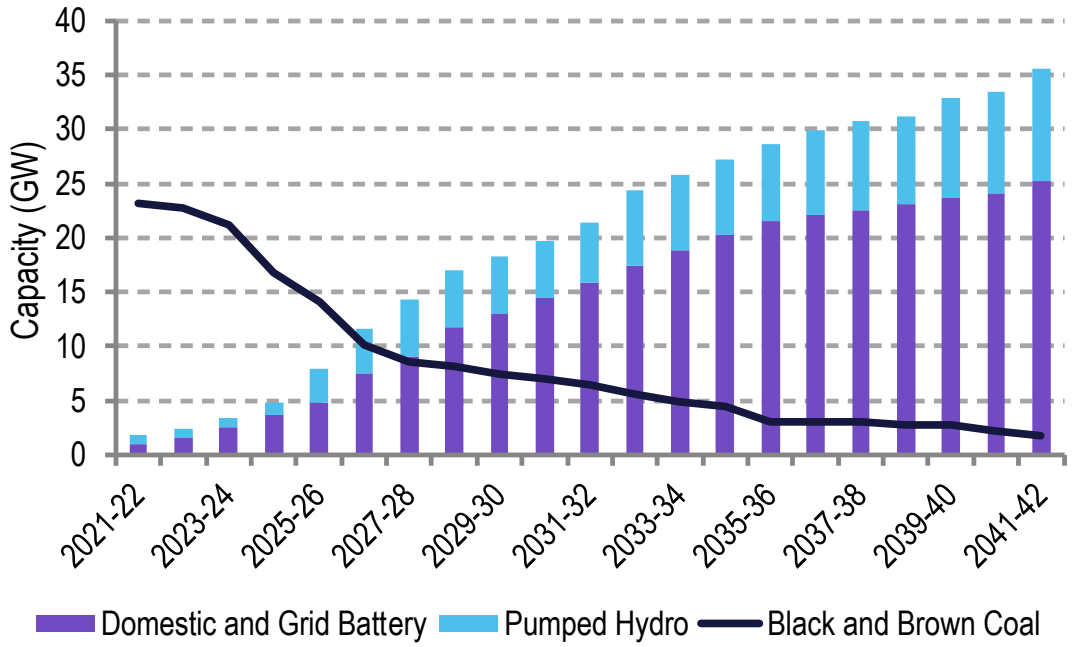
Forecast gross market benefits in Step Change scenario

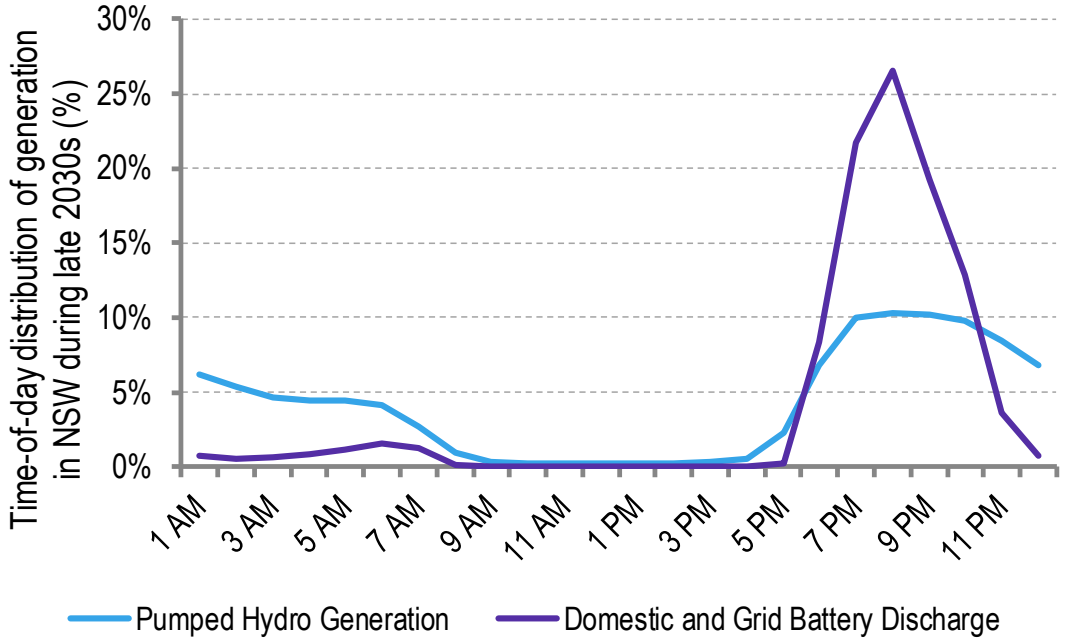
- Gross benefits are forecast to accrue from the first year of Marinus Link's commissioning.
- Major categories of RIT-T market benefits are
  - Capex (and FOM) savings from deferred and redistributed build profile for storage and renewable investment.
  - Fuel cost savings predominantly from reduced use of existing gas-powered generators.
- Stage 1 of Marinus Link unlocks existing conventional Tasmanian hydro and on-island renewable energy development.
- With the commissioning of the second stage of Marinus Link, long duration pumped hydro is forecast to be built in Tasmania.



Forecast storage capacity in Step Change scenario

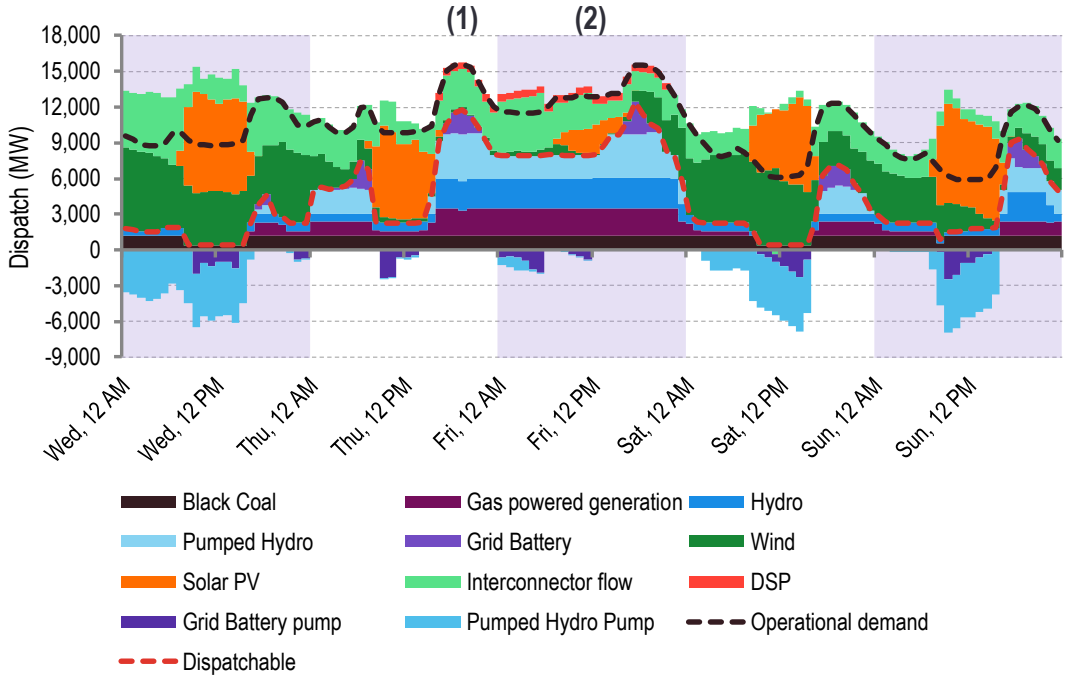
- A combination of short-term storage (up to 6 hours of storage) and long-term storage (more than 6 hours of storage) form the least cost forecast to replace retiring coal capacity.
- Short term storage predominantly operates to assist in meeting peak daily demand. During the late 2030s in NSW it is forecast that 90% of battery generation occurs from 5pm to 10pm, with 27% of discharge occurring from 7pm to 8pm.
- Due to the longer number of storage hours, pumped hydro generation is able to be spread throughout the evening and into the morning. Approximately 50% of daily generation occurs from 5pm to 10pm.



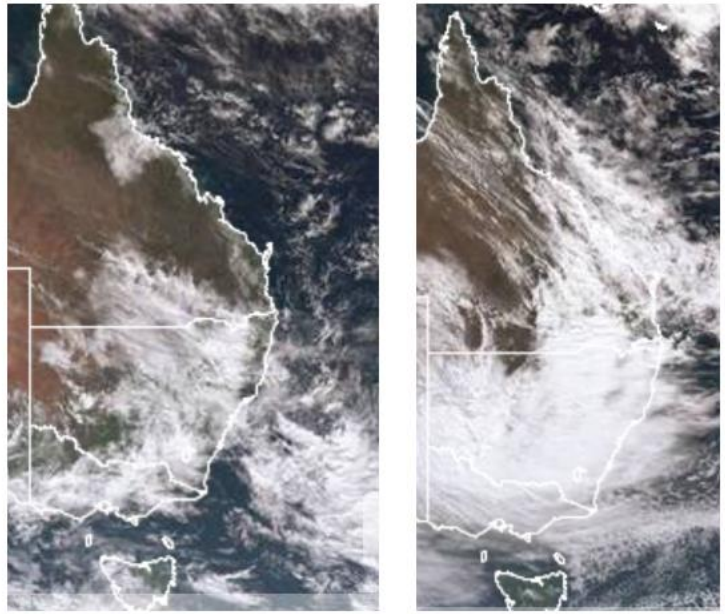


Navigating a VRE drought (Step Change scenario forecast)

- High cloud coverage and low wind availability has the potential to dramatically reduce renewable generation.
- The example below shows a forecast 5 day period in NSW during July 2037.
- Positive interconnector flow indicates net import (i.e. contributing to meet demand).
- During the forecast Thursday evening **(1)**, demand is met by the remaining thermal generators along with conventional hydro, short and long term storage, and up to 4 GW of import from connected regions in the NEM with excess availability.
- Throughout Friday **(2)**, short term storage is depleted, but long term storage projects are able to partially generate for 34 hours straight, with import from adjacent regions remaining high.

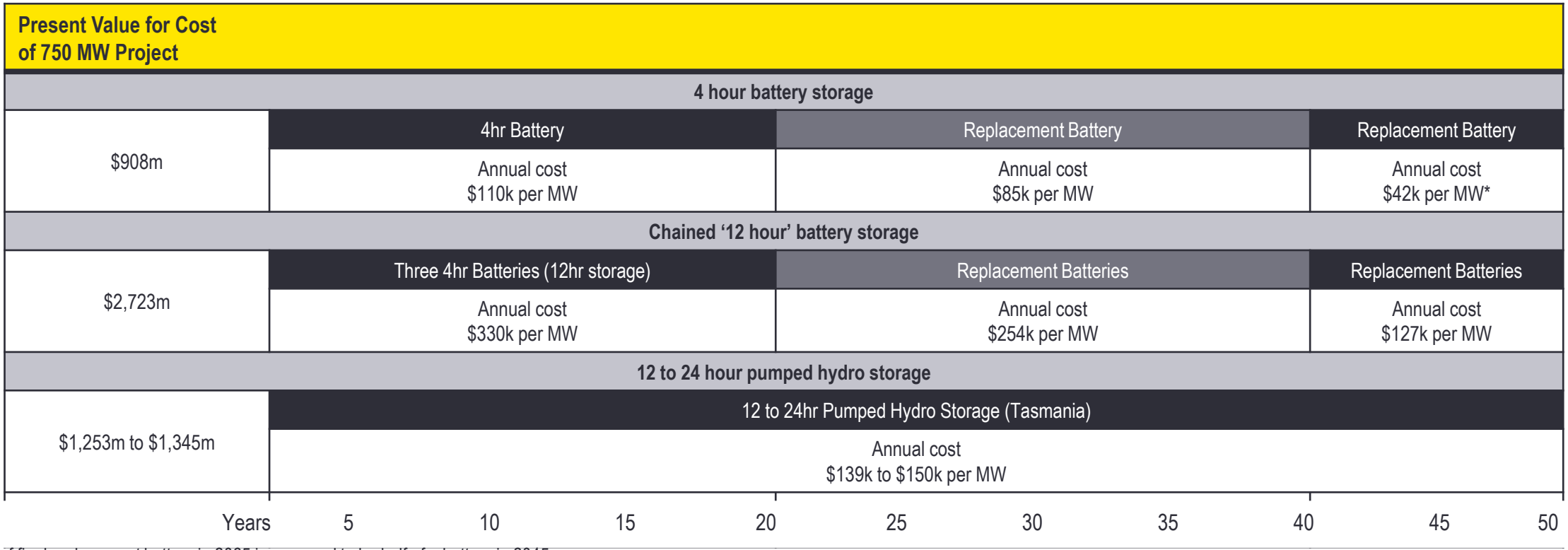


Example cloud coverage on 11 July and 6 August 2020



Relative costs of batteries and pumped hydro

- A battery built in 2025 would need to be replaced in 2045 and 2065 in order to last at least as long as a 50 year PSH project.
- Over a 50 year period, the present value of initially building 750 MW of battery capacity in 2025 with replacements is $908m.
- In Tasmania, the cost of constructing 750 MW of 12 to 24 hour pumped hydro in 2025 ranges from $1,253m to $1,345m.
- However, Tasmanian pumped hydro is lower cost when considering the number of storage hours.
- The NEM requires a combination of these technologies: batteries to operate over a short period in aiding to meet peak demand and pumped hydro to utilise their deeper storage by shifting energy throughout the day.

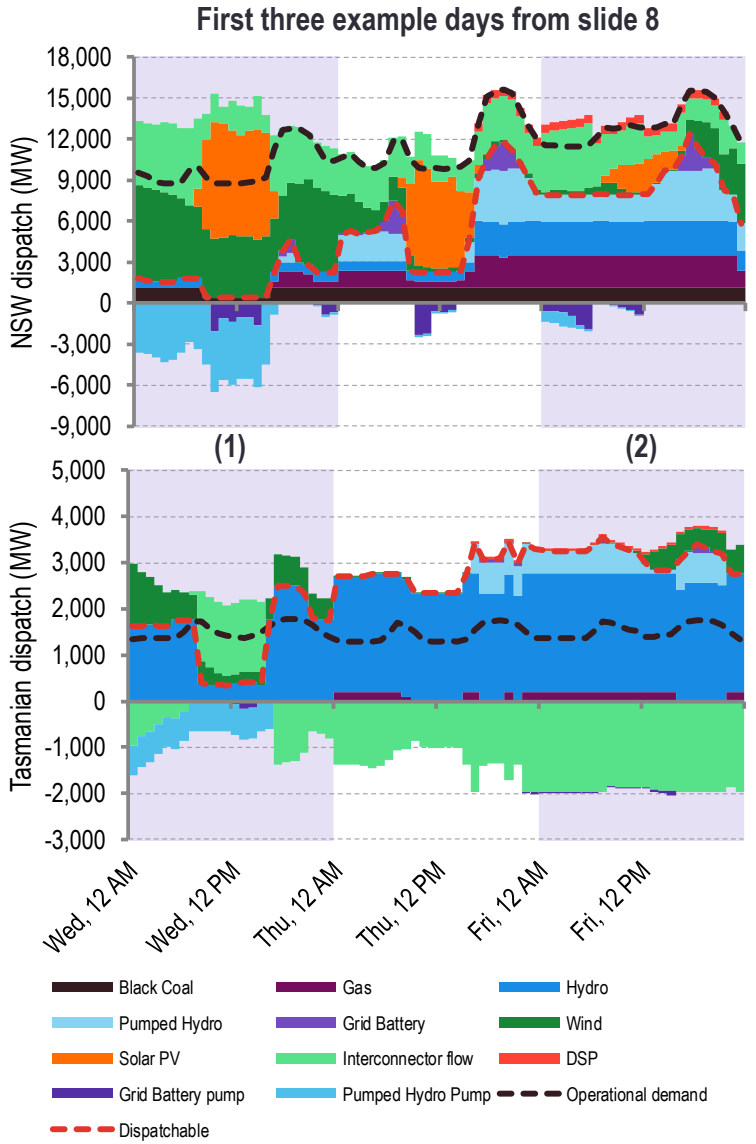


*Cost of final replacement battery in 2065 is assumed to be half of a battery in 2045.

The forecast role of Marinus Link

- As thermal generation retires it is forecast to be replaced by with a combination of renewables, storage and interconnection.
- Long-term storage and interconnection are important in meeting demand when variable renewable generation is unavailable.
- Marinus Link enables the NEM to achieve this at lower cost.
- During days of excess solar availability on the mainland **(1)**, Marinus Link enables Tasmania to use low cost generation to replenish water in pumped storage hydro.
- The combination of existing conventional hydro and new entrant pumped hydro storage in Tasmania can then be utilised during days of low mainland supply **(2)** by exporting on Marinus Link.

- Further details are available in EY's *Appendix to the TasNetworks Supplementary Analysis Report for Marinus Link*. Available at: https://www.marinuslink.com.au/rit-t-process/



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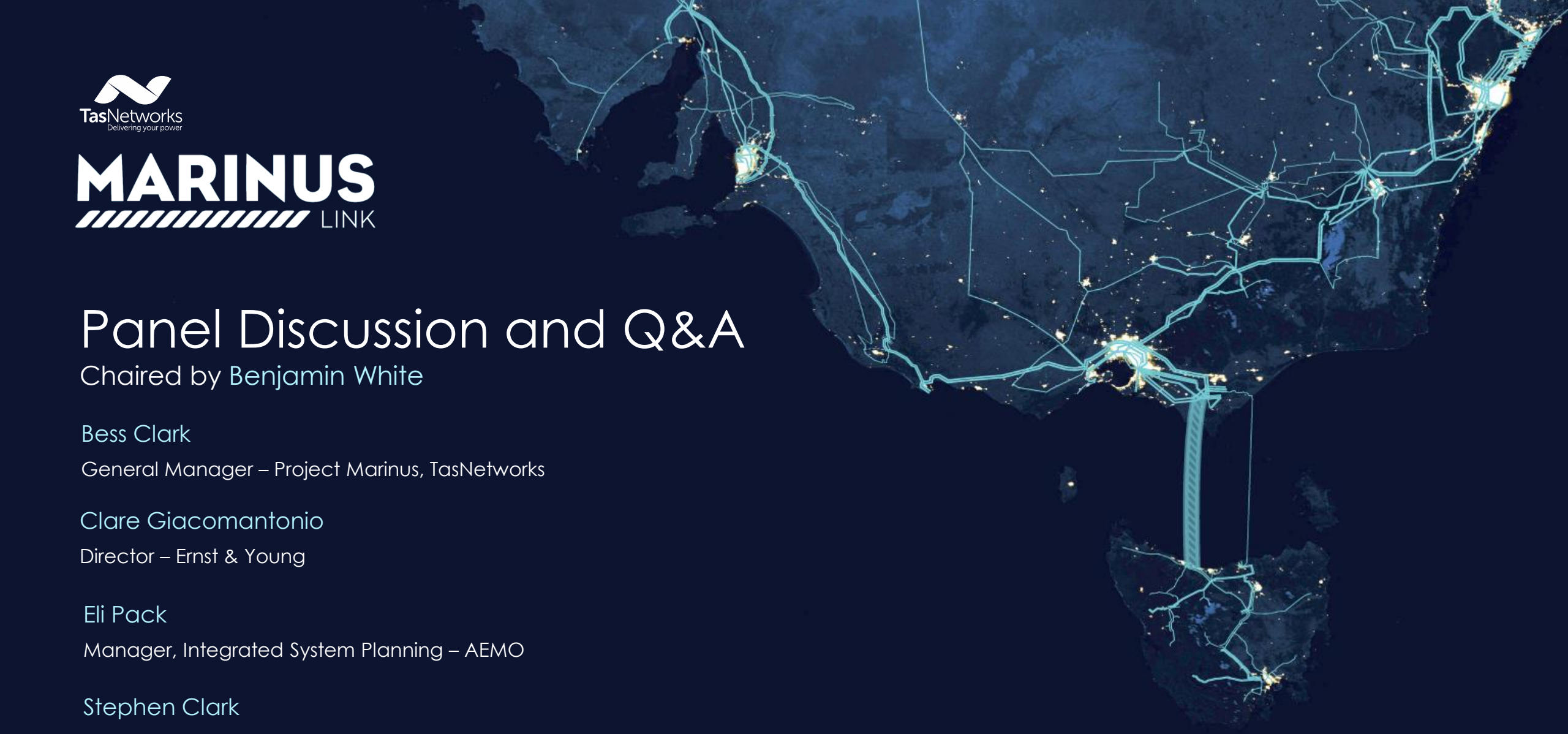

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MARINUS LINK

Panel Discussion and Q&A

Chaired by Benjamin White

Bess Clark

General Manager – Project Marinus, TasNetworks

Clare Giacomantonio

Director – Ernst & Young

Eli Pack

Manager, Integrated System Planning – AEMO

Stephen Clark

Marinus Link, Project Director – Project Marinus, TasNetworks

Marinus Link: Enabling low cost, secure and reliable, clean energy

Questions?

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