Craig Mickle
Partner

Infrastructure Advisory
T +61 2 9248 5196
M +61 411 510 199
E Craig.Mickle@au.ey.com

Bess Clark
General Manager – Marinus Link
Tasmanian Networks Pty Ltd
1/7 Maria Street, Lenah Valley
Moonah Tasmania 7009

20 November 2019

Economic Contribution Report to Tasmania – Marinus Link

Dear Bess,

In accordance with our engagement agreement dated 31 August 2018 (“Agreement”), Ernst & Young (“we” or “EY”) has been engaged by Tasmanian Networks Pty Ltd (“you”, “TasNetworks” or the “Client”) to provide an economic contribution analysis (the “Services”) in connection with Marinus Link, the proposed second Tasmanian interconnector (the "Project").

The results of Ernst & Young’s work, including the assumptions and qualifications made in preparing the report, are set out in Ernst & Young’s enclosed report dated 20 November 2019 (the "Report"). The Report should be read in its entirety including the cover letter, the applicable scope of the work and any limitations. A reference to the Report includes any part of the Report. No further work has been undertaken by Ernst & Young since the date of the Report to update it. This report builds on the earlier report dated 15 April 2019, which assessed the economic contribution of two options for the development of Marinus Link - a 600 MW interconnector and a 1,200 MW interconnector.

This Report focuses on a 1,500 MW interconnector. Since our report dated 15 April 2019, there have been updates to the configuration of the project, the cost estimates and the downstream impact that supports the analysis in this Report.

Purpose of our Report and restrictions on its use

Please refer to a copy of the Agreement for the restrictions relating to the use of our Report. We understand that the deliverable by EY will be used by TasNetworks, or any such party whom we have agreed in writing to accept a duty of care in respect of this Report, for the purpose of demonstrating the economic contribution of Marinus Link (the “Purpose”).

This Report was prepared on the specific instructions of TasNetworks solely for the Purpose and should not be used or relied upon for any other purpose.

This Report and its contents may not be quoted, referred to or shown to any other parties except as provided in the Agreement. We accept no responsibility or liability to any person other than to TasNetworks, or to such party to whom we have agreed in writing to accept a duty of care in respect of this Report. Accordingly, if such other persons choose to rely upon any of the contents of this Report they do so at their own risk.

Nature and scope of our work

The scope of our work, including the basis and limitations, are detailed in our Agreement and in this Report.

Our work was completed on 20 November 2019. Therefore, our Report does not take account of events or circumstances arising after 20 November 2019 and we have no responsibility to update the Report for such events or circumstances.

This analysis considers a number of combinations of input assumptions relating to future conditions, which may not necessarily represent actual or most likely future conditions. Additionally, modelling 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 and Report do not constitute investment advice or a recommendation to you on your future course of action. We provide no assurance that the scenario we have modelled will be accepted by any relevant authority or third party.

Craig Mickle
Partner

Infrastructure Advisory
T +61 2 9248 5196
M +61 411 510 199
E Craig.Mickle@au.ey.com

20 November 2019

Bess Clark
General Manager – Marinus Link
Tasmanian Networks Pty Ltd
1/7 Maria Street, Lenah Valley
Moonah Tasmania 7009

Our conclusions are based, in part, on the assumptions stated and on information provided by TasNetworks 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 this Report. Neither Ernst & Young 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 TasNetworks.

In the preparation of this Report we have considered and relied upon information from a range of sources believed after due enquiry to be reliable and accurate. We have no reason to believe that any information supplied to us, or obtained from public sources, was false or that any material information has been withheld from us.

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. However, we have evaluated the information provided to us by TasNetworks as well as other parties through enquiry, analysis and review and nothing has come to our attention to indicate the information provided was materially mis-stated or would not afford reasonable grounds upon which to base our Report.

While Ernst & Young have consented to the Final Report being published electronically on the TasNetworks website for informational purposes only, Ernst & Young have not consented to any distribution or disclosure beyond this. The material contained in the Report, including the Ernst & Young logo, is copyright and copyright in the Report itself vests in TasNetworks. The Report, including the Ernst & Young logo, cannot be altered without prior written permission from Ernst & Young

This letter should be read in conjunction with our Report.

Thank you for the opportunity to work on this project for you. Should you wish to discuss any aspect of this Report, please do not hesitate to contact Craig Mickle on 0411 510 199.

Yours sincerely

Craig Mickle
Partner

The economic contribution of Marinus Link and Supporting Transmission

TasNetworks

20 November 2019

Building a better working world

Notice

Please refer to a copy of the Agreement for the restrictions relating to the use of our Report. We understand that the deliverable by EY will be used by TasNetworks, or any such party whom we have agreed in writing to accept a duty of care in respect of this Report, for the purpose of demonstrating the economic contribution of Marinus Link (the "Purpose").

This Report was prepared on the specific instructions of TasNetworks solely for the Purpose and should not be used or relied upon for any other purpose.

This Report and its contents may not be quoted, referred to or shown to any other parties except as provided in the Agreement. We accept no responsibility or liability to any person other than to TasNetworks, or to such party to whom we have agreed in writing to accept a duty of care in respect of this Report. Accordingly, if such other persons choose to rely upon any of the contents of this Report they do so at their own risk.

The scope of our work, including the basis and limitations, are detailed in our Agreement and in this Report.

Our work was completed on 20 November 2019. Therefore, our Report does not take account of events or circumstances arising after 20 November 2019 and we have no responsibility to update the Report for such events or circumstances.

This analysis considers a number of combinations of input assumptions relating to future conditions, which may not necessarily represent actual or most likely future conditions. Additionally, modelling 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 and Report do not constitute investment advice or a recommendation to you on your future course of action. We provide no assurance that the scenario 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 TasNetworks 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 this Report. Neither Ernst & Young 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 TasNetworks.

In the preparation of this Report we have considered and relied upon information from a range of sources believed after due enquiry to be reliable and accurate. We have no reason to believe that any information supplied to us, or obtained from public sources, was false or that any material information has been withheld from us.

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. However, we have evaluated the information provided to us by TasNetworks as well as other parties through enquiry, analysis and review and nothing has come to our attention to indicate the information provided was materially mis-stated or would not afford reasonable grounds upon which to base our Report.

While Ernst & Young have consented to the Final Report being published electronically on the TasNetworks website for informational purposes only, Ernst & Young have not consented to any distribution or disclosure beyond this. The material contained in the Report, including the Ernst & Young logo, is copyright and copyright in the Report itself vests in TasNetworks. The Report, including the Ernst & Young logo, cannot be altered without prior written permission from Ernst & Young

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

Executive summary

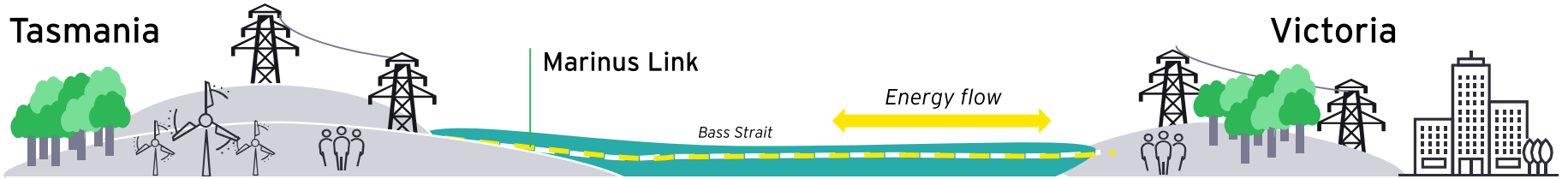
Marinus Link – Connecting economies and communities

Construction for a 1,500 MW Marinus Link is expected to ramp up in 2023, taking between four and five years to complete. The construction phase of the project is expected to provide **$1,019 million** in value added and support **6,222 job years** for Tasmania. For Victoria, Marinus Link is expected to provide **$1,083 million** in value added and support **6,361 job years.**

The peak construction period will span from **2025** to **2027**. During this period, Marinus Link is expected to support **283 direct** and **1,109 indirect** jobs per year in Tasmania, and **220 direct** and **1,174 indirect** jobs per year in Victoria.

During the modelled operating period (2027 to 2050), Marinus Link is expected to provide **$354 million** in value added in Tasmania and support **1,860 job years**. In Victoria, the operation of Marinus Link is expected to provide **$419 million** in value added and **2,141 job years.** Given that Marinus Link is expected to operate beyond 2050, further value added and job years can be expected. In addition to Tasmanian and Victorian benefits, the project is likely to support further value add and job years in other areas in Australia.

In April 2019, Marinus Link received bipartisan support from both the Federal Liberal and Labour parties and the current Federal Government has committed $56 million toward the design and approval of Marinus Link.



1 Refer to page 14 for a detailed explanation of the interpretation of value added and job years. These numbers are gross consistent with the application of economic contribution analysis.

Overview

Purpose and scope

TasNetworks has engaged EY to undertake an assessment of the economic contribution of Marinus Link's construction and operating phases.

This report outlines the following:

1. The total direct and indirect economic contribution to Tasmania and Victoria for Marinus Link – in terms of economic value add and jobs[1]
2. The total direct and indirect economic contribution of the investment in additional Tasmanian generation that the 1,500MW Marinus Link is expected to induce under two scenarios:
    1. Status quo/Current policy scenario ("Status Quo")
    2. Accelerated transition to low emissions scenario ("Accelerated Transition")
3. The total direct and indirect economic contribution to three regions within Tasmania – in terms of jobs.

The analysis provided is intended to assist TasNetworks to quantify the potential wider economic benefits of Marinus Link beyond the electricity market. The electricity market impacts of Marinus Link are set out in a separate EY report.[2]

Marinus Link

Marinus Link or the Second Bass Strait Interconnector ("Marinus Link"), along with significant supporting on-island AC transmission upgrades, is a proposed HVDC (High Voltage Direct Current) electricity transmission connection between mainland Victoria and Tasmania. If built, Marinus Link will complement the existing Basslink interconnector, which began trading energy between Tasmania and Victoria via the National Electricity Market in 2006.

TasNetworks are currently in the process of preparing a preferred Marinus Link configuration. For this analysis, EY has considered a 1,500 MW, Twin Symmetrical Monopole configuration.

The Project is expected to be completed in two phases ("Phase 1" and "Phase 2"). Each phase is expected to take four years to construct. Operation of Phase 1 is expected to commence on 1 July 2027, and Phase 2 on 1 July 2028. Each phase will deliver 750 MW. The estimated project cost used in this analysis is $3.5 billion. This includes an allowance for accuracy and contingency. The key alternative would be for the development of the two 750MW links to be spaced by 2 – 4 years.

Induced renewable investment in Tasmania

Marinus Link is expected to induce further renewable electricity generation in Tasmania to meet the growing demand for cleaner energy from the National Electricity Market.

AEMO's Integrated System Plan (ISP) has identified the North-West, Tasmanian Midlands and North-East as indicative locations for pumped hydro storage, wind and solar farms. These locations are generally more competitive for renewable energy generation than many sites on the mainland due to their natural characteristics.

The induced investments are expected to be incrementally installed after the construction of Marinus Link. The installation magnitude (MW) and timeframe is estimated through EY's "market model", which forecasts generator dispatch and new builds.[3] This analysis considers two scenarios for the induced investment:

- **Status Quo:** broadly aligns with AEMO's 2019 Central scenario. It reflects the current transition of the energy industry under current policy settings and technology trajectories, where the transition from fossil fuels to renewable generation is generally led by market forces and supported by current federal and state government policies.
- **Accelerated Transition:** broadly aligns with AEMO's 2019 Step Change scenario. It reflects strong action on climate change, with the NEM targeting a 90% reduction in emissions by 2050, compared to 2016 levels. In this scenario, aggressive global decarbonisation leads to faster technological improvements.

The analysis of induced investment in both scenarios was focused on the incremental capacity. That is, the resulting capacity over and above the base case of no Marinus Link being installed.

1 Please refer to the jobs explanation on page 16
2 Please refer to the EY draft report titled "Project Marinus PADR economic modelling report"
3 AEMO, 2019 forecasting and planning scenarios, inputs, and assumptions, August 2019.

Economic Contribution Analysis

Our approach has involved using economic contributions analysis to capture the direct effects of an industry (i.e. revenues or output) relevant to Tasmania and Victoria. It then applies an economic multiplier to capture the flow-on (or 'indirect') effects of Marinus Link's construction phases and operating phases. It applies the same process to the additional Tasmanian generation that Marinus Link is expected to induce. The analysis below assumes that Phase 1 is operational on 1 July 2027, and Phase 2 on 1 July 2028. The table below summarises the total value added and jobs that Marinus Link and the induced investment is expected to support.

Summary value added ($m) and jobs (job years) expected for Tasmania and Victoria (numbers rounded)

	Tasmania				Victoria	
	Marinus Link		Induced investment		Marinus Link	
	Value added ($m)	*Jobs (job years)*	*Value added ($m)*	*Jobs (job years)*	*Value added ($m)*	*Jobs (job years)*
Status Quo						
Construction	1,019	6,222	2,543	15,530	1,083	6,361
Operations [1]	354	1,860	1,850	12,872	419	2,141
Accelerated Transition						
Construction	*As above*		3,278	20,013	*As above*	
Operations			2,502	17,403		

During the peak construction period spanning from 2025 to 2027, Marinus Link is expected to support:

- **283 direct** and **1,109 indirect** jobs per year in Tasmania
- **220 direct** and **1,174 indirect** jobs per year in Victoria.

The above economic contribution analysis is focussed on estimating value added and job years in Tasmania and Victoria. As outlined in Appendix A, the REMPLAN model accounts for 'leakage' of direct expenditure from the economy in its multipliers. Therefore, it may be possible for value added and job years to be realised in places other than Tasmania and Victoria.

As outlined in Appendix G, further value added and job years can also be expected from the telecommunications infrastructure that is needed to provide power support to Marinus Link.

1 *Note that the 'Accelerated Transition' scenario uses the same construction costs and profile as the Status Quo scenario.*

Induced Investments in Tasmania

The scale of induced investments expected to flow from the installation of Marinus Link were estimated by:

- Calculating the net difference in the amount of induced capacity installed relative to the base case, by technology type
- Calculating total installation costs for that capacity
- Estimating the change in the variable and fixed operating and maintenance costs (VOM and FOM) for each technology

Key investments – Status Quo:

The installation of Marinus Link, when compared to the base case, is expected to result in:

- $4,285m being spent on an additional 2,089MW of wind capacity
- $2,025m being spent on an additional 1,203MW in pumped hydro capacity

Key investments – Accelerated Transition:

The installation of Marinus Link under the Accelerated Transition scenario, when compared to the base case, is expected to result in approximately:

- $5,338m being spent on an additional 2,265MW of wind capacity
- $2,542m being spent on an additional 1,505MW of pumped hydro capacity

Further information on the expected incremental capacity of induced investments can be found in Appendix C.

Regional investment

The report isolates three local economies that are expected to realise most of the economic contribution of Marinus Link and its induced investment. Specifically: North West Tasmania, North East Tasmania and the Tasmanian Midlands. The direct benefits of Marinus Link are modelled in North West Tasmania but it is likely that some would flow state wide. The table summarises the total jobs that Marinus Link and the induced investment is expected to support:

Summary jobs (job years) expected for selected local economies [1]

	North West Tasmania		North East Tasmania		The Tasmanian Midlands		Rest of Tasmania [2]	
	Marinus Link	Induced investment	Marinus Link	Induced investment	Marinus Link	Induced investment	Marinus Link	Induced investment
Status Quo								
Construction	4,981	6,726	0	1,222	0	2,551	1,241	5,031
Operations	1,474	4,178	0	1,970	0	2,522	386	4,202
Accelerated Transition								
Construction	As above	8,582	As above	1,615	As above	3,299	As above	6,517
Operations	As above	5,715	As above	2,628	As above	3,399	As above	5,661

1 The jobs (job years) expected to be attributable to each region do not add up to the total jobs expected for the whole of Tasmania. This is driven by construction and operating jobs flowing to regions not captured in the regional investment analysis – the unshaded areas in the map to the right.

2 Benefits for the Rest of Tasmania are indicative only, and were not specifically modelled in this analysis. The value added and job years supported that are included in this table assume that any Whole of Tasmania benefits that are not captured in the three local Regions would flow to the Rest of Tasmania.

Indicative renewable investment locations in Tasmania

Source: TasNetworks

Types of jobs supported

Marinus Link

The construction and operations of Marinus Link and its induced investment is expected to support jobs across a wide range of industries, education levels and occupations.

Construction

Core jobs in the construction phase include:

- Those physically involved in the building and installation process, such as:

Electricians	Engineers	Builders	Carpenters
Plumbers	Welders	Metal workers	Support workers

- Those indirectly involved in the building and installation process, such as:

Cost estimators	Engineers	Construction managers	Architects
Financial advisors	Technicians	Surveyors	Safety and incident support staff

Operations

Core jobs in the operations phase include:

Safety and incident support staff	Operations and maintenance manager	Plumbers, welders and other maintenance staff	Corporate and financial staff, asset managers

Given Marinus Link's unique status as a maritime project, professionals with experience in dealing in ocean-based environments are required throughout both construction and operating phases:

Maritime safety staff	Marine preservation advisors	Maritime construction and engineering specialists	Maritime logistics and transportation specialists

Induced investment

With the exception of maritime related jobs, the induced investment is expected to support jobs similar to those identified above. Specialists with expertise in solar PV, wind and Pumped Hydro generation will also be required.

Table of contents

Report structure	
Introduction	
12	Introduction
13	Overview of Marinus Link
14	Our Approach
Marinus Link	
18	Overview of Marinus Link's construction and operations profile
19	Economic contribution to Tasmania
21	Economic contribution to Victoria
Induced investment	
24	Overview
27	Economic contribution to Tasmania
Local investment	
32	Local investment - Overview
33	North West Tasmania
35	North East Tasmania
37	Tasmanian Midlands
Appendices	
40	Glossary
41	Appendix A - REMPLAN
42	Appendix B – Marinus Link Cost Apportionment Methodology
43	Appendix C – Induced Investments in Tasmania
44	Appendix D – Local Investment Methodology
45	Appendix E – Calculation Example: Tasmanian Wind Installation
46	Appendix F – Calculation Example: Tasmanian Wind Operations
47	Appendix G – Telecommunications Investment

12 Introduction
13 Overview of Marinus Link
14 Our Approach

Introduction

Introduction

Purpose of this report: Capturing the broader economic benefits of Marinus Link

TasNetworks has engaged EY to undertake an assessment that captures the total direct and indirect economic contribution of Marinus Link's construction and operating phases and the investments it is expected to induce.

This analysis in this report outlines the following:

1. The total direct and indirect economic contribution to Tasmania and Victoria for Marinus Link – in terms of economic value add and jobs
2. The total direct and indirect economic contribution of the investment in additional Tasmanian generation that Marinus Link is expected to induce (under Status Quo and Accelerated Transition)
3. The total direct and indirect economic contribution to three regions within Tasmania – in terms of jobs

The analysis provided is intended to assist TasNetworks to quantify the potential wider economic benefits of Marinus Link beyond the impacts on the electricity market. The impacts on the electricity market of Marinus Link are the subject of a separate EY report.

What is Marinus Link?

Marinus Link and supporting on-island (in the case of Tasmania) AC Transmission, or the Second Tasmania Interconnector, is a proposed HVDC (High Voltage Direct Current) electricity transmission connection between mainland Victoria and Tasmania. When built, Marinus Link will complement the existing Basslink interconnector, which began trading energy between Tasmania and Victoria via the National Electricity Market in 2006.

Based on guidance from TasNetworks, this analysis assumes Marinus Link's currently preferred alignment and configuration, shown in the diagram overleaf.[1]

Cost Breakdown

Cost Category	Value ($m)
HVDC cable and converter station costs	2,390
Supporting network integration costs	530
Project costs	557
TOTAL	3,477

Note: contingency and accuracy allowances are included in the cost estimate used in this analysis.

1 *Basslink is a HVDC interconnector between Loy Yang in Gippsland to Bell Bay in Northern Tasmania.*

Overview of Marinus Link

Possible alignment for the second interconnector

Source: ARENA, Project Marinus, <https://projectmarinus.tasnetworks.com.au/2019/10/a-1500-mw-marinus-link-is-technically-feasible-and-delivers-greatest-benefits/>

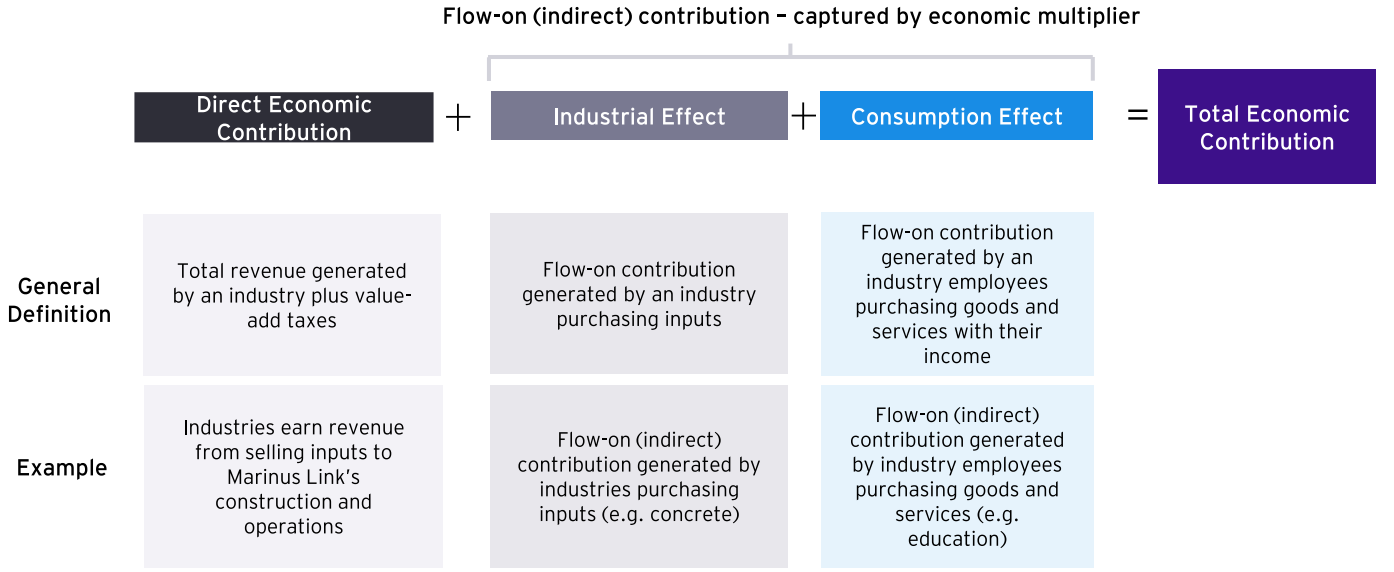
Marinus Link is expected to be a 1,500 MW, Twin Symmetrical Monopole

The total capital cost for Project Marinus could be up to approximately $3.5 billion.

The Project is expected to be completed in two phases. Each phase is assumed to deliver 750 MW of power on a continuous basis in either direction. Phase 1 is expected to be operational by 1 July 2027 and Phase 2 by 1 July 2028.

Approach – How we have captured the broader economic benefits of Marinus Link

Economic Contribution components



Economic contribution is a gross measure rather than a net measure of the contribution of an industry or a project to the economy.

Economic contribution studies do not consider substitution impacts, or what would happen if the relevant industry did not exist, or the relevant project did not occur.

The value add estimates are therefore gross measures, as are the employment impacts.

Economic contribution analysis measures market related direct and indirect expenditure and economic activity generated by a specific industry and / or activity. Direct contribution analysis involves understanding and mapping the contributions directly attributable to an activity (i.e. the construction of Marinus Link). The key direct impacts will come from capital and operating expenditures, employment and tax contributions associated with Marinus Link's construction and operations and the construction and operations of its induced investment. These processes will also directly contribute to value add and jobs.

Indirect economic contribution involves mapping the flow-on impacts from a proposed industry / activity as the direct impacts of the activity flow through the economy. These flow-on impacts are typically reflected through the supply chain effects as more goods and services are demanded and consumption effects where a proportion of wages and salaries paid to workers are spent on consumptions activities.

In our analysis, separate multipliers were sourced for installation and equipment costs. Installation multipliers were based on input-output data from the Heavy & Civil Engineering Construction sector, while equipment multipliers were based on input-output data from the Electrical Equipment Manufacturing sector. Installation multipliers were applied to the total installation costs for Project Marinus and induced investments (i.e. equipment costs were removed from the total cost figure) to estimate value add and job years. This is due to the assumption that the key electrical equipment components of Marinus Link will be sourced from overseas. This is a conservative assumption.

Project installation and maintenance costs are not discounted for this economic contribution analysis. Financial data expressed in real 2019 dollars was used to estimate indicative value add and jobs benefits. Induced investment data already makes assumptions regarding the change in the future real cost profile of renewable technologies.

Approach

REMPLAN and other data sources

Economic contributions analysis has been undertaken using REMPLAN software. REMPLAN is an economic analysis software package designed for use by economic development practitioners to estimate the direct and indirect impacts of infrastructure developments or policy changes. REMPLAN provides detailed economic data for single or combinations of local government areas and also incorporates a dynamic economic modelling capability to allow the analysis of 'what if' scenarios.

Other data sources used to inform calculations in this report include:

- **IRENA Renewable power generation costs in 2017:** Used to obtain capital expenditure cost breakdowns for hydro turbine, wind and solar PV electricity generators;
- **Marinus Link – Project Specification Consultation Report:** Used to obtain inputs on capital and operating expenditure
- **EY's market model:** Used to obtain forecasting data on potential investments induced by Marinus Link. This includes information on:
  - Fixed operating and maintenance costs ($);
  - Variable operating and maintenance costs ($);
  - Capital expenditure costs ($/MW);
  - Planned investments in renewable energy in MW until 2050 for hydro, solar and wind electricity generation investments in Tasmania;
- **TasNetworks internal model:** Used to obtain preliminary cost breakdowns for Marinus Link.
- **AEMO, 2019 forecasting and planning scenarios, inputs, and assumptions, August 2019:** Used to obtain proposed MW, REZ locations and optimal locations for hydro, wind and solar generation. This data was used to approximate potential investment in the economic regions identified by EY.

All years referred to in this report are financial years. Some figures in this report have been rounded for ease of communication. As a result, not all figures will reconcile exactly to totals (e.g. in some tables).

Cost Allocation

The economic contribution analysis performed for this Report modelled total construction costs

Project Marinus

1. The total capital costs for Marinus Link are estimated to be approximately $3.5bn
2. Equipment costs were removed from the total costs as input costs in the estimation of value add as most of the equipment cost for Marinus Link and renewables will be sourced primarily from overseas. This is a conservative assumption.
3. The residual capital cost was then allocated to the jurisdiction where the cost is likely to be incurred
4. On the advice of TasNetworks, costs were split on an 50/50 basis between Victoria and Tasmania respectively, unless the specific jurisdiction of the cost was identified
5. Installation multipliers were applied to the residual costs to estimate value add and job years supported.

Induced Investments

1. The IRENA Cost Database was used to form assumptions on the proportion of total capital costs that could be attributable to construction
2. Multipliers were then applied to construction costs to determine value added and job years supported. See Appendices E and F for a worked example of economic contribution analysis for induced investments.

Approach (cont.)

Value Add Explanation

Gross value add is typically estimated as the market value of goods and services produced, after deducting the cost of goods and services used. It represents the sum of all wages, income and profits generated.

Gross value add will contribute to Gross State Product (GSP), however the two are different measures of economic impact, as GSP incorporates the value of inputs used in production.

As slide 14 describes, all numbers cited in this report refer to gross value add. An economic contribution analysis model is a high-level model with significant simplifying assumptions, and results should be interpreted with this in mind.

When reporting gross value add figures, it is good practice to always describe the period for which the value add figure applies.

Jobs explanation

The jobs presented in this report represents the gross employment demand that would arise in Tasmania as a consequence of the construction and operation of Marinus Link. The employment footprint disregards any displacement effects – i.e. it does not make assumptions about whether or not the jobs are net additional. The footprint estimates are suited to understand the overall job opportunities and needs Marinus Link is expected to generate. The jobs numbers in this report are estimates, based on sector employment multipliers applied to installation costs. Job year estimates may differ to the actual number of workers directly employed by TasNetworks in any given year.

All jobs in economic contribution analysis represent "job years" - A 'job-year' represents one full time job supported for a full year – for instance, 1,000 job-years may be 500 jobs sustained over 2 years, or 100 jobs sustained over 10 years.

Good practices when reporting these gross employment figures include:

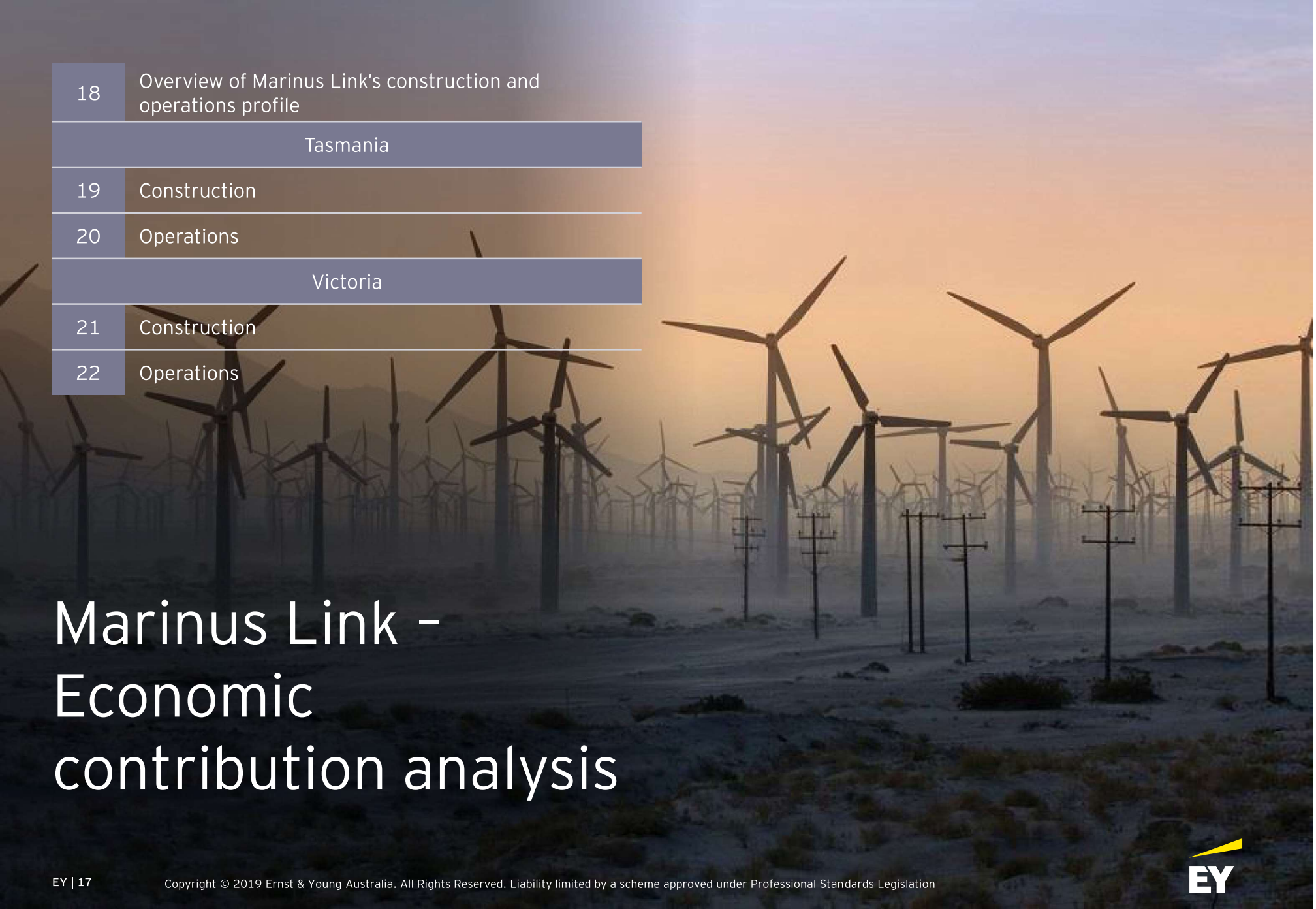
- Always describing the period for which the jobs figure applies; e.g. "for the construction period" or "for ten years", etc.
- Avoiding phrases that assume economic constraints have already been accounted for, e.g. stating that the Project "supports 10,000 jobs" or "expects to result in" is more accurate than "supports 10,000 new jobs"; and being clear that the figures are gross jobs, not net.
- Job figures should not be added to other projects undertaken in Tasmania.

Key approach and assumptions

There are several appendices that the background to our approach. In particular:

- A glossary of key terms
- Appendix A - REMPLAN
- Appendix B – Marinus Link cost apportionment methodology
- Appendix C – Induced investments in Tasmania
- Appendix D – Local investment methodology
- Appendix E – Calculation example: Tasmanian wind installation
- Appendix F – Calculation example: Tasmanian wind operations
- Appendix G – Telecommunications Investment

18	Overview of Marinus Link's construction and operations profile
	Tasmania
19	Construction
20	Operations
	Victoria
21	Construction
22	Operations



Marinus Link – Economic contribution analysis

Overview of Marinus Link's construction and operating profile

Construction

The construction of Marinus Link is expected to take four years for each link. Broadly, the construction phase requires:

- Purchase of intermediate inputs such as metal and metal alloys, cable and converters and construction materials; and
- Construction, financing and project management services.

Core physical components of the interconnector include the:

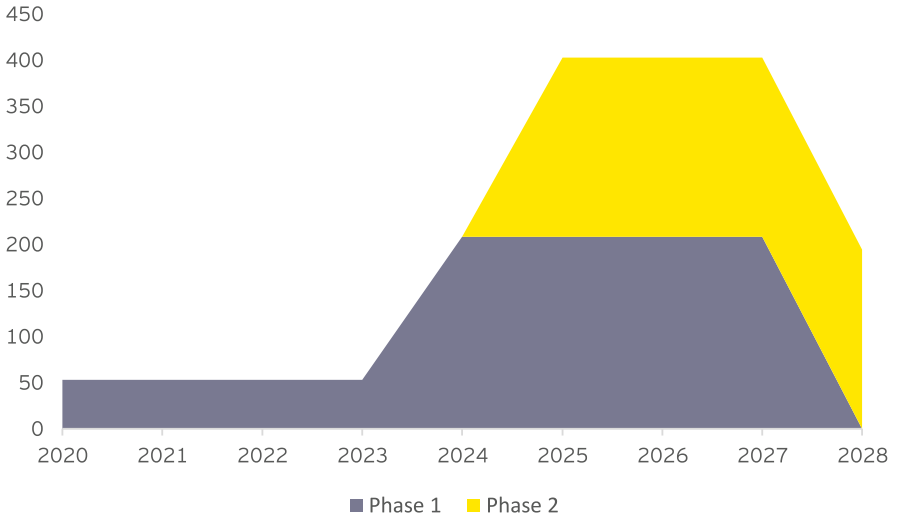
- Undersea cable which transmits electricity;
- Transmission line(s) or cable(s) which carry electricity (to and from the undersea cable) over land to a converter station(s);
- Augmentation of Tasmanian AC Network to support HVDC Link; and
- Converter station(s) which converts direct current (DC) to alternating current and vice versa. Two 750 MW interconnectors delivered under a staggered timeframe.

Overall, expenditure is expected to be comparatively lower during the 'design and approvals phase', from 2019 to 2023. The economic contribution analysis conducted for the purposes of this Report assumes the following timelines:

- **Phase 1:** Operations commencing on 1 July 2027
- **Phase2:** Operations commencing on 1 July 2028

Construction costs associated with Tasmania are higher than Victoria. This difference can be largely attributed to network integration costs, which are estimated to be $488m in Tasmania compared to $15m in Victoria.

Marinus Links One and Two – construction profile ($m)



Operations

Phase 1 has been assumed to begin operations on 1 July 2027, with Phase 2 commencing operations on 1 July 2028. Annual operating costs are expected to be $15m per annum in Tasmania and $15m per annum in Victoria for both Marinus Links 1 and 2.

For consistency with EY Market Modelling forecasts, Marinus Link's operational benefits in this Report are estimated to 2050. However, it is expected that Marinus Link will be operational beyond 2050. Therefore, additional value added and job years supported can be expected beyond 2050.

Tasmania – Marinus Link construction

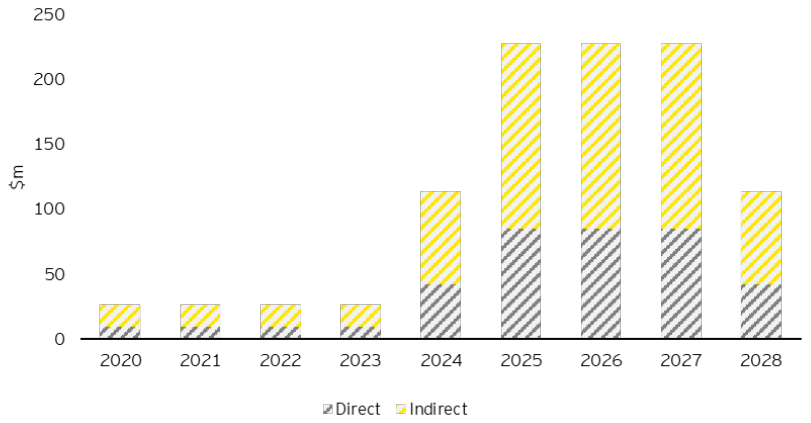
Tasmania	Victoria
Marinus Link	Induced Investment
Construction	Operations

The construction cost of Marinus Link attributable to Tasmania is estimated at $1,015m. It is expected to support value add of $1,019m (direct and indirect) and 6,222 job years.

Value add

Marinus Link's construction is expected to support $382m in direct and $637m in indirect value add. The value added by sector is presented to the right.

Direct and indirect value added profile ($m)



Jobs

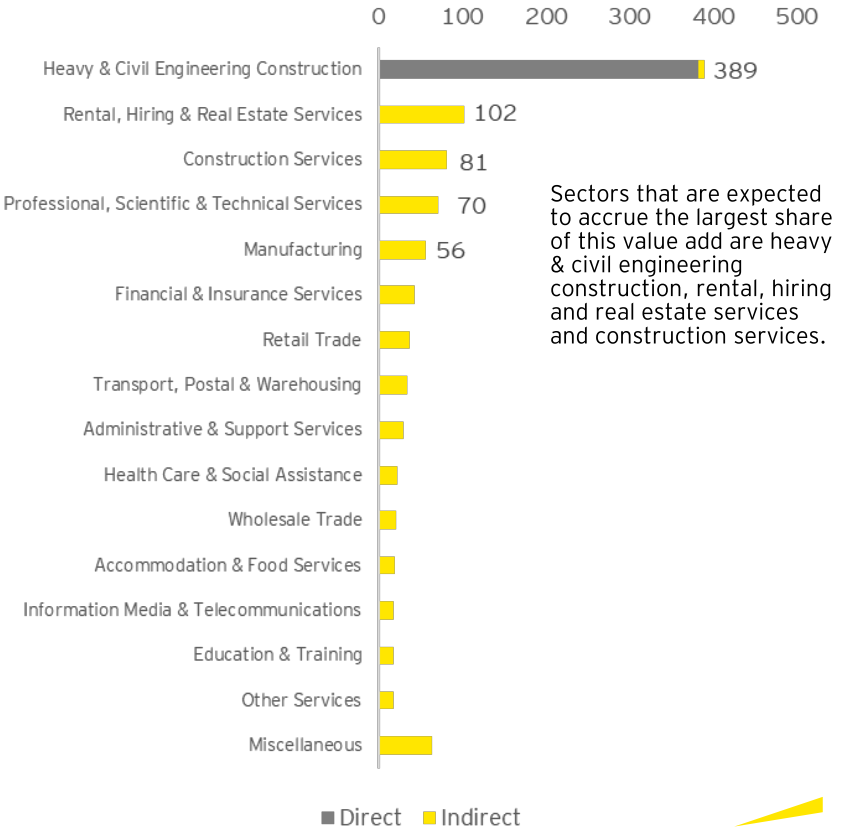
Marinus Link's construction is expected to support 1,264 direct and 4,957 indirect job years.

Direct and indirect value added profile (job years supported)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	Total
Direct	33	33	33	33	141	283	283	283	141	1,264
Indirect	130	130	130	130	555	1,109	1,109	1,109	555	4,957

Value added by sector

Sectors expected to accrue the largest share of value added ($m)



Sectors that are expected to accrue the largest share of this value add are heavy & civil engineering construction, rental, hiring and real estate services and construction services.

Tasmania – Marinus Link operations

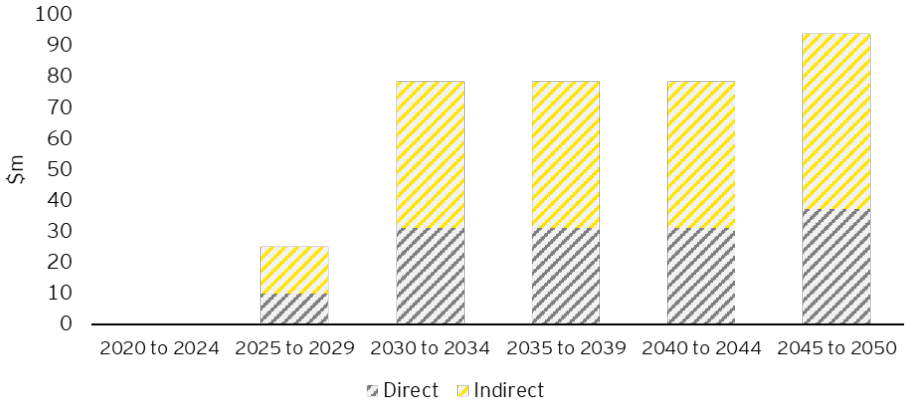
Tasmania	Victoria
Marinus Link	Induced Investment
Construction	Operations

The total operating cost of Marinus Link attributable to Tasmania is estimated at $342m. It is expected to support value add of $354m (direct and indirect) and 1,860 job years.

Value add

Over the operational period, Marinus Link's operations is expected to support $141m and $213m in direct and indirect value added. The value add by sector is presented to the right.

Direct and indirect value added profile ($m)



Jobs

Marinus Link's operations is expected to support 572 in direct and 1,288 indirect job years during the operational period.

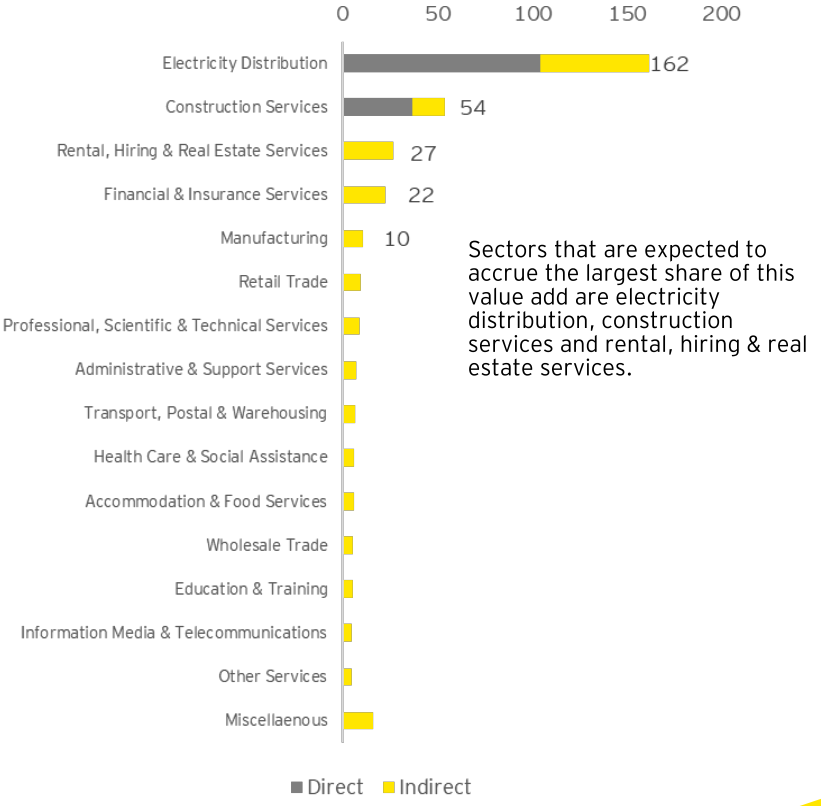
Direct and indirect value added profile (job years)

	2020 to 2024	2025 to 2029	2030 to 2034	2035 to 2039	2040 to 2044	2045 to 2050	Total
Direct	-	40	127	127	127	152	572
Indirect	-	91	285	285	285	342	1,288

Note: *the 2045 to 2050 period contains an extra year when compared to other periods analysed*

Value added by sector

Sectors expected to accrue the largest share of value added ($m)



Sectors that are expected to accrue the largest share of this value add are electricity distribution, construction services and rental, hiring & real estate services.

Victoria – Marinus Link construction

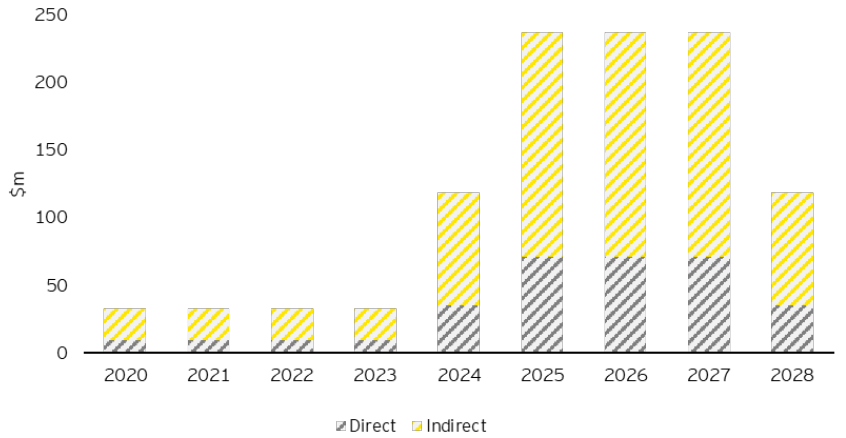
Tasmania	Victoria
Marinus Link	*Induced Investment*
Construction	*Operations*

The total construction cost of Marinus Link attributable to Victoria is estimated at $865m. It is expected to support value add of $1,083m (direct and indirect) and 6,361 job years.

Value add

Marinus Link's construction is expected to support $326m direct and $758m indirect value add during the construction period.

Direct and indirect value added profile ($m)



Jobs

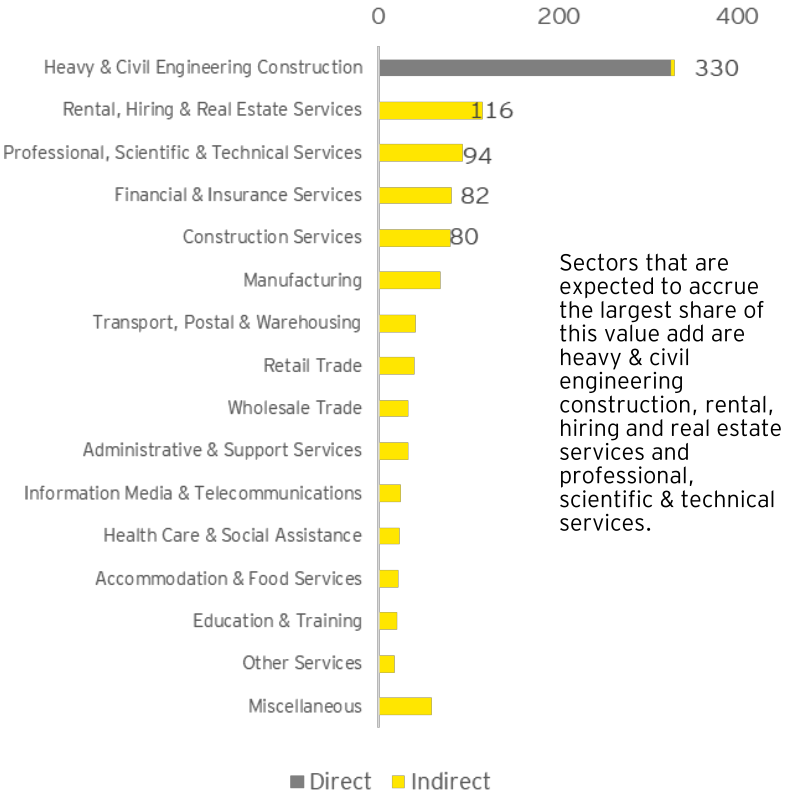
Marinus Link's construction is expected to support 1,004 direct and 5,357 indirect job years.

Direct and indirect jobs profile (job years supported)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	Total
Direct	31	31	31	31	110	220	220	220	110	**1,004**
Indirect	165	165	165	165	587	1,174	1,174	1,174	587	**5,357**

Value added by sector

Sectors expected to accrue the largest share of value added ($m)



Sectors that are expected to accrue the largest share of this value add are heavy & civil engineering construction, rental, hiring and real estate services and professional, scientific & technical services.

Victoria – Marinus Link operations

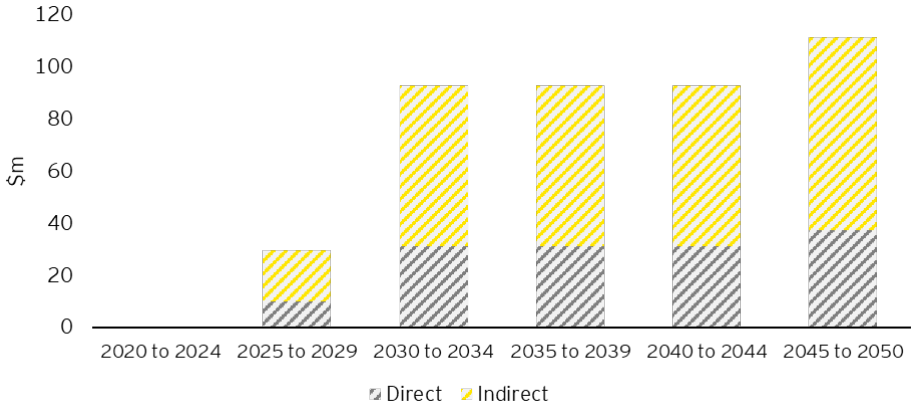
Tasmania	Victoria
Marinus Link	*Induced Investment*
Construction	Operations

The total operating cost of Marinus Link attributable to Victoria is estimated at $342m. It is expected to support value add of $419m (direct and indirect) and 2,141 job years.

Value add

Marinus Link's operations is expected to support $141m in direct and $279m in indirect value add during the operations period.

Direct and indirect value added profile ($m)



Jobs

Direct and indirect jobs profile (job years)

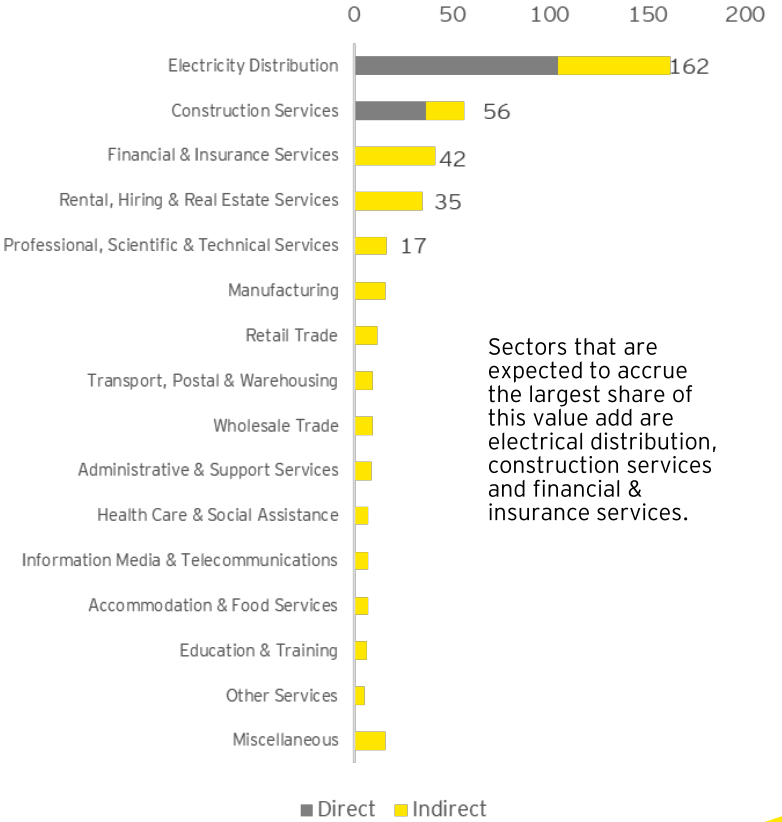
Marinus Link's operations is expected to support 534 direct and 1,607 indirect job years over the operational period.

	2020 to 2024	2025 to 2029	2030 to 2034	2035 to 2039	2040 to 2044	2045 to 2050	Total
Direct	-	37	118	118	118	142	**534**
Indirect	-	113	356	356	356	427	**1,607**

Note: *the 2045 to 2050 period contains an extra year when compared to other periods analysed*

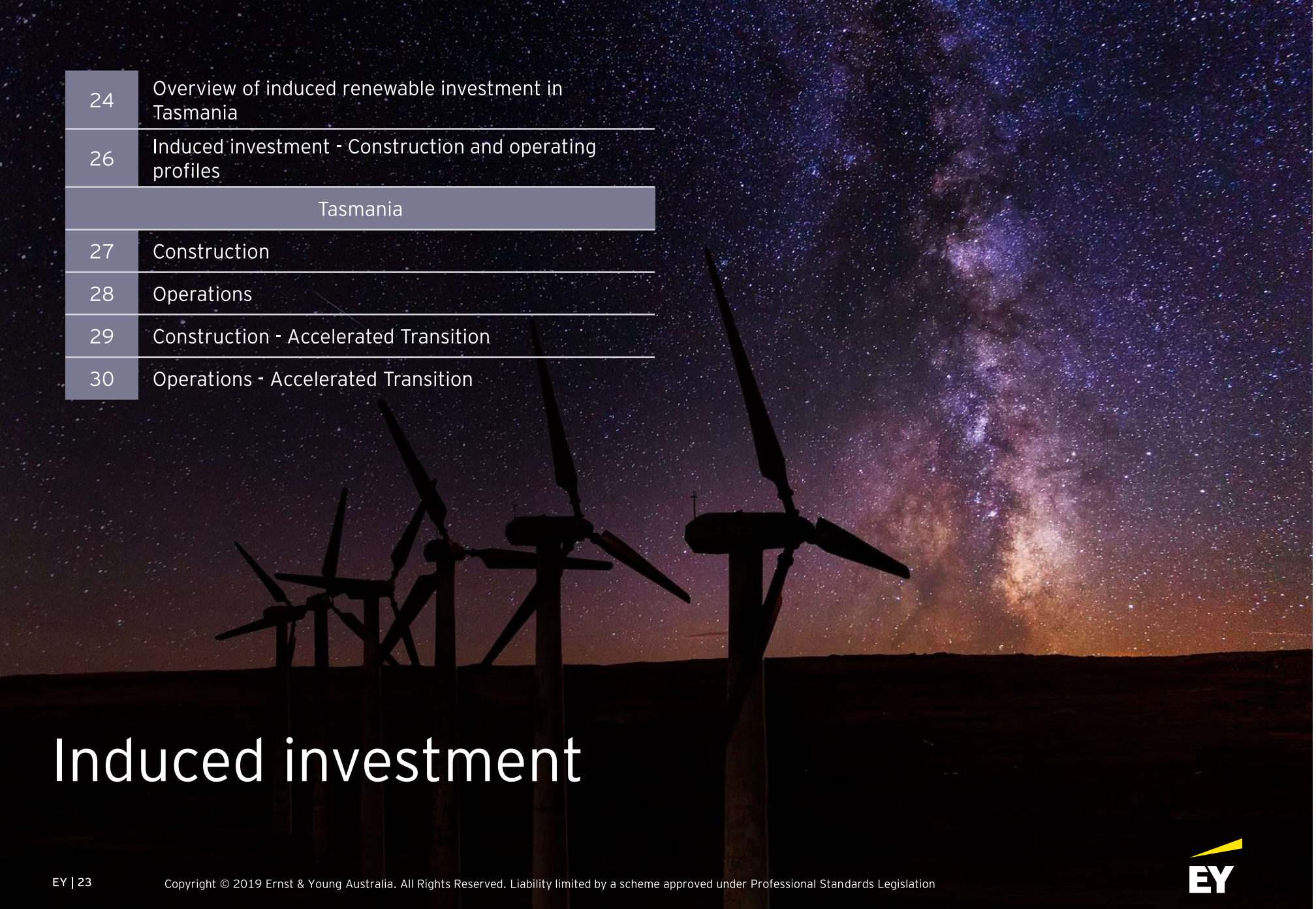
Value added by sector

Sectors expected to accrue the largest share of value add ($m)



Sectors that are expected to accrue the largest share of this value add are electrical distribution, construction services and financial & insurance services.

24	Overview of induced renewable investment in Tasmania
26	Induced investment - Construction and operating profiles
	Tasmania
27	Construction
28	Operations
29	Construction - Accelerated Transition
30	Operations - Accelerated Transition



Induced investment

Induced renewable investment in Tasmania

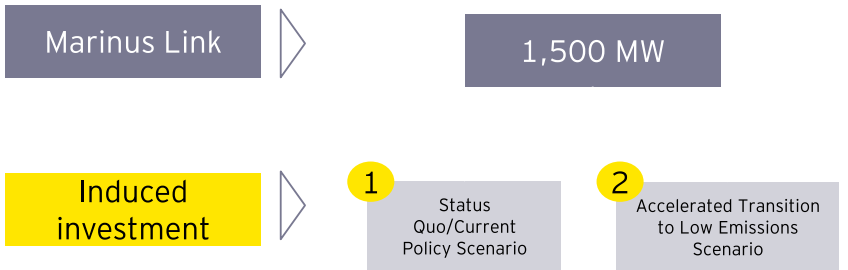
Marinus Link is expected to induce further renewable electricity generation in Tasmania to meet the growing demand for cleaner energy from the Australian Electricity Market.

AEMO's Integrated System Plan (ISP) has identified the North-West, Tasmanian Midlands and North-East as indicative locations for pumped hydro storage, wind and solar farms. These locations are generally more competitive for renewable energy generation than many sites on the mainland due to their natural characteristics.

The induced investments are expected to be incrementally installed after the construction of Marinus Link. The installation magnitude (MW) and timeframe is estimated through EY's "market model", which forecasts costs and likely demand from consumers of electricity.

MW to dollar conversion rates for capital expenditure are drawn from EY's market model.

Induced investment scenarios



The scenarios specified in the diagram describe the renewable investments induced by: [1]

- **Status Quo:** broadly aligns with AEMO's 2019 Central scenario. It reflects the current transition of the energy industry under current policy settings and technology trajectories, where the transition from fossil fuels to renewable generation is generally led by market forces and supported by current federal and state government policies.
- **Accelerated Transition:** broadly aligns with AEMO's 2019 Step Change scenario. It reflects strong action on climate change, with the NEM targeting a 90% reduction in emissions by 2050, compared to 2016 levels. In this scenario, aggressive global decarbonisation leads to faster technological improvements.

The analysis of induced investment in both scenarios was focused on the incremental capacity. That is, the resulting capacity over and above the base case of no Marinus Link being installed.

1 *AEMO, 2019 forecasting and planning scenarios, inputs, and assumptions, August 2019*

Overview of induced renewable investment

The table below shows, for each generation type, the difference in generation capacity expected to be delivered between these scenarios. It is important to note that this economic contribution analysis captures the difference between Marinus Link and the investment that is expected to occur under the base case. In other words, the net additional generation investment induced by Marinus Link.

Installed generation (MW) with Marinus Link compared to the 'No Marinus Case' - Tasmania

	Base Case "No Marinus Link"	Marinus Link	Induced investment
Status Quo			
Solar PV	336	200	(136)
Wind	438	2,527	2,089
Pumped Hydro	-	1,203	1,203
Total	**774**	**3,930**	**3,156**
Accelerated Transition			
Solar PV	350	350	-
Wind	1,173	3,798	2,625
Pumped Hydro	95	1,600	1,505
Total	**1,618**	**5,748**	**4,130**

Installed generation (MW) with Marinus Link compared to the 'No Marinus Case' - Victoria

	Base Case "No Marinus Link"	Marinus Link	Induced investment
Status Quo			
Solar PV	2,323	2,561	238
Wind	4,752	4,752	-
Pumped Hydro	1,200	1,200	-
Total	**8,275**	**8,513**	**238**
Accelerated Transition			
Solar PV	2,561	2,561	-
Wind	4,752	4,752	-
Pumped Hydro	1,200	1,200	-
Total	**8,513**	**8,513**	**-**

Marinus Link is expected to induce relatively minor changes in generation in Victoria compared to the base case. This is due to an expectation that build limits will be reached in Victoria.

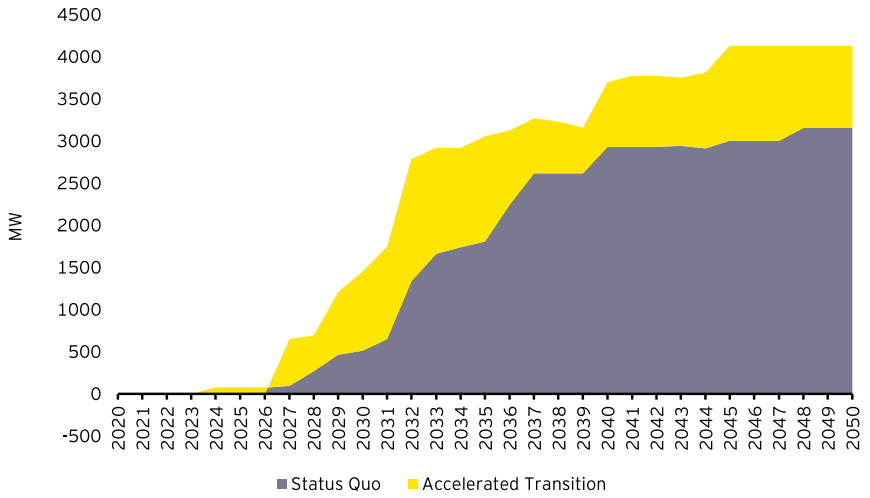
Build limits for renewable energy will be reached sooner in the Accelerated Transition scenario due to a higher demand profile. Therefore, the incremental increase in solar PV investment expected in the Status Quo Scenario is not expected for the Accelerated Transition Scenario.

The analysis on induced renewable generation in the following section therefore focuses on Tasmania only.

Induced investment - Construction and operating profiles in Tasmania

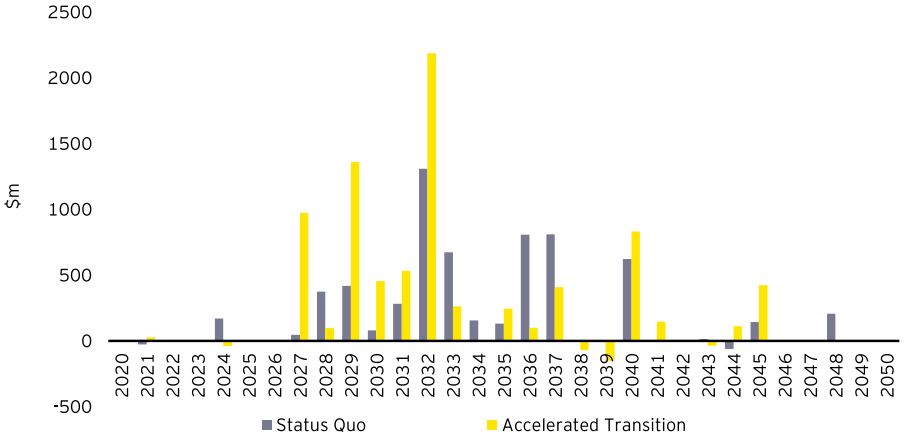
The investment that may be induced in Tasmania will take advantage of its better renewables resources, and the greater market access Marinus Link will provide. All the investment by quantum, location and type is summarised in EY's market modelling report.

Indicative cumulative induced generation MW delivered to Tasmania, by configuration

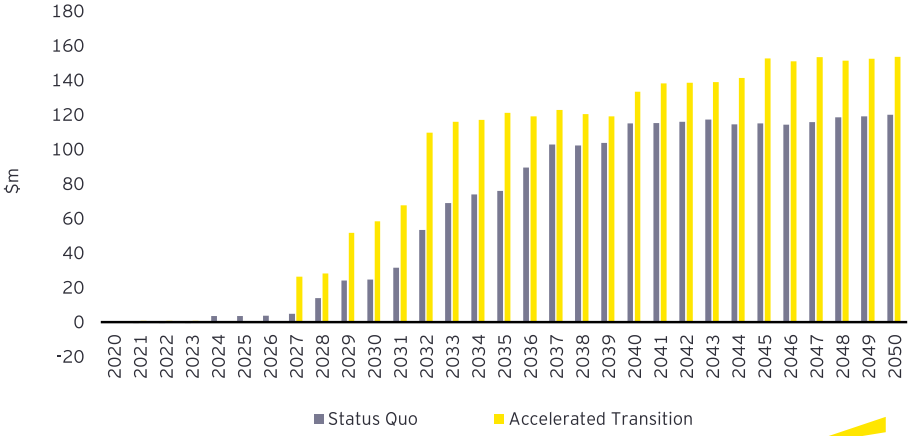


Note, generation capacity is expected to be negative in some years compared to the No Marinus case

Indicative total capital costs– Induced investment ($m), Tasmania, by configuration



Indicative operating costs – Induced investment ($m), Tasmania, by configuration



Induced investment – construction

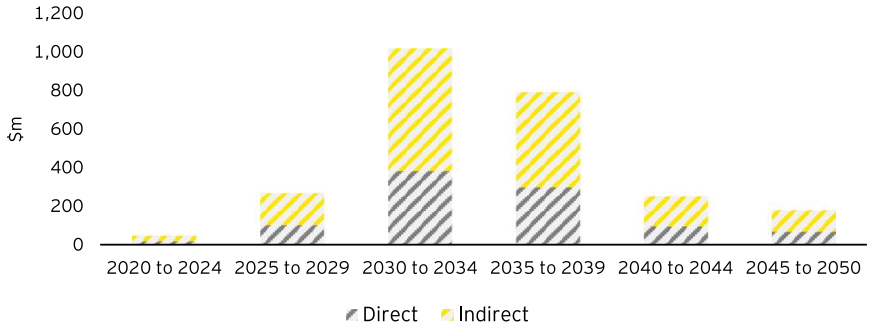
Status Quo	*Accelerated Transition*
Construction	*Operations*

The construction cost of the induced investment is estimated at $2,534m. It is expected to support value add of $2,543m (direct and indirect) and 15,530 total job years.

Value added profile

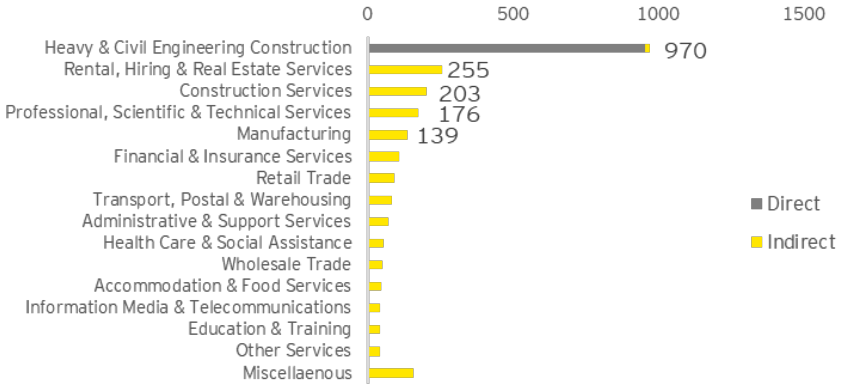
The construction of the induced investment is expected to support $954m and $1,589m direct and indirect value add.

Direct and indirect value added profile ($m)



Value added by sector

Sectors expected to accrue the largest share of value add ($m)



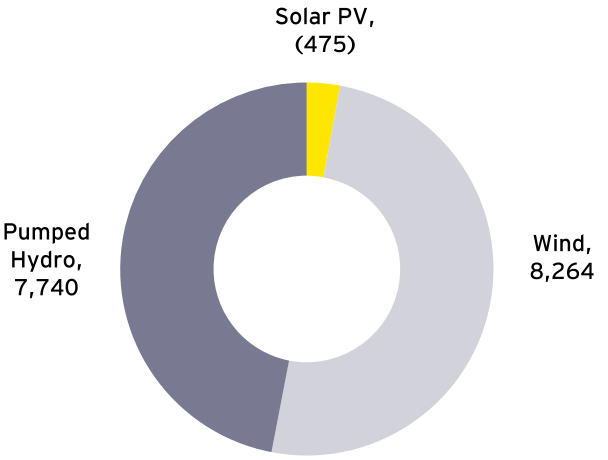
Jobs profile

The construction of the induced investment is expected to support 3,156 direct and 12,374 indirect job years.

Direct and indirect jobs profile (job years)

	2020 to 2024	2025 to 2029	2030 to 2034	2035 to 2039	2040 to 2044	2045 to 2050	Total
Direct	57	330	1,260	978	310	220	**3,156**
Indirect	225	1,295	4,940	3,834	1,215	864	**12,374**
Total	**282**	**1625**	**6200**	**4812**	**1525**	**1084**	**15,530**

Breakdown of jobs (job years supported) by type of generation



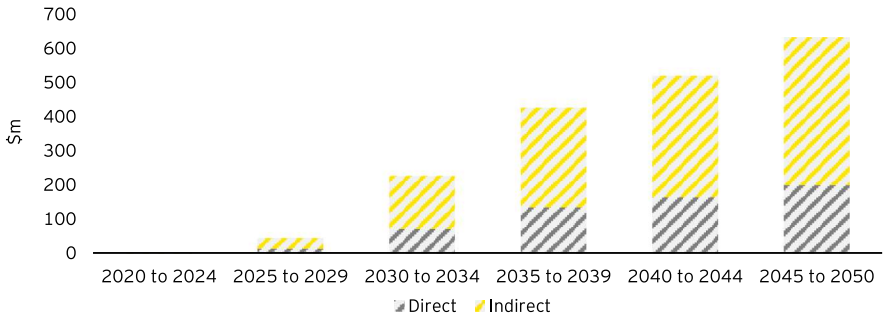
Induced investment - operations

Status Quo	Accelerated Transition
Construction	Operations

The operations cost of the induced investment is estimated at $2,057m. It is expected to support value add of $1,850m (direct and indirect) and 12,872 job years.

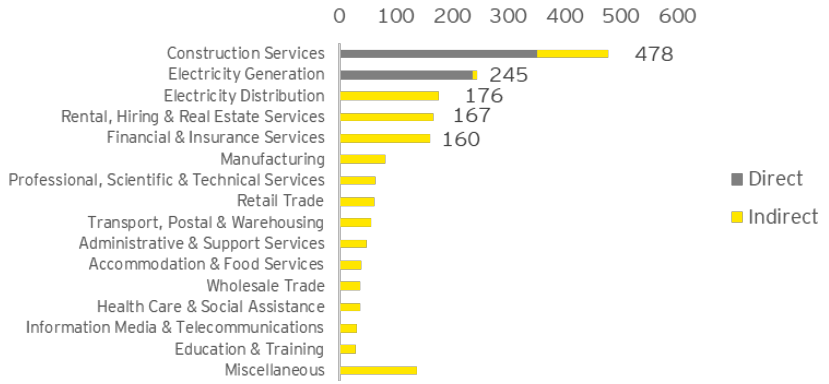
Value added

The operations of the induced investment operations is expected to support $588m and $1,262m direct and indirect value add.



Value added by sector

Sectors expected to accrue the largest share of value add ($m)



Jobs profile

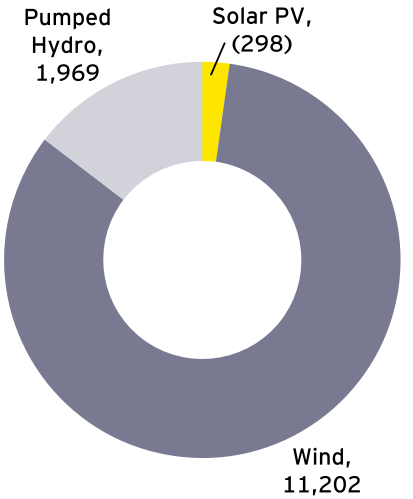
The operations of the induced investment is expected to support 4,383 direct and 8,490 indirect job years.

Direct and indirect jobs profile (job years)

	2020 to 2024	2025 to 2029	2030 to 2034	2035 to 2039	2040 to 2044	2045 to 2050	Total
Direct	4	106	537	1009	1230	1496	**4,383**
Indirect	8	206	1041	1954	2383	2897	**8,490**
Total	**11**	**312**	**1578**	**2963**	**3613**	**4393**	12,872

Note: *the 2045 to 2050 period contains an extra year when compared to other periods analysed*

Breakdown of jobs (job years) by type of generation



Induced investment - construction

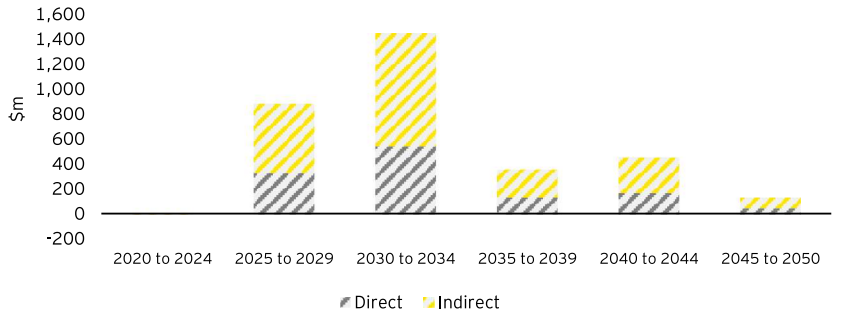
Status Quo	Accelerated Transition
Construction	Operations

The construction cost of the induced investment is estimated at $3,266m. It is expected to support value add of $3,278m (direct and indirect) and 20,013 job years.

Value added

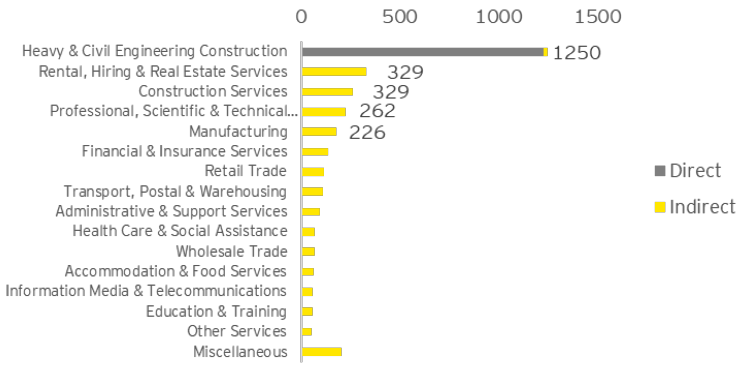
The construction of the induced investment in the Accelerated Transition Scenario is expected to support $1,230m direct and $2,048m indirect value added.

Direct and indirect value added profile ($m)



Value added by sector

Sectors expected to accrue the largest share of value add ($m)



Jobs profile

The construction of the induced investment (Accelerated Transition Scenario) is expected to support 4,067 direct and 15,946 indirect job years during the construction period.

Direct and indirect jobs profile (job years supported)

	2020 to 2024	2025 to 2029	2030 to 2034	2035 to 2039	2040 to 2044	2045 to 2050	Total
Direct	(5)	1,095	1,800	445	566	167	4,067
Indirect	(20)	4,295	7,055	1,744	2,219	653	15,946
Total	(25)	5,390	8,855	2,189	2,785	820	20,013

Breakdown of jobs (job years) by type of generation

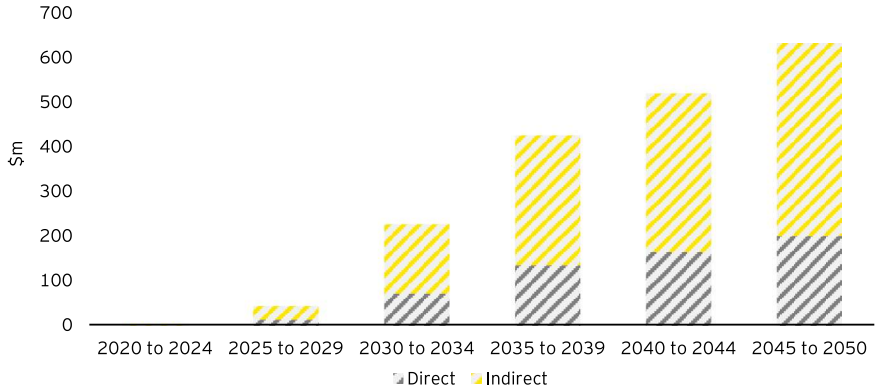
Induced investment – operations

Status Quo	Accelerated Transition
Construction	Operations

The operations cost of the induced investment is estimated at $2,782m. It is expected to support value add of $2,502m (direct and indirect) and 17,403 job years.

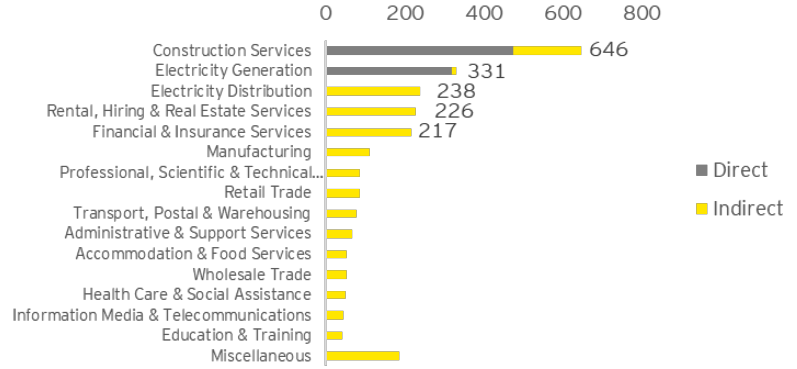
Value added profile

The operations of the induced investment is expected to support $795m direct and $1,706m indirect value add.



Value added by sector

Sectors expected to accrue the largest share of value added ($m)



Jobs profile

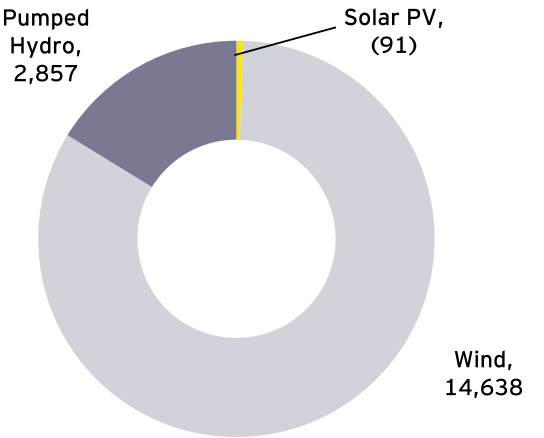
The operations of the induced investment (Accelerated Transition Scenario) is expected to support 5,926 direct and 11,478 indirect job years.

Direct and indirect jobs profile (job years supported)

	2020 to 2024	2025 to 2029	2030 to 2034	2035 to 2039	2040 to 2044	2045 to 2050	Total
Direct	3	224	998	1,283	1,470	1,947	**5,926**
Indirect	6	434	1,933	2,485	2,847	3,772	**11,478**
Total	**9**	**659**	**2,931**	**3,768**	**4,317**	**5,719**	**17,403**

Note: *the 2045 to 2050 period contains an extra year when compared to other periods analysed*

Breakdown of jobs (job years) by type of generation

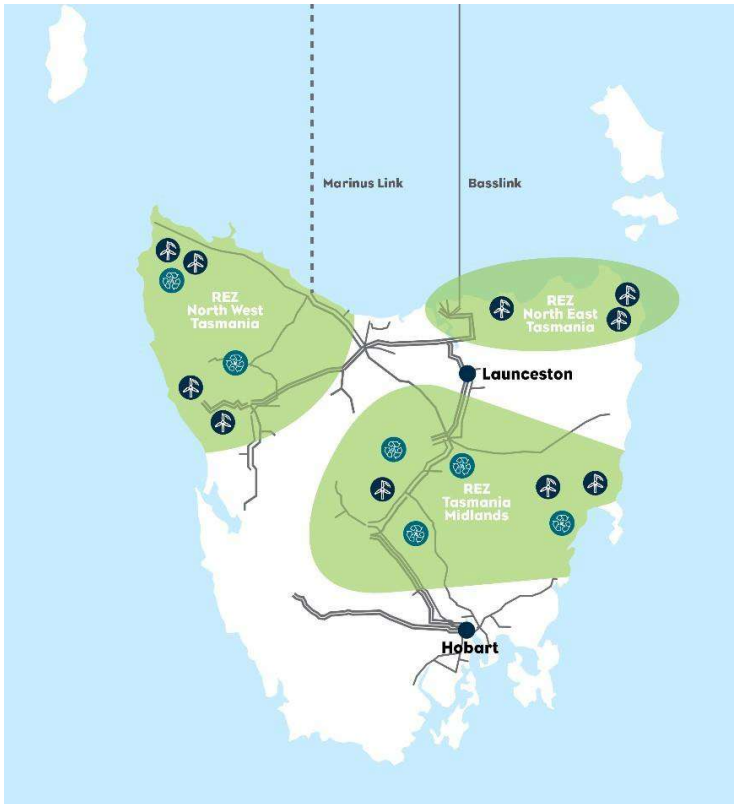


32	Local investment – overview
33	North West Tasmania
35	North East Tasmania
37	Tasmanian Midlands

Local investment

Local investment: overview

Indicative renewable investment locations in Tasmania



Source: TasNetworks

The proposed investment is expected to impact local economies within Tasmania. To capture this, the report isolates three distinct regions in Tasmania where:

- Marinus Link's Tasmanian connection point is located; and
- Induced investment in renewable energy is expected to occur.

Local regions and their economies are expected to realise most of the economic contribution of Marinus Link's and its induced investment. These regions used in this analysis are:

- North West Tasmania (NWT)
- North East Tasmania (NET)
- the Tasmanian Midlands (TM).

These regions were also based on AEMO ISP data which specifies the proposed MW and optimal locations for hydro, wind and solar generation (i.e. the Renewable Energy Zones).

In order to capture the total direct and indirect economic contribution of Marinus Link and the induced investment to these regions, the analysis attributes the expected increase in generation capacity to each region. The methodology to calculate this apportion can be found in Appendix D.

As outlined in Appendix A, the multipliers for smaller regions are generally lower when compared to state or country-wide multipliers. For these smaller regions, multipliers tend to be smaller than national multipliers since their inter-industry linkages are normally relatively shallow. Inter-industry linkages tend to be shallow in small regions since they usually don't have the capacity to produce the wide range of goods used for inputs and consumption, instead importing a large proportion of these goods from other regions.

Note:

- This analysis only focuses on the expected impact on jobs only.
- The sum of jobs supported in these regions does not equal the total sum of jobs supported in Tasmania. This is because the economic multiplier used in this analysis considers exports to other regions as outflows and therefore, not contributing to the local economy of the region.

North West Tasmania (NWT)

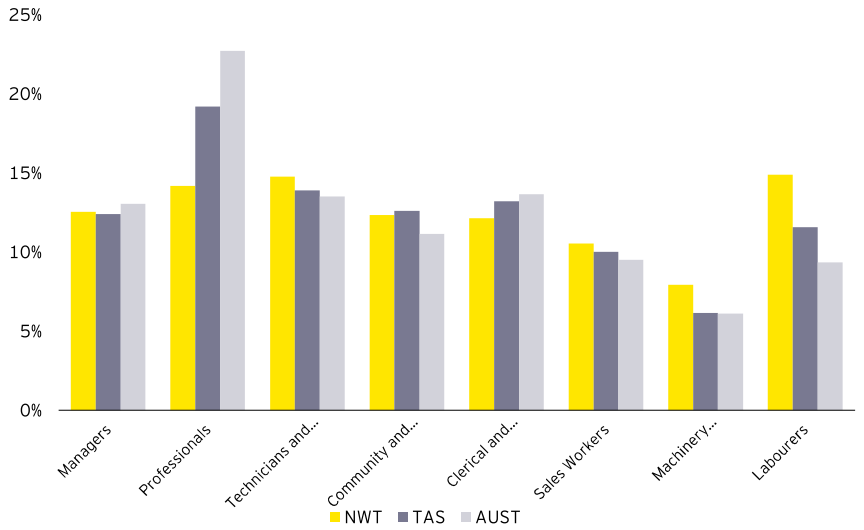
About the region

North West Tasmania is renowned for its high quality national parks and nature reserves. The sub-region possesses relatively strong wind and pumped hydro resources. In terms of generation the sub-region *currently* supports:

- Multiple hydro generators (867 MW in total); and
- Wind farms (140MW in total[1]).

Socioeconomic profile

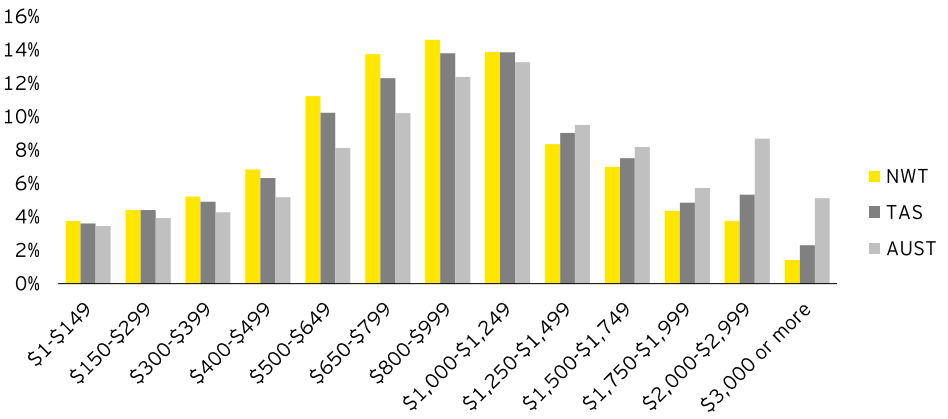
Occupation proportions – NWT, Tasmania and Australia



Source: REMPLAN, ABS Census of Population and Housing (2016) and EY analysis

North West Tasmania's proportion of professionals is relatively low compared to the whole of Tasmania and Australia respectively.

Weekly income proportions – NWT, Tasmania and Australia



Source: REMPLAN, ABS Census of Population and Housing (2016) and EY analysis

North West Tasmania's proportion of individuals in higher income brackets is relatively low compared to the whole of Tasmania and Australia respectively.

1 *Capacity is expected to increase to 252MW once the Granville Harbour wind farm is operational.*

North West Tasmania – cont.

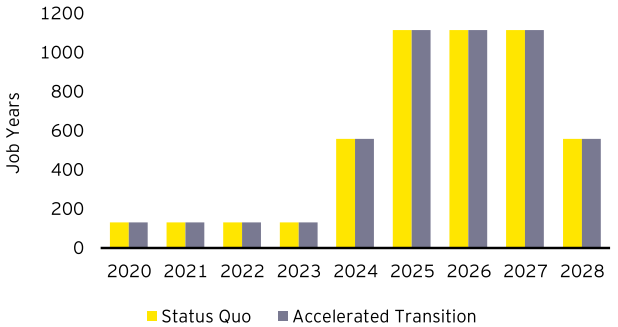
The indicative Tasmanian connection point of Marinus Link is located in the Burnie area, a town in North-West Tasmania. As such, Marinus Link is expected to support construction and operations jobs in the region.

Jobs (Job years) breakdown by configuration

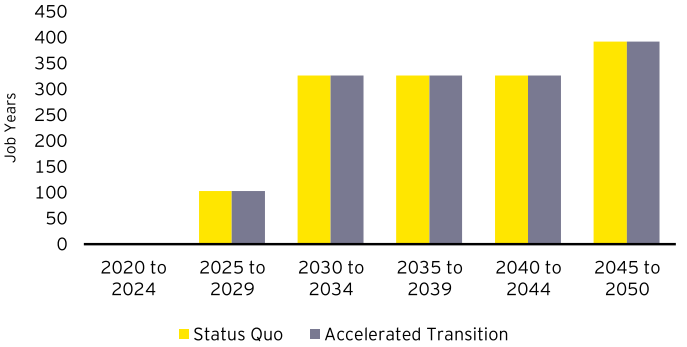
	Marinus Link	Induced investment
Status Quo		
Construction	4,981	6,726
Operations	1,474	4,178
Accelerated Transition		
Construction	As above	8,582
Operations	As above	5,715

Jobs profile (Marinus Link)

Jobs supported by construction

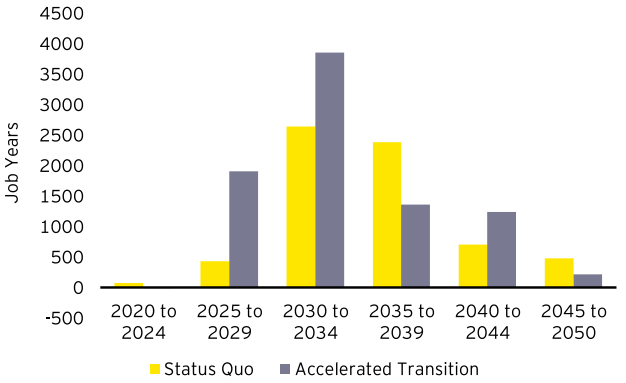


Jobs supported by operations

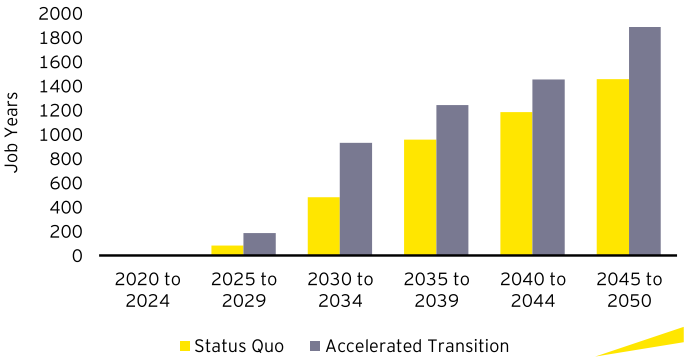


Jobs profile (Induced investment)

Jobs supported by Induced investment - construction



Jobs supported by Induced investment - operations



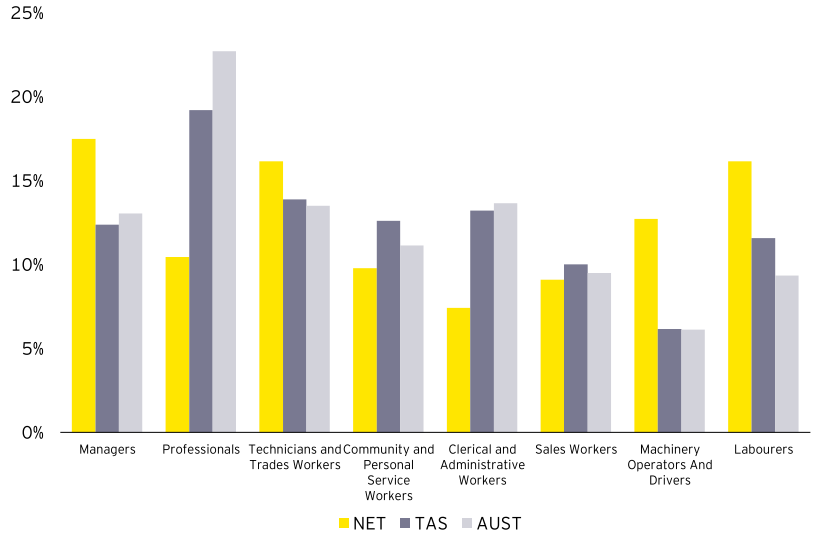
North East Tasmania (NET)

About the region

North East Tasmania is characterised by its rich arts and cultural heritage and diverse natural landscape. Currently, the sub-region possesses one 168 MW wind farm at Musselroe. According to the AEMO ISP, there are additional locations identified for future wind investment.

Socioeconomic profile

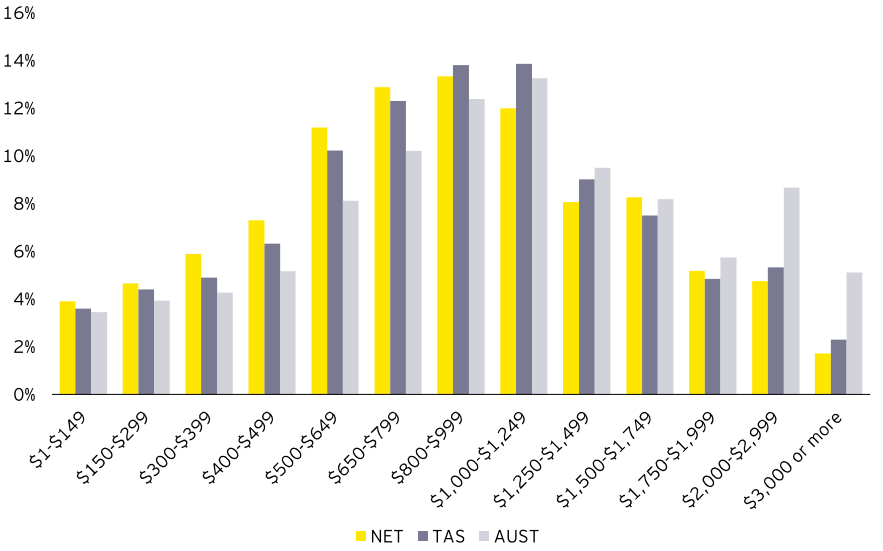
Occupation proportions – NET, Tasmania and Australia



North East Tasmania's proportion of professionals is 46% and 54% smaller than Australia and Tasmania respectively. However, the region's proportion of labourers and machine operators and drivers is higher than both Australia and Tasmania.

Source: REMPLAN, ABS Census of Population and Housing (2016) and EY analysis

Weekly income proportions – NET, Tasmania and Australia



North East Tasmania has a lower proportion of workers in the middle to high income ranges.

Its proportion of workers in the "$2,000 or more" weekly income range is 65% lower than Australia's, while its proportion in the "$500-$649" range is 58% higher.

Source: REMPLAN, ABS Census of Population and Housing (2016) and EY analysis

North-East Tasmania (NET) – cont.

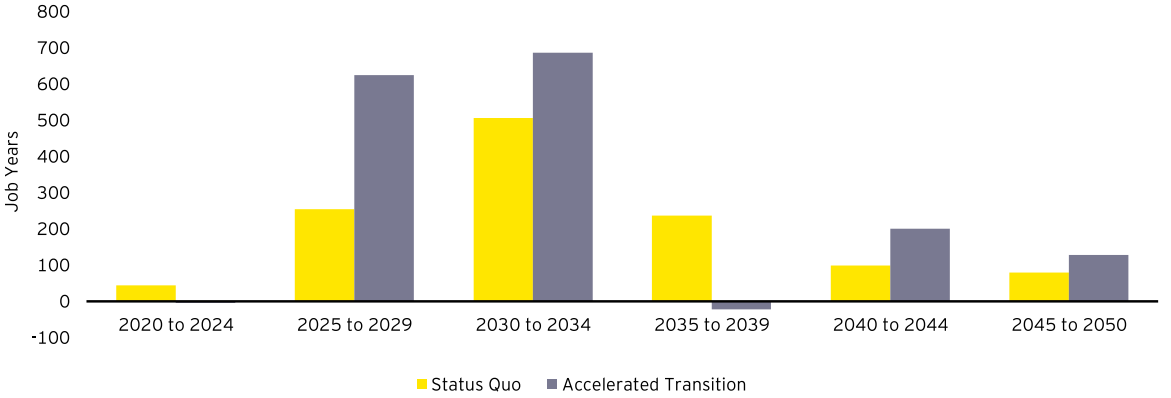
The expected jobs supported by the induced investment is set out in the table below.

Jobs (Job years) breakdown by configuration

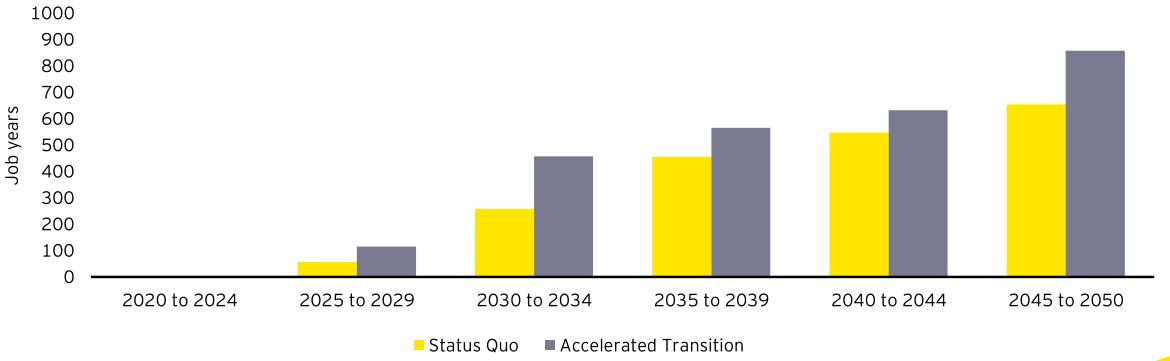
	Marinus Link	Induced investment
Status Quo		
Construction	0	1,222
Operations	0	1,970
Accelerated Transition		
Construction	0	1,615
Operations	0	2,628

Jobs profile (Induced investment)

Jobs supported by Induced investment - construction



Jobs supported by Induced investment - operations



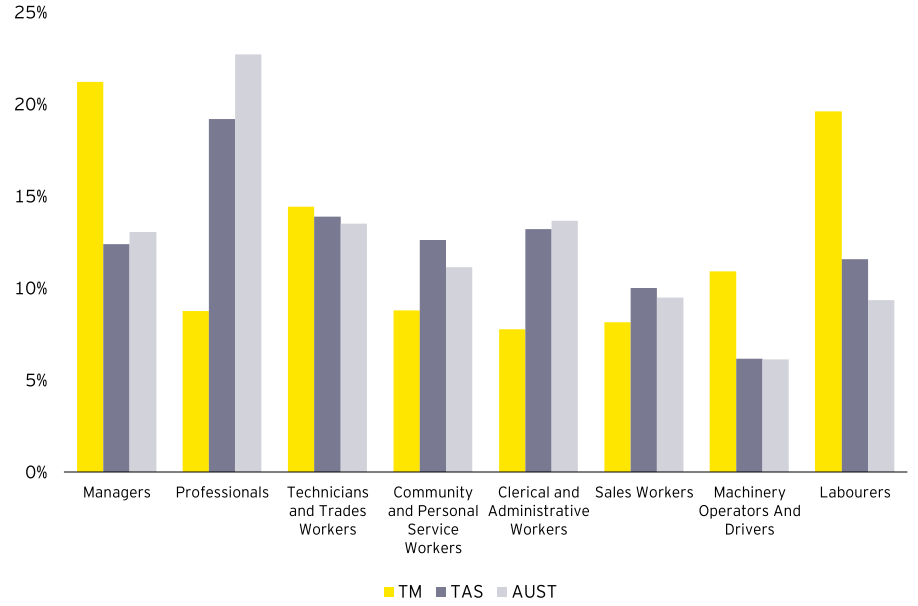
The Tasmanian Midlands (TM)

About the region

The Tasmanian Midlands is replete with prominent national parks and excellent natural resources. Currently there is a total of 1,412 MW in hydro generation throughout the region according to the AEMO ISP. Although the region does not currently possess wind farms[1], the AEMO ISP has identified potential locations for wind investment.

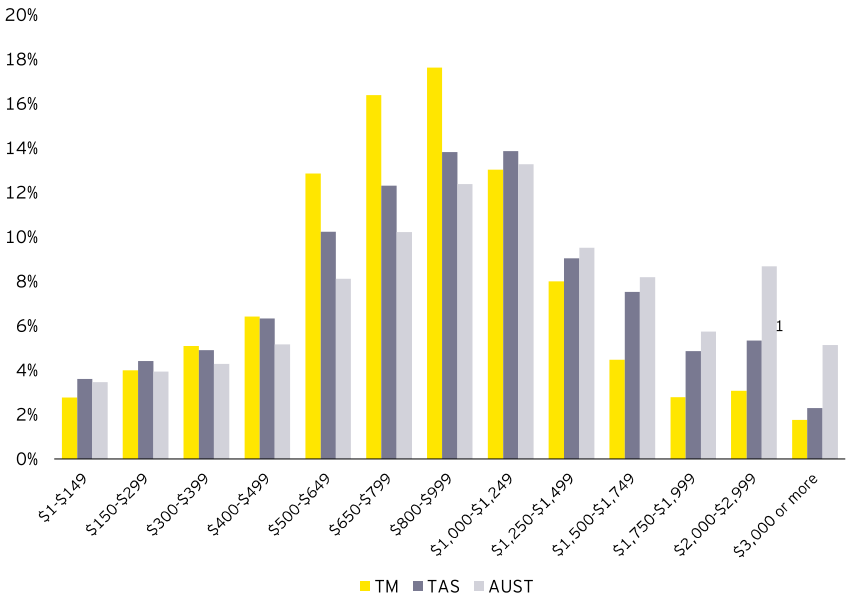
Socioeconomic profile

Occupation proportions – TM, Tasmania and Australia



Source: REMPLAN, ABS Census of Population and Housing (2016) and EY analysis

Weekly income proportions – TM, Tasmania and Australia



Source: REMPLAN, ABS Census of Population and Housing (2016) and EY analysis

TM's occupation and weekly personal income profile largely reflects the two other regions (NWT and NET) presented in this analysis. However, the region's share of managers is significantly higher, 71% and 63% higher than Australia and Tasmania respectively.

*The Cattle Hill wind farm (144MW) is currently under construction. It is expected to be operational by December 2019.

The Tasmanian Midlands – cont.

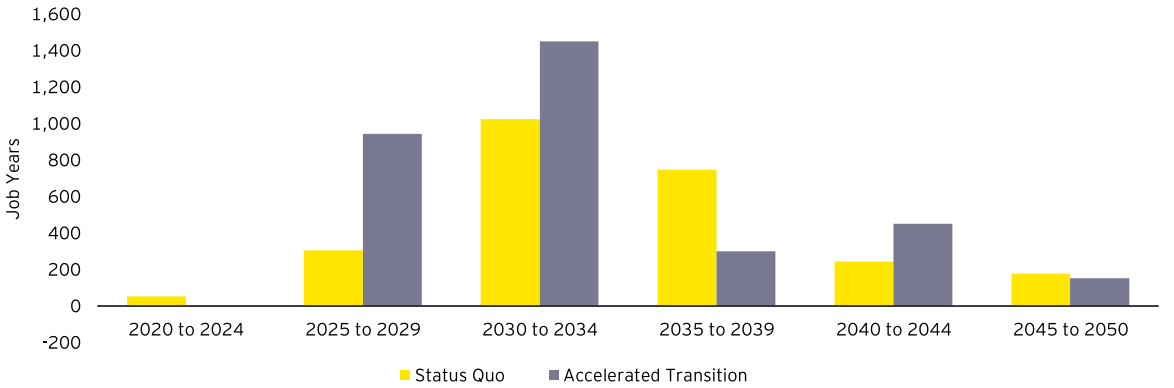
The expected jobs supported by the induced investment is set out in the table below.

Jobs (job years) breakdown by configuration

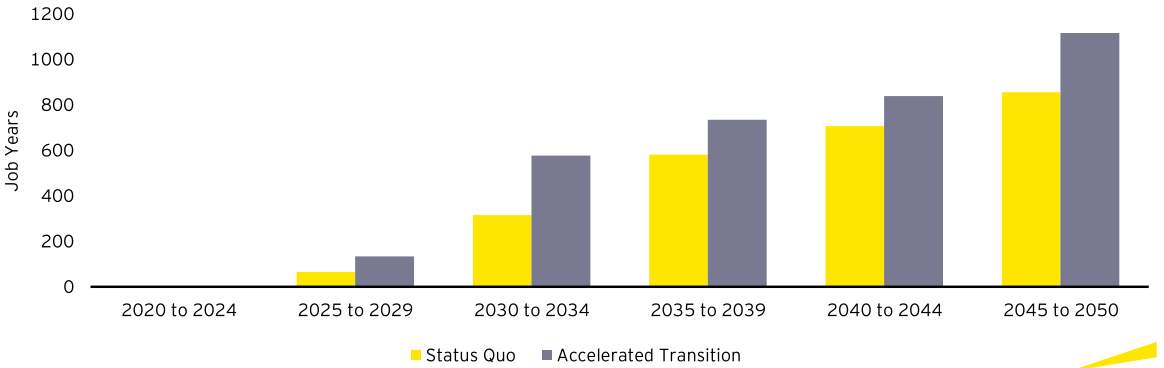
	Marinus Link	Induced investment
Marinus Link		
Construction	0	2,551
Operations	0	2,522
Marinus Link – Accelerated Transition		
Construction	0	3,299
Operations	0	3,399

Jobs profile (Induced investment)

Jobs supported by Induced investment - construction



Jobs supported by Induced investment - operations



Appendices

Glossary

Term	Description
Direct economic contribution	Total revenues generated by an industry, plus any applicable value-add taxes
Economic contribution	The total direct effects of an industry (revenue plus any value-add taxes), plus the flow-on (indirect) effects. The flow-on effects are captured by applying an economic multiplier. It is important to note that economic contribution is a gross measure rather than a net measure of the contribution of an industry. Economic contribution studies do not consider substitution impacts, or what would happen if the relevant industry ceased to exist
Gross Output	Market value of goods and services produced
Value Add	Market value of goods and services produced, after deducting the cost of goods and services used. This represents the sum of all wages, income and profits generated
Direct Effect	The direct impact resulting from the construction and operation of Marinus Link
Indirect Effect	The flow-on impact from Marinus Link and increased spending on wages associated with the direct and supply chain impacts
Economic Growth	Increase in total output of a country / region over a period of time
Economic multiplier	Used to estimate the total economic contribution of an industry by multiplying the direct contribution. The economic multiplier incorporates the additional economic contribution generated by the 'Direct' economic contribution (a) which is the industrial effect (b) and the consumption effect (c)
Employment contribution	The total direct employment effects of an industry (total employees), plus the flow-on (indirect) effects. The flow-on effects are captured by applying an employment multiplier
Employment multiplier	Used to estimate the total economic contribution of an industry by multiplying the direct contribution. The employment multiplier incorporates the additional employment contribution generated by the 'Direct' employment contribution
Flow on (Indirect) economic contribution	Additional expenditure as a result of the direct contribution of an industry. It is the sum of the industrial effect and the consumption effect
Flow-on (indirect) employment contribution	Additional employment that results from the direct employment contribution. For example, if an industry employs one additional person, that person can spend their income, and hence require other industries to employ additional people
Industrial effect	Flow-on (Indirect) contribution generated by an industry as it purchases input goods and services generating revenue for other businesses
Consumption effect	Flow-on (Indirect) contribution generated by an industry as its employees spend their wages and salaries on household consumption, providing revenue for other businesses
Job-years	A 'job-year' represents one full time job supported for a full year – for instance, 1,000 job-years may be 500 jobs sustained over 2 years, or 100 jobs sustained over 10 years.
Jobs during the construction phase	Jobs presented during the construction phase should be interpreted in terms of job-years. They are the total number of job-years supported over the four year construction phase.
Jobs during operations	Jobs during operations can be interpreted as permanent ongoing full-time equivalent (FTE) jobs during the relevant year of Marinus Link and induced investment activities.

Appendix A – REMPLAN

The economic analysis has been undertaken using REMPLAN software that estimates direct and indirect impacts of infrastructure developments or policy changes. REMPLAN is an economic analysis software package designed for use by economic development practitioners. REMPLAN provides detailed economic data for single or combinations of local government areas and also incorporates a dynamic economic modelling capability to allow the analysis of 'what if' scenarios. REMPLAN is an input-output model of the Australian economy and regional economies. Input-output models trace the revenue and expenditure flows that link industries and workers within and outside economic regions.

REMPLAN's core data set is based on the latest Australian Bureau of Statistics (ABS) national accounts figures of the Australian economy, coupled with the latest Census data. REMPLAN's key advantage over other input-output models or "off-the shelf multipliers" is that it can be regional specific. For instance, in the past, economic practitioners have used national multipliers produced by the ABS. It should be noted that the ABS has not published national input-output multipliers since 1998-99 and does not plan to compile and reissue this table because of concerns over the abuse of them in economic assessments.

The region chosen to analyse Marinus Link was the state of Tasmania. To assess contribution to local economies, three "sub-regions" were chosen and its data sets created with REMPLAN software. For these smaller regions, multipliers tend to be smaller than national multipliers since their inter-industry linkages are normally relatively shallow. Inter-industry linkages tend to be shallow in small regions since they usually don't have the capacity to produce the wide range of goods used for inputs and consumption, instead importing a large proportion of these goods from other regions. The REMPLAN model accounts for 'leakage' of direct expenditure from the economy in its multipliers. However, it may still be possible for the economic contribution presented to be realised in places other than Tasmania.

Appendix B - Marinus Link cost apportionment methodology

Locational attribution to Tasmania (or Victoria) — Step 1

TasNetworks provided EY with a construction cost breakdown, including items split within the following broad cost categories:

- HVDC cable costs;
- Converter station costs;
- Network integration costs; and
- Project costs.

Although TasNetworks identified cost items occurring in Tasmania or Victoria, some cost items did not refer to a specific geographic location. For these items, EY has split them 50/50 between Victoria and Tasmania, as directed by TasNetworks. The tables below summarise this approach.

Economic attribution to Tasmania (or Victoria) — Step 2

The construction costs (set out to the left) for both Marinus Link and its induced investments are split between:

- Equipment and material costs; and
- Project management, installation and construction costs.

This analysis assumes that all equipment costs are sourced from interstate and overseas, owing to the small electrical equipment manufacturing industry in Tasmania. Therefore, equipment costs have not been included in the economic contribution calculation (see table directly below).

This analysis assumes that operational costs for both Marinus Link and its induced investments are equally split between:

- Operations and maintenance costs (material inputs only); and
- Wages and salaries.

Separate economic multipliers were applied to these broad categories to reflect the unique nature of transactions occurring in these broad industries.

Indicative high-level construction costs ($m) – Marinus Link

Cost category	TAS	VIC
HVDC cable and converter station costs	1,047	1,343
Network integration costs	488	42
Project costs	279	279
TOTAL	1,814	1,663
		3,477

Construction cost ($m) attribution

Cost category	TAS	VIC
Total cost apportioned to each region	1,814	1,663
Material and equipment costs	-798	-798
Total cost of Marinus Link directly attributable to each Region	1,015	865

Appendix C - Induced Investments in Tasmania

The table provides:

- The net difference in the amount of induced capacity installed relative to the base case by technology type
- The total installation costs for that capacity

Methodology

This analysis is focussed on the induced investment in new renewable energy projects. Therefore, upgrades to existing generators have not been considered. Conventional Hydro has not been included in this analysis, as no new generators are anticipated. However, upgrades to existing generators are expected to provide an additional 250MW of new capacity. The upgrades can be expected to provide additional value added and job years over and above the analysis detailed in this Report.

Some technologies are expected to have negative construction costs despite no change in physical capacity. This due to an assumption that capex costs fall over time. The extent to which contribution analysis can estimate the impact of capital efficiency gains is generally limited. Therefore, where capital efficiency has caused the cost of incremental capacity to be negative, construction costs have been assumed to be zero. Negative construction costs for Tasmanian solar PV have been modelled in this case, as they result from a reduction in physical capacity compared to the base case.

FOM costs are annual payments based on the amount of capacity installed. Some negative FOM costs were modelled, as they were either a result of:

- Less physical capacity installed overall compared to the No Marinus Case for certain technologies
- Less physical capacity installed in some years compared to the No Marinus Case, despite the overall capacity remaining unchanged for certain technologies.

Summary of Construction Costs[1]

Induced Investment Technology	Difference in Physical Capacity (MW)	Total Construction Cost ($m)
Marinus Link		
Solar PV	(136)	(135)
Wind	2,089	4,285
Pumped Hydro	1,203	2,025
Marinus Link Accelerated Transition		
Solar PV	-	-
Wind	2,625	5,338
Pumped Hydro	1,505	2,542

1. *Note that numbers have been rounded for ease of reference*

Appendix D – Local investment methodology

Methodology to apportion Marinus Link, by local region

The location of the Tasmanian connection point is expected to be located in North West Tasmania. Therefore, the entire direct investment of Marinus Link is expected to be attributable to North West Tasmania.

Methodology to apportion induced investment, by local region

Induced investment

- **For hydro:** The number of indicative 24-hour pumped hydro projects listed in Entura's Pumped Hydro Cost Modelling Report December 2018
- **For wind:** The number of indicative wind farms and hydro generators according to the AEMO ISP; and
- **For solar:** The number of indicative solar farms from the AEMO ISP.

The figure to the right illustrates the process to calculate the generation capacity attributable to each region (in MW).

Costs for Solar PV and Wind could have been apportioned based on the anticipated MW in each REZ, which may have produced different results for the regional analysis. This data was not available for pumped hydro. Therefore, indicative locations were used to deliver a consistent approach.

After calculating the generation capacity attributable to each location, the direct investment and subsequently, the economic contribution in terms of jobs and value added is calculated. MW to dollar conversion rates for capital expenditure were sourced from EY's market model.

The economic multipliers unique to each region used in the economic contribution analysis were obtained from this analysis.

Methodology to calculate the generation capacity attributable to each region

MW expected of from **induced investment, by Marinus Link Scenario** × Proportions by generation type from the **AEMO ISP** = **Proportion of MW from the induced investment attributable to region, by Marinus Link scenario**

	Induced renewable investment (MW)	
Scenarios	Status Quo	Accelerated Transition
Solar PV	(136)	-
Pumped Hydro	1,203	1,505
Wind	2,089	2,625
TOTAL, by scenario	**3,156**	**4,130**

Proportions generation type from AEMO ISP data		
North West Tasmania	North-East Tasmania	The Tasmanian Midlands
33%	33%	33%
75%	-	25%
33%	33%	33%

	Indicative locations		
	North West Tasmania	North-East Tasmania	The Tasmanian Midlands
Pumped Hydro (locations)	3	0	1
Wind (locations)	2	2	2
Solar PV (MW)	1	1	1

Appendix E – Calculation example: Tasmanian wind installation

Cost Assumptions

- Total Capex = $4,285m
- Assumed Installation Proportion = 31%
- Installation Cost = $1,349m
- Note: costs are spread over the construction period.

Calculation Method

Note that multipliers are cumulative, as they capture benefits up to and including the specific stage of the contribution effect. The incremental effect is used as it isolates the specific stage of value add. Therefore, each component is calculated as follows:

- **Direct Effect** = installation cost x direct effect multiplier
- **Industrial Effect** = (installation cost x industrial effect multiplier) – direct effect
- **Consumption Effect** = (installation cost x consumption effect multiplier) – (direct effect + industrial effect)

Value Added

Note: *some totals may not reconcile due to rounding.*

Value added Component	Multiplier	Cumulative Effect - Value Added ($m)	**Incremental Effect – Value Added**
1. Direct Effect	0.38	508	508
2. Industrial Effect	0.71	962	454
3. Consumption Effect	1.00	1,353	391
TOTAL			**1,353**

Job Years Supported

Note: *some totals may not reconcile due to rounding.*

Output (Job Years) Component	Multiplier	Cumulative Effect - Job Years Supported	**Incremental Effect – Job-Years Supported**
1. Direct Effect	1.25	1,679	1,679
2. Industrial Effect	3.98	5,369	3,689
3. Consumption Effect	6.13	8,264	2,895
TOTAL			**8,264**

Appendix F – Calculation example: Tasmanian wind operations

Cost Assumptions

- All variable and fixed operating costs are captured in the economic contribution analysis
- Assumed 50/50 split between 'maintenance' and 'corporate' costs
- Wind maintenance costs = $895m
- Wind corporate costs = $895m
- Note: costs are spread over the operating period.

Calculation Method

Note that multipliers are cumulative, as they capture benefits up to and including the specific stage of the contribution effect. The incremental effect is used as it isolates the specific stage of value add. Therefore, each component is calculated as follows:

- **Direct Effect** = installation cost x direct effect multiplier
- **Industrial Effect** = (installation cost x industrial effect multiplier) – direct effect
- **Consumption Effect** = (installation cost x consumption effect multiplier) – (direct effect + industrial effect)

Value Added

Note: *some totals may not reconcile due to rounding.*

Value added Component	Maintenance Cost Multiplier	Cumulative Effect - Value Added ($m)	Incremental Effect – Value Added ($m)	Corporate Cost Multiplier	Cumulative Effect - Value Added ($m)	Incremental Effect – Value Added ($m)	Total Value Added ($m)
1. Direct Effect	0.34	306	306	0.23	206	206	512
2. Industrial Effect	0.69	620	314	0.64	569	363	677
3. Consumption Effect	0.98	878	258	0.82	732	163	421
TOTAL			878			732	1,610

Job Years Supported

Note: *some totals may not reconcile due to rounding.*

Job Years Component	Maintenance Cost Multipliers	Cumulative Effect - Job Years Supported	Incremental Effect – Job Years Supported	Corporate Cost Multiplier	Cumulative Effect - Job Years Supported	Incremental Effect – Job Years Supported	Total Job Years Supported
1. Direct Effect	3.21	2,870	2,870	1.05	944	944	3,814
2. Industrial Effect	6.14	5,493	2,624	2.89	2,589	1,645	4,268
3. Consumption Effect	8.27	7,403	1,910	4.24	3,799	1,209	3,119
TOTAL			7,403			3,799	11,202

Appendix G – Telecommunications investment

TasNetworks have indicated that they intend to install a telecommunications link during the construction phase of Marinus Link. Based on the information provided by TasNetworks, the link is expected to be a dual fibre optic cable, with a capital cost of $6.8 million, and an operating cost of approximately $30,000 per annum.

The construction phase of the link would produce modest value added and jobs impacts, given that the majority of the $6.8 million in capital cost would largely be comprised of the cost of the cable itself, which is likely to be sourced from outside Tasmania and Victoria.

The telecommunications link is necessary to provide power support to the two HVDC cables, but it will also have the capacity to service commercial telecommunications needs. The link will be installed contemporaneously with the HVDC cables, so will require only relatively modest additional construction activity.

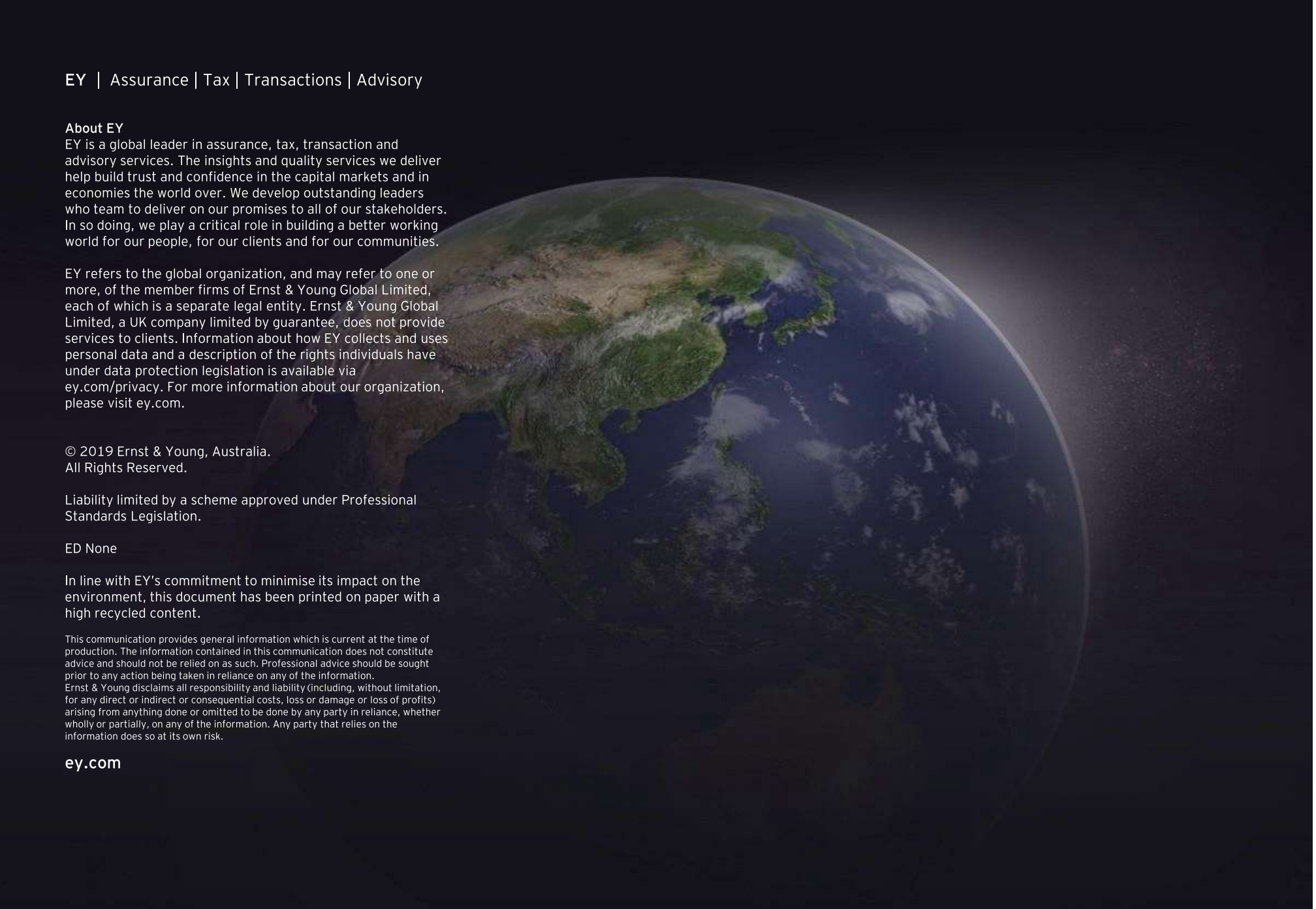
So while the link is necessary, it will provide the capacity to improve telecommunications capability in the region at very low incremental cost.

A report by Acutel Consulting Report finds that the link has the potential to deliver several commercial service offerings, including:

- The provision of fixed network capacity for services such as the National Broadband Network
- Improved mobile networks for customers with the expected growth of 5G networks
- Data centres that can be used by Government and financial services sectors

The Acutel Consulting Report does not attempt to quantify these economic benefits, but given the low incremental costs, any benefits it does provide are likely to add economic value.[1]

1 *Acutel Consulting, Project Marinus Telecommunications Update Report.*



EY | Assurance | Tax | Transactions | Advisory

About EY
EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organization, and may refer to one or more, of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. Information about how EY collects and uses personal data and a description of the rights individuals have under data protection legislation is available via ey.com/privacy. For more information about our organization, please visit ey.com.

Liability limited by a scheme approved under Professional Standards Legislation.

ED None

In line with EY's commitment to minimise its impact on the environment, this document has been printed on paper with a high recycled content.

ey.com