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E3 Fast track

Electricity Sector Workforce Projections for the 2022 ISP: Focus on Tasmania

Final report

UTS Institute for Sustainable Futures
AEMO
Australian Government Department of Industry, Science and Resources
AusIndustry Cooperative Research Centres Program

RACE for Everyone
Research Theme E3: Future Energy Workforce

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Industry Report
The Australian Electricity Workforce for the 2022 Integrated System Plan: Focus on Tasmania

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Contributors

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What is RACE for 2030?

RACE for 2030 CRC is a 10-year co-operative research program with AUD350 million of resources to fund research towards a reliable, affordable, and clean energy future: https://www.racefor2030.com.au

Acknowledgement of Country

The authors of this report would like to respectfully acknowledge the Traditional Owners of the ancestral lands throughout Australia and their connection to land, sea and community. We recognise their continuing connection to the land, waters and culture and pay our respects to them, their cultures and to their Elders past, present, and emerging.

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List of abbreviations

Acronym	Term
AEMO	Australian Energy Market Operator
GW/GWh	Gigawatt / Gigawatt Hours
ISF	Institute for Sustainable Futures
kW/kWh	Kilowatt / Kilowatt Hours
NEM	National Electricity Market
MW/MWh	Megawatt /Megawatt Hours
O&M	Operations & Maintenance
PV	Solar Photovoltaic

1 Introduction

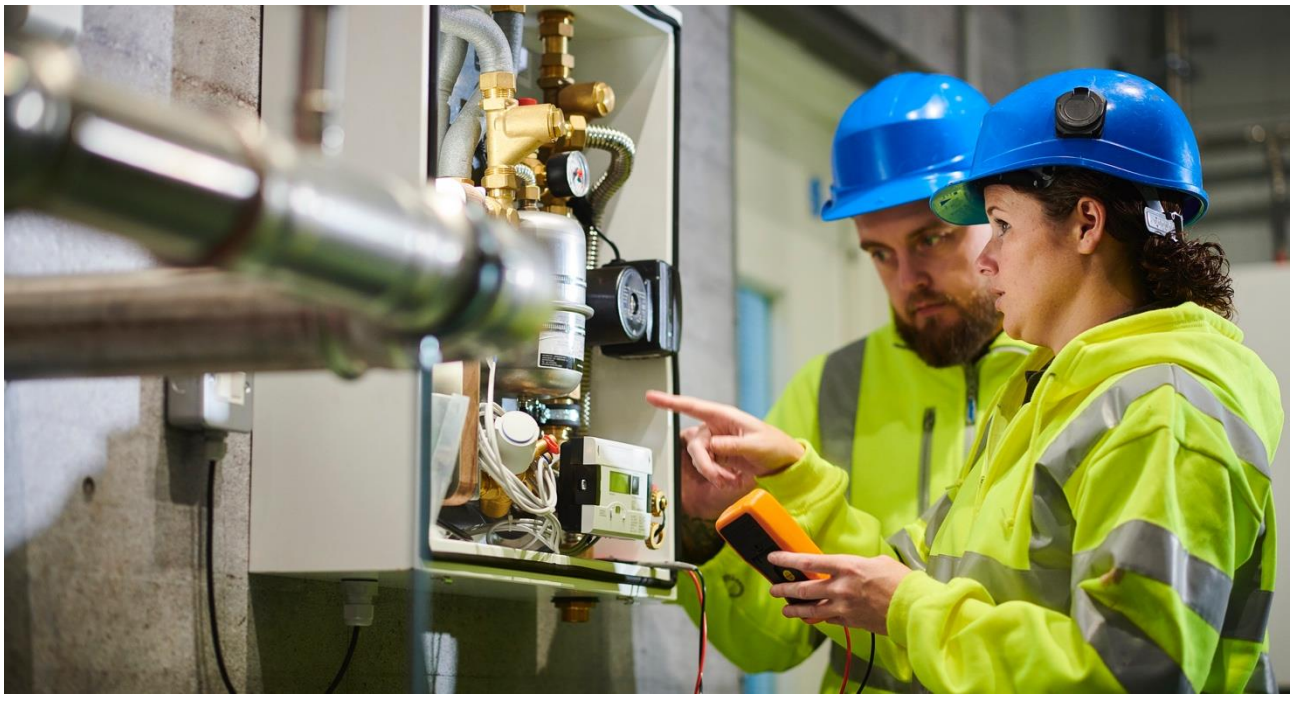
This report provides electricity sector workforce projections for Tasmania and is part of a wider project which provides projections for the National Electricity Market based on the 2022 Integrated System Plan (ISP) developed by the Australian Energy Market Operator (AEMO). Projections cover electricity generation and transmission construction.

The project was undertaken by the Institute for Sustainable Futures, University of Technology Sydney (ISF) in collaboration with the AEMO and was funded by the RACE for 2030 Co-operative Research Centre and by the NSW and Victorian State governments. The project has benefited from an Industry Reference Group made up of state government, industry, and university representatives.

The report provides electricity sector workforce projections for Tasmania broken down by technology, occupation, and location for three ISP scenarios and one sensitivity:

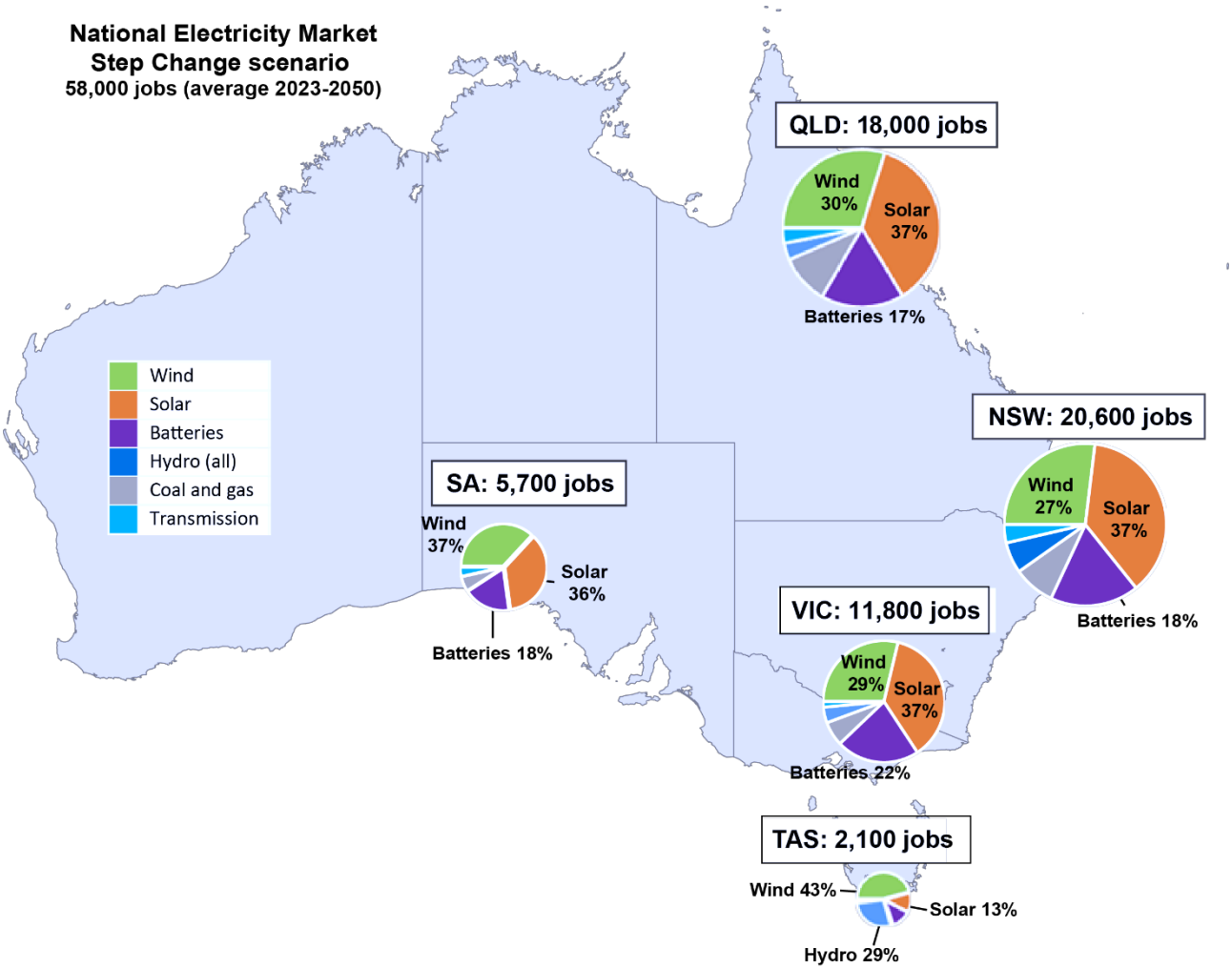
- The Step Change scenario: includes rapid consumer-led transformation of the energy sector and coordinated economy-wide action moving fast to fulfil Australia's net zero policy commitments. Energy stakeholders consider this the most likely scenario, as the NSW Electricity Infrastructure Roadmap is broadly aligned with this scenario, and during this project Victoria and Queensland released energy plans similarly aligned.
- The Hydrogen Superpower scenario: includes strong global action, significant technological breakthroughs, and a near quadrupling of NEM energy consumption to support a hydrogen export industry. There is large-scale development of the renewable energy sector, especially in the 2030s and 2040s.
- The Slow Change scenario: features a slow pace of policy and technology change, assuming a challenging environment following the COVID-19 pandemic, with the risk of industrial load closures. This scenario is considered unlikely and would not reach Australia's decarbonisation targets.
- The Offshore Wind sensitivity: the ISP includes a sensitivity to the Step Change scenario that takes account of the Victorian target to build 9GW of offshore wind by 2040 and assumes a lower cost. In all other scenarios, no offshore capacity is projected until the late 2040s. Offshore wind displaces onshore wind and utility-scale solar and reduces the overall capacity needed, with 9% (13 GW) less generation capacity over the entire NEM by 2050. In NSW Offshore Wind reduces the overall generation capacity by 14% (6 GW) by 2050.

The Progressive Change scenario was not included as the workforce profile is very similar to the Step Change.



To put the workforce demand in Tasmania in context, Tasmania accounts for an average of one twentieth of the forecast electricity sector workforce (Figure 1). NSW is the leading state for renewable energy employment, averaging over 20,600 full-time jobs per year. This is followed by Queensland (18,000) and Victoria (11,800). The share by technology is very similar for the three largest states, with solar contributing 37%, wind 27%-30% and batteries 17%-22%. South Australia has a higher proportion of wind (37%), while Tasmania has a very different distribution, with 29% of jobs in hydro.

Figure 1 Average electricity sector jobs by State, 2023-2050 (Step Change)



See the main report *The Australian Electricity Workforce for the 2022 Integrated System Plan: Projections to 2050* (Rutovitz et al, 2022). for details on the methodology including a full list of employment factors, results for the National Electricity Market as a whole, and a comparison of results by State, and recommendations for further work to support planning for workforce development.

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2 Workforce projections for Tasmania by scenario

Employment projections for each of the four workforce scenarios are presented in Figure 2:

- Under the Step Change scenario, employment averages 2,000, increasing from 1,000 in 2023 to peak just over 3,500 in 2030.
- Under the Hydrogen Superpower scenario, employment averages four times more, 9,000 per year with strong growth in the 2030s and especially in the 2040s, to a peak around 27,000 in 2050.
- Under the Slow Change scenario, employment averages 1,000 (compared to 1,000 in 2023), and peaks in 2027 with 2,200.
- The Offshore Wind scenario has somewhat lower employment compared to the Step Change scenario, with an average of 2,000. The peak is the same as, at 3,500, although slightly earlier in 2028.

Figure 2 Tasmania, electricity sector jobs by scenario

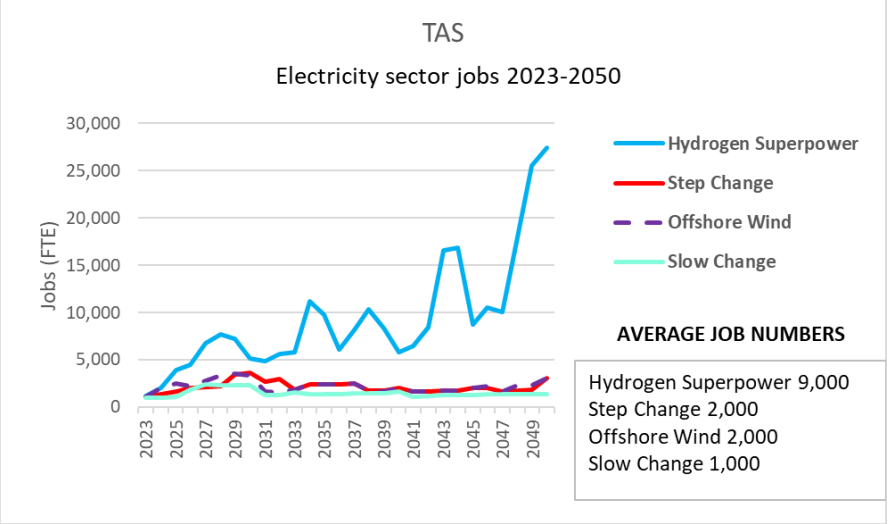


Figure 3 shows the total employment by whether it is construction, manufacturing, operations and maintenance or fuel supply. Under all scenarios, construction dominates the employment profile through the 2020s but ongoing operations and maintenance (O&M) employment gradually increases as the fleet of renewable energy generation and storage increases. The variation between the Step Change and the Offshore Wind scenarios is extremely small when all technologies are considered, so the the rest of this section will present graphical results comparing the Step Change to both the Hydrogen Superpower and the Slow Change scenarios. The Step Change is widely considered the most likely scenario; results for the Offshore Wind scenario are presented in Section 4.

In all scenarios, O&M employment is greater than 40% by 2050, varying from 41% in the Hydrogen Superpower to 78% in the Slow Change scenario.

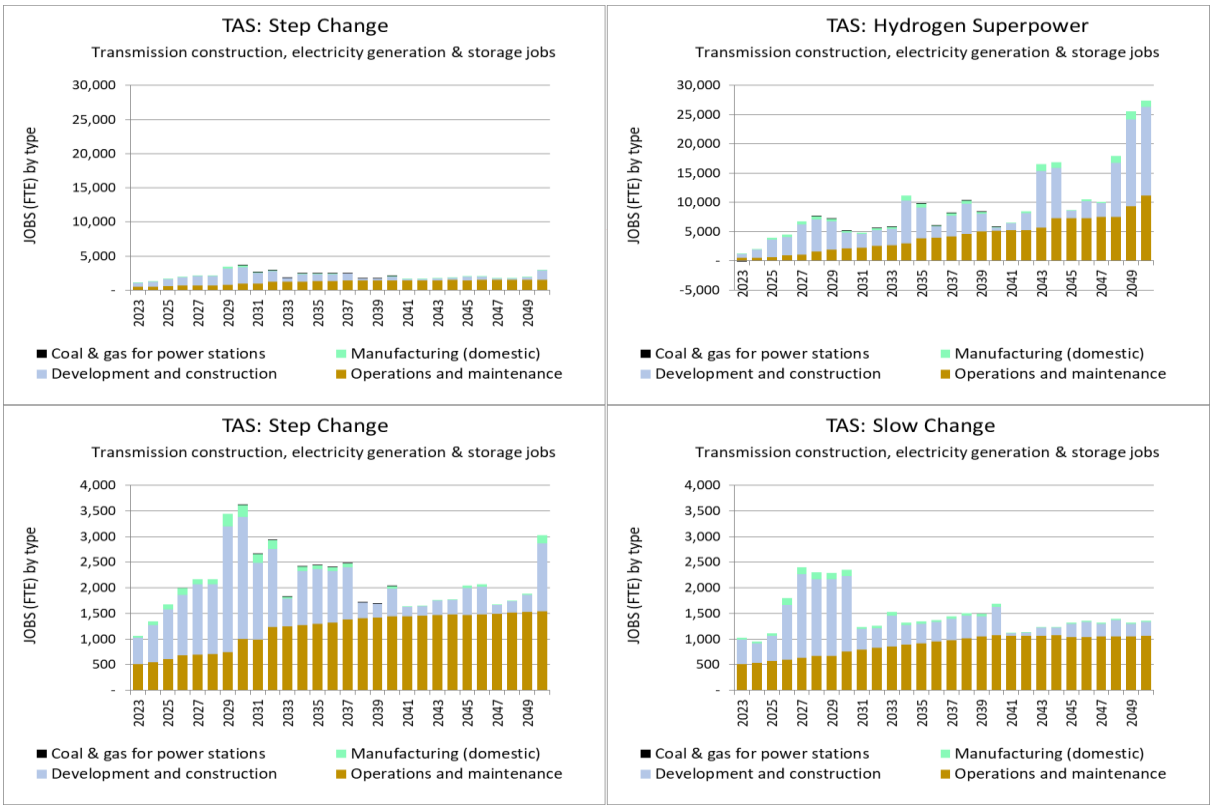
Figure 4 shows the breakdown between renewable generation, fossil fuel generation, storage, and transmission construction. Most of the employment growth in all scenarios is produced by renewable energy, with storage contributing to the Step Change scenario. The proportion of coal and gas generation employment falls below 1% of electricity sector workers in all scenarios.

Jobs are presented as full time equivalent (FTE) for each year and are the sum of people working on construction projects, operations and maintenance, manufacturing, and fuel supply for coal and gas generation in that year. One FTE could be one person working full time, two people working full time for six months, or an ongoing full-time job in operations and maintenance. Construction jobs are by their nature temporary, although workers may move from one project to another and be in continuous employment.

The numbers of jobs added varies significantly by scenario, particularly by the end of the projection period. Taking the 2023 total in the Step Change scenario (1,000) as the reference point in all cases, in the Step Change scenario there are 1,000 additional jobs in 2040

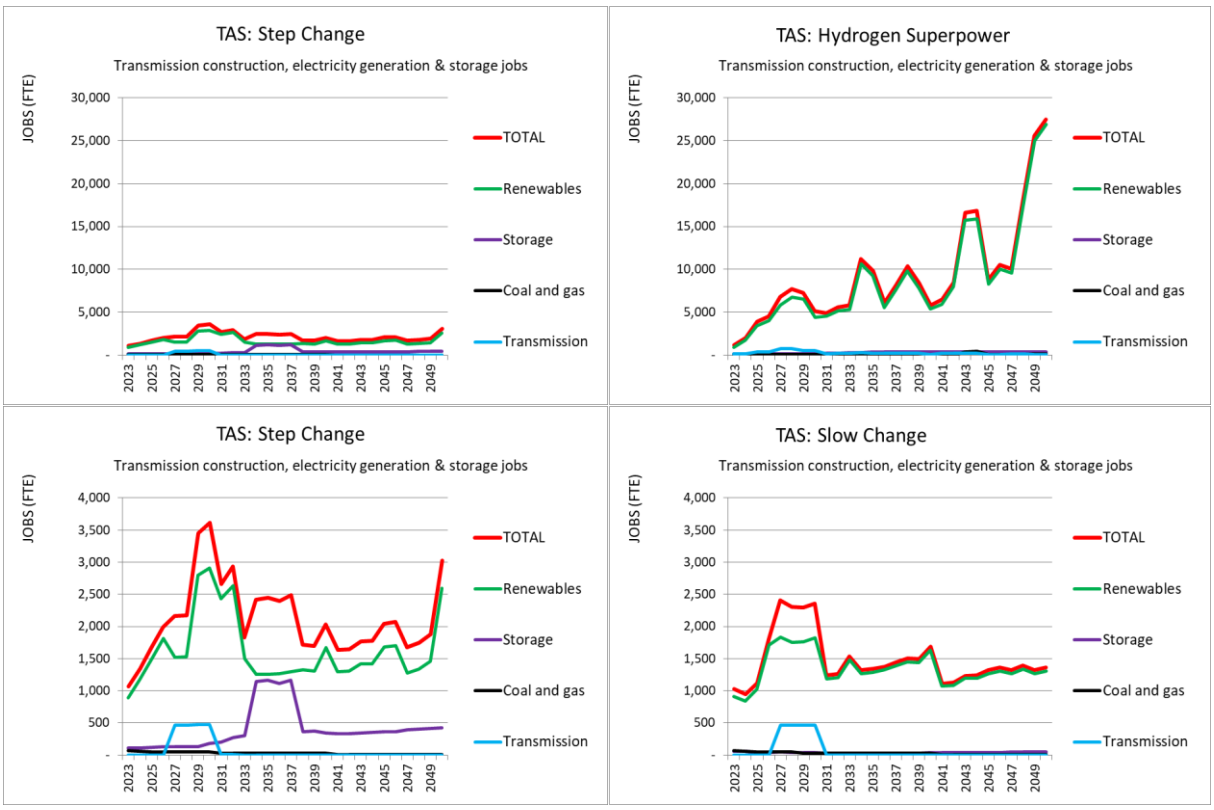
(2,000 extra by 2050), in the Hydrogen Superpower scenario there are 4,700 additional jobs in 2040 (26,000 extra by 2050), in the Slow Change scenario there are 600 **fewer** jobs in 2040 (300 fewer by 2050), and in the Offshore Wind scenario there are 1,000 additional jobs in 2040 (2,000 extra by 2050).

Figure 3 Tasmania, jobs by phase (Step Change, Hydrogen Superpower, and Slow Change)



Note different scale for lower graphs

Figure 4 Tasmania, jobs by technology group (Step Change, Hydrogen Superpower, and Slow Change)



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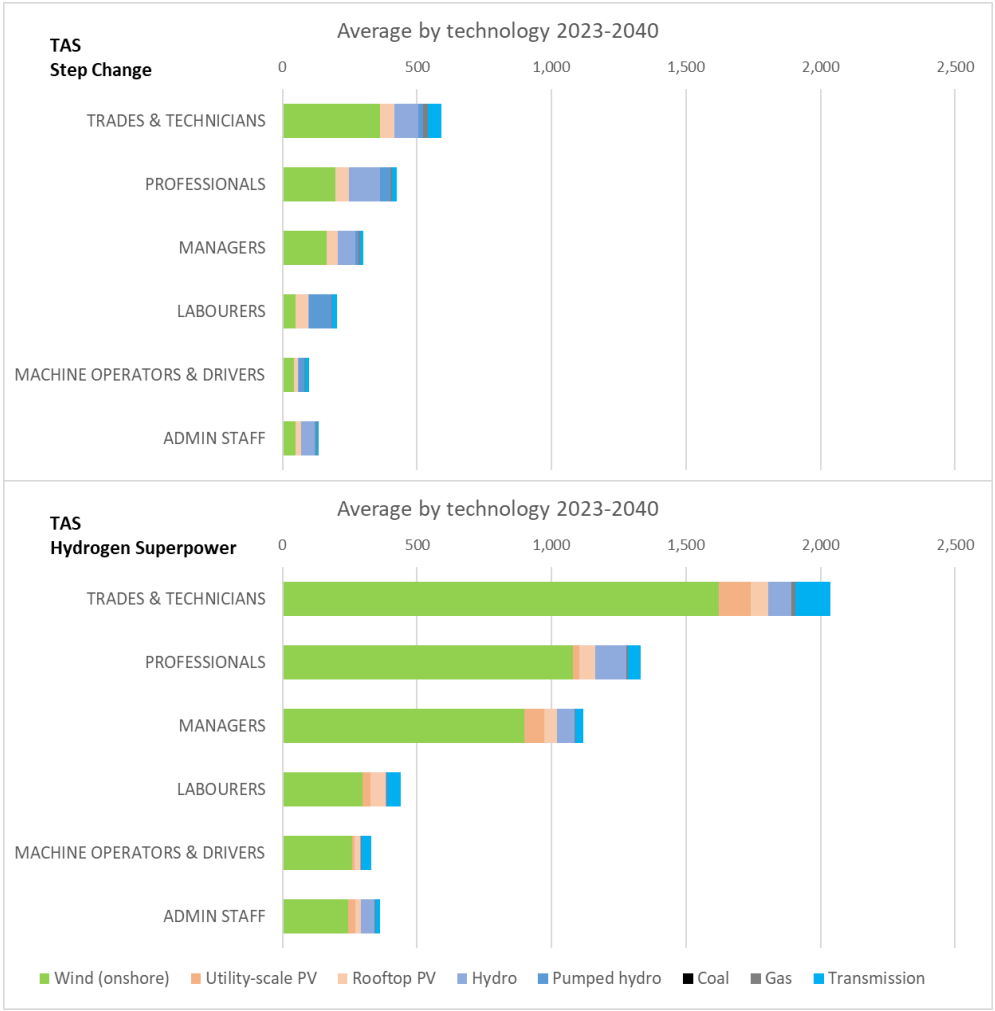
3 Tasmania – employment by occupation

Occupational employment trends are important for government, industry, the training sector, and the community to understand what type of jobs will be required as a result of the energy transition.

Average annual employment projections illustrate the bulk distribution of jobs between technologies, and the occupations that are most in demand overall. Figure 5 shows the average annual employment demand from 2023 until 2040 by employment grouping:

- The largest group of occupations is trades and technicians, which average almost 600 per year until 2040 under the Step Change scenario and over 2,000 in the Hydrogen Superpower scenario.
- The next largest groups are professionals (more than 400 per year across a wide range of occupations including finance, health and safety, engineers) and managers (300 per year, divided between business managers, construction managers, and operations managers). In the Hydrogen Superpower scenario demand for professionals is over 1,300 per year, and for managers over 1,100 per year)
- Around 200 labourers are projected per year (especially construction labourers), around 100 machine operators and drivers (e.g. truck drivers, crane operators), and around 100 administrative staff. Under the Hydrogen Superpower scenario, there would be demand for around 400 labourers and around 300 machine operators and drivers, and 400 administrative staff combined.

Figure 5 Tasmania, average occupational structure



From the perspective of skills, training, and labour supply, the peaks in employment are the most important, with training provision in the medium term likely to be designed to cater to the next ten to fifteen years. The peak labour requirement year in this period is chosen to illustrate peak demand for the most in-demand occupations.

Labour requirements in 2030 (the peak year before 2035 in the Step Change scenario) are shown in Figure 6. There are more than 300 electricians and more than 150 mechanical trades and technicians needed in the Step Change scenario. In the Hydrogen Superpower these requirements are higher, with 800 electricians and more than 400 mechanical trades needed. Annual requirements for in-demand occupations in the Hydrogen Superpower scenario are shown in Appendix A.

Annual requirements for the six most in-demand occupations over the entire period are shown in Figure 5. Those occupations needed in large numbers primarily during construction (such as construction labourers and managers, and electrical engineers) are very volatile, while occupations such as electricians and mechanical trades increase steadily over the entire period.

Figure 6 Tasmania, in-demand occupations during peak year (2030)

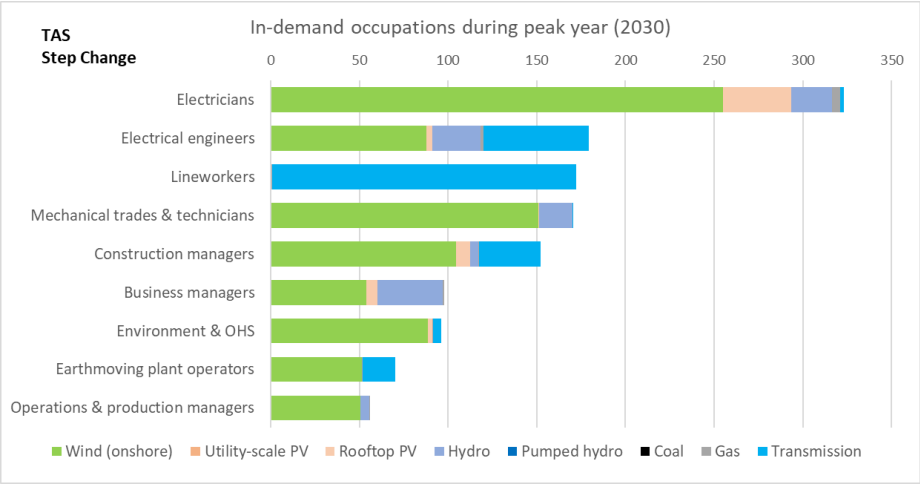
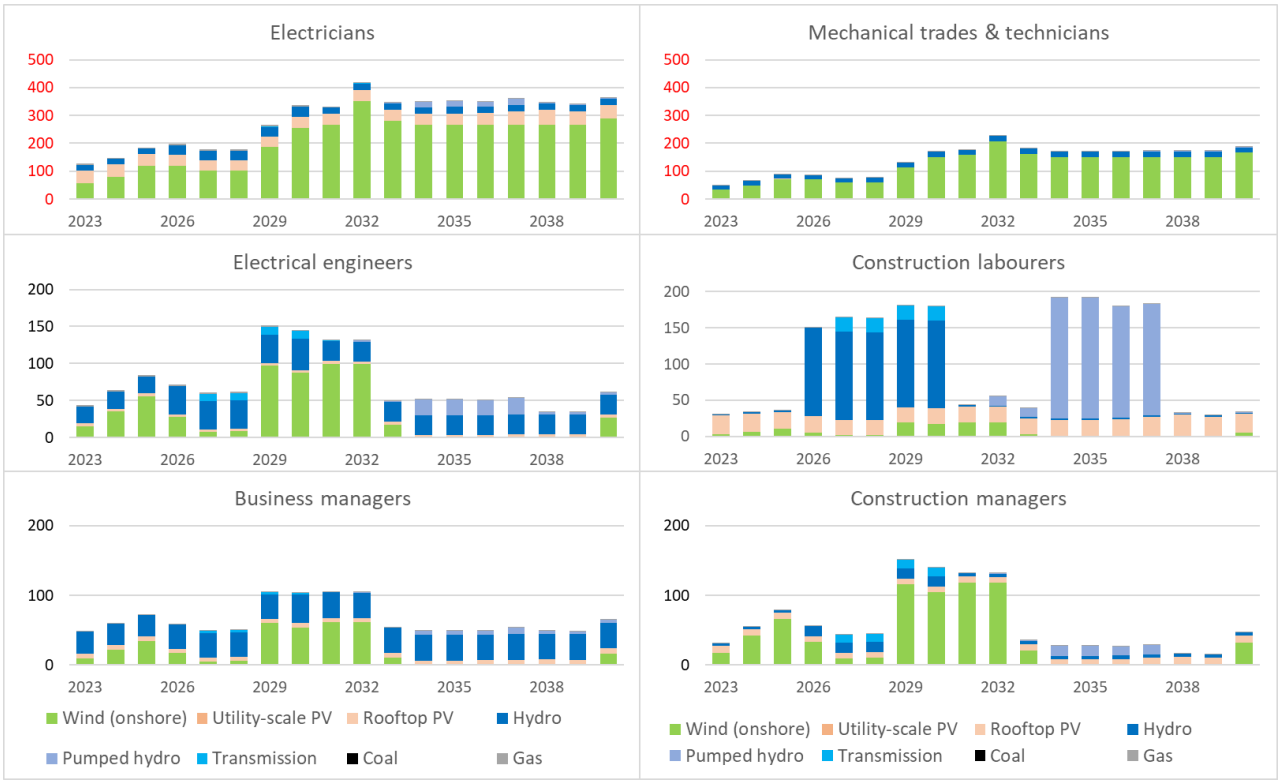


Figure 7 Tasmania, in-demand occupations annual requirement by technology, Step Change



Note the scale for electricians goes from 0-500, all other graphs from 0-200

4 Workforce projections by technology for Tasmania

In the Step Change, Slow Change and Offshore wind scenarios, employment growth is divided fairly evenly between wind farms and hydro. In the Hydrogen Superpower scenario growth is almost entirely in wind power. Figure 8 shows the average employment by technology over the period, while Figure 9 shows the annual variation.

- Wind accounts for close to half of the electricity sector employment on average in all but the Hydrogen superpower scenario, with between 43% in the Step Change and 49% in the Slow Change scenarios. In the Hydrogen Superpower it accounts for 73% of electricity sector employment, and the total goes up to 10,000 on average from 2,000.
- Hydro accounts for the next largest share, between 28% and 31% except in the Hydrogen superpower scenario.
- Rooftop solar provides steady employment, accounting for an average of 10% to 12% in all scenarios except for the Hydrogen Superpower. Utility-scale PV only grows significantly in the Hydrogen Superpower scenario.
- Batteries are only significant in the Step Change and Offshore wind scenarios, where they account for approximately 12% of electricity sector employment.

Repowering is replacing wind turbines or solar panels, either at the end of their life, or because technology improvements mean that the replacements are sufficiently higher performance to make replacement economic. Repowering is included for wind, utility solar, and rooftop solar, with employment factors and construction times assumed to remain the same. Employment associated with recycling of panels or turbines is not included.

Figure 8 Tasmania, average electricity sector jobs by technology and scenario

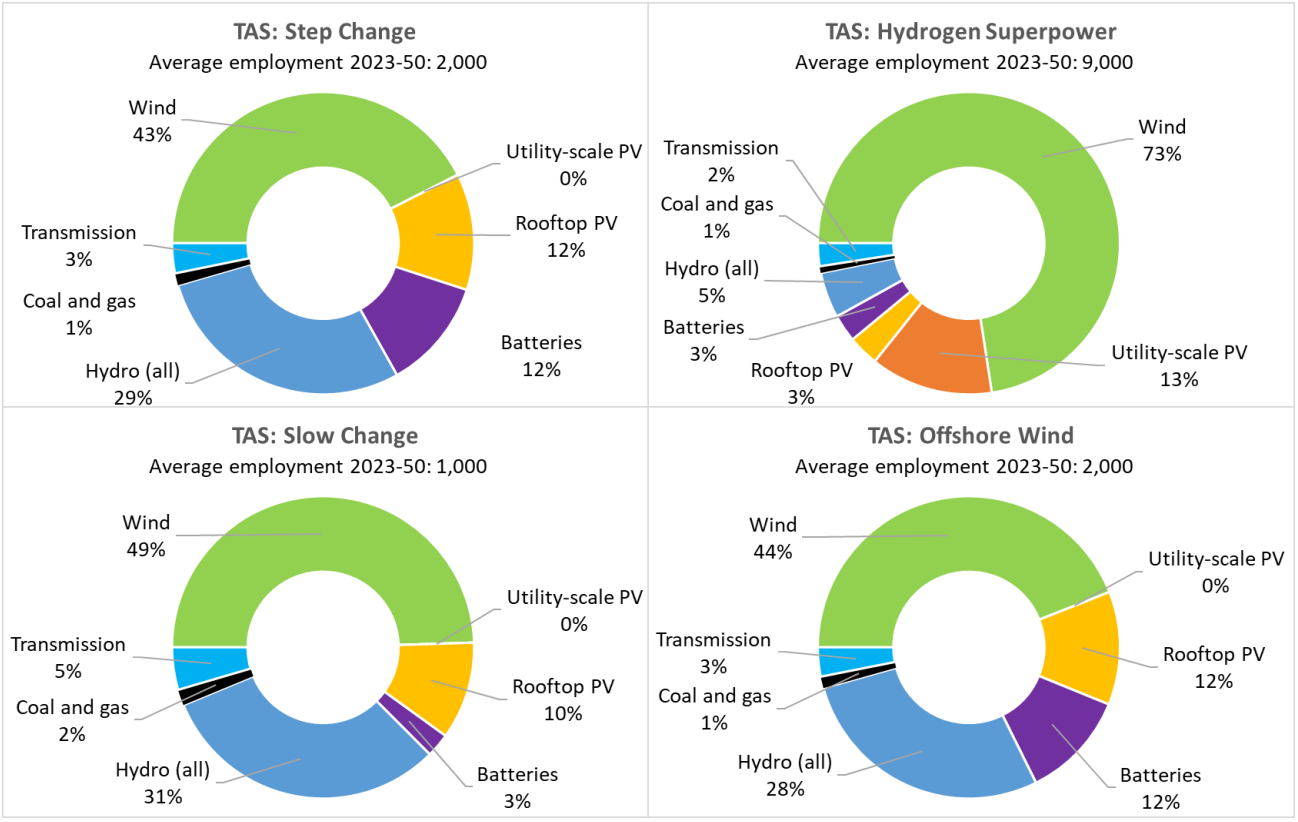
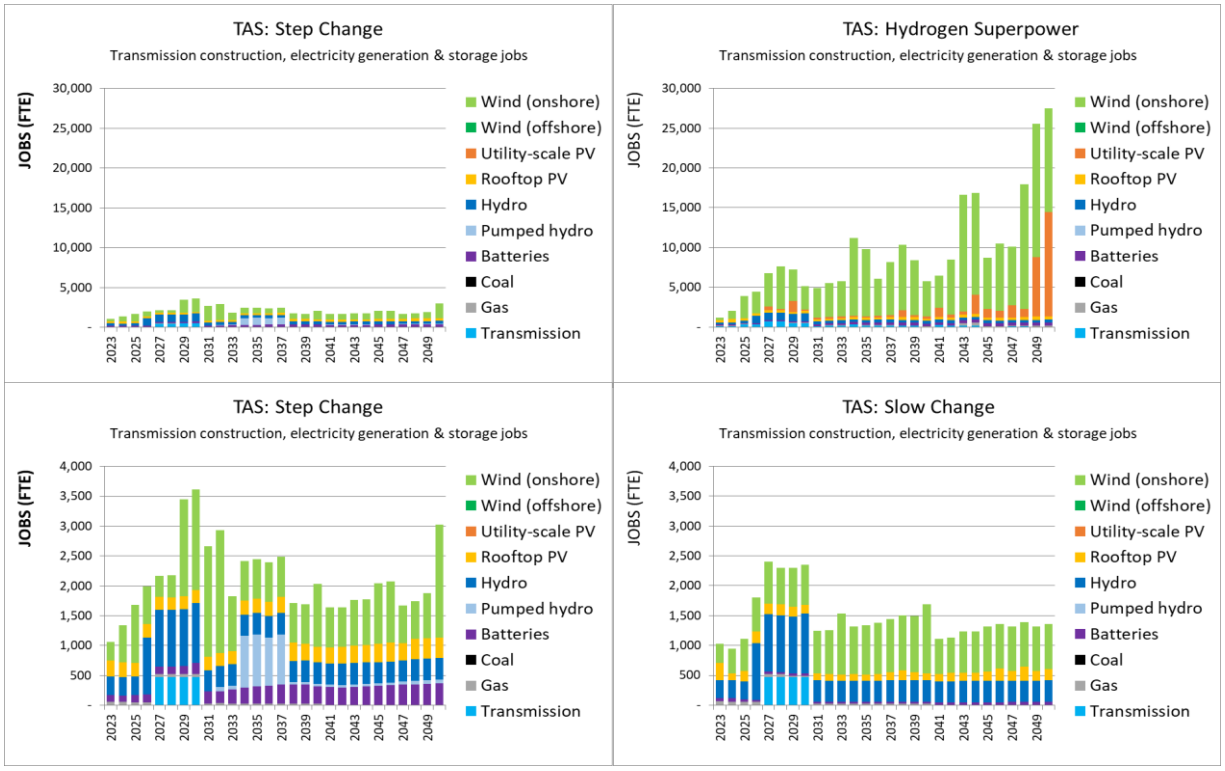


Figure 9 Tasmania, jobs by technology (Step Change, Hydrogen Superpower, Slow Change)

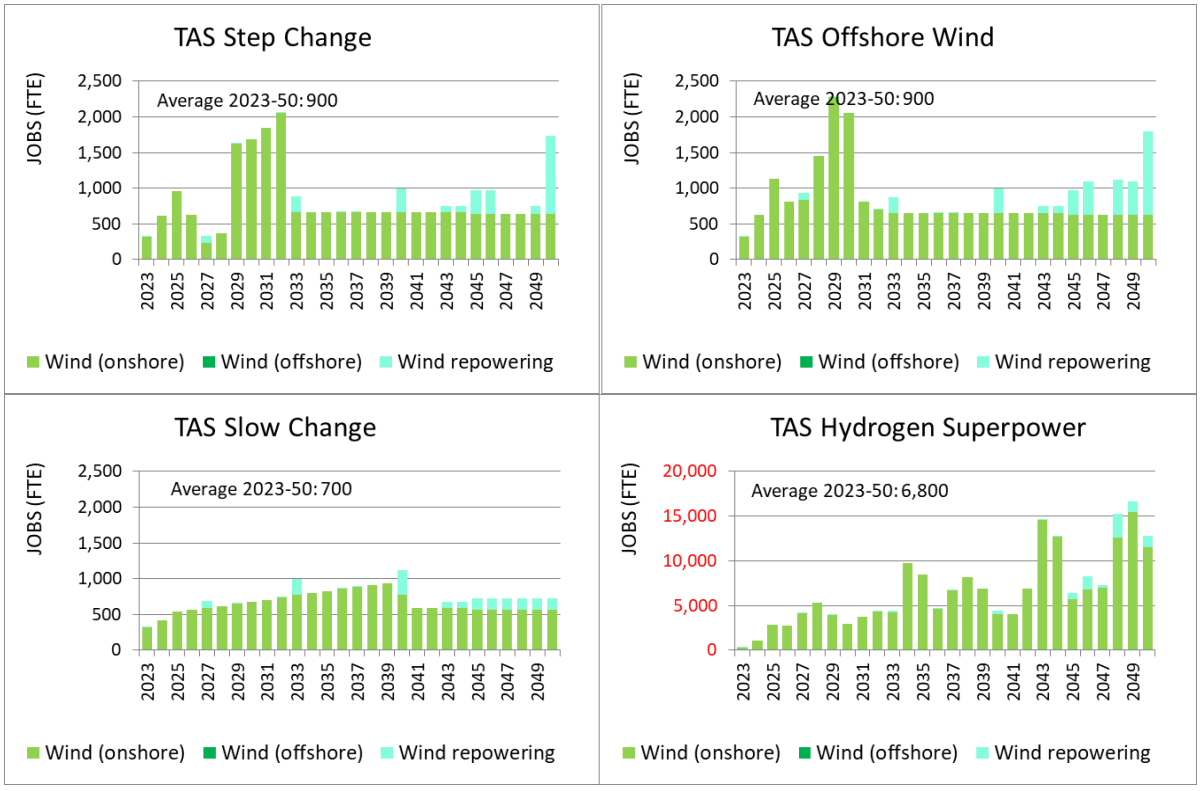


Note different scale for lower graphs

4.1 Wind

Total jobs in wind power for all four scenarios are shown in Figure 10 with an average of between 700 in the Slow Change and up to a staggering 6,800 in the Hydrogen Superpower scenario (note the different scale).

Figure 10 Tasmania, jobs in wind (all scenarios)



Note different scale for Hydrogen Superpower

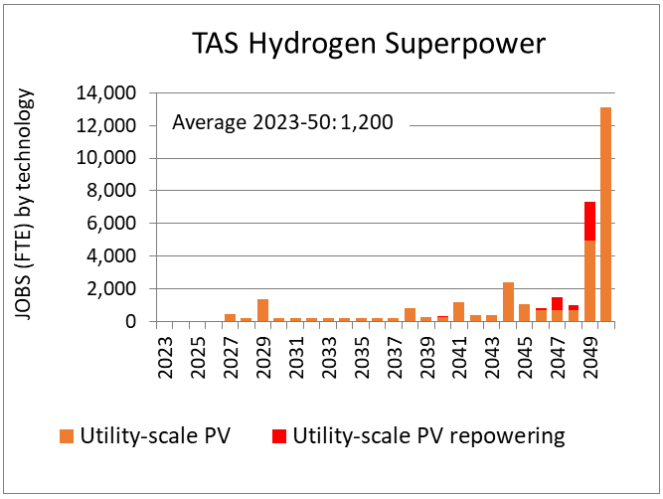
In the Step Change and Offshore wind employment fluctuates during the 2020s during a period of intense construction, and then remains very steady until repowering starts in the late 2040s. In the Slow Change employment grows slowly but steadily. The peak in the Step Change, Slow Change, and Offshore wind is between 1,000 to 2,000, while in the Hydrogen Superpower wind power employment reaches 16,000 by the end of the period. Employment is greatest in the Hydrogen Superpower scenario by a considerable margin, with an average of 6,800 jobs.

In the Offshore Wind scenario, the average wind employment is somewhat lower than in the Step Change, reflecting the lower labour intensity of offshore compared to onshore wind and the fact that offshore tends to displace onshore wind capacity.

4.2 Utility-scale solar

Tasmania only sees utility-scale PV installations in the Hydrogen Superpower scenario, employment averaging 1,200 over the whole period. This average represents a burst in the late 2020s, an average of 300 during the 2030s, and then a steep rise during the 2040s, to finish with employment reaching 12,000 in the late 2040s (Figure 11).

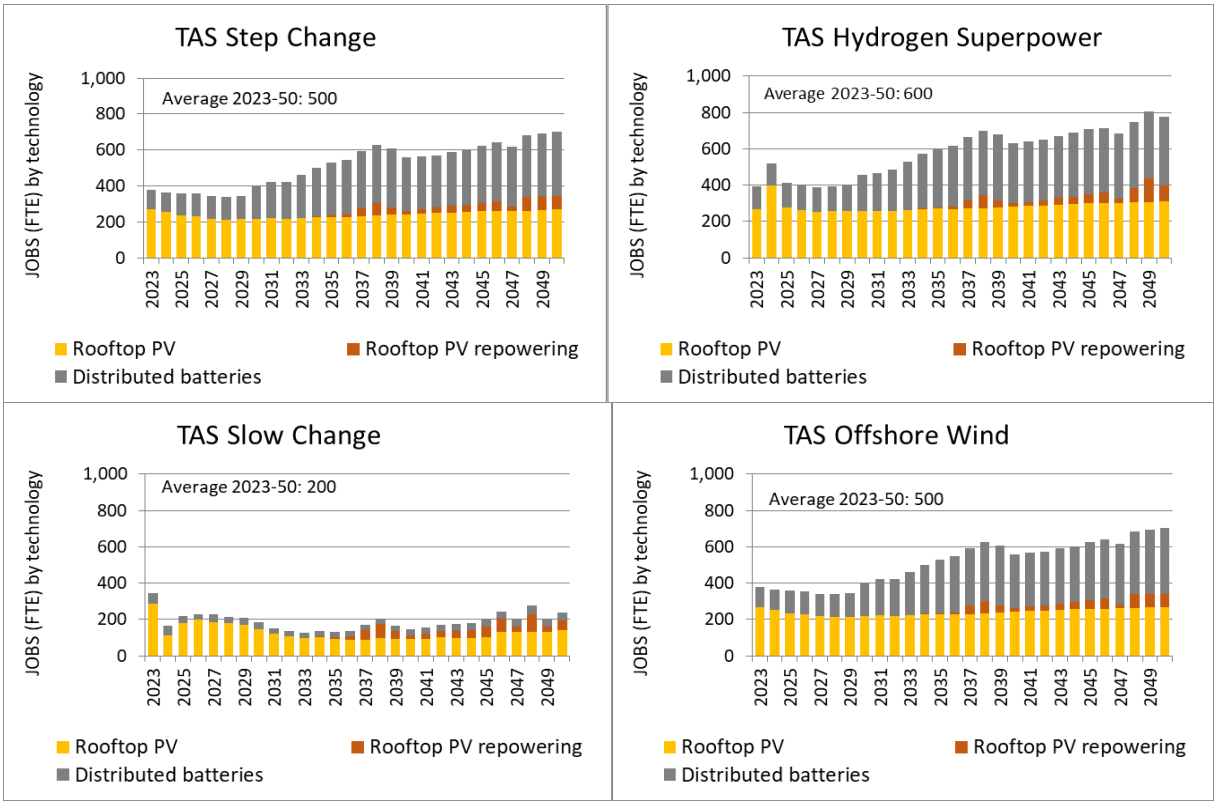
Figure 11 Tasmania, jobs in utility-scale PV (Hydrogen Superpower)



4.3 Rooftop solar and distributed batteries

Total jobs in rooftop solar and distributed batteries for all four scenarios are shown in Figure 12. The Step Change, Offshore Wind, and Hydrogen Superpower scenarios are almost identical, with an average of between 500 and 600 per year. Rooftop solar in particular, is almost constant throughout, while batteries increase almost steadily after 2030. Rooftop solar repowering starts to play a role in the late 2030s. Rooftop repowering starts to play a role across all scenarios in the 2030s. The profile in the Slow Change is quite different, with employment in rooftop solar falling to a low around 100, and remaining almost constant thereafter, while installation of distributed batteries never really takes off.

Figure 12 Tasmania, jobs in rooftop solar and distributed batteries (all scenarios)



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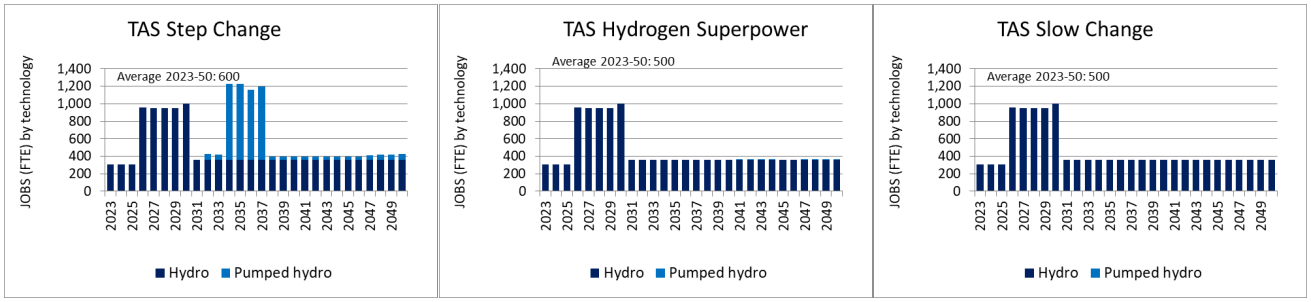
4.4 Hydro and pumped hydro

Hydro and pumped hydro jobs are shown in Figure 13 for the Step Change, Hydrogen Superpower, and Slow Change scenarios. Offshore Wind is not shown, as the profile is the same as the Step Change scenario.

Figure 13 Tasmania, jobs in hydro and pumped hydro (Step Change, Hydrogen Superpower Slow Change)



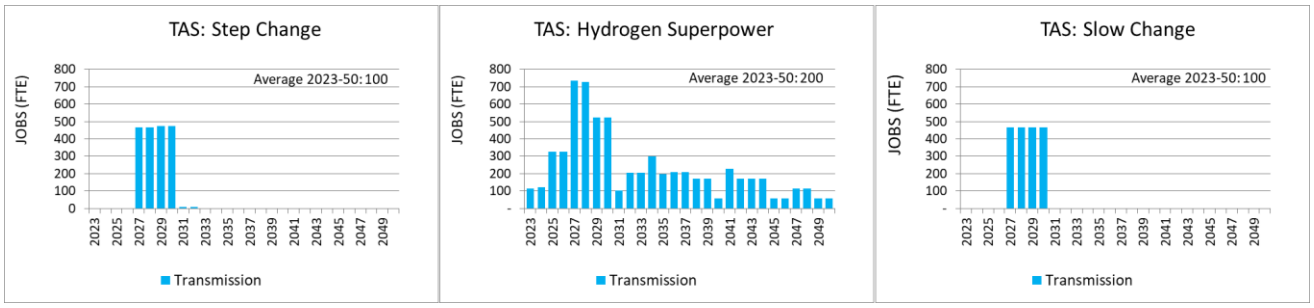
There are about 300 jobs in hydro O&M, which are constant throughout the period, overlaid by two periods of construction in the Step Change scenario, and one period in the Slow Change and Hydrogen Superpower scenarios. This adds about 700 jobs for a period of years, although it is likely that the real profile will be more volatile than this during construction, as the actual build programme progresses. The second period of construction for pumped hydro does not occur in the Hydrogen Superpower or Slow Change scenario.

4.5 Transmission construction

Employment in transmission construction is compared for three scenarios in Figure 14 (Offshore Wind is identical to the Step Change scenario). The employment in the Step Change and Slow Change scenarios is the same, and results from construction of the Marinus Link, with a about 500 jobs created during the construction period in the late 2020s. In the Hydrogen Superpower Marinus Link and a suite of other transmission projects create jobs, so there is labour demand throughout the period, with an average labour demand of 200 and a peak of over 700 in the late 2020s.

It should be noted that actual employment is likely to be more variable than shown here, as these calculations assume that employment is spread evenly across the construction period for each project.

Figure 14 Tasmania, jobs in transmission (Step Change, Hydrogen Superpower, Slow Change)



5 Electricity sector workforce projections, by REZ

In Tasmania, over 2 GW of new utility-scale wind and solar renewable generation is projected in the ISP for the candidate REZs shown in Figure 15 by 2050 (provided the Marinus Link is built). It is not yet determined which REZs will go ahead, so the two with the most significant renewable capacity shown in the ISP were selected. Figure 15 shows the candidate REZs identified in the ISP, with the two modelled here indicated in red. They are North West Tasmania and the Central Highlands, noting that employment associated with any offshore development in Offshore Zone 4 would be allocated to North West Tasmania. Employment associated with electricity infrastructure that has not been specially allocated to a REZ, or associated with the North East Tasmania REZ, has been modelled as 'Rest of Tasmania'.

Figure 15 Candidate REZs for Tasmania, and the REZs with modelled employment

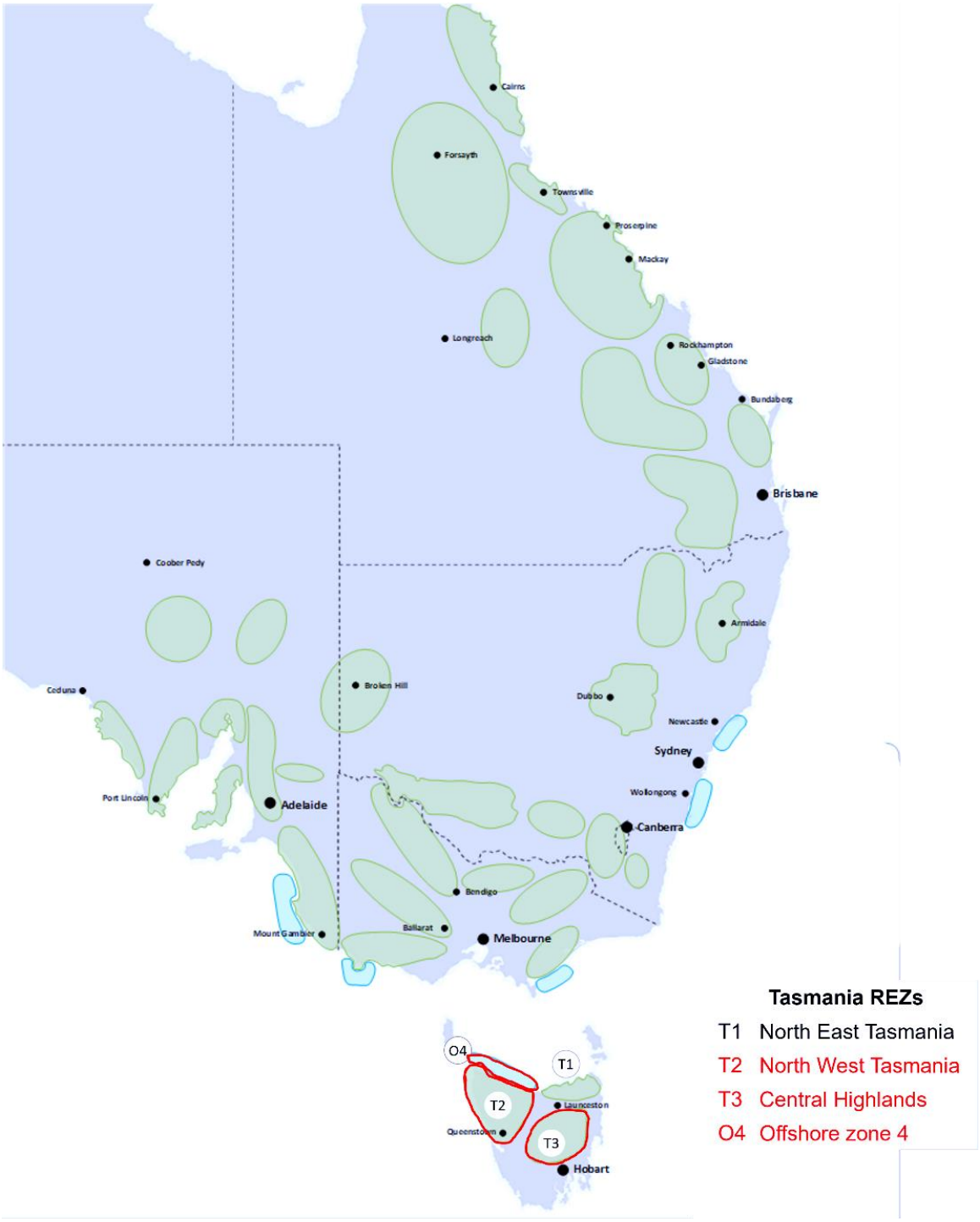
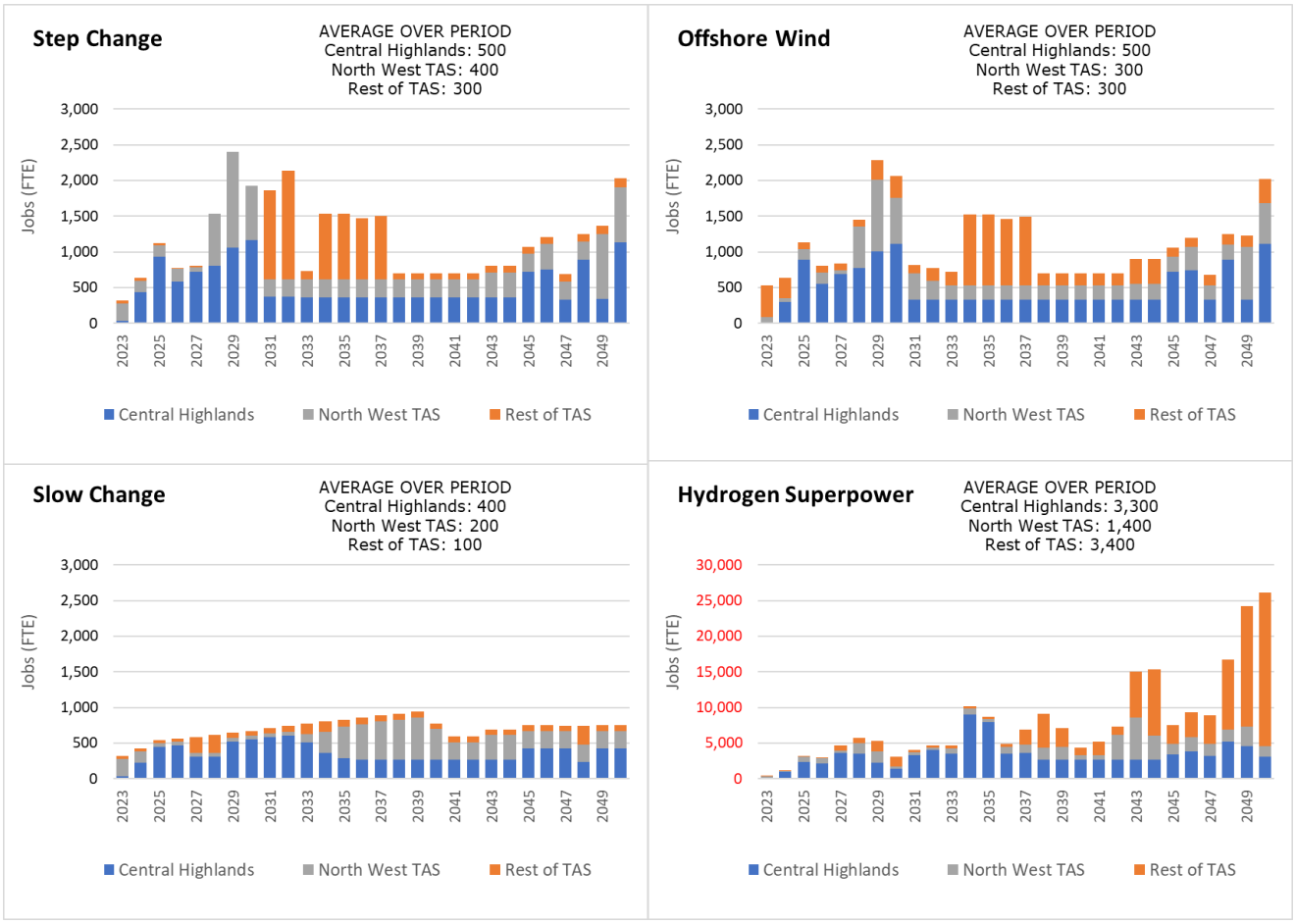


Figure 16 Employment by REZ and Rest of Tasmania (all scenarios)



Note different scale for Hydrogen Superpower

The distribution of employment growth across the REZs is shown in Figure 16.

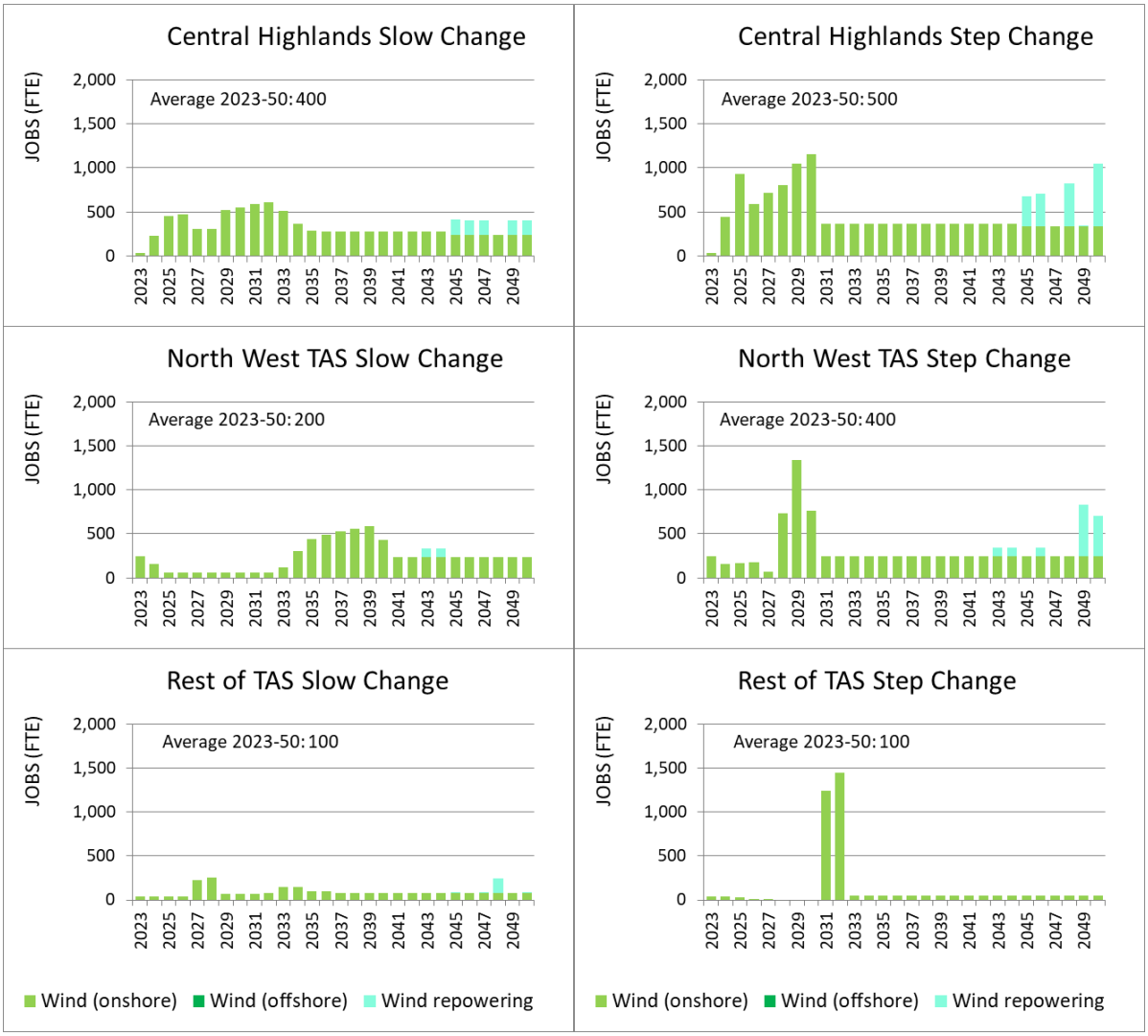
In the Hydrogen Superpower scenario electricity sector average employment triples in Tasmania, with the Central Highlands particularly benefiting.

Figure 17 compares wind employment for two REZs and the rest of Tasmania in the Step Change, Slow Change, and Hydrogen Superpower scenarios; the Offshore Wind scenario is not shown as there is no impact in Tasmania.

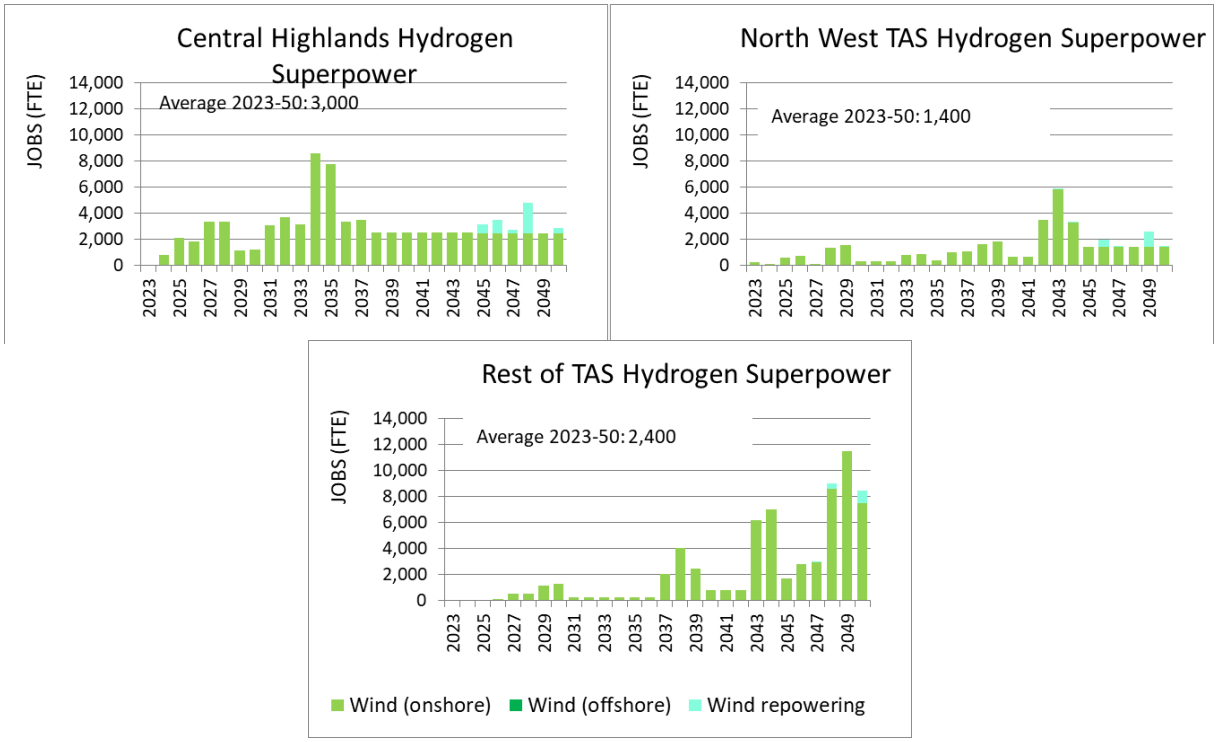
Overall wind employment in Tasmania drops from an average of 900 in the Step Change scenario to 700 in the Slow Change, and this is reflected in the individual REZs. Most employment is in the Central Highlands REZ, with an average of 500 per year. Repowering starts to play a role in the 2040s in all scenarios.

The Hydrogen Superpower sees employment in this REZ peaking at close to 10,000 in the mid-2030s, while employment in the rest of Tasmania increases especially in the latter part of the period.

Figure 17 Employment in wind technology in Tasmania, all scenarios



Note different scale for Hydrogen Superpower (0-14,000)



Appendix A – Additional information on Tasmanian occupational breakdown

Figure 18: Tasmania, in-demand occupations during peak year 2028

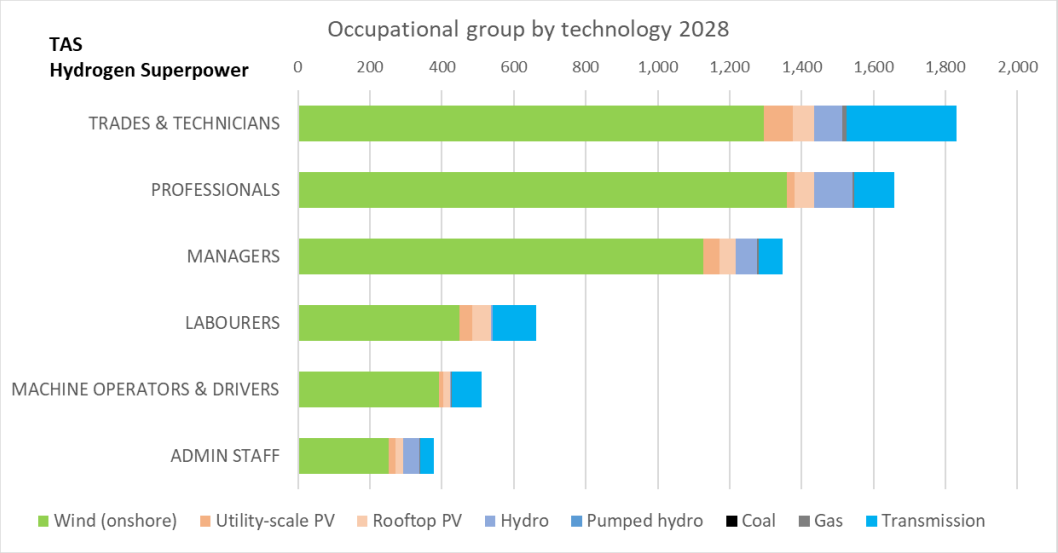
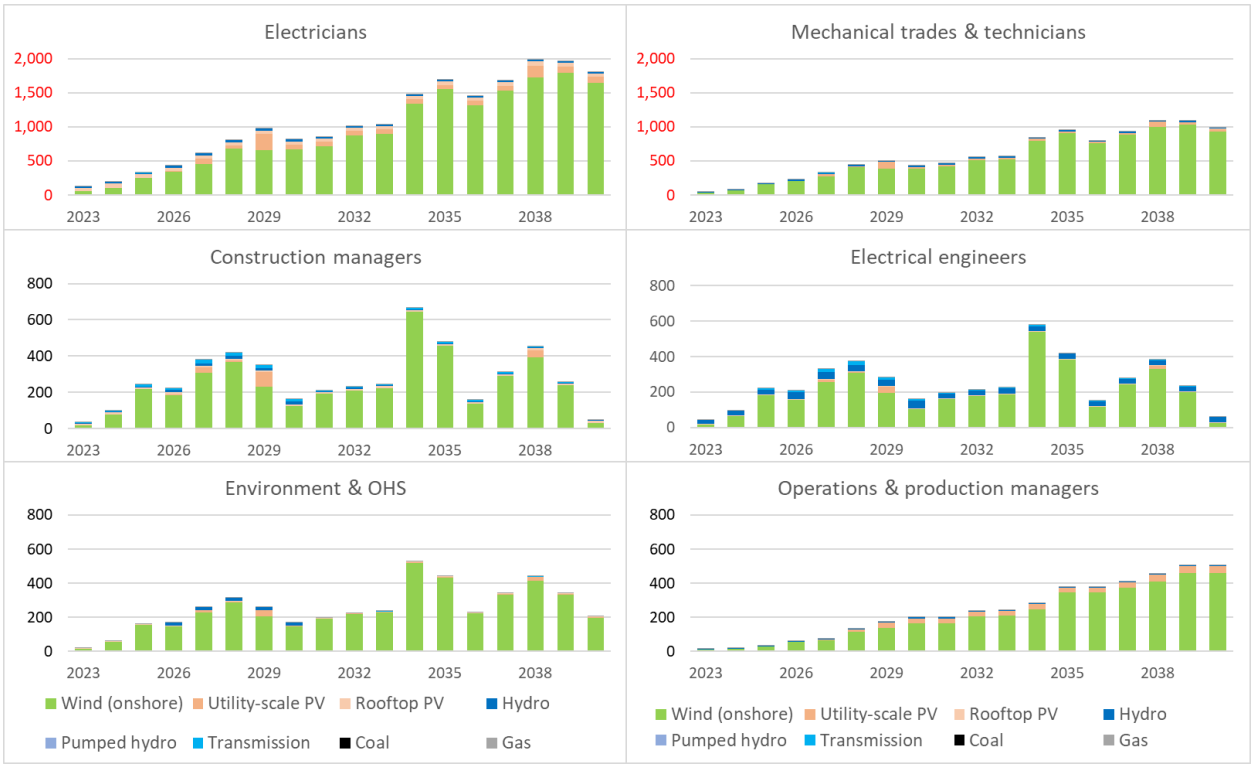


Figure 19: Tasmania, in-demand occupations annual requirement by technology, Hydrogen Superpower



Note the scale for electricians and mechanical traders goes from 0-2,000, all other graphs from 0-800

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