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Electricity Workforce Projections for the 2024 Integrated System Plan: Focus on New South Wales

Final Report

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

Final report

RACE for Change

Research Theme CT11: Electricity Workforce Projections for the 2024 Integrated System Plan: Focus on New South Wales

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RACE for 2030

Project partners

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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.

What is RACE for 2030?

Reliable, Affordable Clean Energy for 2030 (RACE for 2030) is an innovative cooperative research centre for energy and carbon transition. We were funded with $68.5 million of Commonwealth funds and commitments of $280 million of cash and in-kind contributions from our partners. Our aim is to deliver $3.8 billion of cumulative energy productivity benefits and 20 megatons of cumulative carbon emission savings by 2030. racefor2030.com.au

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List of abbreviations

Acronym	Term
AEMO	Australian Energy Market Operator
FTE	Full-Time Equivalent
GW/GWh	Gigawatt / Gigawatt Hours
ISF	Institute for Sustainable Futures
ISP	Integrated System Plan
MW	Megawatt
NEM	National Electricity Market
O&M	Operations & Maintenance
PV	Solar Photovoltaic
REZ	Renewable Energy Zones

1 Introduction

This report provides projections for the electricity sector workforce in New South Wales. It is part of a wider study[1] that looks at the projected electricity workforce requirements associated with the Australian Energy Market Operator's (AEMO) 2024 Integrated System Plan (ISP).

Projections cover the workforce needed to build and operate the generation and storage infrastructure and construct the new transmission lines included in the New South Wales in the ISP.

The project was conducted by the Institute for Sustainable Futures, University of Technology (ISF) in partnership with AEMO and funded by the RACE for 2030 Cooperative Research Centre. An Industry Reference Group made up of representatives from state government, industry and peak bodies, provided valuable insights.

The aim of this report is to provide stakeholders with an in-depth understanding of the workforce implications of different electricity scenarios, with a specific focus on New South Wales. This report develops workforce projections broken down by technology, occupation and location, for each of the ISP's three scenarios.

The ISP's three scenarios (or optimal development paths) reflect various policy and market contexts on the path towards net zero by 2050. All scenarios comply with all existing state and federal legislated targets and consider state and federal energy policies. The scenarios are:

- **Step Change** includes a rapid pace of energy transition with strong economic growth and with Consumer Energy Resources (CER) playing a strong role. It supports Australia's commitment to keep global temperature rise to below 2°C.
- **Progressive Change** reflects a constrained economic and supply chain environment meaning less uptake of CER and deployment of utility-scale developments. as less energy is required to meet the needs of a smaller economy. While meeting legislated commitments, cumulative electricity sector emissions to 2050 are 36% higher than under the Step Change.
- **Green Energy Exports** indicates an exceptionally fast rate of decarbonisation aimed at Australia making its contribution to keeping global temperature increase to below 1.5°C, with a strong emphasis on a green energy exports economy and electrification. Cumulative electricity sector emissions to 2050 are 46% reduced compared to the Step Change.

After extensive consultation with a wide range of stakeholders, AEMO has determined that the most likely scenario is Step Change (43% likelihood), followed closely by Progressive Change (42% likelihood), with Green Energy Exports assigned a likelihood of just 15%.

[1] Rutovitz, J., Gerrard, E., Lara, H., and Briggs, C. (2024). The Australian Electricity Workforce for the 2024 Integrated System Plan: Projections to 2050. Prepared for RACE for 2030. www.uts.edu.au/isf/explore-research/projects/australian-electricity-workforce-2024-integrated-system-plan-projections-2050

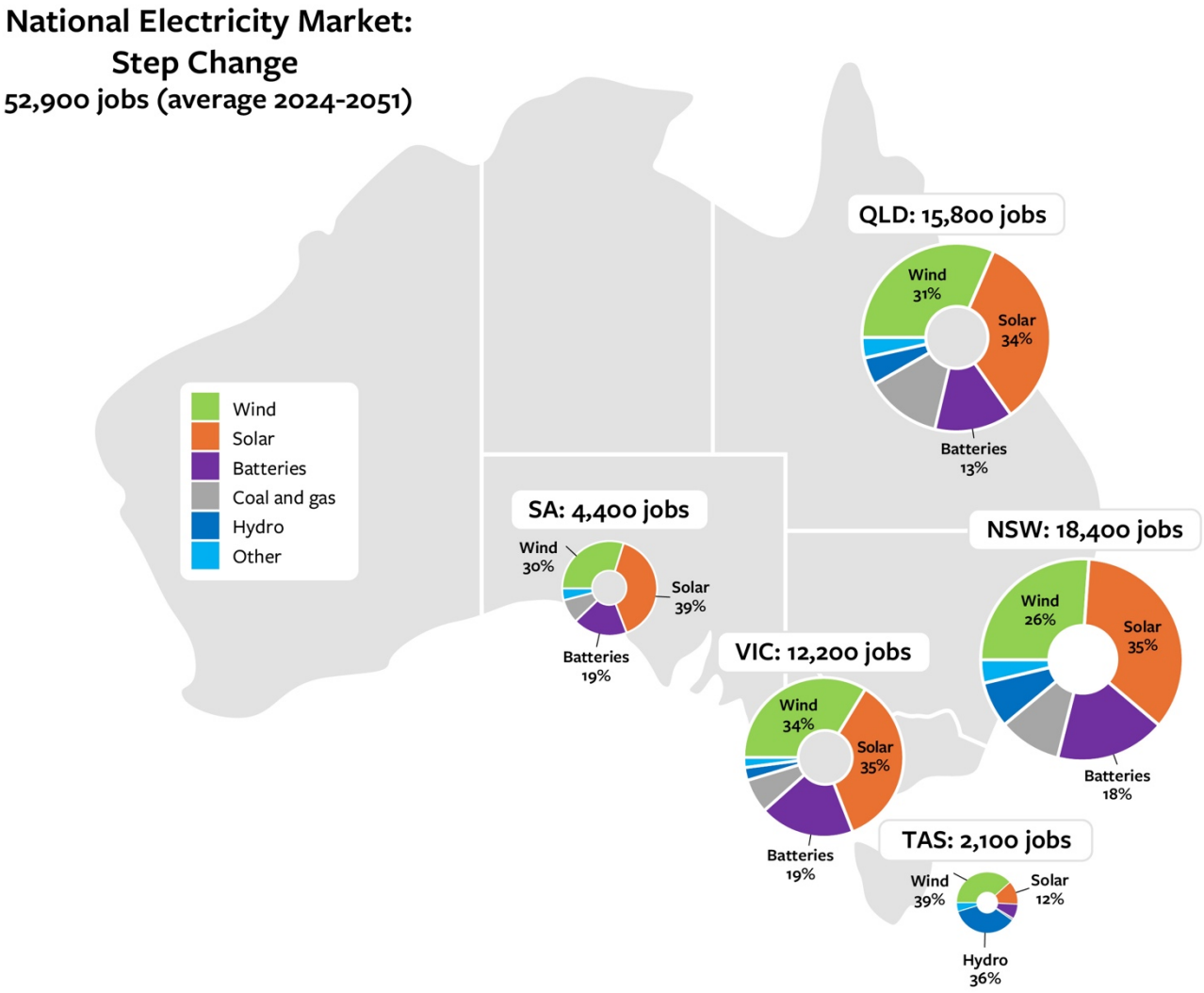

Figure 1 Average electricity sector jobs by State, 2024-2050 (Step Change)

Under the Step Change scenario, New South Wales averages 18,400 jobs in generation and storage or transmission line construction from 2024-2050. New South Wales contributes over a third of the total electricity sector workforce in the National Energy Market (NEM) (Figure 1). New South Wales is the leading state, followed closely by Queensland (15,800). Victoria is some way behind with 12,200 jobs on average. Solar and wind account for between 61% and 69% of jobs in all states except Tasmania, where hydro and wind account for 75% of jobs.

In the Green Energy Exports scenario, the highest number of jobs are created in Queensland (32,300 on average), followed by New South Wales (22,600) and Victoria (15,900).

See the main report, *The Australian Electricity Workforce for the 2024 Integrated System Plan: Projections to 2050* (Rutovitz et al, 2024) for details on the methodology including a full list of employment factors, results for the National Electricity Market as a whole, a comparison of results by State, and recommendations for further work to support planning for workforce development.

There are also downloadable workbooks of results available for each state and for the NEM.

www.uts.edu.au/isf/explore-research/projects/australian-electricity-workforce-2024-integrated-system-plan-projections-2050

2 Workforce projections for New South Wales by scenario

Electricity sector workforce projections for New South Wales are shown for all scenarios in Figure 2. Employment initially peaks in 2028 or 2029 in all scenarios, reflecting the New South Wales legislated emission reduction target of a 50% reduction compared to 2005 by 2030. [2] There is a general trend upwards to the early 2030s, followed by sharp workforce reductions. Under the Step Change scenario, the workforce picks up again in the mid-2030s, before plateauing till the early 2040s. Progressive Change follows a similar profile, but with more constraint. The Green Energy Exports scenario follows a volatile profile through to 2050.

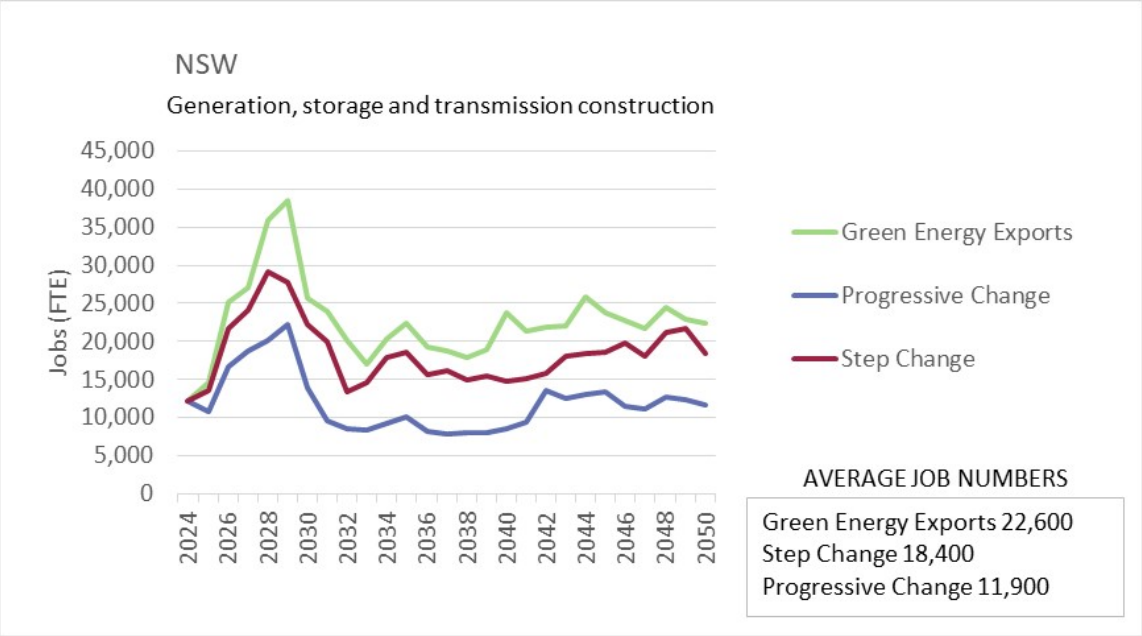

Figure 2 NSW, electricity sector jobs by scenario

- Under the Step Change scenario, there is an average of 18,400 jobs from now to 2050. The workforce more than doubles by 2028, from 12,000 jobs to reach 29,200.
- Under the Green Energy Exports scenario, there is a similar pattern overall. Exponential job growth occurs over the next five years, with numbers increasing to 38,400 by 2029. For the remainder of the projected period to 2050, jobs fluctuate, with four peaks and following troughs. The average after the initial peak is about 22,200 jobs.
- Under the Progressive Change scenario, average electricity sector employment is 11,900, a little less than today. Like the other two scenarios, the workforce peaks in 2029 with a total of 22,300 jobs. It then drops significantly to 9,500 by 2031 and plateaus till the early 2040s.

Total jobs: *when we talk about the number of jobs in this report, we mean the number of full-time equivalent (FTE) positions for each year. These are the sum of people working on construction projects, operations and maintenance, manufacturing (as it relates to the energy sector), 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 temporary by nature, although workers may move from one project to another and be in continuous employment.*

[2] NSW Government, Climate Change (Net Zero Future) Act 2023

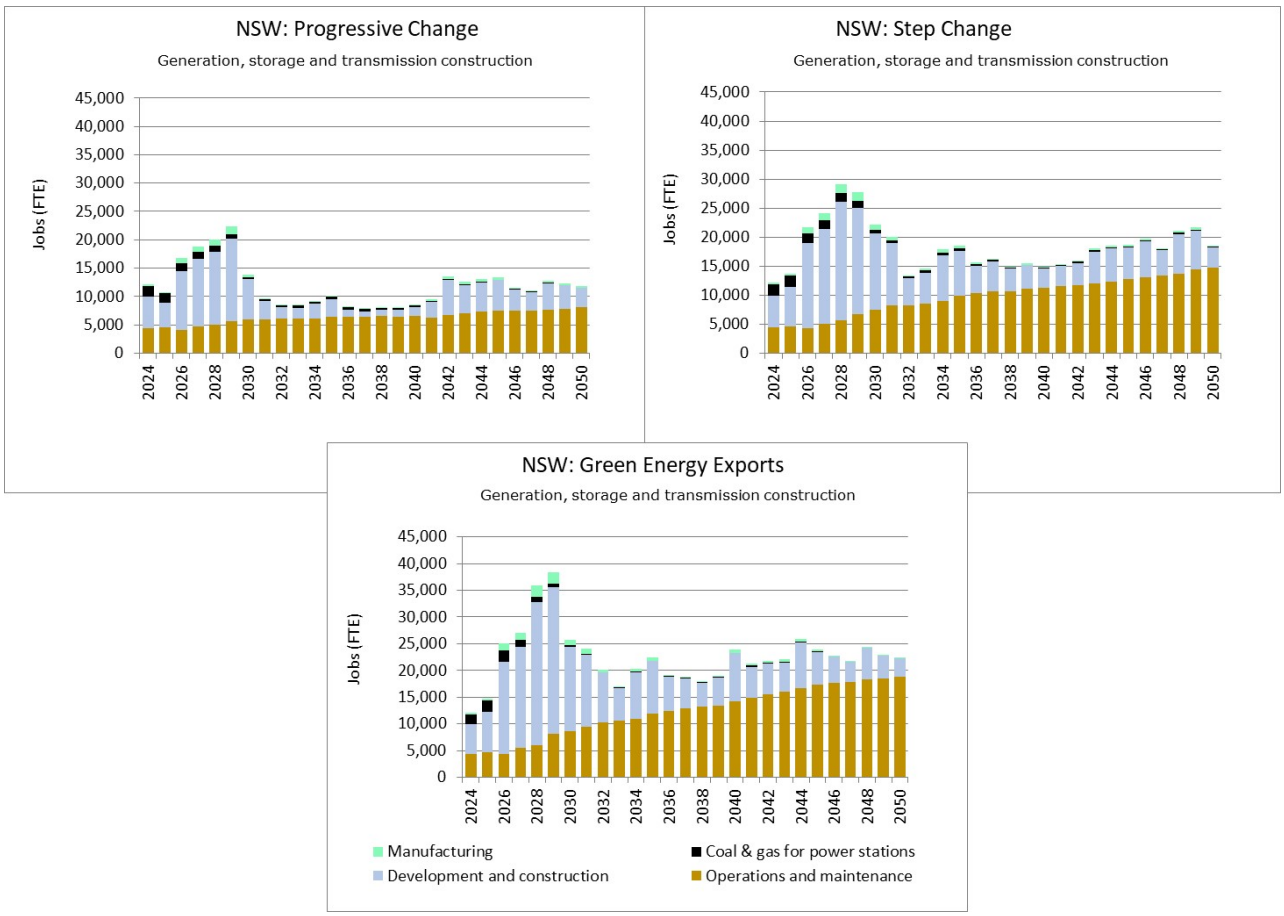

Figure 3 NSW, jobs by phase (all scenarios)

Figure 3 shows the total employment by project phase, including manufacturing, development and construction, operations and maintenance, and fuel supply jobs for coal and gas generation. Under all scenarios, development and construction jobs dominate in the next five years. This gradually switches to operations and maintenance (O&M) roles, which overtakes construction in the mid-2030s. The steady growth in O&M jobs, under all scenarios, results from the increased fleet of renewable energy and storage projects coming online.

By 2050 under Step Change, O&M represents 80% of the total electricity sector workforce. Under Green Energy Exports it reaches 84% and under Progressive Change, it makes up 69%. The O&M workforce will be servicing not only utility-scale developments, but also the growth in rooftop solar and distributed batteries.

In Figure 4, jobs are shown according to technology group for each scenario. The breakdown covers renewables, storage, transmission construction and coal and gas. Under all scenarios, renewables generate the largest share of jobs. Employment in fossil fuels (coal and gas) falls to less than 150 jobs by 2050 under all scenarios.

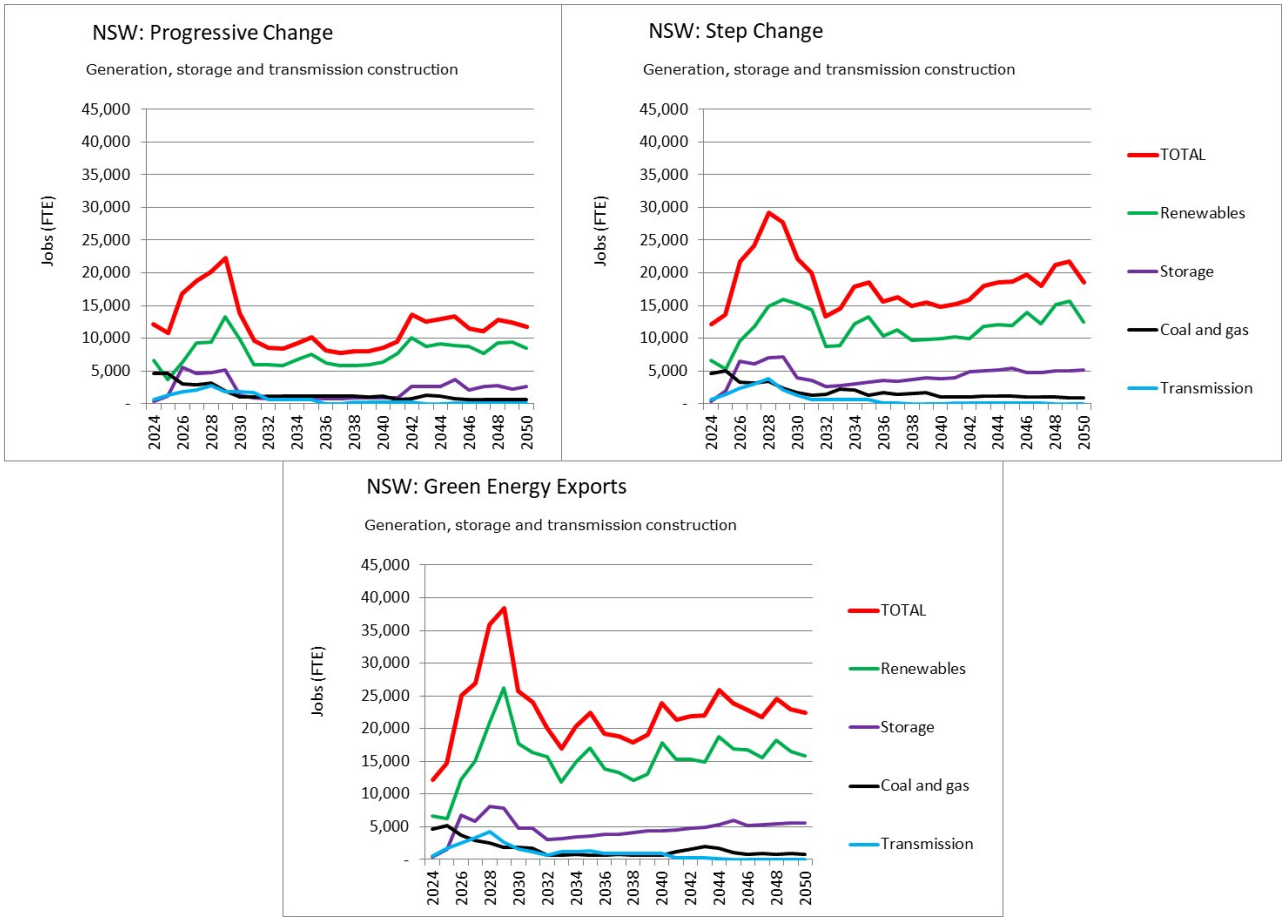

Figure 4 NSW, jobs by technology group (all scenarios)

3 Employment by occupation for New South Wales

When it comes to planning for the energy transition, occupational employment trends – the type of jobs required – provide government, industry, the training sector, and the community with vital insights. This information can inform policy design, education and training packages, as well as individual employment pathways.

Figure 5 illustrates the average employment demand from 2024 through to 2041 in terms of occupational structure (employment grouping) for the Step Change scenario. It includes generation technologies and the construction of transmission lines but does not include employment in batteries. Employment in batteries is not included because we do not have sufficient occupational share data due to the emerging nature of the technology. Solar includes both rooftop and utility-scale, although the majority of the employment is in rooftop solar.

- For New South Wales, the occupational group with the highest number of jobs is trades and technicians, with an annual average of 5,100 jobs. Wind is the dominant technology, accounting 40% of the average trades and technician workforce, followed by solar at 32%.
- Following trades and technicians is the professional workforce, which includes occupations such as engineers, finance, stakeholder and community engagement professionals. Under the Step Change scenario, the professional workforce averages 2,800 from now until 2041.
- Managers average 2,400, driven in large part by the demand for construction managers in the build out of renewable energy infrastructure.
- Labouring jobs average at 2,000 from now until 2040. These jobs will largely consist of construction labourers, with solar being the dominant technology, accounting for half of the workforce. Machine operators (such as truck drivers and crane operators) average 1,300 jobs in the Step Change scenario, with coal and gas still contributing significantly to demand. Lastly, an average of 1,100 administrative jobs will be required under this scenario.

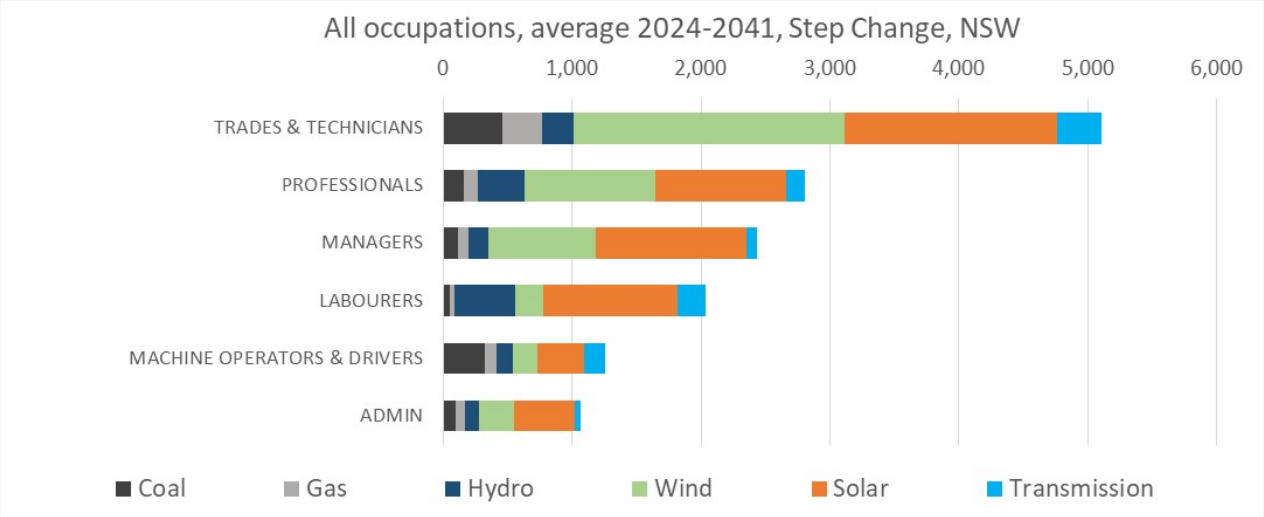

Figure 5 NSW, average occupational structure

To effectively manage labour supply and the requisite skills and training, understanding employment peaks is important. The peak year up to 2040 under Step Change is 2028, while the peak year under both the Progressive Change and the Green Energy Exports scenarios is 2029; their respective occupational requirements are shown in Appendix A. The labour requirements under the Step Change scenario for the peak year for energy sector employment in New South Wales are shown in Figure 6.

Under Step Change, electricians are in high demand in 2028, with 2,900 electricians needed, with wind and solar sector making the bulk of demand. This is followed by a demand for 1,800 construction labourers, mostly required for pumped hydro construction. Admin staff are required at just over 1,500 jobs in the peak year. This is followed by 1,300 professional roles working in finance, business, legal and policy roles.

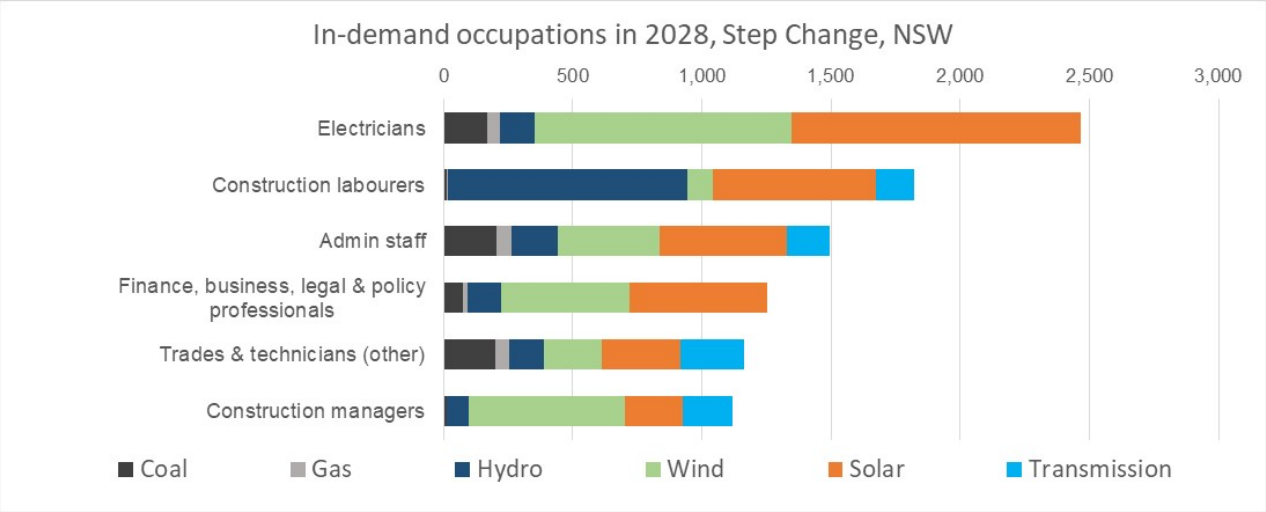

Figure 6 NSW, in-demand occupations during peak year (2028)

Figure 7 shows annual requirements for the six most in-demand occupations by technology for the period 2024-2041 under the Step Change scenario. Electricians dominate, growing consistently over the period. Construction labourer employment, and to a lesser extent, administrative staff, follow a more volatile profile, with peaks in demand up until the early 2030s, before dropping off. Demand for mechanical trades and technicians grows steadily, with the wind sector needing the most workers. Electrical engineers grow steadily for the next five years, then drop off by the early 2030s, save for a minor boom in 2034-2035. While their numbers are smaller, operations and production managers grow steadily over the period from now until 2041.

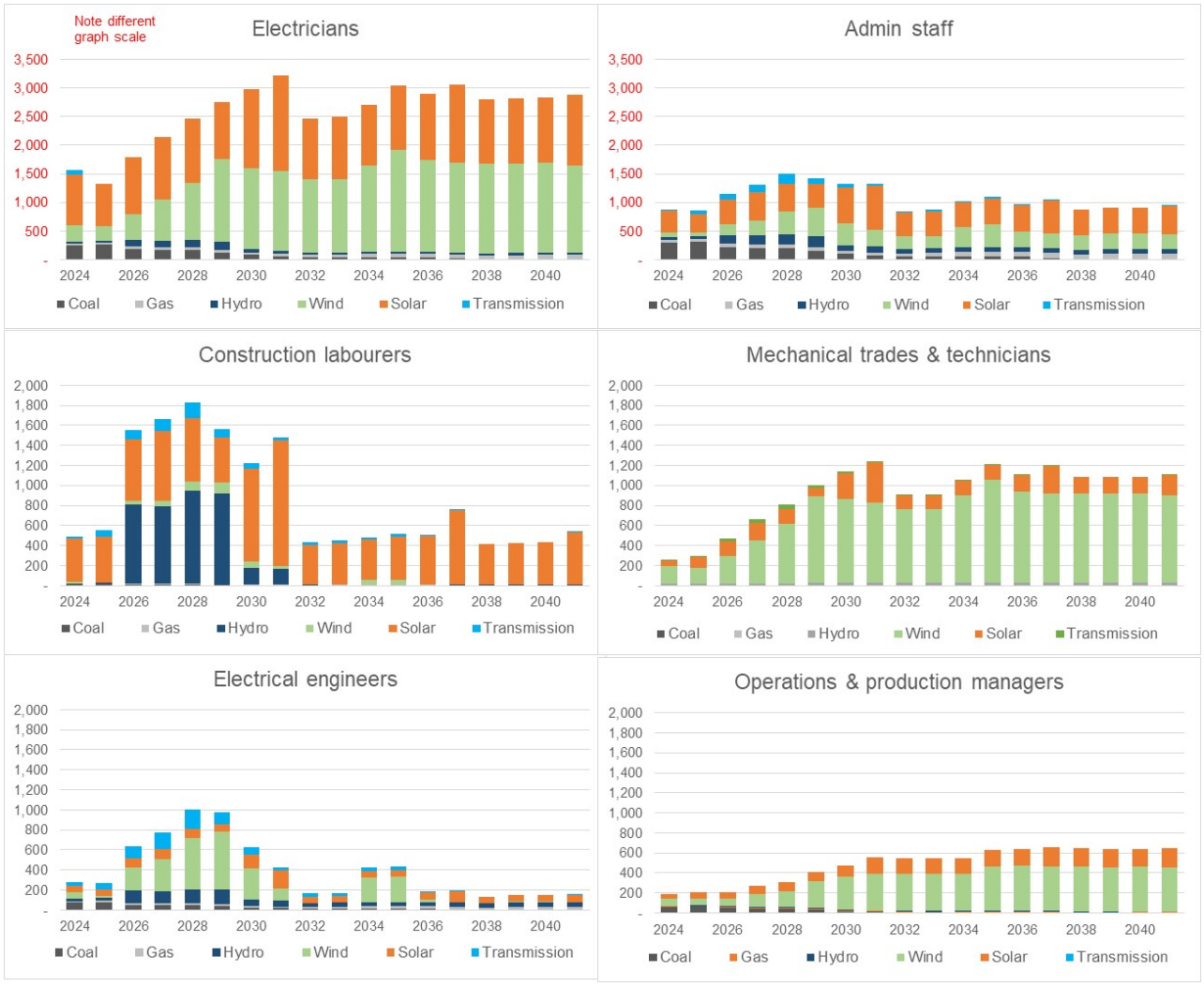

Figure 7 NSW, in-demand occupations annual requirement by technology, Step Change

Note: Electricians and admin staff have a scale reaching 3,500 jobs, whereas other occupations have a scale reaching only 2,000 jobs.

4 Workforce projections by technology for New South Wales

New South Wales is set to see significant employment growth in the wind sector and rooftop solar under all scenarios. Figure 8 illustrates the average electricity sector jobs under each scenario, broken down by technology. Figure 9 breaks this down further by showing a more detailed technological breakdown and the annual total employment.

- Rooftop PV and distributed batteries draw from the same workforce, with installers working across both technologies. Combined, this sector accounts for between 27% and 43% of average employment in all scenarios, and jobs in rooftop solar grow steadily.
- Under all scenarios, employment in wind makes up 26% or more of the average electricity sector employment profile.
- Utility-scale solar accounts for an average of 10%-12% of total electricity sector employment.

These projections include repowering for wind and solar, assuming that wind turbines are replaced after 25 years, utility solar after 30 years, and that 80% of rooftop solar is replaced after 25 years. Repowering refers to the process of replacing hardware due to end of life or because improvements in the technology have significantly enhanced performance, meaning it is more profitable to do so. In this study, we have included repowering in the model for utility-scale solar, rooftop PV and onshore wind. Any employment associated with recycling of materials or mineral extraction (other than coal and gas for fuel) is not included.

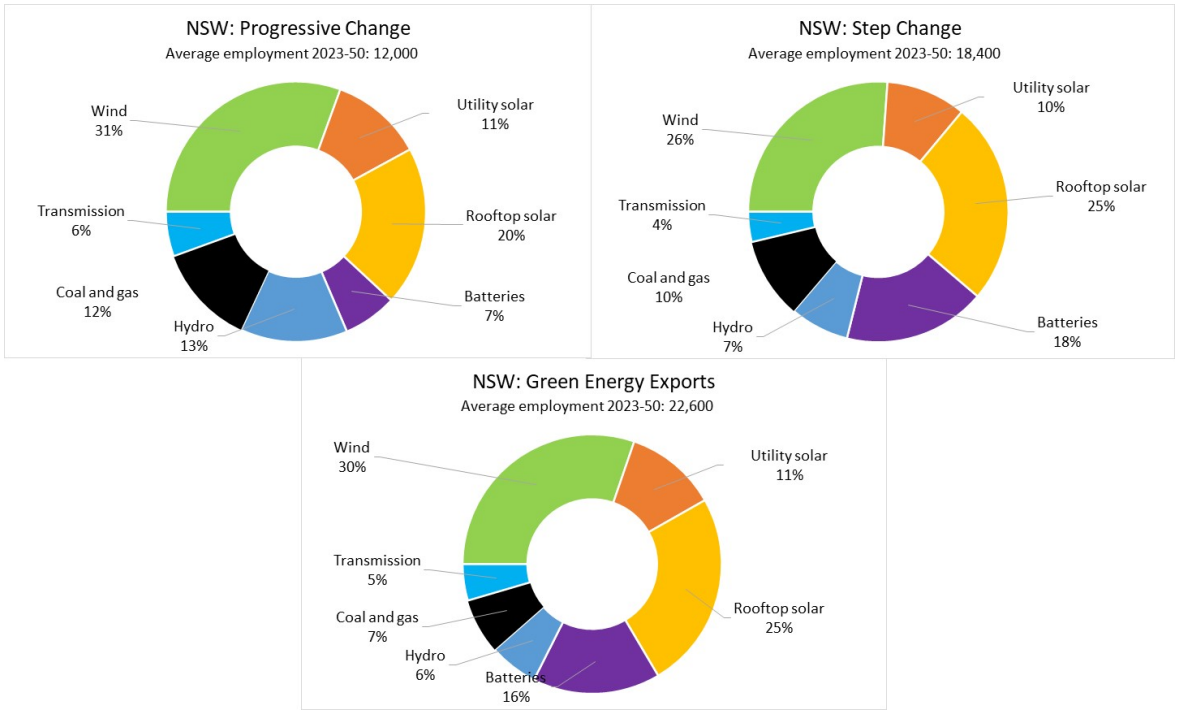

Figure 8 NSW, average electricity sector jobs by technology and scenario

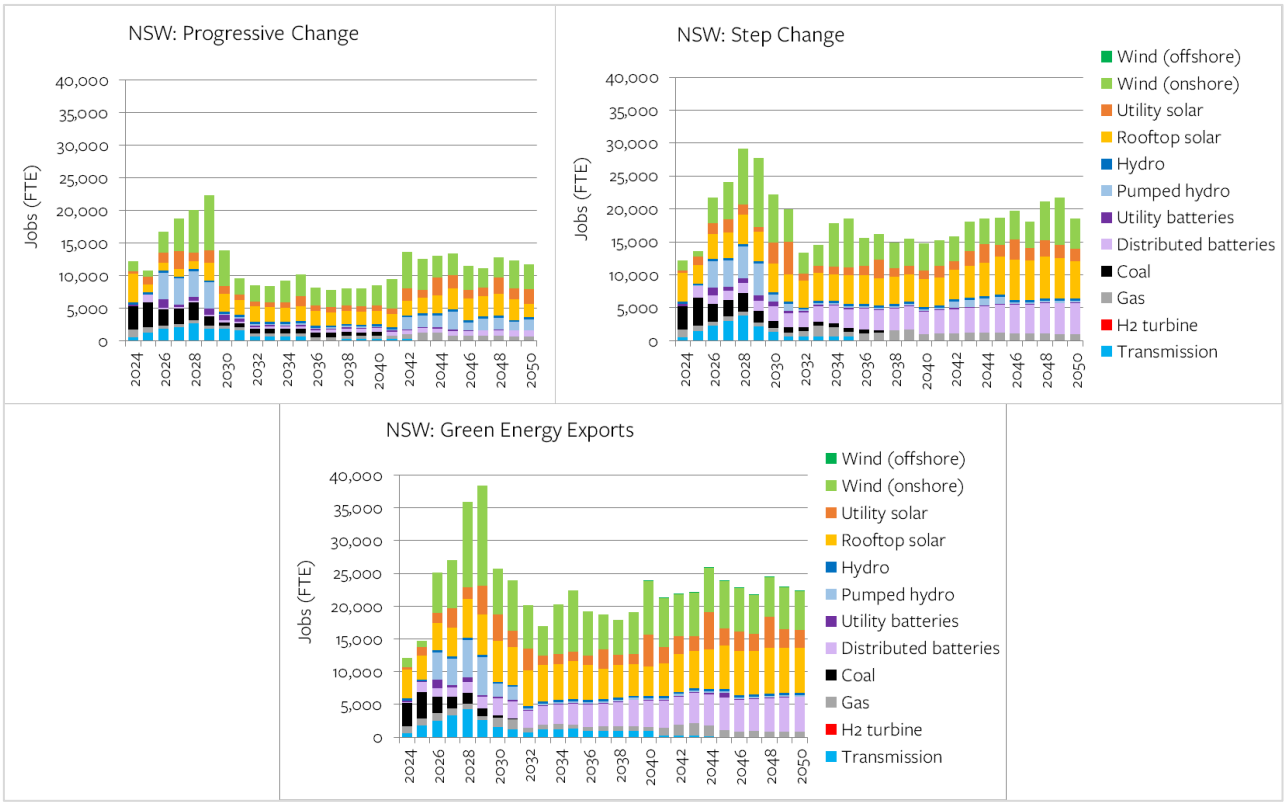

Figure 9 NSW, annual jobs by technology (all scenarios)

4.1 Wind

Employment in the wind sector in New South Wales is shown in *Figure 10*. Under Step Change, wind averages 4,800 jobs over the period. Under Progressive Change, average employment is lower, at 3,700. Under Green Energy Exports the average workforce is 6,800, nearly double that of the Progressive Change average.

Repowering kicks off in the mid-2030s across all scenarios, and averages around 200 jobs during the 2040s.

There is no offshore wind in New South Wales under Progressive Change or Step Change. In Green Energy Exports, offshore wind creates a small amount of employment during the 2040s, with peak employment of approximately 50 FTE jobs.

Under all scenarios, the main sector growth occurs in the lead up to 2030. During the 2030s, jobs drop off and remain low under Progressive Change (a drop of 3,000 jobs in just one year from 2030 to 2031), but under Step Change the reduction is more gradual. Under Green Energy Exports and Step Change, there is a second boom in workforce demand in 2034 and 2035.

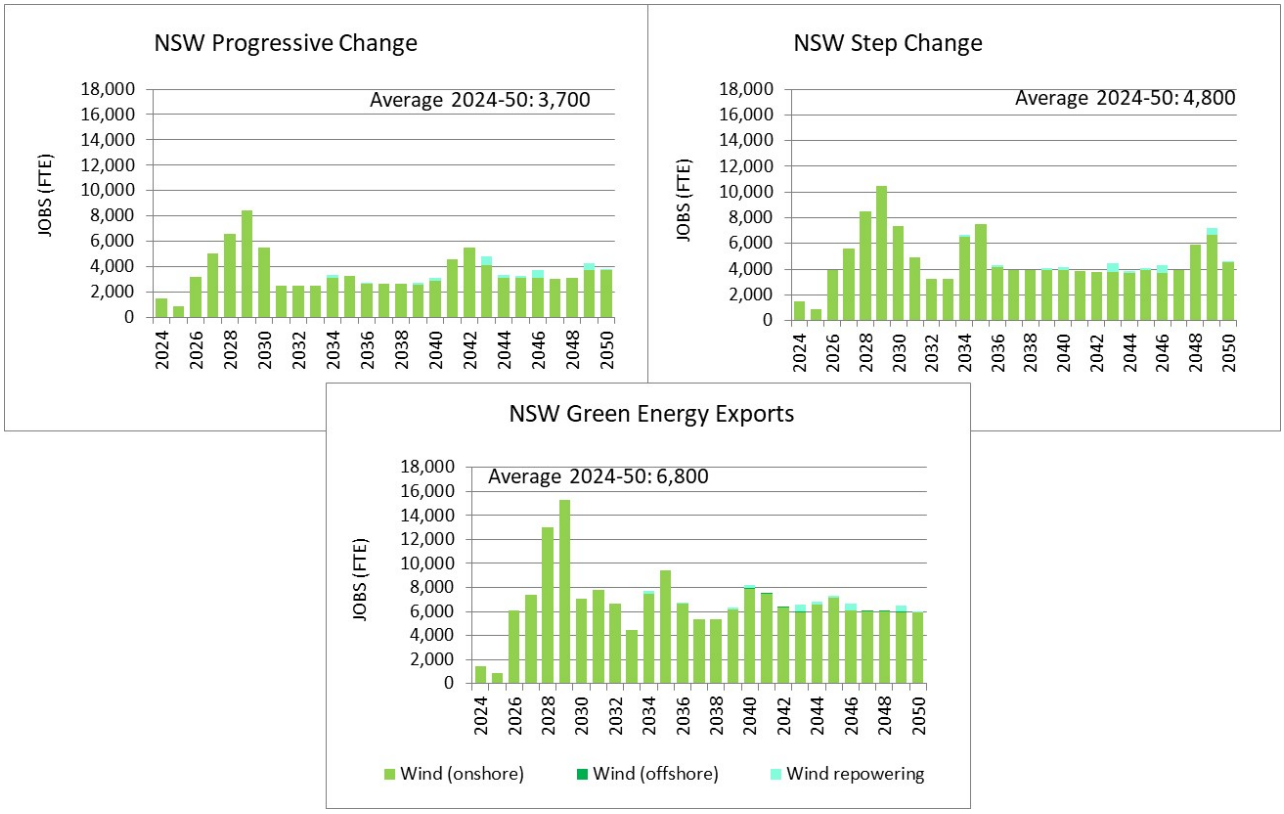

Figure 10 NSW, jobs in wind (all scenarios)

4.2 Utility-scale solar

Utility-scale solar averages 1,400 jobs under Progressive Change, 1,800 jobs under Step Change and 2,600 jobs under Green Energy Exports (

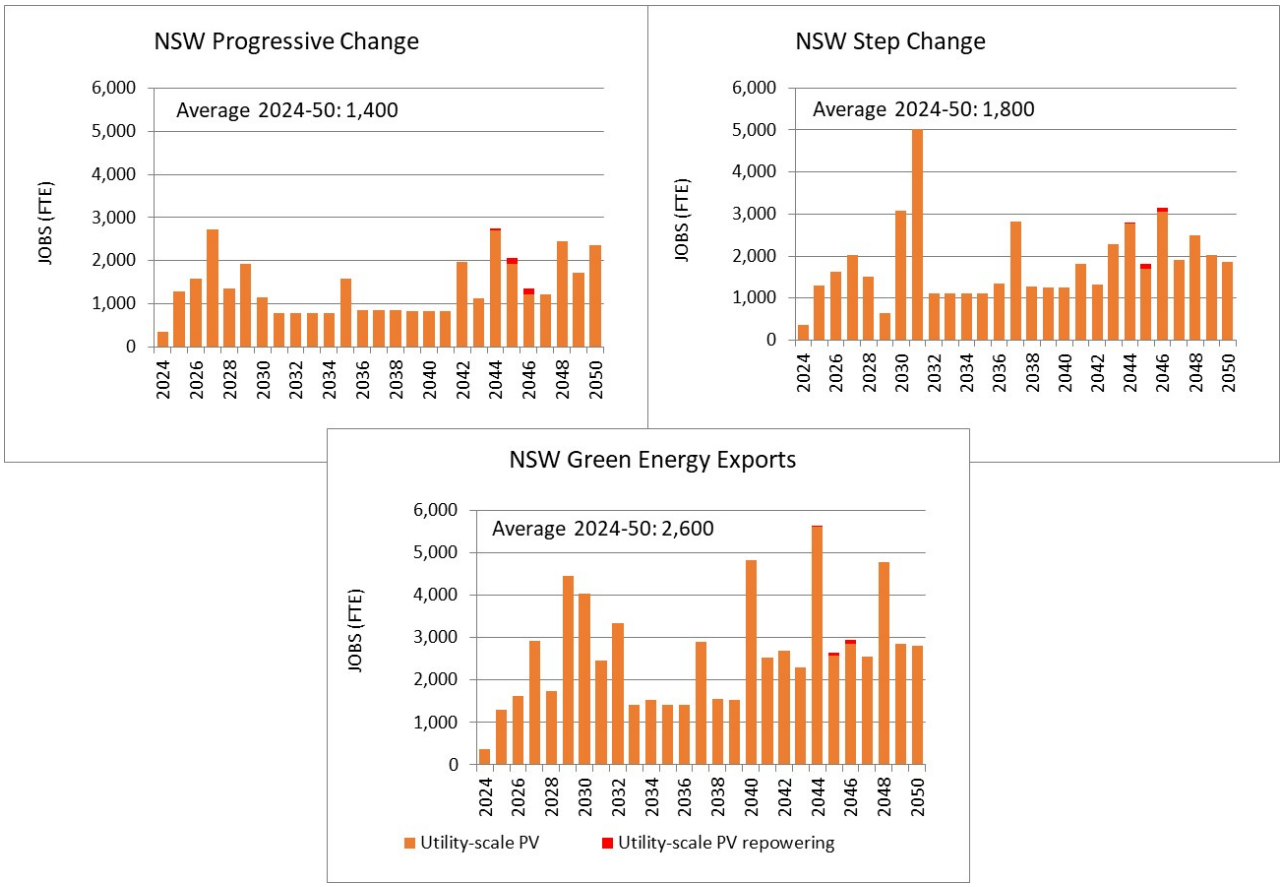

Figure 11). Under Progressive Change, there is initial volatility in the jobs profile, before stabilising through to 2041, except for a construction spike in 2035. Under both Step Change and Green Energy Exports, employment follows a volatile profile, with peaks in demand in the early 2030s, followed by a brief plateau and then volatility from 2040 onwards. In Step Change, jobs peak at 5,000 in 2031. Under Green Energy Exports, employment peaks later, at 5,500 in 2044.

Under all scenarios, repowering of large-scale solar happens from 2044 onwards, but numbers are small, with less than 50 jobs created on average during the 2040s.

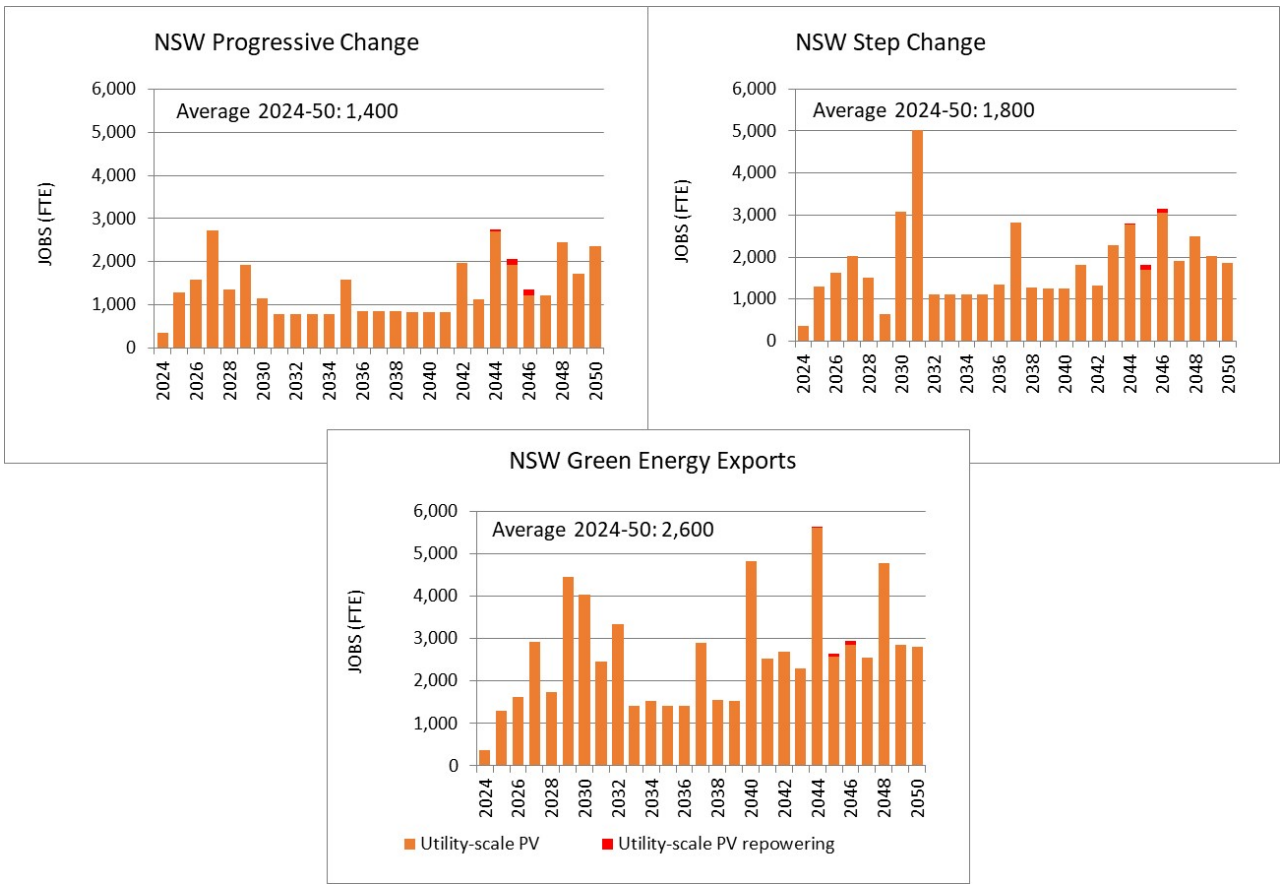

Figure 11 NSW, jobs in utility-scale PV (all scenarios)

4.3 Rooftop solar and distributed batteries

For New South Wales, rooftop solar and distributed batteries contribute significant numbers to overall electricity sector employment growth under all scenarios (Figure 12). Under Progressive Change, an average of 2,900 jobs are in rooftop solar and distributed batteries from now until 2050. Under Step Change, however, this number more than doubles, with an annual average of 7,600 jobs. Green Energy Exports is triple that of Progressive Change with an average of 9,000 jobs. Under all scenarios, repowering of rooftop solar begins to contribute to overall jobs in the mid-2030s, and averages close to 1,000 jobs during the 2040s.

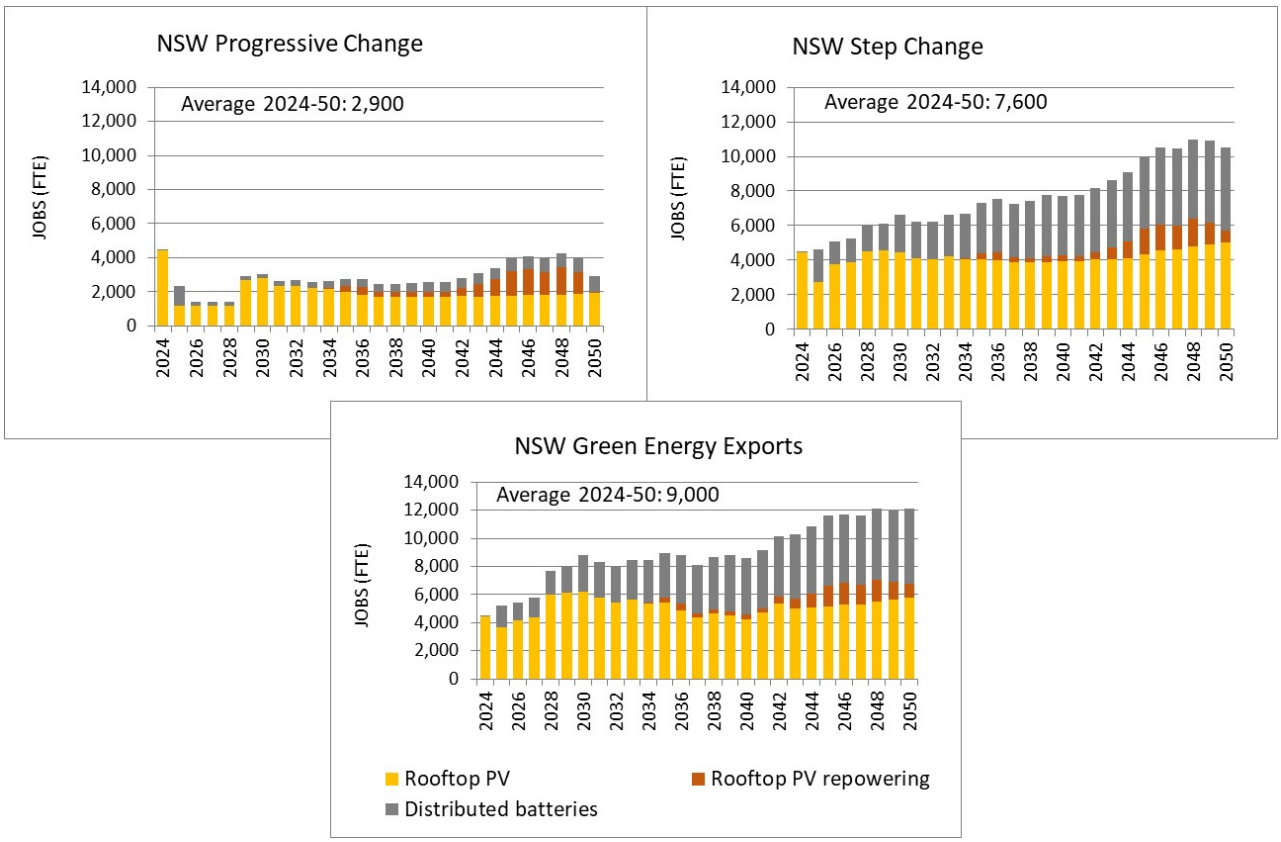

Figure 12 NSW, jobs in rooftop PV and distributed batteries (all scenarios)

4.4 Large-scale storage and hydro

Jobs in large-scale storage, that is utility-scale batteries and pumped hydro, and conventional hydro are captured in Figure 13 and

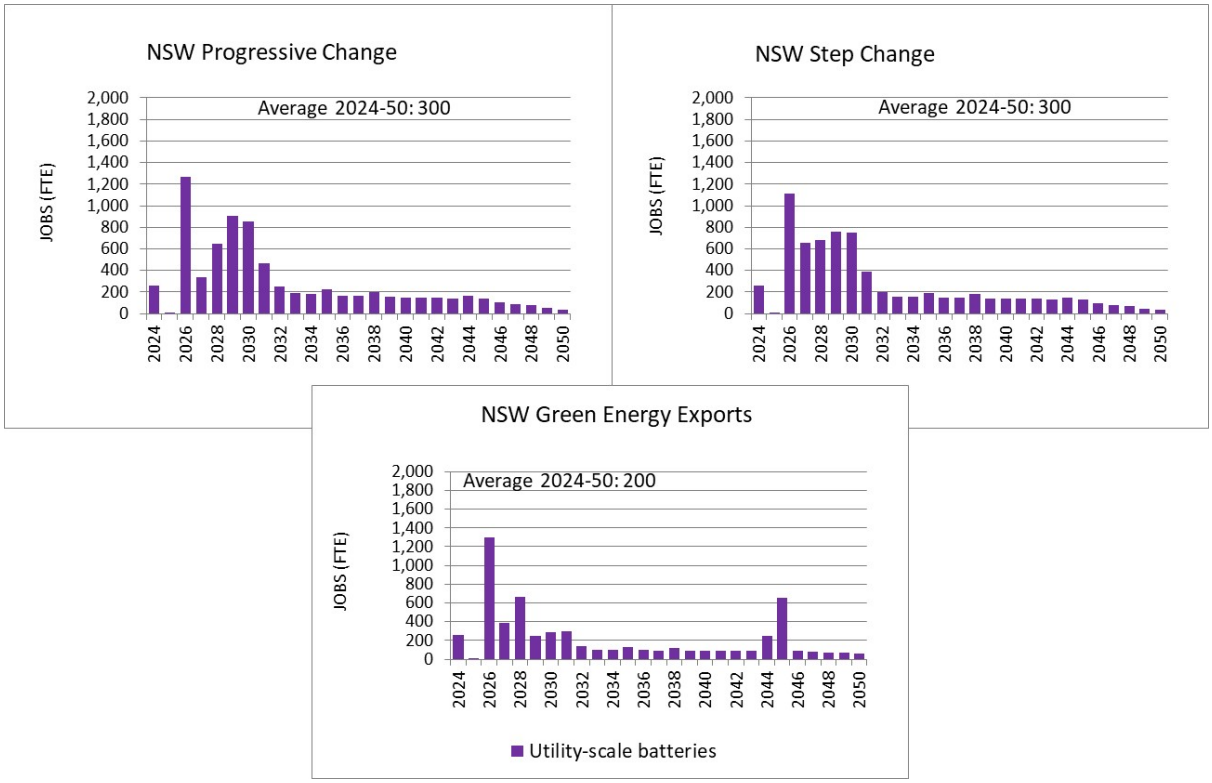

Figure 14.

Employment trends in pumped hydro are volatile, indicative of the workforce requirements for construction of the projects.

Under all scenarios, jobs in pumped hydro peak from 2026 through to 2030 reflecting construction periods for pumped hydro. Under Progressive Change, jobs average at 1,600. Under both Green Energy Exports and Step Change, jobs average somewhat less at 1,400. Across all scenarios, jobs are predominately in pumped hydro.

Jobs in utility batteries are volatile under all scenarios, with an initial period of higher workforce needs that peak in 2026 (at just over or under 1,200 jobs) but remains strong until 2031. Under both Progressive Change and Step Change there are 300 jobs on average, and under Green Energy Exports there are 200.

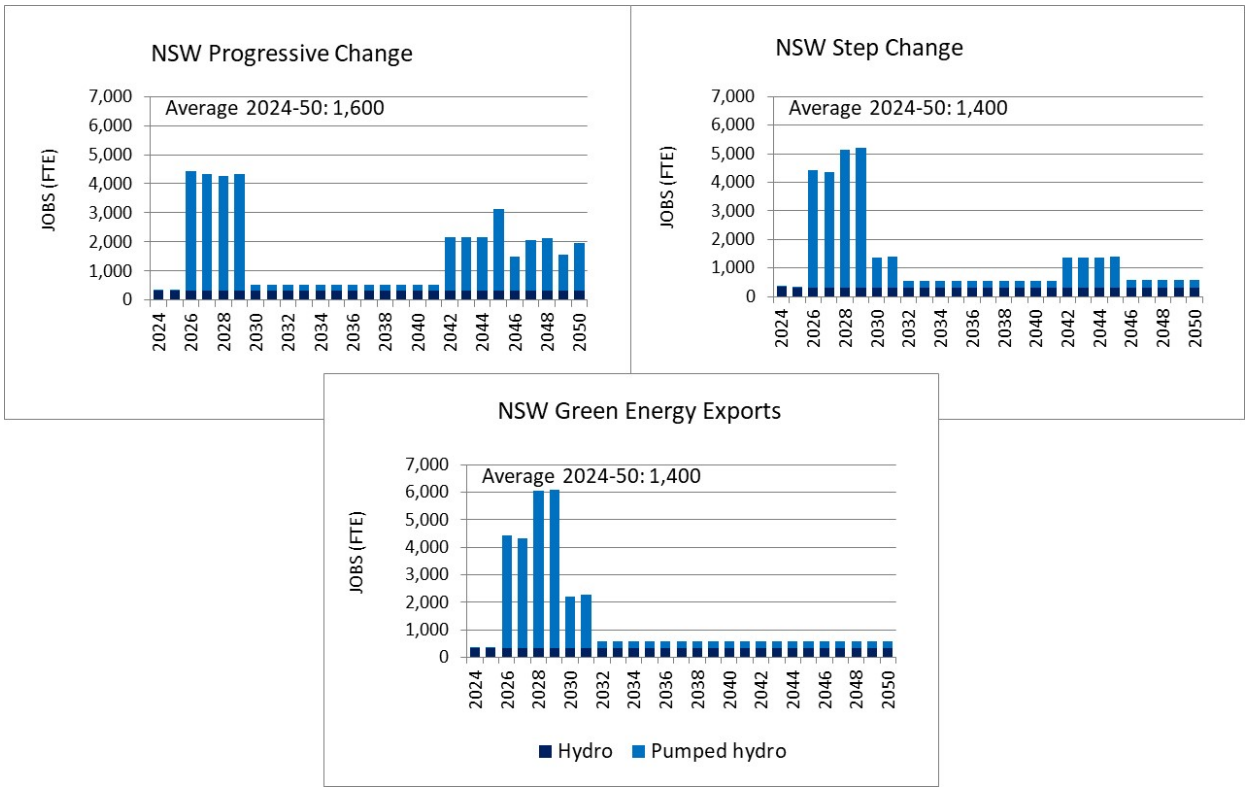

Figure 13 NSW, jobs in pumped hydro (all scenarios)

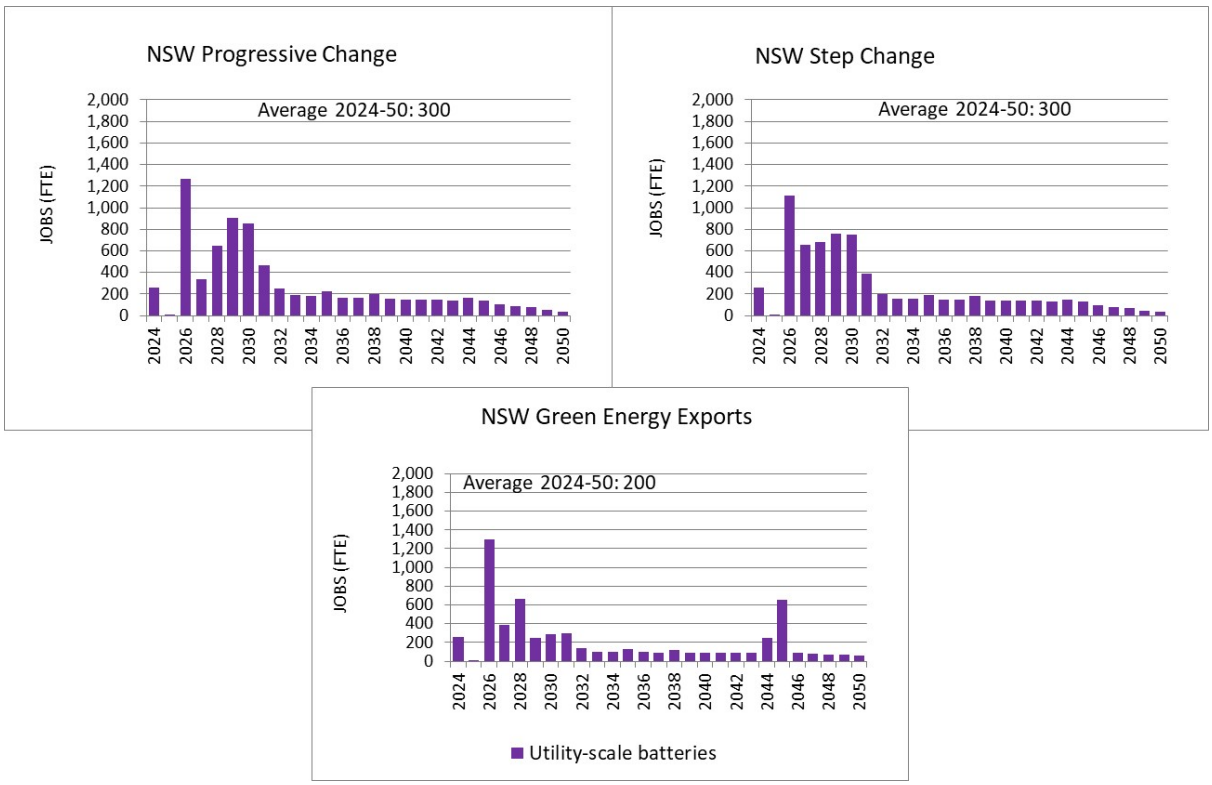

Figure 14 NSW, jobs in utility batteries (all scenarios)

4.5 Transmission construction

Employment for transmission construction[3] in New South Wales is shown in Figure 15 for all scenarios. Under both Step Change and Progressive Change, the work force averages 700. For both scenarios employment peaks in 2028; under Step Change the workforce peaks at 3,800, while under Progressive Change it is 2,700. Under Green Energy Exports jobs average 1,000, peaking at 4,200 in 2028.

Under all scenarios, transmission construction jobs show strong growth from now until the early 2030s. By 2032, jobs drop to just over 500 under Step and Progressive Change. By 2035 they drop to next to nothing and remain minimal through to 2050. Under Green Energy Exports, transmission construction jobs stop entirely by 2044.

Actual employment in transmission construction, it should be noted, is likely to be more variable than illustrated here, as these calculations work with the assumption that employment is spread evenly across the construction period for each project.

[3] In this study, only employment in transmission construction is included in projections, as we do not have employment factors for operations and maintenance.

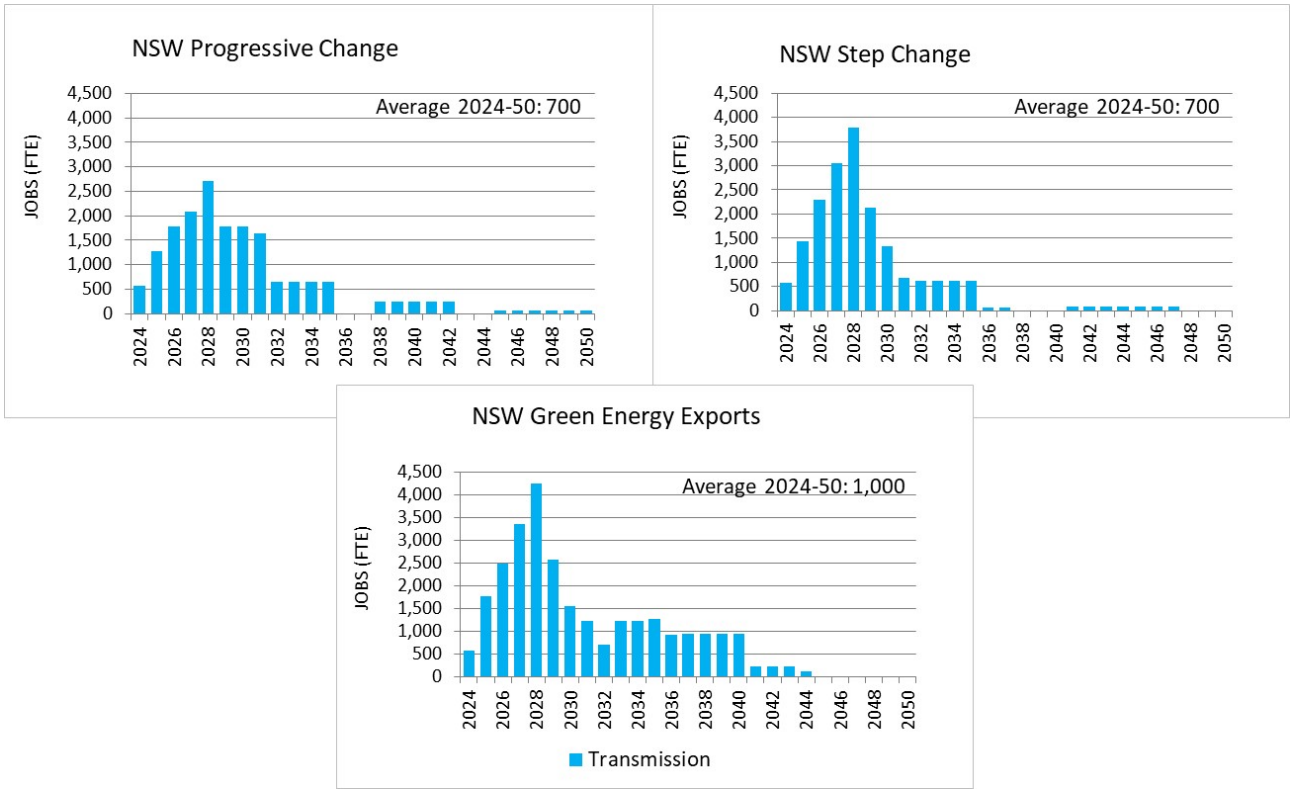

Figure 15 NSW, jobs in transmission (all scenarios)

4.6 Coal and gas

Jobs in coal and gas are approximately 4,700 now and fall to around 1,000 by 2050 in Step Change, 800 in Green Energy Exports and 500 in Progressive Change (

Figure 16). Jobs in coal account for the greatest share at present, and these are phased out in Step Change by 2037 and in Green Energy Exports by 2031. In Progressive Change, coal jobs are phased out by 2040.

In all scenarios, gas jobs are more volatile and remain that way through to 2050. Under Progressive Change, gas jobs are fewer, in part due to the extended presence of coal jobs through to 2040. Under Green Energy Exports, gas jobs peak at 2,000 in 2043, but in Step Change this peak occurs in 2039 at 1,800 jobs, and under Progressive Change the peak happens in 2043 at 1,100 jobs.

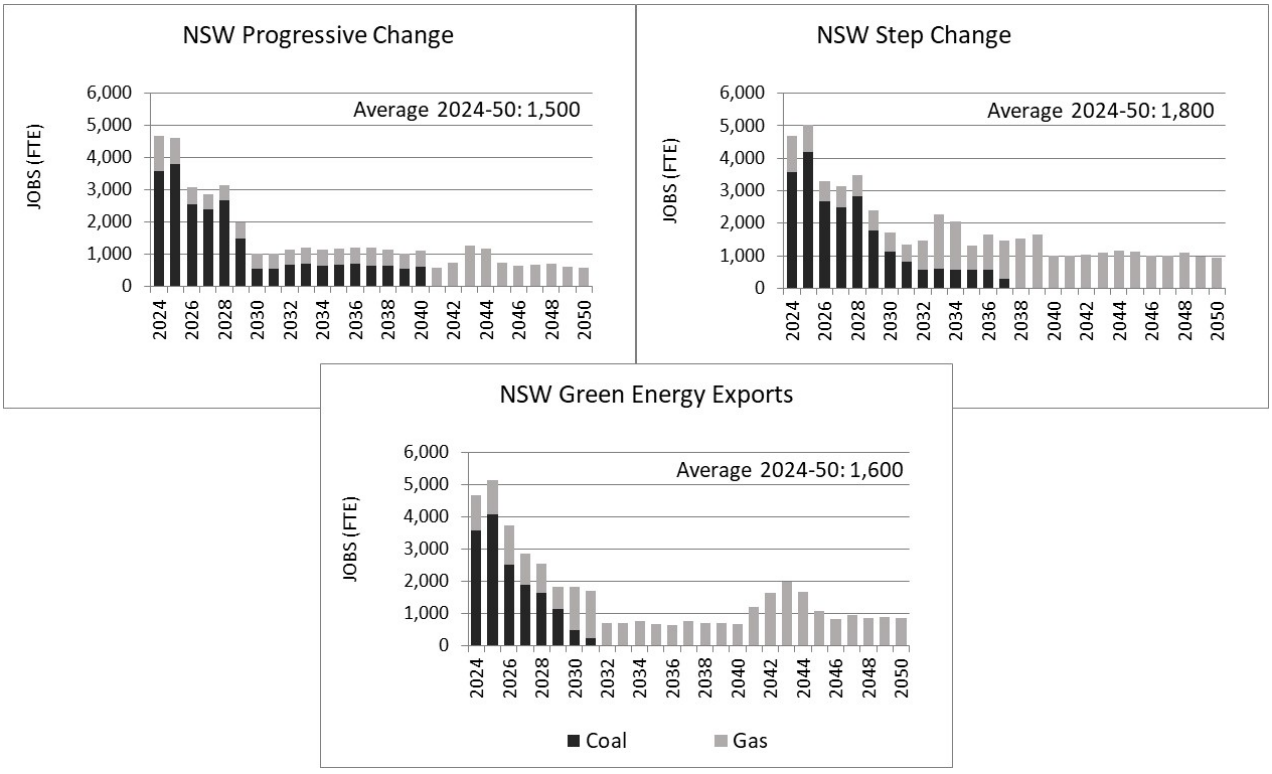

Figure 16 NSW, jobs in coal and gas (all scenarios)

Appendix A Additional information on occupational breakdowns

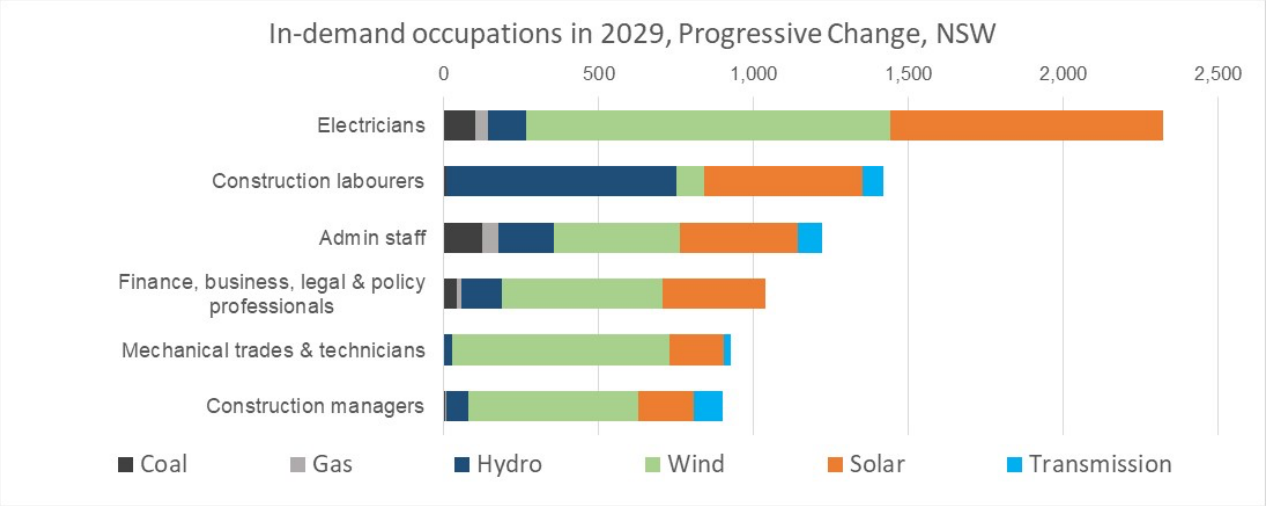

Figure 17 NSW, in-demand occupations during peak year (2029) for Progressive Change

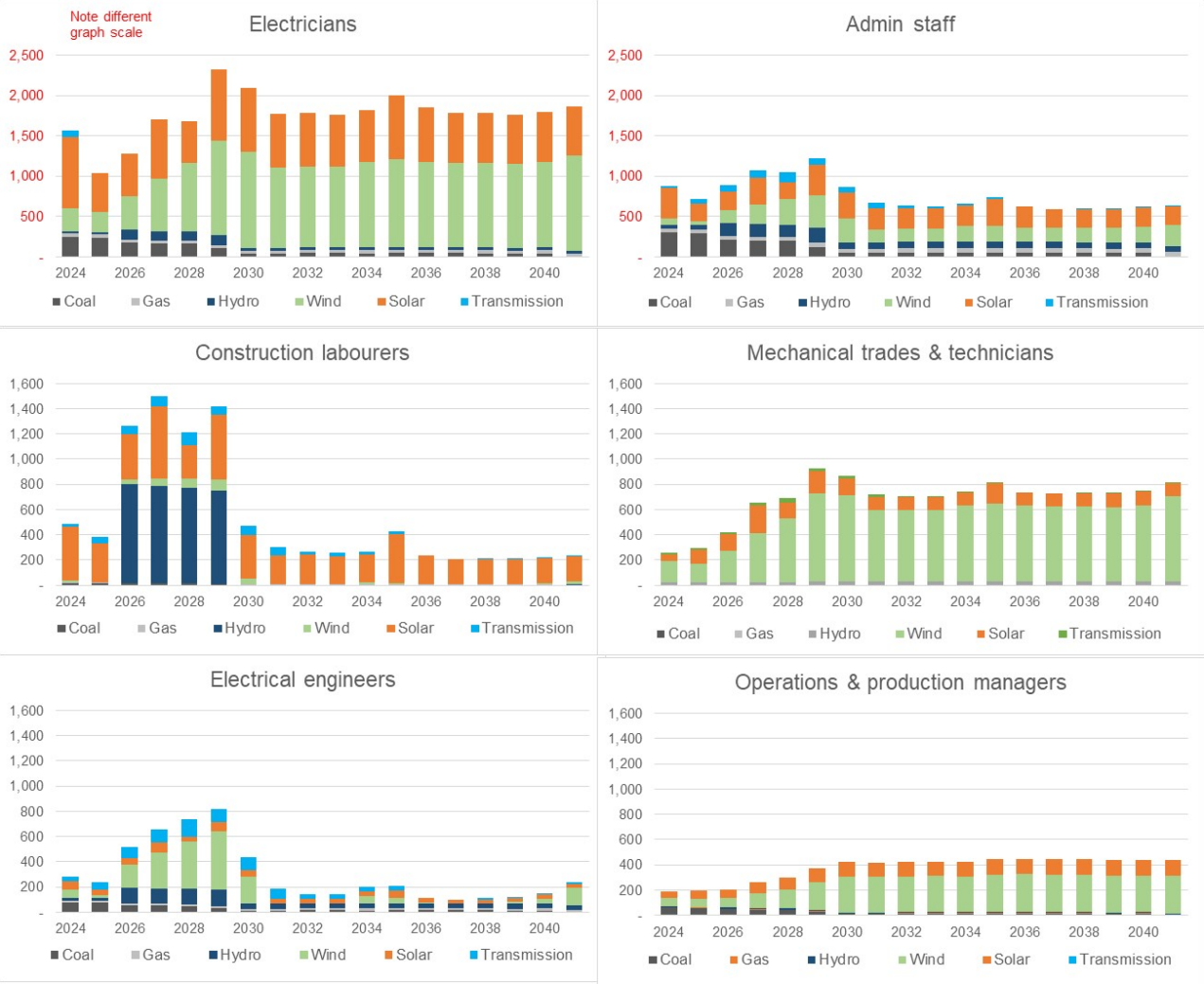

Figure 18 NSW, in-demand occupations annual requirement by technology, Progressive Change

Note: Electricians and admin staff have a scale reaching 2,500 jobs, whereas other occupations have a scale reaching only 1,600 jobs.

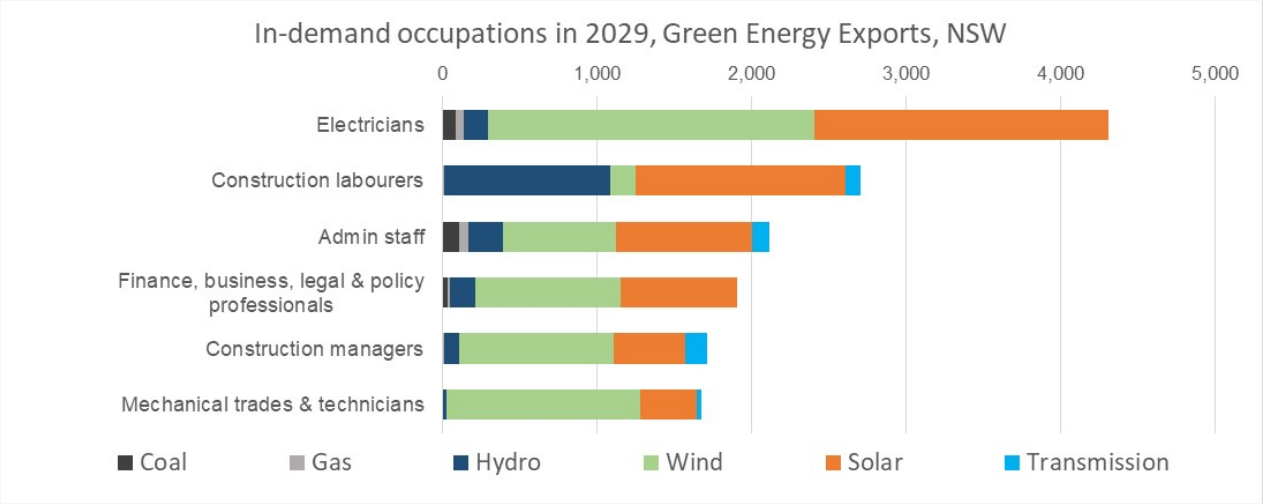

Figure 19 NSW, in-demand occupations during peak year (2029) for Green Energy Exports

Figure 20 NSW, in-demand occupations annual requirement by technology, Green Energy Exports

Note: Electricians and admin staff have a scale reaching 5,000 jobs, whereas other occupations have a scale reaching only 3,000 jobs.

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