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

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

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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

Disclaimer

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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 South Australia. 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 ISP for South Australia.

The project was conducted by the Institute for Sustainable Futures, University of Technology Sydney (ISF) in partnership with AEMO and funded by the RACE for 2030 Co-operative 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 South Australia. 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 temperatures to below 1.5°, with a strong emphasis on a green 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

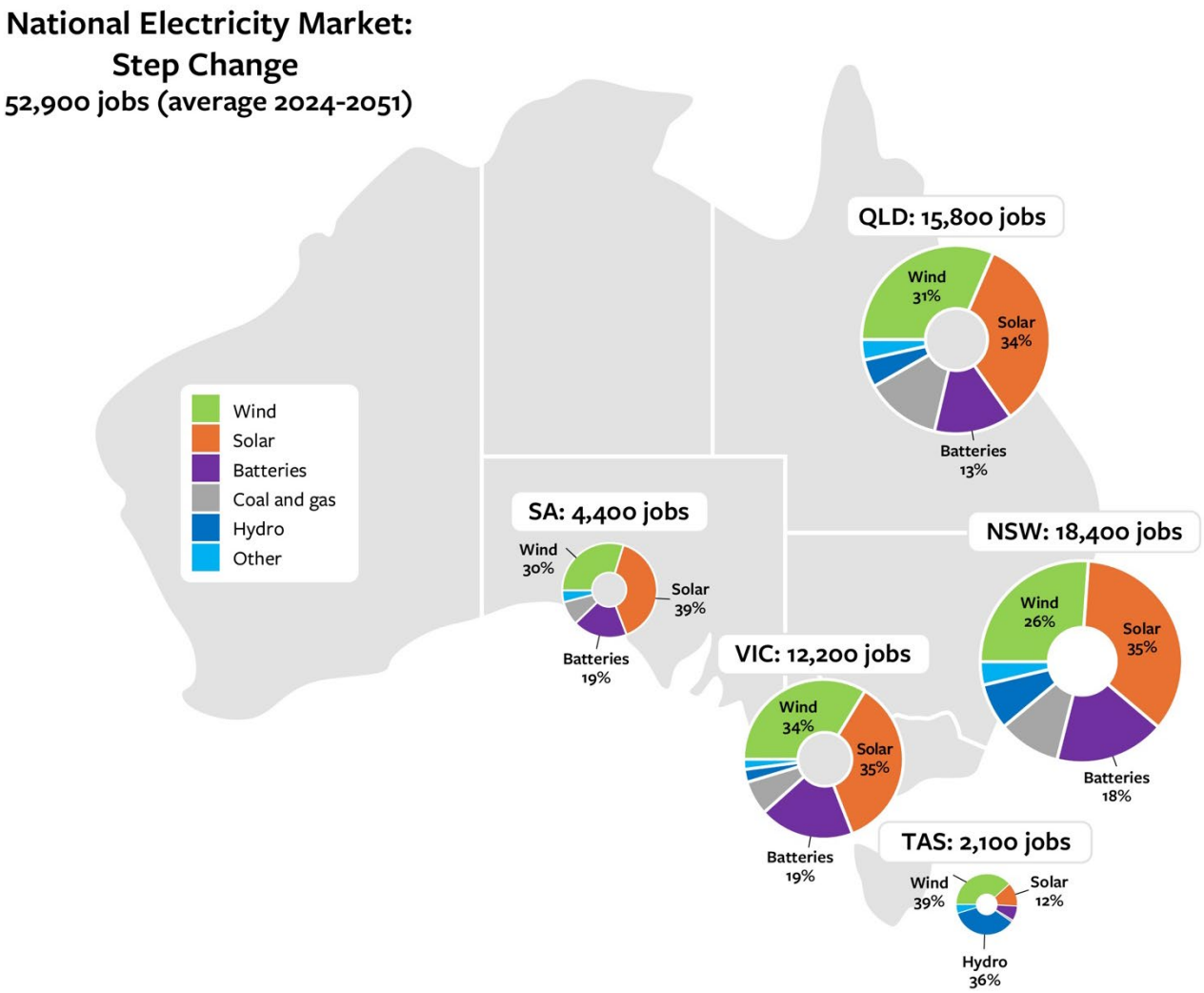

Figure 1 Average electricity sector jobs by State, 2024-2050 (Step Change)

Under the Step Change scenario, South Australia averages 4,400 jobs in generation and storage or transmission line construction from 2024-2050.

New South Wales is the leading state, averaging 18,400 full-time jobs per year under the Step Change, followed closely by Queensland (15,800). Victoria is some way behind with 12,200 jobs on average, followed by South Australia (4,400) and Tasmania (2,100). 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 (32,400 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 NEM 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 South Australia by scenario

Electricity sector workforce projections for South Australia are shown for all scenarios in Figure 2. Employment first peaks close to 2030 in all scenarios, reflecting South Australia's legislated emissions reduction target of 50% reduction on 2005 emissions by 2030[2]. In Step Change and Progressive Change, the workforce increases by 50% and 24% respectively and then drops back to the present levels by 2032. Jobs plateau until the late 2030s and then rise slowly, with a boom in the mid-2040s under Step Change. In Green Energy Exports the workforce nearly trebles to reach 9,000 in 2030, and then sheds 4,000 jobs in three years. This is followed by gradual growth, with another peak in the mid-2040s when employment jumps by 6,000 in just two years.

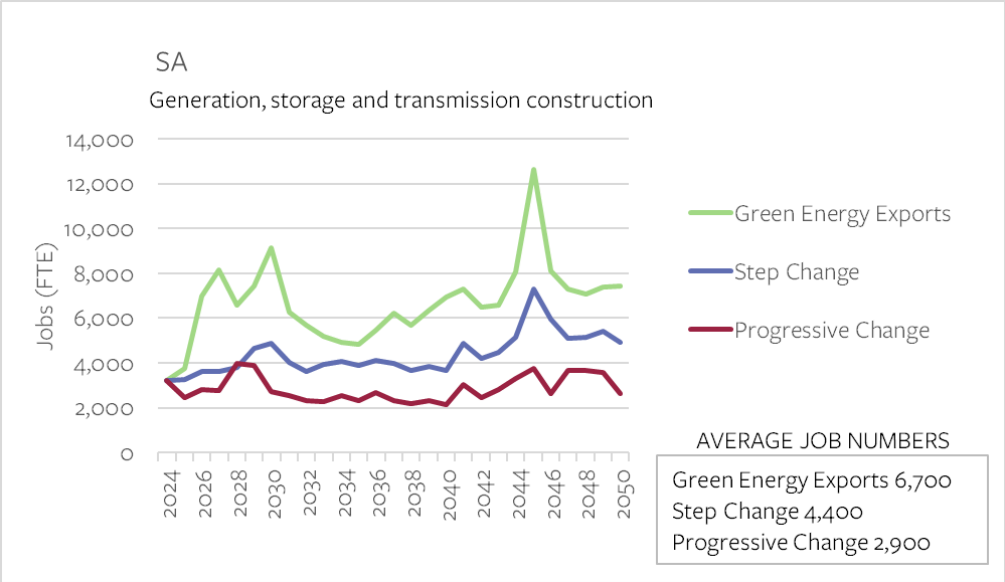

Figure 2 SA, electricity sector jobs by scenario

- Under the Step Change scenario, there are an average of 4,400 jobs from now to 2050. The workforce increases gradually to 2030, starting out at 3,200 and reaching 4,900 jobs.
- Under the Green Exports scenario, jobs average 6,700. There is exponential growth over the next six years, with average jobs starting at 3,200 and a near tripling of the workforce by 2030 (9,100). Jobs then fluctuate significantly, with employment peaking in 2045 at 12,600 jobs.
- Under the Progressive Change scenario, annual electricity sector employment sits at an average of 2,900 jobs. Unlike the other two scenarios, the workforce peaks in 2028 and 2029 at 4,000, and 3,900 jobs respectively.

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 by their nature temporary, although workers may move from one project to another and be in continuous employment.

[2] Government of South Australia, Department of Environment and Water, https://www.environment.sa.gov.au/topics/climate-change/net-zero-pathway

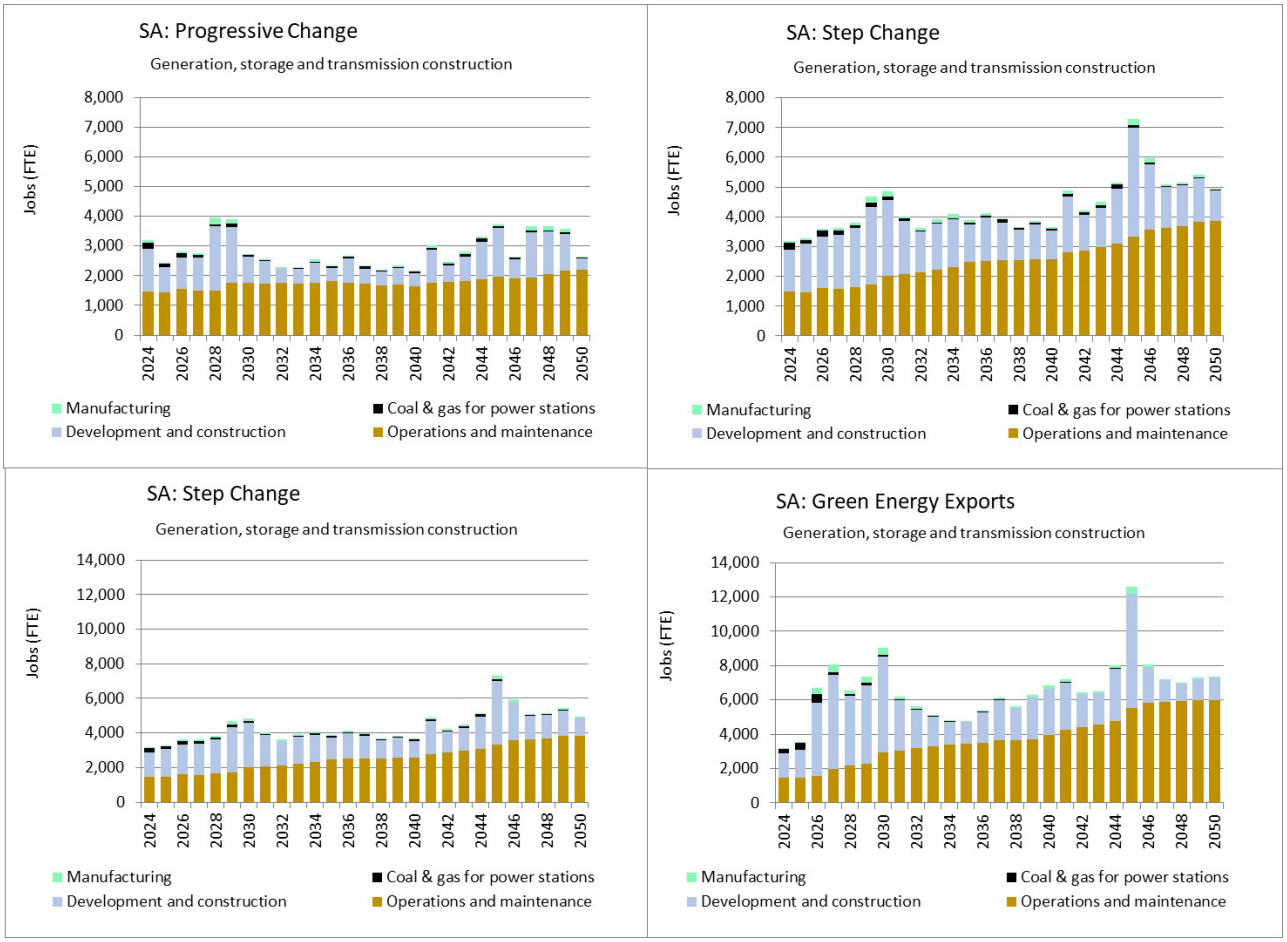

Figure 3 SA, jobs by phase (all scenarios)

Note the scales are 0-8,000 on the top graphs and 0-14,000 on the bottom graphs

Figure 3 shows the total employment by project phase, from manufacturing to development and construction, operations and maintenance (O&M), and in 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 O&M roles, which overtake 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, O&M makes up close to 80% of the workforce in all scenarios. 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.

Renewables already account for 66% of electricity sector jobs; this rises to 77% in Progressive Change and Green Energy Exports, and to 72% in Step Change. Storage jobs increase significantly over the period, from 9% now, to between 17% and 24% in 2050. Coal and gas jobs combined fall from 22% now to close to 5% by the end of the period.

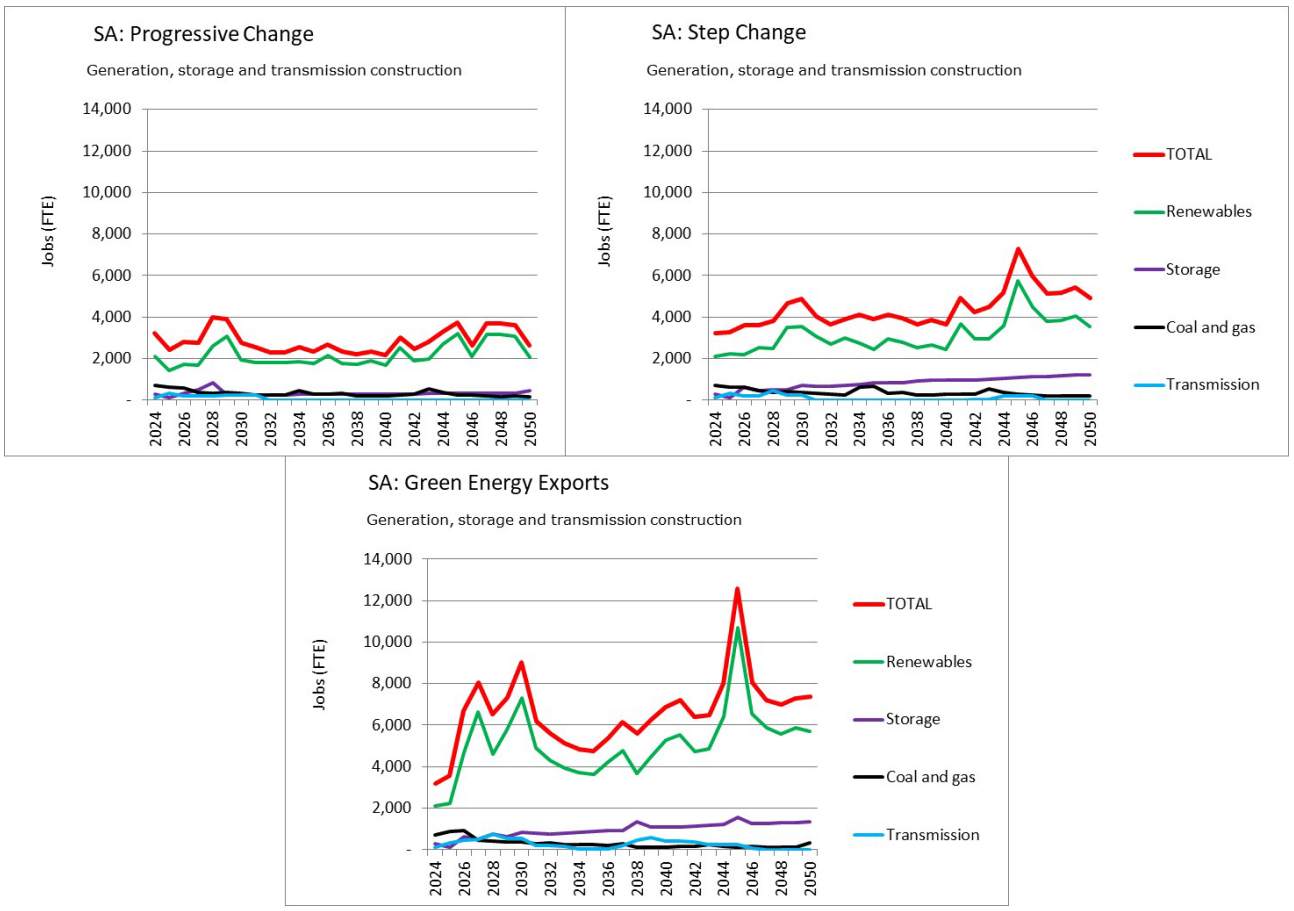

Figure 4 SA, jobs by technology group (all scenarios)

3 Employment by occupation for South Australia

When it comes to planning for the energy transition, occupational employment trends – the types 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 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 employment factor data for projections due to the emerging nature of the technology. Importantly, solar represents both rooftop and utility-scale.

- For South Australia, the occupational group with highest number of jobs is trades and technicians, with an average of 1,100 jobs. Wind is the dominant technology, followed by solar.
- Following trades and technicians is the professional workforce, which includes occupations such as engineers, finance, stakeholder and community engagement professionals. The professional workforce averages 600 jobs from now until 2041.
- Managers average 500, driven in large part by the demand for construction managers in the build out of renewable energy infrastructure.
- Labouring jobs average 400 from now until 2041, driven largely by the solar sector. Lastly, there is also an average of 200 jobs in both administration and machine operators and drivers from now until 2041.

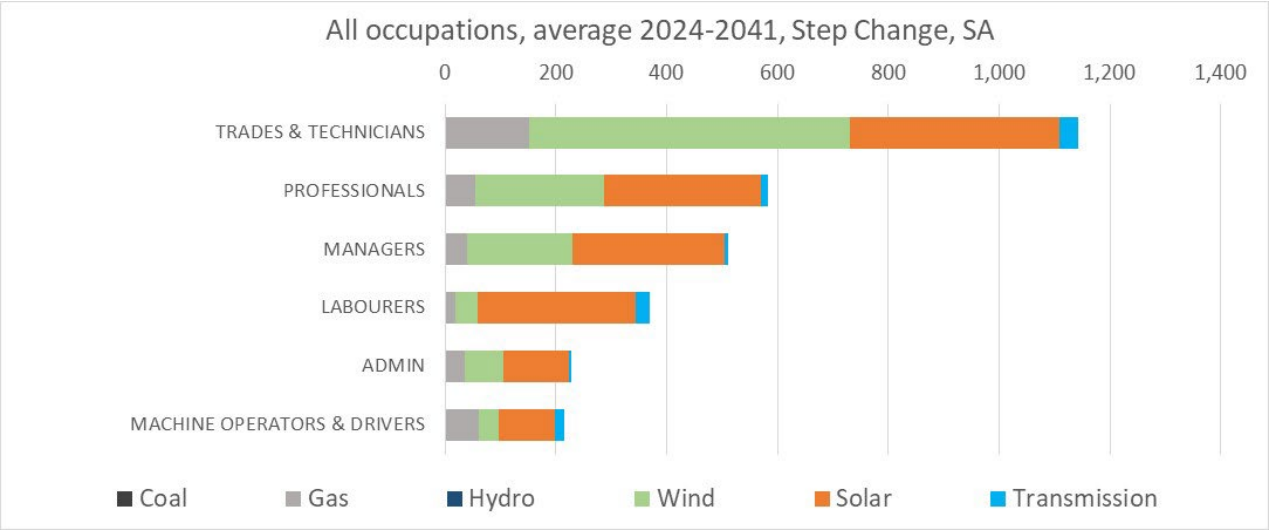

Figure 5 SA, average occupational structure

To effectively manage labour supply, and the requisite skills and training, the peaks in employment are the most significant. The labour requirements under the Step Change scenario for the peak year for energy sector employment in South Australia (2029) are shown in Figure 6.

For South Australia 2041 is the peak year for all electricity sector employment in the period 2024-2041 under the Step Change scenario. In the Progressive Change and the Green Energy Exports scenarios, the peak year (See Appendix A) occurs earlier in 2029 and 2030, respectively.

Under Step Change, electricians are in high demand in 2041, with 800 electricians needed, with both the wind and solar sectors making the bulk of demand. This is followed by a demand for 300 mechanical trades and technicians finance, with the wind sector needing the most workers. Administration staff also account for just under 300 jobs in the peak year, as do business, legal and policy professionals (white collar workers) and construction labourers, with solar requiring the most workers. Lastly, there is a demand for just under 200 trades and technicians (other) jobs in the peak year, 2041, under Step Change.

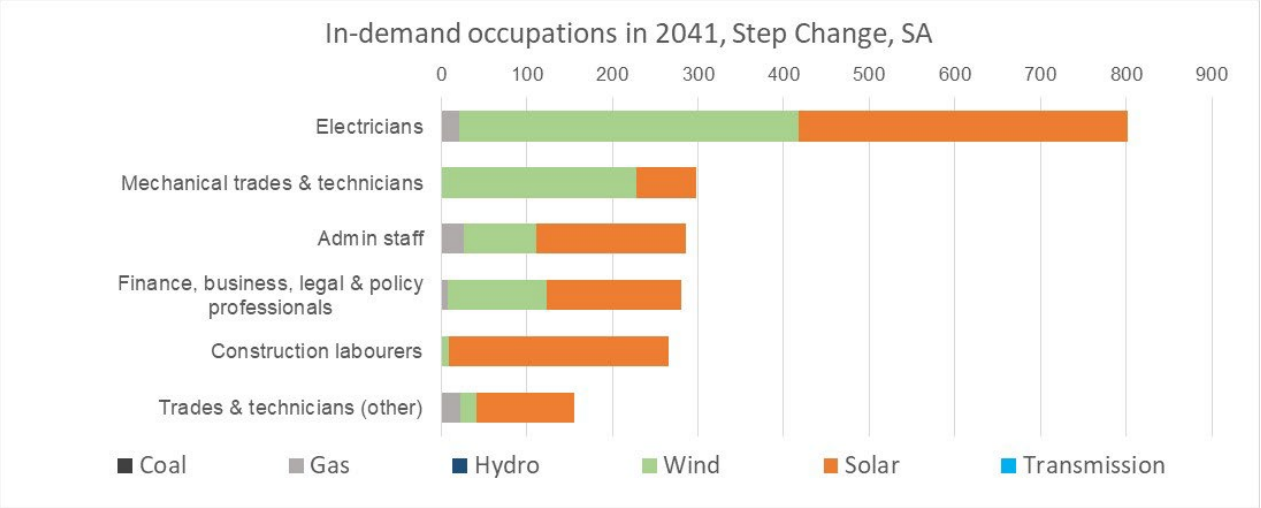

Figure 6 SA, in-demand occupations during peak year (2041)

Figure 7 shows the six most in-demand occupations by technology for the period 2024-2041 under Step Change.

Electricians dominate, growing consistently over the period, followed by administrative staff. Both have a relatively smooth employment profile with both solar and wind contributing to demand. Construction labouring jobs fluctuate significantly reflecting the booms in employment from renewable developments.

Mechanical trades and technicians also grow steadily in demand, with the wind sector accounting for the highest demand for workers. Electrical engineer employment follows the volatile profile associated with construction projects.

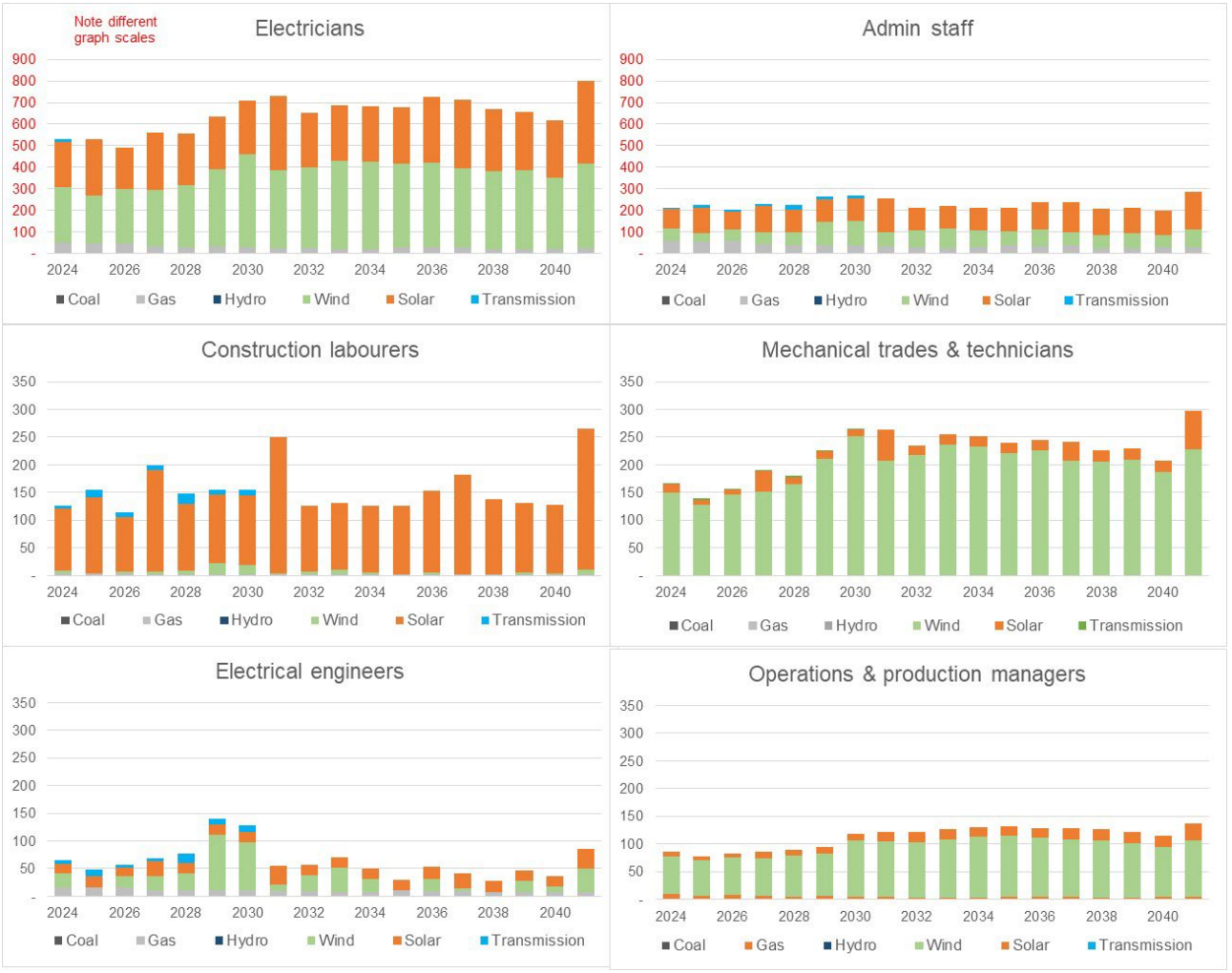

Figure 7 SA, in-demand occupations annual requirement by technology, Step Change

Note: Electricians and admin staff have a scale reaching 900 jobs, whereas other occupations have a scale reaching only 350.

4 Workforce projections by technology for South Australia

South Australia is set to see significant employment growth in the wind sector and in distributed batteries. Figure 8 shows the average electricity sector jobs under each scenario, broken down by technology. Figure 9 shows the annual workforce requirements and gives a more detailed technological breakdown.

- Rooftop PV and distributed batteries draw from the same workforce, with installers working across both technologies. Combined, this sector accounts for between 39% and 50% of average employment in all scenarios.
- Under all scenarios, employment in wind makes up 30% or more of the average electricity sector employment profile.
- Utility-scale solar accounts for an average of 8% - 15% 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 either due to end of life or because improvements in the technology have significantly enhanced performance, meaning it is more profitable to do so. Any employment associated with recycling of materials include mineral extraction (other than coal and gas for fuel) is not included.

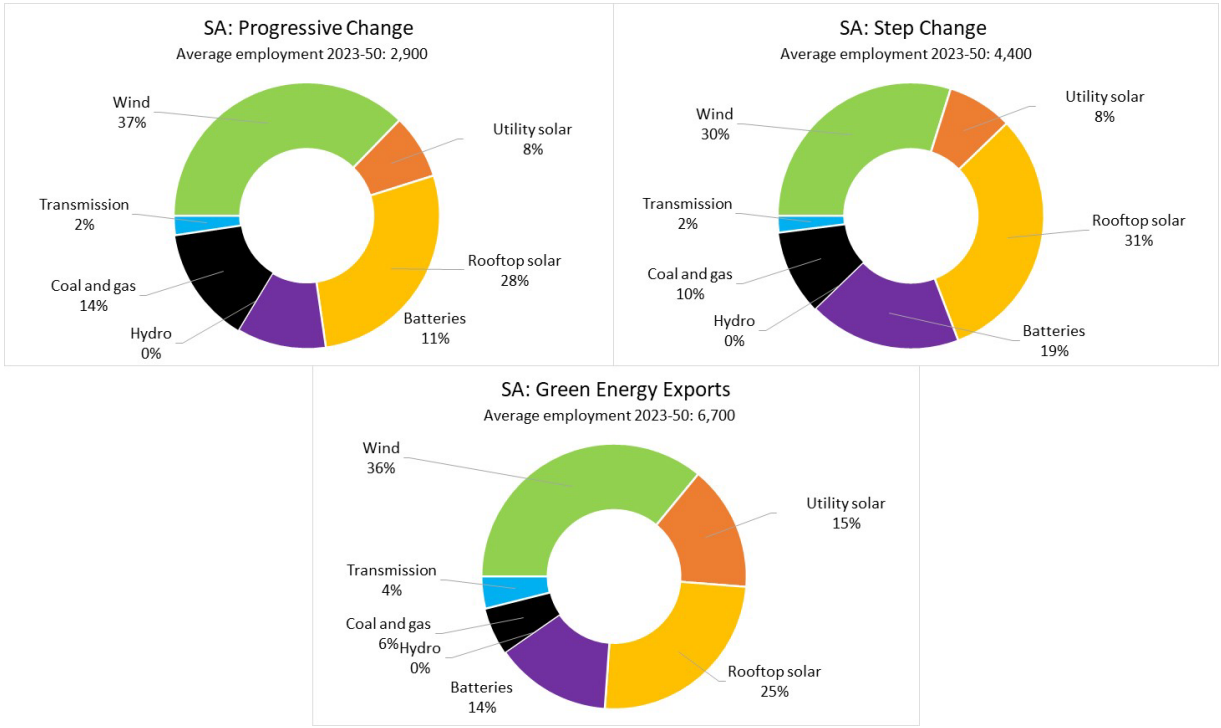

Figure 8 SA, average electricity sector jobs by technology and scenario

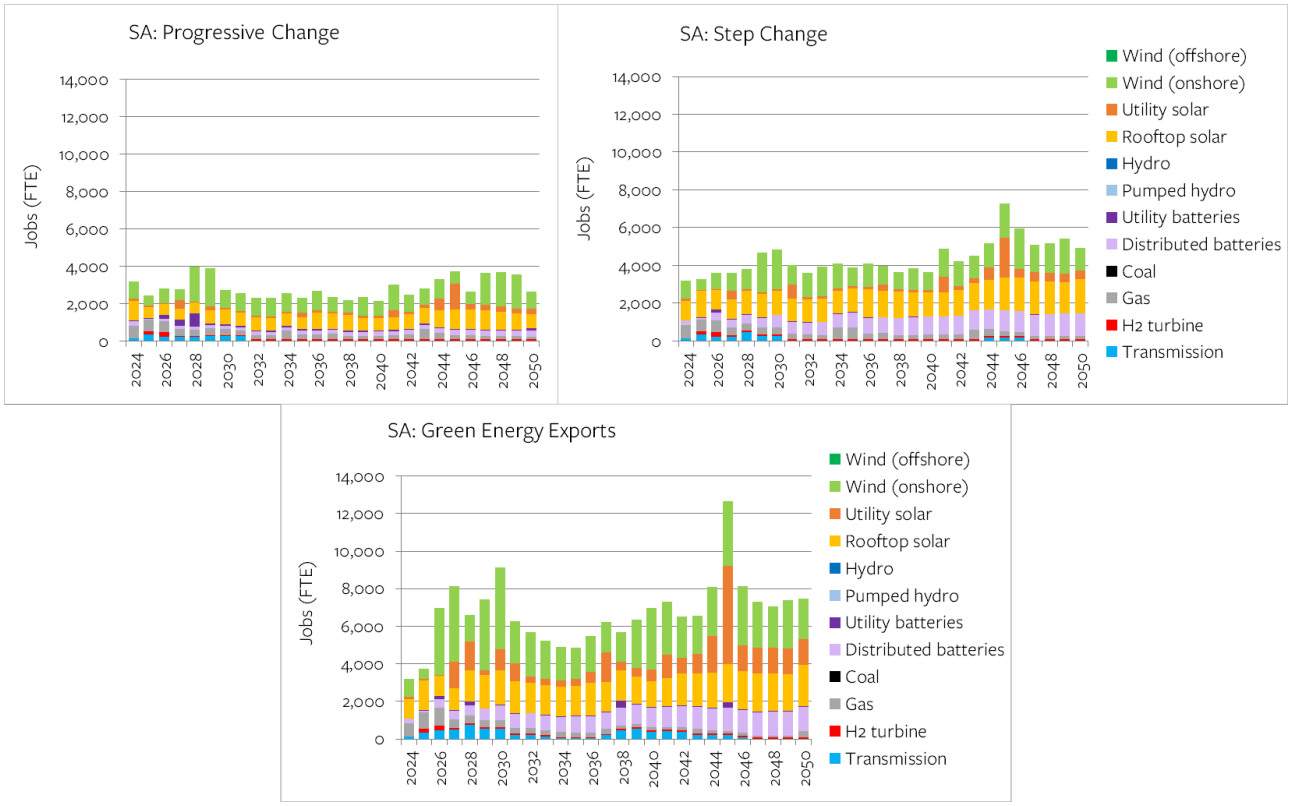

Figure 9 SA, jobs by technology (all scenarios)

4.1 Wind

Employment in the wind sector in South Australia is shown in Figure 10. Under Step Change, wind averages 1,300 jobs from now until 2050. Under Progressive Change, average employment is lower at 1,100 jobs. Under Green Energy Exports, the average workforce is 2,400, double that of Progressive Change. For South Australia, offshore wind does not feature under any of the scenarios. Under all scenarios there are two main booms, the first in the lead up to 2030 and another in the mid-2040s.

Repowering kicks off in 2029 across all scenarios, but overall numbers are small, with an average of 100 jobs.

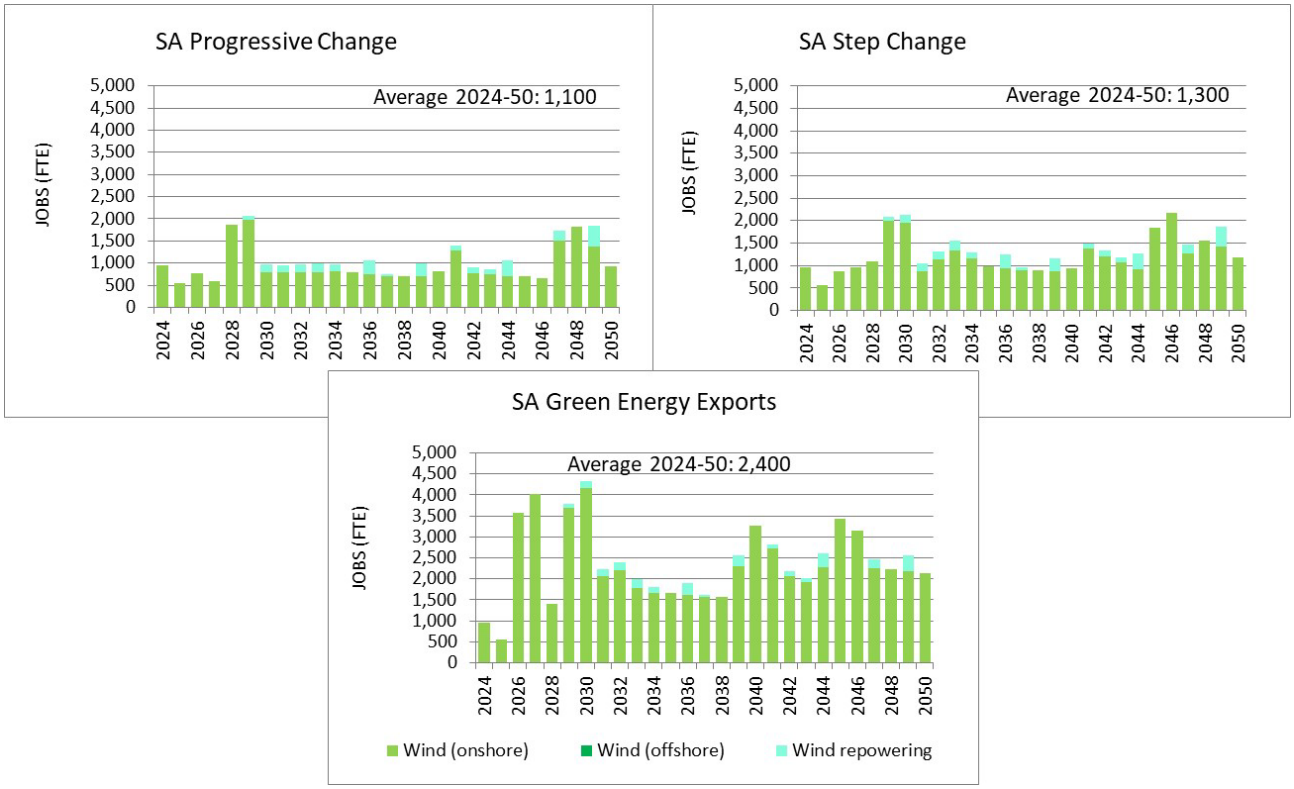

Figure 10 SA, jobs in wind (all scenarios)

4.2 Utility-scale solar

Utility-scale solar averages 200 jobs between now and 2050 under Progressive Change, 300 jobs under Step Change and 1,000 jobs under Green Energy Exports (Figure 11).

Both Progressive Change and Step Change show a constrained jobs profile, with small booms in employment both peaking in 2045 at 1,200 and 2,000 jobs respectively. Under Green Energy Exports, however, there is stronger investment in utility-scale solar, with several booms in employment throughout the period. Jobs peak at just over 5,000 in 2045 before dropping to 1,200 for the final five years.

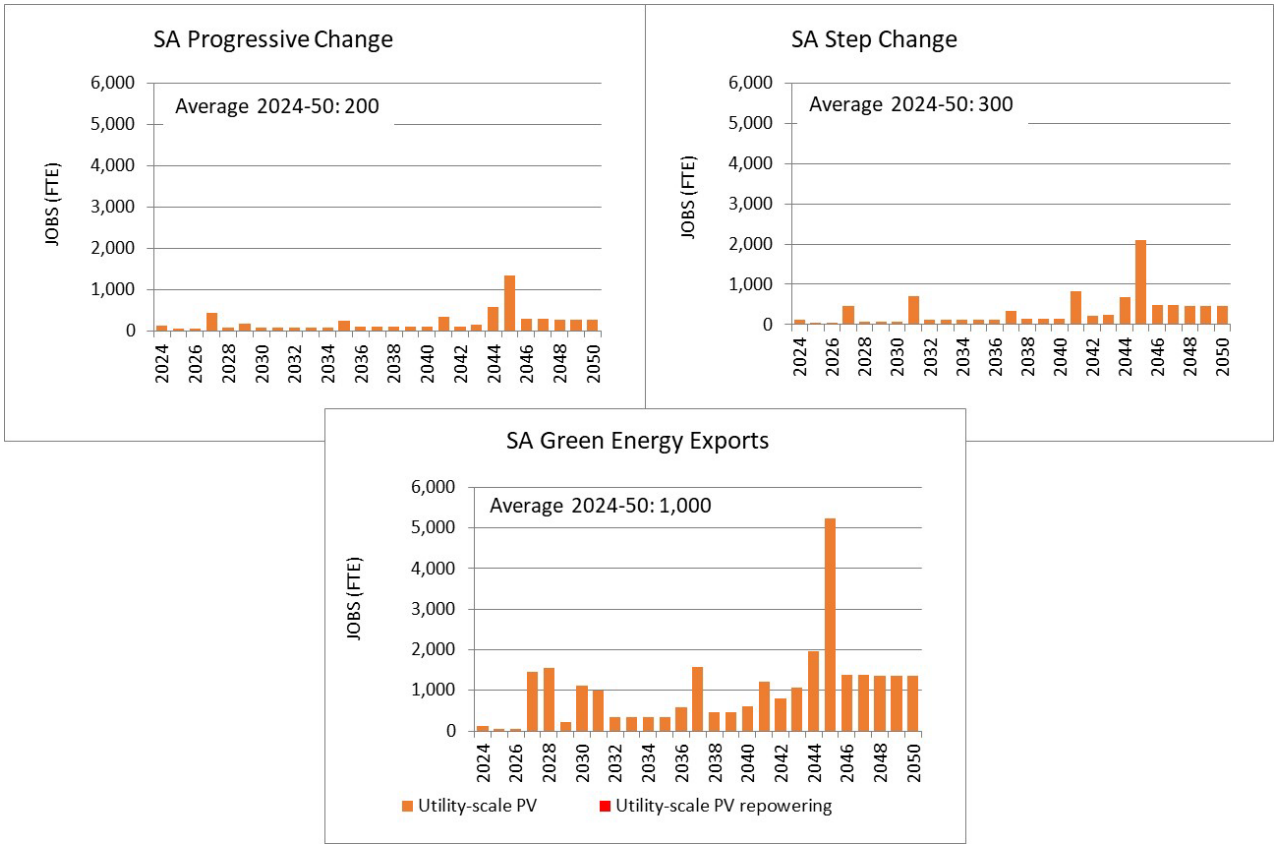

Figure 11 SA, jobs in utility-scale PV (all scenarios)

4.3 Rooftop solar and distributed batteries

For South Australia, 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 1,000 jobs are in rooftop solar and distributed batteries from now until 2050. Under Step Change this more than doubles to an average of 2,200 jobs. Green Energy Exports follows a similar profile as Step Change, of steady annual growth, averaging 2,600 jobs. Under all scenarios, repowering of rooftop solar begins to contribute to the overall share of jobs in the mid-2030s.

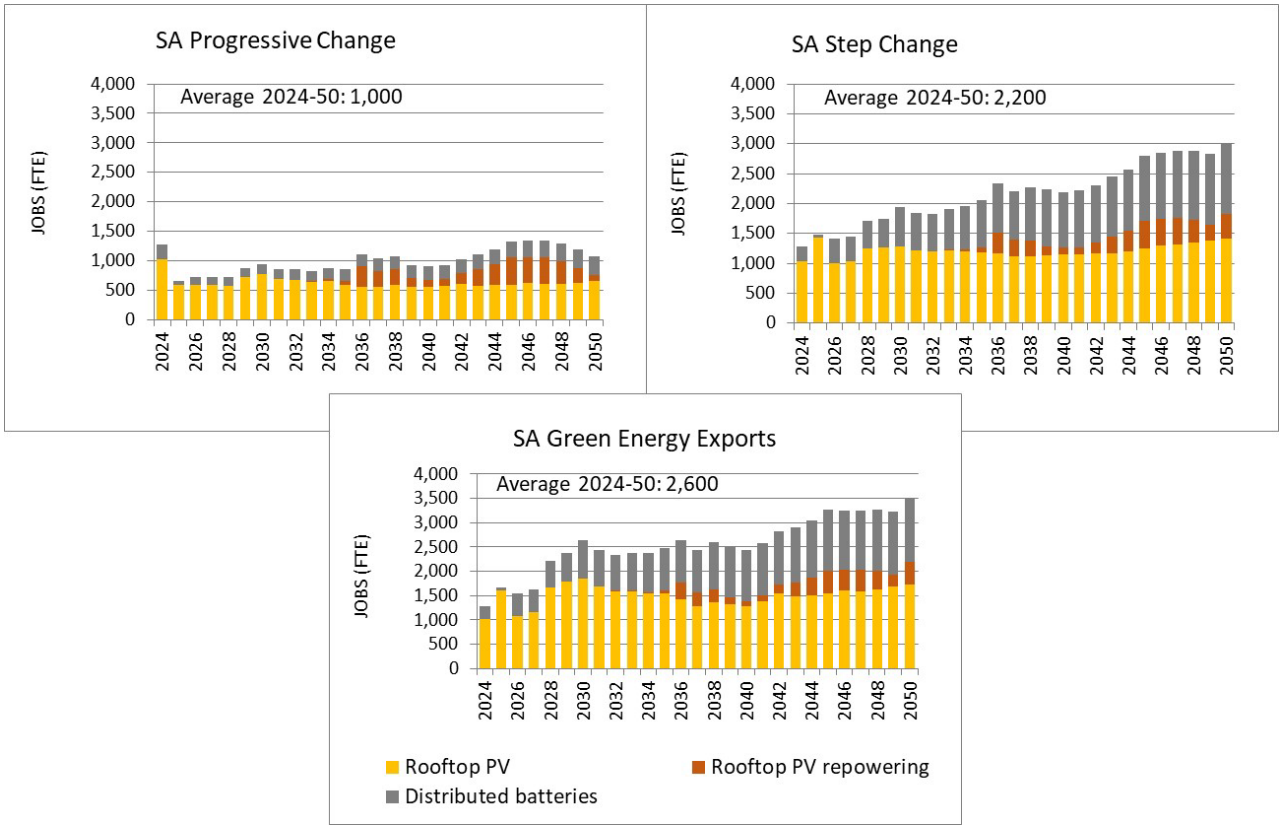

Figure 12 SA, jobs in rooftop PV and distributed batteries (all scenarios)

4.4 Large scale storage

Jobs in utility-scale batteries are shown in Figure 13. There are no jobs in hydro and pumped hydro projects under any scenarios in South Australia.

Jobs in utility batteries are low and volatile under all scenarios. Under Progressive Change and Green Energy Exports, there is an average of 100 jobs from now until 2050. Whereas under Step Change there is an average of 0 jobs.

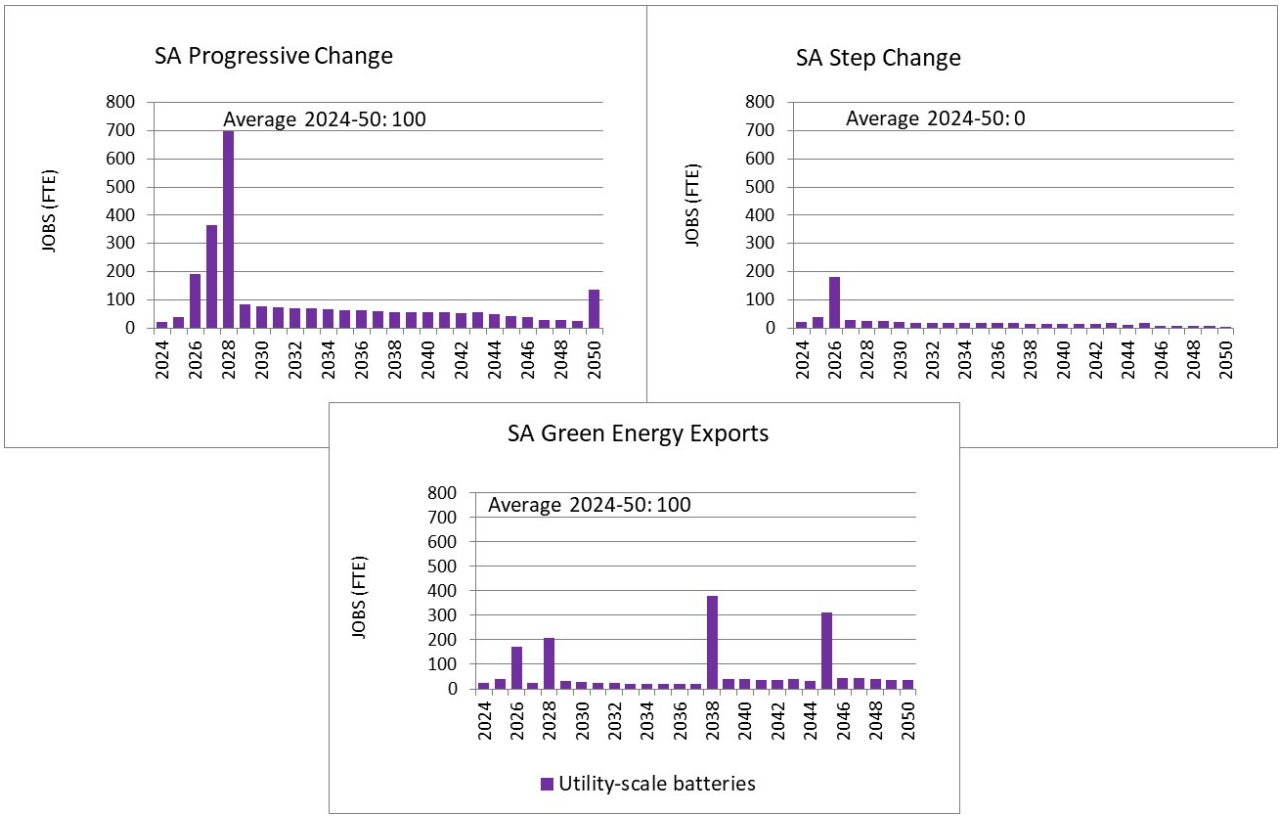

Figure 13 SA, jobs in utility batteries (all scenarios)

4.5 Transmission construction

Employment for transmission construction[3] in South Australia is shown in Figure 14. Under Progressive Change, the workforce averages 100 jobs from now until 2050, with the peak of 300 jobs in 2025. The trend remains consistent till 2031, before employment ends. Under Step Change, the workforce also averages 100 jobs, with a peak of 450 jobs in 2028, but by 2030 employment drops to 0. This is followed by a second minor construction boom in the mid-2040s.

Under Green Energy Exports, the workforce averages at 300 jobs, peaking in 2028 with 700 jobs. Construction then slows before a second boom in the mid-2030s which runs through the mid-2040s.

Actual employment in transmission, 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.

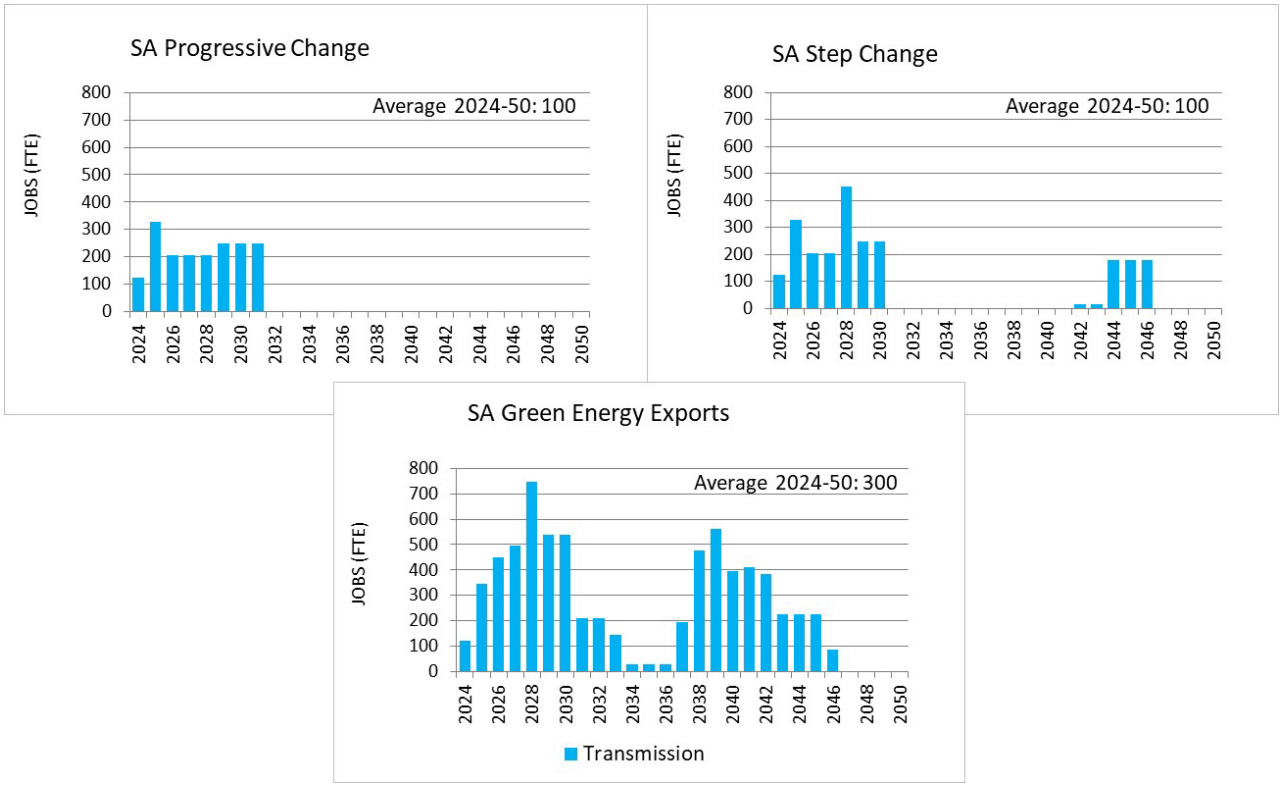

Figure 14 SA, jobs in transmission (all scenarios)

[3] In this study, only employment in transmission construction is included in projections. This is because it would be extremely difficult to demarcate between operations and maintenance work for the new lines from the operations and maintenance for the rest of the network.

4.6 Coal and gas

Jobs in gas are shown for all scenarios in Figure 15. Coal is not present in the South Australian energy mix, so there are no coal jobs.

Employment in gas follows a similar volatile profile in the Step Change and Progressive Change scenarios, with an average of 400 jobs (Step Change) or 300 jobs (Progressive Change) from now until 2050. Jobs start at over 600, and generally decline apart from construction peaks around 2034 and 2044. Under Green Energy Exports, there is an initial increase to 900 jobs in 2026, followed by a steady decline.

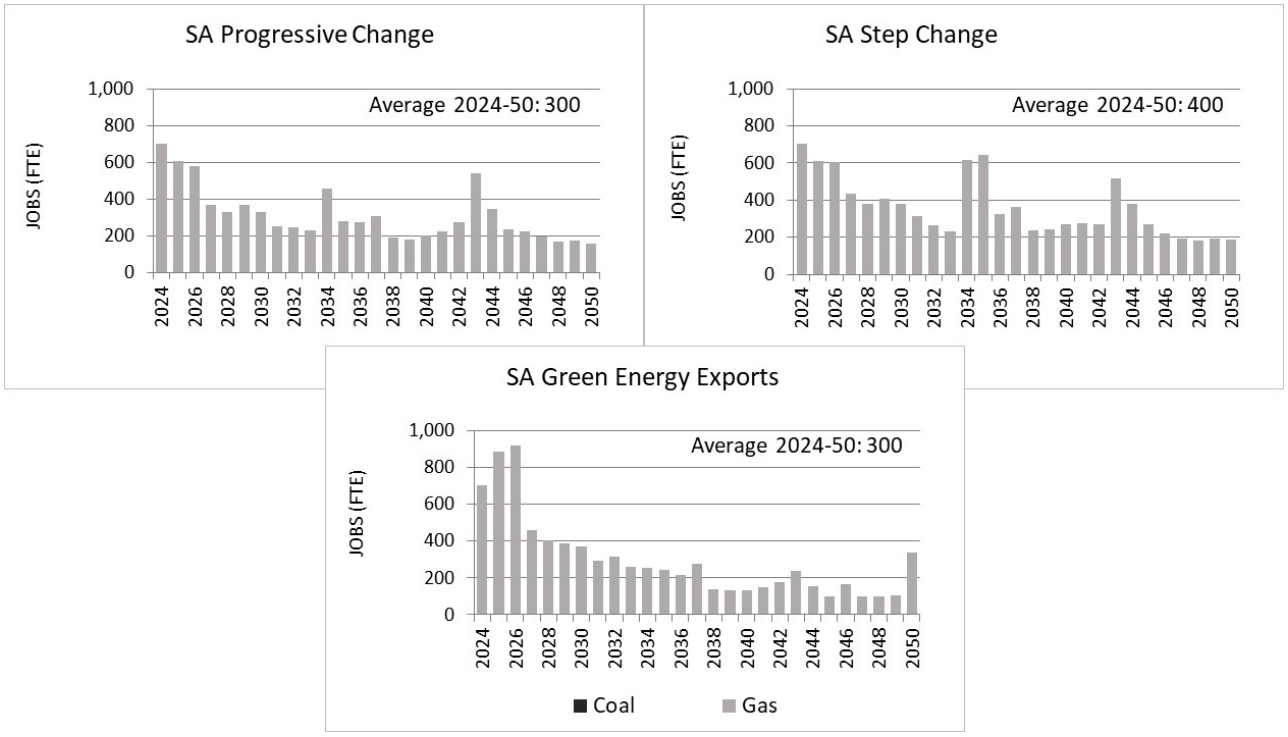

Figure 15 SA jobs in coal and gas, all scenarios

Appendix A Additional information on occupational breakdowns

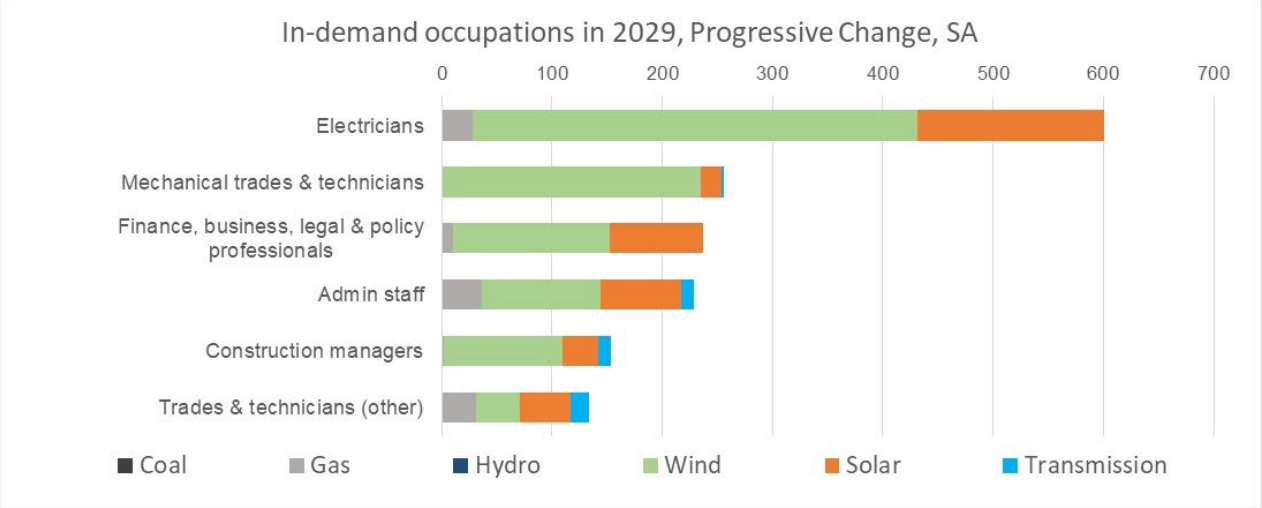

Figure 16 SA, in-demand occupations during peak year (2029), Progressive Change

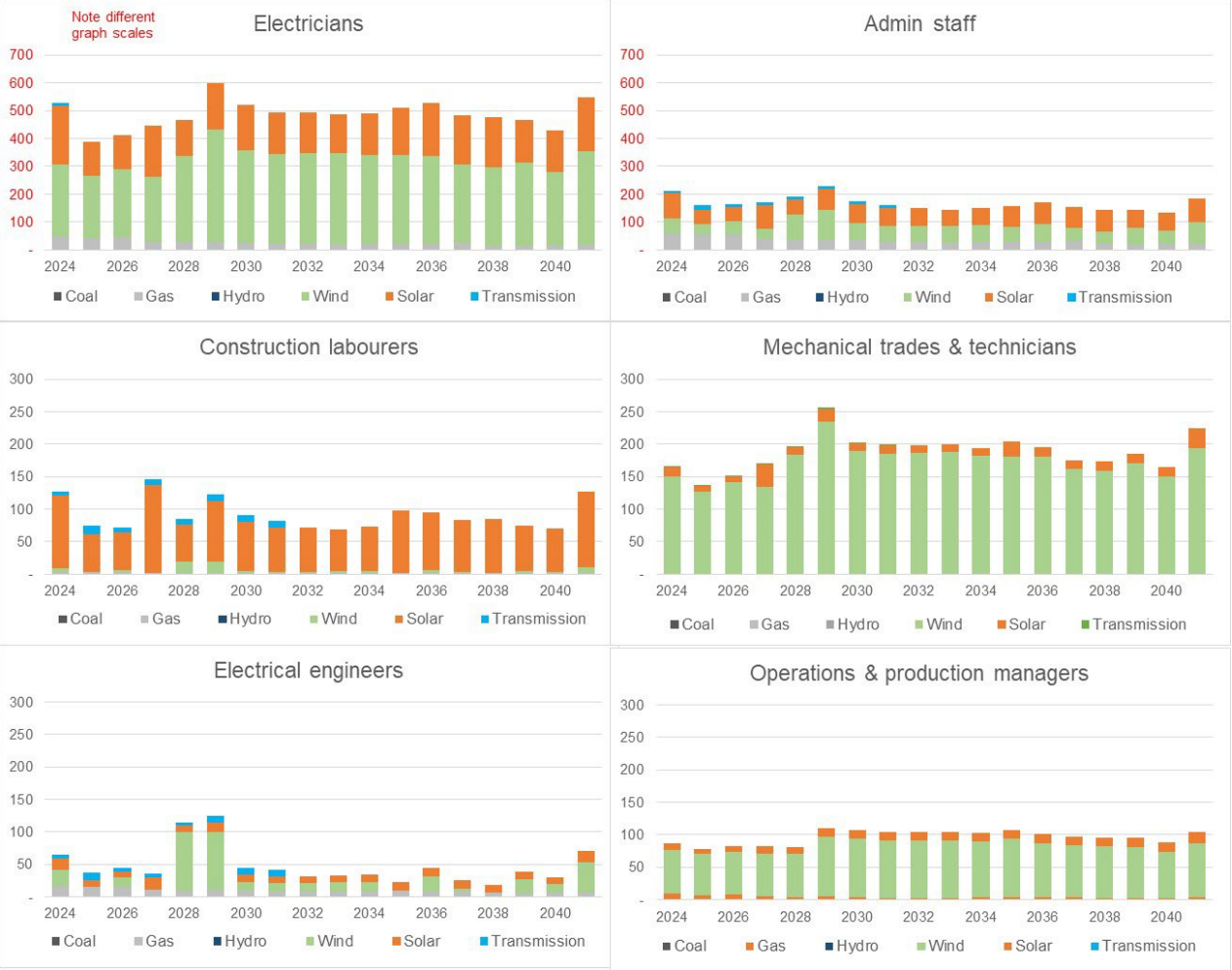

Figure 17 SA, in-demand occupations annual requirement by technology, Progressive Change

Note: Electricians and admin staff have a scale reaching 700 jobs, whereas other occupations have a scale reaching only 300.

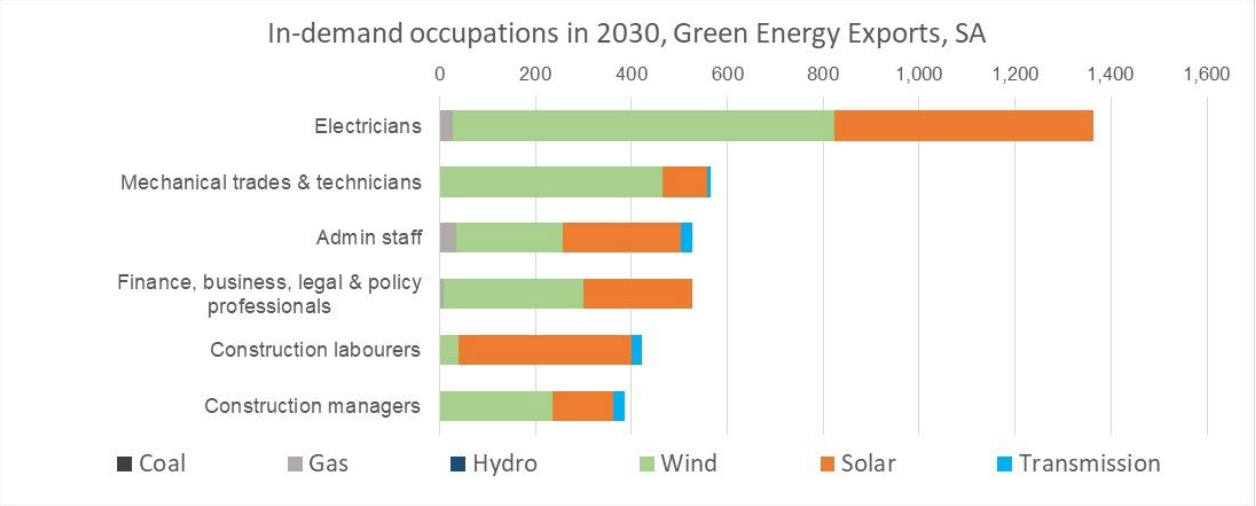

Figure 18 SA, in-demand occupations during peak year (2030), Green Energy Exports

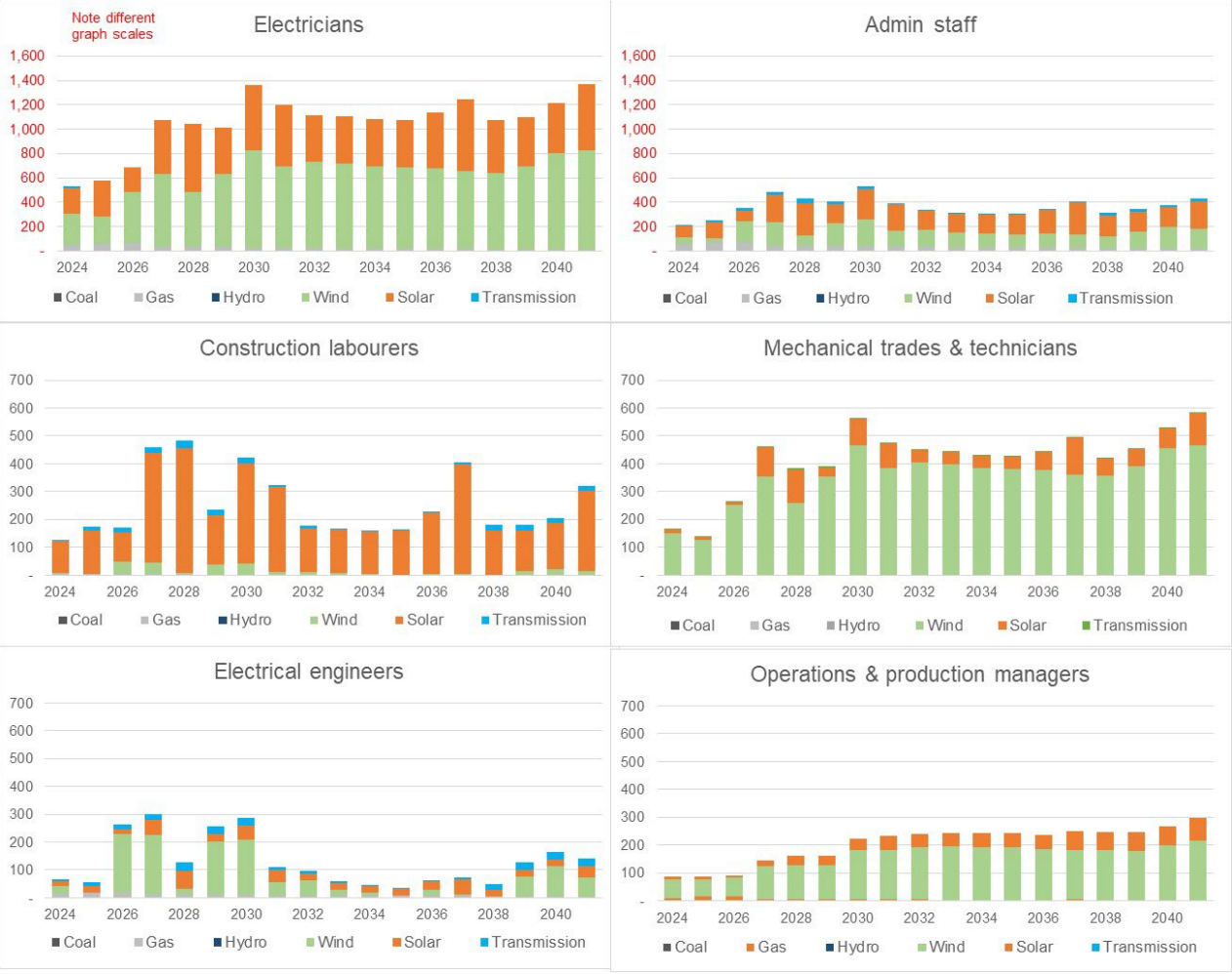

Figure 19 SA, in-demand occupations annual requirement by technology, Green Energy Exports

Note: Electricians and admin staff have a scale reaching 1,600 jobs, whereas other occupations have a scale reaching only 700.

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