

## Statement 4: Structural Shifts Shaping the Economy

The Australian economy is changing in profound ways, with implications for society, policy, and public finances. While there are many structural shifts shaping our economy, this statement focuses on 3, common across many advanced economies: the growing care and support economy; our expanding use of data and digital technology; and climate change and the net-zero transformation. Harnessing the opportunities that come with these transitions, whilst effectively managing the challenges, is critical to our future economic performance and prosperity.

The care and support economy is growing rapidly, driven by an ageing population, a transition from informal to formal care, and heightened community expectations around the standard of care. The care and support workforce must keep growing to meet demand, and more can be done to address barriers to recruitment and retention including pay and conditions, and to improve productivity growth in the sector.

Data and digital technologies are reshaping our society and, with it, our economy. With a highly skilled workforce, and strong and responsive institutions and regulatory settings, Australia is well placed to adapt and thrive. Proficiency in digital skills will be important to capitalise on the economic opportunities afforded by these new technologies, and to ensure the gains are widely shared. Government investment and regulatory frameworks will also need to rapidly evolve to realise the productivity enhancing potential of data and digital technologies; protecting consumers while delivering dynamic and competitive markets.

The economy is changing dramatically due to the global and domestic response to climate change, and as we adapt to the physical impacts of climate change. The net-zero transformation holds major opportunities for Australia, given our endowment of renewable energy sources and our large reserves of many critical minerals. Investment in low emissions technologies and transforming the energy sector will help seize the opportunity to create and benefit from emerging industries and to leverage traditional strengths. Decarbonising the Australian economy will require significant capital investment and a workforce capable of meeting increased demand for greener jobs.



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## Statement 4: Structural shifts shaping the economy

Over time, Australia has undergone profound shifts in the structure of its economy, with significant implications for society and for government policy and finances. Notable examples include the various phases of the mining boom, opening up the economy to the world and the advent of information and computer technology. Other ongoing changes, such as demographic ageing and growth of the Chinese and Indian economies, will continue to impact over the coming decade. Some of these have been the focus of Statement 4 in several previous budgets.<sup>4</sup>

This statement focuses on a further 3 structural shifts that will have a major bearing on our economic performance over the next decade and beyond: the growing care and support economy; our expanding use of data and digital technology; and climate change and the net-zero transformation. Each of these shifts are interconnected and may also be shaped by other shifts such as changing demand for goods and services or the uncertain geopolitical environment. How Australia responds to these changes will be central to growth prospects and opportunities more broadly in the years to come.

The continued rapid growth in the care and support economy reflects many underlying factors. As the population ages, demand for health and aged care increases. The steady expansion of women’s workforce participation has led to a shift away from unpaid care provision, towards formal care arrangements, including for children and ageing parents. Standards of care have also increased in response to rising community expectations. These trends are resulting in increasing fiscal pressures, and wages and conditions have remained a concern for those in the sector. As the care and support economy continues to grow, so too will the macroeconomic importance of workforce and productivity challenges in the sector.

Data and digital technologies are continuing to reshape society and, with it, the economy. Since the Industrial Revolution, persistent waves of technological change have driven phenomenal growth in living standards, with the workforce shifting into higher productivity and higher wage jobs. But these benefits have not always been shared equally across society. Ensuring Australia has the right policy settings in place to harness the benefits of this latest wave of technological change and create more opportunities for Australians is critical. This includes putting the right enabling infrastructure in place, building responsive education and skills systems, and implementing regulation that protects consumers, while delivering dynamic and competitive markets.

Climate change and the net-zero transformation will affect all aspects of our economy and our society over the coming decades, bringing enormous challenges and opportunities. The consequences of rising temperatures are already being felt across Australia through the increasing frequency and severity of extreme weather events. Necessary global and domestic action on emissions reduction will drive significant changes in the structure of the global economy, requiring huge capital investment and significant workforce adaptation.

<sup>4</sup> For example, in the 2001–02, 2003–04, 2005–06, 2006–07 and 2011–12 budgets.

Australia’s skilled workforce, and natural endowments of renewable energy and the minerals critical for decarbonisation means our economy is well placed to prosper in a net-zero future. However, significant coordination will be required to ensure these growth opportunities are realised, and that workers, communities and industries benefit from a smooth transformation.

Governments have a clear role to play in providing a stable and supportive policy environment that allows individuals, communities and businesses to adapt and prosper in the face of these changes. Ensuring we have well-functioning education, training and labour market systems will allow all Australians to make the most of their potential. In many instances, more targeted responses are also warranted. Clear policy leadership and careful policy design will ensure these interventions are efficient and effective and allow market participants to plan with more confidence. Fostering dynamic and competitive markets, supported by necessary investments in enabling public infrastructure, such as digital connectivity, can also help spread opportunity. Finally, the different distributional impacts of these changes mean there is an important role for tailored support to individuals and communities to assist with the transitions.

Getting the policy settings right can also give rise to benefits at the intersection of these structural shifts. For example, better harnessing data and digital technologies can help meet growing demand for high quality care and support services. Providing certainty for the net zero transformation can also encourage greater private investment in new technologies that will help Australia achieve its emissions reduction targets in the most efficient way.

These major structural shifts in the Australian economy are occurring at a time when the global environment is becoming more contested and fragmented (Box 4.1). Russia’s invasion of Ukraine has raised geopolitical risk levels and strategic competition in the Indo-Pacific is intensifying. Rising geopolitical tensions will complicate the climate and digital transformation, affect trade and investment flows, and make unpredictable shocks more likely. This makes it even more critical to manage these shifts well to support future prosperity.

#### Box 4.1 Geopolitical risk and fragmentation

Since the 1980s, the opening of the Australian economy and globalisation have given rise to decades of economic growth and increased prosperity for the Australian people. Australia's economy has become more interconnected with the Indo-Pacific and the world. The benefits of deepened global economic integration, reduced barriers to trade and investment, and regional stability continue to pay dividends.

However, Australia faces a complex and uncertain global strategic environment. We face challenges to supply chain resilience and increased scepticism about the benefits of globalisation. Russia's invasion of Ukraine has raised measures of geopolitical risk (Chart 4.1). Strategic competition in the Indo-Pacific has intensified.

These tensions pose downside risks to Australia's economic outlook. Persistent instability is historically associated with tighter financial conditions, lower investment and employment, as well as a higher probability of negative economic shocks and larger downside risks to the global economy.<sup>5</sup>

The IMF has recently raised concerns that policy-driven geoeconomic fragmentation may reverse the efficiency gains generated by trade, investment and people flows, potentially exacerbating inflationary and supply chain pressures. In a severe scenario, the IMF estimates that trade fragmentation could reduce long-term global output by up to 7 per cent.<sup>6</sup> This risk is especially relevant for a medium-sized trading nation such as Australia.

Australia's region faces increasing strategic competition, including rising risks of military escalation or miscalculation. Australia's response to this changing environment requires new investments in diplomacy, development, defence and national security, at a time of increased fiscal pressure. Other priority areas for enhanced effort include transnational serious and organised crime, humanitarian and disaster relief, border security, cyber, space, intelligence and counterterrorism.

Intensifying geostrategic competition in the Indo-Pacific poses immediate and future security challenges for Australia. The Government is responding to these challenges by implementing the Defence Strategic Review, which recommends a significant defence restructuring and capability uplift. Implementing the review's recommendations will create opportunities to build our sovereign industrial base and create high-skilled jobs, while generating additional pressures in areas such as manufacturing, infrastructure, education, training and workforce development.

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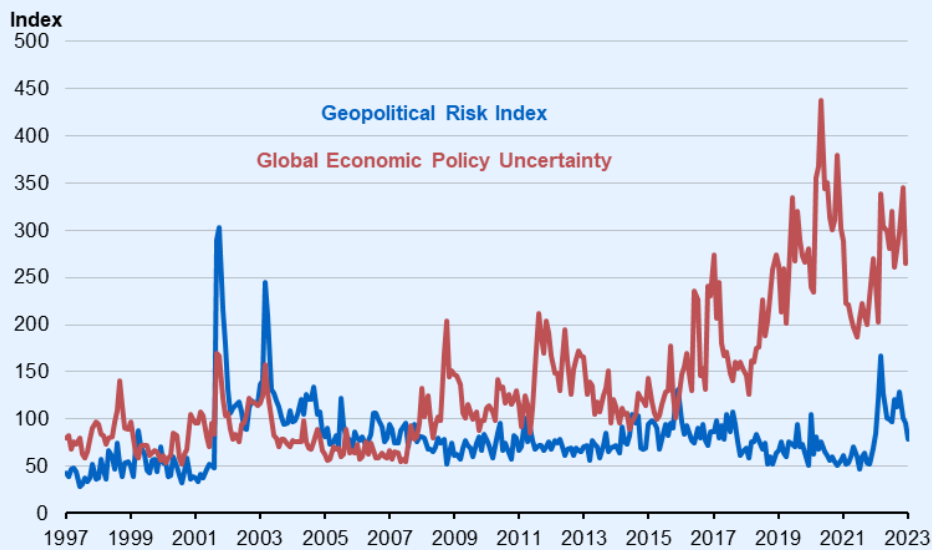
5 Caldara, D & Iacoviello, M. (2022). Measuring Geopolitical Risk. *American Economic Review*, 112(4), 1194-1225.

6 Aiyar, Shekhar, Ilyina, Anna, and others (2023). Geoeconomic Fragmentation and the Future of Multilateralism. Staff Discussion Note SDN/2023/001. International Monetary Fund, Washington, DC.

### Box 4.1 Geopolitical risk and fragmentation (continued)

A more fragmented and volatile global economic and political environment makes it even more important to harness the full range of opportunities that come from the care, digital and green transitions.

**Chart 4.1: Geopolitical risk is elevated**



Note: Higher index values denote higher geopolitical risk or global economic policy uncertainty.

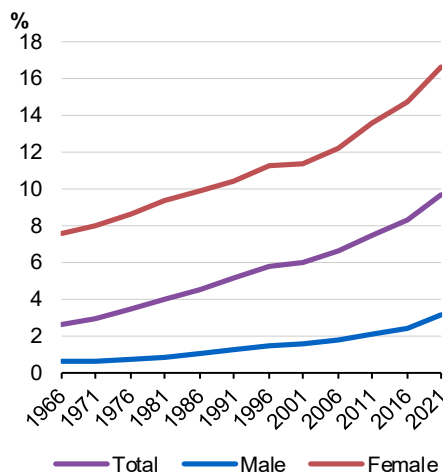
Sources: GPR: Caldara, Dario and Matteo Iacoviello (2022), "Measuring Geopolitical Risk," *American Economic Review*, April, 112(4), pp.1194–1225. Data downloaded from <https://www.matteoiacoviello.com/gpr.htm> on 1 March 2023). GEPU: Davis, Steven J., 2016. "An Index of Global Economic Policy Uncertainty," *Macroeconomic Review*, October. Data downloaded from [https://www.policyuncertainty.com/global\\_monthly.html](https://www.policyuncertainty.com/global_monthly.html) on 1 March 2023.



## A growing care and support economy

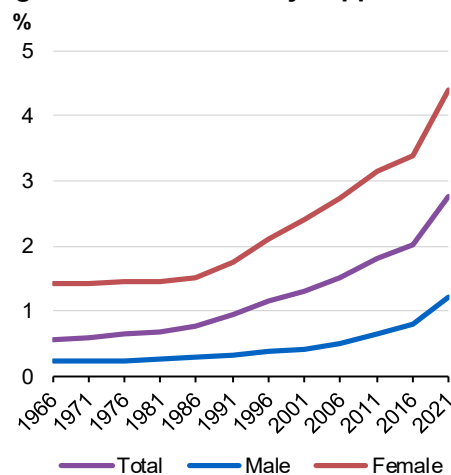
The care and support economy covers formal care services provided to millions of Australians, including nursing, social and aged care, disability support, and early childhood education and care.<sup>7</sup> The care and support economy is growing rapidly, driven by an ageing population, a transition from informal to formal care, and increased citizen expectations of government. This growth gives rise to significant fiscal pressures and it will be important to ensure sectors grow in an efficient and sustainable way so they can continue to provide quality care. To meet demand for quality care, a larger care and support workforce is required. This is particularly true in the aged and disability sectors. Improved education and training, and better use of technology, will also help the care and support economy to deliver the best possible care to all Australians.

**Chart 4.2: Share of workers in care and support occupations**



Source: Treasury analysis of ABS Census.

**Chart 4.3: Share of workers in personal care and support, primarily aged care and disability support**



Source: Treasury analysis of ABS Census.

<sup>7</sup> In this chapter, ‘care’ workers include care and support workers, health and welfare support workers, social professionals, registered nurses, allied health professionals, and early childhood education and care workers. ‘Personal care and support’ workers are a subset of this group that is made up of aged care, disability care, nursing support and personal care assistants.

## Half a century of growth in the care and support workforce

The demand for care and support services has grown substantially over the past 50 years. About 10 per cent of the workforce are in a care occupation, up from 2½ per cent in 1966 (Chart 4.2). This demand has been met overwhelmingly by women, with around 1 in 6 employed women working in a care occupation in 2021. Within the sector, aged care and disability support has been the strongest driver of recent employment growth (Chart 4.3). This growth will continue. By 2049–50, the former National Skills Commission expects the total demand for the care and support workforce will be around double that seen today.<sup>8</sup>

As with many advanced economies, Australia’s population is ageing (Box 4.2). The retirement of those born from 1946 to the mid-1960s (often referred to as ‘the baby boomers’) between 2010 and 2030 will cause a particularly rapid period of ageing, resulting in a smaller share of working-age Australians to help fund more government services. In a decade, almost 1 in 5 Australians will be aged 65 years and over. However, in contrast to previous generations, this cohort will retire with larger retirement savings balances which may result in demand for more and higher quality care services.

Care work has also continued a long transition from informal to formal care, driven by increased labour force participation by women. Informal care primarily relies on family members – particularly women – forgoing paid work to provide unpaid care at home. Improved options for formal care can reduce barriers to women’s workforce participation, improving their economic security and financial independence. These changes can also support productivity to the extent that formal care arrangements allow for better matching between jobs and skills, and through economies of scale as the workforce expands.

The transition towards more formal care, advances in technology, and higher incomes has led to rising expectations of how and where care is delivered. A recurring finding of past intergenerational reports is that these non-demographic factors are a key force behind rising aged care and disability support costs, and resulting fiscal pressures.<sup>9</sup> Shifts in consumers’ preferences have been accompanied by reforms to aged care since the mid-2000s, such as increasing availability of care in the home, and by the implementation of the National Disability Insurance Scheme (NDIS) from July 2013.

These drivers have affected segments of the care and support sector differently. An ageing population and longer life expectancies have been the primary driver of aged care demand, leading to longer and more complex care demands. Demand for disability supports, particularly those delivered through the NDIS, has also grown, driven by increased recognition of disability needs, high uptake among children, and low exit rates from disability programs as people age.<sup>10</sup> Together, this has seen the personal care and support workforce treble as a share of the total workforce over the past 30 years, from 0.9 per cent in

8 National Skills Commission (p. 10, 2021), ‘[Care Workforce Labour Market Study](#)’.

9 Treasury (Section 7.2, 2021), ‘[Intergenerational Report](#)’.

10 National Skills Commission (Sections 2.4.1–2.4.2, 2021), ‘[Care Workforce Labour Market Study](#)’.

1991 to 2.8 per cent in 2021 (Chart 4.3), and become the largest care and support sector occupation group.

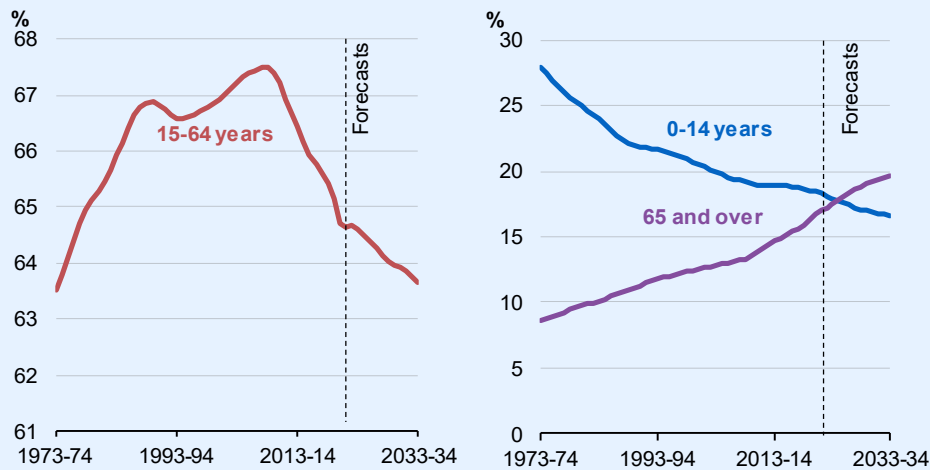
NDIS is a vital scheme. Ensuring the long-term sustainability of the Scheme is critical to ensuring supports can continue to be provided to Australians with significant and permanent disability. The National Cabinet has committed to an NDIS Financial Sustainability Framework to ensure the NDIS can continue to provide life-changing outcomes for future generations.

**Box 4.2: How Australia’s population is expected to change**

Australia’s population will continue ageing over the next decade, with fertility rates expected to gradually decline and life expectancies expected to increase, consistent with long-running trends. From 2023–24 to 2033–34, the share of the population aged 65 years and over is projected to increase by 2.2 percentage points to 19.7 per cent, while for those aged 85 years and over it is expected to increase by 1.0 percentage point to 3.2 per cent. Over the same period, the share of younger people will continue to fall with those aged 0 to 14 years projected to decrease by 1.3 percentage points to 16.7 per cent.

Population ageing is reflected in an increasing old-age dependency ratio – or the number of people aged 65 years and over per 100 people aged 15 to 64. This ratio is projected to increase from 27.0 in 2023–24 to 31.0 in 2033–34. The increase is particularly significant between 2010 and 2030 driven by the large baby boomer cohort reaching the age of 65. Population ageing is expected to continue in the longer run beyond the effects of the baby boomer cohort, driven by low fertility rates. The increasing old-age dependency ratio presents challenges for Australia’s long-term economic growth and fiscal outlook. Helping elderly people age well could partially offset some of the economic effects of population ageing, which include decreased productive capacity of the economy and greater government spending on healthcare, aged care, the Age Pension, and end-of-life support.

**Chart 4.4: Share of Australia’s population by age group**



Source: ABS, National, state and territory population, September 2022, and Treasury.

## A larger aged care and disability support workforce is needed to meet future demand

The care and support workforce must keep growing to meet demand. A 2021 report by the former National Skills Commission predicted Australia would require 425,000 personal care and support workers – mostly aged and disability carers – by 2050, up from 225,000 in 2020.<sup>11</sup> A suitable care workforce will help ensure everyone who needs quality care can receive it. But attracting and retaining workers to these occupations has proven difficult.

The personal care and support workforce is highly feminised, with women accounting for around 80 per cent of all workers. The rise in women’s workforce participation over the past 40 years, partly enabled by increased availability of early childhood care and education, has been an important driver of growth in the care and support workforce.<sup>12</sup> However, a highly gender segregated workforce can artificially constrain labour supply, which increases the likelihood of a skills shortage (see *Women’s Budget Statement*). With the women’s workforce participation rate expected to flatten over coming decades, growing the care and support workforce is likely to require some reallocation of workers from other industries, and encouraging more men to pursue careers in care. The growth in demand for care and support workers, and the fact that entry level roles in the sector do not require minimum mandatory qualifications, creates an opportunity for Australians who are not currently employed or are looking to shift careers. However, the nature of many care and support jobs – with variable hours and worker screening requirements – can present a barrier for existing employment service models to place workers in the sector.

As demand for aged care has grown, reliance on migrants to grow the workforce has increased (Chart 4.5). Migrants working in aged care typically arrive as secondary applicants to skilled migrants (such as spouses and dependants) or are family or humanitarian migrants. There is an opportunity to improve the effectiveness of the training and skills system in growing the future care and support workforce, and to ensure the migration system provides effective pathways and protections for migrants working in the sector.

While the aged care and disability support sector has grown, attracting and retaining workers has been challenging. Only around half of people who enrol in a relevant vocational course end up employed in the sector.<sup>13</sup> Furthermore, about 60 per cent of the aged care and disability support workforce have been working in their occupation for less than 3 years. Attrition rates are particularly high for young people and are lower for older women.<sup>14</sup>

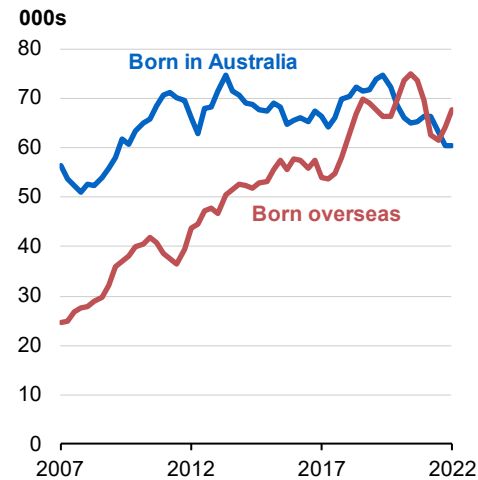
11 National Skills Commission (Figure 291, 2021), ‘Care Workforce Labour Market Study’.

12 Treasury (Chapter 3, 2021), ‘Intergenerational Report’.

13 Of people enrolled in a Certificate III in Individual Support: National Skills Commission (Section 7.3, 2021), ‘Care Workforce Labour Market Study’.

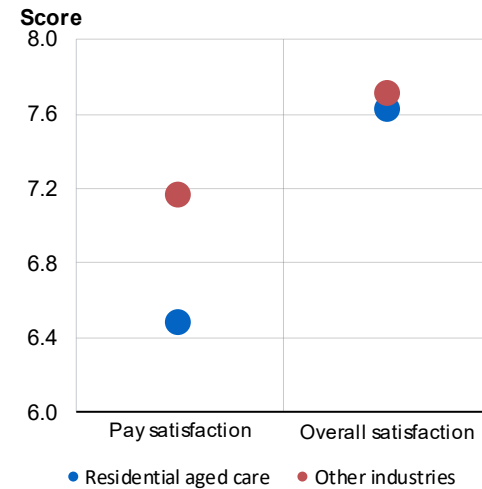
14 National Skills Commission (Section 7.2.1.1, 2021), ‘Care Workforce Labour Market Study’.

**Chart 4.5: Migrant status of care workers in residential aged care**



Note: In 2021, 85 per cent of residential aged care workers born overseas arrived in Australia aged 18 years or older: Treasury analysis of Census (2021).  
Source: Treasury analysis of ABS Labour Force microdata.

**Chart 4.6: Average satisfaction with various job characteristics**



Note: Average satisfaction score out of 10.  
Source: Treasury analysis of HILDA Survey Release 20.0.

Current pay levels, progression and conditions have been a particular concern for care and support workers and have been barriers to attracting suitable workers into the sector. As care roles were once part of the informal economy, the level of skill and experience required can be disguised, which can lead to wages and conditions that do not reflect the value of the work performed. Personal care and support workers earn \$34 per hour on average, about 25 per cent less than the average worker.<sup>15</sup> Satisfaction with wages is particularly low for aged care workers, who are far less satisfied with their pay than other workers (Chart 4.6). Career paths in the aged and disability sector are limited, with little professional development or pay progression.<sup>16</sup> The Government’s support for, and commitment to fund, the interim outcome of the Fair Work Commission’s decision on the Aged Care Work Value Case will help to alleviate some of these barriers. This funding will support a 15 per cent increase to award wages and more than 250,000 aged care workers will benefit from the increase.

<sup>15</sup> Treasury analysis of ABS Characteristics of Employment Survey (2022).

<sup>16</sup> Aged Care Royal Commission (p. 125, 2021), ‘Final Report’.

## Improving productivity and care outcomes

As the formal care and support economy grows, so does its importance to Australia's productivity performance. The Productivity Commission noted in the final report of its 5-year Productivity Inquiry, *Advancing Prosperity*, that productivity gains in service sectors, which includes aged and disability care, have proved difficult to achieve.<sup>17</sup>

Productivity measures in the care and support sector provide an incomplete picture of the sector's performance. This is because productivity growth – measured by value added relative to labour and capital inputs – does not fully capture the value of these services to those who benefit. Focusing on outcomes – measured by the health and wellbeing of Australians receiving care and support services – rather than just inputs will better measure what matters and help guide the allocation of scarce care resources.<sup>18</sup>

Measuring better outcomes directly is difficult and will likely require new uses of existing data and the collection of new data. But without a better understanding of how the sector is serving the community, governments' ability to drive improvements in the quality of care and productivity is constrained and there is a risk that the services delivered grow only in volume, and not value.

There are significant opportunities to improve the quality and efficiency of care by ensuring care is provided in the right setting, at the right time. Improved co-ordination and integration of primary care services can improve health outcomes and reduce costs by preventing unnecessary hospitalisations. Similarly, effective home care services can be a high productivity approach to delivering aged care, as living independently for longer can deliver better outcomes for some older people, with lower labour requirements and costs than residential aged care.

There are also opportunities to improve the quality of care by better integrating technology into existing care settings, including better use of data within the care and support system. For example, the transformation of *My Health Record* into a comprehensive data sharing system across the whole health and care sector can ensure carers have up-to-date, readily accessible information about their clients and participants to deliver care that is more timely and better tailored to need.<sup>19</sup>

Rather than replacing the human aspect of care work, better use of technology and data can increase direct support. By reducing time spent on inefficient tasks, technology can free workers up to spend more time with clients, supporting improved care outcomes. Training for aged care and disability support workers in better processes and use of these technologies is crucial to help capture these quality-enhancing productivity gains.

17 Productivity Commission (Vol 1 p. ix, 2023), '[Advancing Prosperity](#)'.

18 For example, client-centred funding approaches can incentivise improvement in care outcomes rather than solely rewarding activity: Productivity Commission (Vol 1 p. 35-36, 2023), '[Advancing Prosperity](#)'.

19 Productivity Commission (Vol 1 p. 60, 2023), '[Advancing Prosperity](#)'.

Data and technology can also be key enablers of delivering care in settings that best suit individual needs and preferences. The adoption of health monitoring technology, such as portable heart rate monitoring and fall detection devices, can allow better settings for care while also improving outcomes. For example, in the right circumstances, formal at-home care is a more effective substitute for residential aged care. The majority of older Australians prefer to remain in their own home and delay entry into residential care until later in life. The use of modern technologies will help meet rising preferences for in-home aged care, delivering quality outcomes with fewer labour and capital resources, driving productivity growth in the sector.

Adoption of technology can also help improve aged care and disability support services in regional and remote areas. Regional and remote areas often have ‘thin markets’ in care service provision, meaning people have little choice in service providers, and sometimes no access at all.<sup>20</sup> Some are forced to permanently relocate or forgo formal care. Older Australians living in small rural and remote areas are less likely to use residential aged care services or home support packages.<sup>21</sup> The use of technology, such as video consultations with specialists and remote health monitoring and support, can go some way to improving the quality of care that regional Australians receive.

## Technological and digital transformation

From the Industrial Revolution to the Green Revolution, technology has stretched the limits of what was once thought possible. Life-saving surgeries, medications and vaccines have ensured that many Australians live longer and healthier lives. The widespread adoption of technologies and the implementation of new and more efficient production processes have resulted in a higher standard of living.

### Technological change and the nature of work

Past waves of technological change have seen the aggregate workforce shift over time into higher skilled, higher paid jobs, and have changed the nature of work (Chart 4.7). In the post WWII era, most workers were engaged in routine work, such as agriculture and manufacturing labourers (routine manual work) and clerks (routine cognitive work). Automation has allowed workers in these occupations to produce more with less, aided by the adoption of new technologies. The rise of non-market services, including the care and support economy, is partly reflected in the increase in non-routine manual work. Most employment growth has been concentrated in non-routine cognitive work, such as in the professional services sector, which now accounts for the bulk of employment.<sup>22</sup>

20 National Skills Commission (Section 4.8, 2021), ‘Care Workforce Labour Market Study’.

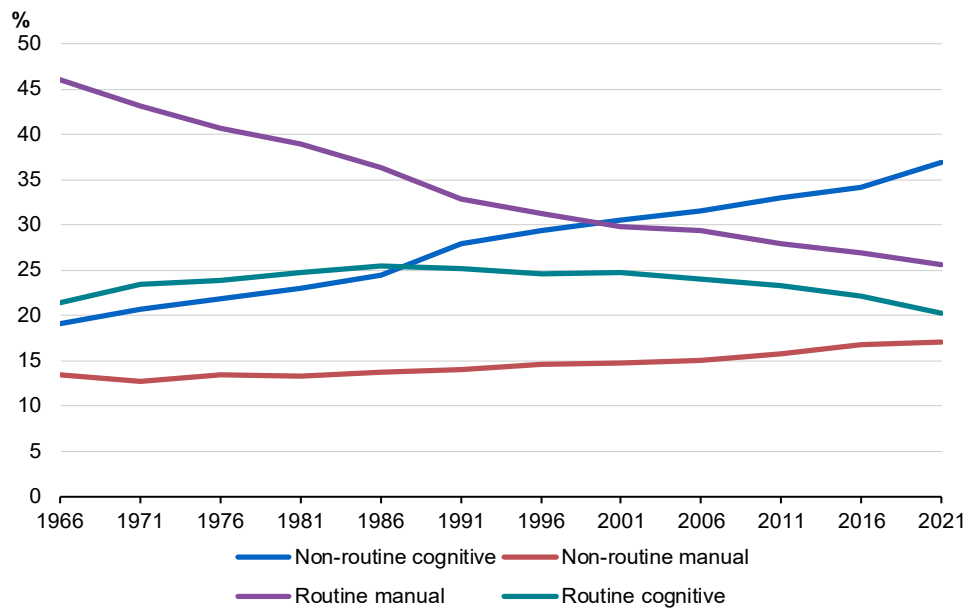
21 National Skills Commission (Figure 15, 2021), ‘Care Workforce Labour Market Study’.

22 For more detailed examinations of the changing nature of work see, for the United States, Autor, D. H., Levy, F., & Murnane, R. J. (2003). The skill content of recent technological change: An empirical exploration. *The Quarterly Journal of Economics*, 118(4), 1279-1333, and for Australia, Coelli, M., & Borland, J. (2016). Job polarisation and earnings inequality in Australia. *Economic Record*, 92(296), 1-27.



Automation has not reduced hours worked and has improved opportunities for some previously excluded sections of the workforce. Average hours worked per person aged 15 years and over has remained at around 20 hours per week since the early 1980s. The shift towards services has also supported the participation of older Australians in the workforce. Women are also participating at much higher rates than in the past. This partly reflects changing social norms, but also increased availability and use of formal childhood education and care and labour-saving technology in the home.

**Chart 4.7: Employment by occupation task category**



Note: Data and classifications from ANZSCO using RBA skills structure framework.  
 Source: Treasury analysis of ABS Census data.

### Recent trends in data and digital technologies and skills

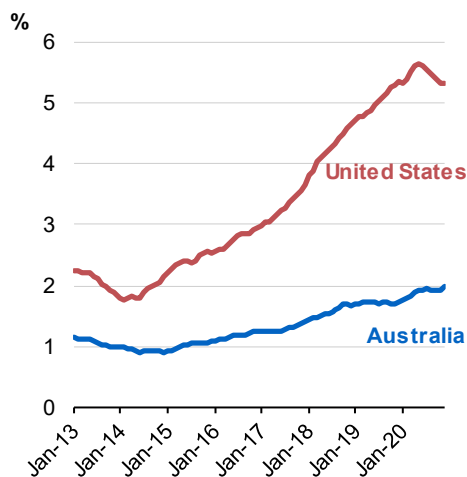
Digital technologies have transformed our lives in ways that, even a few decades ago, would have seemed unimaginable. The recent and rapid take up of technologies like cloud computing, machine learning and artificial intelligence are now changing how we live and work. The nature of work is once again shifting, with new tools that allow workers to do more with less, and new skills being demanded by businesses. Fittingly, new data makes it possible to see these changes playing out in close to real time.

Australian businesses are increasingly adopting emerging technologies, but still lag behind the frontier, suggesting scope for further growth. Recent Treasury analysis highlights the near doubling in references to emerging technologies in online job advertisements between 2012 and 2020, with around 7 per cent of online job advertisements now referencing such

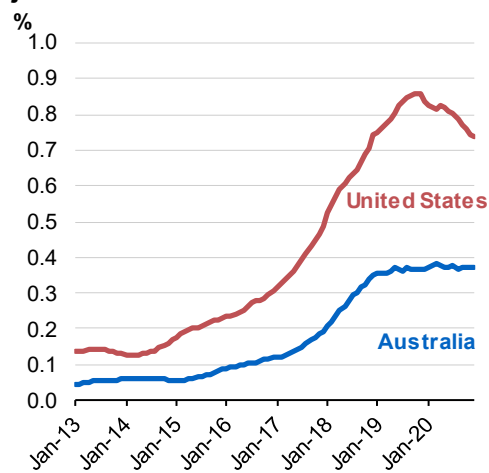
technologies.<sup>23</sup> Yet frontier technologies such as cloud computing, machine learning and artificial intelligence remain less prevalent than in the United States (Charts 4.8 and 4.9).

There are opportunities for businesses to close this gap with international peers, and further expand the set of opportunities available to workers. Businesses report a range of barriers to adoption of technologies, including insufficient knowledge (12 per cent of businesses), uncertainty around costs and benefits (12 per cent), slow internet speeds (13 per cent) and a lack of skills within the business (13 per cent).<sup>24</sup> Yet the rapid adoption of online sales and hybrid work arrangements during the COVID-19 pandemic also highlights the ability of businesses to rapidly adopt technologies when conditions demand it.

**Chart 4.8: Share of cloud computing job ads**



**Chart 4.9: Share of artificial intelligence/machine learning job ads**



Notes: 12-month rolling average of monthly share of job ads that require each technology skill. Cloud Computing also includes Cloud Storage and Cloud Solutions.

Source: Treasury analysis of Lightcast data for Australia and the United States (2012–2020).

Digital skills proficiency is important to capitalise on the economic opportunities afforded by new technologies and to ensure the gains are widely shared. The workforce is already responding to meet the skills challenge posed by a growing digital economy. The number of people with an IT qualification jumped by 36 per cent between 2016 and 2021. By keeping pace with demand, the education system can position Australian businesses to tap into global digital markets and leverage digital innovations in how they develop,

<sup>23</sup> Bahar, E. & Lane, O. 'How dispersed are new technologies in the Australian job market?' *Treasury Round Up*, 2022.

<sup>24</sup> ABS 2019 Characteristics of Australian Business, 2019-20 financial year.

produce and sell products and services. Equitable access to digital skills is critical to ensure the benefits of these new digital employment opportunities are broadly shared.<sup>25</sup>

As jobs change in response to new technologies, our education and training systems cannot only deliver new skills but also need to adapt in how they deliver them. Encouraging life-long learning and on the job training, and ensuring smooth integration and recognition of training experiences can help workers keep their skills up to date and lower the transition cost between jobs. Labour mobility between firms and locations, and a responsive skilled migration system, will also support the diffusion of local and global best practice across Australian businesses.

### Data, digitalisation and productivity growth

Amid a global slowdown in productivity growth, data and digitalisation have significant potential to improve Australia's productivity performance. Such technologies can reduce business costs, allow workers to focus on higher value tasks, and improve product quality and consumer choice.<sup>26</sup> New technologies can make existing businesses more efficient, bring about increased competition and better meet consumer needs.

Productivity gains associated with transformative new technologies take time to emerge as the economy adjusts to make the most of new opportunities. While past innovations such as electrification completely reshaped the way we lived, it took multiple decades for the benefits to be fully realised. Electrification required investments in complementary public and private infrastructure, and the redesign of factory layouts and industrial processes.<sup>27</sup> In a similar vein, the data and digital technologies that began to take off in the 1990s and continue to evolve today will require complementary investments – in new products, processes, infrastructure and skills – before their full benefits are realised.<sup>28</sup>

A competitive and dynamic economy will amplify the benefits of new technologies. Most Australian businesses – 98 per cent – adopt innovations created by others rather than generate new innovations themselves.<sup>29</sup> Increasing the speed and scale of this diffusion of existing ideas is an important focus for productivity policy. Competitive pressures accelerate the diffusion of good ideas by incentivising resources to flow to the most productive businesses. Yet while more productive businesses tend to grow their workforces and invest more than less productive businesses, there is evidence that both tendencies

25 Goldin, C., & Katz, L. F. (2010). *The race between education and technology*. Harvard University Press.

26 Productivity Commission (Vol 4 p. 1, 2023), 'Advancing Prosperity'.

27 David, P. A. (1990). The dynamo and the computer: an historical perspective on the modern productivity paradox. *The American Economic Review*, 80(2), 355-361.

28 Brynjolfsson, E, Rock, D and Syverson, C (2021) 'The Productivity J-Curve: How Intangibles Complement General Purpose Technologies', *American Economic Journal: Macroeconomics*, 13 (1): 333-72.

29 Productivity Commission (Vol 5 p. 1, 2023), 'Advancing Prosperity'.

have declined over time in Australia.<sup>30,31</sup> Addressing barriers to firm entry and exit, labour mobility and competition more generally will help fuel the take up of new technologies and ideas.

Complementary public investments can help realise the benefits of data and digital technologies. This includes ensuring accessible, secure and inclusive digital platforms through ongoing and sustainable government investments and coordination in connectivity and cyber security. Infrastructure Australia has assessed that almost half of Australia's regions have digital infrastructure gaps, and the Government has made additional investments in the National Broadband Network and in the mobile and broadband connectivity and resilience of regional Australia.<sup>32</sup> Enabling policy may also include programs to help businesses adopt new technologies, like artificial intelligence.

Australia's identity system is another critical piece of national infrastructure that enables core government functions and the broader economy. Solutions like Digital ID provide a voluntary and secure means of digital verification, and the Government is supporting broader use through reforms and enabling legislation.

Underpinning many new technologies is the large-scale collection of data about people, systems and services by businesses. These datasets are a valuable input into models that maximise consumer engagement and have enabled platforms like Amazon, Netflix and Meta to appropriate a large consumer share. As these datasets become an increasingly important driver of innovation, they have become products in their own right, supporting services like advertising and market research. However, this commercialisation of data has implications for the protection of consumer rights, privacy and security, as well as regulation of competitive markets. The ethical implications of increasing uses of data, algorithms, and artificial intelligence to shape consumer choices and automate business interactions are also attracting greater scrutiny.

Regulatory frameworks must continue to evolve in the face of technological change, as they have done in the past. This includes ensuring consumers benefit from the data held about them and providing for appropriate privacy and security protections. Better use can also be made of government data, with appropriate protections, as through the *Data Availability and Transparency Act 2022*. The Productivity Commission has recommended policy changes to address gaps in protections for platform workers (or 'gig workers'), and the Government is currently consulting on changes to empower the Fair Work Commission to better support employee-like arrangements. The Government also has a role in empowering Australians to have safer and more positive online experiences, with investments in this Budget supporting the ongoing role of the eSafety Commissioner.

30 Andrews, D., & Hansell, D. (2021). Productivity-Enhancing Labour Reallocation in Australia. *Economic Record*, 97(317), 157-169.

31 Hambur, J., & Andrews, D. (2023). Doing Less, with Less: Capital Misallocation, Investment and the Productivity Slowdown in Australia (No. rdp2023-03). Reserve Bank of Australia.

32 Productivity Commission 2023 *Advancing Prosperity: Volume 4, Data and Digital Dividend*.

Finally, new technologies offer tremendous scope for improvements in the efficiency and quality of government provided and funded services. This includes the care and support economy where, as discussed in the preceding section, better use of technology can free up more time for the human aspect of care work and support improved outcomes in settings that best meet individual needs and preferences. The health and education systems more broadly stand to benefit from technologies that make better use of the scarce time of workers in these sectors, and that harness new ways of delivering services that are more flexible and responsive to individual circumstances.

Predicting the future of technological change is inherently hard. As with past changes, it is likely that the nature but not the quantum of work will change. A responsive skills system will help set Australians up to respond to that change and share the benefits of it. A dynamic and competitive business environment and fit for purpose policy will further make sure that Australia is well positioned for change.

## Climate change and the net zero transformation

Australia's economy will be reshaped by global and domestic actions to meet emissions reduction commitments and the physical impacts of climate change. Over 150 countries have now committed to net zero, and many are taking steps to transition away from fossil fuels and towards cleaner sources of energy. This implies significant shifts over time to the size of some markets and to global patterns of trade, which will, in turn, impact the products and commodities Australia will provide to the world.

Physical impacts of climate change on ecosystems, infrastructure, food production, economies, health, and livelihoods are already becoming more apparent. The globe has already warmed 1.1 degrees Celsius on average over pre-industrial levels.<sup>33</sup> Insufficient action on climate change could place significant pressures on how we live and work, damage the economy and give rise to mounting fiscal costs.

Achieving the net zero transformation represents one of the most significant economic structural shifts since the Industrial Revolution. It comes with challenges, but also significant growth opportunities for the Australian economy and will accelerate significant investment in capital, people and communities.

## Embracing opportunities in the net zero transformation

The world needs to reduce emissions and reach net zero to limit the impacts of climate change. The latest findings of the Intergovernmental Panel on Climate Change make clear that deep, rapid, and immediate greenhouse gas reductions are needed to limit warming to 1.5 to 2 degrees Celsius. Under the 2015 Paris Agreement, countries agreed to put forward and maintain commitments to address emissions through Nationally Determined

<sup>33</sup> IPCC, 'Summary for Policymakers', in *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge 2021.

Contributions (NDCs). Over 170 countries have lodged updated NDCs, with many having recently strengthened their commitments.

Countries are deploying a range of policies to mitigate against climate change (see also *Statement 3: Fiscal Strategy and Outlook*). The European Union's Emissions Trading System is now being integrated with a new Carbon Border Adjustment Mechanism to manage competitiveness implications of stronger mitigation. Globally, direct investments in renewable energy and clean energy technology are taking a more prominent role, including through the United States' US\$369 billion *Inflation Reduction Act*, the EU's €250 billion green industrial package, and Canada's C\$80 billion package for clean energy, clean technology manufacturing and hydrogen. Strengthened regulatory interventions, such as new fuel efficiency standards in the United States and New Zealand, are also significant elements of international responses. Together these policy shifts are bringing down the costs of technologies that will enable net-zero emissions and increase the penalties associated with inaction.

Australia has an important role in this historical global economic transformation. In 2022, Australia updated its NDC to include a strengthened commitment to reduce emissions by 43 per cent from 2005 levels by 2030 and reaffirmed a commitment to net zero by 2050. Australia is also committed to playing a constructive leadership role to advance ambitious climate action in the region, including by supporting its partners to adapt to the impacts of climate change and to carry out their own orderly energy transitions.

The net-zero transformation will create new opportunities in emerging green industries that will facilitate a decarbonised global economy. Australia has the resources, knowledge, and experience to seize the resulting opportunities, including in low emissions technologies that flow from the global transformation, critical minerals, and in broader industries. Australia's future prosperity will depend on how quickly and how well the economy adapts to these changes. Delayed action will increase the cost of transformation and could reduce the competitiveness of some of Australia's industries, particularly given the scale of direct investment in clean energy technology in other jurisdictions.

Transitioning the economy towards cleaner, cheaper forms of energy will be structurally important to the competitiveness of Australia's economy. Energy is an important input for many business activities, as well as to household living costs. This means the cost of Australia's energy supply has a substantial impact on the overall competitiveness of Australia's economy and the ability for output to grow. Reducing barriers to entry and investment will be essential to ensuring this period of change generates greater dynamism and competition within the economy, and to provide opportunities for traditional and emerging industries.

Australia's endowment of critical minerals and cheap, clean energy positions it to be a key supplier of low emissions technologies across the supply chain. For example, Australia's abundance of renewable energy resources could see the production of green hydrogen at scale become more commercially viable in Australia than in many other countries. Furthermore Australia's announced pipeline of hydrogen projects represents

close to 40 per cent of all global clean hydrogen project announcements, and underlines Australia’s potential to be among the global leaders in hydrogen.<sup>34</sup>

Global action is already driving shifts in trade and investment patterns, rapidly increasing demand for critical mineral commodities and creating new opportunities for Australian firms to move up the value chain. Australia is well placed to seize these opportunities and has some of the world’s largest reserves of commodities and critical minerals that will enable the global economy to decarbonise. Australia is the largest producer of lithium, the third largest producer of cobalt, fourth largest producer of rare earths, and houses almost a quarter of the world’s nickel resources. These commodities are essential inputs to products such as electric vehicles and batteries and global demand for lithium and nickel is expected to grow around 40 times from 2020 to 2040.<sup>35</sup> Australia also has a comparative advantage in renewable energy generation. Success in transforming our economy to meet new demand for low-emissions products will also be key to enabling international partners to meet their emission targets.

Refinement, manufacturing, processing, reusing, and recycling all present new industry and employment opportunities. For example, large scale uptake and manufacture of batteries will be necessary in the transition to net zero, and Australia has a rich endowment of key input materials including lithium, nickel, cobalt, manganese and graphite. Bolstering Australia’s battery manufacturing capability presents an opportunity to create jobs, contribute to economic growth and diversify geographically concentrated global battery supply chains.

Many existing emissions-intensive facilities are in regional areas that are well placed to capture green industry opportunities. For example, iron ore is expected to remain an important commodity for Australia, given its natural endowment and the continuing global demand for materials. As renewable technologies become more commercially feasible, the cost of processing iron ore into green steel is expected to become viable, with Australia possessing an energy-cost advantage given its abundance of natural resources. Realising these opportunities will require regional areas to attract significant investment, build up relevant skills and manage complex changes in infrastructure. Effective co-ordination of investment, industry growth and engagement with each level of government will be key.

While more action is needed, the Government’s policies support an orderly transition towards net zero, and help provide the certainty that businesses, households and global partners need for a dynamic and sustainable economy (*Statement 3*). Among these the Government’s reforms to the Safeguard Mechanism ensure Australia’s largest emitters remain internationally competitive within a decarbonising global economy while contributing to the emissions reduction task. Further, the Government is developing a Sustainable Finance Strategy which will include regulatory reforms to increase the transparency and credibility of Australia’s growing sustainable finance market. This will

<sup>34</sup> DCCEEW 2023, *State of Hydrogen 2022*, Australian Government Department of Climate Change, Energy, the Environment and Water.

<sup>35</sup> IEA 2021 *The Role of Critical Minerals in Clean Energy Transitions*, World Energy Outlook Special Report.

enable investors to confidently align their investment decisions with net zero emissions targets and increase the flow of capital toward new opportunities that support Australia's net zero pathway.

The net zero transformation has created opportunities for clean and cheap energy to become Australia's competitive advantage and for the emergence of new clean energy industries, such as hydrogen and critical minerals, to drive clean jobs. But capturing these opportunities requires significant investments across the economy by governments and businesses, including in electricity transmission, generation, and storage.

The net zero transformation will incentivise investments in hydrogen and critical minerals, and require support for regions and industries through the transformation. The Government is making significant investments in support for the transformation to capture these opportunities (see *Statement 1*). The Government will continue to assess the implications of intensifying global competition for clean energy industries in Australia.

### **The electrification and energy efficiency challenge**

Decarbonising the economy will require large investment across most sectors and industries. One of the most important areas where investment will be required is the electricity sector. In Australia it will be necessary to simultaneously increase the quantity of electricity supplied to the system each year, while shifting to a renewable electricity grid.<sup>36</sup> Both require large, coordinated investments in energy infrastructure. While these changes are immense, clear policies will give businesses, households and global partners the ability to plan, helping ensure a vibrant and sustainable economy.

Electrification is critical to decarbonising the economy. As demand for fossil fuels is replaced with demand for electricity to support transport, industry, offices and homes; electricity generation will need to at least double by 2050.<sup>37</sup> And this figure may under-estimate the necessary increase in new capacity given the potential need to support new, large-scale export industries such as hydrogen or green steel production.

With further investments Australia has the potential to become a global leader in renewable energy. There are opportunities to expand onshore and offshore wind, solar, and green hydrogen production in Australia. This could help underpin a comparative advantage in low emissions industries and exports. However, by some estimates this will require accelerated investment in industry technologies and energy efficiency, by around 81 per cent more than business as usual.<sup>38</sup>

The increase in demand arising from electrification can be offset through 2 key pathways. The first is improving energy efficiency, including by mandating greater energy efficiency

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36 AEMO 2022, *Integrated System Plan for the National Electricity Market*.

37 AEMO 2022, *Integrated System Plan for the National Electricity Market*.

38 Climateworks Centre and Climate-KIC Australia 2023, 'Pathways to industrial decarbonisation: Positioning Australian industry to prosper in a net zero global economy', Australian Industry Energy Transitions Initiative, Phase 3, Climateworks Centre.



in building codes, encouraging more energy efficient lighting solutions, and improving low energy intensity transport options. The second is by optimising time of use toward periods with abundant renewable energy, specifically during daylight hours with abundant solar resources. For example, as electric vehicle uptake accelerates, providing charging facilities in workplace car parks would lead to more charging during daylight hours, which in turn reduces demand at peak demand and low-renewable times during the evening.

Even with energy efficiency and demand shifting measures, a substantial transformation to the energy grid will be required. The Australian Energy Market Operator’s Integrated System Plan highlights the scale of this challenge. Under its Step Change<sup>39</sup> scenario, 44 GW of new capacity will be required between now and 2030–31, and another 154 GW by 2050 (Chart 4.10). Renewables supply electricity more intermittently. As such, significant storage capacity will be necessary for firming the system with dispatchable and consistent electricity supply throughout the day as carbon-intensive technologies are phased out. Investments will need to increase current utility-scale wind and solar capacity 9-fold by 2050, build new transmission lines to connect states and new renewables, and install solar panels on over half of all Australian households’ rooftops.

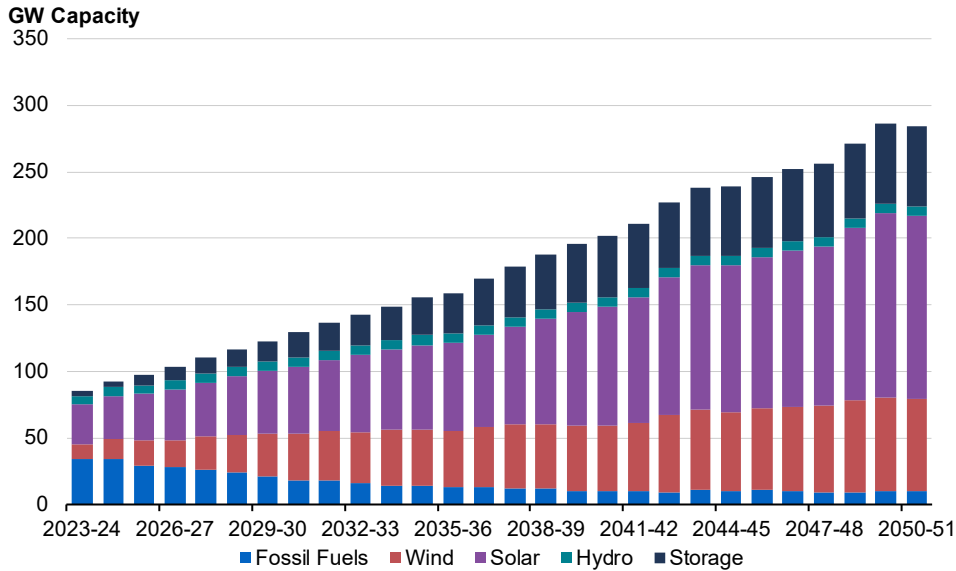
Peaking gas-fired capacity may also be required to support the firming of the system with around 9 GW forecasted to still be in the NEM by 2050 under the Step Change scenario. The flexibility of gas as a firming fuel and a key manufacturing input will be required as the transition accelerates domestically, and in our region. Gas supply also assists Australia and its international partners to process critical minerals and manufacture the wind turbines, batteries and other clean energy technologies that will play a critical role in reaching net zero emissions.

To achieve the Government’s target of an 82 per cent renewable electricity grid by 2030, investment in electricity generation, transmission and storage infrastructure will need to accelerate. While this target is ambitious, Australia has deep renewable energy resources, and as technology costs decline, renewable energy will continue to be a cheap source of energy that can underpin Australia’s competitiveness in new green industries.

Achieving the target requires effective coordination across governments, market operators and private sector entities. This will involve the securing of complex and competitive supply chains in a short period of time, reliable, low-cost financing arrangements, consensus within relevant communities, and a significant increase in high-skilled technical employment.

<sup>39</sup> The AEMO has modelled a few potential scenarios to the energy transformation. The Step Change scenario has been described as most likely by stakeholders. It describes a rapid, consumer-led transformation with coordinated action to limit global temperature increase to 2 degrees Celsius.

**Chart 4.10: Generation capacity, National Electricity Market, 2023–24 to 2050–51**



Source: AEMO ISP Step Change scenario 2022

### Growing a green workforce for a decarbonised economy

The net-zero transformation will see new job opportunities arise with the introduction and expansion of green industries. For example, already almost half of industry groups are involved in a green value chain, according to the former National Skills Commission.<sup>40</sup> Labour market shifts will occur not only across specific industries but also within them, as workers will spend more time focused on tasks relating to decarbonisation and the net zero transformation.

The scale of the transformation will see job opportunities spread across the labour market, reaching many industries, occupations, and regions. Supporting the transition for the National Electricity Market alone requires an extra 12,000 workers in just 2 years to 2025, from the current level of about 45,000.<sup>41</sup> Direct full-time employment in renewable energy activities has already increased sharply.<sup>42</sup> Employment increased by 120 per cent from 2009–10 to 26,850 full-time workers in 2018–19, with rooftop solar systems accounting for

40 National Skills Commission 2022, Australia’s current, emerging and future workforce skills needs. The NSC identified 99 out of 213 industry groups at the 3-digit level of the Australian and New Zealand Standard Industrial Classification (ANZSIC) as being involved in the green value chain.

41 Race for 2030, The Australian Electricity Workforce for the 2022 Integrated System Plan: Projections to 2050, [ISP Workforce Projection \(racefor2030.com.au\)](https://www.racefor2030.com.au).

42 ABS 2020, Employment in renewable energy activities, Australia.

most energy related employment.<sup>43</sup> Treasury analysis has found that the share of green jobs (those related to wind or solar) among online advertisements has approximately doubled between 2012 and 2020. The analysis also found evidence of a 5 per cent wage premium for green jobs compared to non-green jobs in equivalent occupations and locations. This illustrates both the demand for these roles and the skill level needed for the net zero transformation workforce.

Well-defined emissions mitigation and adaptation measures can support opportunities in growth areas and reduce the likelihood that workers impacted by the net zero transformation move to occupations with lower hours or mismatched skill levels or exit from the labour force. Jobs and Skills Australia is completing a Clean Energy Capacity Study to provide evidence and insights to support the workforce transition as the clean energy sector expands.

The Australian Government will also establish a new national Net Zero Authority with responsibility for promoting the orderly and positive economic transformation associated with achieving net zero emissions. The Authority will work across governments and with workers, companies, investors and communities to facilitate economic development and diversification.

## Adapting to a changing environment

Although there are global efforts to reduce emissions, the climate will continue to change in response to greenhouse gases that are already in the atmosphere and those released on the path to net zero. IMF estimates suggest that if temperatures are allowed to increase by 3.4 degrees Celsius above 2014 levels by 2100 with no mitigation, then global GDP will be 7 per cent lower compared to baseline scenarios which keep warming to 1.6 degrees Celsius.<sup>44</sup> Additional reductions in emissions by Australia and other countries will help lower the magnitude of the increase and the likelihood of climate-related impacts. Nevertheless, over this century these physical impacts of climate change will increasingly affect Australia's economy as governments, businesses and households adjust their behaviour in response.

CSIRO and the Bureau of Meteorology have projected that even with a reduction in emissions, it is extremely likely that hot days will become more frequent and more severe. The impact of rising temperatures and seas is already being felt across Australia through the increased frequency and severity of extreme weather events including heatwaves, floods, heavy rainfalls, storms and drought. These events can cause severe damage to affected regions, disrupt economic activity and supply chains, add to the cost of doing business, and impose substantial ongoing fiscal costs of disaster relief (see *Statement 3: Fiscal Strategy and Outlook*).

<sup>43</sup> ABS 2020, *Employment in renewable energy activities, Australia*.

<sup>44</sup> Kahn, M.E., Mohaddes, K., Ng, R.N., Pesaran, M.H., Raissi, M. and Yang, J.C. (2019) 'Long-term macroeconomic effects of climate change: A cross-country analysis', International Monetary Fund.

The physical impacts of climate change will also affect workers through harsher working conditions. The International Labour Organisation has estimated that an average 1.5 degree Celsius temperature rise by 2100 could equate to a global labour productivity loss equivalent to 80 million full-time jobs by 2030 due to increased heat stress.

The physical impacts of climate change will also affect different regions and industries in different ways. Some industries such as agriculture, transport, construction and in some instances, mining are more likely to be impacted by natural disasters and extreme weather events than others. By some estimates, climate change has reduced wheat yields by 27 per cent since 1990 and average farm profits by 23 per cent in the last 20 years.<sup>45</sup>

Continued investment and planning in climate change adaptation and resilience will be important in reducing the economic and fiscal costs of the physical impacts of climate change and natural disaster events. The Government is developing a national approach to identifying and responding to climate risks across Australia. The National Climate Risk Assessment (NCRA) will provide a baseline of known risks and impacts, and enable ongoing monitoring of climate risks, evaluation of the effectiveness of adaptation action, and evolution of responses over time. A National Adaptation Plan will respond to the urgent climate risks identified in the NCRA with an agreed, nationally consistent pathway for adaptation action in Australia and practical, evidenced based actions to reduce climate risks.

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<sup>45</sup> PC 2023, 5-Year Productivity Inquiry Report, Volume 6: Managing the Climate Transition.

## Making the most of structural shifts

Australia has a strong record of successfully responding to and embracing major changes in our society, technology, and the world. Over the coming decade and beyond, Australia's economy will be reshaped by the growing care and support economy, expanding use of data and digital technology, and climate change and the net zero transformation.

Understanding and anticipating these changes will ensure that policy settings can again be adapted and refined to make the most of these opportunities and challenges. These shifts also present both challenges and opportunities for gender equality and inclusion and require a specific focus on ensuring that the benefits are fairly distributed and risks for different groups addressed. The challenges outlined are diverse, but at their core, they present opportunities for Australia that can be harnessed through a suite of complementary efforts.

Well-functioning education, training and labour market systems, including a responsive migration program, will play a critical role. These systems will provide the economy with the skills it needs to meet growth in care and support, data and digital, and green jobs. A responsive and accessible skills system and labour market will also ensure structural shifts broaden rather than narrow the opportunities for those in the labour market, wherever they are in their careers.

Fostering dynamic and competitive markets, with complementary investments in enabling public infrastructure and the regulatory environment, will tackle productivity challenges and better realise the benefits of structural shifts. Fit for purpose policy and market settings will better diffuse best practice in both public and private sectors, lifting quality and access to care and support services, and the adoption of new digital and green technologies. Responsive regulation can also manage competition and privacy concerns arising from technological development and ensure responsive consumer and worker protections.

A sound and stable policy environment also allows market participants to plan with more confidence. This is particularly important for the net zero transformation, underscoring the importance of policies such as the safeguard mechanism and legislated commitments. Certainty around the pathway to the net zero transformation will help encourage private investment and position Australia to make the most of significant new opportunities. More broadly, clear and careful policy design will allow communities, businesses and individuals to adapt and prosper in the face of profound structural shifts.

The 2023–24 Budget is laying the foundations for a stronger, more inclusive, and more sustainable economy. A key part of this is responding to these major structural shifts that are shaping the economy, and that will have an important bearing on growth prospects and public finances in the years ahead. Continued investments in the skills system, in dynamic, competitive, and well-functioning markets, and in a sound and stable policy environment, will help ensure Australia is well placed to capitalise on the opportunities that come with these shifts and to handle the challenges.