



A Blueprint for Better, Cleaner Jobs.

Industrial strategies for the
post-carbon economy.

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with **Sam Ibrahim**

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**Centre for
New Industry**
A **percapita initiative**

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About the Centre

The Centre for New Industry is an applied research centre that aims to propose policy solutions that support a mission-oriented approach to industrial policy, and advocate for economic diversification, decarbonisation and democratisation.

We believe that Australia needs a vision of the future that provides greater employment opportunities for workers and their families, greater stability and security for regional communities, and better equips Australia to respond and adapt to economic and industrial change.

About the authors

Shirley Jackson is the Director of the Centre for New Industry and a renowned policy expert in the fields of industry policy, employment, and skills formation. His work has helped shape new approaches to industrial development and is widely cited by government and media sources. Shirley has extensive experience in not only thought leadership and public policy, but has spent a decade working in government engagement, political campaigning, and stakeholder relations. This expertise is grounded in years of lived experience relating to the issues that he is so passionate about.

Prior to his public facing work, Shirley spent years working in warehousing and logistics, hospitality, retail, academia, the print industry and being unemployed. These experiences have guided Shirley's research and policy work, and shaped his approach to inclusive, participatory methodologies.

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Executive Summary

The political, ecological and economic challenge of decarbonising Australia's energy and industrial base is crying out for leadership. The next five to ten years are crucial to ensure that the worst outcomes of the climate crisis are mitigated, and we have a unique opportunity to reframe our economy in the interests of the people who work within it.

This report aims to provide insights and options to policy makers, so that we can both confront the challenges and seize the opportunities of action on climate change. We must start by acknowledging that there are no easy answers, no quick fixes to our ecological and economic predicaments, but the evidence shows that there are credible options available if we have the collective will to implement them.

The first section of the report outlines the case for a renewed focus on the role of government in managing a swift and secure structural adjustment to a post-carbon economy. We consider how previous structural adjustments have been managed and outline the macroeconomic policy levers that need to be utilized in order to flip the

switch on the new economy: industry policy, skills formation, new industrial models, infrastructure spending and social procurement policy.

The second section makes the case for *better* jobs, with skilled pathways into employment that provide certainty, security and stability for workers and their families. We argue that only by investing in workers and their communities can the shift to a net-zero carbon economy avoid the unemployment, underutilisation and insecurity that previous structural adjustments have created.

In the third section, we turn our attention to the *cleaner* jobs that will come through an industrial diversification project, not just in renewable energy but also in battery technology, additive and advanced manufacturing, regenerative land care and rare earths.

Finally, we conclude with concrete recommendations that the federal government must implement as soon as possible after the coming election, in pursuit of a safe and prosperous future for all Australians.

Key recommendations

1. Convene a Climate Summit
2. Set ambitious interim emissions targets
3. Establish A Federal Transformation Authority
4. Establish a Clean Transport Commission
5. Set concrete targets for the energy mix
6. Create sector specific industry plans
7. Kickstart a research revolution
8. Create targeted incentives in Renewable Energy Zones
9. Support small and medium enterprises to take advantage of new supply chains
10. Audit and review the private provision of vocational education and training
11. Restore TAFE funding to pre-2013 levels

Lidell power station in Muswellbrook, NSW will close in 2023, the closure of Yallourn in Victoria's Latrobe Valley has been brought forward to 2028 and AGL has announced that they would bring forward to closures of their Victorian Loy Yang A power plant and their Bayswater plant in NSW's Hunter Valley by seven years.⁵ The final nail in the coffin came with the announcement that Eraring, Australia's largest coal-fired power station which produces 2% of our electricity, will be closing in 2025, a full 7 years earlier than anticipated.⁶ This move alone threatens the lives and livelihoods of 500 workers in NSW's Central Coast, placing them in the list of more than 7,000 workers who have already been, or soon will be, affected by these rapid, poorly planned closures.⁷

Additional pressures are being felt in carbon heavy industries. Alcoa, one of Australia's leading producers of aluminium, announced in 2021 that they were at risk of closing their smelter in Portland in Victoria's far south west, citing the uncertainty of energy generation as a key factor.⁸ This smelter provides 500 workers with employment directly, and contributes to an additional 2,000 jobs in downstream industries. In a community of 10,000, this closure would have disastrous effects on the local economy.

The threat of climate change and worse to come is also having an unprecedented effect on our mental health. Recent research shows that high levels of concern about climate change are felt

by all Australians, regardless of gender, age, or location, and that this concern is having devastating impacts on our lives.⁹ In short, climate anxiety is leading to widespread hopelessness across the country.

That's why this report is about hope. On one level, it has been written to assist policy makers in a renewed focus on industrial development, building a strong evidentiary basis for a policy agenda that promises to stimulate our economy, encourage new industries, and reduce inequality, all while reducing our emissions and impact on the earth. But at a more fundamental level, this report is about delivering a better future that Australians can hope for.

We need a better future that provides greater employment opportunities for workers and their families, greater stability and security for regional communities, and makes Australia better equipped to respond and adapt to the uncertainty of the future. This report is designed to assist policy makers and politicians deliver for our communities.

Our unique country, with a vast land mass and low population density, requires unique economic solutions. While lessons can be learnt from successes and failures in other countries, we need to chart our own course, acknowledging our unique challenges and advantages.

⁵ Briggs, C., Hemer, M., Howard, P., Langdon, R., Marsh, P., Teske, S., & Carrascosa, D. (2021). *Offshore Wind Energy in Australia*. July; Hannam, P. (2022, February 10). AGL brings forward closure date of two largest coal-fired power plants as market shifts to renewables. *The Guardian*. <https://www.theguardian.com/australia-news/2022/feb/10/agl-brings-forward-closure-date-of-two-largest-coal-fired-power-plants-as-market-shifts-to-renewables>

⁶ Ibid.

⁷ Ludlow, M., & Macdonald-Smith, A. (2022, February 17). Plan needed for exit of thousands of coal workers: unions. *Australian Financial Review*. <https://www.afr.com/companies/energy/plan-needed-for-exit-of-thousands-of-coal-workers-unions-20220217-p59xcl>

⁸ ABC News. (2021). Portland Aluminium smelter thrown \$150m government lifeline to secure its future. *ABC News*. <https://www.abc.net.au/news/2021-03-19/portland-aluminium-smelter-deal-state-federal-governments/13261804>

⁹ Patrick, R., Garad, R., Snell, T., Enticott, J., & Meadows, G. (2021). Australians report climate change as a bigger concern than COVID-19. *The Journal of Climate Change and Health*, 3, 100032. <https://doi.org/10.1016/J.JOCLIM.2021.100032>



Above all else, we need hope. We need leaders who are capable of doing what is necessary, regardless of the criticisms levelled from their political rivals, and who are able to provide certainty in increasingly uncertain times. These compounded crises have crystallised the need for an economic development plan that provides for all in the complex and shifting landscape of the coronavirus crisis and the ongoing environmental catastrophe.

We need plans for affected communities that are based on concrete, deliverable employment pathways, tied to specific industries, in specific locations: not just broad narratives about 'backing in regional workers'. We need to reconfigure the apparatus of government and reimagine what economic policy making could be.

This is the challenge before us as a nation that is already feeling the impact of climate change more

acutely than most, and which stands to gain more than most by tackling it. We can only confront it together.

Moving to a post-carbon economy

Following a tense campaign that put climate change front and centre, newly elected Prime Minister Anthony Albanese declared that the climate wars were over. While this was a welcome change from the previous government's position, there is much to be done to repair Australia's reputation on the global stage. While savage storms ripped across most of the east coast, bringing a renewed focus on the way that climate is affecting our lives and our landscape, then Prime Minister Scott Morrison's trip to Glasgow to attend the COP26 climate conference was marked by disappointment. Rather than join the global call to reduce emissions and curb fossil fuel

production, our government chose a different path.

This path, which is also being trod by other fossil fuel dependent economies is founded on a kind of political cognitive dissonance. While the former Prime Minister proclaimed to the assembled delegates in Glasgow that Australia could easily pass a 35% reduction in emissions by 2030 without needing to mandate the changes, domestically the government has as many as 116 new coal and gas ventures (each worth at least \$50m) under development or in consideration.¹⁰ In the face of scientific consensus and an increasing global commitment to credible action on climate, the government has produced a political pamphlet that extolls the benefits of carbon capture and places emphasis on the 'net' portion of the phrase 'net zero emissions'.

The global debate on the need for action on climate change is all but over, with a significant number of the world's largest economies, including three of our top four trading partners,¹¹ committing to net zero by 2050, and some as soon as 2030.

As the famed author and key advisor to China and the European Union (EU) on energy transformations, Jeremy Rifkin, has shown, the market is changing.¹² Financially, fossil fuels are becoming less stable and are subject to increasing risk. Indeed, an influential report published by Citigroup's Taskforce on Climate-related Financial Disclosures (TCFD), which conducted an analysis of the trends associated with climate change and fossil fuel production, found that the industry currently holds stranded assets of more than \$100 trillion in pipelines, ports, power plants, and ocean drilling platforms - assets which it believes are overvalued and represent significant risks to any investors.¹³

Recognition of the necessary and inevitable shift to a renewable-powered economy has spread quickly through the corporate boardrooms of Australian industry in recent years, with many of the largest companies in our economy, including steel giants Orica and Bluescope steel and resource companies like BHP and Fortescue, committing to energy diversification with significant investment in renewables and green steel supplemented by internal net zero targets for their own companies.

As we showed in our 2019 report *At The Coalface: Work, Community and Climate Change*,¹⁴ the structural changes in our energy sector will have ramifications not only for our economy and the health of the planet in coming decades, but they will be felt intensely and personally by people in regional coal mining communities like Mackay, Central Queensland and the Hunter Valley. We estimated that, without managing industrial change effectively, over \$66million in weekly wages would be taken out of three coal communities in regional Australia, with devastating consequences for local economies. This equates to a total economic loss across just three regions of almost \$3.45 billion annually.

While there are some who would use the plight of these communities for political point scoring, these are real people who deserve better. Whether due to automation, offshoring or obsolescence, regional workers have been at the coal face of the globalised economy since the 18th century. The current debate about climate change is apparently a line in the sand for coal mining communities: they are saying they refuse to bear the brunt of industrial upheaval again and are unwilling to see their economic security sacrificed, however important the goal. We must understand what these regional communities value, what they fear and what they need before decisions are made that affect the lives of thousands of working families.

As Australia moves towards a post-carbon economy, we must enact industrial policies that will ensure that there are secure, reliable, well-paid jobs for those communities who, too often, bear the brunt of industrial change and economic progress.

That's why this report is about hope. On one level, it has been written to assist policy makers in a renewed focus on industrial development, building a strong evidentiary basis for a policy agenda that promises to stimulate our economy, encourage new industries, and reduce inequality, all while reducing our emissions and impact on the earth. But at a more fundamental level, this report is about delivering a better future that Australians can hope for.

¹⁰ Murphy, K. (2021). Scott Morrison tells Cop26 Australia will exceed 2030 target in bid to fend off criticism. *Guardian (Australia)*. <https://www.theguardian.com/environment/2021/nov/02/scott-morrison-tells-cop26-australia-will-exceed-2030-target-in-bid-to-fend-off-criticism>;

¹¹ The US, Japan and South Korea have all committed to net zero emissions in 2050, including large scale investment in renewable technologies and ambitious 2030 emissions reduction targets of 50%, 46% and 40% respectively (See <https://www.theguardian.com/us-news/2021/apr/22/us-emissions-climate-crisis-2030-biden>, <https://apnews.com/article/joe-biden-climate-yoshihide-suga-carbon-neutrality-summits-3690e8078574dd69de658c60b6d4a167> and <https://www.reuters.com/world/asia-pacific/skorea-raise-emissions-reduction-goal-40-by-2030-2021-10-08/>).

¹² Rifkin, J. (2019). *The Green New Deal: Why the Fossil Fuel Civilization Will Collapse by 2028, and the Bold Economic Plan to Save Life on Earth*. St Martin's Publishing. https://www.google.com.au/books/edition/The_Green_New_Deal/KkCLDwAAQBAJ?hl=en&gbpv=0

¹³ Citigroup. (2015). *Finance for a Climate-Resilient Future: Citi's TCFD Report*.

¹⁴ Jackson, S. (2019). *At The Coalface: Community, work and climate change*.



Background

External crises have major effects on national economies. Whether it's a resource crisis like the oil shock of the 1970s or a pandemic like COVID-19 that has swept the world over the last two years, globally integrated, open market economies like Australia's are inherently susceptible to externalities.

However, these exogenous shocks are also a time for reflection and renewal. In the current context, Australia is faced with a choice: on one hand, we can remain resolute in our continued belief that a resource driven economy supported by services will 'snap back' and perform better than before, and that we can invest in natural gas and carbon capture technologies to combat a rapidly changing climate.

On the other is a sober realization that, while our resource boom has undoubtedly boosted Australia's economic fortunes, it has also left our economy in a state of arrested development, entrenching our dependence on a single industry and reducing our capacity to address climate change.

As the current crisis has laid bare the deficiencies in our economy, it is up to all of us to build a better economy that works for all Australians, and realize that diversifying the economy through active support measures for non-resource industries is once again, and indeed always has been, an urgent priority.

Australia's industrial landscape has undergone many changes in the 120 years since federation, and has become a modern globalised economy, open to export and trade with key regional and international partners.

Yet, despite the promise that this brave new world of economic opportunity would lead to prosperity for all, Australia's economy has become increasingly crisis-prone and has failed to provide safe and secure livelihoods for millions of Australians.

An over reliance on mineral commodity exports and service industries has led to a situation where the Australian economy, and the people who work in it, are remarkably susceptible to exogenous shocks, a weakness which has been on full display during the coronavirus crisis.

While the pandemic and its social impact laid bare the deficiencies in our economic agenda, the problems associated with this overreliance have been readily observable since the turn of the century. Between 2002 and 2012, the Reserve Bank of Australia (RBA) estimates that the price paid for Australia's extractive economy more than tripled, as investments in the sector grew from 2 to 8% of GDP.¹⁵

However, while prices in mining grew, the Australian dollar appreciated significantly. An increase in the value of our dollar had some

¹⁵ Downes, P. M., Hanslow, K., & Tulip, P. (2015). The Effect of the Mining Boom on the Australian Economy. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2701080>

benefits for the average consumer, as prices of imported goods like smartphones, electronics and fashion dropped. However, this appreciation of our currency hindered our agricultural and manufacturing sectors, further entrenching our reliance on the resource sector.

While jobs in mining reached a peak of 2.3% of the Australian workforce in 2013-14, manufacturing and agriculture combined used to employ a quarter of the Australian workforce.¹⁶ Since the start of the mining boom, this combined employment has fallen to just over 15% - still over seven times the employment rate of mining, but a significant drop.

Australia's economy is not only plagued by the 'Dutch Disease' or 'Resource Curse',¹⁷ where the increased development of a one industry (such as mining) has led to a decline in other important industries (like manufacturing and agriculture), it has become so lopsided that it is making headlines around the world.

In their recently publicised Atlas of Economic Complexity, Harvard University found that despite being ranked 8th in the world for GDP per capita, Australia's economic profile was ranked 93rd for economic complexity.¹⁸ Rather than being compared to complex and innovative economies like Japan, Germany and South Korea, Australia is instead keeping company with developing economies such as Uganda, Senegal and Mali.

Worse still, we are falling in those rankings. Since the time of the GFC, Australia's economic complexity ranking has fallen by 22 places. This means that without diversification, our economy

will continue to be less able to provide for Australians in times of crisis, and our resource dependence will remain vulnerable to external shocks and international crises.

Economic complexity research in Australia has found substantial unexploited 'opportunity value' across the country that could be used to guide effective industry policy.¹⁹ What's needed in order to stimulate the creation of jobs where they are needed is adjustment programs that are tailored to specific conditions and opportunities in regions of high unemployment or where we know major structural adjustments are on the horizon.

The key limitation of economic complexity analysis is that it does not consider relationships, population density and geography. Combining economic complexity with knowledge network analysis and maps of the distribution of current economic activity in specific regions would create a resource that could inform multiple levels of policy-making.

Such a resource could be used to identify industries and locations with the greatest growth potential, in order to effectively direct government resources. Additionally, it would be possible to identify the best opportunities for particular towns or regions that are at risk of, or already have, high levels of unemployment.

Intentionally increasing local and national industrial complexity through strategic industry policy will not only increase employment, make us more resilient and able to withstand future

structural adjustments, it will also reduce social and economic inequality.²⁰

Structural adjustment and technological disruption

It should not be surprising to any keen observer that the people who stand to be most affected by the shift from fossil fuels to renewable energy show hesitancy and significant concern about what it will do to jobs, prices and energy security.²¹ Our relationship to technological change has always been one of anticipation and anxiety, in equal measures. The enticing promise of better, faster and cheaper goods or services has driven technological growth for millennia. Yet from the metallurgical advancements of the bronze age through to the renewable energy revolution of the 21st century, technological development has brought with it disruption, excitement and fear.

This is because technology is not a neutral force within the economy, but is rather embedded with the values, ideas, institutions, and power relations of the place and time in which it is created.²² The steam age brought with it a new method of industrialised production that brought people from the farms of their forebears to factories and mills in new cities founded on industry. It also saw a rise in industrial accidents, a new growth in inequality and exploitation that led to social revolutions across Europe. Similarly, the rise of telecommunications in the computer age saw the descendants of those factory workers move into offices, and the line between work and home, which had been so hard fought for, began to blur

as workers were more accessible and accountable than ever before through digital technologies.

Numerous examples of our complex relationship with advancing technologies, and the political economic context of their creation and usage, are rife throughout our history. Perhaps the most famous example of this intersection between technology and power comes from the Luddite movement, which saw workers smashing advanced textile machinery and burning mills across the industrial north of England in the early 19th century. While this story has become allegorical, and the name Luddite become synonymous with outdated beliefs, it is worth remembering the dire economic situation in which these acts occurred, and their original purpose.

The experience of the Luddites was actually remarkably similar to contemporary circumstances. Despite the popular characterisation, the Luddites were not technologically fearful or inept: in fact, many were highly skilled machine operators who were employed in textile mills across England;²³ and indeed, while work was technologically advanced for the time, they faced a struggle for decent wages and working conditions that most workers in contemporary Australia would find familiar.

During the 19th century, the working families of Britain were feeling the effects of a protracted war with Napoleonic France, compounded by an emerging conflict with the American colonies, resulting in widespread poverty and insecurity in employment. During this time, radical political and industrial action was on the rise, as skilled workers

16 See Figure 1 in the introduction of this paper.

17 Koitsiwe, K., & Adachi, T. (2015). Relationship between mining revenue, government consumption, exchange rate and economic growth in Botswana. *Contaduria y Administracion*, 60, 133-148. <https://doi.org/10.1016/j.cya.2015.08.002>

18 Harvard University. (2022). *The Atlas of Economic Complexity*. <https://atlas.cid.harvard.edu/>

19 Reynolds, C., Agrawal, M., Lee, I., Zhan, C., Li, J., Taylor, P., Mares, T., Morison, J., Angelakis, N., & Roos, G. (2017). A sub-national economic complexity analysis of Australia's states and territories. <https://doi.org/10.1080/00343404.2017.1283012>, 52(5), 715-726. <https://doi.org/10.1080/00343404.2017.1283012>

20 Hartmann, D., Guevara, M. R., Jara-Figueroa, C., Arístarán, M., & Hidalgo, C. A. (2017). Linking Economic Complexity, Institutions, and Income Inequality. *World Development*, 93, 75-93. <https://doi.org/10.1016/j.worlddev.2016.12.020>

21 Energy Consumers Australia. (2021). *Sentiment Survey - June 2021*. <https://ecss.energyconsumersaustralia.com.au/sentiment-survey-june-2021/featured-content/>

22 Mueller, G. (2021). *Breaking things at work: the Luddites are right about why you hate your job*. Verso., pp.22-31; Sadowski, J. (2020). *Too smart : how digital capitalism is extracting data, controlling our lives, and taking over the world*. MIT Press., pp.4-11

23 Conniff, R. (2011, March). What the Luddites Really Fought Against. *Smithsonian Magazine*. <https://www.smithsonianmag.com/history/what-the-luddites-really-fought-against-264412/>

who had been stretched to breaking point under the wartime economy began to demand better treatment and higher wages.²⁴

On the 11th of March 1811, a demonstration against increasing penury amongst the industrial workers of Nottingham was dispersed by armed police on horseback.²⁵ Later that night, angry workers broke into a nearby factory and smashed the machinery they used every day in an act of industrial vandalism.

While equipment was broken in protest, the attacks were not driven by hostility to technology: ‘...machinery was just a conveniently exposed target against which an attack could be made’.²⁶ Crucially, the act of industrial vandalism targeting looms and frames was the Luddites’ tactic, not their goal. After a number of similar incidents occurred across the north of England, Parliament passed the Frame Breaking Act, which made the destruction or damage of textile machinery a criminal act punishable by death.

In his first speech to the House of Lords on the 27th of February 1812, poet and politician Lord Byron spoke to the Frame Breaking Act, noting that:

*Whilst these outrages must be admitted to exist to an alarming extent, it cannot be denied that they have arisen from circumstances of the most unparalleled distress...nothing but absolute want could have driven a large and once honest and industrious body of the people into the commission of excesses so hazardous to themselves, their families, and the community.*²⁷

These sentiments are readily applicable to the contemporary experience of workers affected by technological advancement, automation and insecure employment.

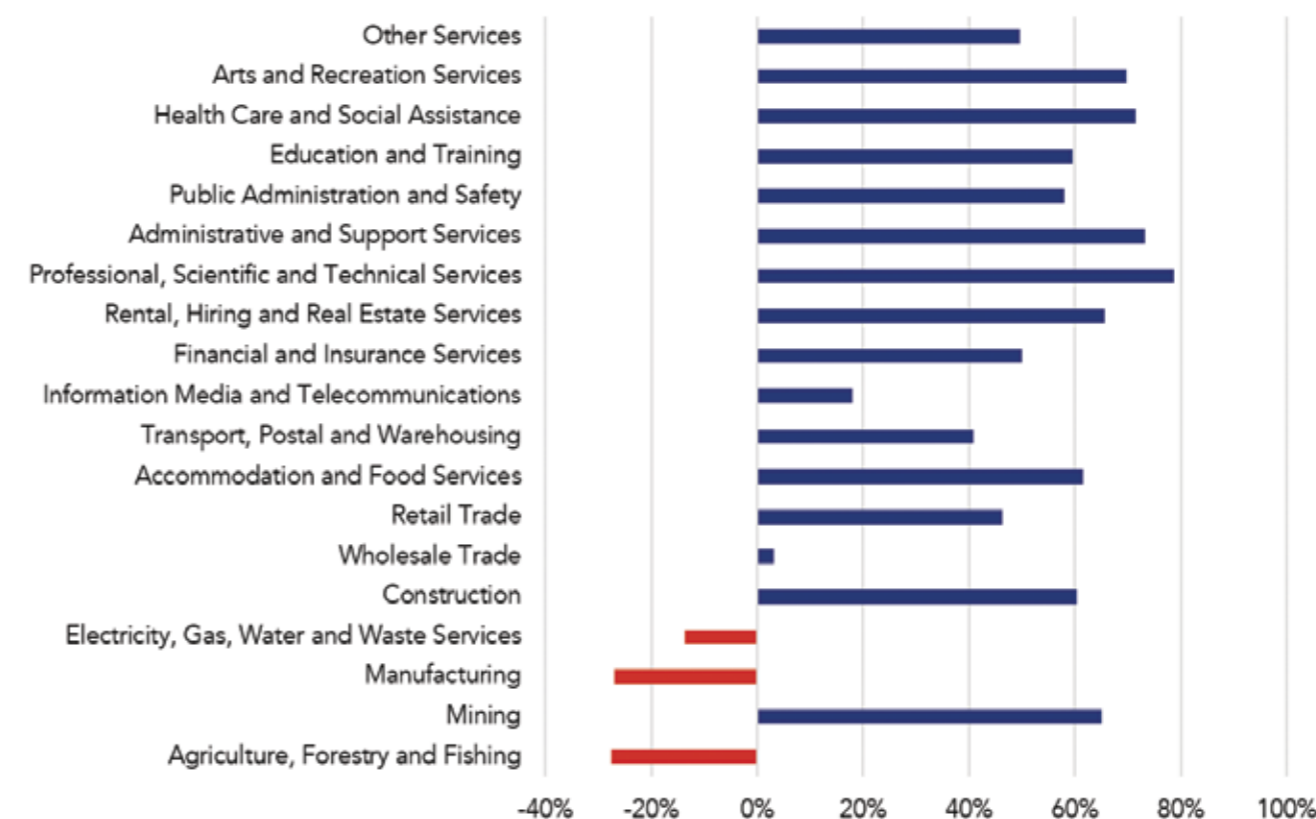
Indeed, the unequal way that technological displacement is distributed throughout the economy has been an evolving conversation within political economy, discussed early on by David Ricardo who wrote in *Principles of Political Economy and Taxation* that he was convinced ‘that the substitution of machinery for human labour is often very injurious to the interests of the class of labourers’.²⁸ While this discourse has continued and evolved across the interceding centuries, it is significant that, with the latest round of structural adjustment and technological displacement due to automation and the need to decarbonise our economy, highly skilled, previously secure and well-paid jobs are under threat of disappearing completely.

Ultimately, we need to be cautious when dealing with the question of technological change, but also be cognisant of potential opportunities. This idea was famously outlined by Austrian economist Joseph Schumpeter, who described the process as *creative destruction*, whereby ‘industrial mutation...incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one’.²⁹

While this theory has been widely cited and applied to describe technological displacement and job creation across the developed world, the realities of the Australian situation have been inconsistent. Technological disruption of the

manufacturing industry and its supply chain has been happening since the 1960s, and the resulting fall in manufacturing jobs as a proportion of the Australian economy has been consistent from the 1980s (see Figure 1).

Figure 1
Industrial Change, by Employment (1984-2021)



Source: ABS, *Labour Force, Detailed, Quarterly, Table 04*.

Between 1985 and 2019, employment in manufacturing fell by almost 10%, while jobs in the utility services (electricity, gas, water and waste) nearly halved. Overwhelmingly, jobs in these sectors were full time, well paid and unionised jobs, with strong regulations covering occupational health and safety, dispute resolution and working hours, and in which workers were employed directly by a firm to carry out skilled work.

Since 1985, while there has been steady growth in demand for the professional, technical and scientific workforce, there has been just as much growth in employment and productivity across the service economy, health and community care, hospitality and retail (Table 1).³⁰

³⁰ While retail trade has remained constant at around 10% of the economy, there have been significant demographic and industrial changes that have led to a growth in insecure work. Throughout much of the 20th century, this industry directly employed full- and part-time employees who were predominantly women to work for large department stores (with large workforces), while the modern retail trade has seen significant growth in young women and men, as well as a growth in older workers. The most alarming changes have come from the near total casualisation of the industry, with significant growth in smaller boutique stores with smaller staff (see Productivity Commission, 2011, pp.9-22).

²⁴ Mueller, G. (2021). *Breaking things at work: the Luddites are right about why you hate your job*. Verso., pp.32-4

²⁵ Thomis., M. I. (1970). *The Luddites: Machine-Breaking in Regency England*. Archon Books., p. 177

²⁶ Ibid.

²⁷ Hansard (UK). (1812, February 27). Frame Work Bill. In *Hansard*. <https://api.parliament.uk/historic-hansard/lords/1812/feb/27/frame-work-bill>

²⁸ Ricardo, D. (1821). *On the Principles of Political Economy, and Taxation*. The University of Michigan Press., p.388.

²⁹ Schumpeter, J. (1942). *Capitalism, Socialism and Democracy*. Taylor & Francis., pp. 82-3

Table 1
Industry Shares of Activity

	Agriculture	Mining	Manufacturing	Services
Output^(a)				
- 1960s	13%	2%	26%	59%
- 1980s	6%	6%	19%	70%
- 2000s	3%	7%	12%	78%
Employment				
- 1960s	10%	1%	26%	63%
- 1980s	6%	1%	17%	75%
- 2000s	4%	1%	11%	84%
Investment^(b)				
- 1960s	11%	5%	19%	64%
- 1980s	6%	11%	13%	70%
- 2000s	4%	13%	11%	72%
Exports				
- 1960s	62%	15%	9%	14%
- 1980s	33%	38%	10%	18%
- 2000s	18%	42%	17%	23%

(a) Nominal value added excluding ownership of dwellings

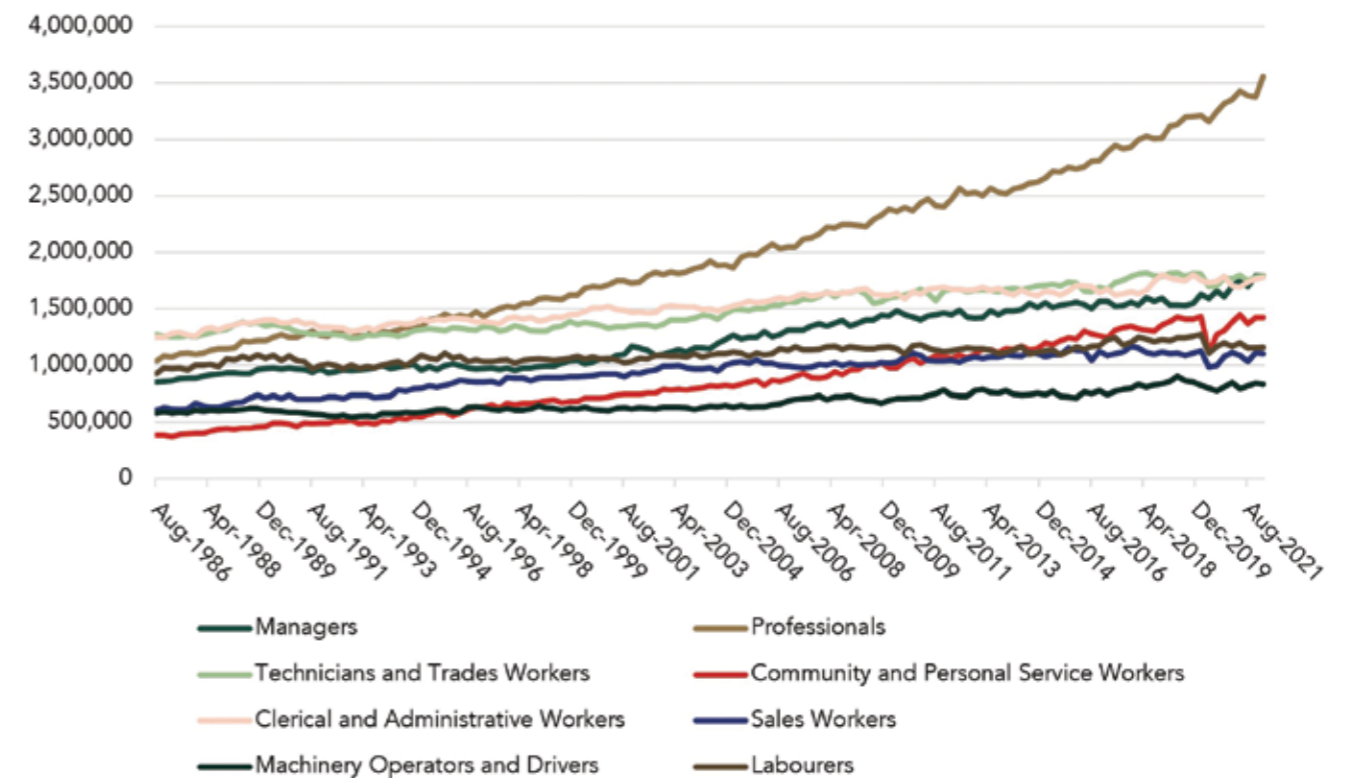
(b) Investment excludes dwelling investment and cultivated biological resources. When cultivated biological resources are included, the share of agriculture is 30 per cent in the 1960s, 11 per cent in the 1980s and 6 per cent in the 2000s.

Source: (Connolly and Lewis 2010, 2)

Similarly, Australia has seen drastic change in occupations since the globalisation of our economy (see Figure 2). In 1986, almost half of working Australians were employed in blue collar jobs, either as technicians and trade workers, machinery operators and drivers, or labourers. A combination of offshoring, structural adjustments, automation, and technological advancements has seen these career paths dwindle, so that by 2021, less than a third of the working population was employed in a blue-collar job.

At the same time, while there has been significant growth in professional careers, these careers have become increasingly precarious and fragmented, too often without the protections afforded by full-time, unionised jobs with a direct employer-employee relationship.

Figure 2
Occupational Changes 1986 - 2018



Source: ABS, 6291.0.55.003, Table 07.

Careers in allied healthcare professions, particularly in aged and disability care, have become dominated by labour market intermediaries: third party labour hire providers who take contracts from a number of firms and offer casual employment to desperate workers. Work in education, both school and tertiary, and in academic research, has also become increasingly insecure, with tens of thousands of education workers in tertiary institutions being left stranded without ongoing employment following the pandemic.

Ultimately, while the process of creative destruction does indeed create new jobs in the face of technological advancements, not all jobs are created equal. Increasingly, Australia's structural adjustments have been marked by the destruction of secure, full-time, well-paid union jobs and their replacement with insecure, casual, minimum wage jobs lacking adequate protections.



A Blueprint for the Post-Carbon Economy

When considering how we navigate the uncertain waters of our future, we must ensure that there is a steady hand on the tiller of our economy. The role of government in planning for and managing the new economy is essential, and must be reclaimed. For generations, we have seen the role of government eroded through rhetoric that denigrates the public sphere as inferior to the private market, and through direct policy interventions that have led to widespread privatisation and deregulation across our economy. The costs of this historical deviation from the accepted role of government as the representative body of the people in shaping society have been exponential increases to our income and wealth inequality, an intensification of our ecological degradation and the collapse of the social compact that was foundational to trust in democracy.

As a result, government has become less able to confront the challenges that we face as a nation.

When external economic shocks have reached our shores, the government is expected to do more with less. When environmental crises have ravaged regional communities, the government has been unable to provide for those affected.³¹

We must foster a renewed appreciation for the role of government, so that we are better able to navigate the oncoming storm of ecological destruction and urgent industrial change. Governments must be smart, agile and invested in our future. We need political leaders who are willing to accept responsibility for the challenges we collectively face, and the political will to do what is necessary to confront them. History shows that when governments act courageously, in the interests of the people they represent, we can turn crisis into opportunity, and that it is ordinary Australians who pay the price for governments who fail to act at all.

³¹ See Per Capita's 2021 report *Smokescreen: The rhetoric and reality of federal bushfire recovery funding*.

Learning from the Past: Structural Adjustments

Historically, Australia does not have a good record with periods of structural adjustment, particularly when it comes to the employment outcomes of retrenched workers.³² Major examples include the dramatic decline of the textiles industry, the closure of Ansett airlines, and the demise of automotive manufacturing and assembly. Policy responses have often focussed on training and skill development, which is important but of limited assistance in situations when there is a shortage of demand for labour.³³

While some retrenched workers relocate to areas with higher employment opportunities following major industrial disruption, many remain trapped in regions of high unemployment, particularly older workers with deep roots in their local communities, and who are forced to compete with new entrants to the labour market.

In most instances where there have been mass layoffs in Australia's past, a substantial proportion of the retrenched workforce did not return to stable, long-term employment and the majority of older workers remained unemployed until retirement.³⁴ Indeed, the recent *Senate Inquiry into Future Jobs in Regional Areas* found that in instances of industry closure, a third of affected workers find full time secure work that utilizes their skillset, a third move into insecure work that is

often unrelated to their skillset, and a third never find work again.³⁵

The key lesson from examining past structural adjustments is that there is no such thing as a 'one-size-fits-all' structural adjustment package or policy. Every instance is different, and every response needs to be tailored to a specific place and time. For example, the automotive industry closures in Geelong had a much more devastating impact on workers than comparable closures in Adelaide because of the relative economic conditions, differences in the local labour market and varying alternative employment opportunities.³⁶

Future adjustment packages and policies for displaced workers must consider and balance a range of services including job creation, skills and training, relocation assistance, and counselling and advice services that commence well ahead of the occurrence of mass layoffs.

Meaningful job creation cannot be done in large numbers at the time of structural adjustment, but instead requires location and sector specific programs commenced years in advance. Economic complexity research in Australia has found substantial unexploited 'opportunity value' across the country that could be used to guide effective industry policy.³⁷

What is needed in order to stimulate the creation of jobs where they are needed are

adjustment programs that are tailored to specific conditions and opportunities in regions of high unemployment or where there are known major structural adjustments are on the horizon.

Intentionally increasing local and national economic complexity through strategic industry policy will not only make us more resilient and able to withstand future structural adjustments, it will also reduce inequality,³⁸ by providing more options for people to transfer their existing skills base and earning potential to new jobs and industries in the same region or community.

Of course, we could, and should, have engaged in the process of diversifying our industrial base and preparing communities for the shift to a post-carbon economy years, if not decades, ago: neither the climate crisis Australia is now experiencing, nor the economic disruption we face by acting as urgently as is now needed to decarbonise our economy, was unavoidable or necessary. Yet while our political discourse is too often dominated by allocating blame for past mistakes or transgressions, this does little to support the regional communities who will bear the cost of the urgent structural adjustment that is essential to saving our planet. It is time to look forward: the second best time to commence this work is today.

Comparative Approaches to Structural Adjustment

The need to effectively respond to structural adjustments is imperative for both our fight against global heating and the urgent task of lifting wages and living standards to address growing inequality. While Australia does not have a strong record of planning for periods of social and economic change, there are some initiatives,

both at home and abroad, that offer insight into what is needed to manage the change effectively.

A recent review of Germany's multiple successful structural adjustments away from coal found that the best outcomes came from plans in which local communities were involved in decision making, and the approach was pre-emptive of changes rather than reactive to closures.³⁹

As a general rule, ensuring community participation and adequate planning time are good starting points for any regional development plan, whether they are fossil fuel dependent or otherwise. However, when the changes happening are so central to the local economy and the people who live and work within it, the need to ensure adequate involvement from those affected becomes paramount. As we show below, there are a range of other features that stand out as necessary for successful navigation of structural adjustment in fossil fuel dependent economies.

Latrobe Valley Authority

The Latrobe Valley is a district in the Gippsland region of eastern Victoria, centred on the three regional towns that surround the Latrobe river: Moe, Morwell and Traralgon. For generations, this region has been the heart of Victoria's electricity system, home to coal fire power stations including the Energy Brix station (closed in 2014), the Hazelwood station (closed 2017), as well as the Yallourn and Loy Yang A & B stations, which are all slated to close by or before 2030.

Following the closure of Hazelwood in 2017, the Latrobe Valley Authority was created in response to a campaign led by local community members, trade unionists and environmental activists to

32 Jones, S., & Tee, C. (2017). *Experiences of Structural Change*. <https://treasury.gov.au/publication/p2017-t213722b>

33 Weller, S. A. (2017). The geographical political economy of regional transformation in the Latrobe valley. *Australasian Journal of Regional Studies*, 23(3), 382–399.

34 Armstrong, K., Bailey, D., De Ruyter, A., Mahdon, M., & Thomas, H. (2008). Auto plant closures, policy responses and labour market outcomes: a comparison of MG Rover in the UK and Mitsubishi in Australia. <https://doi.org/10.1080/01442870802160051>, 29(3), 343–355. <https://doi.org/10.1080/01442870802160051>

35 Commonwealth of Australia. (2019). *Select Committee into Jobs for the Future in Regional Areas* (Issue December). https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Jobs_for_the_Future_in_Regional_Areas/JobsRegionalAreas/Report

36 Barnes, T. (2016). *Transition to Where? Thinking through Transitional Policies for Victoria's Automotive Manufacturing Industry*.

37 Reynolds, C., Agrawal, M., Lee, I., Zhan, C., Li, J., Taylor, P., Mares, T., Morison, J., Angelakis, N., & Roos, G. (2017). A sub-national economic complexity analysis of Australia's states and territories. <https://doi.org/10.1080/00343404.2017.1283012>, 52(5), 715–726. <https://doi.org/10.1080/00343404.2017.1283012>

38 Hartmann, D., Guevara, M. R., Jara-Figueroa, C., Aristarán, M., & Hidalgo, C. A. (2017). Linking Economic Complexity, Institutions, and Income Inequality. *World Development*, 93, 75–93. <https://doi.org/10.1016/j.worlddev.2016.12.020>

39 Furnaro, A., Herpich, P., Brauers, H., Oei, P.-Y., Kenfert, C., & Look, W. (2021). *German just transition: A review of public policies to assist German coal communities in transition* (Issue November).

save the Valley.⁴⁰ This state government authority has since led the way in planning for industrial transformation, with community involvement at the forefront of its operations.⁴¹

The Authority not only consults the community on decision making, but provides resources and support for community-led initiatives, from business creation to mine rehabilitation. In its first three years of operation, it helped stimulate \$99m in new investment within the region that created 2,500 new jobs. During this period, the local unemployment rate, which has been relatively high by national standards for three decades or more, fell by nearly 4%.

The Authority has also provided a number of additional services, including a 'worker transition service', which provided assistance and guidance to former coal station workers with a range of supports including access to specialised re-training opportunities, financial planning and individual case management. It also provided specialised support to firms operating within the Valley, through targeted assistance and tax incentives as well as prioritising local firms to engage in government contracting work. There were also special funds to support local businesses to enter new supply chains across a range of industries.

Additionally, the Authority has provided numerous grants and supports for community building projects across youth, sports and recreation and cultural portfolios.

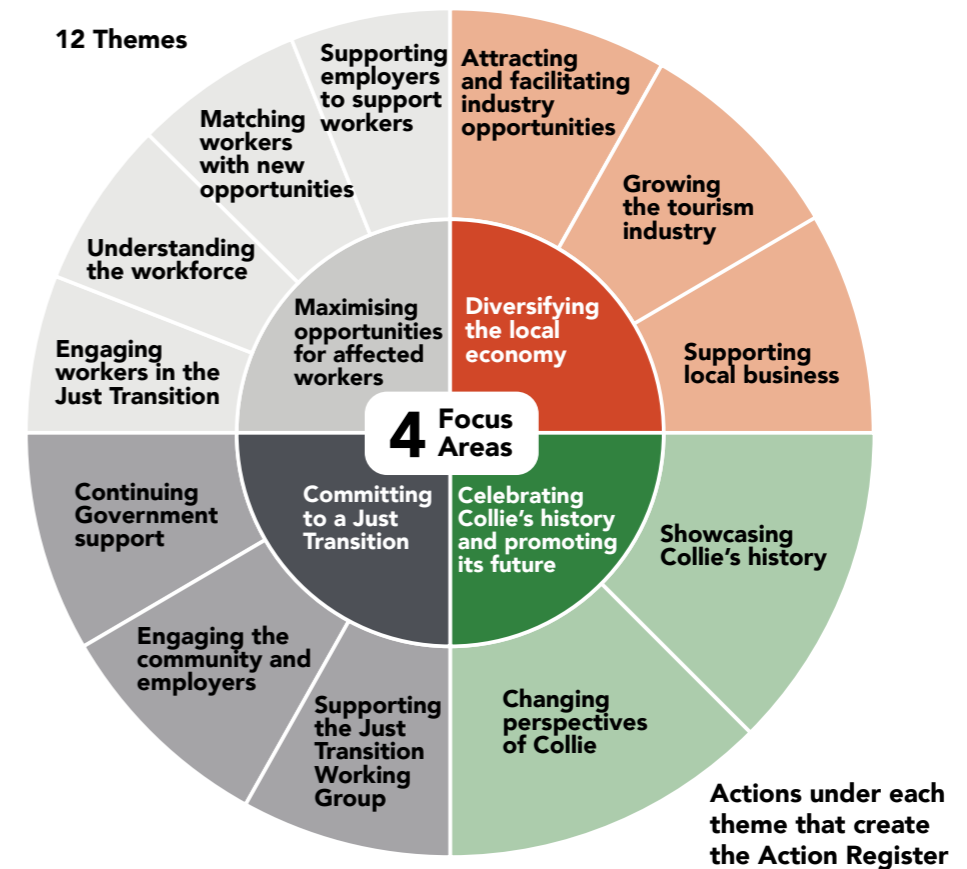
While it is hard to measure the long-term impacts of the Authority's activities, given the Authority has only been operating for five years, the early results have been impressive. Most importantly, the Authority was the result of community led action, and it continues to work closely with local community members to deliver on local issues. This model provides great insight for what other coal-dependent communities might need to successfully navigate future powers station closures and the economic insecurity that follows them.

Collie Just Transition

Collie is a town in the Wilman region of Western Australia's south-west, home to the state's coal fields and coal fired power generators. It has powered the state's energy grid for 100 years. In 2018, the community came together with representatives from unions, businesses, and community groups, as well as state and local governments, to form the *Collie Just Transition Working Group* (JTWG) in order to develop a plan, which would span 10-15 years for Collie to move its economy to a post-carbon setting. Focusing initially on the 2021-5 period, the resulting Plan is expansive and considered in its approach.⁴²

Figure 3
Collie 'Just Transition' Plan

Strategic Focus Areas



Source: Department of Premier and Cabinet (2020), 17.

Primarily, the plan is centred around four key focus areas: diversifying the local economy; maximizing opportunities for affected workers; committing to a 'just transition'; and celebrating Collie's history and promoting its future. Firstly, to diversify the local economy, the government has allocated \$80m in specialised industry development funds to attract and develop new operations across the Renewable Energy; Tourism, Creative Industries; Mining and Mining Equipment, Technology and Services; Advanced Manufacturing and Primary Industries. Particular attention is paid to the building of a sustainable tourism economy that will '...bring external investment and expenditure into the town; and maximise opportunities for local small to medium enterprises, including Aboriginal business, through existing and new investment'.⁴³

40 Ziffer, D. (2021, November 8). Latrobe Valley coal community already looking to future as COP26 delegates discuss end of fossil fuel - ABC News. ABC News. <https://www.abc.net.au/news/2021-11-08/coal-burning-future-fuel-emotions-in-regional-communities/100596172>

41 Latrobe Valley Authority. (2019). *Transitioning to a strong future*. November 2016.

42 The Department of the Premier and Cabinet. (2020). *Collie's Just Transition Plan* (Issue December).

43 Ibid., p.21

Secondly, in order to maximize the opportunities created for affected workers, the plan advocates for a range of specialised services for workers in the coal industry, including skill assessments, personal planning support, redeployment, upskilling, financial planning support, assistance with job search, training programs, funding for approved training programs and preparation for retirement where applicable. Crucially, the plan names the importance of including and engaging workers in its design and implantation.

Thirdly, to demonstrate their commitment to a 'just transition', the government is creating a dedicated team within the public service, the *Collie Delivery Unit* to work alongside the JTWG in managing the community consultation and co-design.

Finally, the government places particular emphasis on celebrating Collie's history and promoting its future. This step, while apparently small and immaterial, is a crucial element in ensuring the plan is desirable and workable in the community. Far too often in the debate surrounding climate change, coal communities have been misrepresented, mischaracterised and in some instances even demonised, merely for wanting to live their lives in the towns in which they grew up. By specifically targeting a shift in narrative that recognises the difficult and often dangerous tasks that coal workers have historically done to 'keep the lights on', the government is recognising the importance of the industry while supporting the community through its closure.

While this plan is still in its early stages, it provides another example of the importance of centring community in any plans for economic diversification and development, and in acting early to avoid the worst outcomes of any industrial change.

Queensland CleanCo

CleanCo is the recently established, state-owned, renewable energy utility company, which began operation in 2019 with an operational budget of \$250m in government investment. As of 2021, the company provides 1,100MW of renewable energy generation infrastructure, including the hydro pumped storage facility at Wivenhoe Dam west of Brisbane.⁴⁴ The company has also committed to building an additional 830MW of renewable energy capacity across the state, starting with the 103MW Karara Wind Farm in the Queensland's Southern Downs region in the south west of the state. This project will see 180 wind turbines installed across the region, and will provide upwards of 640 construction jobs, with an additional 14 ongoing position to maintain operations.

While this project is still in its infancy, it shows how quickly capacity can ramp up under state development. By creating a state-owned utility, the government has begun to act decisively, taking responsibility for the energy future of the state, while the private sector has remained cautious. While its operations will need to be significantly increased to meet the state's commitment of a 50% reduction of carbon emissions by 2030 and net zero by 2050, the early investments are proof that the state can act decisively and make significant gains on behalf of its citizenry.

New South Wales Renewable Energy Sector Board

In 2020, the NSW government established the legislative infrastructure to create the Renewable Energy Sector Board, a tripartite body that includes representatives from businesses, trade unions and government bodies and is charged with the task of developing a roadmap for investment in clean energy.⁴⁵

As a general rule, ensuring community participation and adequate planning time are good starting points for any regional development plan, whether they are fossil fuel dependent or otherwise. However, when the changes happening are so central to the local economy and the people who live and work within it, the need to ensure adequate involvement from those affected becomes paramount.

The establishment of this Board has led to the development of NSW's Electricity Infrastructure Roadmap,⁴⁶ a document that outlines the plan to turn NSW into a 'renewable energy superpower' and kick-start the renewables industry across the state. To accomplish this, the plan relies on the development of three crucial Renewable Energy Zones (REZ) in the Central West, New England and South West regions of the state: areas which have the greatest capacity for renewable energy generation and storage.

The REZ initiative underpins a suite of policy changes and incentives to drive investment in specific regional locations, mirroring traditional special economic zones (SEZs) which have been utilised by governments across Australia. The operations of the REZ include local planning bodies that are made up of community

representatives, government, businesses and unions to develop location-specific plans to drive investment. Businesses that invest in these zones will receive additional government support, tax incentives and specialised assistance to develop and implement the operation of renewable energy infrastructure within the designated regions.

This approach differs from the Queensland method by focusing on the coordinating power of the state to bring together disparate actors around a shared goal, and drive private investment through targeted incentives. The mapping and planning work done by the department ensures that the regions chosen will have the best chance of developing strong and sustainable industries, and will maximize opportunities for renewable energy generation and storage.

⁴⁴ CleanCo. (2021). *Annual Report FY21.*, p. 5

⁴⁵ Department of Energy. (2021, February 23). *Renewable Energy Sector Board to boost local manufacturing and jobs | Energy NSW.* <https://www.energy.nsw.gov.au/renewable-energy-sector-board-boost-local-manufacturing-and-jobs>

⁴⁶ NSW Government. (2020). *Electricity Infrastructure Roadmap*. In *Energy NSW* (Issue November). <https://www.energy.nsw.gov.au/government-and-regulation/electricity-infrastructure-roadmap>

Reimagining Industry Policy

We live in uncertain times. Our economy is slowing, our planet is warming, and our trust in our political system is at an all time low.⁴⁷ Political trust is a difficult thing to pin down, but at its core is a belief that, in uncertain times, political institutions will provide certainty.⁴⁸ It's no accident that when we face external crises or conflict, the population expects that the government will provide support, security and solutions.

For generations, our political imagination has been hamstrung by a fallacious belief that the only benefit of government spending comes from the value it returns to shareholders, whether they are public or private. However, as the renowned economist and policy expert Marianna Mazzucato has repeatedly shown, if this kind of thinking had been applied in the past the world would have been incalculably worse off.⁴⁹

For example, in September of 1962 then President of the United States John F. Kennedy declared that the US Government, under his leadership, would attempt '...the most hazardous and dangerous and greatest adventure on which man has ever embarked':⁵⁰ to land someone on the moon within a decade. He didn't cite the tax revenue that his project would generate, or reassure his constituents that it would be cost neutral for next year's budget, or even try to make the 'business case' for investors. In fact, he did the exact opposite.

His famous justification for the record investment of US\$28bn (or approximately A\$387.5bn adjusted for inflation) in then-experimental space age technologies was a commitment that they would '...choose to go to the moon and do other things, not because they are easy, but because they are hard'. While this phrase is no doubt inspiring, it often overshadows the important point he made following it: that '...the goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win'.⁵¹

In other words, the opportunities that strategic investment in a new industry presents could not be measured against the mere cost of the project: the benefits were potentially limitless, as any commitment to exploration and experimentation will be. Results are unmeasurable not because they are unpredictable, but because they are unknown. Innovation is not the act of reducing overheads and removing constraints: it is the creativity that comes when people are forced to solve problems given the constraints that confront them.

Mazzucato terms this kind of thinking a *mission-oriented* approach to industry policy, which rethinks: '...the role of government in the economy, putting purpose first and solving problems that are important to citizens. It means transforming government from being merely an "enabler" or even a "stifler" of innovation to becoming the engine of innovation'.⁵²

47 Evans, M., Stoker, G., & Halupka, M. (2018, December 5). Australians' trust in politicians and democracy hits an all-time low: new research. *The Conversation*. <https://theconversation.com/australians-trust-in-politicians-and-democracy-hits-an-all-time-low-new-research-108161>

48 Van Der Meer, T. W. G. (2017). Political Trust and the "Crisis of Democracy." *Oxford Research Encyclopedia of Politics*. <https://doi.org/10.1093/ACREFORE/9780190228637.013.77>

49 Mazzucato, M. (2013). *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*.

50 Kennedy, J. F. (1962, September 12). *Speech*. <https://er.jsc.nasa.gov/seh/ricetalk.htm>

51 Ibid.

52 Mazzucato, M. (2021). *Mission Economy: A moonshot guide to changing capitalism*. Penguin Books. <https://www.penguin.com.au/books/mission-economy-9780241435311>, p. 123



This approach recognises that the opposite of *small* government isn't simply *big* government but *smart* government, where the state takes the innovative investment risks for which the private sector doesn't have the appetite.

This approach has led to some of the most critical advancements in technology that the world is still benefiting from.⁵³ From laptop computers and the technology that allows our smart phones to have cameras, through the aerospace propulsion systems that led to our modern planes, to everyday conveniences like scratch resistant lenses, water purification systems, ear thermometers and home insulation, the Kennedy government's commitment to the space race for its own sake has improved the lives of billions of people around the world.

Similarly, in the late 1970s and 1980s the United States Government actively brought on the computer age through a targeted industrial

strategy. The Carter administration established the Small Business Innovation Research (SBIR) program to support small businesses in the growing digital sector.⁵⁴ Beneficiaries of this program include digital giants like Compaq, Intel and Hewlett Packard, all of which grew as a direct result of government support.

This support included a series of public procurement strategies that supported emerging high-tech companies, modernised governmental operations and invested in R&D funding for universities and government labs working on computer technologies. Indeed, it was in these government labs that ARPANet, the predecessor to the internet, was produced.⁵⁵

However, if the cosmic example feels too far removed from our contemporary experience, there are many terrestrial examples that show the benefits of mission-oriented thinking.

53 Spadoni, A. (2020, May 9). How Technology From the Space Race Changed the World. *Now*. <https://now.northropgrumman.com/how-technology-from-the-space-race-changed-the-world/>

54 Small Business Agency. (2022). *About*. <https://www.sbir.gov/about>

55 Moyer, M. (2012, June 23). Yes, Government Researchers Really Did Invent the Internet. *Scientific American*. <https://blogs.scientificamerican.com/observations/yes-government-researchers-really-did-invent-the-internet/>

Mazzucato terms this kind of thinking a mission-oriented approach... which rethinks '...the role of government in the economy... solving problems that are important to citizens. It means transforming government from being merely an "enabler" or even a "stifler" of innovation to becoming the engine of innovation'.

South Korea is now one of the world's leading producers of a range of specialised goods, from electronics to textiles. However, their growth as one of the most innovative and productive economies on the planet wasn't a result of a natural comparative advantage or prescient application of cost benefit analyses – it was driven by a government that understood the value of modern industry policy.

While there are a number of industries that grew from the South Korean Government's Heavy and Chemical Industrialization (HCI) programme,⁵⁶ perhaps the most notable example comes from the country's shipbuilding industry.⁵⁷ Following the proxy war that decimated the Korean peninsula in the 1950s, the country's main exports were base products like tungsten ore, seaweed and simple textiles, with little to no heavy industry to speak of.

When the Government proposed an investment in shipbuilding, the powerful Korean business

community, led by the Hyundai group, was resistant, leaving the state to shoulder the risk and go it alone. The Government set up publicly-owned companies across the supply chain to kick-start the industry, commencing with its first shipyard in 1973. When the yard was built, Korea had no presence in the global shipbuilding market. By 1980, its market share was 4% and six years later that share had grown to nearly a quarter of the market.

Today, South Korea is home to the world's largest shipbuilding industry, with 63% of the market choosing South Korean ships. And they aren't stopping there: the government is supporting the shipbuilding industry to decarbonize and has set a target to capture 75% of the 'green sea' transport market.⁵⁸

Despite the overwhelming evidence that smart state investment drives innovation that benefits humanity, since the 1980s, industry policy has acquired a bad name. With the rise of economic rationalism in the 1970s, state involvement in industry policy came to be seen as a protectionist approach to the economy that picked winners and propped up unsustainable companies. Certainly, within the closed economies that preceded globalisation, there was some truth to this charge.

However, a mission oriented approach to industry policy and economic development is a process of working with willing business partners to deliver mutually beneficial outcomes. Rather than 'picking winners', this approach encourages a collaborative method of economic development that sets targets for industry growth and works to share the resulting benefits. Successful industry policy shows that public institutions matter and make

an impact on people's lives. An investment in creating new industries, regardless of the business case, presents countries the world over with opportunities to produce value, both economic and social.

A New Industrial Agenda

A mission oriented approach to innovation and industry policy demands a number of steps of ambitious governments.⁵⁹

Firstly, the mission must be one that is bold and encourages buy-in from the general population: it has to be something that is socially relevant. For example, building 100,000 public housing units would reduce housing insecurity and homelessness while increasing housing affordability.

Secondly, it must be a solution that is grounded in observable outcomes, either by improving people's day-to-day lives or appealing to their imaginations. The long overdue high-speed rail link connecting Brisbane to Melbourne with stops in major regional centres has the potential to both reduce carbon emissions from Australia's aviation sector and create regional development opportunities, as it places regional centres like Grafton, Wagga Wagga and Shepparton in commuting distance to state capitals.

Thirdly, while any mission-oriented strategy must be ambitious, it needs also to be built on realistic, measurable and time-bound interventions that are explicitly linked to a political direction. These measures can either be binary (for example, in the space race: someone lands on the moon, or they don't), or they can quantifiable and progressive targets that are linked to concrete actions, such as an interim emissions target of 65% reduction on

2005 emissions levels which could be achieved through an increasing renewable energy mix in the national electrical grid.

This 'mile-stoning' approach allows not only for review and reflection on progress, but encourages a diversity of tactics to help achieve different milestones across the implementation phase of the agenda. Any goal should be focused on attracting research and innovation investment, from public and private sources, and seek to *crowd in* funding around shared goals. Contrary to conventional logic which presupposes that government investment in research and technology crowds out private investors, in fact this early investment by government often does the opposite, '...stimula[ing] private investment that would otherwise not have happened... [expanding] the overall pie of national output, which has benefits for both public and private investors'.⁶⁰

The final criteria for a mission-oriented approach is that it must '...encourage multiple solutions instead of focusing on a single development path or technology'.⁶¹ Put another way, while there must be a singular purpose to the industrial agenda that targets a specific problem, the goal should be one that is broad enough to encourage multiple projects working towards its solution. This criterion should encourage smart government investment in a range of strategies, approaches and 'angles' that confront the various challenges created by the targeted problem.

If Australia were to apply this approach to renewable energy generation and storage, there is the potential to reduce our contribution to global heating and to grow our economy. So, what would this approach look like in practice?

⁵⁶ Chang, H. J. (2008). Industrial Policy: Can We Go Beyond an Unproductive Confrontation? *ABCDE (Annual World Bank Conference on Development Economics)*.

⁵⁷ Chang, H.-J. (1993). The political economy of industrial policy in Korea. *Cambridge Journal of Economics*, 17(2), 131–157. <https://www.jstor.org/stable/23599704>

⁵⁸ Korean shipbuilders gain full govt blessing for global dominance, stocks rise (2021, September 10). *Pulse*. <https://pulsenews.co.kr/view.php?sc=30800028&year=2021&no=875065>.

⁵⁹ Mazzucato, M. (2021). *Mission Economy: A moonshot guide to changing capitalism*. Penguin Books. <https://www.penguin.com.au/books/mission-economy-9780241435311>, pp. 121-37.

⁶⁰ Mazzucato, M. (2013). *The Entrepreneurial State: Debunking Public vs. Private Sector Myths.*, p. 9.

⁶¹ Mazzucato, M. (2021). *Mission Economy: A moonshot guide to changing capitalism*. Penguin Books. <https://www.penguin.com.au/books/mission-economy-9780241435311>, p. 124

The importance of emissions reduction targets to industrial change

A mission-oriented approach to decarbonising our economy would start with an ambitious but achievable renewable energy target. Australia is currently getting 21% of its energy from renewable sources compared to Germany, which produced 54.5% of its energy from renewables in March 2022.⁶² As a consequence, Germany employs approximately 284,000 workers in the renewable energy sector, while Australia only has 17,740 renewable energy jobs.⁶³ Consider that Germany has, on average, 5.28 daily sunshine hours while Australia has nearly 8 daily sunshine hours on average.⁶⁴ Clearly, Germany has no natural or comparative advantage when it comes to sunlight, yet in June of 2021 solar power accounted for 20.6% of energy generation there. In the same month, solar power accounted for approximately 9% of Australia's energy generation.⁶⁵

Setting interim emissions reduction targets

Australia has recently joined most other developed economies in committing to achieve net zero carbon emissions by 2050, but the plan to achieve this goal is, at best, overly reliant on unknown technological advances and on the widely discredited process of carbon capture and storage.⁶⁶ There is little doubt that

a commitment to net zero carbon emissions by 2050 ticks a lot of boxes for a mission oriented industrial agenda. The goal is broad and invites buy-in. Further, the size and scale of climate protests clearly demonstrate the general public's willingness to mobilize on this issue, and most surveys show an overwhelming majority of people support credible action on climate change. Indeed, a recent nationally representative survey conducted by the Lowy Institute found that three quarters (74%) of respondents believed that 'the benefits of taking further action on climate change will outweigh the costs',⁶⁷ and the vast majority supported subsidies for renewables (91%), subsidies for electric vehicles (77%), and a price on carbon (64%). Clearly, confronting this challenge is a priority for Australian voters.

As a mission, confronting climate change through emissions reduction is realistic, time-bound and measurable. Indeed, the commitment itself contains a due date and a metric to both quantify and qualify success or failure. Furthermore, as many countries around the world have shown, mile-stoning is a key aspect of this proposal.

Therefore, the first step necessary to ensure net zero by 2050 is to create additional targets that encourage investment, coordination and cooperation around the goal. Firm commitments at 2025, 2030 and 2040 would help to mobilise resources and prioritise investment in strategies that help reduce emissions. It would also allow

for strategic investment in strategies that assist reduction at different stages, including easier to implement short-to-medium term goals, such as the introduction of a price on carbon emissions, and longer term, more difficult structural adjustments, such as the closure of coal power plants and scaling up renewable energy generation.

Interim emissions reduction targets *must* be set. A recent report from the Climate Targets Panel, a group of experts in the field from the Australian National University, Macquarie University and the University of Melbourne, recommend that an interim target of between 50% and 75% at 2030 would help to limit the worst effects of climate change.⁶⁸ The recent commitment from the Albanese government which locks in 43% as an absolute floor is a much needed step in the right direction. However, we need not stop there. We could legislate additional interim targets of 20% by 2025 and 60-75% by 2035 as a way to kick start our emissions reduction programme and raise our ambitions.

Such mile-stoning also encourages and allows for the final criteria for a mission oriented plan: one that allows for multiple solutions. Not only can the aforementioned strategies be implemented to different levels at different times, they can also be augmented by a range of additional strategies that tackle the problem from multiple angles.

Decarbonising Industry

Once clear targets have been set, the next step would be to identify companies that are willing to shift away from fossil fuel reliance and work collaboratively to help them create firm-level

decarbonisation plans. This process is already in motion, with large fossil fuel reliant companies like BHP, Fortescue Metal Group and Rio Tinto announcing their decarbonisation plans. While there is a wide variance in the levels of commitment to true decarbonisation, these plans show that even those most reliant on fossil fuels can sense the changes in the market and are looking to capitalise on them.

The Government could incentivise energy usage and efficiency analysis through seed funding via the Clean Energy Finance Corporation, and provide access to information about the domestic and global market, recommendations for cost effective energy reduction strategies and connections to local suppliers of carbon neutral technologies.

Introducing a carbon price

The next step to making this support cost neutral for the government would be to introduce a carbon price. Modelling from 2011 justified the introduction of a carbon price of \$23 a tonne in order to encourage reduction amongst large carbon emitters.⁶⁹ Similarly, the most recent modelling, detailing the former government's net zero plan includes a \$24 a tonne price on carbon.⁷⁰

There is, in fact, no evidence that a mandatory price on carbon would damage the economy. Indeed, there appears to be plenty of evidence to the contrary: that failing to act on carbon emissions would cost billions of dollars a year in lost assets and dealing with the fallout of extreme

⁶² Clean Energy Council. (2012). *Clean Energy Australia Report 2012*. <http://www.cleanenergycouncil.org.au/policy-advocacy/reports.html>

⁶³ Environmental and Energy Study Institute. (2015). *Jobs in Renewable Energy and Energy Efficiency*. November; Australian Bureau of Statistics. (2020, April 6). *Employment in Renewable Energy Activities, Australia, 2018-19 financial year*. <https://www.abs.gov.au/statistics/labour/employment-and-unemployment/employment-renewable-energy-activities-australia/latest-release>

⁶⁴ Meza, E. (2021, July 13). *Solar Germany's biggest power source in June as price reaches all-time high*. Clean Energy Wire. <https://www.cleanenergywire.org/news/solar-germanys-biggest-power-source-june-price-reaches-all-time-high>

⁶⁵ Minister for Industry, Energy and Emission Reduction. (2021, June 4). *2021 Australian Energy Statistics (Electricity) | Ministers for the Department of Industry, Science, Energy and Resources*. <https://www.minister.industry.gov.au/ministers/taylor/media-releases/2021-australian-energy-statistics-electricity>

⁶⁶ Australian Government. (2021). *Emissions Reduction Plan: A whole-of-economy Plan to achieve net zero emissions by 2050*. 1-126. <https://www.industry.gov.au/data-and-publications/australias-long-term-emissions-reduction-plan>

⁶⁷ Lowy Institute. (2021, May 26). *Climate Poll 2021*. <https://www.lowyinstitute.org/publications/climatepoll-2021>

⁶⁸ Hewson, J., Steffen, W., Hughes, L., & Meinshausen, M. (2021). *Shifting the Burden: Australia's Emissions Reduction Tasks Over Coming Decades a Report of the Climate Targets Panel*, March 2021. March.

⁶⁹ Department of Treasury. (2011). Strong growth, low pollution: modelling a carbon price. In *Australian Government, Canberra*. <https://treasury.gov.au/sites/default/files/2019-03/sglp-report.pdf>

⁷⁰ Australian Government. (2021). *Emissions Reduction Plan: A whole-of-economy Plan to achieve net zero emissions by 2050*. 1-126. <https://www.industry.gov.au/data-and-publications/australias-long-term-emissions-reduction-plan>

weather events.⁷¹ Furthermore, while carbon prices affect the operation of emissions heavy production, the evidence points to carbon prices encouraging innovative solutions to low carbon technological problems: exactly the kind of innovation that a mission oriented approach seeks to encourage.⁷²

After setting a carbon price and working with firms to identify decarbonisation and energy efficiency opportunities, governments can start targeting the regions. Renewable Energy Zones (REZs) can be utilised,⁷³ much like Special Economic Zones (SEZs), to stimulate investment through targeted incentives, and encouraging larger companies to act as ‘hubs’ of an investment strategy that would extend through businesses in the supply chain, distributors and energy retailers. Each business in this complex economic ecosystem would need specific information and assistance that would be tailored by a national authority, like the already existing Australian Renewable Energy Agency. This body would not only be responsible for the provision of support to companies in this area, but also with enforcement of national priorities in the sector.

Waste management, employment and local content procurement requirements would need to be set and enforced to ensure that the growth of these decarbonised industries and supply chains effectively distributed the benefits back into the community. Government could also map the material and service needs of industries in key regions and seek to invest strategically in filling gaps in the supply chain with local producers.

Another important area for investment is in research & development (R&D). This funding should be spread through public, private and university sectors to maximize innovation and employment. The funding and employment cap on innovative public sector institutions like the CSIRO should be lifted, and supported with a renewed investment in climate mitigation and adaptation focused R&D.

Finally, government procurement and planning laws should be rewritten to require public buildings and institutions utilised this growing sector. Initiatives could include targets for solar panels on the roofs of public buildings, subsidies for low income households and essential workers to install lithium batteries at home, and requiring all government fleet vehicles to be electric and built in Australia.

Not only would this approach substantially reduce our country’s carbon footprint, it would provide secure jobs for Australian workers, show that the government has vision and purpose, and most importantly, give people hope in uncertain times.

Now is the time for the government to adopt a mission-oriented industry policy and give Australians a future that they can believe in.

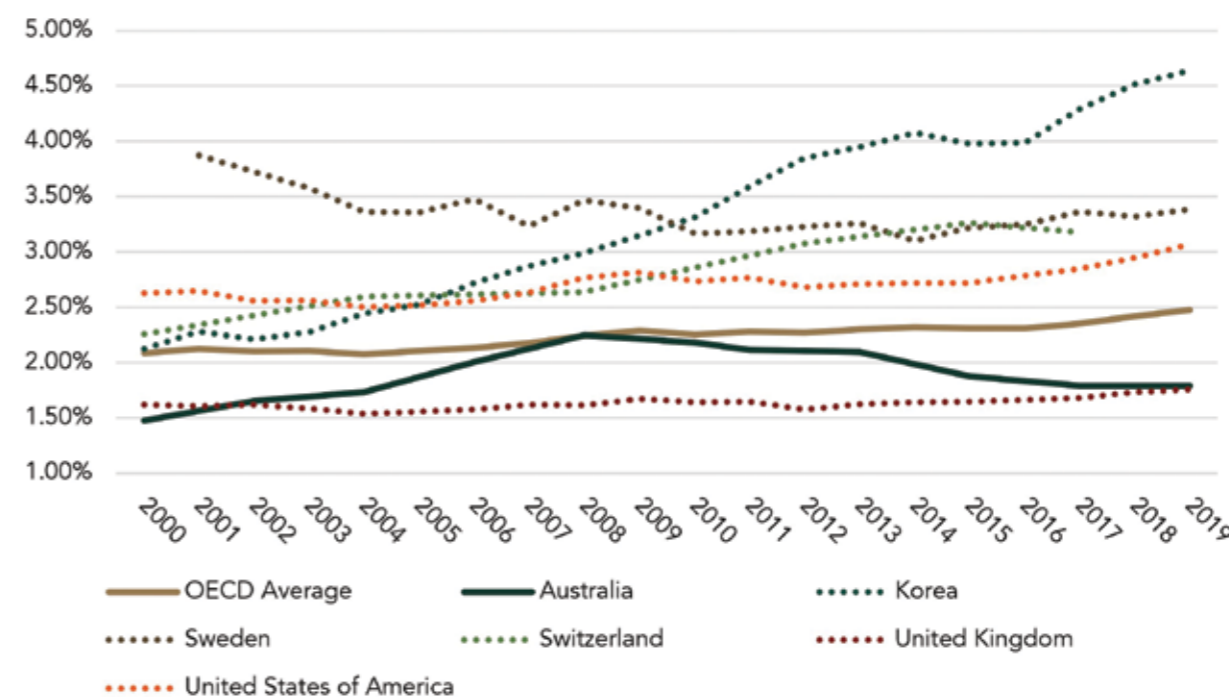
Tax incentives to drive business investment in R&D

Our country lags well behind much of the industrialised world when it comes to investing in R&D, both through state funding and private capital investment. As a result, Australia ranks just 25th in the world on the Global Innovation Index - and we’re going backwards.⁷⁴

Gross expenditure on R&D (GERD) in Australia has diverged from the global trend, and is rapidly falling behind the most innovative and competitive economies of the OECD. Indeed, while the average is now close to 2.5%, many countries with innovative economies, such as Switzerland, Sweden, the United States of America, and Korea,⁷⁵ have increased their GERD ratio to well above 3% of GDP.

Australia, by comparison, has seen a declining investment in R&D since 2008. Over this time, the governmental commitment to R&D has fallen by almost a quarter, from around 2.25% in 2008-09 to just 1.79% in 2019-20 (see Figure 4).

Figure 4
Gross Expenditure on Research & Development (GERD)



Source: OECDstat

Further, where and how that declining share of Australia’s research investment is spent has been changing. Applied STEM fields such as IT (33.99%), Engineering (25.12%), and Medical Sciences (11.88%), receive almost three quarters of all research funding, whereas pure fields like Mathematics (0.84%) and Physical Sciences (1.13%) are mostly ignored. Most concerningly, given the growing dangers of climate change, Environmental Sciences receive less than 2% of all R&D funding.

71 Botzen, W. J. W., Deschenes, O., & Sanders, M. (2019). The economic impacts of natural disasters: A review of models and empirical studies. *Review of Environmental Economics and Policy*, 13(2), 167–188. <https://doi.org/10.1093/REEP/REZ004>

72 Cui, J., Zhang, J., & Zheng, Y. (2018). Carbon Pricing Induces Innovation: Evidence from China’s Regional Carbon Market Pilots. *AEA Papers and Proceedings*, 108, 453–457. <https://doi.org/10.1257/pandp.20181027>

73 Beyond Zero Emissions. (2020). The Million Jobs Plan. *Beyond Zero Emission*, 117. https://bze.org.au/research_release/million-jobs-plan/

74 https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021.pdf

75 Four of the top 5 most innovative economies in the world according to the Global Innovation Index.



Recommitting to funding Research and Development

The Productivity Commission recently identified the lack of R&D investment as one of the reasons for sluggish productivity rates. In the year 2018-2019 multifactor productivity dropped below the five year average to just 0.4%, while labour productivity fell to -0.2%.⁷⁶

Indeed, it is hard to escape the conclusion that innovation policy and practice is being consciously abandoned. Government budget allocations to R&D, while historically rising in line with broader trends, have been essentially static or declining since 2009. Overall government spending on R&D has dropped over 5% in real terms between 2011 and 2018.⁷⁷

Worse still, recent initiatives have seen effective, innovative R&D programs cut. The 2018-2019

federal budget oversaw the abolition of the \$3.9b Education Investment Fund; nearly \$50m removed from entrepreneurship and industry research programs; and \$389m worth of cuts to future allocations for university research, the CSIRO, and research grant programs. The Australian Academy of Sciences responded to these changes by highlighting the 'counterintuitive' desire to reach a budget surplus, while at the same time making 'damaging cuts to Australia's research programs' that have the potential to generate significant productivity and growth in Australia's economy.⁷⁸

Again, Australia risks being left behind. Governments the world over are seeking new ways to capture the gains of next generation technology, and many advanced economies recognise this as a means to reverse the trend of slowing productivity while adapting their economic and industrial vases to the post-carbon economy.

Several nations have established innovation funds for disruptive technology firms. France, for example, has established a US\$13 billion *Disruptive Innovation Fund* to increase the number of start-ups pushing the technological frontier. This will increase the annual spend by government on tech startups from US\$170 million to over US\$530 million.

Ireland similarly has allocated hundreds of millions in their *Disruptive Technologies Innovation Fund*. The EU is planning to spend EURO100 billion on R&D in the 'Horizon Europe' project, focusing on disruptive technology. Their forecasting suggests that for every EURO100 invested they will return EURO850 to the European economy within the decade.⁷⁹

It is essential that such programs be studied in detail to assess their applicability to the Australian context. Given the persistent low levels of R&D investment from both Australian government and local business, the government should immediately instigate a comprehensive review of R&D funding, taking into account direct and indirect funding in both public and private, academic and business contexts.

The government should increase funding streams specifically for start-ups. While the *Early Stage Venture Capital Limited Partnership* (EVCLP) program does improve conditions for firms seeking early investment it, it is in itself not enough to make Australia a competitive location for start-ups. Targeted R&D direct assistance presents an opportunity for the government to support adjustment, with high quality jobs in the post-carbon economy.

Similarly, we must reinvest in university research budgets. Government spending on public R&D is at an all-time low of 0.5 per cent of GDP, following

the A\$328 million reduction in university research budgets. This compares to an R&D spending high of 0.75% in the early 1990s.⁸⁰

Finally, the government should immediately remove the staffing cap on the CSIRO and substantially increase funding for this world class research institution, in order to stimulate and expand the productive capabilities of our premier scientific research institution.

Targeted Use of Social Procurement Policy

Social procurement is the act of embedding responsibility for the provision of social good, equity and/or justice in government contracts, and 'leverage the purchasing power of projects to create social value' (Loosemore, Alkilani, and Murphy 2021, 750). This can broadly encompass any requirement placed on firms successful in the tender process, which add value to society while carrying out the primary business of the government contract. Typically, this practice includes the implementation of employment ratios for disadvantaged groups, requiring certain levels of domestically produced goods and services to be used within the supply chain or ensuring that additional actions are taken to ensure best practice in areas of concern, from waste management to subcontracting.

Social procurement reimagines the value that government spending can produce, and focuses on getting the greatest social value per dollar spent. Traditionally, social procurement policies in Australia have been primarily utilised in the construction sector, as governments of all levels have sought to add value to key infrastructure projects. However, recent research finds that 'the untapped potential of social procurement to address growing social inequity and entrenched

76 PC Productivity Insights: Recent Productivity Trends, February 2020

77 https://stats.oecd.org/Index.aspx?DataSetCode=GBARD_NABS2007#

78 <https://www.science.org.au/news-and-events/news-and-media-releases/mixed-news-science-2019-20-budget>

79 <https://euraxess.ec.europa.eu/worldwide/india/european-commission-proposes-100-billion-eur-research-innovation-budget-2021>

80 <https://www.afr.com/policy/health-and-education/what-australia-can-learn-from-france-on-higher-education-20190227-h1bsc7>

disadvantage is significant and largely unknown'.⁸¹

Regardless of the unknown limits of this potential, there is evidence to suggest that there are significant social and economic benefits to be gained from engaging in this innovative practice. Firstly, it encourages firms to collaborate and create new relationships with both traditional market actors and organisations that might not have been considered through ordinary market mechanisms, challenging 'industry norms, pathway dependencies and institutional imperatives' to create new opportunities to innovate and grow.⁸²

Secondly, it reduces barriers to entry for traditionally disadvantaged job seekers (notably women, Indigenous people, migrants and ex-offenders), which both increases the human capital potential of projects and reduces structural long term unemployment by providing employment opportunities to workers who are more likely to spend prolonged periods out of work.⁸³

Finally, and perhaps most importantly, social procurement has a normalising effect on the sector it targets, embedding the expectation that social good should be a regular part of operation, which recent research shows is unlikely to occur spontaneously in industries without social procurement practices from government.⁸⁴

Additionally, it's important to define the 'local' aspect of local content requirements. In the context of decarbonising our economy, it is imperative that these requirements be centred on the communities, regions, workers, and firms who are most likely to be affected by the shift away from fossil fuels. Fortunately, a workable and considered model for social procurement already exists. The Queensland government's 2017 social procurement strategy, *Backing Queensland Jobs*, defines four levels of locality to be considered, in descending order, when procuring content for major projects (Queensland Government 2017, 3).⁸⁵

Local Zone 1	Prioritise suppliers that maintain a workforce whose usual place of residency is located within a 125km radius of where the goods or services are to be supplied.
Local Zone 2	If a suitable local supplier does not exist within 125km, priority will be given to suppliers within the local region.
Local Zone 3	If a suitable supplier does not exist within the local region, consideration will be extended to suppliers within the state where the goods or services are to be supplied.
Local Zone 4	If a suitable supplier does not exist within the state, consideration will be extended to suppliers within Australia.

The benefits of social procurement become essential when considering the challenge that a shift to a post-carbon economy presents. We must ensure that we not only move swiftly beyond our traditional reliance on fossil fuels, but that the communities who were dependent on carbon heavy industries are not left behind.

A successful social procurement strategy for the energy transformation would have strict training ratios in which one out of every ten workers was either an apprentice, a trainee, or a recent graduate; would preference workers from coal and other fossil fuel dependent regions; and would have strict requirements to utilise domestic goods and services throughout the supply chain. By utilising social procurement strategies that ensure members of affected communities have new jobs to go to, and by maximizing local content, we can ensure that the benefits of this shift to a post-carbon economy can be spread equally throughout society and produce value for local stakeholders as well as shareholders.

It's important to define the 'local' aspect of local content requirements. In the context of decarbonising our economy, it is imperative that these requirements be centred on the communities, regions, workers, and firms who are most likely to be affected by the shift away from fossil fuels.

81 Loosemore, M., Higgon, D., & Osborne, J. (2020). Managing new social procurement imperatives in the Australian construction industry. *Engineering, Construction and Architectural Management*, 27(10), 3075–3093. <https://doi.org/10.1108/ECAM-11-2019-0643>

82 Barraket, J. (2020). The Role of Intermediaries in Social Innovation: The Case of Social Procurement in Australia. *Journal of Social Entrepreneurship*, 11(2), 194–214. <https://doi.org/10.1080/19420676.2019.1624272>; Loosemore, M., Higgon, D., & Osborne, J. (2020). Managing new social procurement imperatives in the Australian construction industry. *Engineering, Construction and Architectural Management*, 27(10), 3075–3093. <https://doi.org/10.1108/ECAM-11-2019-0643>

83 Loosemore, M., Alkilani, S., & Mathenge, R. (2020). The risks of and barriers to social procurement in construction: a supply chain perspective. *Construction Management and Economics*, 38(6), 552–569. <https://doi.org/10.1080/01446193.2019.1687923>

84 Loosemore, M., Alkilani, S. Z., & Murphy, R. (2021). The institutional drivers of social procurement implementation in Australian construction projects. *International Journal of Project Management*, 39(7), 750–761. <https://doi.org/10.1016/j.ijproman.2021.07.002>; Loosemore, M., Alkilani, S., & Mathenge, R. (2020). The risks of and barriers to social procurement in construction: a supply chain perspective. *Construction Management and Economics*, 38(6), 552–569. <https://doi.org/10.1080/01446193.2019.1687923>; Loosemore, M., Denny-Smith, G., Barraket, J., Keast, R., Chamberlain, D., Muir, K., Powell, A., Higgon, D., & Osborne, J. (2020). Optimising social procurement policy outcomes through cross-sector collaboration in the Australian construction industry. *Engineering, Construction and Architectural Management*, 28(7), 1908–1928. <https://doi.org/10.1108/ECAM-04-2020-0221>; Loosemore, M., Higgon, D., & Osborne, J. (2020). Managing new social procurement imperatives in the Australian construction industry. *Engineering, Construction and Architectural Management*, 27(10), 3075–3093. <https://doi.org/10.1108/ECAM-11-2019-0643>

85 Queensland Government. (2017). *Backing Queensland Jobs: Quality local jobs for Queensland*.



Better Jobs: Ensuring secure pathways into permanent employment

In order to manage the structural adjustment to a post-carbon economy without leaving anyone behind, we need not only to ensure that there are jobs to go to in the post-carbon economy, we must ensure that these jobs provide *decent work* to those who hold them. Decent work is defined by the International Labor Organization (ILO) as work that is:

Productive and delivers a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives and equality of opportunity and treatment for all women and men.⁸⁶

This framework prioritises the creation of work that is productive, fulfilling and provides security for workers and their families. To create decent work, we need to create skilled pathways into employment, ensure that minimum standards are met and applied equally, and that we reduce barriers to entry for all workers.

Education and skills training

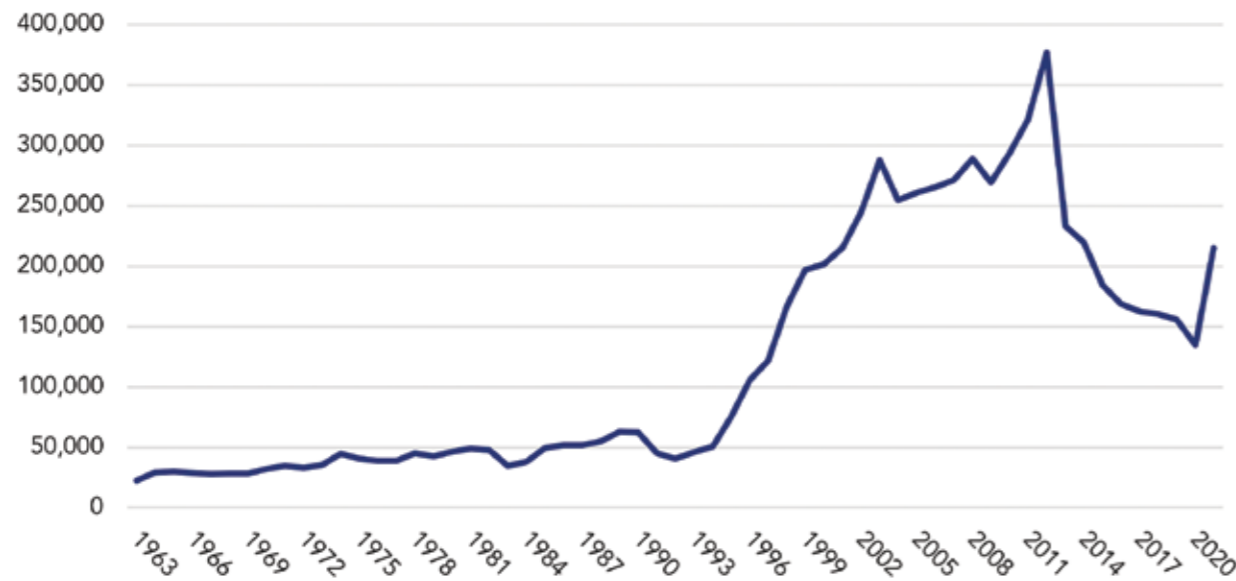
The role vocational education and training (VET) can play in a transformational economy is significant. A high-quality VET sector allows retrenched workers to quickly retrain and find work in industries with skills shortages, or to be able to utilize existing skillsets for growing industries. While Australia has traditionally provided significant value to the economy through its world class skills and training system, recently the sector has faced significant challenges.

Funding cuts and enrolment decline

Firstly, despite a renewed political focus on the performance of our skills system, we have been producing fewer skilled workers. The number of apprentices who undertake training and the number of vacancies available are generally good barometers for the performance of the industry. Unfortunately, commencements have been falling year on year for much of the past decade (see Figure 5).

⁸⁶ International Labour Organization. (1999). Report of the Director-General: Decent work. In *87th International Labour Conference*. <https://www.ilo.org/public/english/standards/relm/ilc/ilc87/rep-i.htm>

Figure 5
Apprenticeship Commencements



Source: Authors calculations, based on NCVET (2021).

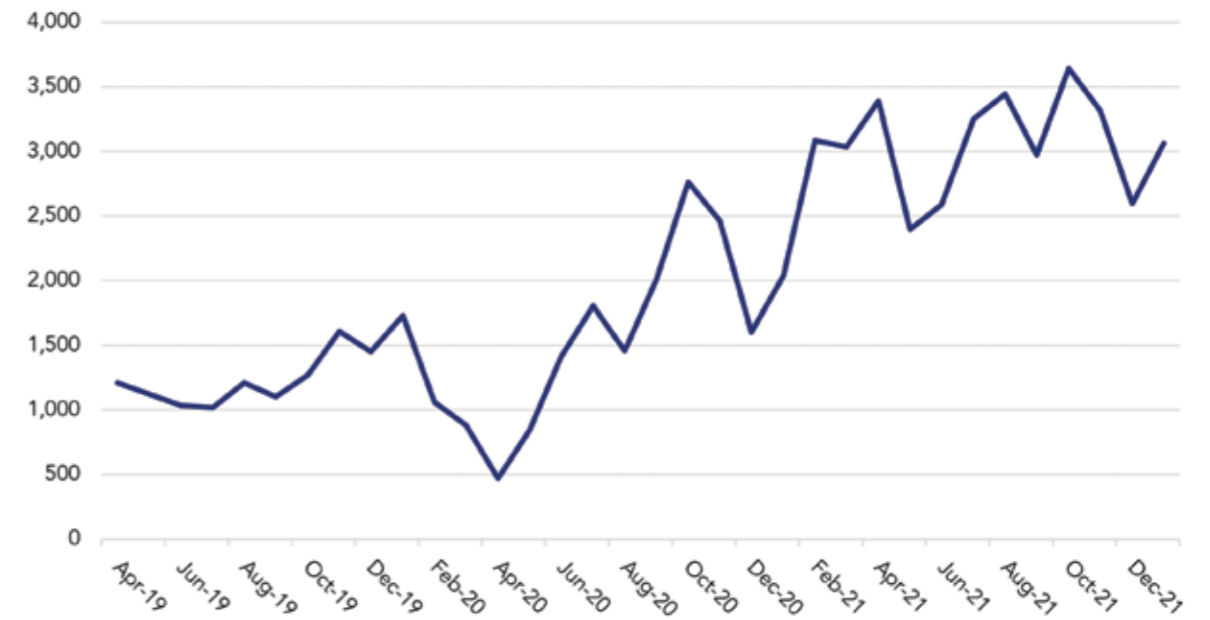
While Australia saw a remarkable growth in the number of commencements each year following the recession of the early 1990s, reaching an all-time high in 2012, Australia's commencement rates dropped sharply by 65% between 2012 and 2020. This coincides with a big cut in funding and support for the public vocational education and training system, from a peak of \$7.65bn in 2012.

The annual Report on Government Services produced by the Productivity Commission shows that, since 2013, there approximately \$3 billion has been cut from vocational education funding, including the closure of the \$3.9 billion Education Investment Fund. This has had disastrous effects on Australia's skills and training capacity, especially in regional areas, where dozens of TAFEs have been closed already and additional closures are on the horizon.⁸⁷

Since the depths of the pandemic-induced recession, there has been an increase in commencements, driven primarily by state governments engaging in stimulus spending on infrastructure projects and offering additional training places. However, it is too early to tell if this is an ongoing trend or a short-term spike.

On the other hand, the number of apprenticeship vacancies remains comparatively low (see Figure 6). The pandemic saw a sharp decline in apprenticeship opportunities, dipping to less than 500 jobs on offer in April of 2020. While the figures have since recovered and are continuing the trend upwards, the rate at which they are growing remains slow.

Figure 6
Apprenticeship Vacancies



Source: Author's own, based on GAN Australia (2022)

Similarly, graduate employment programs across the private sector are increasingly rare. Despite the private sector employing the vast majority - almost 95% - of young Australians, there are remarkably few dedicated graduate positions across the private sector (see Table 2). Analysis of WGEA data reveals that only 17,000 graduate positions are offered by private sector companies with 100 employees or more.⁸⁸ While almost half are offered in Professional, Scientific and Technical services, there are few entry level positions offered in Manufacturing (738), Information Media and Telecommunications (548), and Education and Training (543).

To create decent work, we need to create skilled pathways into employment, ensure that minimum standards are met and applied equally, and that we reduce barriers to entry for all workers.

⁸⁷ Patty, A. (2021, October 28). 'Suitable for disposal': TAFE campuses earmarked for sale. *The Age*. <https://www.smh.com.au/national/nsw/suitable-for-disposal-tafe-campus-earmarked-for-sale-20211026-p593bd.html>

⁸⁸ Pennington, A., & Stanford, J. (2019). *The Future of Work for Australian Graduates: The Changing Landscape of University-Employment Transitions in Australia*, p. 76

Table 2
Number of graduate program positions in private sector companies (>100 employees)

Industry	2015-16	2016-17
Professional, Scientific and Technical services	7,481	7,650
Health Care and Social Assistance	3,018	2,710
Mining	1,558	1,221
Financial and Insurance Services	1,154	1,209
Construction	1,099	1,143
Manufacturing	677	738
Retail Trade	460	625
Information Media and Telecommunications	411	548
Education and Training	397	543
Rental, Hiring and Real Estate Services	125	159
Transport, Postal and Warehousing	125	113
Wholesale Trade	90	99
Public Administration and Safety	111	90
Electricity, Gas, Water and Waste Services	120	82
Other Services	77	51
Administrative and Support Services	23	19
Arts and Recreation Services	24	14
Agriculture, Forestry and Fishing	92	11
Accommodation and Food Services	59	10
TOTAL	17,101	17,035

Source: Pennington & Stanford, 2019, p. 7689

89 Latest publicly available data

Without entry level opportunities, any reforms to the skills formation system will increase the number of people competing for fewer employment opportunities and deepen our frictional unemployment. The increasingly low number of graduate, apprenticeship and traineeship positions being offered by the private sector, particularly in the electrical trades, is a key problem in the labour market when approaching the structural adjustment required to move to a post-carbon economy. Private sector employers demand skilled workers but are unwilling to voluntarily share the costs of training their staff, and successive governments have proved disinclined to intervene in the market to compel private sector employers to contribute to the training system.

Thin Markets and Private Providers

It is essential that the role of VET in the transformation be led by the public Technical And Further Education (TAFE) sector and not by private providers. Currently, there are almost 5,000 registered training providers in Australia, and while most students are recipients of government subsidies, almost half of those providers are private enterprises.⁹⁰

This overabundance of training providers at a time of declining enrolments has led to the creation of a 'thin market' in VET: a market that sees greater competition for fewer buyers than is necessary to sustain healthy competition amongst the number of sellers within a market. This is driven by a range of factors, but one of the essential ones is that delivery of effective VET, particularly in highly technical fields like those in electrical and energy related trade qualifications, requires high capital

and a relatively low return on investment.⁹¹ This leads private providers to make compromises to maximise returns, rather than ensure adequate training that builds the skills base of their students.

While the 51 remaining TAFE institutions make up a small fraction of the VET providers following successive rounds of deregulation and privatisation by state governments since the 1990s, each institution serves an average of 19,577 students. This is approximately 20 times the average number served by private providers. The reason for this consumer choice is reflective of the comparative quality of private providers: that is, students opt overwhelmingly for TAFE courses where they are available.

The National Tertiary Education Union (NTEU) estimates that, in the case of Victoria, the money used by private VET enterprises has often been used to undercut the pay and conditions of the public providers.⁹² The behaviour of private providers is well known to government; the final report of the Senate inquiry into private providers in the VET noted:

...a swathe of evidence from students, staff and advocates that high pressure sales pitches aimed at securing students involved practices such as promises of equipment, downplaying the level of debt the students would incur and providing deceptive impressions of the qualifications to be earned or employment opportunities which would follow.⁹³

These practices are not isolated to individual providers who were operating unscrupulously. The most recent strategic review of registered training organisations by the Australian Skills

90 Korb, P., & Misko, J. (2016). *Uptake and utility of VET qualifications*.

91 Ferrier, F., Dumbrell, T., & Burke, G. (2008). *Vocational education and training providers in competitive training markets*.

92 Barnes, A., & Kniest, P. (2015). *National Tertiary Education Union (NTEU) Submission to Expert review of Australia's vocational education and training system (Joyce Review)*.

93 Education and Employment References Committee. (2014). *Getting Our Money's Worth: The operation, regulation and funding of private vocational education and training (VET) providers in Australia* (Issue May). Australian Government.

Quality Authority (ASQA) found that 45.3% of those investigated 'were identified as having one or more areas of possible non-compliance'.⁹⁴

This has significant effects on the skill development of both new entrants to the labour market and those that need to retrain following industry closure. Private providers have reduced their capacity and focused on the provision of courses that offer the highest profits, rather than on ensuring the necessary skills base to meet our changing energy needs. This highlights the need for government, through greater investment in TAFE, to step in and fill the gaps to provide training in essential skills necessary to manage the growth in renewable energy across the country.

Training Guarantee Levy

One way government create more entry level job opportunities in the private sector is to impose a levy to fund training through a system similar to the Training Guarantee Levy (TGL). Originally proposed in 1989, the TGL was a compulsory levy that required all employers with a payroll of over \$200,000 to spend at least 1.5% of payroll on structured employment related training.⁹⁵ Employers who failed to spend the required amount on entry level positions and related training programs were charged a levy of 1.5%, which would be collected by the Australian Tax Office and placed into a Training Guarantee Fund.

The money was then used to cover administrative and compliance costs within the Education Department, and to help fund the vocational education and training system. A review of the system in 1996 found that 57% of eligible employers reported that their training expenditure had increased over the four years of the operation of the scheme, and training expenditure increased

by 15% for businesses above the \$200,000 threshold.⁹⁶ A reinstatement of the LGT has the potential to significantly increase the number of entry level positions offered to Australian workers in a way that is cost neutral for government.

Precarious and Insecure Work

Insecure or precarious work can manifest in many ways beyond un- or under-employment. A worker can experience precarity as casual or temporary work, as variable or unpredictable hours, as the loss of benefits such as paid leave and overtime pay, as high job turnover rates and as variable income. These are all features of the increasing precarity of our workforce.

A large part of the reason for the increasing insecurity of work in Australia is the loss of bargaining power for workers, due to declining union coverage and successive attacks on workplace rights by governments since the 1990s. Australians could once rely on a system in which workers and employers worked together to increase productivity and growth on the understanding that the spoils would be fairly shared. That system is broken, and the good faith negotiation between workers and their employers that was the hallmark of the Australian 'fair go' is under extreme pressure.

Exacerbating the insecurity caused by the casualization of work in Australia in recent years has been a changing industry composition in the economy. Simply put, employment in higher paying industry sectors with more permanent, full time jobs has been falling relative to that in lower paying sectors with more part-time, casualised and limited term contract jobs, including those offered through labour hire. As noted in our



report *Flexible Ongoing Employment: solving a problem that doesn't exist*, industries with the greatest proportion of casual workers are also the lowest paid industries in Australia.

Given the epidemic of precarious and insecure work being experienced by Australian workers, it is clear that current arrangements to regulate wage payments are not working. Restrictions on the ability of unions to access workplaces, represent workers, monitor wage payments and engage in legal industrial action not only diminish the power of ordinary workers, but reduce the likelihood of contraventions to workplace standards being made public.

Internationally, evidence is mounting to prove the integral role that trade unions play in ensuring stronger wage growth, greater social cohesion and reduced inequality. Notably, a comprehensive paper by the International Monetary Fund (IMF) reported that high union density strongly

predicts low income inequality.⁹⁷ They found that a reduction in union density weakens earnings for middle- and low-income workers and increases the income share of corporate managers and shareholders.

Similarly, recent research from Princeton University in the US found that union density had a strong equalizing effect on income distribution: low skilled workers wages at the low end of income distribution were lifted at times of high union density.⁹⁸ Trade unions and industrial lawyers at union friendly law firms have been integral to uncovering cases of contravention of industrial legislation. The best way to ensure job security and strengthen wage growth is to increase the rights of working people and extend the industrial powers of the trade union movement, including by reinstating the right of unions to enter the workplace and represent the interests of Australian workers.

⁹⁴ The Australian Skills Quality Authority. (2014). *Annual Report 2013-14.*, p. 10

⁹⁵ Hall, R., Buchanan, J., & Considine, G. (2002). 'You value what you pay for': enhancing employers' contributions to skill formation and use: a discussion paper for the Dusseldorp Skills Forum.

⁹⁶ Fraser, D. (1996). *The Training Guarantee: Its Impact and Legacy.*

⁹⁷ Jaumotte, F., & Osorio, C. (2015). Inequality and Labor Market Institutions. *Staff Discussion Notes*, 15(14), 1. <https://doi.org/10.5089/9781513577258.006>

⁹⁸ Farber, H. S., Herbst, D., Kuziemko, I., & Naidu, S. (2021). Unions and Inequality over the Twentieth Century: New Evidence from Survey Data. *Quarterly Journal of Economics*, 136(3), 1325–1385. <https://doi.org/10.1093/qje/qjab012>



Challenges to decent work in the renewable energy sector

When considering the changes to our economy necessary to transform Australia into a renewable energy 'superpower', there are a number of areas that act as barriers to decent work within the sector.⁹⁹

Firstly, there are high rates of corporate churn within the industry. This churn is largely driven by the privatisation of the industry, under which electricity infrastructure has gone from being managed and maintained by publicly accountable entities to being controlled by private, profit-driven businesses. As the profit motive has grown throughout generation, transmission, storage and retail, employment standards across the industry have come under pressure. In particular, the number of small-scale operators in the home solar industry presents particular challenges, as little oversight provided outside largescale unionisation and/or compliance monitoring by the ombudsman. Labour hire and other third party sub-contracting arrangements have become more common across the industry and have consistently undermined employment standards.

Secondly, the profit motive and the desire to reduce energy prices has led to a vicious cycle or 'race to the bottom' on labour cost and working conditions. While government subsidies and rebates have helped to reduce the cost to the consumer, for investment in new renewable energy generation to stack up financially, generation costs need to be competitive with existing fossil fuel assets. As the upfront costs of finance and construction are negotiated as part of the contracting process before labour is engaged in any

⁹⁹ Australian Council of Trade Unions. (2020). *Sharing the benefits with workers - A decent jobs agenda for the renewable energy industry* (Issue 61), pp. 16-21

way, wages and conditions are pressured to fit into an existing project budget envelope, rather than ensuring that fair wages and conditions determine the project's budget from the outset of negotiations.

Thirdly, there are currently no requirements to ensure any involvement for worker representatives in the renewable energy sector. There are no requirements for businesses receiving government assistance through the Clean Energy Finance Corporation (CEFC) or the Australian Renewable Energy Agency (ARENA) to engage with, or ensure access for, trade unions, or to maintain any level of employment standards.

Lastly, there are significant regulatory barriers to workers choosing to collectivise, to join a union and to seek to be represented. From regulatory restrictions on trade union right of entry, the removal of standing for unions in matters such as visa worker exploitation, wage theft and wages recovery and significant regulatory hurdles to agreement making processes, the

legal framework is designed to obstruct and hinder workers accessing their union while leaving employers completely unhindered to join and be represented by their chosen industrial associations. Further, the true 'employer' for these projects are usually three or more tiers removed from the employing entity facilitating corporate avoidance of social and legal obligations to the workforce.

The most effective way to ensure decent work within the industry is to prioritise union involvement in the decision-making process, both at the governmental level and at the firm level, by placing requirements on any renewable energy project to demonstrate that a union Greenfields agreement has been reached before funding is allocated. By ensuring that trade unions have unimpeded access to the renewable energy workforce, the government can guarantee that employment standards will be maintained across the industry and allow for the benefits of the renewable energy boom to be distributed equally throughout the community.

This churn is largely driven by the privatisation of the industry, under which electricity infrastructure has gone from being managed and maintained by publicly accountable entities to being controlled by private, profit-driven businesses. As the profit motive has grown throughout generation, transmission, storage and retail, employment standards across the industry have come under pressure.



Cleaner Jobs: Diversifying Australia's industrial profile in the post-carbon economy

Building a post-carbon economy won't be easy. By most measures, Australia is increasingly an underdeveloped economy with an industrial profile that has more in common with underperforming single product economies in sub-Saharan African nations than with innovative economies such as Germany, South Korea or Switzerland.

Australia's export profile is a case study in resource dependency. Mineral exports account for more than half of Australia's global exports,¹⁰⁰ primarily being linked to the price of iron ore. Worse still, we are increasingly reliant on a single trading partner: China accounts for 30.8% of our export profile, meaning that our economy quite literally rises and falls with the amount that China is willing to pay for iron ore. While any attempt to stigmatise or simplify our complex relationship with this crucial trading partner is misguided and dangerous, an over-reliance on any one commodity or trading partner is

inherently troubling. Without diversification, our economy will continue to be less able to provide for Australians in times of crisis, and our resource dependence will remain vulnerable to external shocks and international crises.

The good news is that the only thing that holds us back from creating a more diverse and dynamic economy is our own political imagination. As discussed in Section 1, countries throughout history have risen to the challenge of diversification and challenged the orthodoxy of economic thinking to overcome resource dependency and create sophisticated economies. Recent research into diversification strategies in resource dependent economies found that those that follow three conditions are most likely to succeed.¹⁰¹ Firstly, diversification should aim to meet existing or anticipated market demand. Secondly, it should build on existing domestic capabilities. Thirdly, diversification strategies should seek to develop complementary

¹⁰⁰ Office of the Chief Economist. (2021). *Resources and Energy Quarterly* (December 2021).

¹⁰¹ Mahroum, S., & Al-Saleh, Y. M. (2017). *Economic diversification policies in natural resource rich economies*. <https://www.routledge.com/Economic-Diversification-Policies-in-Natural-Resource-Rich-Economies/Mahroum-Al-Saleh/p/book/9781138325180>, pp.2-6

capabilities to pre-existing domestic capabilities.

These criteria paint a promising picture for Australia's post-carbon future. The global and domestic market for low and zero carbon technologies is growing at a rapid rate. Australia has significant industrial experience not only in base material extraction, but in value adding to these raw materials to produce a range of goods. We also have a significant comparative advantage in our ability to capture renewable energy, with some of the most dependable solar and wind levels anywhere in the world. Finally, by utilising our considerable historical expertise in manufacturing, we have the ability to build new industries on our pre-existing domestic capabilities, and ensure that not only do we diversify our industrial and export profile, but we create a sustainable and secure future for a whole new generation of Australians.

This section looks at some of the pre-existing businesses, services and products that are ripe for an industry policy approach to development. By utilising the policy levers described in the previous sections, we have an opportunity to transform Australia from a resource dependent, underdeveloped economy to one that is a world class innovator and renewable energy superpower.¹⁰² All that it takes is commitment, willpower and political imagination.

Base Material Manufacturing

Green Steel

Australia's steel industry is well established and extremely valued both domestically and around the globe. However, while Australia exports more than 900 million tonnes of iron ore, we only manufacture 5.5 million tonnes of steel.¹⁰³

Worse still, this production currently creates two tonnes of carbon for every tonne of steel, meaning Australia's steel carbon footprint is in the neighbourhood of 11 million tonnes. This carbon is produced as a result of using coking coal in the blast furnaces to create the intense heats needed to move iron ore into a malleable substance, and to strip the iron ore of oxygen. Exciting technological developments in the use of renewable hydrogen in place of coking coal offers Australia an opportunity to follow Sweden as a green steel superpower. Not only does this adjustment to production offer the opportunity to create thousands of blue collar jobs in a renewed steel industry, it also means that instead of carbon monoxide being the main by-product of steel production, we will be creating simple waste water that can be cleaned and put to good use.

Liberty Primary Steel is the largest producer of steel products in Australia, and has recently announced that it will shift to a patented "GREENSTEEL" manufacturing process that will allow for growth as well as adjustment to the eventual production of carbon neutral steel, whilst ensuring that communities develop these changes. The Liberty Primary Steel plant, located in Whyalla, is approximately 400km north-west of Adelaide and a subsidiary under the larger umbrella that is the Gupta Family Group (GFG Alliance). Ownership of the steelworks has changed hands many times in its long history, most recently in 2017 when it was bought by GFG after the previous owner, Arrium, had passed into receivership. This purchase saved an estimated 3,000 jobs in Whyalla, a town of only 22,000 and presented itself as an opportunity to revolutionize the way in which Australia's number one steel products producer operated.

This development is the tip of the green steel iceberg: a national green steel plan could produce significant value for Australia's economy. Recent analysis shows that a fully functioning green steel industry could provide \$65bn in export revenue and create as many as 25,000 jobs,¹⁰⁴ which crucially have a similar skills distribution to coal mining and could offer workers in coal country a secure, stable and satisfying job in the post-carbon economy.

Automotive Manufacturing

The collapse of the automotive manufacturing industry in Australia has created not only significant economic hardship but emotional damage across the country. When Australia's largest car manufacturers, Ford, Holden and Toyota, made the decision to close their doors in the wake of the GFC, after 100 years of Australian manufacturing operations, more than 50,000 workers were displaced across the automotive supply chain.

There are a number of reasons why this closure occurred.¹⁰⁵ A rapid increase in imports, which from 31% of all vehicles sold in 1992 to 81% in 2012, brought on by the resource-induced appreciation of the Australian dollar, made it difficult for the companies to keep their domestic operations sustainable. Arguably, this led to an over reliance on fleet sales, particularly from state and federal governments. Therefore, when

the Australian government switched from GM Holden to BMW in December 2013, and removed an additional \$500m in industry assistance,¹⁰⁶ the industry went into freefall.

Yet this decline in both manufacturing generally, and automotive manufacturing specifically, is not universal amongst the developed economies of the OECD. Indeed, while low wage nations like China and India produce much of the world's manufactured goods, high wage, high skill base economies in France, Germany, Sweden, Canada, Japan and South Korea maintain highly competitive automotive sectors with dedicated government support and planning.

There is a way to help revitalise Australia's vehicle industry: electric buses.

There is little doubt that we need cleaner ways of getting around, whether it's returning to the commute to work or just getting to the local shops - and transport is Australia's third largest source of emissions.¹⁰⁷ While a single electric bus might seem like a drop in a rapidly rising ocean, its design can potentially offer a real reduction in our nation's carbon emissions.

As of 2019 there were almost 100,000 registered buses in use across Australia - and 79% are running on diesel fuel.¹⁰⁸ While diesel produces slightly less carbon dioxide (CO₂) than traditional petrol, they still produce on average 120g of CO₂ per km while in use.¹⁰⁹

¹⁰² Garnaut, R. (2019). *Superpower: Australia's Low-Carbon Opportunity*. La Trobe University Press.

¹⁰³ Allen, J., & Honeyands, T. (2021, June 2). "Green steel" is hailed as the next big thing in Australian industry. Here's what the hype is all about. *The Conversation*. <https://theconversation.com/green-steel-is-hailed-as-the-next-big-thing-in-australian-industry-heres-what-the-hype-is-all-about-160282>

¹⁰⁴ Wood, T., & Dundas, G. (2020). *Start with Steel: A practical plan to support carbon workers and cut emissions.*, p. 28

¹⁰⁵ Clibborn, S., Lansbury, R. D., & Wright, C. F. (2016). Who Killed the Australian Automotive Industry: The Employers, Government or Trade Unions? *Economic Papers: A Journal of Applied Economics and Policy*, 35(1), 2-15. <https://doi.org/10.1111/1759-3441.12127>

¹⁰⁶ Department of Industry & Innovation. (2020). *Transition following the end of Australian motor. January*. <https://www.industry.gov.au/sites/default/files/2020-01/australian-automotive-industry-transition-following-the-end-of-australian-motor-vehicle-production.pdf>, p. 8

¹⁰⁷ Climate Council. (2016). *Transport Emissions: Driving Down Car Pollution in Cities*.

¹⁰⁸ Australian Bureau of Statistics. (2021, January 31). *Motor Vehicle Census, Australia*. <https://www.abs.gov.au/statistics/industry/tourism-and-transport/motor-vehicle-census-australia/latest-release>

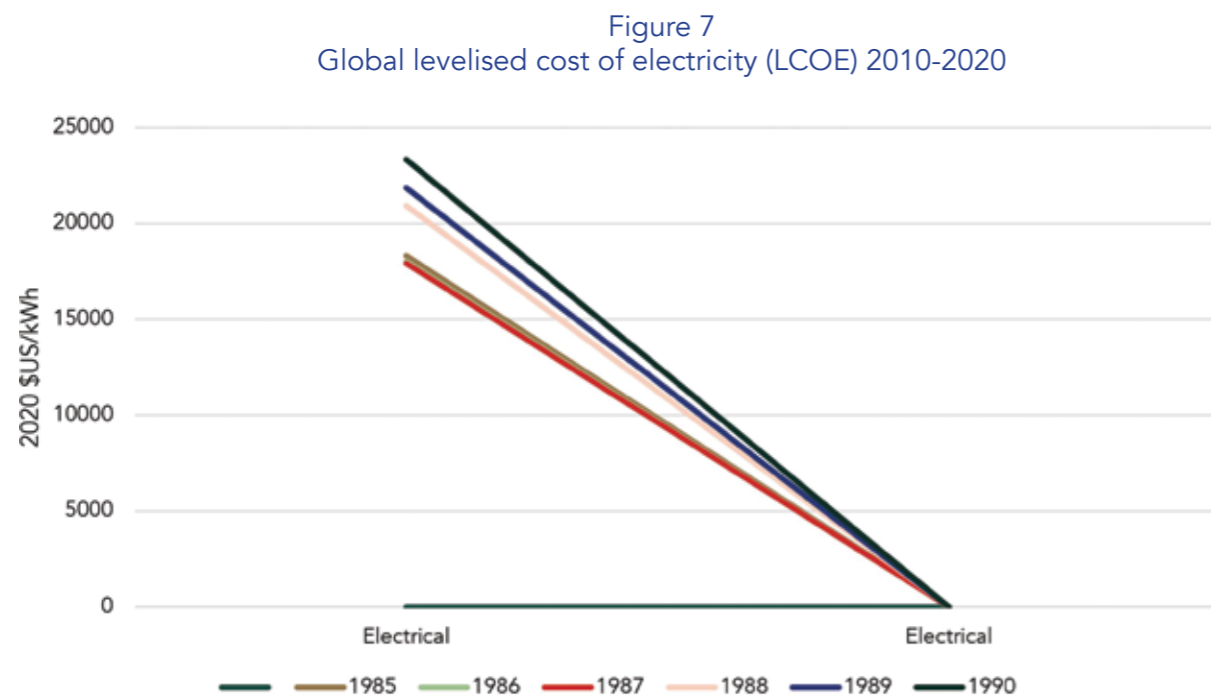
¹⁰⁹ Nieuwenhuis, P. (2017, May 2). Fact Check: are diesel cars really more polluting than petrol cars? *The Conversation*. <https://theconversation.com/fact-check-are-diesel-cars-really-more-polluting-than-petrol-cars-76241>

Given that the average bus travels 36,200km a year in Australia, that means buses alone are responsible for almost half a million tonnes of CO₂ every year. By developing an industry plan for electric buses, the government could reduce the carbon output of our transport system and provide employment in the automotive industry.

Additionally, when coupled with the production of lithium batteries and green steel, the supply chain for other electric vehicles becomes much more viable.¹¹⁰ Australia already leads the world in our reserves of gold, iron ore, nickel and zinc. We rank second in the world for aluminum, cobalt, copper, lithium and tungsten, and third for silver. We have a comparative advantage in all the base materials needed to build a world class electric vehicle industry, and help kick-start a revolution on our roads. As Dr. Mark Dean has decisively shown in his recent report, the only thing missing is the political will to implement it.¹¹¹

Post-Carbon Energy Systems

Australia is uniquely positioned to take advantage of the global shift towards renewable energy generation, transmission and storage. While anxieties about the cost of electricity during this transformation are understandable, they are no longer based in fact. Globally, the cost of renewables has been rapidly declining, becoming as affordable - and in most cases, much cheaper - than fossil fuels (see Figure 7).



Source: Author's calculations based on International Renewable Energy Agency, 2020, p. 15.

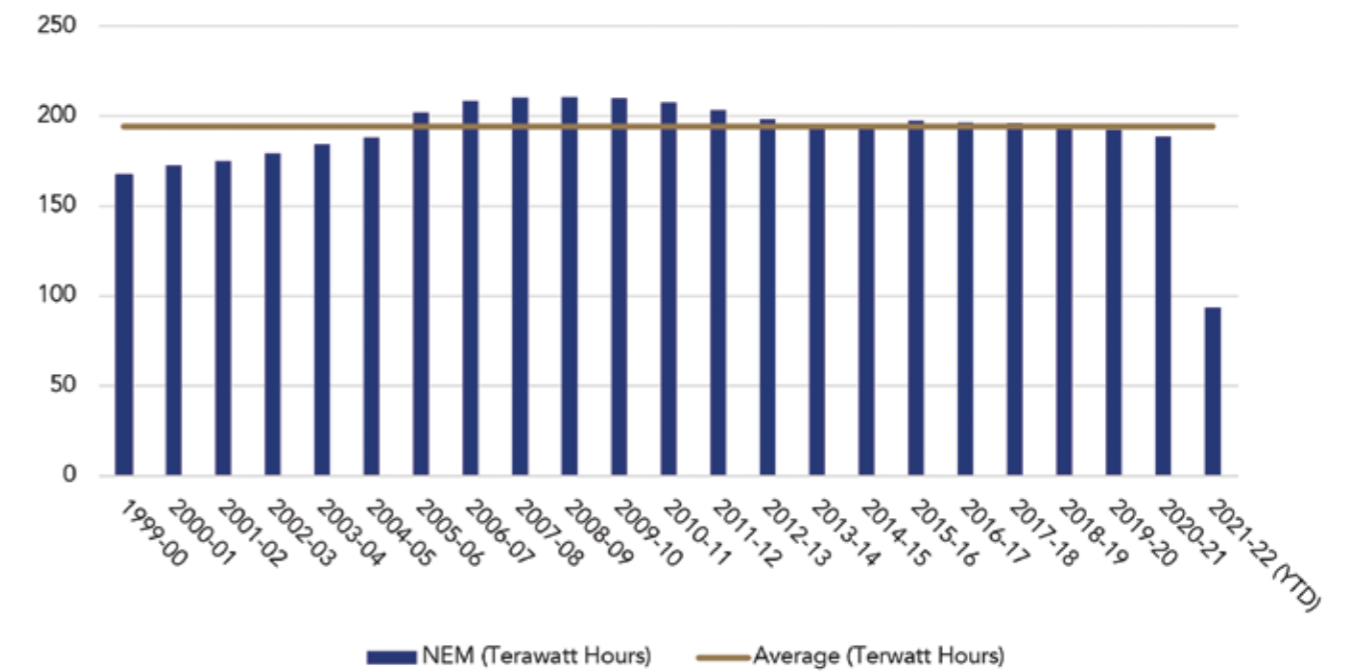
110 Dean, M. (2022). *Rebuilding Vehicle Manufacturing in Australia* : February. <https://australiainstitute.org.au/report/rebuilding-vehicle-manufacturing-in-australia/>

111 Ibid.

As the cost of renewable energy continues to decline, the opportunity to invest in this growing industry becomes more attractive. Around the world, countries are shifting to renewable energy and the demand for the infrastructure and equipment associated with this shift is similarly increasing. While Australia is well suited to make the shift in our energy system, we're currently not well equipped to compete in the renewable energy industry - at least, not yet.

While there is plenty of scope for Australia to become a net renewable energy exporter, for the purpose of this report, we will model what it would take to create enough energy to cover Australia's domestic energy needs (see Figures 8, 9, and 10).

Figure 8
National Electricity Demand



Source: Authors calculations based off (Australian Energy Regulator 2022).

There is strong need for national coordination and leadership to ensure effective growth across the energy sector. As described in Section 1, there are numerous examples of state governments and local communities going it alone to design industry development plans, which shows the vision and political willpower at this level of government. This is in some ways inevitable, as different states have myriad comparative advantages when it comes to natural resources, skills base, industrial capacity and treasury budgets. However, the differing approaches and different pace that the states and territories are taking makes economies of scale hard to realise as we approach industry development. The federal government must take a leading role in coordinating and supporting the state governments, and assist in the creation of national supply chains with national benefits.

Energy Generation

Wind Power

Wind turbines harness resources through kinetic energy, as the wind turns the blades of the turbine generating power with each rotation. These turbines are complex mechanical structures, and contain a number of component parts, including:¹¹²

- Nacelle: the box located on the top of the tower, made of fiberglass, that contains approximately 8,000 subcomponents and connects them to the rotor. The size and weight of the nacelle vary depending on capacity (75 tonnes for a 2 megawatt (MW) turbine);
- Rotor and blades: the rotor is typically composed of three rotor blades, the rotor hub that holds the blades in position as they turn and a pitch mechanism that allows the blade to rotate in the direction of the wind, maximising its capacity to harness wind;
- Tower: the nacelle is mounted on the top of a high tower that allows using the best winds and avoiding obstacles. Towers for large wind turbines may be either tubular steel towers, concrete towers, or lattice towers; and
- Additional parts: transformers, capacitors, cables, inverters, microprocessors, heat resistors, meters and other electrical equipment.

Each of these parts take considerable skill and expertise to produce and requires significant investment to be able to produce them at scale.

The production of wind turbines is already underway in Australia. Notably, in 2019 the Victorian government officially opened the *Vestas Renewable Energy Hub* (VREH) in the old Ford Factory in Geelong, on the south-western

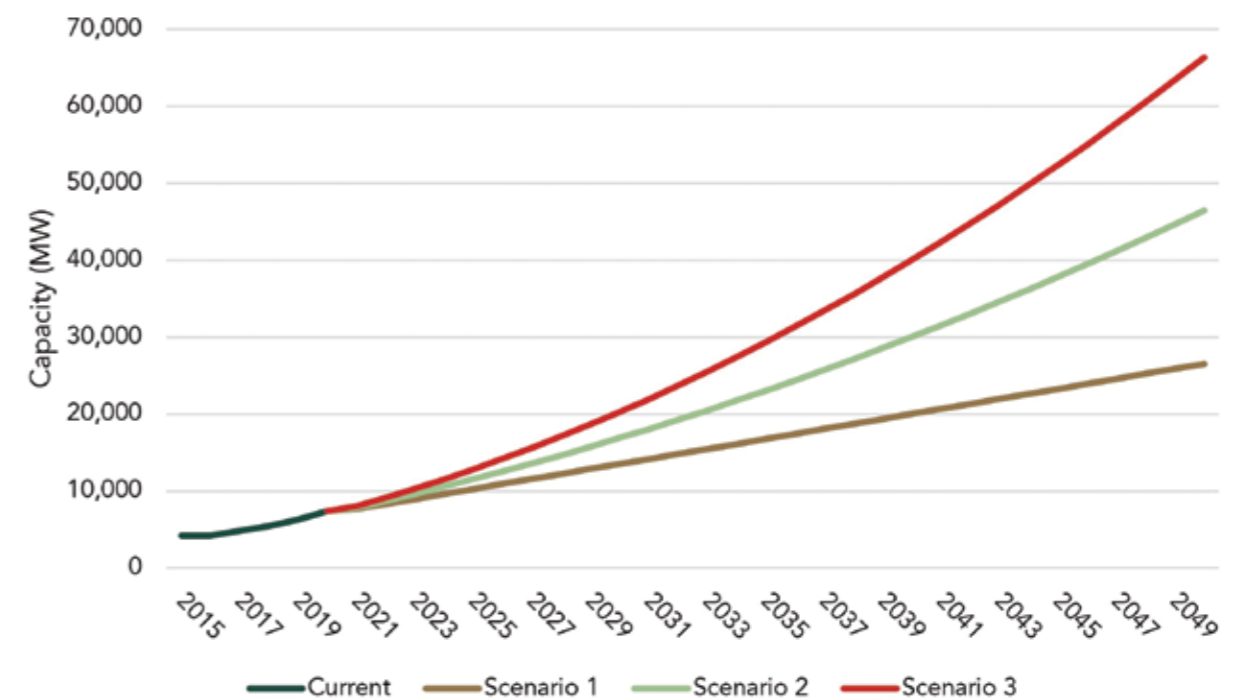
coast of Port Philip bay. The Finnish wind turbine manufacturer Vestas was connected to local supply chains and experienced workers through a partnership with Geelong manufacturer Marand Precision Engineering and was awarded a contract to assemble 100 turbine hubs and 50 drive trains for the 180 megawatt *Berrybank* and the 336 megawatt *Dundonnell* wind farms.

The announcement was the result of years of industry policy planning for the expansion of renewable energy in Victoria. These two wind farm developments utilise the locally assembled wind turbines, which are supported by the Victorian Government's ambitious Renewable Energy Target (VRET). This target not only legislates renewable energy generation of 25% by 2020, 40% by 2025, and 50% by 2030, but supports businesses to hire and train locals in partnership with Federation University. This initiative also contains a collaborative research project with Deakin University, which will look at further development of carbon fibre for wind turbine blades to be more productive. While this initiative conforms to many of the practices outlined in previous sections of this report, if we are to increase our capacity to harness Australia's considerable wind resources we must scale up production.

Victoria has recently taken another leap forwards, announcing a world class industry policy for the offshore wind industry.¹¹³ The policy applies the thinking outlined in Section 1 of this report, and has the potential to create 6,100 jobs across the Gippsland region in Eastern Victoria, including up to 3,000 ongoing jobs following the development and construction phase.

Currently, wind energy accounts for approximately 9.9% of Australia's overall electricity generation. Following the principles outlined in Section 1 of this report, we have modelled three scenarios for an increase in the amount of energy generated by wind through to 2050, based on current data (See Figure 9). Three scenarios are projected: the first captures a scenario where targets are set and assistances given to increase renewables profile in Australia's energy mix. The second assumes that nothing changes and our renewable energy grows at the current rate, with minor support. The third models a stagnating domestic investment, and a lack of government action.

Figure 9
Wind Energy Generation



Source: Authors calculations, based on current data from Clean Energy Council, 2022.

In order to calculate the potential employment gains from investment in local wind turbine production, we used the methodology utilised by the International Renewable Energy Agency (IRENA), reproduced below (Table 3).

¹¹² International Renewable Energy Agency. (2018). Renewable Energy Benefits: Leveraging Local Capacity for Onshore Wind. In *Irena*. /publications/2017/Jun/Renewable-Energy-Benefits-Leveraging-Local-Capacity-for-Onshore-Wind

¹¹³ Victorian Government. (2022). *Offshore Wind: Policy directions paper march 2022* (Issue March).

Table 3
Wind Turbine Employment Gains

Types of Work	Nacelle (Days of work)	Blades (Days of work)	Tower (Days of work)	Monitor and control system (Days of work)	Total by occupation (Days of work)	Total FTE per year (Days of work)
Factory workers	5,890	3,400	2,850	300	12,440	34
Health and safety experts	620	125	300	30	1,075	3
Logistic experts	620	125	300	30	1,060	3
Quality control experts	620	125	300	15	1,060	3
Marketing and sales personnel	480	290	230	45	1,045	3
Industrial engineers	480	227	232	15	1,004	3
Administrative personnel	480	113	230	45	868	2
Management	185	110	90	-	385	1
Telecommunication and computer engineers	-	-	-	15	15	0
Regulation and standardisation experts	-	-	-	15	15	0
Total	9,375	4,515	4,532	510	18,967	52

Source: Authors calculations based on International Renewable Energy Agency, 2018, p. 26.

The figures used by IRENA are based on the production of enough materials to create a 50MW wind farm. When these figures are measured in full time equivalency (FTE), there are approximately 52 jobs required to produce the materials contained within a wind farm that can produce 50MW. Additional opportunities exist in the operation and maintenance (O&M) of offshore wind projects, like the much-anticipated *Star of the South* project in Victoria. Globally, employment in O&M of offshore wind farms increased by 7% in 2020 and projections estimate that these jobs will increase by 25% by 2025 and by as much as 45% within the decade.¹¹⁴ In Victoria alone, the growth of offshore wind projects

¹¹⁴ Rystad Energy. (2021, February 19). *Hiring wave coming: Offshore wind staff demand to triple by 2030, hundreds of thousands needed.* <https://www.rystadenergy.com/newsevents/news/press-releases/hiring-wave-coming-offshore-wind-staff-demand-to-triple-by-2030-hundreds-of-thousands-needed/>

in line with the VRET will result in more than 3,000 ongoing O&M jobs,¹¹⁵ primarily in electrical and metal trades. Recent Australian research estimates that 43% of ongoing work in the offshore wind industry will be made up of technical and trade occupations, providing a much needed pipeline of work that maps well against the existing skills base in the energy sector.¹¹⁶

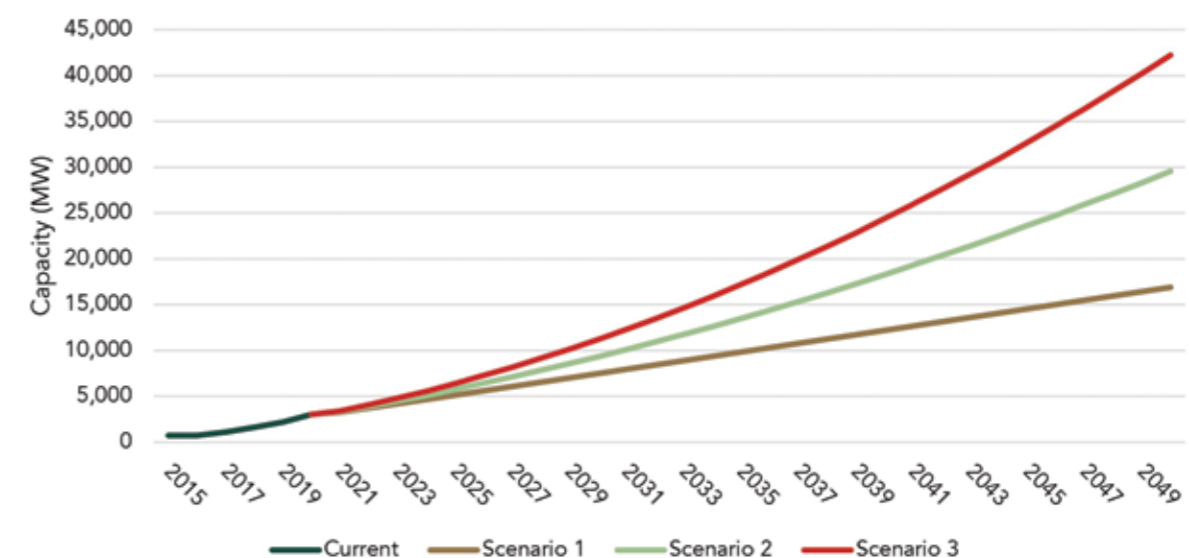
By 2050, using the projections above, anticipated employment gains are between 27,596-68,991 workers over the next 30 years in order to produce the additional energy generation, in particular, the installation of offshore wind offers unique opportunities to build a sustainable and secure energy base in the post-carbon economy.

Solar Power

Solar photovoltaic (PV) cells, or solar panels, consist mostly of an aluminium frame, a glass sheet, about 60 silicon solar cells, and a junction box. Currently, they are the fastest growing energy generation method, accounting for approximately 6.5% per cent of Australia's electricity in 2020.

While large-scale solar (LSS) farms which, depending upon their size, can produce upwards of 124MW, have become more common across Australia, the largest growth has been in rooftop solar. Indeed, more than 30 per cent of Australian households have made the switch to renewable energy for their households, by installing solar panels with support from government incentives.

Figure 10
Solar Energy Generation



Source: Authors calculations, based on current data from Clean Energy Council, 2022.

¹¹⁵ Perkins, M., Toscano, N., & Sakkal, P. (2022, March 4). *Victorian offshore wind farms to drive jobs and Premier's innovation agenda.* *The Age.* <https://www.smh.com.au/environment/climate-change/offshore-wind-farms-underpin-premier-s-plans-for-bold-reform-20220304-p5a1th.html>

¹¹⁶ Briggs, C., Hemer, M., Howard, P., Langdon, R., Marsh, P., Teske, S., & Carrascosa, D. (2021). *Offshore Wind Energy in Australia.* July.

PV cell production is in its infancy in Australia - or rather, it is waiting for its rebirth. Twenty years ago, Australia was home to the largest solar panel factory in the southern hemisphere.¹¹⁷ BP Solar built and assembled cells using technology developed in partnership with the University of New South Wales (UNSW), technology which UNSW research took with them to set up China's first PV production facility. Now, China accounts for about 70% of global PV production, while Australia makes up less than 0.3%.

Unfortunately, there was little support available for the Australian designed technology, as mining investment was on the upswing in 2000, and the researcher who had developed the design decided to move back to China to pursue his new business, *SunTech*.

As *SunTech* went from strength to strength, the once world-leading Australian solar plant struggled to secure any support from the government, and folded in 2009. Today, 90% of solar panels utilise technology developed in the UNSW research facility, but unfortunately the production boom started long after the patent had expired. This missed opportunity meant that instead of leading the solar boom, Australia is struggling for a place at the back of the pack, despite having a rapidly growing domestic need for the product.

Following the same methodology utilised to forecast wind generation, we have modelled three projections for an increase in the amount of energy generated by solar through to 2050. Using the projections above, this means that anticipated employment gains could be as many as 253,566 workers over the next 30 years to produce the additional energy generation (see Table 4). While the high end of this scenario is unlikely in the current political climate, even a fraction of this production could have wide-ranging and long-term economic benefits. With appropriate government support and incentives, the benefits would be significant.

Table 4
Photovoltaics Employment Projections.

	Manufacturing Jobs (FTE)	Installation Jobs (FTE)	Operational & Maintenance Jobs (FTE)
Minimum	6	6.4	0.1
Median	18.8	11.2	0.3
Maximum	34.5	33	1.65

Source: Cameron and Van Der Zwaan 2015, p. 165

117 Purtill, J. (2021, September 19). The world is hungry for solar panels. Why did we stop making them? ABC News. <https://www.abc.net.au/news/science/2021-09-19/solar-panels-why-australia-stopped-making-them-china/100466342>

In particular, while there is dispute that Australia can create a sustainable PV industry, the growth in solar energy will create large demand for component parts, from frames and brackets used in solar arrays, to the cabling needed to transmit electricity. An industry policy for the solar industry should look at the opportunities presented in the supply chain to maximize local production and local benefit.

The real benefits will only be realised with economies of scale in installation and maintenance of Australia's world leading solar homes uptake. As previously mentioned, the plethora of small scale operators make for a variety of standards and a lack of scale. To maximize community benefit, we need centralised oversight and structure to ensure that economies of scale can be reached and standards maintained. A strong regulatory hand is needed at the national level, to ensure compliance and protect both consumers and workers across the industry.

Transmission: Rewiring the Grid

As we move towards greater electrification of Australia's infrastructure, transport and industrial production, the transmission of our nation's electricity becomes paramount to our future success. The National Electricity Market (NEM) was created in 1995, as part of a suit of reforms to encourage uptake of the then government's national competition policy, and commenced operation in December 1998.¹¹⁸

These reforms broke up the previously government-held energy system into discrete areas of operation: generation, transmission, distribution, and retail. While still held in the

hands of state and territories (Excluding WA and NT, which were not included in the interconnected NEM), these discrete areas were openly encouraged to be privatised, a move which was led by the Kennett government in Victoria between 1995 and 1997,¹¹⁹ swiftly followed by South Australia in 1999 and then NSW from 2008.

The NEM is now one of the largest interconnected energy systems in the world, spanning 918,000km of distributed electrical and gas networks managed by a mix of private and public operators, including:

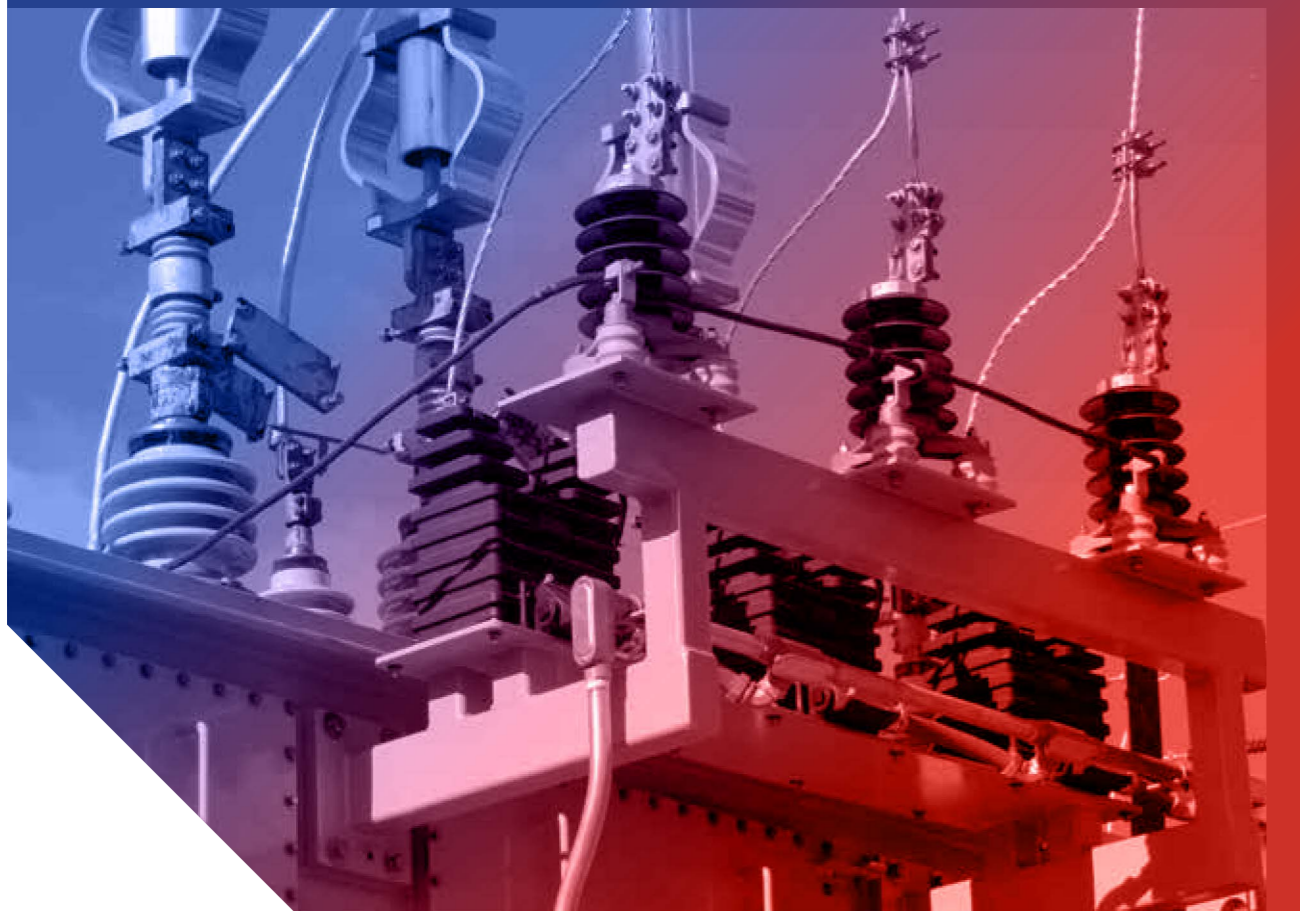
- 100 per cent privately owned electricity networks: Victoria, South Australia;
- 100 per cent government owned electricity networks: Tasmania, Western Australia, Northern Territory and Queensland;
- In NSW, one electricity network is privately owned, two are 50.4 per cent privately owned and one is fully government owned;
- The Australian Capital Territory's electricity network is a joint public and privately-owned entity;
- Australia's gas distribution providers are all privately owned, with the exception of the ACT's, which is half government owned.

While the Australian Energy Market Operator (AEMO) believes that, with adequate reform, the NEM could readily accommodate up to 75% renewable energy by 2025,¹²⁰ the complex interconnectedness and diversity of ownership models has led to a number of key problems with the ageing infrastructure of the physical assets.

118 Energy Networks Australia. (2020). *Guide to Australia's Energy Networks: What are energy networks?*, p.2

119 Costar, B. J., & Economou, N. (1999). *The Kennett revolution: Victorian politics in the 1990s* (1st ed.). UNSW Press., p. 150-9

120 Bolt, S., Hemphill, M., Kilby, P., Halley, A., Lim, A., Havyatt, D., McGranaghan, M., O'Malley, M., Platt, G., Potter, C., & Reed, E. (2020). *Renewable Integration Study: Stage 1 report*. April. <https://aemo.com.au/-/media/files/major-publications/ris/2020/renewable-integration-study-stage-1.pdf?la=en&hash=BEF358122FD1FAD93C9511F1DD8A15F2>, p. 13



Transmission of electricity across the areas of the NEM requires the transportation of high-voltage electricity across the distribution networks to residential homes as well as commercial sites. This distribution network consists of 'poles and wires, substations, transformers, switching equipment, and monitoring and signalling equipment'.¹²¹ The aforementioned AEMO study notes that transmission lines are in desperate need of replacement and repair, a concern which is shared by the workforce.¹²² The asset deterioration across the grid is considerable, and presents a significant opportunity to upgrade the infrastructure, and engage in significant job creation.

Recent modelling assessing the ability of Australia to modernise and rebuild the electricity grid

could create as many as 13,500 direct jobs building transmission infrastructure, with an additional 116,170 indirect jobs in manufacturing, construction, operation and maintenance of the new electricity infrastructure.¹²³

The potential for a dedicated energy industry policy to produce employment results is substantial, and forward-thinking state governments are already showing that they are both politically viable and economically sensible. We need leadership at the Federal level to provide support and coordination to the efforts already being made by the states and by industry partners.

121 Australian Energy Regulator. (2021). *State of the Energy Market 2021*. <http://www.aer.gov.au/node/18959>

122 Armistead, A., Richardson, D., & Stanford, J. (2021). *Missing a Stitch in Time: Consequences of Electrical Grid Underinvestment*. *Missing a Stitch in Time: The Consequences of Underinvestment in Proper Upkeep of Australia's Electricity Transmission and Distribution System*

123 Reputex Energy. (2021). *The economic impact of the ALP's Powering Australia Plan: Summary of modelling results, December 2021*. December 2021., pp. 12-3

Energy Storage

Lithium Batteries

As of 2021, Australia is one of the world's leading producer and exporter of lithium,¹²⁴ a key commodity in modern battery production. However, Australia currently has very little share of battery production, sending the raw material overseas to be processed and manufactured.

A recent report commissioned by the Future Battery Industries Cooperative Research Centre (FBICRC) warns against repeating the mistakes of the mining boom and urges the seizing of a \$7.4 billion local battery manufacturing industry.¹²⁵ By understanding the process of lithium battery production (Figure 11), we can begin to understand the opportunities it presents to Australia.

Figure 11
Battery Production Process



Source: *Future Battery Industries CRC 2021*, p. 13

Australia's lithium footprint is entirely in the extraction of raw materials, accounting for 50% of the world's lithium production. Fortunately, Australia is also a leading exporter of multiple other raw materials necessary in battery production, notably Graphite, Nickel, Manganese, Cobalt, Vanadium, Copper, and Aluminium.

The next step in battery production is in the chemical refinement of the raw materials, an area in which Australia has complementary capacity as we already smelt iron, alumina, copper, silver, lead, zinc and other non-ferrous metals. Following this refinement, a process of activation is necessary to create materials ready for production, including the creation of cathodes like lithium nickel manganese cobalt oxide (Li-MNC) as well as anodes like graphite and silicon. Currently, Australia has next to zero production of these active materials.

124 Pupazzoni, R. (2021, July 29). Australia's lithium miners powering the global electric vehicle charge. *ABC News*. <https://www.abc.net.au/news/2021-07-29/australian-miners-powering-global-electrification/100318108>

125 Future Battery Industries CRC. (2021). *Future Charge: Building Australia's Battery Industries* (Issue June). <https://fbicrc.com.au/wp-content/uploads/2021/06/Future-Charge-Report-Final.pdf>, pp.1-13

Once these active materials are created, they are then used in the manufacturing of battery cells including electrode chemical processing, cell assembly and cell finishing, followed by assembly of the battery pack. Australia is again almost entirely without a production footprint in lithium batteries. For example, in the industrial fringes in Melbourne PowerPlus Energy employs 50 local workers making home battery storage systems in its factory for use in off-grid homes. However, they are one of a very small number of businesses struggling to find a place in the global marketplace.

These opportunities don't stop at the end of the production line. Integration, installation, servicing and management present further opportunities, as does an efficient and effective re-use and recycling industry. In fact, the FBICRC report estimates that if Australia had an industry policy for the lithium battery industry that accommodated the entire through-life of the product, Australia could benefit from value added economic gains of \$7.4 billion and create approximately 34,700 jobs across the supply chain.

Rebuilding Australia's Capacity: The opportunities of electrified industry

The decline in manufacturing across Australia has become a national shame. Despite 83% of Australians expressing a desire to see more manufacturing jobs in Australia (Wade & Ting, 2017), our nation's leaders have allowed the industry to contract over a number of decades. Contrary to popular belief, the manufacturing industry is readily adaptable to modern market economies. In particular, the German example offers insights into how this

valuable sector can be essential to economic success.

Germany is the world's most manufacturing-intensive economy, and the is key to Germany's sustained growth. While Australian manufacturing employs about 8.9% of all workers and contributes around 6% of our GDP, Germany's manufacturing industry accounts for approximately 23% of GDP and employs one in five German workers.¹²⁶

Sadly, where sophisticated, forward thinking economic planners in Germany seek to develop services to complement export strategy, others in Australia develop services to make up for a lack of export strategy. To succeed in the post-carbon economy, Australia must develop and diversify its industrial base by engaging in smart, modern industry planning. It is not enough to merely produce products with a smart industrial agenda, we need to decarbonise our industrial footprint. In short, we need to electrify our industries as well as our home.

Below are some examples of the way Australia could increase its manufacturing footprint in a way that adds value to our already considerable comparative advantage in raw material extraction and production.

Electrifying Industry

Australian inventor and author Dr. Saul Griffiths has recently outlined the unique opportunity that Australia has to lead the world in the electrification of industry.¹²⁷ If we are to seize the opportunity of a renewed manufacturing profile, the energy needs of industry will grow substantially and increase the economies of scale possible for our electricity grid. Throughout economic history, the ability to power industrial machinery has been essential



to economic function and growth.¹²⁸ Where first industry ran on the power of people and beasts of burden, the 19th century saw the rise of steam technology driven by coal fired burners. Since then steam has given way to electricity, but coal has remained its source. The carbon emissions from our industrial heating processes, particularly in the smelting of metals, accounts for 42m tonnes of carbon dioxide, approximately 8% of our total national emissions.¹²⁹

Currently, our manufacturing sector accounts for nearly a third of all energy consumed within Australia, and two thirds of this energy comes from fossil fuels. Electricity only provides 20% of energy use in the industry and it is primarily utilised for lighting and other utility purposes. However, heating is where the most energy intensive work occurs, and where most of the fossil fuel use is stimulated. If we replace the use of coking coal and coal- or gas-fired electricity with renewable energy generation, by increasing

the amount of on-site PV coupled with an increase in the renewable energy capacity of the grid, we can wipe out 42m tonnes of carbon emissions almost immediately. Similarly, by using electrified heat pumps and industrial induction heating, industrial demand for coking coal can be reduced to zero.

As Beyond Zero Emissions has shown comprehensively, the use of renewable electricity in industry has numerous benefits.¹³⁰ Electrification offers benefits in speed, efficiency, capacity and versatility, and can reduce the energy needed to produce the same industrial output by upwards of 50%.

This has flow on benefits to the overall cost of production, and allows savings made on industrial energy bills to be reinvested in additional workers and capacity, creating more community wealth in the long term.

128 Malm, A. (2016). *Fossil capital : the rise of steam power and the roots of global warming*. Verso.

129 Lord, M. (2018). *Electrifying Industry, 2018 – Zero Carbon Industry Plan. Technical Report, Beyond Zero Emissions*. <http://bze.org.au>, p. 17

130 *Ibid.*, pp26-7

126 Dettmer, A., & Wieladek, A. (2019). *Australia Rebooted*.

127 Griffith, S. (2022). *The Big Switch : Australia's electric future*. Schwartz Books.



Conclusion and Recommendations

Building A Post-Carbon Economy Through A Mission-Oriented Approach

In order to address the twinned economic and climate crises that are confronting our nation, we need political leadership at the federal level.

It is imperative that we make significant, but carefully structured, changes to the way we manage our economy, to ensure that the transformation from fossil fuels to renewables is one that shares the resulting prosperity equally across society.

Drawing on the mission-oriented approach to industrial development, there is an opportunity to build political consensus and trust in a vision for the future that provides prosperity and security for all Australians.

To create a mission-oriented approach to industry policy for the post-carbon economy, we recommend that the Federal Government implement the following measures.

Convene an Energy Summit

Scientific consensus about climate change has long ago been settled: political consensus must follow. Both workers and business leaders agree that action is needed, with peak representative bodies the Australian Industry Group (AIG)¹³¹ and Australian Council of Trade Unions (ACTU)¹³² making clear statements on the need to address climate change. The government must play a leading role in bringing together representatives from industry, unions, civil society and governmental bodies at all levels to convene a summit at which negotiations can be held and agreements reached on the way forward to embrace the opportunities of the post-carbon economy. The looming disaster that climate change threatens will affect all parties equally, and any hope of forward momentum relies on the ability of all parties to come together to plan the way forward. Only government can play this essential coordinating role.

¹³¹ http://media.corporate-ir.net/media_files/irol/76/76115/aig_climate_change_updated.pdf

¹³² <https://www.actu.org.au/our-work/climate-change/the-need-for-a-just-transition>

Set ambitious interim emissions targets

The first task of the assembled groups should be to reach agreement to augment our 2030 target and our 2050 net zero commitment with firm emissions reductions by 2025, 2035 and 2040. As discussed in this paper, ambitious yet realistic mile-stoning allows for strategic investment in effective strategies, including easier to implement short-to-medium term goals (such as the introduction of a price on carbon emissions) and longer term, more difficult structural adjustments (such as the closure of coal power plants and scaling up renewable energy generation). Ambitious additional interim targets both encourage action and allow for difficult transformations to be planned and executed justly. Additional targets create key milestones that allow periods of reflection, reallocation and renewal in our journey to net zero.

Establish A Federal Transformation Authority

The change from fossil fuels to renewables needs careful planning to ensure that regional areas are not left behind. An independent Authority should be established by the government, learning from the strengths and weaknesses of the Latrobe Valley Authority in Victoria and the Just Transition Plan in Western Australia, which would oversee planning for place-based economic adjustment plans. These plans would be grounded in local communities that are heavily reliant on fossil fuels and other carbon intensive industries, and would bring together local councils, businesses, trade unions, institutions, education providers and not for profit organisations to assess the challenges and opportunities each discrete location presents.

These place-based taskforces would be supported by specialised public servants to design adjustment plans that attract investment in new and existing industries which can best utilise local skills, resources and suppliers and provide employment opportunities for local workers. Crucially, local workers and community members should be placed at the centre of the decision making. The Authority should be built on inclusive processes, with a legislated seat at the table for workers and community.

This planning should be informed by localised economic complexity research, conducted by the Authority, to identify the best suited opportunities for each region. This research should include common resources and infrastructure that are likely to feed into new and existing industries, and should form the basis of specialised governmental grants to stimulate local supply chains to feed into new and existing industries.

Establish a Clean Transport Commission

An independent body like a Clean Transport Commission could be responsible for coordinating the demand for transport manufacturing, like electric buses, and could maximize efficiency and savings by providing an economy of scale in purchasing.

This would mean that the states who are already going it alone could potentially lower the cost of buying new, electric buses by having their orders coordinated through a federal body, and still retain their own sovereignty in the transport area. This new body would have no power to dictate or force any jurisdictions to comply, but it would significantly reduce the cost of entry into the electric transport market. Additionally, the Commission could partner with the Australian Renewable Energy Authority (ARENA) to model the cost of roll out effectively and efficiently across jurisdictions without tying up the limited resources of state, territory or municipal governments, further reducing costs.

Most importantly, a coordinating national body would provide additional incentives to help kick-start broader electric vehicle production within Australia. Currently, the Victorian electric bus utilises a lot of foreign owned parts, including a Chinese made chassis and battery. By focusing on the larger economies of scale that come from coordinated purchases, domestic manufacturers could utilise domestic supply chains to maximize local content, such as Australian green steel, plastic components and rubber.

Set concrete targets for the energy mix

As Victoria has shown, there is significant benefit to be gained by setting targets and milestones for energy production in wind and solar. Once overall targets for carbon reduction have been set, additional targets for the energy mix should be set, and state-based plans should be developed through a reinstated Council of Australian Governments (COAG), or other collaborative federated body, in order to meet the national reduction thresholds.

Create sector specific industry plans

In order to reach net zero by 2050, representatives from government, industry and the union movement should work to establish industry plans for wind turbines, photovoltaics, lithium batteries, electric vehicles, and green steel, including supply chain mapping. These plans should include incentives and disincentives (including market mechanisms like carbon pricing), investment opportunities and community wealth building strategies that will maximise community benefit in the face of structural adjustments. They should consider the skills mix available and any potential gaps that will need to be filled, the complementarities that are achievable in the supply chains, and local content requirements to encourage maximum benefit to the community.

These should include concrete plans to electrify industry and implement the introduction of onsite PV, electric heat pumps and induction heating where applicable, to reduce the use of fossil fuels in heating and processing.

Kickstart a research revolution

As Mazzucato points out, while there must be a singular purpose to any industrial agenda that targets a specific problem, the goal should be one that is so broad as to encourage multiple projects working towards its solution. In order to ensure that we have as many potential solutions as possible, the government needs to lead the way on the growth of Australia's research capacity. This will require a number of policy changes, starting with the reversal of the CSIRO funding and employment cap. By expanding our premier scientific body's core capacities, we will maximise our chances of creating new and innovative ways to reduce carbon emissions, mitigate the adverse effects of climate change and discover new technologies that can create industrial opportunities in local economies.

Similarly, the government should set research funding targets to be delivered through the Australian Research Council's (ARC) grant system. Much like the budget commitment to spend 2% of our GDP on defence, the government should set a target of 3% of GDP to be spent on research & development by 2025, with incremental targets of 2% by 2023 and 2.5% by 2024. This research funding could be split between independently allocated grants offer by the ARC, and strategic research grants allocated through more targeted institutions like the Australian Renewable Energy Agency (ARENA). Additionally, tax incentives should be offered to businesses to invest in increased R&D capacity, with particular incentives for new R&D programs and those conducted in partnership with universities.

Create targeted incentives in Renewable Energy Zones

Aside from the aforementioned incentives to increase our business investment in R&D, packages of incentives should be designed in order to not only attract domestic and foreign investment in the production of renewable energy generation, decarbonised manufacturing and other carbon neutral industrial advancements, but also to increase the benefits of this investment within Renewable Energy Zones (REZ).

Tax incentives should be linked to local content requirements, training and professional development opportunities for employees, mandatory entry level and early career ratios, community advisory groups, and investments in local supply chains through partnerships with key local suppliers. By encouraging deeper investment in our local economies, these tax incentives could prove cost neutral as the benefits of foregone revenue from primary businesses are recouped through increased income levels in local economies and supplier business growth.

These incentives should be clearly linked to responsibilities of businesses to engage unions in the negotiation of fair and equitable greenfields agreements before the benefits of operating within a REZ are made available.

Support small and medium enterprises to take advantage of new supply chains

To build sustainable opportunities for investment in a post-carbon economy, strategic support should be made available to small and medium enterprises (SMEs) to make the most of new opportunities. These supports could be delivered in the form of specialised investments made through a new SME Adaption Fund created under the CEFC (with requirements to consult and negotiate with unions and local communities) as well as offering assistance by specialised teams of consultants employed by the Transformation Authority. This assistance should include a range of services, from helping connect SMEs to domestic and foreign primary producers through to assisting them with the creation of energy efficiency and decarbonisation plans for their internal operations.

By creating attractive supply chain opportunities for primary producers and supporting SMEs to be prepared for inclusion in new industries, Australia stands to benefit substantially as every dollar spent on the adjustment creates additional economic activity downstream in the supply chain. This multiplier effect will be felt in employment, productivity and ultimately in revenue that will help to make these measures cost neutral over time.

Audit and review the private provision of vocational education and training

In order to ensure that the education and training system is adequate for the task at hand, there are two key starting points that policy makers must consider.

Firstly, a comprehensive national audit of the system must take place. By vesting ASQA with the power to engage in this task, the government can create an accurate picture of the sector. However, consideration must be given to consequences for those found to not be in compliance with regulations, those who consistently underperform and those who engage in unscrupulous practices.

Secondly, in order to ensure that there is adequate evidence on which to build reforms, a review into education and training providers is necessary, particularly given that the recent senate inquiry into private providers found that there was significant 'evidence of rampant abuse, accelerating costs, and doubling of bad debt' across the system (Education and Employment References Committee, 2014, p. vii).

Restore TAFE funding to pre-2013 levels

In order to rebuild our public capacity for training through the transformation of our energy system, funding for public TAFE should be restored to peak levels above \$7bn, with priority investments being made in capital-intensive trade and technical training related to energy and electricity, as well as in regionally specific REZ. By building the skills base of the Australian workforce and creating requirements for entry level positions in renewable energy projects, we can ensure a safe and secure pipeline of skilled workers in the new post-carbon economy.

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