



→ The Million Jobs Plan

A unique opportunity to demonstrate the growth and employment potential of investing in a low-carbon economy



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Recognition of traditional custodians

We recognise that Aboriginal people's sovereignty over their land was never ceded and the impact of this ongoing dispossession continues to this day. Beyond Zero Emissions stands in solidarity with First Nations people in calling for the establishment of a First Nations Voice in the Constitution, as described in the Uluru Statement from the Heart. We further support calls for the establishment of a Makarrata Commission on agreement-making and truth-telling between Aboriginal and Torres Strait Islander peoples and governments.

Beyond Zero Emissions maintains an office on the traditional lands of the Wurundjeri-willam people of the Kulin Nation. We pay our respects to all First Nations Elders past, present and those emerging.



The Million Jobs Plan

*A unique opportunity to demonstrate
the growth and employment potential
of investing in a low-carbon economy*

The Million Jobs Plan can rebuild Australia's Economy

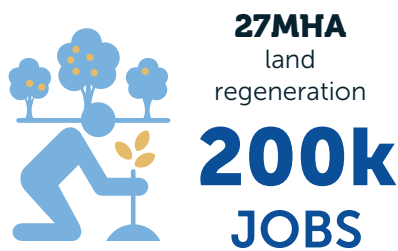
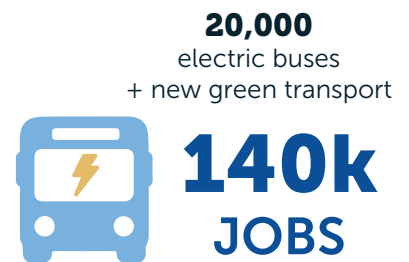
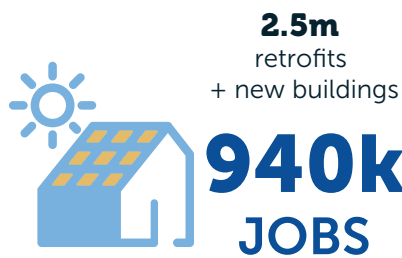
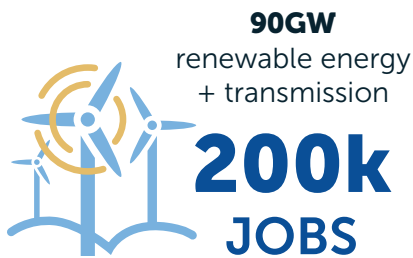


In just **5yrs** renewables + low emissions projects can deliver...

1.8m

new jobs

in regions & communities these are **needed most**



+ 10,000 new jobs in Training, Education and Research

Affordable
Reliable
Clean Energy

Reducing
Cost of
Living

Strengthen
Regional
Communities

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Boston Metal	SwitchDin
Climate Justice Union	Tesla
Finding Infinity	The EcoEfficiency Group
Gemilang Australia	Tritium
Greenfleet	Vecor
	Volgren

Communities

Many community groups have contributed data, including:

Ballarat Renewable Energy and Zero Emissions	Hepburn Z-Net
Banyule Clean Energy Group	KnoxCAN
Baw Baw Sustainability Network	Northern Beaches Climate Action Network
Bulimba Creek Catchment Coordinating Committee	Renewable Energy Benalla
BZE Hunter Chapter	The Goulburn Group
Climate Action Hobart	Transition Gawler
Energy Transformation Association for the Kimberley (ETAK)	WinZero
Friends of Lorne	Zero Carbon Lake Macquarie
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Executive Summary

Australia at the crossroads

Australia has suffered an unprecedented economic shock in 2020. The economy is in recession for the first time in almost three decades and the 7% fall in GDP in the June quarter was by far the largest since the Great Depression. Federal and state governments have resorted to unprecedented fiscal measures in an attempt to stabilise the economy. Even so, it is anticipated that over one million Australians could lose their jobs by the end of 2020.

To reboot the economy, further stimulus measures will be necessary. This presents a unique opportunity to lay the foundations for a globally-competitive Australian economy fit for 21st century challenges. *The Million Jobs Plan* demonstrates the enormous employment potential of investing in clean, low-carbon technologies.

The Million Jobs Plan has been delivered in consultation with dozens of organisations and individuals from across Australia. Project Advisors (Box 1) from business, government, community and industry have steered the process and supported this work.

Political and business leaders across the world have affirmed the merits of a low-carbon recovery from the current crisis (Box 2). The proposals in this plan, in sectors such as renewable energy, buildings, transport and manufacturing would generate more than one million new jobs, reversing the losses from COVID-19 in the first half of 2020.

Many of these proposals can create jobs quickly because they are already planned. Realising these opportunities means bringing forward public or private investment that would have happened anyway. As well as creating new jobs, these opportunities will have many lasting benefits such as revitalising Australian manufacturing, creating regional jobs and improving air quality.

"Every dollar we invest in energy, should be a dollar towards a lower carbon economy."

— Business Council of Australia¹

"It's very important that we put policies in place that help to create jobs and stimulate a clean energy transition."

— Fatih Birol, Exec Director, International Energy Agency²

Box 1: Project Advisors for *The Million Jobs Plan*

- Monica Bradley
- John Connor
- Simon Corbell
- Richard Denniss
- Ross Garnaut
- Paul Gilding
- Roy Green
- John Grimes
- Anne Hellstedt
- Justine Jarvinen
- Katerina Kimmorley
- Caroline Pidcock
- Alexie Seller
- Cristina Talacko
- James Tilbury
- Danny Touma
- Malcolm Turnbull
- Phil Vernon
- Martijn Wilder
- Jaime Yallup Farrant

Project areas

Figure 1 summarises the opportunities in this report and the jobs they could generate. These are new jobs created within a five-year period starting in the financial year 2020-21. These proposals also offer long-term employment benefits, as several sectors, such as green steel, have the potential to become much larger industries over a longer period.

Renewable energy

Few places in the world can match Australia's extraordinary potential to generate renewable energy. There is little doubt that in a decarbonising world, this gives Australia a crucial energy-cost advantage. Many of the opportunities in this report rely on Australia's abundance of renewable resources.

The renewable energy proposal is to build 90 gigawatts of solar and wind energy, backed up with new transmission infrastructure and 20 gigawatts of battery storage. There are already 160 gigawatts of renewable projects in the pipeline in Australia – more than enough to deliver this five-year rollout.

Better buildings

There is an opportunity to make Australian buildings much more energy-efficient. The buildings section proposes deep energy retrofits to 2.5 million Australian dwellings. This would reduce energy bills and create healthier more comfortable homes. We also recommend addressing Australia's chronic shortfall of social housing by building 150,000 energy-efficient social houses. These buildings initiatives alone would create over 900,000 jobs in the next five years.

Better transport

Electric transport is cleaner, quieter and less polluting than petrol or diesel equivalents. It also has lower running costs. This plan proposes introducing 18,000 electric public transport buses to Australia's streets, as well as electrifying 3000 kilometres of existing railways. This would employ thousands of people, particularly in the manufacture of trains and buses. We also recommend creating or improving 5,000 kilometres of cycle lanes, as part of a program to promote cycling. Together these transport initiatives would create 138,000 jobs.

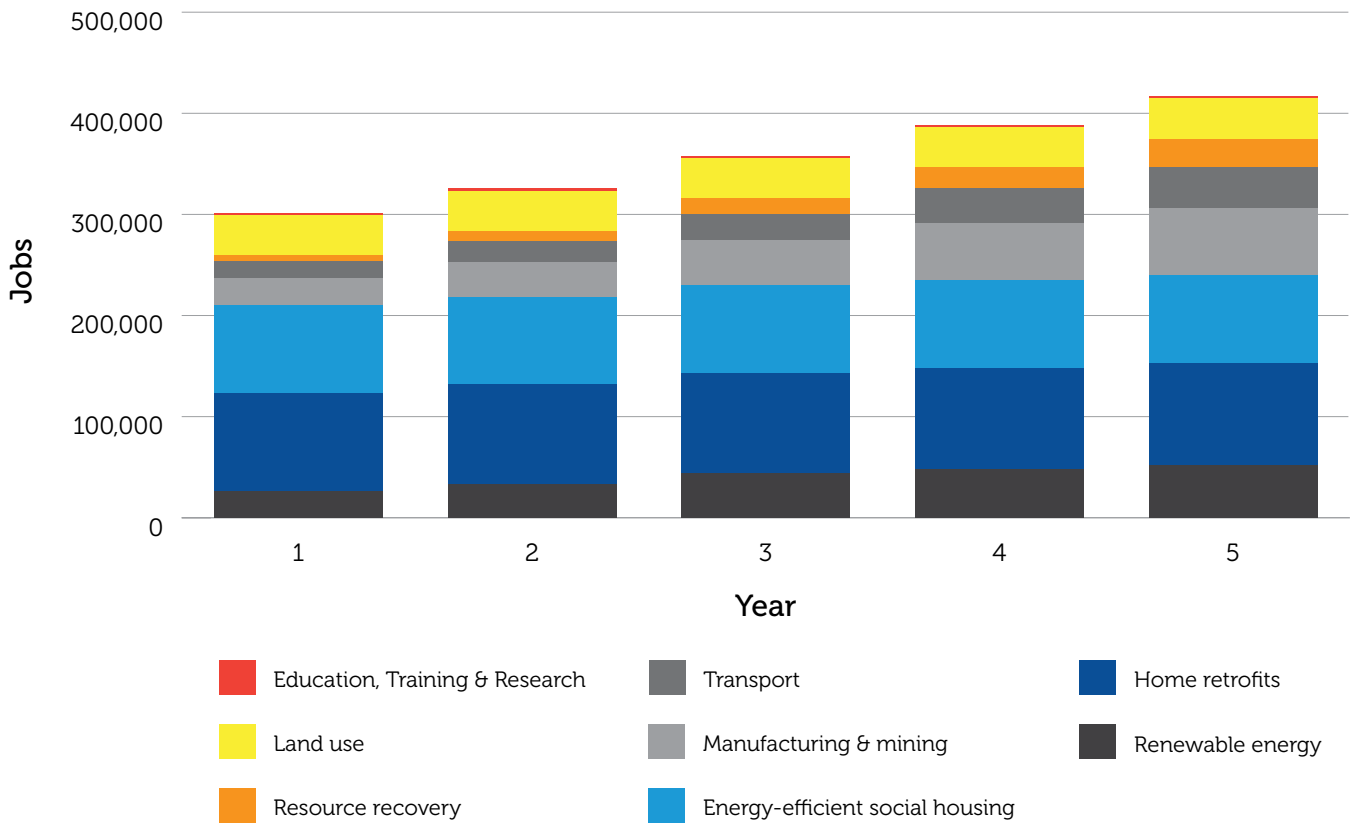
Manufacturing

Australia can once again become a strong manufacturing nation. The global transition to a zero-carbon economy creates exciting opportunities for this country to manufacture equipment such as wind turbines, batteries and electric buses. Australia's abundance of renewable energy creates an opportunity to decarbonise manufacturing and establish major new energy-intensive industries. *The Million Jobs Plan* describes how Australia could quickly become a world leader in the production of hydrogen, ammonia, steel, aluminium and other metals using 100% renewable energy. These opportunities would create 230,000 jobs.

Land use

Australia should embark on a bold program to revegetate 27 million hectares of land by 2025, expanding to 55 million hectares over 10 years. This could be achieved by restoring forests and ecosystems on just 6.5% of agricultural land, and would create 40,000 thousand on-going jobs throughout the life of the program. The five-year program would ultimately lead to an annual reduction of 5% in Australia's emissions for at least 30 years. This program supports land care workers, environmental managers and Indigenous land and water rangers, as well as 5000 community catchment and land care jobs to restore coastal catchments.

Figure 1: Employment opportunities described in *The Million Jobs Plan*



Education, Training and Research

The Million Jobs Plan depends on a strong foundation of training, regulation, accreditation and support in order to deliver initiatives efficiently, safely and economically. This could create 1000 new higher education jobs to train and upskill the workforce at a cost of \$600 million over five years. An additional \$600 million would fund 1000 new researchers to support continuing technical advances in renewable energy and zero emissions technology and practices.

Zero Carbon Community Initiatives

In developing this plan, we sourced projects from communities leading the way on local solutions to the employment and environmental crisis. These initiatives add local detail to this national plan and highlight community benefits such as local jobs, skills and training to help people stay in their communities.

The Hunter Region Case Study

A deep dive into the Hunter Region presents five opportunities for new renewable energy and zero emissions jobs in the Hunter Region which will be further explored in Beyond Zero Emissions’ Hunter Project, which we will develop in collaboration with local Hunter communities, Indigenous people, industry and government.

“It will be the duty of every responsible government to see that our economies are revived and rebuilt in a way that will stand the test of time. That means investing in industries and infrastructure that can turn the tide on climate change.”

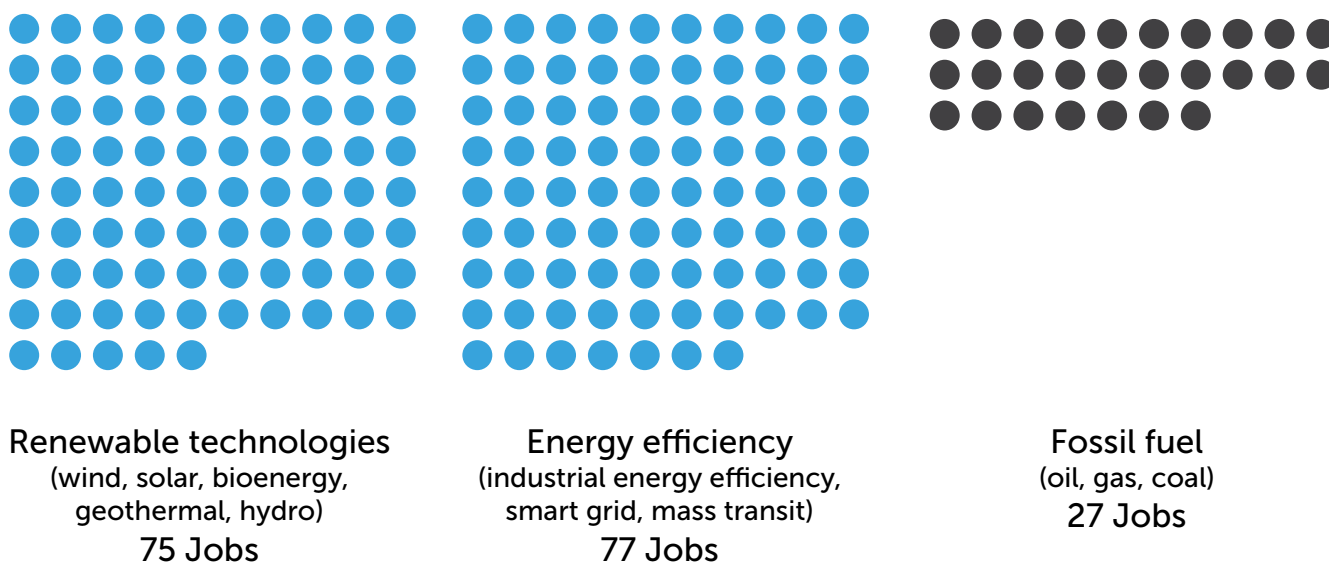
— Dominic Raab, UK foreign secretary³

Box 2: A low-carbon recovery is better for jobs and growth

Over 150 global corporations have signed a public statement calling for a net-zero economic recovery.⁴ Global consulting firm McKinsey has pointed out this would create more jobs and growth than a high-carbon recovery.⁵ Government investment on

renewable energy has been shown to create five times more employment than spending on fossil fuels. Figure 2 charts the magnitude of difference between investment in fossil fuels compared to renewables and energy efficiency.

Figure 2: Jobs created, directly and indirectly, per US\$10 million in energy spending.⁶



What is a job?

Table 1 outlines the employment opportunities across the different sectors of *The Million Jobs Plan*. These are described in three frames: Peak construction jobs; on-going jobs; and job-years.

Peak construction jobs: Temporary jobs during a construction project such as building a wind farm or a factory. These jobs typically last between a few months and two years.

On-going jobs: Jobs that begin during our five-year period, and will continue indefinitely, such as manufacturing jobs. On-going jobs often grow during the five-year plan.

Job-years: A job-year corresponds to one job for one year during the five-year plan. As many jobs could become self-sustaining, over a longer timeframe this plan would create more job-years.

Table 1: Job creation potential of *The Million Jobs Plan* over the next five years

Stimulus Targets by Sector	Jobs		
	Peak Construction	On-going (Year 5)	Job Years
Renewable energy			202,000
Build 90GW of new renewable energy (solar and wind)	18,000	9,300	109,000
Expand electricity transmission network	8,000	1,200	29,000
Establish large-scale wind turbine manufacturing	-	9,000	38,000
Establish battery manufacturing sector	3,200	2,500	27,000
Better buildings			935,000
Home energy retrofits for 2.5M low-income households	101,000	-	497,000
Build 150,000 net-zero carbon social housing dwellings	56,500	30,000	433,000
Solar + batteries for schools & pools	2,000	-	5,000
Better transport			138,000
Buses – introduce 18,000 electric buses for public transport	125	19,000	47,000
Trains – electrify 3,000km of existing railway enabling faster rail	3,000	2,600	26,000
Cycling – build or upgrade 5,000km new or upgraded cycle lane	5,000	10,000	65,000
Manufacturing			215,000
Electrify industry – transition manufacturing from fossil fuels to renewable energy	-	12,000	60,000
Renewable Hydrogen	-	1,500	6,000
Green steel	-	1,500	7,000
Green aluminium (existing and new plant)	-	3,500	23,000
New energy metals (mining, processing, manufacturing)	-	15,000	42,000
Decarbonising mining (electric mining equipment)	-	20,000	77,000
Land use and regeneration			200,000
Land regeneration	-	23,000	115,000
Environmental managers	-	10,000	50,000
Indigenous land and water rangers	-	6,000	30,000
Coastal catchment and land care groups	-	1,000	5,000
Recycling			78,000
Increase national recycling rate to 90%	-	28,000	78,000
Education, training & Research			10,000
Supporting Australia's workforce and knowledge sector to deliver <i>The Million Jobs Plan</i>	-	2,000	10,000
Total Job years			1,778,000

Economic analysis of *The Million Jobs Plan*

Beyond Zero Emissions commissioned independent analysis of *The Million Jobs Plan* by Chris Murphy, one of Australia’s most trusted economic experts. The analysis was carried out using a respected macro-econometric model similar to those used internally by the Australian Treasury and the Reserve Bank of Australia.

This economic analysis confirms that *The Million Jobs Plan* would have a rapid and positive impact on Australia’s most urgent economic problems. Implementing the plan would give a major boost to diverse business sectors and provide jobs throughout Australia – over 70% in regional areas. The plan delivers results almost immediately and its benefits persist for many years.

The economic analysis shows that implementing the plan would:

- **Reduce unemployment** by 0.5% compared to the baseline scenario. Between 2021-22 and 2023-24, *The Million Jobs Plan* reduces unemployment six months ahead of the expected timeline under the baseline scenario.

- **Raise living standards.** Compared to the baseline scenario, *The Million Jobs Plan* lifts real after-tax wages by 1% in 2022- 23 and 2% by 2035-36 (Figure 3). On average this equates to an additional \$1,347 in after-tax wages for working Australians in 2035-36.
- **Increase GDP.** Australia’s GDP is forecast to be 4 to 5% lower in 2020 than in 2019. *The Million Jobs Plan* adds 1 to 2% to the level of real GDP compared to the baseline scenario. This is a long-term effect that lasts until at least 2040 (Figure 4).
- **Boost private investment.** In its first three years, *The Million Jobs Plan* boosts private investment by an average of \$25 billion or nearly 2% of GDP, with more modest increases of around 1% until at least 2040. This investment provides a major stimulus to the Australian economy and requires only modest government support through seed funding.

Figure 3: *The Million Jobs Plan* gives a rapid and long-lasting boost to real wages

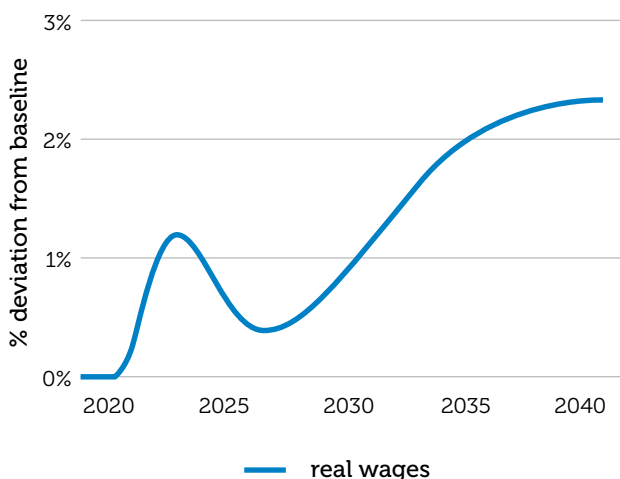
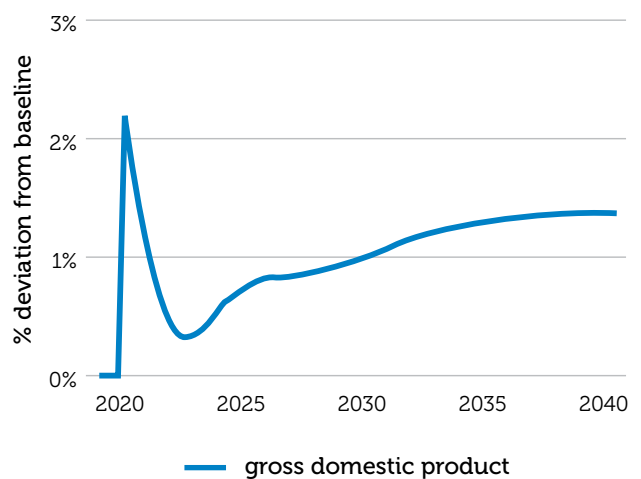


Figure 4: *The Million Jobs Plan* will give an immediate and long-lasting boost to Australia’s GDP



Sharing the benefits

There is no doubt the opportunities outlined in *The Million Jobs Plan* could play a big part in getting Australia back to work. But a second challenge is ensuring the benefits of these opportunities are widely shared and help those who need it most.

The proposals in this report are well-suited to addressing some areas of disadvantage. For example, many of the new jobs would be suitable for low and semi-skilled workers, or could be located in regional areas with higher levels of unemployment. Implementing *The Million Jobs Plan* would also help to offset particularly large job losses in the construction industry.

However, there is a risk that some other groups, such as women and Indigenous Australians, miss out on their fair share of the benefits from the zero-carbon transition. There is also a risk that, in our haste to create jobs and reduce emissions, we neglect the protection of our environment and heritage protection. Only through carefully designed policies can these negative outcomes be avoided. Some useful approaches are discussed briefly below.

Sharing the benefits with women

More women than men have lost their jobs during the current economic crisis. However, many of the industries highlighted in this report, like construction and manufacturing, are male-dominated. This creates a clear risk that women benefit less from the opportunities in this report and from the wider transition to a zero-carbon economy.

There is therefore an imperative to improve the participation of women in these industries. This should start with policies that attract more women to join a sector and stay there. Women are put off certain industries, such as construction, by long hours and inflexible working practices, that are particularly unsuitable for mothers. Policies to address this issue include opportunities to work part-time, equal parental leave for men and women and access to affordable childcare. Workplace culture, including zero tolerance of sexism, must also be welcoming to women.

Governments can influence the introduction of such policies by including them in their procurement criteria. Governments should also include gender-balance targets for staff including apprenticeships in their procurement policies. Finally, Governments can improve funding for vocational education and training, with an emphasis on increasing female participation in traditionally male-dominated courses.

Indigenous development

Australia's enormous potential to generate renewable energy and prosper in a zero-carbon world rests on its vastness. It is important to recognise, however, that much of Australia is subject to native title or is owned and managed by Traditional Owners. The expansion of renewable energy and renewably-powered projects present a valuable opportunity for Indigenous Australians to benefit from the zero-carbon transition. However, for this to happen successfully, governments and renewable energy developers must follow best practice in negotiating and making agreements.⁷ This includes obtaining the free, prior and informed consent of Traditional Owners for projects which impact their land, and a commitment to support the reforms set out in the Uluru Statement from the Heart.

Environmental and heritage protection

The *Million Jobs Plan* promotes projects that can start quickly. However, slow regulatory processes present a potential barrier to rapid job creation. Governments should therefore focus efforts to simplify and speed up the approvals system for renewable energy projects and renewably-powered business ventures.

Nevertheless, Beyond Zero Emissions strongly supports ecologically sustainable development, and opposes any reduction in standards of protection for our environment or heritage. Governments should therefore aim to ensure both efficient decision-making and high standards of environmental and heritage protection. Recent reforms in both Western Australia and Queensland have shown these objectives need not be in conflict. However, cutting approval times without cutting corners will require adequate resourcing of environment departments.

How will *The Million Jobs Plan* be financed?

Private Finance

The Million Jobs Plan requires hundreds of billions of dollars of investment. Fortunately, there has never been a better time to attract private investment in low-carbon initiatives.

Institutional investors, such as superfunds, banks and corporate investors have a large and growing appetite among to fund projects that reduce emissions. The Investor Group on Climate Change reports that the great majority of investors are already implementing low carbon strategies, and undertaking or actively considering low carbon investment across most asset classes.⁸

Clean energy investors have demonstrated their enthusiasm for working in Australia. The existing pipeline of renewable energy projects in Australia is backed by well in excess of \$100 billion. Single projects such as the Asian Renewable Energy Hub and SunCable are aiming to attract over \$20 billion in funding.

However, Australia risks missing out on some wider opportunities linked to the zero-carbon transition. In other countries, sectors such as electric transport, zero-carbon manufacturing and green steel have attracted significant private investment. Such industries also have great potential in Australia but have yet to attract serious backing. Even investment in renewable energy has fallen sharply in the last year.

The main barriers to greater low-carbon investment in Australia are a lack of policy certainty and deals of sufficiently large scale. By pursuing the proposals in *The Million Jobs Plan*, governments could remove these barriers and attract many billions of dollars in private investment.

Government funding

For some of the proposals in this plan governments have a role to play in direct investment. For example, there are several urgent transmission line projects which could be accelerated with the help of public money. Other recommendations in this plan that require public funds include the construction of energy-efficient social housing and the electrification of buses and trains.

Such projects represent excellent value for taxpayers. For example, new transmission infrastructure will unlock billions of private investment in renewable energy. More social housing means less homelessness and fewer resources expended on dealing with the problems of homelessness. Electric public transport leads to better air quality, and fewer health problems linked to pollution.

Government funds can also be used indirectly to stimulate private sector investment. For example, this plan recommends that governments underwrite renewable energy industrial zones, by guaranteeing renewable energy developers a minimum price for their output (**Chapter 1**). Governments access to very cheap finance can also help kick-start new business models, such as home energy retrofits with no upfront costs (**Chapter 2**).

Introduction – Endnotes

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Chapter 1

Renewable Energy

The Million Jobs Plan renewable energy initiative creates 200,000 job-years and delivers 90 gigawatts of zero emissions energy to Australian homes, businesses and industries

Making it happen:

- Support the accelerated deployment of 90 gigawatts of renewable energy in the next five years, creating 124,000 jobs in construction and 22,000 on-going jobs.
- Ensure renewable energy infrastructure is made in Australia. Increase Australia's capacity to manufacture renewable energy components including wind turbines and batteries, to create more than 9,000 jobs in the next five years.
- Underwrite renewable energy industrial zones at guaranteed prices to establish Australia as a top destination for energy-intensive clean industries such as green hydrogen and zero emissions metals.
- Fast track new transmission infrastructure to facilitate the rollout of renewable energy, increase energy security and reduce power prices.



Australia as a renewable energy superpower

Plentiful, cheap, clean electricity will provide the foundation of Australia's economy in a decarbonised world.

Nearly every national government in the world, including Australia, has ratified the Paris Climate Agreement.¹ Every state and territory in Australia has committed to net-zero emissions. The business world backs these aims, with almost one thousand global corporations committing to reduce emissions in-line with the aims of the Paris Agreement.²

Never in history has a technological transition been so clearly flagged as the shift to renewable energy. Affordable renewable energy provides the launchpad for global action to limit damage from climate change. For Australia cheap renewables offer an even bigger prize – the opportunity to become a Renewable Energy Superpower. This will mean:

- affordable power, bringing down the cost of living for all Australians
- improving national security by reducing dependency on foreign oil (see Box 3, page 19)
- a resurgence in Australian manufacturing, creating many thousands of quality jobs especially in suburban and regional Australia
- the development of new export industries in hydrogen, renewable electricity and energy-intensive products such as steel and aluminium.

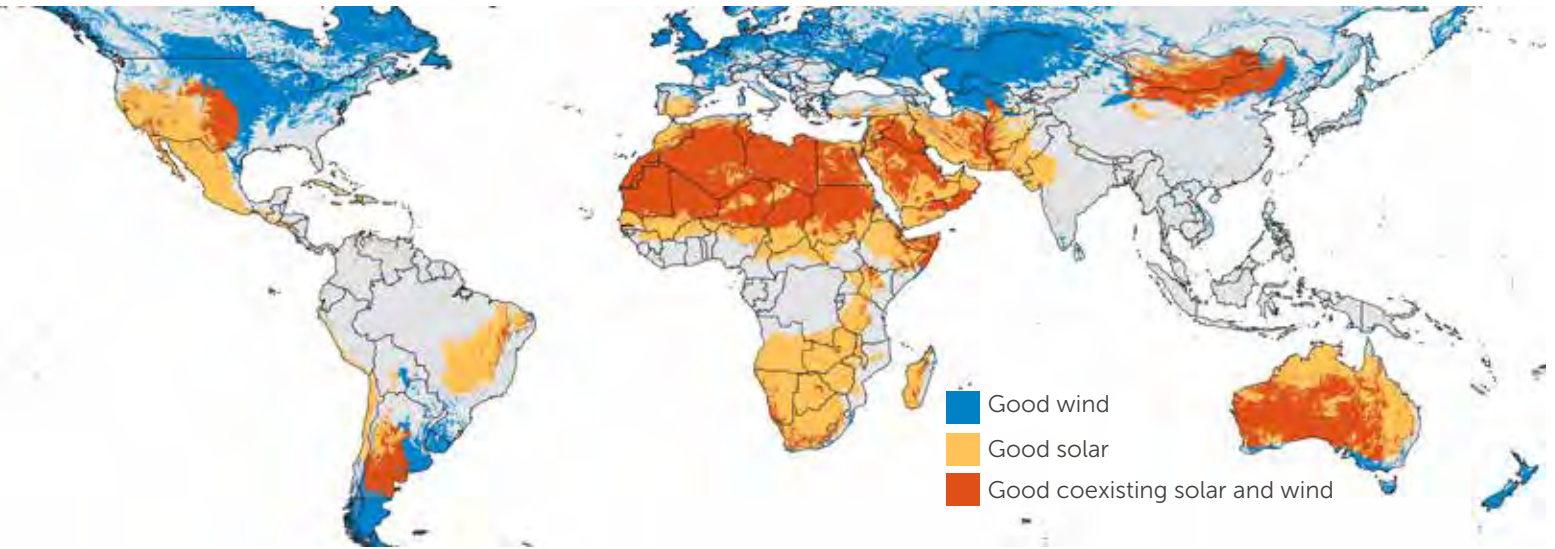
Renewable energy is the driving force of *The Million Jobs Plan*

Beyond Zero Emissions' Stationary Energy Plan in 2010 was Australia's first detailed proposal for an electricity system free of fossil fuels. Today a 100% renewable target is uninspiring. Australia could get there by 2030 simply by maintaining the installation rates of 2018 and 2019. Darren Miller, CEO of the Australian Renewable Energy Agency (ARENA) has said,

*"This idea of not having enough renewable energy will just be a weird concept that we had in the 2010s ... 200% renewables is too small. It could be 6-7 times what we have in the NEM."*³

This vision of building mass-scale renewables is at the heart of *The Million Jobs Plan*. Cheap, abundant renewable energy will spark the emergence of whole new industries, such as renewable hydrogen, energy-intensive manufacturing, zero-emissions steel and electricity exports to our Asian neighbours. It also provides the key to reducing energy costs for all Australians. Seizing our competitive advantage in renewable energy (Box 1) is a route to reviving the Australian economy in the short term. But it is also an exciting long-term strategy, setting up Australia for a century of economic success.

Figure 1: Australia’s exceptional potential to generate renewable energy.
 Australia has 3.9m km² of good coexisting solar and wind – more than any other developed region



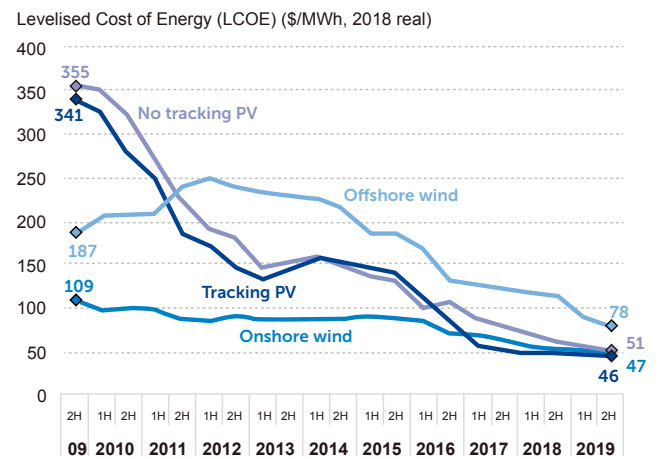
Sources: Grattan analysis of Global Wind Atlas (2020), Global Solar Atlas (2020) and U.S. Geological Survey and National Geospatial-Intelligence Agency (2010).

Box 1: Why Australia, why now?

Australia has extraordinary potential to generate renewable energy. Many places have good solar radiation and wind potential, but few places match Australia’s potential to generate both solar and wind energy (Figure 1). Combined with a large land-mass and small population, this gives Australia a crucial energy-cost advantage in a decarbonising world.

The speed of the fall in the cost of renewable energy has surprised almost everyone. Solar PV costs have fallen by 85% and onshore wind costs by 49% since 2010 (Figure 2). Wind and solar power are now the cheapest forms of new electricity generation. In Australia, large-scale solar and wind can produce electricity for A\$50 per megawatt-hour or less, well below the average wholesale price in recent years.

Figure 2: The rapidly falling costs of electricity generated by solar PV and wind



Source: BloombergNEF
 Note: LCOEs exclude subsidies or tax credits. Global benchmarks are country weighted-averages using the latest annual capacity additions.⁴

Accelerating deployment of large-scale renewable energy

SUMMARY: Building 90 gigawatts of renewable energy in five years

Jobs created	Emissions avoided
124,000 in construction	80% of Australia's emissions ⁴
22,000 on-going	

Australia's renewable energy sector is a major employer, with 26,850 full-time workers in 2019,⁵ several times more than the coal-fired power industry.⁶ This skilled workforce of engineers, technicians, construction workers and consultants is the foundation for a far larger industry. Unleashing the full potential of Australian renewables would create many thousands more jobs (Figure 3).

Investors have already identified a vast pipeline of clean energy projects in Australia. Unblocking barriers in this pipeline will accelerate construction of many of these projects. This plan proposes building 90 gigawatts of renewable energy in the

next 5 years, with a build rate of 15 gigawatts per year for the first two years and then 20 gigawatts per year for the following three years.

Constructing this renewable infrastructure would employ 13,500 workers in the first two years, and 18,000 per year for the next three years. It would also create on-going operational jobs, rising to 6,300 by the fifth year. This new energy infrastructure will be connected by new transmission lines, creating up to 9,000 more jobs (Box 4). Further employment opportunities will arise in professional services, such as engineering and finance skills.

To truly capitalise on this energy transition, Australia must increase its capacity to manufacture renewable energy components. Manufacturing wind turbines in Australia would create over 9,000 on-going jobs by the fifth year (Box 2). Making and installing batteries for energy storage would add another 6,000 jobs.

Overall, by accelerating the deployment of renewable energy over the next 5 years, Australia can **create 124,000 jobs in construction**, as well as more than **22,000 on-going jobs** in operations and manufacturing, totalling 200,000 job-years.

Figure 3: Building 90 gigawatts of solar and wind energy in the next five years would create up to 50,000 jobs each year.

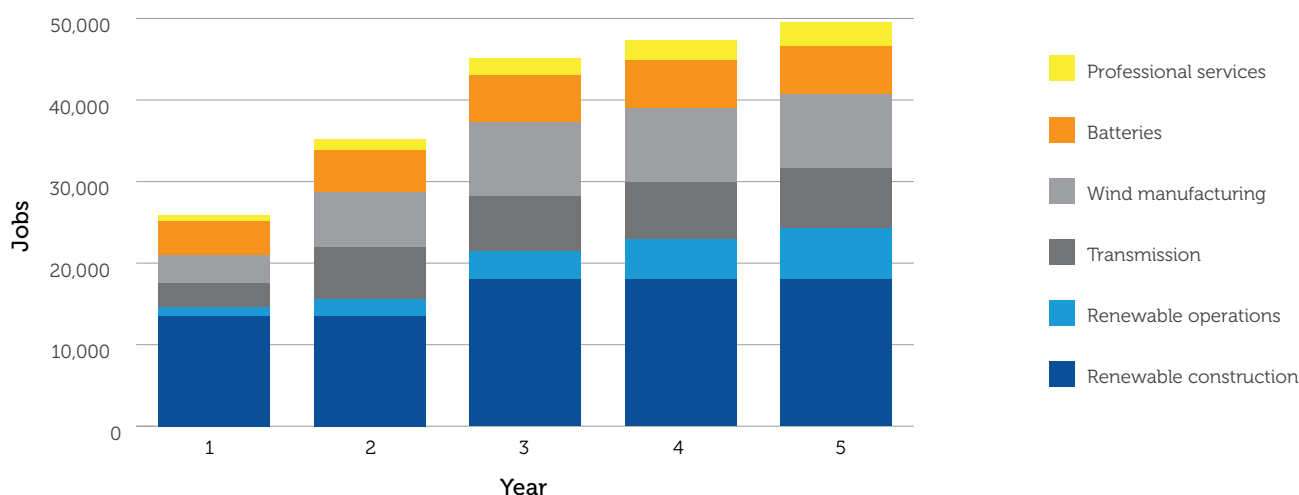
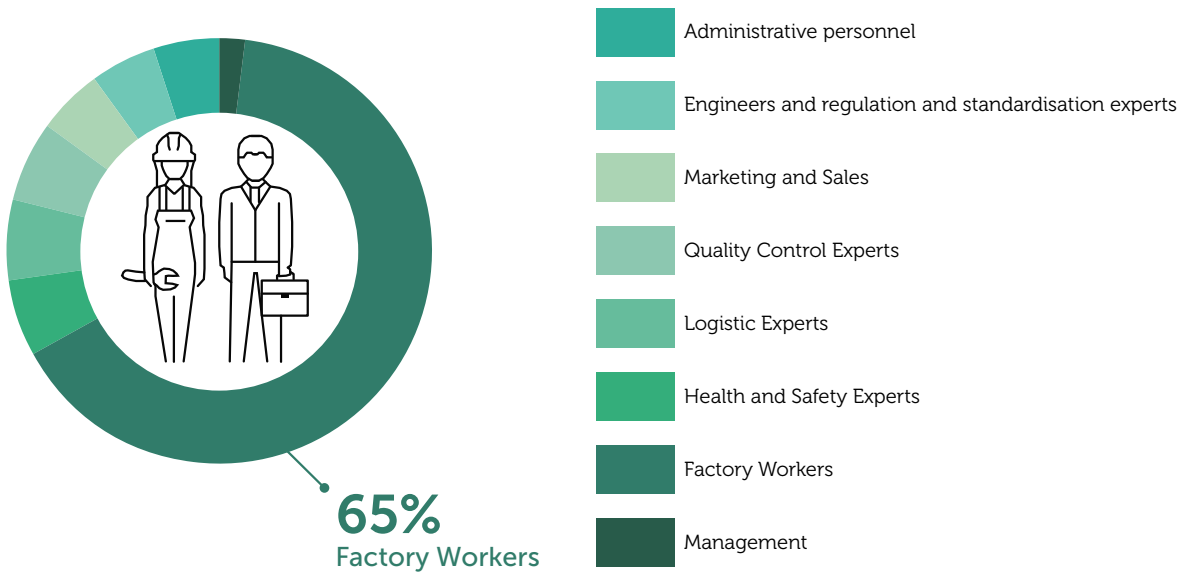


Figure 4: Distribution of labour required to manufacture the main components of a wind farm

The majority of employment is in semi-skilled factory work.



International Renewable Energy Agency (2017), Renewable energy benefits: Leveraging local capacity for onshore wind.

Box 2: Manufacturing wind turbines

Most of the cost of wind farm development relates to the purchase of the wind turbines. Turbine manufacture is labour intensive, requiring 150 people to make the main components of 100 MW wind farm.⁷ Large turbine manufacturers prefer to make components locally once a market reaches sufficient size.⁸

Australia currently has little capacity to manufacture wind turbines, so we miss out on much of the profit and employment opportunities from wind farm developments.

By bringing wind manufacturing on-shore, we could **create over 9,000 new positions**, many of which would be factory jobs with medium to low skills requirements (Figure 4).

A quick way to do this is to convert Australia’s disused factories. This has already happened in Geelong where part of the old Ford factory is now making components for Victorian wind farms. Leading turbine-maker Vestas has indicated that, given sufficient demand, it would expand manufacturing in Australia.⁹

Investors are eager to finance Australian renewables – if governments act

A build rate of 15 to 20 gigawatts per year is ambitious, but represents only an evolution, not a revolution in Australia’s deployment of renewable energy. In 2018 and 2019, Australia installed more than 11 gigawatts of solar and wind energy – the fastest deployment of renewables per person of any country in the world.¹⁰

Even in the current investment environment, the Clean Energy Council’s website lists nearly 100

renewable energy projects under construction or due to start soon.¹¹ These projects are merely the tip of an iceberg. Rystad Energy reports 160 gigawatts of grid-scale solar, wind and battery projects in the pipeline for Australia,¹² and about a quarter of these already have planning approval.¹³ Table 1 presents a handful of some of the larger proposals – gigawatt-scale renewable developments that rival anything happening in the world today.

Table 1: Existing pipeline of gigawatt scale projects in Australia

Project	Location	Proposed end-users	Capacity (GW)
Asian Renewable Energy Hub (solar, wind + batteries)	Pilbara, WA	Hydrogen, local mining and processing	15.0
SunCable (solar + batteries)	Tennant Creek, NT	Electricity export to Asia	10.0
Murchison Renewable Hydrogen Project (solar + wind)	Kalbarri, WA	Hydrogen	5.0
Walcha Energy Project (solar, wind + pumped hydro)	Walcha, NSW	National Electricity Market	4.0
Kennedy Energy Park (solar, wind + batteries)	Flinders Shire, QLD	National Electricity Market	1.2
MacIntyre Wind Farm (wind)	Warwick, QLD	National Electricity Market	1.0

However, unless we send investors an unequivocal signal of Australia’s support for large-scale renewables, many of these projects may never eventuate, and Australia will miss out on billions of dollars in clean energy finance and the associated jobs. The role of governments is to make sure this does not happen. Beyond Zero Emissions proposes three bold steps for federal and state governments to stimulate the flow of clean energy finance into Australia:

Policy proposal 1: Underwrite renewable energy industrial zones

In the past energy-intensive manufacturing, such as aluminium smelters, came to Australia because cheap electricity was already available. In a decarbonising world, Australia can again follow this strategy to attract new industries.

Governments should designate certain industrial areas as ‘renewable energy industrial zones’. They should then underwrite the provision of renewable energy to these zones, with long-term fixed prices of A\$50-55 per megawatt-hour. These zones are likely to be existing industrial heartlands such as Gladstone, the Hunter Valley, Latrobe Valley and Whyalla, as well as areas with growth potential such as Mount Isa. Abundant renewable energy at guaranteed prices will establish Australia as a top destination for energy-intensive clean industry such as green hydrogen and zero emissions metals.

Policy proposal 2: Fast-track new transmission

Box 4 explains that we need to build new transmission quickly, side-stepping the usual regulatory hurdles that delay projects for years.

Governments can facilitate this by taking a stronger role in transmission planning. Governments can also fund new transmission lines connected to the National Electricity Markets. For transmission lines supplying industry, but unconnected to the NEM, governments should incentivise private investment in new unregulated lines.

Policy proposal 3: Local content requirements

Up to a third of renewable energy jobs could be in manufacturing. In return for underwriting renewable energy development, governments should require local production of equipment. The biggest potential employers are wind turbine and battery manufacturing, with further opportunities from making transmission components.

100% renewable, 100% reliable

Australia's renewable electricity grid will be powered by an abundance of sunshine and wind. But a secure electricity system will have to contend with periods when these sources of energy are insufficient, such as calm cloudy days. Renewable energy also plays a role in enhancing our national security and self reliance (Box 3).

The impact of such periods can be minimised with large amounts of solar and wind power spread across the country. For example, a cloudy Queensland can benefit from a sunny South Australia. But a resilient system will depend on a higher capacity to transmit electricity around the country. Box 4 describes how Australia needs to move quickly to build more transmission infrastructure and the jobs this will create.

Even with more transmission, there will inevitably be periods when solar and wind energy alone cannot satisfy demand. To handle this, a reliable electricity system will need to incorporate large amounts of flexible, dispatchable energy sources. Several commercially-available technologies will vie for this role including batteries, pumped hydro, solar thermal, stored hydrogen, as well as demand-side response.¹⁴

It is not possible to predict the future mix and amount of dispatchable technologies, but it will be substantial. (Australian Energy Market Operator (AEMO) foresees the need for up to 21 gigawatts



Box 3: Renewable energy enhances national security and self-reliance

Large-scale renewables will bring an additional benefit to Australia – the ability to end dependence on imported oil. Transport consumes more energy than any other national sector, almost all of which comes from liquid fuels arriving by ship. Any disruption to the supply of oil would quickly cause chaos as Australia has small stockholdings of fuel compared to many countries.

Even without disruptions to supply, Australian businesses and motorists are permanently at the mercy of fluctuating oil prices.

Electrifying all land transport in Australia would increase electricity demand by about one third compared to today while drastically reducing the need for imported oil. This would boost national security, while reducing emissions by 15%.

of such resources.¹⁵) Batteries are likely to play a central role, given the success of Australia's five existing utility-scale batteries. There are proposals for many more utility-scale battery projects in Australia, including 14 projects in New South Wales,¹⁶ and a 600 megawatt battery in Victoria which would be by far the world's largest.¹⁷

The Million Jobs Plan assumes the installation of 20 gigawatts of batteries to support 90 gigawatts of solar and wind development. Box 5 on batteries describes the employment potential from installing and manufacturing these batteries in Australia.

Box 4: Fast-tracking transmission

Transmission lines are the arteries of the electricity system. But in recent years there has been a lack of investment in new transmission, causing bottlenecks. AEMO says that “without further grid development ... consumers will pay more, for less reliable energy”.¹⁸

New transmission infrastructure will facilitate the rollout of renewable energy, increase energy security and reduce power prices. Governments should act to fast-track new transmission projects. Beyond Zero Emissions estimates that this could create around **between 3,000 and 7,000 jobs** per year for the next five years (Figure 5).

Fast-tracking priority transmission projects

AEMO has identified eight “priority” transmission projects which it says are critical to address cost, security and reliability issues.¹⁹ However, despite their priority status, the projects could be held up for years by regulatory processes to assess their economic merits.

Much of this delay can be avoided if governments decide to fund priority projects. This is justifiable because AEMO’s detailed analysis has already demonstrated their economic and technical necessity.²⁰ In fact, recent government funding has brought forward delivery of several transmission projects, including EnergyConnect connecting South Australia with New South Wales and a new interconnector between New South Wales and Queensland.²¹

With sufficient government backing, several transmission projects could begin construction in 2020-21. For this to happen energy regulators, governments and energy network companies must work together to accelerate the required planning approvals and easements. Procurement planning must also ensure timely availability of transmission equipment, such as towers, wires and transformers.

Transmission for a renewable energy superpower

While AEMO’s priority transmission projects are necessary in the short term, they are far from sufficient for Australia to realise its renewable energy potential. AEMO has identified the need for an additional 29 gigawatts of transmission for its step-change renewable scenario.²² But even this level of transmission will be insufficient to meet Australia’s potential as a renewable energy superpower.

Australia will also need tens of gigawatts of new transmission capacity to connect energy-intensive industries with large new renewable energy zones. Other more ambitious transmission projects could connect the NEM with the excellent solar and wind resources in the Northern Territory or Western Australia (Table 2). To avoid the delays and additional costs caused by the current regulatory process, most of these lines should be with private finance outside the normal regulatory system.

Figure 5: Job creation from fast-tracking priority transmission projects and building additional transmission lines required by the 90 gigawatts of renewable energy proposed in this plan.

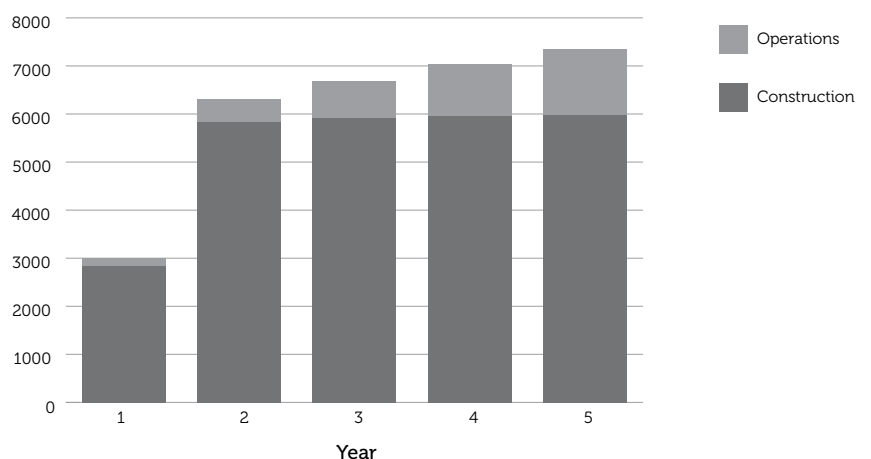


Table 2 : A selection of possible additional transmission lines to allow energy-intensive industries to connect with a massive expansion in renewable energy.

Region of renewable energy generation	Transmission connection to
NSW – Central and Central West	Hunter Valley
Queensland – Central	Gladstone
Queensland – North and Far North	Townsville
Victoria – West, North West, North East	Geelong, Latrobe Valley & SE Melbourne
South Australia – Eyre Peninsula	Whyalla
Western Australia – Pilbara	Pilbara minerals industry and energy exports
Western Australia – South West	National Electricity Market
Northern Territory – large areas	National Electricity Market; connect Darwin to Alice Springs



Indigenous community renewable energy projects

Renewable energy systems offer significant benefits to Indigenous communities, including the opportunities for economic advancement through both direct and indirect job creation. Due to the remote location of the majority of indigenous Australian communities, away from utility grids, they have relied on diesel generators. Today, with the rapidly decreasing costs of solar systems and energy storage this does not need to be the case.

Renewable energy systems avoid access issues during the rainy season; require less maintenance than generators; and solar plus storage creates more jobs. Generators also are environmentally polluting (affecting air quality and impacting human health) and run inefficiently at low load.

Solar systems are now robust enough to perform well in the harsh Australian outback environment. Effective implementation in these remote locations requires empowering communities to have ownership of their systems. As such they require extra investment, and the involvement of multiple parties with additional time compared with installs in urban communities. Yet the benefits significantly outweigh these costs as communities will have a healthier, more resilient and reliable energy source.

Reliable and affordable energy access is proven to drive improvements in livelihoods, boost local economies, increase health and wellness, and support education. Electricity is a powerful enabler which increases the effectiveness of pursuits to increase people's quality of life, from sanitation and water filtration to safety and food storage.

Many indigenous communities across Australia understand the benefits and opportunities that renewable energy systems will bring and are keen to collaborate with partners to make it happen. Solutions need to be tailored to individual communities, especially given the diversity of factors, including different levels of remoteness.²³

Reducing fossil fuel use for electricity in remote communities is an important component of reducing Australia's emissions, they have three times the emissions per capita. As well as generating substantial emissions, this electricity is the most expensive in Australia.²⁴

Successful remote renewable energy projects are those that are wanted, empower communities, and enable them to keep living on country and caring for country. While there are many examples of good practice, few, if any, existing projects demonstrate success across all project outcomes, with the need to balance economic longevity with community engagement and other aspects sometimes coming into conflict. The necessary ongoing improvements can be accelerated through greater knowledge sharing on successful projects, which needs to happen more and in a way that is easily accessible and digestible. It is also important that communities help direct projects from the conceptual level using their Indigenous knowledge and their knowledge of their country, to ensure the projects are best suited to their communities and that the direct and indirect benefits of energy access and job creation can be shared.

Box 5: Jobs in making and installing batteries

Batteries will play a central role in an energy system based on renewables. Batteries increase the amount of rooftop solar energy that Australian households can use at home, and large-scale batteries help balance the variable output of solar and wind energy. In the near future, batteries will also replace petrol and diesel for most land transport.

Australia is already a global pioneer in integrating small and large-scale batteries into the grid. Despite this, Australia currently has very little capacity to manufacture batteries. However, there is a window of opportunity to employ thousands of people and establish a globally-competitive battery industry.

The Million Jobs Plan presents several proposals that rely on rapid growth in the use of batteries.

Implementing these proposals in the transport, electricity and building sectors would create demand for over 70 GWh of battery capacity in the next five years (Figure 6).

This demand could underpin a significant new domestic industry. Installing batteries in homes would **require over 3,000 workers**. The number of jobs in manufacturing would depend on how much of the battery supply chain is located in Australia. If the batteries are assembled in Australia it would create 560 on-going jobs, but if the battery cells are also made here it would create a **further 2,000 ongoing jobs** (Figure 7). Most of these new positions would be for semi-skilled professionals who can be trained in a few months.²⁵

Figure 6: There could be demand for at least 73 GWh of battery capacity in the next five years.

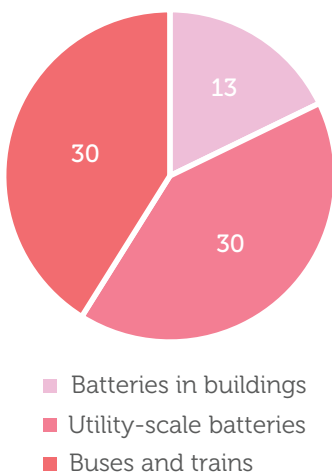
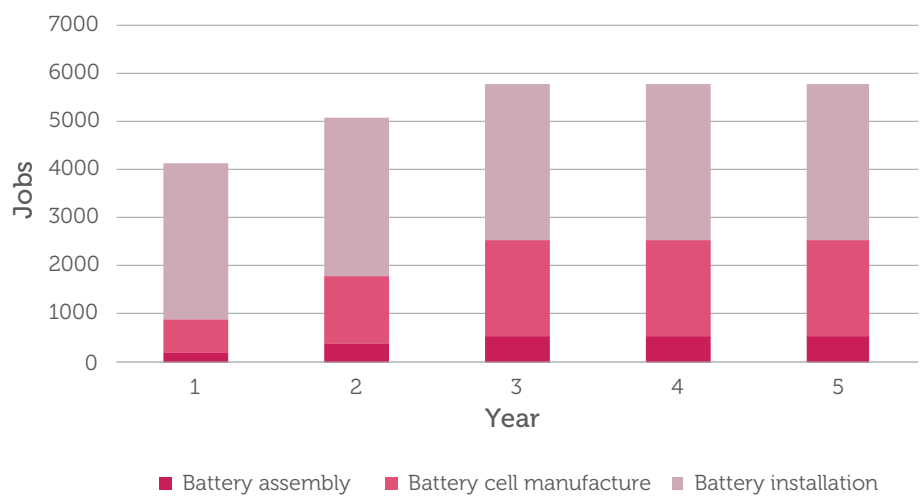


Figure 7: Australia has the potential to create a significant industry based on batteries.



Australia could become a global hub for the battery industry

There are already signs of a battery industry emerging in Australia. German company Sonnen has been assembling batteries in Adelaide since 2018 and now employs 47 workers.²⁶ Competitor Alpha-ESS has also set up a battery factory in Adelaide, aiming to employ 120 workers by 2020.

These new factories are a direct result of the South Australia Government's support for household batteries. But they offer only a taste of Australia's wider potential to become a globally competitive battery manufacturer. Australia has a unique advantage in this sector – the world's largest reserves of key battery materials.²⁷ Australia is already the world's largest exporter of lithium,²⁸ and mines 9 of the 10 elements required to produce lithium-ion batteries.²⁹ Despite this, it has been estimated that Australia captures only 0.5% of the supply-chain value of exported lithium.³⁰

Australia has an opportunity to capture far more of this value through activities such as lithium refinement and manufacturing battery components.³¹ Governments should aim to grasp this opportunity by boosting domestic demand, and then looking to access global export markets. The manufacturing section of *The Million Jobs Plan* will outline the potential of the new metals sector to employ as many **as 100,000 people by 2025**.³²

The green shoots of a wider lithium industry are already appearing. Western Australia will host a national lithium research hub which aims to expand Australia's role in the battery value chain.³³ Two of the world's largest lithium producers – Tianqi (China) and Albemarle (US) are investing in lithium processing in Western Australia. Tianqi's lithium refinery in Kwinana is expected to create 500 construction and 175 full-time production jobs.³⁴ In Victoria, Calix is developing its BATMn reactor, a facility for producing a range of advanced nano-active materials for batteries.³⁵



Credit: Sonnen

A consortium plans to invest over \$2 billion developing a giga-factory in Townsville, creating 1,150 jobs.³⁶ This plant would manufacture 18GWh of battery cells per year for utility-scale energy storage and electric transport. Another company aims to develop a large battery factory in Darwin, but says it is being held back by a lack of guaranteed procurement.^{37,38}

Chapter 1 – Endnotes

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Chapter 2

Better Buildings

The Million Jobs Plan Better Buildings initiative creates 180,000+ on-going jobs and reduces the cost of living for 2.65 million Australian households.

Making it happen:

- Set a national target to eliminate greenhouse gas emissions from the buildings sector.
- Fund deep energy retrofits for social housing and inefficient homes occupied by people on low incomes.
- Invest in social housing to tackle homelessness and rental stress.
- Stimulate millions more deep energy retrofits through an innovative business model which requires no capital input from householders.
- Create a new standard – the net-zero energy home – which generates as much energy as it consumes.



Better Australian homes

The building sector can play a leading role in economic recovery. The initiatives in this paper focus on reducing the cost of living for low-income households through retrofitting poorly performing homes and building more and better social housing.

The benefits to communities from investment in good quality housing are enormous. Delivering healthier, more comfortable, homes that also reduce bills has never been more needed than as we move through a global pandemic.

Energy upgrades reduce greenhouse gas emissions by minimising energy use and replacing household gas appliances with clean electric alternatives. Done well, homes made with green building materials and sustainable urban design can make healthier neighbourhoods and negate the urban heat island effect, keeping temperatures down in our suburbs during heat waves.

Broader co-benefits of the buildings sector initiatives include the upskilling of thousands of construction workers to deliver high performing housing – this will set the industry up for delivering on a rapid trajectory to zero emissions across all new buildings and retrofits.

A parallel commitment to local procurement can amplify these benefits through increasing demand for Australian made energy efficient equipment and green building materials. This in turn secures further investment in commercialisation of new, more advanced building technologies.

The retrofits and new housing are proposed to be funded or underwritten by government investment. This is the fastest way to deploy these projects, but other opportunities to engage latent private capital should be pursued throughout the process.

Retrofit opportunities

Simple retrofits could make millions of homes more energy-efficient. A plan to spend \$25,000 per home would practically eliminate heating and cooling bills for many Australians if spent on energy upgrades.²

The Million Jobs Plan proposes a target of 2.5 million deep energy retrofits within 5 years – 500,000 home renovations per year, with priority given to low income homes. Governments can install solar on public buildings like schools and pools to save on utility bills today.

This retrofit program would create up to **100,000 jobs per year, or 500,000 over the five year period**. The construction industry will be able to supply and support the skilled workforce required to carry out these retrofits.

Social housing opportunities

Australia has a shortfall of over 400,000 social houses. Australia could build 150,000 new social houses – 30,000 each year for the next five years.

Australia could build 30,000 new 7.5 star energy efficient social houses each year with an annual government investment of around \$8.2 billion.

The plan would create **87,000 jobs per year, or over 430,000 over five years**, which would go a long way to addressing the employment crisis facing the construction industry.

The boost to the construction sector would include support for builders to learn new transferable skills in constructing energy-efficient buildings.

National retrofit scheme

SUMMARY: Retrofitting 2.5 million homes

Jobs created	Start time	GHG avoided
100,000	Immediate	20 million tonnes ¹

Most homes in Australia were built prior to the introduction of energy performance standards. Many new homes also fail to meet the efficiency standards now required by law.³ This means many people live in homes that are hot in summer, cold in winter and use a lot of energy – making bills higher.

Simple retrofits could make millions of homes more energy-efficient and practically eliminate heating and cooling bills. Every home has the potential to generate its own renewable electricity, and even eliminate energy bills altogether. Box 3 outlines the suite of measures that can achieve this.

The Million Jobs Plan proposes a target of 2.5 million deep energy retrofits within five years – 500,000 home renovations per year prioritising low-income homes. This program would create up to **100,000 jobs per year** (Figure 1).

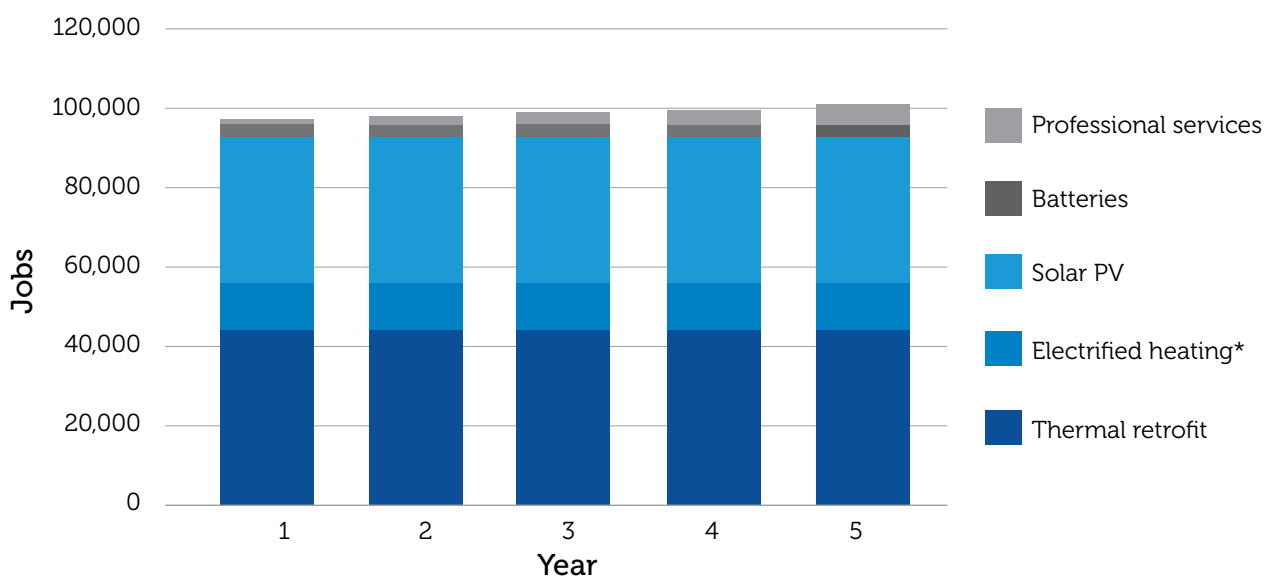
Nearly half of workers would be installing products to improve thermal energy efficiency. Another 36,000 would be installing solar panels, 12,000 replacing gas heating equipment with electrical alternatives and 3200 installing batteries. By the fifth year, 5000 people would be employed in professional services such as maintenance, marketing, customer relations and finance.

The construction industry will be able to supply the skilled workforce required to carry out these retrofits. This could help offset COVID-19 related job losses in the construction sector, estimated to be up to 500,000 by Master Builders Australia.⁴

“The technology to build and retrofit buildings to cover their carbon footprint already exists. Some buildings can produce more renewable electricity than they use.”

The Economist, 2019⁵

Figure 1: A national home retrofit program would employ up to 100,000 people every year.



Net-zero energy homes

A home without energy bills can be achieved through a considered energy retrofit strategy. Figure 2 shows some of the most likely options for building upgrades and equipment that can deliver a comfortable, very low energy, home.

The first step is to reduce energy use with measures such as new or topped up roof and wall insulation, draught elimination and installation of energy efficient appliances, as indicated in Figure 2 and described in Box 3. The aim should be to improve thermal performance for existing homes to at least a 6-star energy rating – equivalent to the minimum requirement for new homes.⁶

Once they have been made energy-efficient, the annual energy needs of most dwellings can be met by rooftop solar PV. Where this is not possible, such as apartments, renewable energy can be generated off-site through community-owned energy schemes.

Batteries, either at the household or community level, help to match generation and demand. Smart energy management software ensures optimal functioning of the whole system.

Box 1: United States: One million efficient homes – thousands of jobs

As part of the national efforts to recover from the global financial crisis, the United States Government allocated US\$11 billion to upgrading homes, businesses and public buildings. These programs created 200,000 jobs and delivered \$2 in energy savings for every \$1 invested.⁹

One program aimed to reduce energy costs for low-income households by increasing energy efficiency in homes. In just three and a half years, one million homes were renovated, saving an average of US\$400 each on annual energy bills. Retrofit measures included adding roof and wall insulation, removing draughts and boiler replacement, prioritising products made in the United States.¹⁰

Reaching 2.5 million homes

Renovating 500,000 homes per year in Australia is feasible: countries including the United States (Box 1) and France (Box 2) have shown it can be done. Australians are already enthusiastic renovators, spending over \$30 billion every year to update their homes.⁷ Half of these renovations cost between \$40,000 and \$200,000.⁸ Australia also leads the world in residential solar PV, with over 200,000 household installations in both 2018 and 2019.

Box 2: France plans energy retrofits for 500,000 homes per year

France has declared energy efficiency in buildings to be a national priority, and aims to halve energy consumption in the building sector by 2030.¹¹ In 2017 the French government set a target of 500,000 home energy retrofits per year, of which half will be households with low or modest incomes.¹² The plan will be accelerated through significant government funding and by training thousands of professionals in building energy efficiency.

France initially adopted a step-by-step approach to home retrofits, with renovations done in several stages.¹³ The government now realises this approach fails to maximise potential energy savings, and is adapting its program to apply efficiency measures in one hit. Australia can learn from this and commit to a complete program of home retrofits to ensure maximum benefit and efficiency.

Box 3: Creating Net-zero energy homes

A net-zero energy home generates at least as much renewable energy as the total energy it consumes. Beyond Zero Emissions' Buildings Plan (2013) showed energy use in most homes can be slashed and use of gas can be eliminated. The remaining energy demand can be supplied with solar power. In a national retrofit program, net-zero energy homes would be achieved through selective application of a range of energy-efficiency measures such as those listed below.

Thermal efficiency – upgrade to minimum 6-Star

Insulation. Roof insulation can reduce energy for heating and cooling by 45%; wall insulation by an additional 20%. Floor insulation also pays off in some homes.

Shading can prevent up to 90% of heat gain from direct sunlight.

Draught-proofing. Plugging air gaps can be a cheap way of reducing energy bills by up to 25%.

Window films or double-glazing reduce thermal gain and reduce heat loss.

Efficient appliances

Includes: LED lighting; Water-efficient showerheads, washing machines and dishwashers; Low energy Refrigerators and Televisions.

Getting off gas

Some households, particularly in Victoria and Tasmania, burn significant amounts of gas, creating carbon emissions. Fortunately, the electric alternatives to gas appliances are significantly more efficient and cheaper to run.

Space heating – split system air-conditioners provide heat rooms several times more efficiently than gas heaters, and could save some homes hundreds of dollars in heating bills.

Hot water heating – electric hot water heat pumps are 400% efficient compared to 95% for the best gas boilers.

Cooking – electric induction cookers are faster, more efficient and safer than conventional gas stoves.

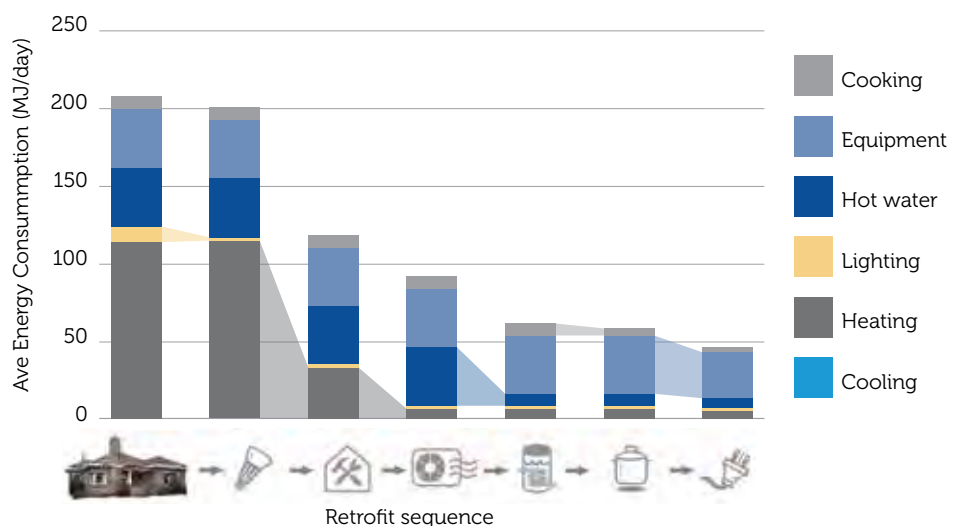
Electricity supply and management

Solar PV – for many efficient homes rooftop solar can generate several times annual energy use. Dwellings with insufficient roof space, such as apartments, can benefit from community-owned renewable energy schemes.

Batteries – a mix of household and community battery storage will minimise reliance on the grid.

Home energy management systems maximise the efficiency and financial benefits of the domestic energy generation and use.

Figure 2: Cumulative energy savings for a 1950's Melbourne home, BZE Buildings Plan



BZE. (2013). Buildings Plan. Beyond Zero Emissions. <https://bze.org.au/research/energy-efficient-buildings-plan/>

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How can this amount of renovations be financed?

The cost of a deep energy retrofit for many Australian homes is around \$25,000. Although this initial investment will pay off through lower energy bills, the upfront cost deters renters and many homeowners, especially those on low incomes.

To overcome this barrier, we need business models with no or low upfront costs to householders. One possible model is a Managed Energy Services Agreement where a company organises and finances entire renovations. Crucially the company guarantees energy performance levels, such as comfortable indoor temperatures and amounts of hot water.

In return the property owner pays a set monthly invoice, but they no longer have an energy bill, as any on-going energy costs become the responsibility of the retrofit company. The company is also obliged to rectify any failure to meet the guaranteed performance levels.

This is very different to the conventional approach to home energy, but anyone with a mobile phone contract is familiar with the basic business model. Many phone users pay a fixed monthly bill, but the handset itself plus a certain amount of calls and data are “free”. Home broadband works on a similar principle.

Providers of Managed Energy Services Agreements have been active for several years in the commercial sector, and the business model is gaining traction for households. Box 4 outlines one innovative Dutch approach. Australian companies are also entering this area. For example, BOOM! is a software platform which reduces retrofit costs by automating the process of energy audits and competitive procurement. Since 2018, BOOM! has helped to provide the business case for thousands of energy retrofits, saving householders nearly \$10 million in energy bills.¹⁴

Box 5 outlines how a government backed Managed Energy Services Agreement could be used to support the delivery of millions of home energy retrofits across Australia.

Box 4: Energiesprong – deep energy retrofits with no upfront costs

Energiesprong is an approach to whole house refurbishment that began in the Netherlands. After an Energiesprong retrofit, a home generates the total amount of energy required for its heating, hot water and electrical appliances. The retrofit comes with a 30-year performance warranty and residents pay no upfront costs. Residents pay for the cost of the retrofit and on-going energy supply through a monthly energy plan which costs no more than their previous energy bills.

So far a few thousand homes have had an Energiesprong refurbishment, but the company believes that by scaling up and standardising its model millions of homes will be able to benefit from a deep energy retrofit at no extra cost.

Figure 3: Social Housing in Nottingham, UK after Energiesprong retrofits



What can governments do?

A program to retrofit 2.5 million homes in five years requires an annual investment of \$15 billion. Making this into a business opportunity depends on low-cost finance. Governments can super-charge this business model by borrowing at interest rates of less than 1%, and then offering cheap finance to energy service providers. The Clean Energy Finance Corporation already takes this approach on a small scale by financing energy retrofits for community housing.¹⁵

This investment should be categorised as infrastructure spending as it reduces expenditure on other infrastructure including energy generation, substations and distribution networks.

It is also one of the best investments governments can make as it could help eliminate energy poverty in Australia – making a significant contribution to reducing inequality.

Governments can begin the national retrofit scheme right away by directing upgrades to social housing and inefficient homes occupied by people on low incomes. Governments should also incentivise deep energy retrofits for rental properties and homes undergoing major renovations.

Box 5: How a government backed Managed Energy Services Agreement (MESA) would work

With a MESA, household energy becomes a service with a flat fee, like many mobile phone or broadband contracts.

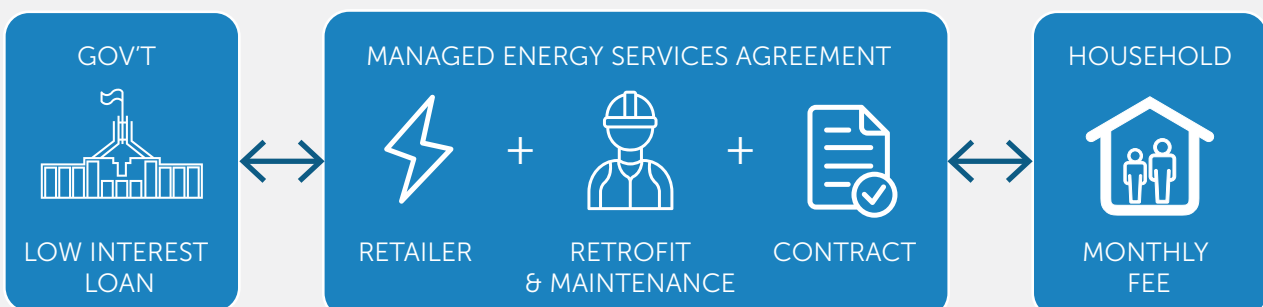
The householder enters into a contract with a MESA provider.

The contract guarantees a level of energy service for an agreed price.

The householder pays a set monthly fee to the MESA provider, which is likely to be lower than the householder's historic energy bills.

The MESA provider:

- engages a Contractor to carry out energy retrofits and maintain equipment throughout the contract period
- pays for retrofits by accessing cheap government finance
- assumes responsibility for meeting guaranteed energy performance, ensuring the Contractor addresses any problems
- assumes responsibility for the on-going relationship with the electricity retailer, including paying bills.



Saving money on public buildings

Governments have an opportunity to use net-zero energy retrofits to generate cost savings through their own building stock. All levels of government have this opportunity, from local government through to the national government. Box 6 explores the opportunities for state government to improve schools and early childhood learning centres through net-zero energy retrofits, starting with solar. Box 7 explores opportunities for local government to benefit from retrofits to local pools.

From these two initiatives alone over 7000 jobs are created avoiding 1.4 million tonnes of GHG per year. In both cases, there is likely to be further benefits by extending the program from solar and batteries to net-zero energy buildings.

Box 6: Schools savings

Governments have an opportunity to rapidly apply solar panels and storage to public and private schools and early childhood learning centres. Several states already have programs to install solar on schools,^{16,17,18} with the cost savings generated over time enabling additional net-zero energy retrofits.

The Million Jobs Plan boldly presents an accelerated program that will see 4000 schools installing 265 MW of solar panels with accompanying 651 MWh battery storage. This plan, developed in conjunction with Tesla,¹⁹ provides for large schools to utilise 250kW of solar plus a medium battery and small schools to use 25kW of solar panels plus a small battery. The cost of this project is \$1.1 billion and **2000 people will be employed**. Large schools have been modelled to save \$114,000 and small schools would save \$12,700 per year.²⁰ Extending this program to all schools and early childhood learning centres requiring solar and batteries would generate at least 6,870 jobs, install 907 MW solar and 2,230 MWh batteries and reduce emissions by 1.35 million tonnes CO₂ equivalent per year at a cost of \$3.78 billion.



Box 7: Pools savings

There are around 1,000 public pools across the continent. We propose installing solar and batteries on 42.5% of these pools as a way to save local councils money and contribute to community energy security. This would generate **290 solar installation jobs** and 12 jobs in battery storage installation at an estimated total cost of \$167 million. In installing solar panels and batteries to 458 pools and aquatic centres, annual cost savings could be expected to be even better than those seen for schools.²¹ An example of the type of retrofit proposed is the Rosebud Aquatic Centre currently under construction. The benefits of solar in pools are so good that after initially accepting quotes for a 231kW solar system they recently approved a quote for a 375kW system.

Image: www.brisbane.qld.gov.au

Building energy-efficient social housing

SUMMARY: Building 150,000 energy-efficient social housing dwellings

Jobs created	Start time	GHG avoided
85,000	Immediate	1 million tonnes

Australia is no longer a country of affordable homes (Box 8).²² The high cost of housing is driving inequality and homelessness and disproportionately impacts our most disadvantaged communities. Most private tenants on low incomes spend more than 30% of their income in rent.²³ Low-income households also tend to live in poorly insulated homes that they cannot afford to adequately heat or cool.²⁴

Investment in social housing²⁵ is the most effective way to reduce homelessness and rental stress. Social housing provides affordable rents, security of tenure, and other support that is not available in the private rental market.²⁶

Building energy-efficient social housing addresses the affordability of both housing and energy. It is a long-term investment in infrastructure that can help revive a flagging construction sector, creating jobs more quickly than major road or rail projects.

Boosting social housing should be a high priority of any economic stimulus package.

*"The Federal Government should also give more funding to the states for social housing carefully targeted to people at serious risk of homelessness."*²⁷

Grattan Institute, September 2019

*"Every dollar we invest in energy, should be a dollar towards a lower carbon economy and lower cost energy bills. When we spend money on housing, we should think about investing in social and affordable housing."*²⁸

Business Council of Australia, April 2020

Box 8: The housing affordability crisis: the facts

- More than 100,000 people are homeless because they cannot afford anywhere to live.²⁹
- Australia requires over 400,000 new homes to meet today's social housing needs. This shortfall is projected to grow to more than 700,000 by 2036.³⁰
- 57% of private tenants with low incomes spend more than 30% of their income on rent.³¹
- Low income households often spend a higher percentage of their income on energy because their homes are inefficient.³²

Building 150,000 net-zero energy social homes in five years

It has been estimated that Australia has a shortfall of over 400,000 social houses.³³ Australia could start to address this by building up to 150,000 social houses – 30,000 each year for the next five years. These new dwellings should be energy-efficient buildings that generate their own renewable energy.

This rate of social home construction is six times the rate achieved by the Nation Building Social Housing Initiative (Box 9). But the current economic contraction demands this level of response. The Housing Industry Association expects annual construction of new dwellings to fall by more than 100,000 compared to 2018.³⁴ As the pipeline of work runs out for builders across all sectors, the construction industry is facing the loss of nearly half a million jobs.³⁵

Australia could build 30,000 net-zero energy social houses each year with an annual government investment of around \$8.2 billion.³⁶

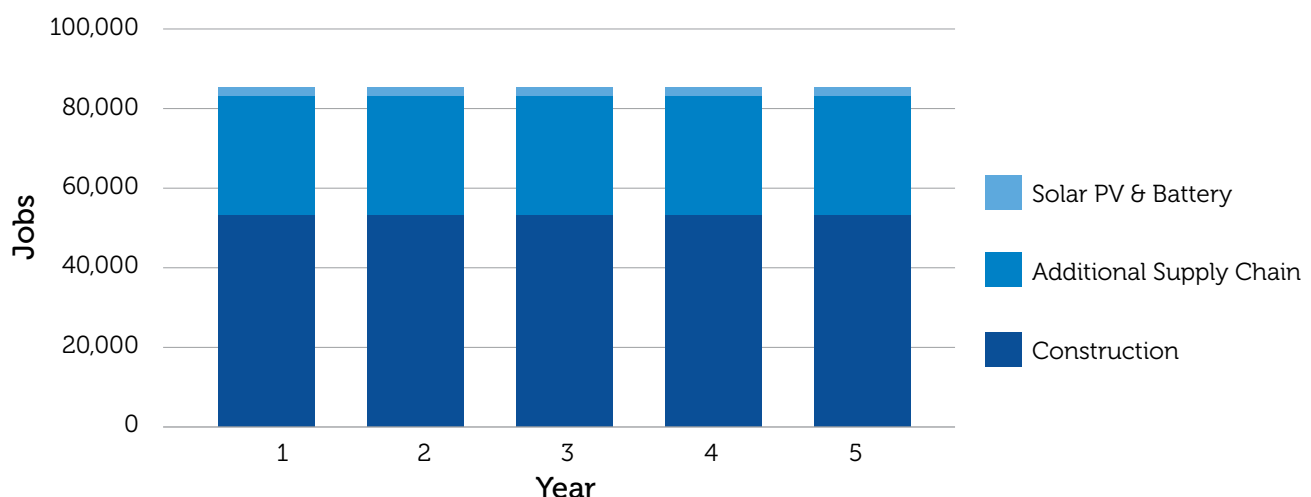
This funding could be provided by expanding the Australian Government’s existing National Housing and Homelessness Agreement, which delivers \$1.5 billion each year to improve access to housing. The National Housing Finance and Investment Corporation can participate by tightening energy performance requirements for all dwellings they provide loans, investment or grants for.

These new social homes should be more energy efficient than the average new Australian home. Building a new 7.5 star home, 1.5 stars above the usual standard, costs only 1 to 2% more than a regular home.³⁷ This extra cost is quickly recovered through energy savings.³⁸

Building 150,000 net-zero energy social homes would create 54,000 on-going jobs in the construction industry, as well as 30,000 jobs in the building supply chain and 2,500 jobs installing solar power and batteries (Figure 4).

These **87,000 new jobs** would go a long way to addressing the crisis facing the construction industry. The boost to the construction sector would include support for home builders to learn new transferable skills in constructing energy-efficient buildings, strengthening the whole sector’s capacity to deliver net-zero energy buildings.

Figure 4: Employment potential from building 150,000 new social homes.



Box 9: Nation Building Social Housing Initiative 2009-2012³⁹

- After the global financial crisis, the Australian Government invested \$5.2 billion to build 19,669 additional social housing dwellings in three and a half years. A further 80,537 existing dwellings were repaired.
- For every dollar invested, the Social Housing Initiative boosted GDP by \$1.30.
- KPMG estimated that 9000 full-time construction industry jobs and 14,000 jobs overall were created.⁴⁰
- These new social homes housed low-income people on the social housing waiting list, some who were homeless or at risk of homelessness, as well as substantial numbers who had a disability, or indigenous background.

Image: www.cehl.com.au/GippsStreetProject



Supply chain benefits

The national retrofit scheme and social housing initiative provide an opportunity to boost local building materials production. Building materials are difficult to transport and are often produced locally. By providing incentives to use locally produced materials in these projects current industry can expand, and new opportunities in the green economy.

Job opportunities exist in zero carbon steel, concrete, insulation, glazing and cross laminated timber manufacturing. Box 9 describes an opportunity raised by the community in Tasmania.

Box 10: Zero Carbon Communities want to manufacture local building materials

The Tasmanian Government has announced a stimulus retrofit program, social housing construction roll-out and the planned redevelopment of Macquarie Point. Climate Action Hobart and their network sees an opportunity to create a new cross laminated timber (CLT) manufacturing industry driven through local content requirements on government projects. By increasing the ambition of these programs to net-zero energy buildings, and including a procurement target of locally made CLT, this new industry would get an important kick start. CLT is light and structurally strong and Tasmania has the plantation forestry and manufacturing skills to deliver.

Image: <https://woodtech.events/>



Chapter 2 — Endnotes

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Chapter 3

Manufacturing & Mining

The Million Jobs Plan manufacturing & mining initiative revitalises Australian manufacturing, establishing major new industries powered by renewables. It creates over 50,000 on-going jobs and 200,00 job-years.

Making it happen:

- Initiate a national Zero Carbon Industry Strategy to support the development of zero-carbon manufacturing and the establishment of new industries powered by renewables, such as green steel and hydrogen.
- Create 'renewable energy industrial zones' where energy-intensive manufacturers are able to access renewable energy at a low, fixed cost.
- Use government procurement policy to prioritise locally-manufactured products with lower embedded emissions.
- Enhance the Safeguard Mechanism by introducing 'Safeguard Mechanism Credits', as recommended by the Australian Government's report into low-cost abatement.



Manufacturing in Australia

In the early 20th century, Australia developed quickly from a rural economy to a manufacturing nation. Manufacturing was a vital component of national resilience and growth. By the 1930s Australia's manufacturing sector was strong enough to lead the recovery in employment after the Great Depression.¹ Then from 1940 until 1970 manufacturing employed at least one quarter of the Australian workforce.² Successful industries included iron and steel, non-ferrous metals, electrical equipment, car assembly, food processing and textiles.

Since 1970 the manufacturing workforce has shrunk dramatically. Today just 7% of Australian workers are employed in manufacturing³ – the lowest percentage in the developed world.⁴

In some developed countries, such as Germany, Japan and Italy, the manufacturing sector's share of the workforce is more than twice as high.⁵

Many factors have contributed to the decline in Australian manufacturing, but a recent difficulty is the cost of energy. For most of the last half century Australian industry has been fuelled by cheap natural gas. But this era has ended, with Australian manufacturers now paying at least twice as much for natural gas as competitors in the United States, Russia, and the Middle East.

Australia can become a manufacturing nation again

It is highly unlikely that Australian manufacturers will ever regain a competitive advantage based on cheap gas. However, in a decarbonising world Australia has a far more compelling competitive advantage – exceptional potential to generate renewable energy. As shown in Beyond Zero

Emissions' 2018 report, *Electrifying Industry*, renewable electricity can provide the foundation for a successful and sustainable manufacturing sector.

Renewable energy also provides Australia's key to a zero-carbon industrial sector. Growing climate action by governments, investors, and corporations, means manufacturers will be rewarded for decarbonising production. Many of the world's largest companies are already prioritising suppliers with lower emissions processes to help meet their own climate targets. Investors are also making increasingly clear that they equate high-carbon with high risk.

Reviving Australian manufacturing is important due to the sector's special role in the economy. More than any other sector it is a driver of innovation, productivity growth and high-quality jobs. Manufacturing has a particularly powerful multiplier effect – the ability to create jobs indirectly – due to manufacturers' reliance on extensive supply chains. The impact of COVID-19 on international supply chains has also reminded Australia that domestic manufacturing capacity is a critical component of national resilience.

The opportunities in manufacturing

This chapter outlines some of the opportunities for Australia's manufacturers from the global transition to a zero-carbon economy, made possible by outstanding renewable resources. Table 1 summarises the employment potential from these opportunities, which fall into three categories:

1. **Electrifying industry** – transforming the existing manufacturing sector to operate on renewable energy.
2. **Energy-Intensive exports** – expanding energy-intensive production of hydrogen, ammonia, steel, aluminium and other metals using renewable energy.
3. **Manufacturing for decarbonisation** – making equipment for the Australian and global transition to a zero-carbon economy, such as wind turbines, batteries and electric buses.

Each of these opportunities is described in the following sections. Together they would create over 200,000 job-years including 53,000 on-going roles in manufacturing (Table 1).

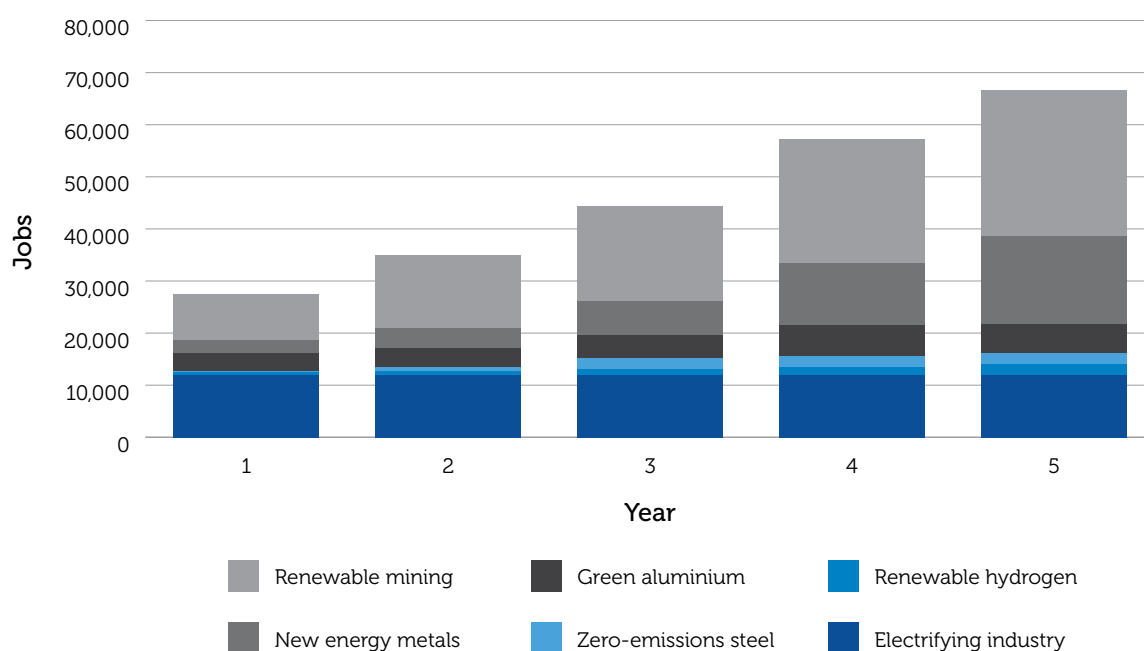
The jobs in Table 1 exclude many additional manufacturing jobs that a national zero-carbon transition, as described in the full *Million Jobs Plan*, would create. For example, the jobs identified in the Transport chapter of this report are mostly in the manufacturing chapter and the Renewable

Energy chapter. Both chapters show the need for 11,500 workers to manufacture batteries and wind turbines. There are many more opportunities for job creation in the manufacturing sector beyond those highlighted the Million Jobs Plan. For example, Australian manufacturers will have an opportunity to make many of the products required to improve the energy efficiency of buildings, such as heat pumps, insulation and double glazing.

Table 1: Employment potential in manufacturing for the zero-carbon transition

Sector	Jobs created in next 5 years			Long-term employment impact
	Construction	On-going	Job-years	
Electrifying industry		12,000	60,000	Protecting 900,000 existing jobs
Renewable hydrogen	500	1,500	6,000	17,000
Green steel	2,000	1,500	7,000	37,000
Green aluminium	1,500	3,500	23,000	14,000
New energy metals	2,000	15,000	42,000	30,000
Electric mining equipment	3,800	20,000	77,000	Protecting 150,000 existing mining jobs
TOTAL			215,000	

Figure 1: Jobs growth over 5 years in the manufacturing sector



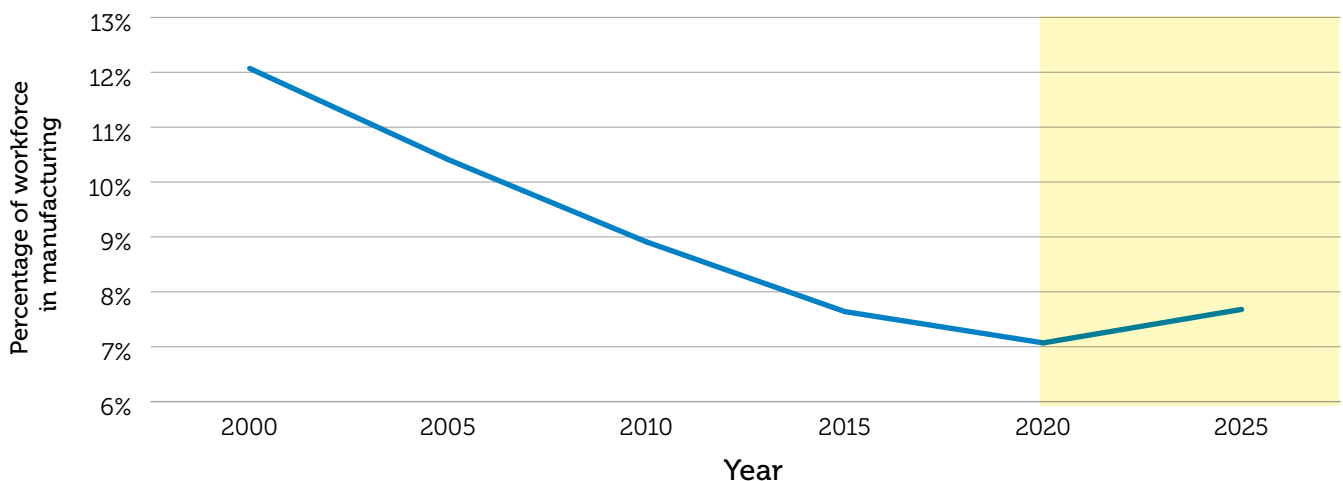
Making it happen

Many countries' governments are helping their manufacturers adapt to a zero-carbon world. So far the policies and incentives in Australia have been less supportive. The Million Jobs Plan proposes five areas for government action.

- 1. Zero Carbon Industry Strategy** – The Australian Government should initiate a national industrial strategy to promote growth in Australian low-carbon manufacturing and rapidly reduce industrial emissions to zero.
- 2. Industrial Energy Agency** – The Australian Government should establish a national agency to oversee implementation of the Zero Carbon Industry Strategy. The agency would provide grants, loans and tax credits to manufacturers to invest in new heat processes that do not rely on fossil fuels. It would also fund research and development, as well as feasibility studies into renewable alternatives. This agency would play a similar role to the Clean Energy Finance Corporation and the Australian Renewable Energy Agency, but on a far larger scale.
- 3. Renewable energy industrial zones** – As proposed in **Chapter 1**, governments should create 'renewable energy industrial zones' where manufacturers are able to access renewable energy at a low, fixed cost. Manufacturers would be given incentives to set up in these zones, on the condition of using only renewable energy.
- 4. Sustainable procurement** – Public purchasing policies can provide a powerful incentive for pioneers in zero carbon production. State and territory governments should use their considerable spending power to procure products and materials with lower embedded emissions. They should also prioritise local manufacturing as part of programs to decarbonise industry, buildings, energy and transport.
- 5. Enhance the Safeguard Mechanism** – Introduce 'Safeguard Mechanism Credits', as recommended by the Australian Government's 2020 report into low-cost abatement led by Grant King. Companies achieving emissions reductions below agreed baselines could be rewarded with saleable credits. The baselines could also be progressively ratcheted down through discussion with industry and other stakeholders.

Figure 2: With the Million Jobs Plan, Australia could start to reverse the long-term decline in manufacturing-sector employment

*Includes manufacturing jobs in transport and renewable energy.



Electrifying industry

Most industrial processes could eliminate fossil fuels by switching to renewable electricity. This would improve efficiency, productivity and marketability. A five year program to electrify Australian industry would create 12,000 on-going jobs.

Most manufacturing processes require heat, which is usually generated by burning a fossil fuel. Beyond Zero Emissions' 2018 report, *Electrifying Industry*, showed how almost any industrial heat process can be fully electrified (Table 2).⁶ The full electrification of manufacturing, powered by renewable energy, would bring many benefits to Australian manufacturers including:

- **Improving energy-efficiency and reducing energy costs.** Australian manufacturing is inefficient compared to comparable countries. Electrical heating technologies provide a fast-track route to high efficiency, as they can halve the heat energy input to many industrial processes. This means that, combined with cheap renewable electricity, they can reduce operational energy costs.
- **Eliminating emissions and increasing marketability.** Manufacturers' consumption of fossil fuels causes 8% of Australia's greenhouse gas emissions. By switching to renewable electricity, these emissions can be eliminated. This would make Australian products more attractive to the increasing numbers of consumers and corporations concerned about the embodied emissions of the goods they buy.
- **Productivity.** Electrical heating is often faster. Some electrical technologies, such as induction and infrared, take only seconds or minutes to complete a heating task that would take hours using a gas-fired system. The resulting productivity gains can be the biggest financial advantage of electrification.

- **Control and digitisation.** Heat supplied by electricity is easier to control and can be more precisely focused. This not only saves energy but improves the quality and consistency of some products such as processed foods. Electrical heating also complements industry's evolution towards greater digitisation (Industry 4.0).
- **Safety.** Because electrical heating methods target heat more precisely, they reduce workers' risk of burn injuries. They are also quieter and emit fewer toxic pollutants such as nitrogen oxides.
- **Modularity.** Many electrical heating technologies can be installed as small, modular units – allowing them to be implemented over time, spreading cost and risk. This can help foster an economy of reduced scale as smaller equipment requires less space. Facilities can be sited regionally, close to raw material sources or product markets.
- **Reduced price and supply risk.** Fossil fuels costs are volatile. Switching to renewable electricity allows manufacturers to lock in long-term fixed energy prices. It also enables them to take advantage of new sources of electricity generation without altering factory processes.

Despite the strong case for the electrification of industry, it faces large barriers. Electrical technologies must compete with existing fossil fuel-dependent manufacturing processes that are deeply entrenched. These traditional processes are well understood by manufacturers, and supported by entire supply chains of consultants, equipment suppliers and technicians with vested interests in maintaining the status quo. Governments have an important role to play in supporting the development of equivalent supply chains that enable the electrification of industry.

A program to electrify Australian industry

A five year program to electrify Australian industry would employ a large workforce of designers, engineers and technicians, creating around **12,000 on-going jobs**. This estimate is based on previous estimates of the job-creation potential of industrial energy efficiency upgrades.⁷ This plan makes the conservative assumption that the workforce required to electrify industry would be double that for industrial energy efficiency upgrades. The wider benefits of electrifying industry would also help secure 900,000 existing jobs in manufacturing.



Table 2: A range of electric heating technologies are available to replace gas heating processes.⁸

Technology	Capability	Industries
Industrial heat pumps	Hot water, air and steam up to 160 °C. Many times more efficient than any type of boiler.	Food, textiles, paper, timber, chemicals
Electrical resistance	Simple technology for heating furnaces and kilns up to 1800°C Electric boilers can produce hot water or steam up to 220°C	Glass, food, plastics, carbon fibre, chemicals
Infrared	Heats surfaces and thin materials faster than any other method (up to 2000°C). Broad potential across many industries, particularly for drying and curing.	Food, paper, wood, plastics, packaging
Induction	Fast, efficient, non-contact method of heat-treating and melting metals.	Metal casting, fabricated metal, and machinery
Microwaves	Fast, efficient method of heating bulky material, such as stacks of bricks. Can also speed up chemical reactions.	Ceramics, bricks, chemicals, timber
Electric arc heating	Melting and refining metals such as steel and silicon. Plasma arc furnaces can run at very high-temperature up to 5000°.	Steel, silicon, ferrosilicon Cement, waste processing
Renewable hydrogen	Renewable hydrogen is made using renewable electricity. It can be used as a feedstock to decarbonise high-carbon sectors such as steel and ammonia.	Steel, ammonia, chemicals

Renewable hydrogen

Governments can kick-start Australia's renewable hydrogen sector by stimulating domestic demand. Heavy-duty transport, ammonia and steel production are three key sectors where renewable hydrogen could replace fossil fuels. This would create 1,500 new jobs within five years, providing the launchpad for a much larger industry.

Renewable hydrogen is a clean, versatile fuel with potential uses including steel production, shipping, trucks, buses and electricity generation. ARENA has estimated the global future market for hydrogen as an energy source could be worth up to A\$300 billion by 2040.⁹

This would make it one of the world's largest markets, and Australia's natural advantage in renewable energy puts it in a prime position to benefit. BloombergNEF estimates the cost of renewable hydrogen made in Australia as 25% cheaper than China or Western Europe, and 50% cheaper than Japan or South Korea.¹⁰

Many countries including Germany, Japan, China and South Korea see renewable hydrogen as a central component of their plans to decarbonise. However, these countries may not have sufficient renewable resources to make all the hydrogen they need.¹¹ They are therefore likely to rely partly on imports from countries like Australia that can make renewable hydrogen cheaply. In recognition of this, Japan has signed a statement of cooperation on hydrogen with Australia.¹²

Australia's leaders are enthusiastic about the future of hydrogen. In 2019 state and federal energy ministers approved the National Hydrogen Strategy¹³ which outlines steps towards a commercial hydrogen industry.¹⁴ The strategy anticipates that by 2050 the industry could employ between 7,600 and 17,000 people in Australia.¹⁵

Getting started with domestic demand

While the National Hydrogen Strategy discusses many potential uses of hydrogen, it provides no clear pathway for an industry based on domestic consumption. Instead it sees the main economic potential in hydrogen exports and promotes a gradual approach to building local capacity while monitoring the evolution of global demand.

A less passive strategy would be to create *domestic* demand. The following industries could easily consume enough renewable hydrogen to stimulate a major national industry.

- **Heavy-duty transport.** Current battery technology is not well-suited to the heaviest trucks in mining and for long-haul freight. However, hydrogen-powered trucks that can fulfil these functions are now available.¹⁶ The National Hydrogen Strategy gives the breakeven cost to run trucks as \$3.50 per kilogram of hydrogen – a cost which is already achievable in Australia.¹⁷
- **Ammonia.** The ammonia industry is the largest consumer of hydrogen – extracting hydrogen from natural gas to make fertilisers. The breakeven point for renewable hydrogen as a feedstock for ammonia production is \$2.50 per kilogram of hydrogen.¹⁸ This cost is likely to become achievable within five years and could fall to \$1.50 per kilogram by 2030.^{19,20} Several fertiliser companies are planning to use renewable hydrogen at their Australian ammonia plants. For example, Queensland Nitrates proposes an annual production of 20,000 tonnes of green ammonia at its facility near Rockhampton.²¹
- **Steel.** The next section outlines Australia's potential to produce green steel with hydrogen. The two new steel plants proposed by this scenario would initially consume around 165,000 tonnes of hydrogen per year, eventually rising to over five million tonnes.

These three sectors alone have the potential to use millions of tonnes of renewable hydrogen. *The Million Jobs Plan* assumes they could consume at least one million tonnes of hydrogen per year by 2025. This would create about **1,500 on-going jobs in hydrogen production**,²² as well as another several thousand jobs in building hydrogen infrastructure including electrolysis plants.

Zero-emissions steel

Australia should act now to develop a green steel industry to avoid losing further ground to international competitors. Governments should lay the foundation of a major new industry by supporting construction of hydrogen-based steelworks in the next five years.

Australia is the world's largest exporter of iron ore but produces little steel. By combining exceptional resources in iron ore and renewable energy, Australia could become a pioneering producer of zero-emissions steel.

Most new steel is made using coal and its production causes 7% of global greenhouse gas emissions. Some producers use an alternative lower-emissions method of steel production called direct reduction. Most direct reduction plants burn no coal at all, using natural gas instead.

The direct reduction process is important because it can be adapted to run on hydrogen. This has already been done on a commercial scale with hydrogen extracted from natural gas.²³ If renewable hydrogen were used instead, zero-emissions iron becomes possible. Zero-emissions iron can then be converted into zero-emissions steel using an electric arc furnace powered by renewable energy.

Several major steel-makers are exploring this option. The most advanced project is HYBRIT, a Swedish consortium that has already built a pilot plant. The consortium aims to launch its first fossil-free steel products by 2026. Initially these products are likely to cost 20-30% more than conventional steel, but this cost premium is expected to disappear as hydrogen production becomes cheaper.²⁴ Even at a slightly higher cost, there are likely to be many customers for zero-emissions steel.

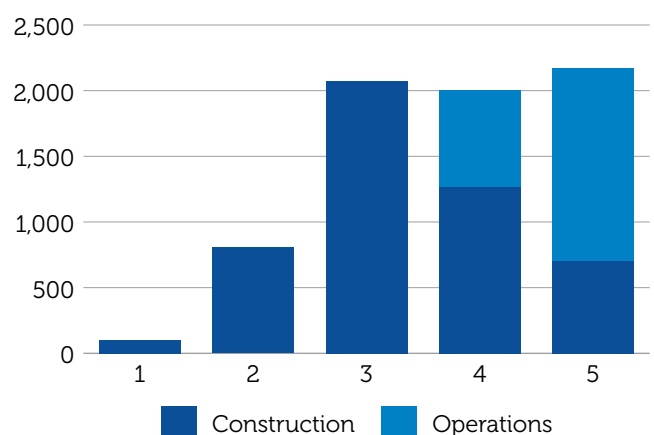
Australia's opportunity to pioneer zero-emissions steel

A recent Grattan Institute report showed how Australia could establish a major iron and steel industry based on renewable hydrogen. The *Start with steel* report presented a scenario where Australia exports 48 million tonnes of iron and 40 million tonnes of steel.²⁵ The annual revenues from a green steel industry of this scale would be about \$65 billion, only slightly less than today's value of Australia's coal exports.

This green steel industry would create **25,000 manufacturing jobs**, or 37,000 if all of the iron were converted into steel. The Grattan report identified the Hunter Valley and Central Queensland as ideal locations for this new industry. One advantage of these regions is that their existing coal-mining workforce has a similar skill-set to that required by a future steel industry.²⁶

The Million Jobs Plan proposes that Australia acts now to develop a green steel industry to avoid losing further ground to international competitors. A realistic aim is to complete two integrated steel works in the next five years, with both plants operating by the fifth year. This would create 5,000 jobs in years 3, 4 and 5. By year 5 there would be 1,500 permanent steel-making jobs (Figure 3).

Figure 3: Early employment potential from initiating a green steel industry.



Green aluminium

Australian aluminium is carbon intensive and expensive. By switching to renewable-powered smelters, Australia could produce globally-competitive green aluminium. This would protect 3,500 existing jobs and could ultimately create 10,000 new jobs. Smelters could also play a critical role in grid security by operating as huge virtual batteries.

Australia plays a crucial role in the global aluminium industry. Australia is the world's largest producer of aluminium ore (bauxite) and the second largest manufacturer of alumina – the raw material for aluminium smelters.²⁷ Most Australian alumina is exported, but around 15% is processed domestically at four aluminium smelters owned by Alcoa and Rio Tinto.

Aluminium has a high carbon-intensity – on average about six times higher than steel per tonne of metal – due to the large amount of electricity required to power the smelting process.^{28 29} There is growing concern about this carbon-intensity. A separate market for green aluminium is starting to emerge as major customers such as Apple, Bosch, Toyota, Audi, BMW and Tetra Pak commit to using lower-emissions aluminium.³⁰ Investors too are factoring in carbon risk.

In response leading producers such as Rio Tinto, Alcoa and Rusal have launched green aluminium products. Green aluminium has only a third of the carbon footprint because it is made in smelters powered by clean hydropower.^{31 32} Alcoa and Rio Tinto are committed to using more renewable energy and further reducing the carbon footprint of their aluminium.³³

Australian aluminium production clashes with this low-carbon vision as it is more carbon intensive than the global average. To make matters worse, Australian production is also expensive due to the price of electricity.³⁴ Alcoa and Rio Tinto have both hinted at the closure of all four Australian smelters, resulting in the loss of 3,500 direct jobs and many more indirect ones.

The future of Australian aluminium is renewable

The only viable future for Australian aluminium is one powered by renewable energy. Renewable energy developers could supply aluminium smelters with reliable power at around \$50 per megawatt-hour.³⁵ This would make Australian smelters competitive again and enable them to compete in the growing green aluminium market. The smelters could also play an important role stabilising an electricity grid based on variable renewable energy (Box 1). This would provide extra revenue for the smelters and reduce electricity costs for everyone.

Keeping the smelters open would save the jobs of **3,500 people**.³⁶ But it could just be the start for a green aluminium industry in Australia. A 2019 report by the Energy Transition Hub at the University of Melbourne presented a scenario of 14 aluminium plants all powered by renewable energy.³⁷ This would create over 10,000 new on-going jobs, increasing the revenues from Australia's aluminium-based exports by A\$15 billion per year.

"Renewable energy is the way that Australia can once again become a cheap energy superpower and industries like aluminium smelting will relocate onshore."³⁸

Kobad Bhavnagri, Head of Bloomberg New Energy Finance in Australia



Box 1: Aluminium smelters can boost energy security in a renewable electricity system

As the electricity system integrates more variable renewable energy, there is increasing value in flexible forms of demand. Aluminium smelters, which use around 12% of the electricity in the National Electricity Market, have great potential to provide this flexibility. Smelters could provide similar services to utility-scale batteries, but at a fraction of the cost.

Traditionally aluminium smelters run inflexibly with a constant demand for electricity throughout the year. Australian smelters are occasionally called on to reduce consumption for short periods to avoid blackouts. However, they could run far more flexibly. Smelters in France and the United States have shown that aluminium smelters can provide valuable grid services by modulating consumption on a daily basis.³⁹ A smelter in Germany has gone further by retrofitting a technology called *Enpot* that was originally developed in Australia.⁴⁰ *Enpot* allows the German smelter to rapidly ramp up or down its consumption of energy for unlimited periods.

If *Enpot* was installed on Australia's four smelters they could operate as a virtual battery many times larger than the Tesla big battery in South Australia. The smelters could earn substantial revenues by providing this service. It would also reduce wholesale electricity prices and network costs by reducing peaks in demand.

New energy metals

Expanding Australia's capacity for processing new energy metals could deliver 30,000 jobs by 2025 and create high value products for export. Powering the plants with renewable energy will boost Australia's competitive advantage.

Metals are key to the zero-carbon future. All renewable energy technologies as well as electric vehicles, electronics and electricity grids, rely on the unique properties of metals. For example, wind turbines incorporate a steel tower, copper wiring and magnets contain cobalt and neodymium. Lithium-ion batteries are made not only of lithium but also cobalt, aluminium, manganese, nickel, copper, steel and titanium.

Australia is one of the world's most significant producers and exporters of many of these new energy metals.⁴¹ For example, Australia mines most of the 16 minerals used in solar panels,⁴² as well as nine of the 10 elements required to produce lithium-ion batteries.⁴³ It is also the world's second largest producer of rare-earth elements used in electric vehicles, wind turbines, fuel cells and batteries.⁴⁴

Most of these metals are exported in a raw form, with minimal processing. This means Australia captures only a small portion of the ultimate value of its mineral resources. It has been estimated that Australia earns only 0.5% of the ultimate value of its exported lithium ore, with the remainder captured by companies overseas that refine lithium or manufacture lithium-ion batteries and their components.⁴⁵

From mining to making

There is a clear opportunity for Australia to build on its success as a miner, to become a world-leading processor of new energy metals. This opportunity was highlighted by the Australian Government's Resources 2030 Taskforce which recommended that governments "develop strategies to enhance and grow competitive downstream processing industries in key regional centres".⁴⁶

If metals such as lithium, manganese, cobalt and rare earths were refined domestically, Australia would create higher value products. For example, the value of a tonne of manganese ore increases four-fold when converted into high-purity manganese. As Box 2 describes, secondary processing of metals, including high-purity manganese, can be carried out with renewable energy.

Processing of new energy metals is already taking off in Western Australia. Two of the world's largest

lithium companies, Tianqi and Albemarle, have invested in local processing facilities. Tianqi's plant in Perth has started producing battery-grade lithium hydroxide. The plant employed 1,000 workers during peak construction and expects to employ a permanent workforce of more than 200.

Analysis carried out for Regional Development Australia showed that, in Western Australia alone, expansion of the energy metals industry could directly create 21,500 new jobs, and a further 53,000 indirect jobs.⁴⁷ *The Million Jobs Plan* assumes that 70% of new jobs in the energy metals sector will be located in Western Australia, with the remaining 30% shared across the rest of Australia. This equates to the creation of **30,000 new jobs by 2025**.

Most of these jobs would be in secondary processing of lithium and the manufacture of battery cell components such as cathode and anode materials. These would be on-going jobs with higher wages than normal mining operations.⁴⁸

Box 2: Making metals with renewable energy

Australian producers of energy metals can gain a market edge by using renewable energy. As most metal processing relies largely on electrical energy, the emissions associated with production can be greatly reduced by switching to solar and wind power.

Pioneering firms are already doing this. In Queensland, Sun Metals' investment in a 125 MW solar farm to supply its zinc refinery has helped to justify a \$300 million expansion, creating hundreds of jobs.⁴⁹ In Western Australia, Element 25 plans to use renewable electricity to produce high purity manganese at a new mine site. Element 25's analysis has shown how using up to 90% renewable energy can help the company produce at a lower cost than Chinese competitors, despite access to a nearby gas pipeline.⁵⁰ Element 25 believes that its future customers will be attracted by its lower-emissions product.⁵¹



Electrifying mining

Replacing diesel-powered machines with electric or hydrogen-powered alternatives in Australia's minerals mining sector would create 20,000 new jobs. This would increase the efficiency and sustainability of Australia's high-value mining sector.

The mining sector is under pressure, from investors, customers and local communities, to improve its environmental performance and reduce carbon emissions. EY reports that mining and metals executives now see damage to their social licence to operate as the number one threat to their business.⁵²

After a slow start, the Australian mining sector is starting to replace fossil fuel electricity generation with renewable energy. Mines will be important customers for the 90 gigawatts of renewable electricity projected by **Chapter 1** of this report.

But to become truly sustainable mines must become 100% renewable. This means no longer using diesel to run vehicles and equipment for excavating, loading and transporting ore and waste rock. Burning diesel creates not only carbon emissions, but also a serious health risk for mineworkers, particularly those who work underground. The threat of legal action by workers affected by exposure to diesel particulates has been called a "ticking time bomb" on a par with asbestos.⁵³

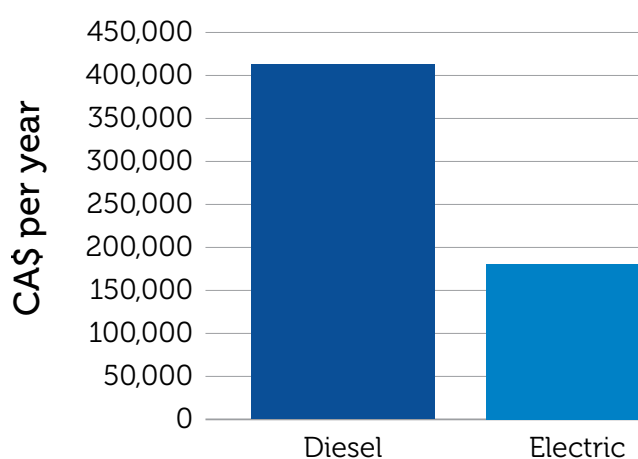
Electrified mining is safer, cheaper and cleaner

The mining sector should replace diesel-powered machines with electric or hydrogen-powered alternatives. Going electric eliminates emissions, reduces operating costs and makes mining safer and quieter. It will be a big change for the industry, but all-electric mining is now a reality. The first all-electric underground mine began operating in 2019 at Borden Lake in Canada, and the world's first all-electric open-pit mine is at the planning stage.⁵⁴

Electric alternatives are available for all types of mining equipment including loaders, drill rigs, excavators, personnel carriers and small to mid-sized electric trucks.⁵⁵ Hauling the heaviest loads may require hydrogen-powered trucks.⁵⁶ However, the best solution for haulage could be alternative systems such as conveyor belts and trolley systems whereby large electric trucks are powered through overhead cables. This type of system used to be more common and interest is returning since a successful trial at Sweden's largest open-pit copper mine.⁵⁷

Electric mining equipment tends to have higher upfront costs but much lower operational costs (Figure 4). Borden Lake mine expects to save \$9 million on energy bills by quitting diesel.⁵⁸ Such cost advantages are likely to accelerate the electrification of mining. Swedish manufacturer Epiroc aims to electrify all its underground machines by 2025,⁵⁹ and global consultancy BDO predicts that by 2023, "diesel machinery will not be used in new underground mines in Australia, and existing underground mines will have begun to phase them out."⁶⁰

Figure 4: Operating costs for similar diesel and electric load haul dump trucks



Electrifying mining creates jobs in engineering services

The transition to electric mining will create many new employment opportunities. Unfortunately, Australia has little capability to manufacture specialised mining machinery and equipment.⁶¹ However, about 10,000 people are employed to provide engineering services to the mining industry.⁶² Roles include the supply, servicing, modification and maintenance of mining vehicles and equipment.

These roles will multiply as the Australian mining sector moves away from diesel. The adoption of zero-carbon mining machinery will create local jobs in engineering, design, assembly, installation, modification, maintenance and the production of parts for electric mining machinery.

Governments can accelerate this transition in two ways. Firstly, they can set a target for existing mines to phase-out diesel-fuelled machinery and vehicles within 10 years. New underground mines should be diesel-free at the outset. Secondly, targets should be accompanied by local content requirements to ensure the extensive involvement of Australian firms in the provision of new electric mining equipment.

The rapid electrification of mining could stimulate a three-fold increase in the number of workers providing engineering services. Several thousands more workers will be required to design and construct new electric trolley systems to replace the largest diesel trucks. In total the electrification of mining could **create 20,000 new on-going jobs** by 2025, and over 70,000 job-years..

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Chapter 4

Transport

The Million Jobs Plan transport initiative starts Australia on a journey to modern zero-emissions transport. It electrifies regional railways, introduces thousands of electric buses and expands safe cycling infrastructure. This would create 138,000 job-years, including over 30,000 on-going manufacturing jobs and 8000 short-term jobs at peak construction.

Making it happen:

- Improve air quality by electrifying public transport and encouraging cycling.
- Roll out 13,000 buses in the next five years to replace 30% of existing bus fleet.
- Expand the number of bus services across Australia by 5000, using electric buses.
- Make regional rail faster and cleaner by electrifying 3000 kilometres of rail track in five years.
- Encourage safe cycling by building or improving 5000 kilometres of cycle lanes in five years.



Electric buses

There is increasing concern about the impact of transport on local air quality. Pollution from diesel and petrol engines can damage heart and brain function, circulation, breathing and the immune system.¹ In Australia, poor air quality kills more people than the road toll.^{2,3}

Public transport buses are part of the solution because they can reduce cars on the road. However, because most buses also run on diesel or petrol, cities around the world are increasingly opting for electric buses in order to improve air quality.

Electric buses have no tailpipe emissions, lower running costs and offer a quieter ride. They also reduce greenhouse gas emissions. Even using standard grid electricity, an electric bus in Sydney would have significantly lower emissions over its lifetime than a diesel equivalent.⁴

There are already about half a million electric buses operating worldwide, most of them in China. Beijing aims to electrify more than half of its bus fleet by 2020, and Shenzhen has already switched to an all-electric fleet (Box 1 – Shenzhen).

Other cities are following suit. Santiago has set a target for an 80% electric bus fleet by 2022.⁵ In London every new single-decker bus must be electric, and there are even many electric double-decker buses.⁶

Thirty-five cities including Paris, Los Angeles, Copenhagen, Barcelona, Mexico City and Tokyo have signed the *Fossil Fuel Free Streets Declaration* committing to all-electric bus fleets by the first-half of the 2030s.⁷

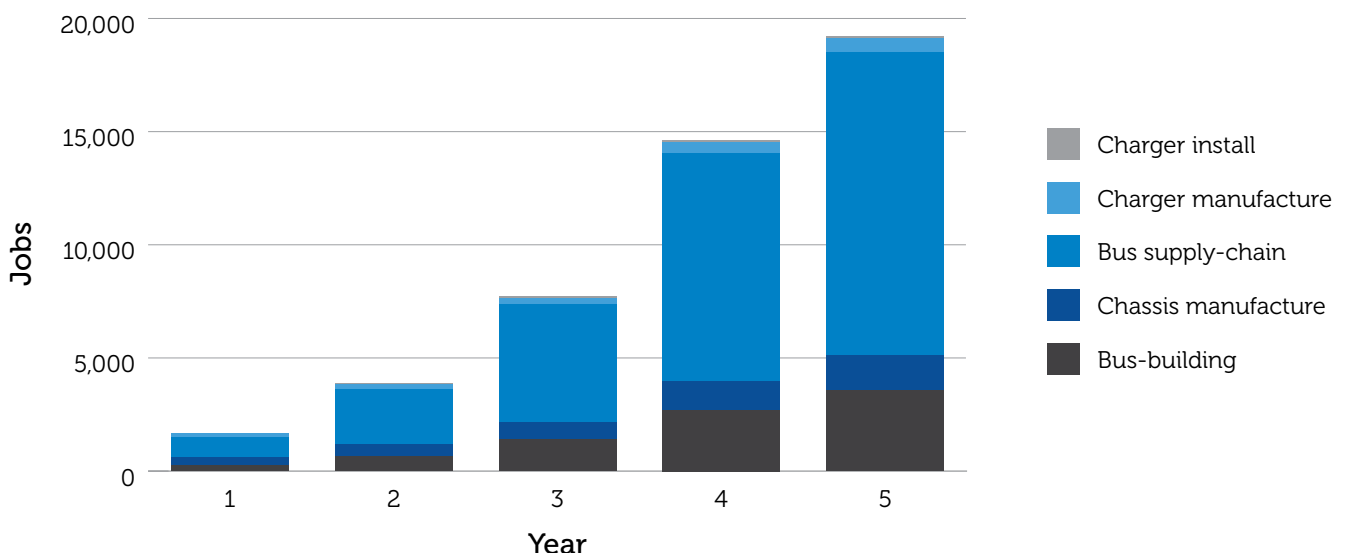
More electric buses

The Million Jobs Plan proposes that Australia rolls out 18,000 electric buses in the next five years:

- 13,000 electric buses to replace 30% of buses used for public transport. (These will be the oldest, most polluting diesel buses, with an average age of around 16 years.)
- 5000 electric buses to expand public bus services across Australia.

This bold initiative would create **19,000 new manufacturing jobs** by the fifth year (Figure 1). These workers would be involved in the production of bus bodies, chassis, battery chargers and a range of bus parts. Box 2 explains these sectors in more detail.

Figure 1: New employment potential from a rapid roll-out of 18,000 electric buses in Australia





Box 1: Shenzhen's 16,000 electric buses – the express route

Shenzhen, China is a city of more than 16,000 public buses. Not long ago these buses produced 20% of the city's transport emissions. But by the end of 2017, every single bus in Shenzhen was electric. This is the largest-scale electric bus transition ever achieved.⁸

The transition was mandated by the city government as a way to improve local air quality. Local bus operators received electric bus subsidies from the national and municipal governments. Some operators reduced upfront costs by leasing buses from manufacturers. Battery charging takes place mostly overnight, with supplementary fast charging on some routes.⁹

Box 2: Build on Australia's existing capabilities in bus manufacturing

Bus building. The majority of new buses in Australia are built domestically using imported chassis and drivetrains. Australia's bus-building industry produces around 1150 buses every year, employing about 900 workers.

Our plan would require a significant scaling-up of the capacity of Australia bus builders. Several companies have already started making electric buses and are preparing for an upsurge in demand. Some are also developing innovations such as by lighter buses¹⁰ and integrated chassis.¹¹

Production capacity is likely to be boosted by the arrival of international bus manufacturers. Dutch bus company Ebusco has announced plans to partner with the Australian Bus Corporation to build a new factory making lightweight, carbon-fibre electric buses.¹² BYD and Scania have also expressed interest in setting up facilities in Australia.

Chassis manufacture. Australia currently imports chassis for buses, but a larger bus industry could support the development of local chassis production. Bustech in Adelaide has already manufactured chassis for a small number of electric buses, and Nexport plans to set up a bus chassis factory in New South Wales.¹³

Bus supply chain. Australian bus manufacturing is supported by a large industry making and supplying components, including seats, flooring, poles, air-conditioners and CCTV systems. This supply chain is estimated to currently employ 6000 people in Australia.

Charger manufacturer and installation. The plan for 20,000 new electric buses will require at least 15,000 new battery charging stations. Most charging is likely to take place overnight at bus depots, with supplementary fast charging on some routes. Many of these chargers can be manufactured in Australia. Tritium, a Brisbane-based company, is already one of the world's largest manufacturers and exporters of fast-charging stations. Tritium employs 300 to produce 1500 chargers per year and believe they could scale up to meet larger demand.

Bus exports. Expanding the capacity of the electric bus industry will put Australia in a strong position to become an exporter of electric buses. Exports can help sustain a larger sector into the future as the world's bus fleet is electrified.



Electric buses save money and lives

The upfront cost of an electric bus is 30% to 40% more than a diesel bus,¹⁴ but the total cost of ownership is often less. The International Energy Agency has shown that in Europe electric buses are cheaper overall, thanks to lower running and maintenance costs.¹⁵ An electric bus trial in Canberra came to the same conclusion. Rapidly falling battery prices mean that the upfront cost of an electric bus could reach parity with a diesel bus during the 2020s.¹⁶

The economic advantage of electric buses is even greater when health benefits are considered. The Chicago Transit Authority estimates that each electric bus saves the city nearly US\$110,000 a year in health care expenses due to reduced air pollution.¹⁷

Making it happen in Australia

Australia's slow adoption of electric buses may be speeding up. Canberra is aiming for a zero-emissions bus fleet by 2040, and Brisbane City Council plans to introduce 60 electric buses.¹⁸ But the most encouraging development is the New South Wales Government's plan to eliminate diesel buses. The NSW Transport Minister, Andrew Constance, has said:

"The experience of other leading European cities demonstrates that a rapid transition to zero-emission buses is possible. We will challenge the industry to begin an ambitious transformation of our bus fleet from particulate-emitting diesel to zero-emission buses."¹⁹

Governments can accelerate the transition to electric buses by:

- Setting clear targets for the replacement of diesel buses
- Expanding bus services as part of integrated public transport
- Establishing local content requirements for bus bodies, chassis and other components
- Subsidising the rollout of charging infrastructure
- Taxing vehicle emissions, e.g. imposing fees on dirtier vehicles within certain areas
- Ensuring Australia's electric buses are powered by renewable energy. Victoria provides a model for this with its scheme to power Melbourne's tram network with solar power.²⁰

In the short term, government subsidies may also be required to reduce the upfront costs of electric buses. These costs can be reduced through a rental model where bus operators lease either the battery, or the whole bus, from the local manufacturer.

Electric trains

Railways are a safe and efficient means of moving people and goods. Australian governments are investing billions of dollars in new and upgraded railways to accommodate population growth and ease road congestion. It has been estimated that each passenger train takes 525 cars off the roads, and one freight train replaces 110 long-haul trucks.

There is a worldwide shift towards more electrified rail. Compared to diesel trains, electric trains are faster, quieter, more efficient and more reliable. They are also cheaper to operate and maintain, and often have lower upfront costs. Electric trains are also cleaner, emitting almost no local pollution and fewer greenhouse gas emissions.

The main barrier to electrification is the initial expense. Modern electrified lines require the installation of overhead electrical wires, new substations to supply the power and high-standard rail track that can accommodate faster speeds. Electrifying an existing rail line costs at least \$1 million per kilometre. However, it is an investment that pays off in terms of lasting benefits, including job creation.

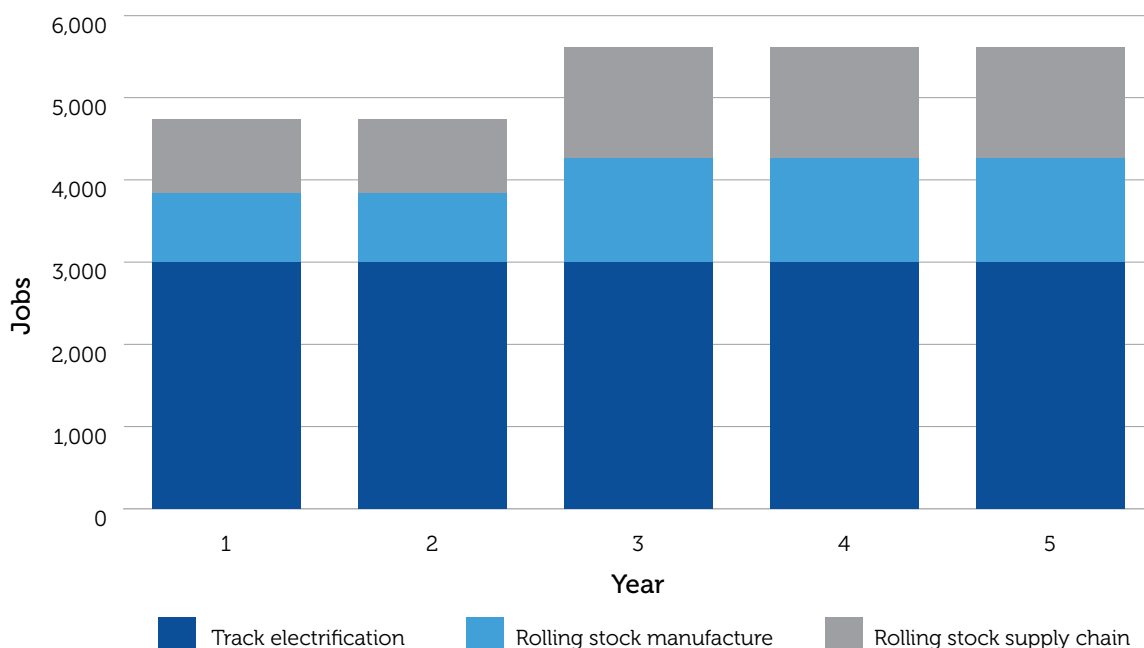
Fast-track to electric rail

Australia's urban rail networks are largely electrified. But most regional routes are serviced by slow diesel trains. Governments are already considering the electrification of some of these routes, to enable faster travel between regions and capital cities.

A new federal body, the National Faster Rail Agency, is developing business cases for upgrades to rail lines such as Sydney to Newcastle, Melbourne to Shepparton and Brisbane to the Sunshine Coast. These upgrades would enable faster electric trains capable of travelling up to 200 km/h – twice as fast as many of the current diesel locomotives.

The National Faster Rail Agency promotes a 20-year rail strategy. *The Million Jobs Plan* proposes that Australia accelerates upgrades to regional rail routes, aiming to electrify 600 kilometres of track every year for the next five years. This would create 15,000 construction jobs installing overhead lines and laying new track. It would also create 2,600 on-going jobs in the manufacture of new electric trains and components (Figure 2).

Figure 2: Electrifying railways creates many jobs in construction and manufacturing.



National plan to electrify the Australian railways

The proposal to electrify 3000 kilometres of rail track in five years should be part of a strategic objective to electrify and decarbonise the national rail network. Other countries are already pursuing this course of action in order to reduce emissions. The UK, for example, has committed to end diesel-only trains by 2040, and Irish Rail plans to buy 600 hybrid and battery electric trains to shift its entire fleet away from diesel.²¹

Rail electrification projects are an ideal stimulus project as they can happen quickly – the rail lines and stations already exist and shorter routes can be electrified in a couple of years. Table 1 lists some of the potential projects that could be tackled in the

next five years. These routes have been selected because they carry large numbers of passengers, or could do so if they were electrified. Beyond Zero Emissions also supports high speed rail between Melbourne, Sydney and Brisbane, though this may not create many jobs in the short term (Box 3).

Even without considering carbon emissions, these electrification projects would yield benefits in terms of journey times, service frequency and reliability. For example, the journey from Sydney to Canberra takes over four hours by train, compared to three hours by car. With an electrified rail line, the journey could take less than two hours. Similarly, the journey time between Melbourne and Geelong could be halved with electric fast rail. The Australian Government has already committed \$2 billion towards Geelong fast rail in order to ease road congestion and promote regional growth.²²

Table 1: Existing rail routes that could benefit from electrification

Rail route	Route length (kilometres)
Sydney <> Canberra	320
Sydney <> Melbourne *	1024
Sydney <> Parkes	360
Sydney <> Bomaderry (Nowra)	153
Sydney <> Wauchope (near Port Macquarie)	359
Sydney <> Newcastle ♦	160
Melbourne <> Ballarat	123
Melbourne <> Geelong	85
Melbourne <> Bendigo	162
Melbourne <> Traralgon	150
Melbourne <> Shepparton	130
Frankston <> Baxter	31
Brisbane <> Sydney	1008
Brisbane <> Sunshine Coast ♦	120
Brisbane <> Toowoomba	120
Brisbane <> Melbourne (Inland Rail – new freight line)	1700

*About 300km of this line would be electrified for Sydney to Canberra route.

♦These lines already electrified but travel times could be slashed with upgrades.

Box 3: High speed rail in Australia

Beyond Zero Emissions strongly supports a high speed rail line linking Melbourne, Sydney and Brisbane. Our *High Speed Rail* report (2014) showed how train times from Sydney to both Melbourne and Brisbane could be cut to under three hours. High speed rail is currently the best way to shift emissions from domestic air flights, which until COVID-19 were growing steadily in Australia. Sydney to Melbourne represents one of the best opportunities to do this as, until recently, the world's second busiest air route with over nine million passengers per year. High speed rail could also replace many longer car journeys.

High speed rail has not contributed to our assessment of employment potential in the rail sector.

Without government support or any agreed route or design, this project is unlikely to generate much employment within five years. However, with sufficient government backing, a high-speed rail route could start in two or three years and be operational in Australia by the early 2030s. (The 1318 kilometre high speed railway from Beijing to Shanghai was built in just three years.) In this case, several thousand more jobs would be created.



Cycling

Cycling as a means of transport has clear environmental and health benefits. It produces no direct emissions, reduces road congestion and helps to improve people’s fitness and wellbeing. These advantages are multiplied during a global pandemic, when cycling presents an inexpensive alternative to both crowded public transport and over-crowded roads.

The United Nations recommends that countries spend at least 20% of transport budgets on walking and cycling infrastructure.²³ Australian governments manage on average just 1%.²⁴ This low spending results in low rates of cycling – only 1% of journeys to work in Australia are by bike.²⁵ This contrasts with some European countries where cycling accounts for well over 10% of all trips.

Investing in cycling is investing in jobs

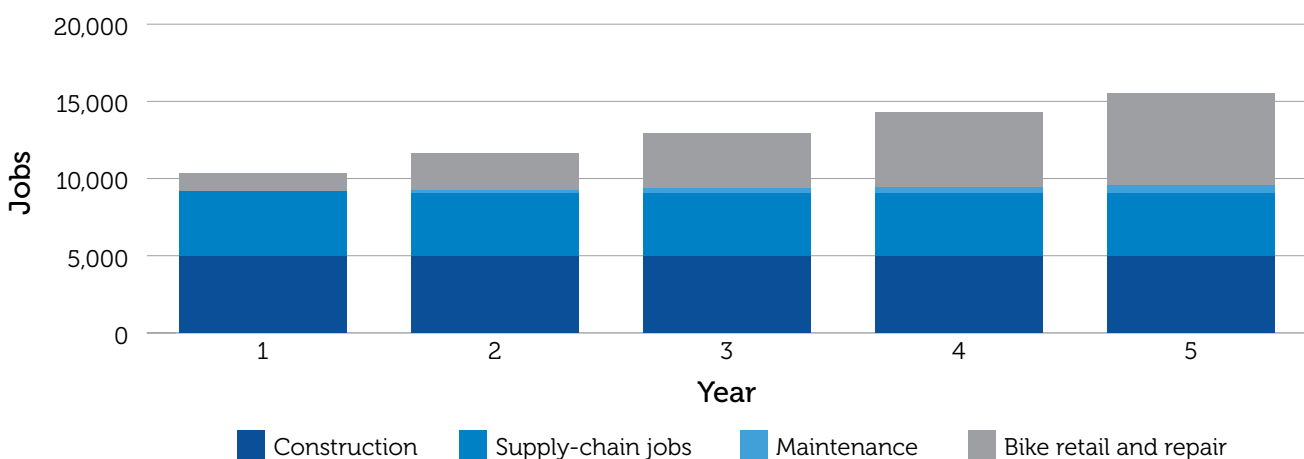
Investment in safe cycling infrastructure is the best way to encourage more Australians to get on their bikes. But it is also a fast and efficient way to create jobs. Building cycling infrastructure generates more employment than any other type of transport spending,²⁶ creating six jobs created for every \$1 million invested.²⁷

The Million Jobs Plan proposes a five-year plan to create or improve 5000 kilometres of bike lanes. Every year of this plan would create:

- nearly **5000 jobs** every year in the engineering and construction of bike lanes – almost 25,000 jobs over the five-year period.
- **500 on-going jobs** by the fifth year, for maintenance, cleaning and landscaping.
- over **4000 jobs** for suppliers and manufacturers of concrete, signage, pavers and other cycling infrastructure products (Figure 3).

This infrastructure plan should be part of a wider program to triple the number of journeys made by bike. European research suggests that this would also double employment in bicycle retail and repair, creating over 6000 new jobs by the fifth year.^{28,29} Altogether this proposal would create 10,600 on-going jobs, 24,000 short-term construction jobs and over 64,000 job-years.

Figure 3: Investment in cycling infrastructure creates construction and maintenance jobs, as well as jobs in bicycle retail and repair



Getting it done

This five-year plan to boost cycling infrastructure would cost around \$1.5 billion per year³⁰ – a small fraction of the \$30 billion spent on new roads and rail infrastructure.³¹ Investments in cycling infrastructure are quickly paid back. The Queensland Government estimates that for every dollar invested in cycling infrastructure the state can expect almost \$5 in economic benefits.³²

Cycling infrastructure can be delivered quickly. Bicycle Network, Australia's biggest bike riding organisation, has identified 750 kilometres of shovel-ready bike lane projects across Australia. The organisation says these initial projects could occur in the next six months at a cost of just \$370 million.³³ The organisation points to many international cities taking the opportunity of quieter streets during the COVID-19 pandemic to reshape streets in favour of cyclists and pedestrians.

Beyond these initial projects, the objective should be to fast-track thousands of kilometres of new or upgraded bike lanes. Many of these routes have already been mapped out. For example, the Queensland Government has identified 550 kilometres of high-priority bike lanes needed to improve its state cycling network,³⁴ and Victoria has a plan for 3500 kilometres of on-and off-road cycling routes, much of which is yet to be built or needs improving.³⁵ These plans should be funded now to boost cycling and create jobs.



Box 4: Zero Carbon Communities – Tasmania

Climate Action Hobart and local community groups including Circular Economy Huon and Bicycle Network Tasmania have a vision to kick start emissions transport. The community supports the construction of a network of bike lanes and parking facilities to promote active transport. Focusing on building a pedestrian and cycling friendly path on the Tasman bridge would be a great accelerator. Incentives for the electric bike industry to grow through no interest loans and charging networks are also supported.

The Tasmanian government's current and planned renewable energy projects mean that the electrification of transport is now possible. Building electric public buses, ferries and charging stations with local labour and content requirements would create a new industry. Local shipbuilder, INCAT, is fantastically positioned to take on the challenge of building electric ferries and Metro Tasmania's fleet of new diesel buses are "electric ready" for easy conversion to electric. A conversion workshop should be set up in Tasmania, training and employing Tasmanians and using locally sourced parts where possible.

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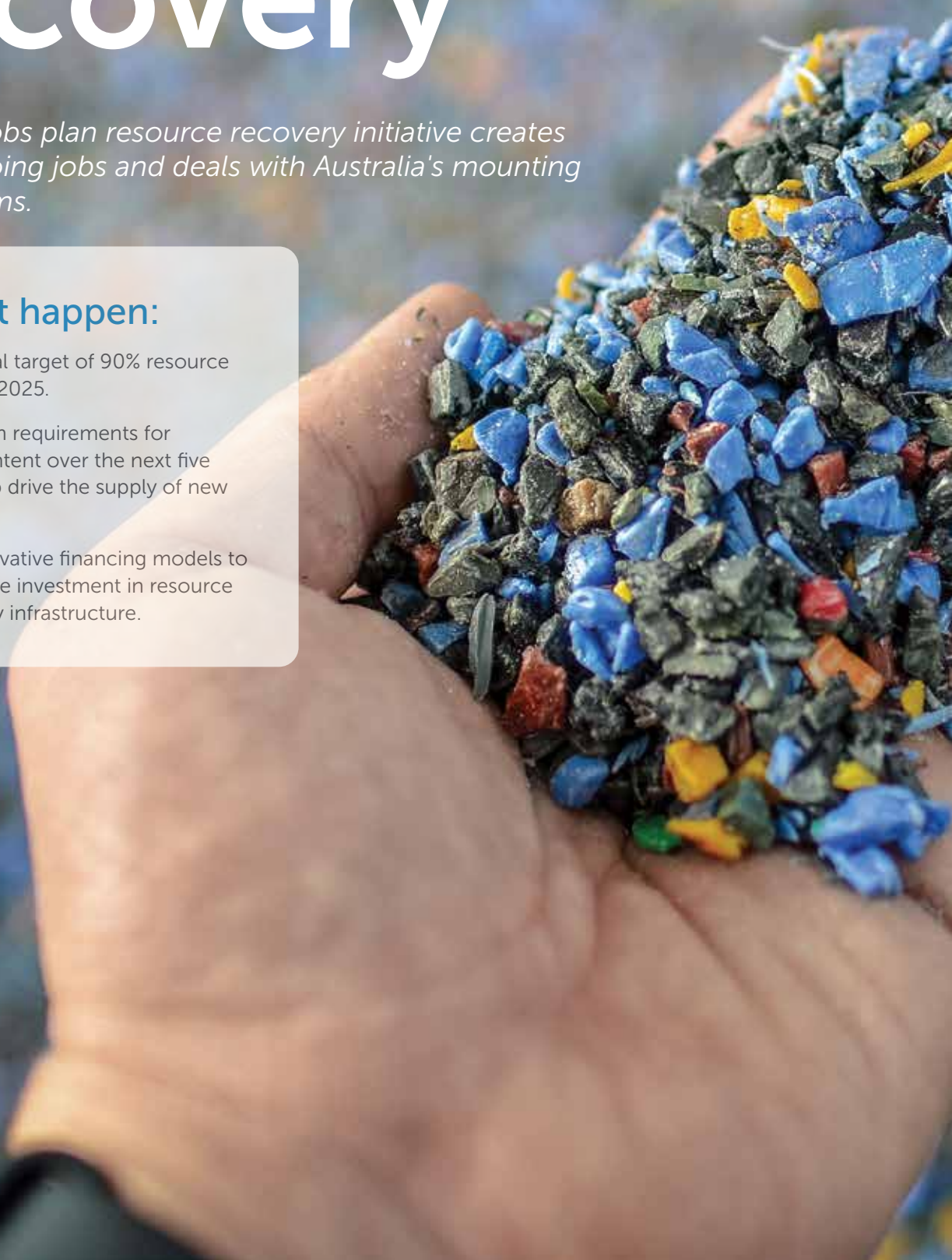
Chapter 5

Resource Recovery

The Million Jobs plan resource recovery initiative creates 28,000 on-going jobs and deals with Australia's mounting waste problems.

Making it happen:

- Set a national target of 90% resource recovery by 2025.
- Set minimum requirements for recycled content over the next five years to help drive the supply of new products.
- Explore innovative financing models to attract private investment in resource and recovery infrastructure.



Recovering resources

Australia's current waste and resource recovery system is inadequate to meet the nation's growing needs. Around 67 million tonnes of waste were generated in Australia in 2018, of which only 55% was recycled¹.

Until recently China dealt with large amounts of Australia's recycled materials. In 2017, 29% of paper and 36% of plastics were exported to China.² China's decision to ban imported waste from January 2018 caused turmoil in Australia's recycling industry.³ Waste stockpiles grew, and many recyclable materials were sent to landfill.

This crisis prompted action by Australian governments at all levels. In December 2018 they released the National Waste Policy, setting a unified direction for waste and recycling in Australia. This was followed by the National Waste Policy Action Plan 2019, which established a target of 80% average resource recovery from all waste streams and a 50% reduction in food waste by 2030.⁴

Some jurisdictions have higher goals, the most ambitious being the ACT's target of 90% resource recovery by 2025.⁵ *The Million Jobs Plan* proposes that all states and territories match the ACT's target. This would not only reduce waste and greenhouse gas emissions, but generate employment.

For every 10,000 tonnes of waste recycled, 9.2 jobs are generated compared to just 2.8 jobs for landfilled waste.⁶ Recycling 90% of waste would create almost **30,000 new on-going jobs** in resource recovery (Figure 1).⁷ Recycling facilities will be sited close to urban and regional populations, so the economic benefits of investment in this sector will be broadly shared. Recycling targets should be integrated into a broader circular economy approach dealing with all parts of the resource chain, from raw material extraction to end-of-life.

*"A truly circular economy is not only possible, but is achievable. And it's of course, essential. And Australia intends to do more."*⁸

Prime Minister of Australia, Scott Morrison.

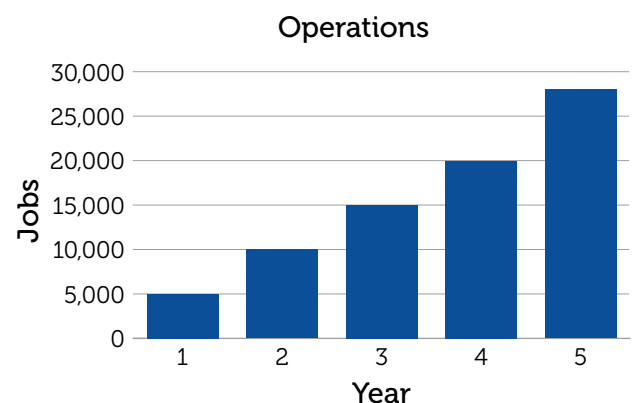
Waste infrastructure investment

Many new processing facilities will be required to achieve a 90% rate of resource recovery. Infrastructure Victoria has estimated this level of recycling would require 87 new or upgraded waste facilities across the state, costing \$1 billion.⁹ Based on this estimate it would cost around \$5.6 billion to build sufficient capacity to recycle 90% of Australia's waste.

Governments should explore innovative financing models to attract private investment in resource and recovery infrastructure. For example, Infrastructure Victoria recommends the Victorian Government consider an auction scheme for each waste processing type. Bidders would submit multiple proposals indicating the quantity of materials they could process across a range of prices.¹⁰

Waste processing represents a significant commercial opportunity for private investors. For example, waste worth \$1.2 billion was recovered in Victoria in 2018/19. The potential to profit from recycling depends largely on the quality of recovered materials. Processors need well-sorted waste streams. This would be assisted by a clear and consistent national approach to kerbside collection, including separate household bins for organics, glass, paper and cardboard.¹¹ The value of recycled materials will also rise as new facilities are built to incorporate innovative processing solutions.

Figure 1: Employment potential in resource recovery





Establishing markets for recycled materials

Increased resource recovery also depends on the development of end markets for recycled products. Through the 2019 National Waste Policy and Action Plan, governments have committed to increasing the amount of recycled content used by government and industry, but have set no targets.

Governments should set minimum requirements for recycled content over the next five years to help drive the supply of new products. They should also fast track the approvals process so that recycled products can meet existing standards and review

these standards to see how various recycled products can be included. Box 1 shows two good examples of governments stimulating demand for recycled materials.

Businesses are also helping to drive the demand for recycled products. The Australian Packaging Covenant is driving an industry-led target for 100% of Australia's packaging to be reusable, recyclable or compostable by 2025.¹² IKEA aims to entirely phase out use of virgin plastic and increasingly uses its own recycled waste and offcuts to produce new products.¹³

Unilever aims to halve the use of virgin plastic by 2025 and has committed to collecting and processing more plastic than it sells. The company will ensure that 100% of plastic packaging is designed to be reusable, recyclable or compostable and aims to increase the use of recycled plastic material in its packaging to at least 25%.¹⁴

Box 1: Governments can help drive demand for recycled products.

In Victoria, the Recycled First program requires contract bidders to demonstrate how they will optimise the use of recycled materials in road and rail projects. Materials must meet existing standards and specifications for road and rail projects. Contractors must also report on the types and volumes of recycled products they will prioritise over the use of virgin materials.¹⁵

In NSW, the Environment Protection Authority has approved the use of Downer's Reconophalt road surfacing material which incorporates recycled soft plastics as well as toner, glass and reclaimed road.¹⁶ Reconophalt was first trialled to construct a local road in Craigieburn, Victoria, in 2018 and has now been used Australia-wide.



Box 2: Community composting – waste can be food

Measures to address food and organic waste are particularly important, as organics release methane gases in landfill, contributing to global warming. The Food and Agriculture Organisation notes, if global food waste was a country, it would be the third-largest emitter of greenhouse gases in the world. In Australia, households throw out 20% of the food they buy. This waste generates 7.6 million tonnes of carbon emissions.



Box 3: CERES Community Environment Park

Around Australia many community-schemes help people to recycle their organic waste. One such scheme is run by CERES in Melbourne. CERES is an environmental education centre, urban farm and social enterprise located on the land of the Wurundjeri people beside the Merri Creek in Melbourne. It was founded in 1982 as a response to the pollution and environmental degradation of the Merri Creek. Originally a 'work-for-the-dole' program where local people would learn about using the site to grow vegetables and composting, CERES has transformed the once degraded site into an award-winning community environment park. It runs workshop courses, training programs, school excursions and incursions, community outreach programs, flea markets, a grocery store, organic farms, a fair food distribution program, a cafe and a nursery.¹⁷

As part of their outreach and education programs, CERES is engaged with several local primary schools as part of their community composting and gardens programs. With the help of CERES many local primary schools have successfully begun their own composting systems.^{18,19,20} For the public, the hub offers to set up compost systems, as well as provides education about compost maintenance and correct use.

The CERES model can also extend to rural locations, with emissions reduction and social benefits. A regional community environment centre could act as a centre for biological agricultural products and education on regenerative agriculture.



Credit: Daniel Beuchat

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Chapter 6

Land Use

The Million Jobs Plan land use initiative creates 40,000+ jobs per year and removes 30 million tonnes of CO2 from the atmosphere per year

Making it happen:

- The Million Jobs Plan land use initiative revegetates 27 million hectares in five years and a total of 55 million hectares in ten years generating 40,000 jobs in land care.
- Revegetation of 27 million hectares represents 3.5% of Australia's land mass, within approximately 6.5% of agricultural land. Seed propagation, planting and environmental management at this scale represents 38,000 ongoing jobs. 5000 of these jobs involve roles for Indigenous land rangers.
- A further 2000 jobs for Indigenous water rangers and restoring coastal wetlands and rivers will complement the agricultural revegetation plan.
- To realise the employment potential of this bold reforestation proposal, the Australian and state governments must commit to funding for the ten year project, and to encouraging investor spending.
- We also recommend ongoing support for carbon trading via the Emissions Reduction Fund (ERF).



Land revegetation

Australia should embark on a bold project to revegetate 27 million hectares of land by 2025. By revegetating approximately 3.5% of Australia’s land mass, within approximately 6.5% of agricultural land, over the next five years, we could create **38,000 thousand jobs**.¹ The program would reduce emissions by 5% (approximately 30 million tonnes CO2 equivalent per year, for at least 30 years, based on 2006–2010 emissions²) for an investment of between \$5.3³ to \$27.5⁴ billion per year. (Figure 1). Planting practices need to be developed for local areas. Different planting practices in different locations can also result in higher carbon sequestration and greater planting efficiency.

This ambitious task would constitute the largest revegetation project in Australia’s history, providing rewarding jobs in areas such as site planning, seed collection, planting, agroforestry, environmental management, education and agritourism.

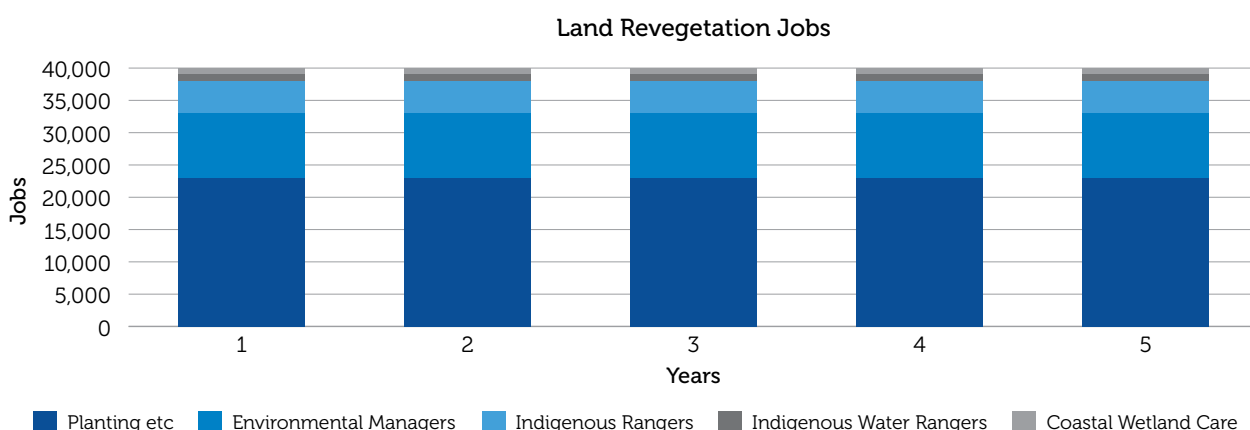
To maximise the benefits of the revegetation plan, including improved food security and biodiversity, the project should continue to 2030, bringing the

total area of hectares revegetated to 55 million and reducing national emissions by 10% (or 60 million tonnes CO2 equivalent per year).

The new revegetation industry would require 23,000 workers in areas such as site planning and preparation, seed collection, planting, re-planting, rehydration, remineralisation, monitoring and ongoing management.⁵ Expertise in environmental management and indigenous land care practices would be required, including **10,000 environmental managers**, trained and qualified to be deployed nationwide to work strategically with farmers, experts, volunteers and community groups to facilitate the long-term protection and preservation of recovering ecosystems and biodiversity.⁶

To support effective restoration and long-term forest management efforts, employment of at least **5000 trained indigenous rangers** would also be required.⁷ Further employment opportunities will be generated in sectors such as education, tourism, and agroforestry (not included in the above total).

Figure 1: Revegetating 27 Mha of land by 2025 (approximately 3.5% of Australia’s land mass) over five years (with a view to double this in 10 years)



Such a large revegetation project would benefit from the skills of forestry industry workers during revegetation and would also provide long term avenues for commercial plantations to provide economic benefits. This is important as state governments start to phase out the logging of native forests.⁸ The Victorian Government plans to end native logging by 2030. Since the forestry

industry employs 70,000 annually, ensuring jobs in the industry is mandatory for a just transition.⁹

With millions of hectares revegetated, the forestry industry could utilise exclusively commercial plantations, protecting native forests. For every billion plantation trees established (0.4MHa), 18,000 jobs would be created over the next 10 years (not part of the Million Jobs Plan accounting).



The land use sector is the only sector able to both reduce future emissions and sequester past emissions, meaning the land use sector could become not only carbon neutral, but carbon negative.¹⁰ The land's ability to store carbon in soils and vegetation is vast, and research has shown trees and grassy woodlands are critical to restoring a safe climate.¹¹ To realise the benefits of natural sequestration in soils and trees, Australia will need to both plant vast areas of new trees and, most importantly, protect existing forests. By allowing forests to recover and expand through managed natural regeneration, far fewer new trees will be required to plant as more carbon is stored in older trees.^{12,13}

Since European settlement, Australian land use has been driven by farming, grazing and agroforestry, providing a substantial and important contribution to Australia's economy as well as a large contribution to Australia's greenhouse gas emissions (15% of emissions).¹⁴ More than half (58%) of the continent has been heavily modified by clearing and/or grazing, which has led to soil erosion, biodiversity loss and climate change.¹⁵ Australia has also lost almost 40% of forested areas.¹⁶ Despite investments in land restoration and management, Australia continues to experience growing land clearing and degradation in a

changing climate.^{17,18} Climate change heightens the challenges of farming and agroforestry with more pronounced droughts, reduced rainfall, higher temperatures and bushfires. However, the land use sector is uniquely positioned to play a vital role in climate solutions. This landscape regeneration program will support near term resilience to increasingly extreme weather, and if done globally in the long term, remove enough atmospheric carbon to ultimately reverse global warming.

Executing a national plan

A project of this scope and ambition will require a strategic approach that is able to align and include all the key stakeholders. A national plan will have to be developed based on clear principles and values agreed to by all stakeholders. Effective implementation will be carried out on a local level and for this reason devolving governance and planning to local organisations will encourage farmers, landowners and communities to undertake the work together.¹⁹ Collaboration across industries, levels of government and other communities will also be needed to support the long-term goals of the revegetation program.

Recommendations:

1. Seek additional funding from Australian and State Governments

Funding must be committed for the ten-year project to unlock the immediate and medium-term employment opportunity presented by the reforestation proposal
2. Take advantage of carbon trading with the Emissions Reduction Fund (ERF)
3. Establish a Land and Environment Investment Fund with a budget of \$1 billion over 5 years, in addition to the 2 billion over 15 years in the Climate Solutions Fund which the Government has dedicated to the Emissions Reduction Fund^{20,21}
4. Invest in expansion of current carbon farming methodologies to include improved landscape and livestock methodologies and accelerate blue carbon, or wetland, methodologies for the Emission Reduction Fund
5. Empower local communities and farmers to collaborate through training and information resources, following best practice (such as South Australia case study)
6. Support the addition of 5000 Indigenous rangers and 1000 Indigenous water rangers
7. Annual monitoring of progress via satellite imagery and on-ground observations

Agritourism and Education – Supporting Industries

The revegetation plan will also provide opportunities in supporting industries such as agritourism, ecotourism and education. Teaching and learning opportunities will grow and need to be scaled up around land management and revegetation, with the purpose of training tens of thousands in the various aspects of land revegetation. Agritourism could expand as landscapes are restored, providing new revenue for tourism operators and farmers. Biodiversity and carbon credits can also provide additional sources of income for farmers.

Benefits for farmers

In addition to carbon emission reductions and carbon sequestration, large-scale revegetation on agricultural land will have many benefits for farmers. Revegetating parts of farming land can increase farming productivity, resilience and wellbeing of farmers.^{22,23,24} Soil is a substantial sink for storing carbon,^{25,26} and soil carbon can greatly improve water retention in soil. For every 1% of soil carbon added to soil, 144,000 litres of additional water can be held per hectare.²⁷ Vegetation such as trees and shrubs are vital for maintaining healthy soils and minimising soil erosion and land degradation. Strategic revegetation has the potential to restore important hydrological functions and build capacity in the land to weather droughts through greater water availability in the land.^{28,29} Trees also provide shelter and shade for grazing animals. Revegetation with native plants enhances biodiversity and greater ecosystem services such as nutrient cycling and natural pest resilience for crops.

Box 1: Indigenous rangers managing fire to avoid emissions from hot savanna wildfires

"This fire management program has been successful on so many levels: culturally, economically and environmentally. Through reinstating traditional burning practices, new generations of landowners have been trained in traditional and western fire management, hundreds of thousands of tonnes of greenhouse gas have been abated, and the landscape is being managed in the right way."

Dean Yibarbuk, fire ecologist and senior Traditional Owner, West Arnhem Land.³⁰

'Right way' fire management by indigenous land managers across north Australia (northern parts of Queensland, the Northern Territory and Western Australia) is reducing emissions from fires and sequestering carbon in woody debris. These practices are informed by thousands of years of experience and traditional knowledge.

In 2006, the West Arnhem Land Fire Abatement (WALFA) was brokered by the area's Traditional Owners, the Northern Territory Government, Northern Land Council, Tropical Savannas Cooperative Research Centre and ConocoPhillips to offset some of the greenhouse gas emissions generated at ConocoPhillips' liquefied natural gas plant in Darwin Harbour. ConocoPhillips committed to pay around \$1 million a year for 17 years to the WALFA project to provide fire management services.

The project was registered with the Clean Energy Regulator as an eligible carbon offset project. Traditional burning of Country began generating Australian Carbon Credit Units that could be sold in the carbon market. Based on the measured emissions savings from avoiding hot savanna fires, the project has now evolved to 29 indigenous-owned fire projects across the north, engaging around 34 indigenous organisations to support fire management across 17.9 million hectares.

The key to success has been the collaboration between traditional knowledge and modern science in developing fire management techniques.

Willie Rioli, senior land ranger for the Tiwi Islands, says right way fire management is known as prescribed burning, but it is far more

nuanced and combines traditional knowledge with modern tools, including aerial burning:

"Fire is a tool and it's something people should see as part of the Australian landscape. By using fire at the right time of year, in the right places with the right people, we have a good chance to help Country and climate."

Through the savanna fire projects, ranger groups work with Traditional Owners and scientists to meticulously plan, map out and record their work to create detailed fire maps of their Country.

Since 2012, indigenous savanna burning projects have abated over 5.2 million tonnes of carbon emissions (CO₂-equivalent), representing 7% of Australia's total annual credited carbon abatement, and generating an estimated \$63 million³¹ to \$92 million³² in carbon credit revenue.

Indigenous carbon businesses are able to attract a premium for their ACCUs in recognition of the multiple co-benefits delivered by indigenous carbon projects to the environment and indigenous communities. Revenue from the projects is directly reinvested into improved fire management, employment and governance and capacity building support for Prescribed Bodies Corporates and Aboriginal Corporations.

The Darwin Centre for Bushfire Research is working with indigenous ranger groups to study how carbon is sequestered in the landscape. These new methods are estimated to improve the accounting of carbon from savanna fire management, resulting in around a five-fold increase in the amount of ACCUs produced from the same activity.³³

Early this year, Federal Indigenous Affairs Minister Ken Wyatt and Environment Minister Sussan Ley announced the Australian Government's Working on Country program. It provides \$700 million from 2021 to 2028 to support indigenous rangers from over 120 ranger groups employing nearly 840 full-time positions.

Having a longer time horizon allows rangers to tackle critical environmental threats including uncontrolled wildfires, feral animals and noxious weeds. Rangers also help protect culturally significant sites and threatened species.



Credit: David Hancock

Regenerative agriculture

There is great potential to reduce emissions in the agricultural sector through carbon sequestration via regenerative agriculture. Regenerative agriculture offers benefits for animal and crop farming, typically through rotational grazing for animal agriculture and rotation of different crops.

Healthy soils, composed of a multitude of biological organisms, rely on increased ground cover and allow more carbon to be sequestered.³⁴

“Soil represents the largest carbon sink over which we have control”³⁵

Christine Jones

With widespread adoption of regenerative agriculture, we could see the sector move from a large net emitter to a net absorber of carbon emissions.³⁶ It is not merely the potential for emissions reduction that gives regenerative agriculture its appeal. Increased carbon sequestration in soil results in greater water storage, making the land more drought-resistant and improving yield productivity.³⁷ With these co-benefits, farmers can increase their profits and become less reliant on inputs such as pesticides, herbicides and fertilisers.

New businesses are already emerging in carbon farming and regenerative agriculture, providing a range of services to farmers interested in the process of transitioning. Services including soil improvement, agronomic assessment, education, training, marketing for carbon credits, biochar and organic product manufacturing, machinery production, resource recovery and technology, and reinvigoration of local land are just some examples of the potential that carbon farming has to generate the jobs of the future.³⁸ The Carbon Market Institute estimates carbon farming could create 10,000 direct jobs and 20,000 indirect jobs for small and medium sized businesses.³⁹ All that is needed is a government incentive strategy to begin putting this in place. This should involve:⁴⁰

- Ensuring the Emissions Reduction Fund is adequately funded until there is a sustainable private sector demand
- State Governments providing funds to drive regional market developments and positive land-use change
- Supporting education and training to enhance market participation

Box 2: Zero Carbon Communities want regenerative agriculture jobs

Several Zero Carbon Communities have expressed an interest in further regenerative agriculture projects. Programs such as rural education hubs can provide training jobs for local experts and accreditations for farmers.

Z-Net Uralla, NSW

In the Northern Tablelands, 68% of land is used for agricultural production, primarily beef, sheep and wool. Despite taking many steps to reduce emissions in the Uralla Shire, the township lacks an overall agricultural and land management strategy. Local regenerative agriculture farmers, like Tim Wright and Lorraine Gordon from Southern Cross University, are leading the way with education and by example from years of practical experience. There is a lot of local support for regenerative agriculture initiatives.

Uralla is in the Northern Tablelands and is currently working on multiple emissions reductions strategies including widespread installation of renewable energy generating equipment, sustainable firewood harvesting, thermal home insulation, replacement of old hot water heating systems and increasing eco-tourism. Uralla has pledged to be independent of the energy grid by 2024. All that Uralla is lacking is an overall government incentive strategy to begin expanding regenerative agriculture practices.

WinZero, Wingecarribee, NSW

The Wingecarribee Shire is an important catchment area for water supply to Sydney, Wollongong and the Northern Shoalhaven and is a biodiversity hotspot.

In February 2020, the council declared a climate emergency. The community believes they have huge potential within Wingecarribee to create a 'Centre of Excellence' in the Southern Highlands where residents and farmers can gain knowledge about best to worst soil types and the most effective methods of regenerative agricultural practice.

Z-Net Hepburn, VIC

The central Victorian shire of Hepburn has experienced great success in reducing its emissions with projects such as Hepburn Wind. Hepburn is renowned for community leadership in grassroots environmental action. Agriculture and tourism are key sectors of the economy in the Hepburn Shire. Hepburn is already a community-based leader in practicing regenerative agriculture, food security, permaculture, artisan agriculture and carbon sequestration methods. Their Community Supported Agriculture programs are part of their climate change mitigation advocacy strategy.

Climate Action Hobart and Network, TAS

Climate Action Hobart and local community groups including Circular Economy Huon, Greening Australia, and Regenerative Agriculture Network Tasmania see the potential of regenerative agriculture. Their vision is that a team of experienced trainers will work with farmers across all sectors (grazing, vegetable production, cereal production, small seed cropping) building communities of practice and developing practical manuals for Tasmanian conditions.

Box 3: Biochar manufacturing, organic inputs, and bioenergy

An example of a successful new product in the agricultural sector is biochar. Biochar is a type of charcoal produced by the conversion of biomass or feedstock to a charred product under oxygen-limited conditions in a reactor. Biochar can lead to soil improvement and is an excellent source of carbon sequestration, which leads to improved agricultural productivity. A new manufacturer in this space, Soft Agriculture, employs 25 people and specialises in the manufacture and processing of organic inputs required for regenerative agriculture and carbon farming.

With widespread adoption of a regenerative agriculture and carbon farming model, there are opportunities for more businesses to spring up and fill the market gap for the supply of bio-char activated products and organic inputs required for sustaining the practice. We could see a complete redesign of the Australian manufacturing industry, as we utilise our abundance of natural resources to generate high quality organic products which can be sold domestically and internationally.

ARENA is developing a bioenergy roadmap. Bioenergy has the capacity to bring economic opportunities to rural Australian towns.

Blue carbon

– Coastal wetlands and Riparian zones

Coastal wetlands, riparian areas under council management and other high value areas near the coast represent a significant opportunity for regeneration.

These areas provide high levels of carbon sequestration – remarkably higher than reported in woodland and open forests in sub-humid Queensland.⁴¹ With relatively fertile soils and abundant soil moisture, riparian sites may prove to be more profitable sites for mixed species environmental plantings now eligible to be registered as a carbon offset project under the Australian Government’s Emissions Reduction Fund. Farmers and other land managers can claim carbon credits for sequestering carbon in soil or vegetation as it grows. However, while riparian vegetation (trees and other plants along waterways) are currently included in the fund, coastal wetlands are not.

Wetlands have some of the greatest potential as carbon sinks per area. A hectare of mangrove wetlands stores an estimated 550 tonnes of carbon⁴², higher than any other vegetated habitat. Revegetation on coastal wetlands provides an additional job and emissions reduction opportunity. The carbon stored in coastal wetlands, mangroves and seagrass is often collectively referred to as ‘blue carbon’.

Catchment groups like the Bulimba Creek Catchment Coordinating Committee⁴³ are employing local specialists to regenerate and replant riparian zones and coastal wetlands such as salt marshes. Revegetating riparian zones sequesters carbon and also provides co-benefits such as protecting river banks from erosion and reducing silt and other pollution in downstream streams, estuaries and marine areas.

Employing over 10 staff, this catchment group is a preferred council provider and offers essential services through predominantly grant funding. With

substantial areas of coastal and other riparian zones and coastal wetlands in need of regeneration,^{44,45} additional support for catchment groups in urban and rural areas is warranted. Specialist education can provide these groups with the skills to replant riparian and wetland areas, identify and remove feral species of animals and plants, and provide additional ecosystem protection services to their communities. Supporting local catchment and land care groups, within 100 coastal local government areas (estimated at around 20% of existing local governments areas), to protect and regenerate blue carbon areas across coastal municipalities would generate 1000 jobs and cost around \$104 million per year including salaries and a 30% overhead.

Kelp farming

The ocean farming of kelp and seaweeds, also known as marine permaculture, has the potential to counteract ocean acidification, climate change and loss of biodiversity. Seaweed and kelp provide biofuel and cattle feed and could be used to provide food security for millions of people.⁴⁶ However, marine permaculture arrays continue to require further research to allow them to be financially viable on a large scale in Australia. Issues include the need for cooler waters and extended periods of cloud cover to improve the quality of kelp. This area of research and application has significant potential, as \$1 million of value can be generated from a hundred-hectare marine permaculture array.⁴⁷

Indigenous land and water rangers

Indigenous land and sea rangers work to protect and conserve important ecosystems and Aboriginal and Torres Strait Islander cultural heritage. The conservation work they do can include removal of feral animals and pest plants, soil conservation, recording and protecting cultural heritage, biodiversity and species monitoring and managed burns.⁴⁸ However, rangers require additional training and support to learn, research and rediscover indigenous knowledge about freshwater. The

Warreen Beek Cultural Rangers⁴⁹ training delivered by Holmesglen TAFE provides a model for how education for land rangers can be delivered. The training supports indigenous communities to train and care for Country,⁵⁰ developing a way to access modern technology and ensure traditional knowledge is a part of management practices.

Water is an essential part of the land, yet water and land systems are often separated; currently there is not an acknowledged indigenous water ranger profession. For example, often Native Title is given

to land and not water, giving rangers a limited ability to help the country thrive and to engage in the meaningful growing of food. A water ranger could collect local water lore, train in modern water technology and management and speak on behalf of the community about the water of a place.

In addition to the 5000 indigenous land rangers, we propose an additional 1000 indigenous water rangers are needed to support the *The Million Jobs Plan*. There is an educational component outlined in the Education section of *The Million Jobs Plan*.

Box 4: Coorong, Lower Lakes Recovery Project – A Ramsar wetland of international importance

The \$137 million Coorong, Lower Lakes and Murray Mouth (CLLMM) Recovery Project⁵¹ was funded by the South Australian Government's Murray Futures program and the Australian Government's Water for the Future initiative. In collaboration with the community and the Ngarrindjeri people (the region's traditional owners), this vegetation program aims to help the region recover from drought and low flows. It delivered much-needed funding, jobs, and training opportunities for the region, including the establishment of two information hubs at Milang and Meningie.

Trial plantings commenced in 2009 when more than 5000 native plants were hand-planted and many hectares of exposed lake beds were seeded by air. Toward the end of the project (August 2016) more than five million native plants were revegetating 2334 hectares and 120 sites, with 60 km of fencing protecting lakeshore and important areas, and over 1.1 million sedge plantings improving the habitat connection between land and water. Pest plant and animal control activities extended over 6000 hectares of native species and their habitats.

The community has been key to the success of the CLLMM vegetation program. A network of community nurseries administered by the Milang and District Community Association was created to propagate native plants and with the

help of volunteers they planted over 1.3 million plants. The Ngarrindjeri have planted another 390,000. Commercial planting was responsible for 3.4 million more native plants. The planting sites included the Coorong National Park and local council reserves and private properties that qualified for revegetation (having existing remnant vegetation was an important criterion).

Further job opportunities came with the monitoring and research necessary to better understand the changes in the region and provide guidance for the recovery work. Research activities included trialing site preparation methods and propagation of difficult species.

Because of the cultural significance of the CLLMM region to the Ngarrindjeri people, protection of their heritage was vital to the program's success. The prolonged drought had significantly impacted on their culture and wellbeing. The Kungun Ngarrindjeri Yunnan Agreement between the South Australian Government and the Ngarrindjeri Regional Authority enabled the Ngarrindjeri to provide advice, knowledge, and input into the vegetation program. While the revegetation work has delivered training and sustainable jobs for the Ngarrindjeri, the program has also benefited from the invaluable cultural heritage advice for revegetation across the region.

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Chapter 7

Education Training & Research

The Million Jobs Plan depends on a strong foundation of training, regulation, accreditation and support in order to deliver initiatives efficiently, safely and economically. This could create 1000 new higher education jobs and 1000 new research positions.

Making it happen:

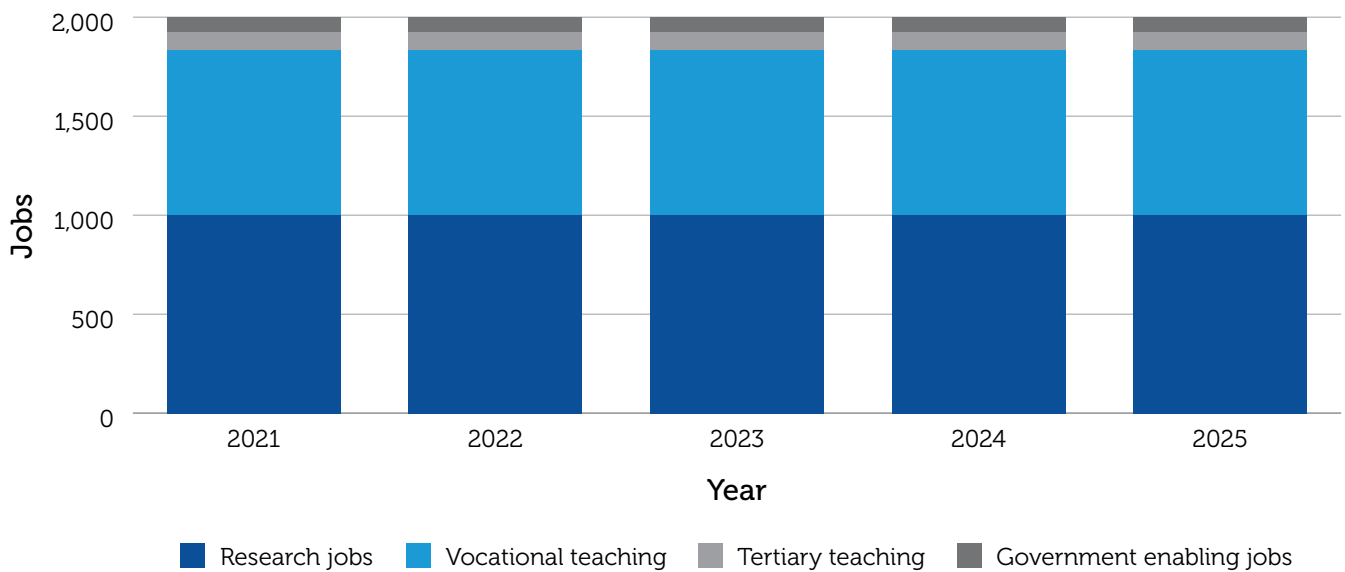
- An agency such as the National Careers Institute should conduct a detailed skills analysis to identify additional training needed to implement *The Million Jobs Plan* (using Table 1 as a guide).
- Additionally, research funding should be provided to support continuing technical advances in renewable energy and zero emissions technology and practices to support the uptake and effectiveness of the Million Jobs plan.

Investing in a skilled workforce

There could be **1000 additional jobs** created in the higher education sector to train and upskill the workforce at a cost of \$600 million over five years.

Additionally, **1000 researchers** will support continuing technical advances in renewable energy and zero emissions technology and practices to support the uptake and effectiveness of the Million Jobs plan. This research is expected to cost a similar amount to the education and training jobs.

Figure 1: Education, training, research and enabling



Education and training

Education and training represents a significant jobs opportunity to support the initiatives from *The Million Jobs Plan*.

A green stimulus package needs a strong foundation of training, regulation, accreditation and support in order to deliver emissions reduction programs efficiently, safely and economically.

The numbers below have been estimated based on the scale of the jobs outlined in the plan, as well as a high-level desktop review of the relevant training already being provided. What is shown below are additional jobs to those already taught. For example, there are already people teaching renewable energy engineering within mechanical engineering programs. The five programs suggested are additional to support increased numbers of people needed to teach the renewable energy specialist engineers in future. There will be a significant amount of investment needed into the government organisations that plan and manage training. There are many initiatives that can be delivered easily with a quick short course; for others, completely new jobs and courses will be required. A detailed skills analysis will need to be done and the training programs required to meet any gaps will need to be identified. An agency such as the National Careers

Institute¹ based in Canberra is well positioned for the task, working in collaboration with state and territory departments and training providers.

Table 1 outlines the types of training that would need to be provided for each of the sectors:

- Existing training points to those programs that are already being taught
- New Job relates to new professions that need to emerge to support the new industries such as, hydrogen green steel, water rangers.
- Additional skills are subjects that need to be developed within existing programs
- Retraining relates to short programs that take a skill and adapt it to a new role, for example, taking gas fitters and training them to be electrical and renewable energy retrofitters.

The cost of providing full support for all jobs within *The Million Jobs Plan* (from the first day of year one to the end of year five) is approximately \$600 million. This assumes an average salary of \$95,000 for university staff and \$85,000 for vocational education and government staff as well as an additional 30% to support overheads, such as leave and superannuation.

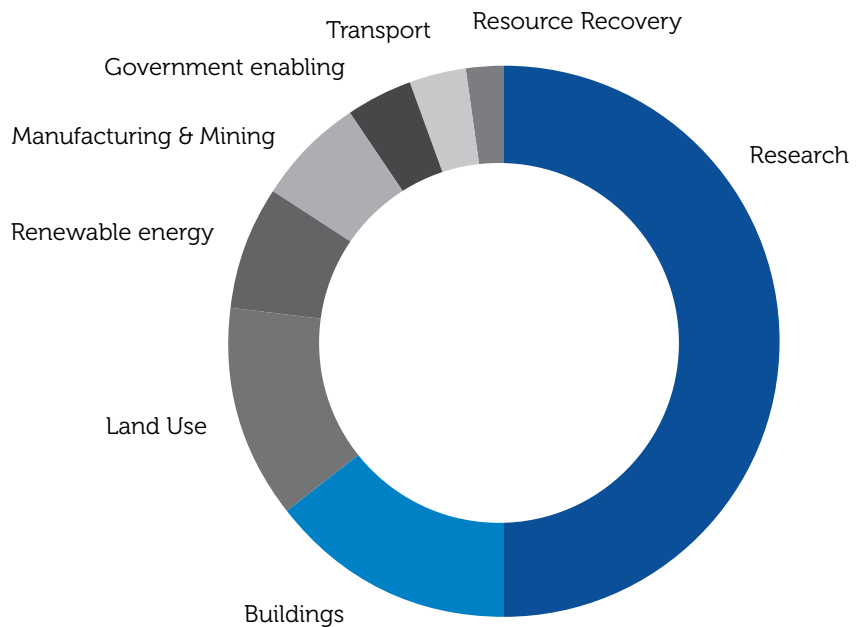
Table 1: The education and training needs for *The Million Jobs Plan*

	New jobs total	Vocational Education	University education
Renewable energy and transmission	145		
Renewable energy		100 jobs to teach skills relating to installation and maintenance of wind turbines, solar panels and pumped Hydro	Five jobs to add specific subjects on civil and renewable energy engineering
Transmission		30 jobs to teach skills relating to building and laying transmission infrastructure	
Management			10 jobs developing a new course (management, modelling and engineering) – Renewable energy aggregator curriculum development and teaching

	New jobs total	Vocational Education	University education
Manufacturing & Mining	130		
Wider manufacturing – general		25 jobs to upskill manufacturing trades in cleaner production	10 jobs to train manufacturers in the circular economy and decarbonising production
Wider manufacturing – gas to electrical retrofit		50 jobs over 5 years to upskill all gas fitters to renewable energy retrofitters	10 jobs to include electrical heat processes and retrofits subjects to all engineering and manufacturing management courses
Green steel / hydrogen		10 jobs to develop a hydrogen technician trades course	10 jobs to develop a hydrogen engineering degree
Green metals (Incl old + new aluminium)			Five jobs to add subjects on cleaner production and decarbonised metals to manufacturing engineering courses
100% renewable mining		10 jobs to develop Cert III and IV training for electrical mechanics including retrofitting	
Buildings	290		
Retrofits – homes		250 jobs to deliver energy efficiency retrofit training with partners including Master Builders Association, Housing Industry Association and TAFE sector.	
Retrofits – schools		20 jobs with government school building crews	
Getting council buildings off gas		20 jobs to retrain gas fitters into electrical retrofitters	
Transport	70		
Electric buses		30 jobs to develop and add to automotive courses on how to handle high voltage technology	Five jobs to support new subjects on electric bus programming, design and high voltage engineering
Electric trains		30 jobs to develop and add to mechanical courses on how to handle high voltage technology	Five jobs to support new subjects on electric train programming, design and high voltage engineering
Cycling			
Land Use	250		
Land use – agriculture/ agroforestry/blue-green carbon		200 jobs in delivering short courses on restoring land, planting, weeds and land management. Peer-to-peer training short course – renewable energy, soil, water, crop rotation, carbon, etc.	10 jobs teaching subjects on horticulture, soil science and Indigenous knowledge

	New jobs total	Vocational Education	University education
Water rangers		10 jobs to develop an Indigenous-led water ranger Cert. III and IV qualification	Five jobs to research and support the gathering and teaching of Indigenous water knowledge
Land rangers		20 jobs to build on existing knowledge and create new Indigenous-led land ranger Cert. III and IV qualification	Five jobs to research and support the gathering and teaching of Indigenous knowledge on managing Country
Waste	40		
Recycling		25 jobs creating and supporting Cert III and IV in waste recycling, waste to energy and cleaner production. Develop a Cert IV for PV and battery recycling.	15 jobs in MBA/management subjects on waste to energy and waste recycling management and waste policy development engineering in recycling and waste to energy plant design.
Government enabling	75		
TOTAL	1000		

Figure 2: Vocational, university and enabling jobs to support education needs of the *The Million Jobs Plan*





Credit: Greenfleet

Box 1: Education jobs specialising in regenerative agriculture or carbon farming

In February 2020, Southern Cross University launched a world-first Bachelor of Science degree with a major in regenerative agriculture.² Career opportunities with this degree include farm management, agronomic consultancy, local government administration, carbon trading specialisation, regional land services and catchment management bodies.³ The expansion of regenerative agriculture courses offered at universities can create teaching and research jobs in the tertiary sector. Given the nature of these jobs and the need to live close to the lands being managed, degrees like these offer an opportunity for economic growth in regional towns with the skills required for the jobs of the future. Regional communities could specialise in carbon farming and regenerative agriculture, with enough diverse employment opportunities to provide a self-sustaining economic model now and into the future. As carbon prices continue to rise and the industry becomes more lucrative it is likely that more land sector projects will arise delivering more sustainable co-benefits and more economic opportunities.⁴

Research and development

Of the 13 million⁵ Australian workers employed in February 2020, around 164,000 of them were researchers (almost half were academic staff and postgraduate research students).⁶ Based on these figures, researchers make up 1.3% of the workforce.

The Million Jobs Plan calls for over a million job years to deliver the plan. The number of educational jobs is around 1000 and 1000 new research roles are estimated to be required too, costing a similar amount.

Additional research funding through support for university scholarships and fellowships, industry partnerships and other research groups, additional research will help accelerate breakthroughs. This will provide new opportunities in technology, social science, business, economics and other aspects relating to accelerating the uptake and use of solar, wind, and other renewables technologies, batteries, renewables for manufacturing, recycling and resource recovery and other technical elements.

Social science is also an important avenue for additional research in order to understand community perceptions and best practice models for community engagement. Research to better understand effective implementation of renewable energy systems in remote communities and the economics underpinning this is also warranted.

Newly-identified training and education job types

Water rangers

Water ranger training will support Indigenous communities to train and care for Country, developing a way to access modern technology and ensure traditional knowledge is a part of management practices. The Million Jobs plan research has identified the need for 5000 rangers; to this we add 1000 water rangers, as outlined in the Land Use section, with 10 vocational-education based support roles to co-develop curriculum and support training.^{7 8}

Ideas around cultural rights to water that can support the training have already been explored through the National Cultural Flows Research Project⁹ with support from the Murray Lower Darling River Indigenous Nations and the Northern Basin Aboriginal Nations. Additional resources are available via the Australian Curriculum.¹⁰

Hydrogen engineers

Australia is entering a hydrogen economy, yet currently we are adapting existing training to the role of designing, managing and building hydrogen systems. What is needed are several new programs, both at university and TAFE level to create the new roles of hydrogen engineer and hydrogen technician.

Renewable energy aggregators

This is a management level role requiring engineering, modelling, systems thinking, integration knowledge and renewable energy competency. The aggregator's role is to understand the grid as a series of energy niches with surplus energy at different times, and needs the skills and understanding of load management to enable effective sharing of energy across the grid.

Regenerative agriculture and carbon farming specialists

Regenerative agriculture courses will ideally be taught close to the lands being managed, offering an opportunity for economic growth in regional towns. We could see a reinvigoration of regional communities in Australia with specialist courses in carbon farming and regenerative agriculture. As carbon prices rise and the industry becomes more lucrative, it is likely that more land sector projects will arise.¹¹ In February 2020, Southern Cross University launched a world-first Bachelor of Science degree with a major in regenerative agriculture.¹² Career opportunities with this degree include farm management, agronomic consultancy, local government administration, carbon trading, regional land services and catchment management.¹³



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Chapter 8

Zero Carbon Communities

Beyond Zero Emissions collaborated with local communities and stakeholders to champion community led projects throughout Australia.

Making it happen:

- BZE's Zero Carbon Communities initiative provides support and resources to empower local communities.
- Over 38,000 jobs have been identified through our community consultation.
- Over 100,000 jobs can be generated within Zero Carbon Communities.
- Community benefit and input into planning secures social licence for change.
- Legislative support can unlock renewable energy, regenerative agriculture and other community led projects.

Zero Carbon Community initiatives in *The Million Jobs Plan*

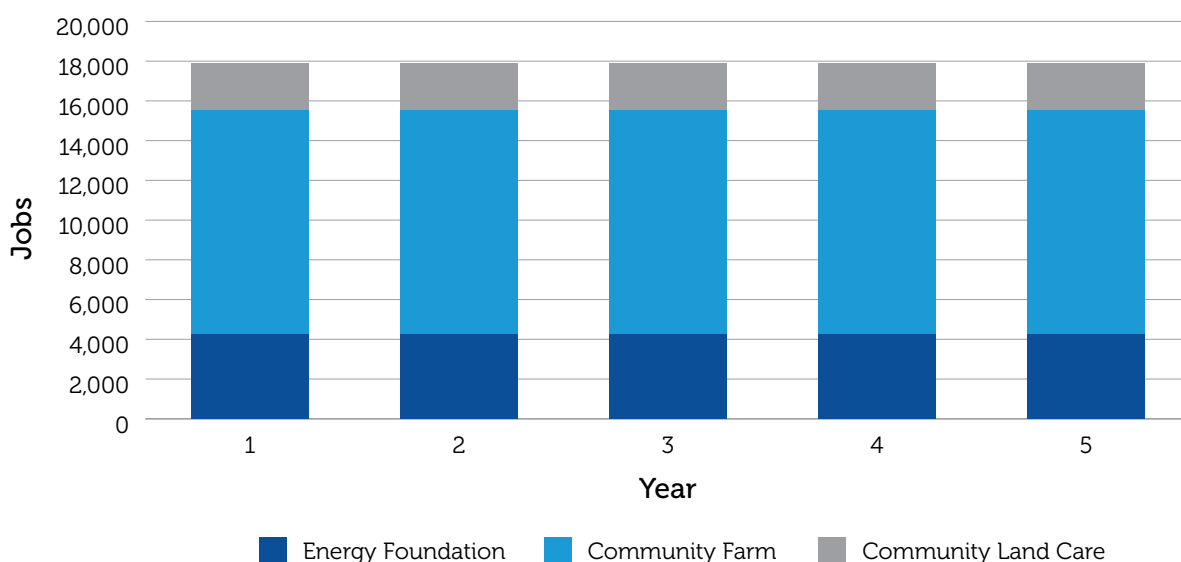
Zero Carbon Community initiatives provide clear community benefits: local jobs, skills and training to help young people stay in their communities. Each of the initiatives described in this report include community led initiatives that deliver strong employment opportunities and zero emissions outcomes within local communities. These project ideas bring the Million Jobs initiatives to life with real-world examples highlighting the range of benefits to local communities.

Community led initiatives include local decision-making and include local voices. People value having a say in their community, and can become strong champions for local projects when they are involved. A critical employment component in community led initiatives is employing local facilitators and community development workers, not just technical and construction jobs.

The Million Jobs Plan has reached out through BZE's Zero Carbon Community program and through our stakeholder network to draw in local expertise on strong community led projects in regions around Australia. BZE has compiled these opportunities into one Long List, an ongoing project that communities and businesses can contribute to.

Using the most popular community initiatives as a proxy for the quantum of jobs involved in local communities, Figure 1 shows the scale of employment in community led initiatives that could be delivered over the next five years if effective support is provided.

Figure 1: Extrapolating community jobs from three simple initiatives



Community jobs

Community and environmental co-benefits have been identified, including jobs in community energy hubs, urban farming, community hubs for work and education, and biodiversity protection.¹ Additional ideas include electric vehicle bulk buys and infrastructure roll out, promoting renewable energy uptake, and energy audits. If all of these initiatives were implemented in every community, **over 100,000 jobs** would be created over the next five years. Many of these are already captured in the headline figures in the Chapters of this report so are not added here. Local ambition, and support from government, will determine how many of these opportunities for diverse, resilient communities are taken up.

Over **18,000 ongoing jobs** (90,000 job years) have been identified through consultation with our Zero Carbon Communities and other community groups (Figures 1 and 2). The jobs in community initiatives have been determined through selecting three exemplar project types across renewable energy (an energy hub), farming/waste (a community farm)

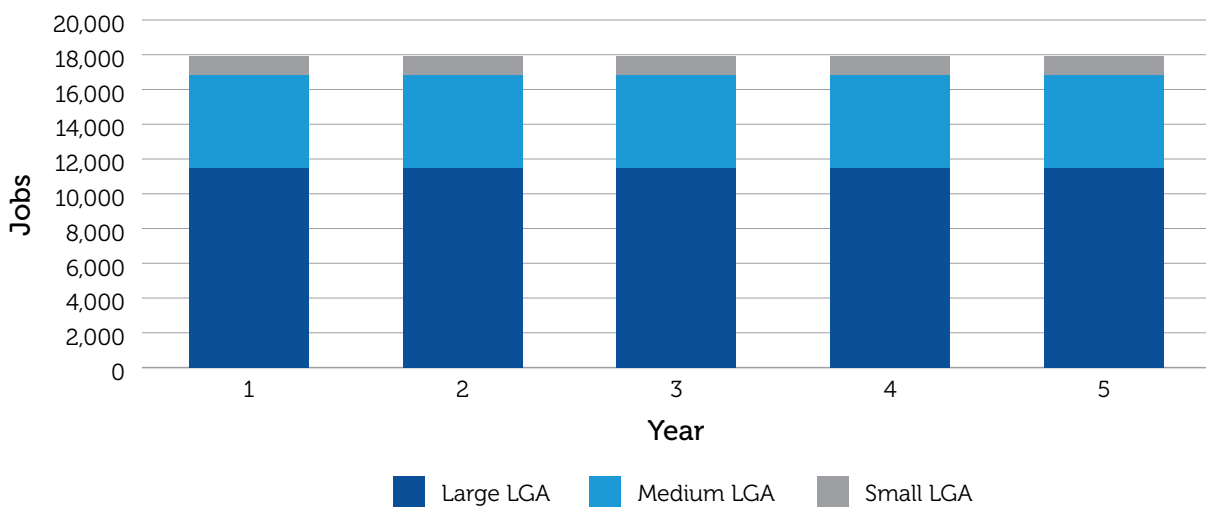
and land care, and scaling job numbers along with population size across three categories. A desktop study of local government areas was conducted which separated local government areas into a range of sizes.

For the purpose of this study, three categories of Local Government Areas have been selected, 1) 82 large population local government areas (populations of 100,000 and above), 285 medium population local government areas (populations of 5000 to 100,000) and 176 small population local government areas (populations under 5000).

For a project in a medium population local government area, a project would involve five people as a minimum, while in a small area a project would involve two people.

In addition to these community ideas, we can see over 50,000 jobs identified in the Hunter region for rolling out energy efficient homes (see the Hunter section of the Million Jobs report) and we have also identified that investing in community led initiatives to support regenerative agriculture can generate 10,000 jobs (see the Land Use section).

Figure 2: By size of Local Government Area (LGA)



About Zero Carbon Communities

Beyond Zero Emissions' Zero Carbon Communities initiative helps local communities reduce local carbon emissions.

We launched Zero Carbon Communities to highlight nation-leading initiatives for 100% renewables and zero carbon emissions, to tackle State and Federal impediments to action and to encourage local communities to put our research and solutions into action.

Our first collaborations were with Zero Emissions Byron, Baw Baw Sustainability Network, Renewable Energy Benalla and Clean Energy Nillumbik. We now have over 65 Zero Carbon Communities all around the country networked together.

Our vision is an ever-growing network of communities across Australia, working together to achieve zero carbon status.

Building community support and involvement is instrumental in turning this vision into action.

Zero Carbon Communities offers a simple framework for working towards zero carbon status. We inspire confidence and action, improve knowledge transfer, publicise initiatives and innovations, offer proven models for action and to point aspiring communities towards the growing number of relevant resources.

A Zero Carbon Community is any community where people, businesses, clubs, groups and councils are acting to reduce carbon emissions.

Zero Carbon Communities take targeted action to reduce community-wide emissions. Our program focuses on helping communities implement change in the following sectors: Buildings, Energy, Land use, Waste, Transport and Industry.²

These communities inspire others to start their own journeys towards zero carbon status, building on each other's work to replicate and scale their approach.

Key benefits of Zero Carbon Communities include significant growth in local jobs and investment, slashed electricity and gas bills for households, businesses and industry and a cleaner, healthier environment for local residents.

Individuals alone can't solve the climate crisis.

BZE supports Zero Carbon Communities all around the country. We help individuals and communities champion change, engagement, advocacy, strategy and policy at community, local, state and national levels.

We provide data and evidence for systematic solutions such as the Snapshot³ emissions profiles, a world first tool providing community-wide greenhouse gas profiles for every council in the nation.

We build long term partnerships to develop shared resources, skill sharing and strategy. We provide support for emissions intensive regions such as Port Augusta, Collie, the Northern Territory and the Hunter Valley.

With support from our Investment Reference Group we identify and champion locally led light house projects and connect with project developers and funders to fast track investment in emissions reducing projects.

As part of *The Million Jobs Plan*, Zero Carbon Communities from across Australia shared their ideas, feasibility studies and business cases for local projects. Some of these are described below.

Communities leading the way

BZE's ongoing research program draws on place-based research approaches to support communities with pathways to strong local economies beyond fossil fuels. Box 1 describes the Collie community's work with BZE in 2019, which proposed an economic diversification scenario replacing 1200 local jobs in coal with over 1700 well paid and secure local jobs in a low carbon economy.

In the Hunter, local communities are pulling together their own community action plan to filter *The Million Jobs Plan* ideas with a local lens⁴. This is described in **Chapter 9** of this report and identifies employment opportunities at state and regional levels and within industry or other communities. The Hunter community is in the early stages of a process similar to Collie.

Communities also have a role to play in advocating for renewables-powered industry like green metals

and electric bus manufacture and improved bike and public transport infrastructure. In addition to the home, school and business energy rollouts already identified in *The Million Jobs Plan* Better Buildings chapter (**Chapter 2**) three million "zero energy bill" homes and building retrofits often have a community led component. All of these projects benefit from community support and engagement.

In addition to providing jobs and emission reductions, community led projects benefit their communities through improved air quality, energy bill reductions, local jobs and training, and community empowerment. Engaging the community also ensures projects are fit for purpose and tailored to their local needs. For example, small remote communities will have different energy and resource needs and different capacity to maintain systems than larger towns and cities.

The social benefits of community renewable energy and zero net emissions projects are also important.⁵

Box 1: A community-led vision for Collie

For years the Collie community has been wrestling with its economic future given the inevitable transition away from coal fired power. BZE joined that work to explore what a large scale renewable energy, low carbon transition could look like.

A focus for the community was high skilled local work with good conditions, local economic diversification and broader community benefits. BZE's Collie at the Crossroads report reflects a shared vision for a planned transition that shows how a renewable energy economy can benefit families and communities, diversify WA's economy, enable a localised renewable led, low emissions manufacturing industry, and create healthier, more sustainable regions.

Collie at the Crossroads describes a range of industries set to grow rapidly in coming years, and highlights the secure, well-paid jobs they can create in Collie.

Taken together the opportunities have the potential to create over 1700 jobs in Collie, more than offsetting 1200 positions in the coal industry. The transition described in the Collie at the Crossroads report would avert more than 14 million tonnes of CO₂-e per year by 2030.

The opportunities include:

- **Renewable Energy Transition:** Hundreds of new jobs in the South West supporting a grid powered 100% by renewable energy. Collie's role at the heart of the network maintained.
- **Sustainable Building Materials:** Collie supplies Western Australia with valuable sustainable construction materials, and helps to decarbonise the state's buildings and infrastructure.
- **Recycling Renewable Technology:** Western Australia leads the world in battery and PV recycling, processing and reuse.

Benefits for the community in the Gnaala Karla Boodja region need to be planned at the outset and this work to secure a social licence for change has begun. Existing workers can be looked after and conditions can be maintained. Local communities must also be supported through the transition, including programs to assist small businesses and low-income earners.

The Collie project has catalysed conversations about farm forestry land care, zero carbon cement and other zero net emissions ideas for Collie's workforce as local funders seek opportunities to invest in Collie's future.

Communities want future proof jobs

The nation-wide initiatives identified in *The Million Jobs Plan* have a strong resonance with local communities.

Looking at *The Million Jobs Plan* through a community lens, we can see that the following initiatives offer the potential for communities to lead the transition to a zero net emissions economy.

- Local renewables – for jobs, energy security, grid stability and community ownership
- Renewable energy for remote communities including Indigenous communities
- Local batteries for grid stability and leading and supporting the battery revolution
- Home retrofits – the ideas presented in the Buildings section of *The Million Jobs Plan* are scalable to local government areas and can be supported by community networks for market penetration
- Local manufacturing – building off the needs and skills of local workers
- Regenerative agriculture and local contributions to revegetation
- Waste – community efforts to call for and support increased recycling levels can help reduce emissions as can building community support and engagement for local composting and locally grown food
- Education and research – community led education programs can be effective in increasing awareness of opportunities and barriers to renewable energy, and can provide skills and training to local communities.

Renewables for grid stability, local ownership and jobs

Alongside the rapid deployment of large scale renewable energy, renewable energy projects on a local scale have additional benefits. Decentralisation provides an opportunity to provide renewables to areas not connected to the grid, where grid stability is an issue, where local ownership is a desired outcome or in fire zones. Many communities who responded to our request for information expressed an interest in community solar and other community renewable energy projects. In addition to designing systems to provide the best financial return, jobs can be generated through related services such as the provision of advice and education. Table 1 provides an overview of the local innovations happening in the solar energy sector.

Table 1: Community solar has traditionally been used in the following scenarios:

Solar gardens	An alternative to solar on your roof – solar near home you can buy or lease
Solar investment	Allows public investment without ownership
Community solar	Shareholders can invest in and receive dividends, they also own and manage the solar power infrastructure.
Microgrids	Localised grids connected to the network that can disconnect from the main grid and operate autonomously when required.
Mini grids	Small, self-sufficient electricity grids for communities that do not have access to the main grid.

Box 2 : Local renewables to support those who cannot access rooftop solar

An example of a local renewables project is Enova Energy's North Coast Community Housing (NCCH) Solar Garden. Enova Energy in Northern NSW is the first example in Australia of community ownership within the mainstream National Electricity Market (NEM). The NCCH Solar Garden consists of a 35kW solar array on the roof of NCCH's administrative building in Lismore. NCCH purchases electricity from Enova for onsite use, and the funds generated through this sale are divided between 23 solar gardeners, which include 19 NCCH tenants and four community groups. This model allows the solar garden to act as if it is behind the meter – because the NCCH can use the electricity before it enters the main grid, unlike other solar garden models. Enova is interested in replicating this system in collaboration with partners across Australia.

If we want to roll out Solar Gardens across Australia, then addressing additional costs⁶ is a critical enabler. The Institute for Sustainable Futures (ISF) at the University of Technology Sydney, in partnership with Community Power Agency (CPA), recommend applying a similar level of subsidies to these solar hubs as is offered for home rooftop solar.⁷

Community batteries help stabilise grid energy

Community batteries allow the energy generated from solar power in a neighbourhood to be shared and retrieved.⁸ They offer the promise of an overall cheaper solution to household batteries, which can also improve the state's clean energy supply. Large batteries such as the Tesla Hornsdale Power Reserve in South Australia have been shown to provide grid stability and savings.⁹

Initial installation costs are substantial and regulatory barriers, especially in the National Energy Market mean that there is still a need for pilot projects to develop and test effective business models.¹⁰

Batteries are also used for certain microgrids, and in support of school solar systems. Australian National University's preliminary modelling suggests that while household batteries can reduce the potential for damaging energy flows by 25 percent during peak periods, community batteries can be twice as effective.¹¹

Community scale batteries have so many benefits yet there are few active examples. However, there are many proposed, for example ENOVA has a 2MWh battery in NSW¹²; Ausgrid intends to trial shared community batteries in NSW¹³; and, ACT recently announced a community scale battery for Jacka.¹⁴ To enable roll out around all our communities we need to address NEM regulations and legislated restrictions (such that generators cannot directly engage customers without partnering with a retailer).

Western Australia does not have the same requirements for multi-way partnerships between generators, retailers and customers, and has seen several community battery trials, including Powerbanks for Western Power¹⁵ and a community battery trial is also planned for Alkimos Beach via the Synergy energy company. Tesla units are being trialled in Ellenbrook in Perth and near the Kalgoorlie Border.¹⁶

Additional barriers to community batteries include concerns around battery life cycle environmental impacts.¹⁷ This highlights the need for battery recycling for battery minerals recovery and whole of life waste minimisation approaches.¹⁸



Community battery projects have another reason for success in Australia – the potential to increase local resource extraction and manufacture. Australia could become a global hub for the battery industry.

Indigenous community renewable energy projects

As discussed in the Renewable energy section of *The Million Jobs Plan*, reducing fossil fuel use for electricity in remote communities is an important component of reducing Australia’s emissions, and can also provide energy security and co-benefits like improving access to water for remote indigenous communities. While two percent of Australia’s population live in off-grid areas, over six percent of the country’s electricity is consumed in off-grid and remote areas. Natural gas provides 70 percent of this electricity generation and the remainder is predominantly from diesel fuel. As well as generating substantial emissions, this electricity is the most expensive in Australia.¹⁹

In reviewing the effectiveness of remote renewable energy projects, the following outcomes demonstrate successful practices:

1. **Pure intentions** – The community wants the system and it will support and enable them to live on and care for the land that they are responsible for.
2. **Community engagement** – Successful cooperation with the community to understand and meet their needs and involve them throughout the project.
3. **Technical excellence** – Systems working extremely well, covering all energy needs, using appropriate technologies.
4. **Longevity and maintenance** – Achieve a sustainable solution which has proven to last the test of time through good maintenance procedures and suitable construction for the environment.
5. **High RE penetration** – Achieved a high penetration of renewable energy or a completely renewable energy system.
6. **Ongoing community involvement** – Community members are involved in ongoing system reporting, they know how to troubleshoot problems and maintain the systems themselves.



7. **Knowledge transfer** – The community benefit from education on electricity, design of power systems, maintenance, how solar works and business models.
8. **Economic benefits** – The project resulted in direct short term and/or long term jobs for local people or indirectly helped expand industry and jobs within the community.
9. **Financially self-sufficient** – The project supports itself (or in conjunction with another venture) and doesn't require ongoing external funding (this must include replacement components).

10. **Local knowledge** – Project planning or construction utilised local knowledge and actively involved the indigenous community in the process.

To improve the rollout of renewable energy in Indigenous communities, additional jobs could be created. Important services such as independent audits, research, media, maintenance, training and community engagement can be delivered to increase project success and documentation. These roles would be a combination of jobs within remote communities as well as outside of them and would increase the effectiveness of remote renewable energy installations.

Lockhart River Solar Farm



Status	Operational as of 2017, delivered by Australian Sustainable Energy [ASE] and Energy Queensland, Housing for Queensland, Queensland Department of Education with consulting by Indigenous Energy Australia [IEA]		
Community	Lockhart River, Cape York Peninsula Qld, classified as very remote, population of 724		
Drivers	To reduce the community's reliance on expensive and polluting diesel fuel which was the sole source of electricity. As a state trial to assess the impact of cloud events on installed solar systems and how batteries can assist.		
Construction period	October 2017 – March 2018		
System Ownership and business model	Ergon Energy will continue to operate and maintain the assets as part of the community mini-grid. Residents pay subsidised energy rates to Ergon Energy Retail. Information on funding model and cost is not available.		
Electrical Demand	Approximately 3,410MWh/year		
System components	209kW rooftop solar and 60kWh battery storage for cloud smoothing, integrated with existing diesel generators.		
Utility Interaction	The community operates on an Energy Queensland mini-grid which is not connected to the main grid.		
Installers	External installers were used (external to the local community)		
Brief	The solar power is being generated by 750 solar panels installed on government buildings, including council and school roofs, and includes a small amount of battery energy storage. The solar power generated will be used by everyone in the community, providing around 10% of the community's energy needs (341MWh/year). Energy cost savings are shared with public housing tenants and reduce the Government subsidy required to supply affordable electricity to the community.		
Average Yearly Cost Savings	\$90,000 (year 1)	Emissions Savings	365 tonnes/year, 8% reduction in diesel to date – 62,000 litres

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Chapter 9

Hunter Case Study

The case studies presented here will provide over 50,000 jobs over the first 5 years, and 115,000 jobs over 10 years with 24,000 of these being ongoing.

Summary:

- COVID-19 has highlighted that the Hunter is highly risk-exposed due to its reliance on coal, however the Hunter's legacy coal infrastructure and workforce paves the way to diversify the economy
- The Hunter has been on a path of transformation since the BHP closure. Ongoing diversification is an extension of this with an emphasis on clean energy, an electrified industry and land restoration.
- There is optimism and confidence for the future, and a strong desire to seize the stimulus opportunities available now to fast-track change.
- The Hunter case studies for *The Million Jobs Plan* are housing retrofits, land use, fly ash, green steel and zero emissions vehicles, however there are many other potential opportunities in the Hunter that can create jobs that benefit ALL Hunter communities.
- These case studies are a first step of the Hunter Diversification Project, a two-year ongoing research project led by BZE in partnership with Hunter communities, businesses, government and investors.

The Hunter summary

The Hunter Valley is Australia's leading regional economy. It has been the heart of energy in NSW, hosting coal mining, power stations and transmission infrastructure. The Hunter's low-cost energy has attracted manufacturing and energy intensive industry to the region. Excellent port, rail and air infrastructure underpins the Hunter's energy export hub.

The Hunter's reliance on coal has left it exposed to changing market conditions. There are 16,300 people who work directly in the coal industry¹, and many thousands more who are indirectly reliant on the mines for income. During the COVID-19 crisis, the coal price at Newcastle dropped to a very marginal \$50 a tonne. This has led at least one mine to temporarily shut down.² The Reserve Bank of Australia has stated that the long-term future Australian coal is uncertain.³

The only way to reduce this risk exposure of thousands of Hunter Valley workers in a changing world is to diversify the Hunter economy. The Hunter's legacy of transmission, port and rail infrastructure has left a rich endowment for next generation energy and manufacturing. BZE's recommended renewable energy rollout of 90 GW can power an electric revolution in the Hunter.

"Carbon workers deserve honesty about the ability of Australian governments to protect their jobs."

Grattan Institute, 2020

Stimulus projects during the Great Depression created Australian icons such as the Sydney Harbour Bridge, built in part with steel from Newcastle. The COVID-19 recovery stimulus investment in the Hunter's carbon workers can guarantee the Hunter's future as a global energy icon.

The Million Jobs Report outlines short-and long-term jobs; yet for a place, a region such as the Hunter the potential contributions go much further than jobs – it creates healthier, more comfortable homes that are cheaper to run; a clean steel industry; a zero emissions vehicle manufacturing industry; a healing landscape; a decarbonised energy grid providing the capacity for any industry to set up and provide low emissions products, using microgrids, storage and creating an industrial ecosystem. Over time this will lead to a diversified, resilient economy that will help the Hunter continue to thrive.

This chapter, therefore, talks about specific jobs. It showcases examples of emerging industries and provides a brief glimpse into the reality of what is possible. Sometimes this means looking beyond a 5-year horizon as some developments need time to ramp up. The chapter finishes with a narrative looking back from 2030, envisaging what the Hunter could be like if we act now.

The Hunter Project – a two-year journey

Context

These five Hunter case studies for *The Million Jobs Plan* are the first output from the BZE Hunter Project, the outcome of the first three months of a 2-year project. It is our intention for the Hunter Project to be a collaborative, inclusive and co-created outcome with the local Hunter Indigenous Peoples, all other communities, industry and government.

We acknowledge that the Hunter project will span the lands of the Worimi, Awabakal, Gringai, Darkinjung, Geawegal and Wonaruah, and we look forward to working with everyone to learn from the past and think about how the future for the Hunter could be sustainable, healthy, resilient, safe and prosperous.

We have already heard that the land is a critical part of a thriving future. The Hunter Project looks forward to working with all interested parties in the Hunter to ensure inclusion and collaboration. We will build on the hard work that BZE Newcastle and Hunter volunteers have done to date, and add to their capacity to consult, engage, and support.

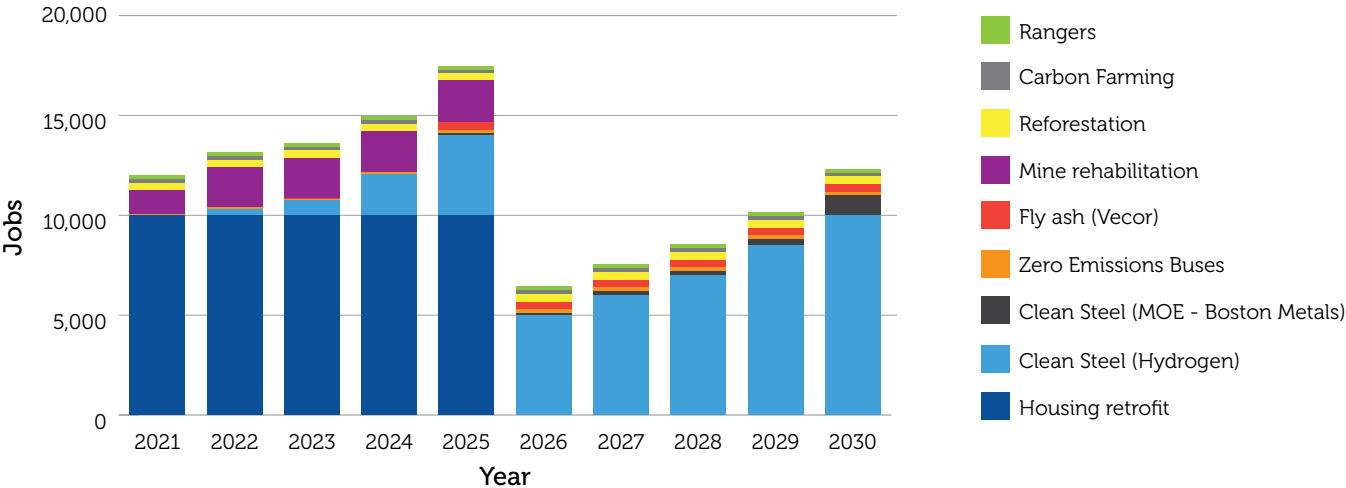
Introduction – Five case studies and a vision

The Million Jobs Plan is based on the best knowledge gathered from around Australia and the world on jobs that are shovel ready and will support a more resilient, prosperous, healthy and sustainable Australia. Yet they are a macro vision and need to be adapted to be meaningful to each particular place and region.

To connect the Million Jobs vision with a specific location we looked at the Hunter Valley. The Hunter Valley has been on a path of transformation since the closing of the BHP steel works. Plans for the future of the Hunter are not about shutting down industries, or about what is good or bad. They are based on a realistic view of the future with the goal of positioning the economy to adapt and move with the times through diversification of its industries.

Enter *The Million Jobs Plan* (MJP) – what could these future-focused diversified jobs look like for the Hunter? The outcomes presented were drawn from speaking to industry, peak bodies, unions, governments, researchers, and the community; some high-level modelling; and, an international

Figure 1: Total jobs estimated for the Hunter over 10 years.



literature review. From the various sectors in the MJP, we have chosen a few to illustrate what this could mean for a region: Zero Emissions Vehicles, Clean Steel, Housing Retrofits, Land Use and Fly Ash Reuse. This should not take away from the potential for jobs in Hydrogen, Tourism, Education, Renewable Energy and so forth.

The five examples above as case studies could result in **more than 50,000 jobs over 5 years**. In fact, if we see the first 5 years as the stage that enables the Hunter to position itself as a leading renewables and decarbonised product manufacturer, then in 10 years (using just the case studies presented here) **115,000 jobs will have been created**, with over 24,000 of these being ongoing jobs.

Case Study 1

Housing retrofits for improved energy efficiency

For our communities to flourish, we need safe and healthy homes where we can rest, relax and raise our families. Through the COVID-19 crisis, for many of us, our homes have become our work spaces.

Many homes in the Hunter Valley are not suitably adapted to the local climate, making them costly to heat and cool. During heatwaves, not being able to escape the heat of the day or cool off at night can place those with existing health issues at risk of illness ranging from exhaustion to stroke. This is especially the case for our elders, and those with existing health issues. For some, it can be fatal. Heatwaves are Australia's deadliest natural hazard.⁴

Image: Dr J Shiel

Deep retrofits 264,000 Hunter homes in five years

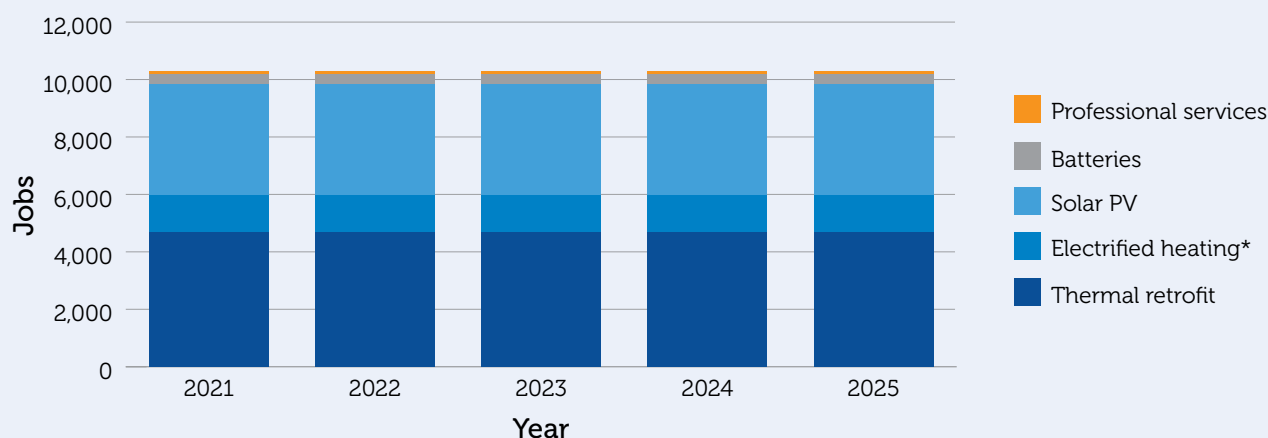
Jobs created	Emissions avoided
10,000 per year in construction	2 million tonnes CO ₂ -eq per annum



Safe, healthy and comfortable homes for all Hunter residents can be achieved within five years while creating 10,000 jobs that earn approximately \$90,000 per year. Deep retrofits of 52,800 houses over five years can bring 264,000 Hunter homes to a 6-star energy rating and virtually eliminate power bills. Deep energy retrofits can be broadly categorized as a combination of the most appropriate energy conservation measures in an existing building that leads to a minimisation of energy use.

For Hunter residents, the cost of deep retrofits will range from \$15,000 to \$60,000 depending on the style and age of the home. The Federal Government's HomeBuilder offers \$25,000 grants to home-owning citizens who are able to commit to spending over \$150,000 before December on specific home renovations. This package could be linked to reducing energy consumption⁶, sustainability and lowering energy bills. It could be extended to include people on lower incomes.⁷ If this grant was broadly applied tied to sustainable building outcomes it could enable many Hunter households to undertake full or partial retrofits and create jobs for local tradesmen. The long-term benefits would be safer, more climate resilient

Figure 2: A Hunter home renovation program would employ over 10,000 people every year.



Step one, thermal efficiency, will employ local tradesmen and small businesses to install insulation, seal gaps and treat windows to keep the heat out in summer, and maintain warmth in winter.

Step two, energy supply and efficient use, gets more tradesmen and electricians up on the roof to install solar panels and air conditioning. A plumber will disconnect gas lines to cooktops and ovens, which will be replaced with electric ones. Finally, batteries and behind the meter solutions will be set up to reduce the need to buy power from the grid.

President Obama's stimulus after the Global Financial Crisis demonstrated that housing retrofits can be very successful. Obama invested \$11 billion in upgrading homes, business and public buildings, and created 200,000 jobs, plus \$2 in savings for every dollar invested.⁵

buildings, improved health outcomes, lower energy bills and reduced carbon emissions.

The private sector is stepping up. The Sustainable Australia Fund⁸ offers "Environmental Upgrade Finance" for businesses and is working towards opening this up to residential properties in Victoria. This new financing model removes the barrier of the large upfront cost for the environmental upgrade/retrofit, which is paid off at a fixed rate and still delivers savings to the buyer. Repayments can be split between landlords and the tenants who would benefit from the reduced operating cost of the building.

New models of financing in NSW along with a revised HomeBuilder grant linked to building sustainability has the potential to drive the full retrofit of 264,000 homes. This can make our Hunter homes healthier, more comfortable and cheaper to run and create real jobs for 10,000 Hunter residents over the next five years.

Case Study 2

Revitalising the landscape

The Hunter Valley has many remarkable landscapes. There are the ancient Antarctic Beech forests in Barrington Tops, sacred Mt Yengo, the extraordinary rock formations of the Bylong Valley, the soils that produce great beef, dairy, poultry, dryland crops and some of the world’s best wines and horses. Some of the tributaries feeding the Greater Hunter water catchment and wetlands are pristine. The beaches and estuaries are beloved by Hunter residents and tourists alike.

However, the Hunter is a damaged landscape – as of 2018, over 22,400 ha of mined land has yet to be rehabilitated⁹. Groundwater and water courses have been fractured, leaving disrupted water tables and deep erosion gullies. The recent drought had a severe impact on almost 100% of the Hunter¹⁰, even though the region had received damaging deluges from a super storm in 2015¹¹. Rivers that supply industry and agriculture are no longer fulfilling the environmental needs of the catchment. “The Hunter River and its estuary have a long history of human use and, unfortunately, misuse and contamination.”¹²

Deforestation began with colonial settlement. Demand for timber such as red cedar stripped much indigenous forest, and the Hunter is still listed among land clearing hotspots in NSW.¹³ Weeds such as Scotch Broom are prolific in the World Heritage Barrington tops. Yengo National Park was part of the 512,000 hectares¹⁴ that burned in the

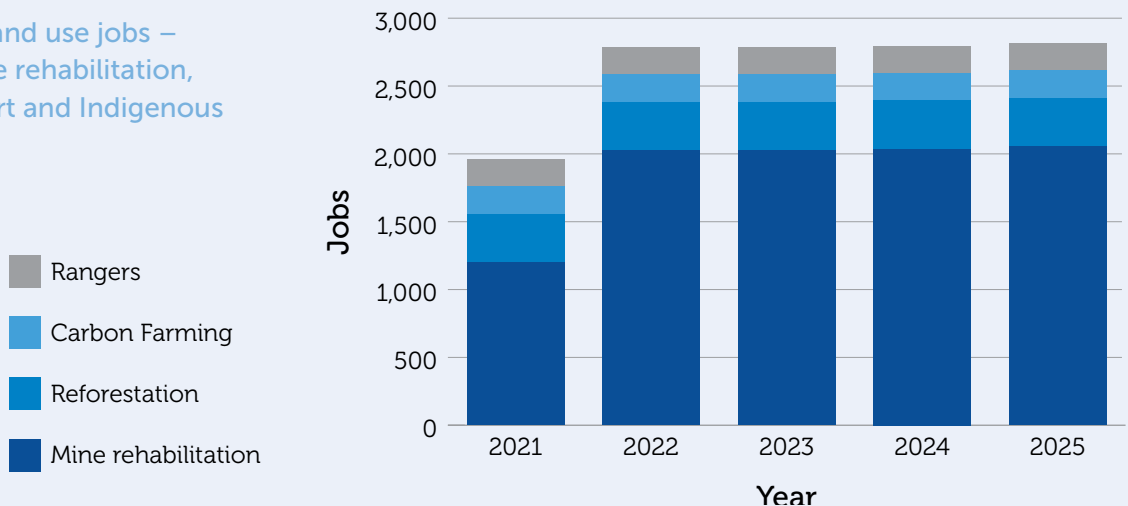
Rehabilitation of mine sites and other degraded landscapes

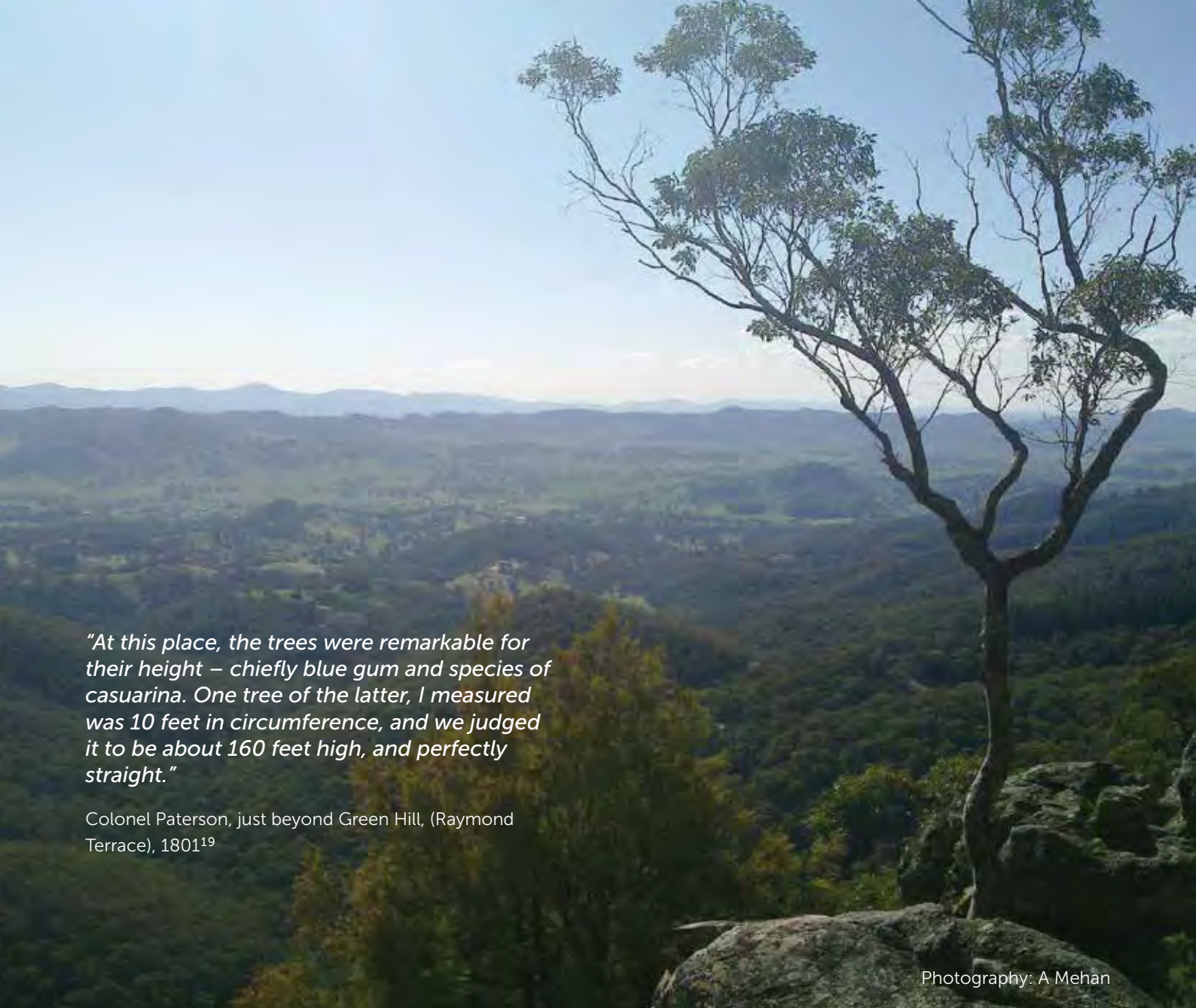
Jobs created	Emissions avoided
13,138 over 5 years	1.5 million tonnes CO2-eq for 5 yrs

Gospers’ Mountain mega-fire. This is catastrophic for wildlife, as even before the fire, approximately 60 local species of plants and animals were endangered.¹⁵

In addition to federal stimulus, the NSW Government’s Net Zero Emissions Strategy is investing money to support agriculture and regional communities with abatement and sequestration projects.¹⁶ Protecting, conserving and restoring the land provides an opportunity to create up to 2627 jobs, reduce emissions and make the landscape in the Hunter Valley more resilient to climatic extremes. Full mine site rehabilitation alone would create 1867 jobs.¹⁷ Reforestation of 20% of the Hunter’s existing agricultural land, about 2820 square km, would create an additional 360 jobs. Reforestation would improve air quality, have a cooling effect, support biodiversity and human health and even increase rainfall and soil hydration.¹⁸

Figure 3: Hunter land use jobs – revegetation, mine rehabilitation, soil carbon support and Indigenous rangers





“At this place, the trees were remarkable for their height – chiefly blue gum and species of casuarina. One tree of the latter, I measured was 10 feet in circumference, and we judged it to be about 160 feet high, and perfectly straight.”

Colonel Paterson, just beyond Green Hill, (Raymond Terrace), 1801¹⁹

Photography: A Mehan

Land use has the powerful ability to cut present and future emissions and to draw down carbon from past emissions. Farms in the Hunter can play a significant role in this practice and generate income in the process. Farming techniques that restore soil carbon and soil health make land more fertile. Soil carbon helps rehydrate the soils, providing some protection from drought.

Primary and secondary carbon markets pay landholders for carbon credits and there is also now discussion of a NSW carbon market.²⁰ Carbon farming can provide 200 jobs in the Hunter, and provide support to farmers who wish to improve their soil health.

The recent devastating fire season has emphasised the value of Indigenous Australians’ extensive knowledge of land and water management. Mainstream adoption and practice of Indigenous

knowledge as part of the science of local land management²¹ is highly beneficial to the region.

Indigenous perspectives incorporated into the planning process can provide guidance on land use and protect remnant habitats. For example, there are Indigenous concerns about additional land clearing for solar projects.

An Indigenous workforce incorporates a proven long-term view of managing land and water systems. Employing 200 Indigenous land and water rangers across the Hunter catchment will help to restore riparian zones, gather and share local Indigenous knowledge, bring back cultural practices, encourage greater farming of resilient bushfood crops, restore native grasses and grains, create local bushfood ecosystems and community gardens. It will make Hunter landscapes and local communities resilient and self-sufficient.

Case Study 3

A new era for fly ash

Eraring Power Station is set to close between 2026²² and 2032²³ but it has a rich resource that can be used to develop a new line of jobs. The resource is Fly Ash, and although some is being used by the cement industry, it is still seen as a problematic waste product.

Eraring sits on the edge of Lake Macquarie, the largest saltwater lake in the southern hemisphere, home to an array of water and shorebird species, fish and aquatic flora. The region's ecological assets are beloved by residents and tourists, but heavy metal pollution from coal-ash waste leaching into Lake Macquarie ground and surface water risks its prosperity and ecological abundance.²⁴ A reuse facility capable of excavating and beneficially reusing the coal-ash reserves in the region could alleviate the burden placed on this key Hunter ecosystem and would provide employment

Fly ash use for cement, tiles, manufactured sand and light weight aggregate

Jobs created

400 people by 2025

Impacts avoided

Engineered sand mining, fly ash leachate and heavy metal bioaccumulation risking species decline, impacts on the health of communities.

opportunities for Hunter residents. These would be welcome to replace jobs lost in the coal/energy sector.

Image 1 – Eraring Fly Ash site (Source: LEGACY: Eraring Power Station's ash dam. A NSW Upper House inquiry has begun into the costs for remediation of such sites. Picture: Environment Justice Australia)

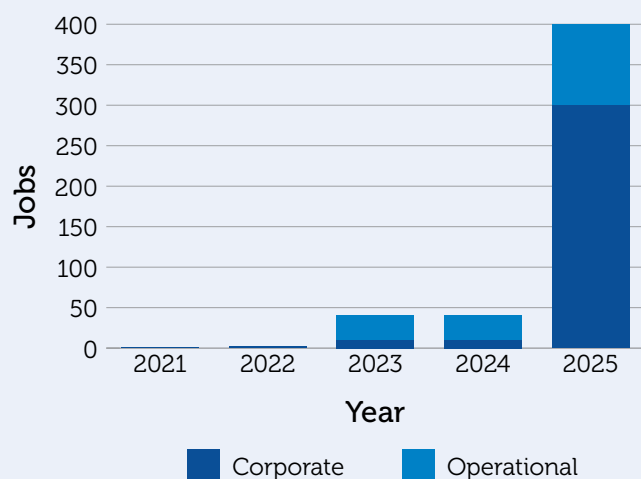


There are several companies who see fly ash as a resource they can 'mine' and are developing ways to use the fly ash, for example Polyagg (still in early development) and Vecor. Vecor is ready to set up production in the Hunter.

Vecor produces manufactured sand and coarse aggregate from fly ash.²⁵ The company can process this ash in a way that locks up all harmful components including heavy metals, sintering the fly ash into an aggregate to create a stable end product²⁶. The company has done testing of the fly ash at the Eraring Power station site and found its chemical, mineral, and physical properties suitable for their purpose.

The first step for Vecor to set up in Eraring would be a feasibility study to ensure commercial viability in the first 18 months. This would then be followed by a pilot plant in the second year, processing 20,000-50,000 tonnes of fly ash and producing light weight aggregate, engineered sands and ceramic tiles²⁷, employing 40-80 people. The last step would be to set up a full-scale industrial facility within five years that would employ around 400 people.²⁸ Vecor estimates it needs less than \$100 million per production line in this scenario.

Figure 4: Hunter Vecor Fly Ash jobs



There are around 150 million tonnes of fly ash across four power stations in the Hunter. Vecor estimates that the full scale reuse plant for light-weight aggregates could use 500,000 tonnes of fly ash per annum. The 400 full-time employees would be made up of 100 corporate jobs and 300 operational staff.²⁹ It would be a place where those who have been working in the coal industry could easily transition using similar skills.

Such a facility would be a win for the community, the Hunter, the economy and the environment. Fly ash has been a real problem, both from the dust and from the leachate and their impacts on human and ecological health³⁰ including increased rates of asthma and other respiratory problems.³¹ Across Australia, coal ash waste makes up nearly one fifth of Australia's total solid waste production.³²

There is a big market for the fly ash products. The NSW Government has committed to net Zero Emissions by 2050 and describes a zero emissions economy as a major opportunity for businesses in NSW. The NSW Government is responsible for the procurement for huge infrastructure projects, for example low emissions buildings, and can use its procurement spending to prioritise local NSW businesses who can improve their performance.

The Hunter can establish itself further as an innovation hub, known for developing decarbonised tiles, engineered sand and low carbon aggregate for use in the construction industry. It could be known as a leader in conservation, with the Vecor sands helping to protect the many turtle and bird habitats currently being negatively impacted by sand mining.

Vecor could potentially use BZE's Electrifying Industry research to plan their production facilities using electrical kiln technologies powered by renewable energy.

Image 2: Façade of the tile processing plant China © 2019 Vecor Limited



Case Study 4

Green steel – two pathways to 2025

From the Sydney Harbour Bridge to the railway lines that span Australia, some of the steel was made at Big Harry's Place (BHP). At its peak, the BHP steelworks in Newcastle employed 11,000 people and produced 2 million tonnes of steel a year.³³ When the steelworks closed in 1999, the city grieved. Thousands of jobs were lost, and so was Newcastle's identity as Australia's first Steel City.

Now, green steel smelted using green hydrogen instead of metallurgical coal is coming into focus. By capturing 6.5% of the global steel market, 10,000 manufacturing jobs could be created in the Hunter in the long term.³⁴ As discussed in the manufacturing section, a realistic aim is to complete two integrated steel works in the next five years, with both plants operating by the fifth year. This would create 5,000 construction jobs in years 3, 4 and 5, and at completion it will generate 1,500 permanent steel-making jobs (see Figure 1 in Manufacturing section).

Hydrogen is not the only pathway to green steel. There is an emerging technology called "molten oxide electrolysis" (MOE), which uses electricity

Green steel

Jobs created	Emissions avoided
MOE – 30 jobs for pilot, to 100 jobs by 2025 up to 1,000 by 2030	1.85 tonnes of CO2 per tonne of steel
Hydrogen – 7,144 jobs by 2025 two factories, 10,000 jobs by 2030 (Grattan)	

to extract crude steel from iron ore. It is a simpler, cleaner and cheaper process than *blast & basic oxygen furnace smelting*, and can produce high quality steel from most grades of iron ore. Using 100% clean energy, oxygen is the only gas emitted in MOE production. MOE was developed in the USA by MIT and is now being commercialised by Boston Metal.

Figure 5: Hunter hydrogen steel jobs

Hydrogen Steel Jobs if two plants opened in the Hunter

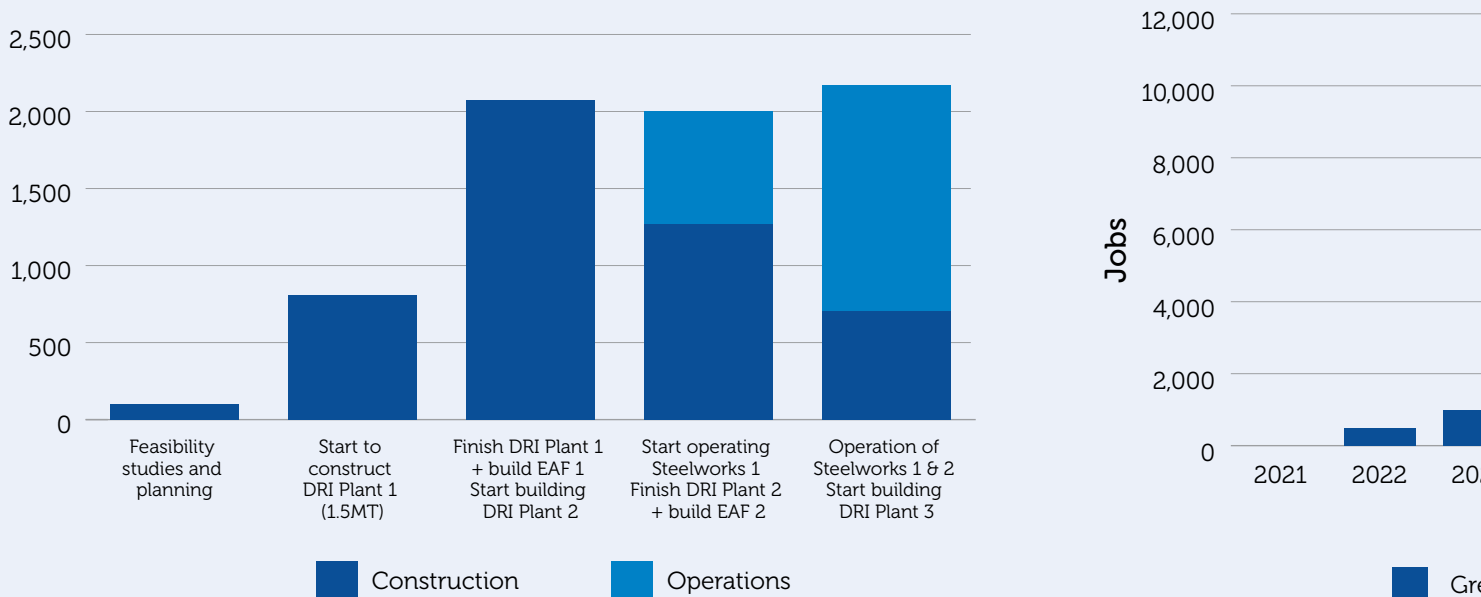


Image 3: Molten Oxide Electrolysis process versus conventional steel process.



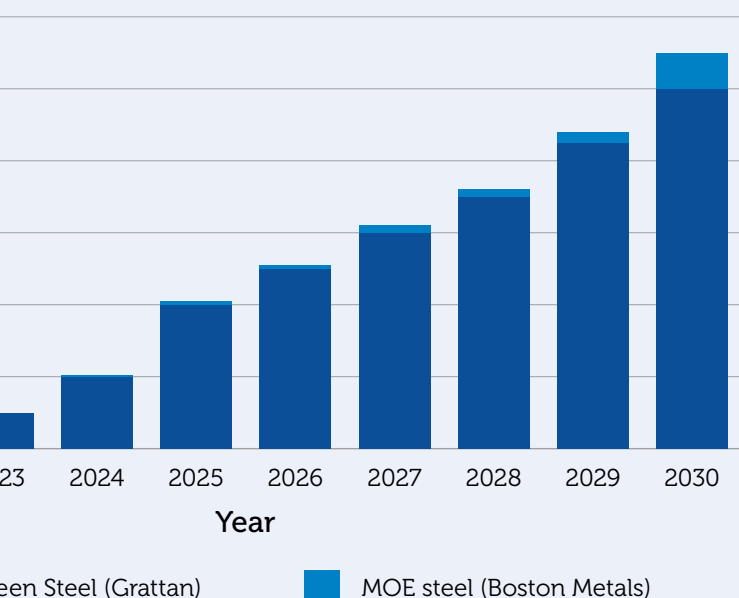
Source: Boston Metal

Newcastle can pioneer the next-gen green steel industry now by hosting the first commercial scale MOE factory in the world run on 100% renewable energy. By 2024, it could produce 10,000 tonnes of premium carbon emission free steel and carbon free ferro-alloy in a state-of-the-art electric factory, creating around 30 full time jobs. In 2025, this factory could produce 100,000 tonnes of crude steel, and employ over 100 people. By 2030, several million tonnes of clean steel can be produced, employing over a thousand people.³⁵

NSW Government procurement³⁶ of homemade green steel would bring steel making back to

Figure 6: A Hunter clean steel jobs over 10 years

Hunter – Clean Steel Jobs



Newcastle and support the state's Net Zero Emissions targets. Local green steel can be used as feedstock for local manufacturing such as wind turbines and electric buses. Surplus green steel can be exported from the Port of Newcastle to compete directly with conventional steel.

Green steel can be seen as another way to export energy, for example one million tonnes of green steel produced by MOE would require 4,000 GWh of renewable energy and that would be "embodied" in the steel. This would replace 770,000 tonnes of metallurgical coal³⁷ leaving the port and would prevent 1,850,000 tonnes of greenhouse gas emissions offshore.³⁸

The emergence of new technological processes can lead to massive and rapid market shifts. Being early adopters of MOE and producing green steel at a lower cost than conventional steel will place the Hunter at the forefront of the green steel revolution. It will also act as a hedge for metallurgical coal workers who may be affected by the rapid technology shift. And the Hunter has all the elements to lead the way: a skilled workforce; integrated transmission infrastructure; access to renewable energy zones; a harbour suitable for import of raw materials and export of finished products; a history of steelmaking and a desire to get it back.

There is already a groundswell of support across the Hunter from both government and the community for green steel production with hydrogen. The Hunter can leverage this existing support to get behind MOE and create a new local industry.

The MOE factory can attract interest and investment from existing steelmakers including Infrabuild and BlueScope. Pilbara iron ore producers such as BHP, Rio Tinto, FMG and Roy Hill will have the opportunity to add value by processing iron ore in Australia. MOE can also create opportunities for joint ventures with Japanese and Korean steel makers who do not have access to cheap renewable energy.

As producer of both iron ore and metallurgical coal, a Hunter based MOE steel factory could be of special interest to BHP.

Case Study 5

Zero emissions buses drive local jobs

Transport for NSW (TfNSW) is seeking to fully decarbonise its bus fleet by 2050 as part of the NSW Government’s Net Zero Emissions Strategy. A total of 5000 zero emission buses (ZEB) are required for Sydney and 3000 across regional NSW. The NSW Government plans to use procurement to drive capacity in Zero Emissions business models. TfNSW is seeking expressions of interest from industry to trial ZEB projects in the outer metropolitan regions including the Hunter.

These trials ask for the end-to-end ZEB solution to be delivered on a small scale. This is a complex deliverable. The full ZEB “ecosystem” includes charging stations, smart electronics, batteries, grid capacity, load and data management in addition to the bus body manufacture. TfNSW also wants the supply chain to address scope 2 and 3 emissions. While the initial trials are small, their complexity requires a high level of investment from the private sector. Consortiums with experience in the ZEB space overseas will have a significant advantage.

The Hunter also has significant advantages that can support the full ZEB ecosystem. For the trial, a commitment to purchase 300 buses over three years creates 50 bus assembly jobs in the Hunter. If the Hunter won the full 8000 bus contract over

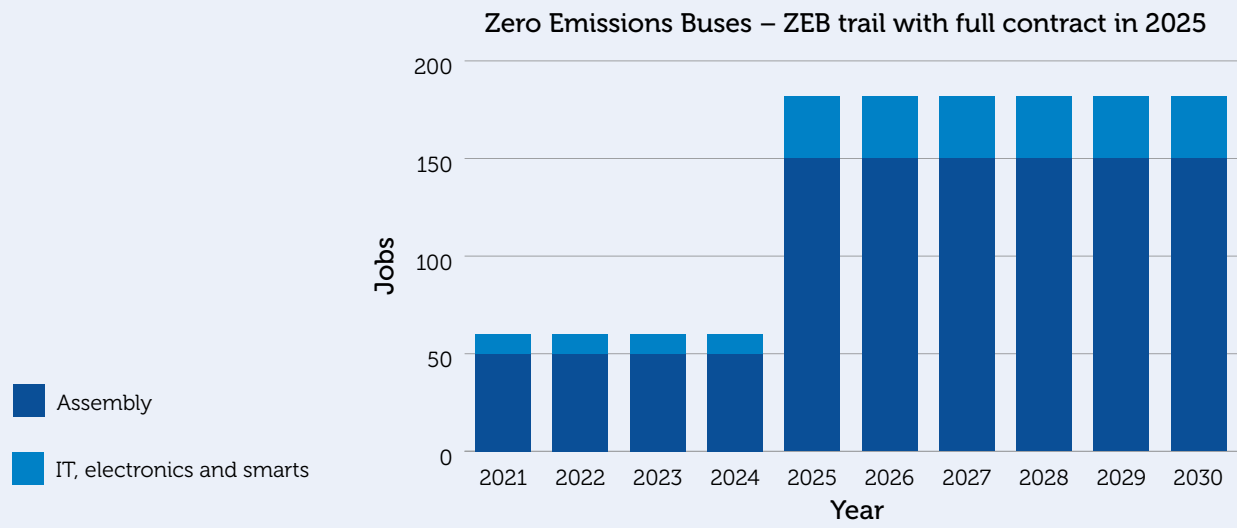
Electric Bus Ecosystem

Jobs created	Emissions avoided
ZEB trial – 60 jobs (300 buses)	60 tonnes of CO2 per bus per annum
Full contract – 182 jobs (8000 buses)	

25 years, it would create at least 160 local jobs in assembly.

Electric buses require a lot of energy to charge. Newcastle has the tech sector to support the complex data management and grid capacity aspects of the ZEB project. Companies like SwitchDin have experience with managing the distributed energy resources (solar, batteries and loads) required to manage power flow. They could manage the charging stations to ensure smooth demand on the grid in real-time, thereby reducing the need for grid augmentation and associated costs. This would create 10 jobs for the trial and 32 jobs in full contract.

Figure 7: Hunter Zero Emissions bus jobs over 10 years





Bus-related Industries

There would be other niche manufacturing opportunities for capable Hunter businesses that are looking to diversify. For example, Hunter-based Ampcontrol recently applied the electronics expertise it developed in the mining industry to design and manufacture a ventilator prototype for NSW Health in just 18 days.³⁹ It is now prepared for a rapid scale-up to manufacture 600 ventilators at its Tomago factory if required. Engineering and manufacturing electronic components for the ZEB ecosystem, such as charging stations, could create many more local jobs and support Hunter businesses to pivot to supply the zero emissions economy.

Hunter-based green metal processing can address the supply chain emissions requirements of the ZEBs. Processing Australian minerals onshore with renewable energy is a major economic opportunity.^{40,41} The Hunter's legacy transmission corridors from coal-fired power can connect across the state to the new gigawatt-scale Renewable Energy Zones (REZ). There is also a pipeline of dispatchable power from pumped hydro at Bell's Mountain near Muswellbrook and Snowy 2.0. Electrifying metals processing with competitive renewable energy and being a first mover on green steel will give the Hunter an extraordinary advantage to deliver the reduced scope 2 and 3 emissions that the NSW Government is seeking.

The Hunter advantage of electrified industry is already happening. Newcastle-based Molycop makes steel components for the mining industry sourcing 50% of its power from wind and solar and is working to increase this to address supply chain emissions.

The Hunter has long been the engine room of the NSW economy. The ZEB procurement is an excellent opportunity for the NSW Government to invest in the Hunter and support local industry to pivot to the zero emissions economy and keep both the Hunter and NSW economies strong. Hunter-based ZEB procurement can demonstrate the viability of zero emissions manufacturing with Australian green metals and zero emissions supply chains.

Image 4: A Gemilang Electric Bus from Canberra



A narrative from the future

The Diversified Hunter Valley looking back from 2030

In 2030, the Hunter Valley is the electric motor of the Australian economy, powered by 500% renewable energy. The prolific availability of reliable, affordable, secure, zero emissions energy coupled with a highly trained workforce has made the Hunter a new Mecca for heavy industry and advanced manufacturing. The re-industrialisation began following the coronavirus pandemic in 2020, when governments and some metallurgical coal producers became foundation investors in the new Hunter green steel industry – a pivot to the post-carbon world to stimulate jobs. Some metallurgical coal producers recognised that the 1890s technology had been surpassed and they became the foundation investors in the Hunter green steel industry.

The Hunter has clean energy on tap. The transmission corridors that once took coal-fired power out of Bayswater, Earing and Liddell power stations now carry clean energy to the Hunter from gigawatt-scale Renewable Energy Zones in Hay, Dubbo and New England, carefully designed with First Nations People to co-exist with and benefit land and water. Offshore wind, pumped hydro-storage, utility scale batteries, green hydrogen and a “battolyser”⁴² are part of the reliable energy system that underpins heavy industry.

Green hydrogen production is the second pillar of the renewed Hunter economy. Green hydrogen is the “waste” product of the battolyser energy storage system. Hydrogen production also soaks up peaks of renewable energy and uses existing wastewater. Locally, green hydrogen generators firm electricity, produce oxygen for hospitals and fuel long distance haulage vehicles. Collaborative green hydrogen ventures have enabled the Hunter to continue the strong trade relationships forged by coal to support the emerging hydrogen economies. South Korean and Japanese energy giants have invested in green hydrogen production facilities here. Outbound ships now carry hydrogen to these markets as well as coal.

The Hunter is emerging as the Global Centre of Excellence for green metal production. There are molten oxide electrolysis and hydrogen-based green steel factories along the old coal chains up the Valley. The long trains that once left the port empty are now laden with iron ore, and return filled with high-grade, low emissions crude steel. The Hunter pioneered minerals processing powered by renewable energy, and now other metals processors are coming to the Hunter. Green metal feedstock ramped up manufacturing to build fully decarbonised supply chains for metal products. Businesses that established themselves on the back of the mining industry now build zero emissions wind turbines, mining equipment, heavy vehicles, building materials and complex electronic components, for both domestic and export markets.

In 2030, advanced manufacturing, ammonia and green metals are how we export energy. Power from the Australian sun, wind and water is embodied in metals and products processed in the Hunter’s electrified factories. We still export coal, just much less of it, and the Port is busier than ever. The Hunter’s carbon and post-carbon sectors are intertwined in a symbiotic way. The legacy fossil-based industries, infrastructure and workers created a framework for post-carbon investment, opportunities and jobs.

The Hunter’s homes are healthy, comfortable and very low cost to run. During the COVID-19 Recession the government invested in the rolling upgrade of all homes because of the understanding that a safe, comfortable place to live is critical to the future of the Hunter’s population especially as more people choose to work from home. Working from home allows people more time for family, community and enjoying the Hunter’s wonderful environment.

Around the large industrial framework, other adaptable industries also thrive across the Hunter – recycling and 100% resource recovery, flexible manufacturing, industrial ecosystems, high tech industry and microbusinesses, and forestry. Practices such as coppicing enable mature trees to be repeatedly harvested and thinning by coppicing supports forestry. Restoration of Indigenous



practices created new ways of land management and harvesting.

Using a partnership model with Indigenous custodians the Hunter has become a massive carbon sink. Mine restoration projects have forested 20,000 hectares of land, and these young forests suck carbon out of the atmosphere. A whopping 2800 square kilometres of agricultural land has also been restored. One million trees were planted in the Maitland local government area alone. Hunter farmers now typically have multiple streams of income – agroforestry, biodiversity, carbon offset and water credits. Many rural businesses also have renewable energy generation onsite.

Most rural communities have learnt from the microbreweries and set up processing co-ops. These are mobile, renewably run processing plants that fit on a truck and can help communities process their own products, control quality and customise their goods.

A renaissance in Indigenous knowledge has occurred as the ancient science of land and water management was applied. There are hundreds of Indigenous rangers who work on the land, rivers and lakes, looking after Country and stabilising the water supply in the catchment. The Dark Emu Centre of Indigenous Knowledge has played a huge role in recording, applying and disseminating ancient Indigenous land management techniques. Some endangered habitats and species are coming back. There are Indigenous community gardens in every town supplying bushfoods and locally-

sourced foods. Since COVID-19, the region has become more self-reliant within its own circular economy.

Wages have stabilised and there is less sense of the two-speed economy. The clean re-industrialisation has meant that there is plenty of work for everyone, and households have two guaranteed incomes. Full employment is funded by the NSW's sovereign wealth fund built on the surplus from the net zero economy. NSW wisely took a page out of Norway's book.

The morale in the Hunter is optimistic and upbeat, effusive even. The residents of the Hunter, First Nations people, workers, land holders, government and private sector investment united together to shape their future. Coal, timber, fossil fuels and steel birthed the Hunter's energy economy. It created the Hunter's workforce, culture, and infrastructure. The coal industry established the heavy industry and built the trade and export relationships. As decarbonisation commercialised in global markets in the early 2020s, the Hunter made the natural succession to a renewable based economy.

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Beyond Zero Emissions is an internationally recognised energy think-tank, that shows through independent research and innovative solutions how Australia can thrive through a transition to a zero-emissions economy.

Beyond Zero Emissions is working with communities and partners around Australia to finalise a post-COVID economic recovery 'The Million Jobs Plan' that will pave the way for Australia to become a renewable energy superpower in the decades to come.

Our plan will create employment, modernise our infrastructure and reduce greenhouse gas emissions.

Jobs will be distributed around Australia including the places where traditional heavy industry has gone, droughts and fires have ravaged the agricultural sector, unemployment is high and long-term employment opportunities have appeared increasingly limited.

The Million Jobs Plan will propose nation-building, transformative projects that can upgrade our economy, modernise our industry, reskill our workforce and deliver a bright and vibrant future – economically and socially. Our early research shows clearly that this is entirely achievable.

The Million Jobs Plan aims to show a way forward to make Australia more prosperous, fairer and more resilient. This means that jobs need to be local, lasting, secure, well-paid and backed by safe and fair working conditions. We have prioritised local, long term jobs as part of local solutions.

