

REPORT

Recover and reduce

Prudent investments to boost the economy and lower emissions
September 2020



Co-founded by Monash University and The Myer Foundation
and working within the Monash Sustainable Development Institute.

Executive summary

The COVID-19 pandemic is profoundly affecting all Australian jurisdictions and sectors. The economic fallout is ongoing, unresolved, and the full extent of the impacts are unknown. While immediate actions by governments are focused on minimising the severity of short term shocks, states and territories can also lay the groundwork for a recovery to full employment and higher standards of living. Prudent recovery packages provide a timely boost to aggregate demand and employment, while also increasing long run productivity and income growth.

The packages announced in the coming months and years will shape Australia's economy between now and 2030. By this point, significant emissions reductions are needed for states and territories to achieve their targets of net zero by 2050 in a prudent manner. Furthermore, most of the assets that are built this decade will still be in use in 2050, and most of the individuals who undertake education and training in this period will still be working in 2050. Considering emissions outcomes in recovery efforts will allow states and territories to seize the opportunity to prepare the economy and workforces for the transition to net zero emissions.

This report identifies government investment opportunities that will meet key recovery objectives of job creation and productivity growth, while also making material progress towards net zero emissions. These investments are in transport and energy infrastructure, natural capital, education and training, and upgrades to businesses and homes. Specific opportunities include electric vehicle charging infrastructure; land restoration funds; residential, commercial and industrial energy efficiency and electrification retrofits; and renewable energy training.

The report also identifies opportunities to develop nascent low-carbon industries that can capture Australia's competitive and comparative advantages. These industries include lithium battery manufacturing, cobalt production, low-carbon steel, circular economy industries, renewable hydrogen and ammonia, biofuels, and anti-methane livestock solutions. These industries have an estimated value of over \$500 billion and a potential to generate over 400,000 jobs by 2050.

Recover and Reduce is a companion to ClimateWorks' agenda-setting *Decarbonisation Futures* work. The report draws upon the capital investment data of scenarios modelled in *Decarbonisation Futures* that are aligned to net zero by 2050, and combines this with leading economic research to identify priority investments for states and territories.

The report makes recommendations for how to maximise the potential of these investments by leveraging private sector involvement, pairing them with structural

and market interventions, and collaborating with other jurisdictions. Employing complementary measures in this way can generate increased returns to scale: the policies are more effective than they would be if deployed in isolation.

If states and territories invest prudently, they can achieve multiple outcomes from economic recovery measures: generating short term jobs and demand, boosting long term productivity, and making material progress toward their stated objectives of achieving net zero emissions by 2050.

About us

ClimateWorks Australia

ClimateWorks Australia bridges research and action, to achieve the system-level transitions required to reach net zero emissions across Australia, SouthEast Asia and the Pacific. We act as trusted advisers, influencing powerful decision-makers to reduce emissions at scale. Co-founded by The Myer Foundation and Monash University in 2009, ClimateWorks is a non-profit working within the Monash Sustainable Development Institute.

Acknowledgment of support

This report was supported by funding from the 2050 Pathways Platform. ClimateWorks Australia would also like to thank the experts who have provided input to and review of this report.

Acknowledgment of country

We acknowledge and pay respect to the Traditional Owners and Elders – past, present and emerging – of the lands and waters of the people of the Kulin nation on which the ClimateWorks Australia office is located, and all of the Elders of lands across which ClimateWorks operates nationally. We acknowledge that sovereignty was never ceded. [More info.](#)

Contents

Executive summary	2
Contents	5
Section one: a rationale for investing for the economy, community and climate	6
State and territory investment is central to Australia’s economic recovery	6
Achieving net zero emissions targets by 2050 in a prudent manner means acting now	7
Aligning recovery investments to net zero emissions commitments makes economic sense	11
Section two: Prudent investment opportunities for the economy, community and climate	12
Fiscal spending can catalyse private sector investment at scale	14
States and territories can collaborate and co-invest	15
All state and territory investments can be assessed for alignment to net zero emissions targets	16
Section three: Focus areas for investment	17
FOCUS AREA ONE	
Invest in infrastructure and natural capital	17
FOCUS AREA TWO	
Reduce business and household costs	22
FOCUS AREA THREE	
Support new low-carbon industries	26
FOCUS AREA FOUR	
Invest in education and training	31
Conclusion	33
References	34

Section one: a rationale for investing for the economy, community and climate

Prudent economic recovery packages boost employment and demand, while contributing to long term productivity growth and higher standards of living. States and territories can meet these objectives with investments that also make progress toward their net zero emissions by 2050 targets. Aligning recovery spending with net zero makes economic sense. To delay emissions reduction efforts until after the recovery is to miss an opportunity to achieve multiple objectives at once, and will significantly increase the cost for states and territories in meeting their net zero targets.

State and territory investment is central to Australia's economic recovery

The COVID-19 pandemic continues to shock the economies of Australian states and territories. Household consumption declined in all states and territories between March and June, ranging from a 13.7% drop in Victoria to 7.5% in the Northern Territory (ABS, 2020a). Unemployment rates in July ranged from 4.6% in the Australia Capital Territory to 8.8% in Queensland (ABS, 2020b). Consumption and employment have declined significantly in Victoria since July as a result of Stage Four lockdowns (Grattan, 2020a). National unemployment is expected to rise to 10% by late 2020 (Reserve Bank of Australia 2020a), and Gross Domestic Product (GDP) fell 7% in the June quarter (ABS, 2020a).

The recession resulting from COVID-19 calls for greater government involvement in the economy. Government borrowing and spending today will mitigate greater losses to activity and employment, which would place a larger and more protracted strain on the community and on government budgets (Reserve Bank of Australia 2020b). The necessary fiscal response is well under way: government consumption increased between March and June in all states and territories, except the Northern Territory (ABS, 2020a). At the time of writing, states and territories had contributed nearly \$45bn – 2% of combined Gross State Product, while the Federal Government had contributed \$314bn – 16% of GDP (The Australian 2020).

Despite the Federal Government investing most heavily to date, state and territory government action will be central to Australia's recovery. State and territory governments have responsibility and remit over areas of the economy that have been negatively impacted by coronavirus, such as transport infrastructure and services, education, health and agriculture. State and territory governments will also receive a share of the budgetary benefits that come from

restoring the economy to trend growth and full employment, such as through revenue streams like payroll tax, stamp duty and land tax.

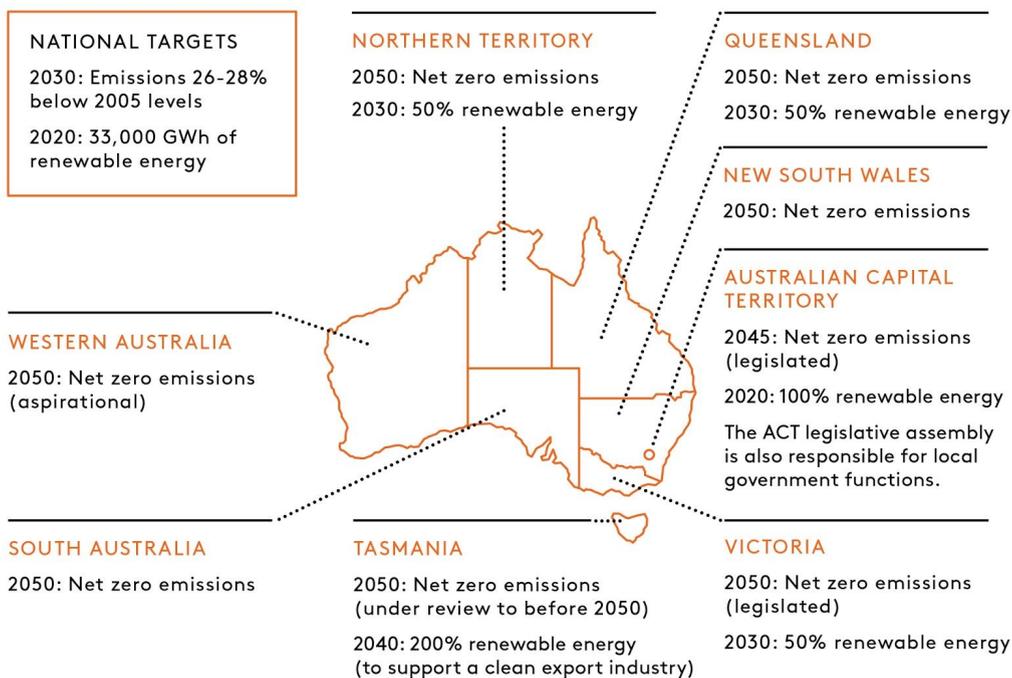
Prudent recovery spending by states and territories will promote short term aggregate demand and employment, while boosting productivity growth. While Federal payments such as JobKeeper and JobSeeker have positive effects in terms of welfare and consumption, they do not contribute to the productivity growth that is needed to improve future standards of living (Garnaut, 2020). Government spending that will improve productivity while targeting aggregate demand and employment includes the construction of infrastructure and business and household energy efficiency upgrades.

Effective recovery also involves laying the foundations for a globally competitive economy in the future. Governments can assist in this process by providing support for infant industries that capture untapped state and territory comparative and competitive advantages. These advantages include established mining and primary industry sectors, abundant available land, renewable energy resources such as wind and sun, and well established education and research capabilities (Australian Council of Learned Academies, 2015). Section two of this report outlines key opportunities for states and territories, such as green hydrogen production and lithium battery manufacturing, that capture these advantages.

Achieving net zero emissions targets by 2050 in a prudent manner means acting now

Parallel to the health and economic shocks of COVID-19, Australia and the world face the challenge of halting climate change. As a signatory to the Paris Agreement on climate, Australia is committed ‘to keeping a global temperature rise this century to well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius’ (UNFCCC 2016). All Australian states and territories have set goals or aspirations to reach net zero emissions by 2050 or earlier (see Figure 1).

FIGURE 1.1: Australian national, state and territory commitments



ClimateWorks' *Decarbonisation Futures (2020a)* shows that net zero by 2050 is possible for Australian states and territories, but significant effort is required this decade in order to achieve this goal. Table 1 shows the scale of emissions reductions for Australia in scenarios modelled by ClimateWorks between now and 2030 that are aligned to 1.5 and 2 degrees of warming.

Most assets that will be built this decade – such as infrastructure, commercial and residential buildings – will still be in operation in 2050. If these are not built in line with state and territory net zero commitments, they risk being stranded, requiring costly retrofits or imposing greater emissions reductions or offsets elsewhere in the economy. Similarly, many people undertaking education and training this decade will still be in the workforce in 2050. This suggests that these people will be best equipped for employment if their education and training reflects the coming transition.

Table 1: Benchmarks of progress towards net zero emissions by 2050¹

Annual Emissions Benchmarks	2°C Pathways		1.5°C Pathways	
	2030 (MtCO ₂ e)	Change versus 2020	2030 (MtCO ₂ e)	Change versus 2020
Australia-wide	291-322	-37% to -43%	159	- 69%
Electricity emissions	62-65	-63% to -64%	46	- 73%
Building emissions	36-37	-63% to -64%	27	- 73%
Transport emissions	108-115	+2% to -9%	93	- 12%
Industry emissions	141	-40%	120	- 49%
Agriculture and land emissions	37-75	-6% to -54%	34	- 57%

ClimateWorks modelling shows that the deployment of mature and demonstrated emissions reduction solutions needs to be accelerated, as does developing and commercialising emerging technologies in sectors such as industry, transport and agriculture. State and territory governments have a role to play in assisting the private sector overcome the barriers to development and deployment, such as cost, in sectors for which they have constitutional powers and responsibilities.

Taking steps toward net zero emissions now will significantly reduce the cost of achieving targets. One set of scenarios estimates that the impact to GDP will be three times greater if efforts to reduce emissions are delayed from now until 2030 (Network for Greening the Financial System 2020). This is the case even when both pathways are aligned to net zero by 2050, and relates only to the economic cost of transitioning in a less orderly manner. It does not account for the additional costs of increased physical climate change impacts related to delayed action.

There are also significant economic risks if Australian states and territories do not keep pace with the global transition to a low carbon economy. Australia's economic output is 43% more carbon intensive than the OECD average (World Bank 2020) due to exports such as iron ore, coal, meat, aluminium and steel. If

¹ ClimateWorks scenario benchmarks do not intend to be prescriptive, but instead provide an indication of the level of change required in the next ten years in order to be on track to net zero by 2050 or earlier.

these sectors are not modernised and decarbonised, they may face declines in export demand as countries and companies seek to reduce the emissions of their supply chains². Transition risks are predominately borne by the private sector, but the public sector has an interest in ensuring there is an orderly transition to net zero emissions rather than a disorderly one, due to the impact on public welfare, Gross State Product and financial stability (see Box 1).

There are a range of trajectories states and territories could take to net zero, with new technologies and solutions continuing to emerge. To help manage the uncertainty around when and what to invest in, states and territories can pursue a real options approach – investing in a range of technologies now to maintain flexibility as the technological frontier advances.

Box 1: Australia’s financial institutions highlight the economic risks presented by climate change are severe but preventable

- Guy Debelle, Reserve Bank of Australia (2019): “Both the physical impact of climate change and the transition are likely to have first-order economic effects. [...] Financial stability will be better served by an orderly transition rather than an abrupt disorderly one.”
- Geoff Summerhayes, Australian Prudential Regulation Authority (2017): “Some climate risks are distinctly ‘financial’ in nature. Many of these risks are foreseeable, material and actionable now. Climate risks also have potential system-wide implications that APRA and other regulators here and abroad are paying much closer attention to.”
- John Price, Australian Securities and Investments Commission (AFR 2019): “The world is rapidly transitioning to a low carbon economy, driven principally by the decisions of governments, business leaders, investors and consumers. Companies that fail to respond to these forces risk being left behind.”

² See, for example, multinational companies such as Amazon, Apple, Microsoft and BT, who have set targets for reducing their supply chain emissions (to net zero as early as 2030, in the case of Apple and Microsoft).

Aligning recovery investments to net zero emissions commitments makes economic sense

States and territories have a unique opportunity to pursue both their recovery and emissions objectives. With substantial action required this decade to be on track to net zero by 2050, state and territory recovery packages will have emissions ramifications whether intended or not. Meanwhile, state governments can make investments that meet immediate recovery objectives while ensuring that progress to net zero is not delayed and made costlier.

Support for aligning recovery measures to emissions reductions is strong domestically and abroad. Industry groups such as the Australian Industry Group, the Business Council of Australia and the Property Council (The Guardian 2020a) have called for climate-aligned spending, and the majority of Australians agree that climate change should be prioritised in economic recovery actions (Ipsos 2020). Internationally, bodies such as the International Energy Agency, World Bank, and International Monetary Fund have noted the importance of climate-aligned stimulus spending, and the European Union has committed 30% of its total economy recovery expenditure and next budget to addressing climate concerns (European Council 2020).

As the proceeding section of this report shows, investments can be made now in infrastructure, natural capital and energy efficiency that will leverage private investment and boost aggregate demand, productivity and standards of living, while also making material emissions reductions.

Investments in new low-carbon industries such as renewable hydrogen and lithium battery manufacturing will leverage Australia's comparative and competitive advantages in mineral, land and renewable energy resources. This will assist in returning Australia to full employment, increasing productivity, and laying the foundations for a globally competitive economy (Garnaut 2019).

Australia's new industries, and future productivity improvements, can be further supported by investments in education and training that address information and knowledge gaps, and the structural employment related to the transition to a zero emissions economy.

Now is the time for states and territories to make prudent investments that boost demand and employment in the short term, while preparing the economy for the future. The cost of borrowing has never been lower, and underemployed labour is ready to be mobilised. Opportunities exist to achieve multiple objectives: creating needed jobs, boosting productivity, and making progress toward net zero emissions by 2050 targets.

Section two: Prudent investment opportunities for the economy, community and climate

Prudent fiscal recovery packages provide a timely boost to aggregate demand and employment, while increasing long run productivity and income growth. There are options to meet these key objectives while also making progress towards net zero emissions targets.

Leading global economists from Oxford University (Hepburn et al. 2020) surveyed more than 200 economic, central bank and finance ministry experts to assess common fiscal policy types across three criteria: long-run economic multiplier, climate impact potential and speed of implementation. The most attractive investments were found to be:

- Clean physical infrastructure such as renewable energy assets, storage (including hydrogen), and grid modernisation.
- Building efficiency retrofits, including improved insulation, heating and energy storage systems.
- Education and training that addresses immediate unemployment from COVID-19 and structural shifts from decarbonisation.
- Natural capital investment for ecosystem resilience and regeneration including restoration of carbon-rich habitats and climate-friendly agriculture.
- Clean energy research and development.

ClimateWorks has mapped these categories to the Australian context, and requirements for the transition to net zero emissions, recognising Australia's specific competitive and comparative advantages (Table 2). ClimateWorks has identified recovery investment opportunities within four focus areas:

- Investing in infrastructure and natural capital.
- Reducing business and household costs.
- Supporting new low carbon industries.
- Investing in education and training.

Table 2: Recovery investments required to meet net zero by 2050 targets

		Desirable fiscal stimulus categories			
		Investing in infrastructure and natural capital	Reducing business and household costs	Supporting new low carbon industries	Investing in education and training
Critical investments required to meet net zero by 2050 targets	Electricity	Renewable generation Storage Transmission network	Demand management solutions	Lithium battery value chain	Renewable energy education
	Buildings		Energy efficiency Solar PV Electrification		Energy efficiency certifications
	Transport	Active transport Infrastructure Electric vehicle charging		Lithium battery value chain Advanced biofuels	
	Industry		Energy efficiency Solar PV Electrification	Renewable hydrogen and ammonia Electric vehicle manufacturing Green metals Circular economy	Energy efficiency certifications
	Agriculture & Land	Natural capital investments (carbon forestry and land conservation)		Anti-methane livestock solutions	

Investments in infrastructure, natural capital, and those that reduce business and household costs have high job and economic multiplier potential, the cornerstones of effective recovery measures (Centre on Budget and Policy Priorities 2020). They will boost aggregate demand in the short term as well as improving productivity growth and/or addressing a market failure that requires public intervention.

Investments that support new industries, such as those in research, development and demonstration (RD&D), also have high short term job creation potential, but more critically will prepare states and territories to capitalise on future export markets and employ large workforces over the long term.

Investments in education and training similarly have high short term job potential, while enabling greater private sector investment in the other identified opportunities and new industries.

In scenarios aligned to net zero emissions by 2050 for Australia, investment and uptake of these opportunities is significantly accelerated this decade (as compared with recent historical rates). The investments either make direct contributions to state and territory emissions reductions or are necessary enablers of emissions reductions across the economy.

Fiscal spending can catalyse private sector investment at scale

As the economy returns to full employment, fiscal spending will be scaled back to balance state and territory budgets over the medium-to-long term. To maximise the economic benefits of recovery expenditure, governments can design programs to maximise private investment and catalyse lasting change.

For each of the opportunities identified in the proceeding sections, an example of a mechanism for maximising the fiscal multiplier is given. In some cases this involves specific mechanisms like reverse auctions (auctions in which the private sector bids for the prices at which they are willing to contract their goods and services to the government). In others it involves ensuring the investments made are targeted and strategic.

Governments can also combine short term ‘pushes’ with long term ‘pulls’ to achieve lasting change. To ensure economic activity generated from stimulus measures does not lose momentum once funding packages cease, ‘push’ packages can be combined with structural interventions and strategic plans, or ‘pulls’ that provide a conducive environment for future sectoral growth and development. Used in concordance with stimulus packages, policies such as this will have more impact than they would otherwise, and vice versa.

Structural interventions are changes to regulation or market structures that shift consumer and/or business behaviour and uptake. Environmental Upgrade Agreements, for example, allow businesses and homeowners to take out loans for energy efficiency upgrades at a low fixed interest, paying repayments through council rates. Often the repayments are lower than the savings on utility bills. By carefully coordinating the deployment of policy instruments – both funding packages and changes to regulation or market structures – states and territories can maximise economic returns and emissions reductions.

Similarly, strategic planning and target setting by the government can give the private sector the confidence to invest beyond the immediate boost provided by fiscal outlays in the recovery. The combination of strategic planning and investment has been effective in New South Wales' development of Renewable Energy Zones (REZ). The combination of a statutory authority to guide the process combined with co-investment led to 113 registrations of interest for projects in energy generation and storage, totalling 27GW and valued at \$38 billion. The Central-West REZ is expected to generate \$4.5 billion in private sector investment off just over \$40 million in government spending, while creating 450 construction jobs (Energy NSW 2020).

States and territories can collaborate and co-invest

The benefits of recovery investments will be maximised by collaboration between jurisdictions. Coordination and consistency between state and territory spending will generate greater investor and community confidence in the possibility of a strong recovery (Edenhofer and Stern 2009).

Collaboration and communication between states can also ensure that multiple jurisdictions do not pursue the same research and development activities at the same time. States and territories will do best to specialise in areas for which they have competitive or comparative advantage, with spillover effects captured across industries, workforces and geographies. For example, Western Australia is best placed to develop early stages of the lithium battery value chain due to its mineral resources, but other states such as Victoria may be better placed to capture the latter stages of the chain due to existing manufacturing workforces and facilities.

Established avenues for state and territory co-investment exist, including Australia's Renewable Energy Agency (ARENA). The Australian Hydrogen Centre, for example, is a collaboration between ARENA, the South Australian and Victorian Governments, and private sector groups. The Centre is investigating the feasibility of blending hydrogen into the Victorian and South Australian gas networks. The Clean Energy Finance Corporation (CEFC) presents another opportunity for states to work with the Federal Government. State grants, supported by CEFC loans, have the potential to leverage significant private investment and jobs.

State collaboration also has strong precedent overseas. The Pacific Coast Collaborative (PCC) between British Columbia, Washington, Oregon, California, and the cities of Vancouver, Seattle, Portland, San Francisco, Oakland, and Los Angeles is one recent example. Emissions were lowered in the region by 10% in the last 12 years while introducing 650,000 clean energy jobs (PCC 2019). The PCC demonstrates that economic benefits can be enhanced through increasing the scale of key initiatives and sharing information and strategies.

All state and territory investments can be assessed for alignment to net zero emissions targets

While this report recommends specific focus areas for investment, stress testing all state and territory expenditure for climate-related transition risks and opportunities is also advised. This can help manage future risks of not achieving net zero targets, or of investing in assets or capabilities that risk being stranded in a low emissions world. Central to this is ensuring investments avoid infrastructure and facilities that lock in high emissions path dependencies.

Section three: Focus areas for investment

FOCUS AREA ONE

Invest in infrastructure and natural capital

Investments in infrastructure and natural capital (soil, water, plants and ecosystems) can mobilise large workforces in the wake of economic crises. Victoria has deployed resources to upgrade public transport and active transport (walking and cycling) infrastructure through its BuildingWorks program. The Western Australian Green Jobs Plan will see more than \$60 million invested in the creation of more than 1,000 conservation jobs.

‘Shovel ready’ pipeline projects, small scale infrastructure and natural capital investments such as carbon forestry and land restoration initiatives can be operationalised quickly, while larger investments can be staggered over the medium term. Infrastructure creates jobs in construction, project management, and administrative roles, while natural capital projects can mobilise vulnerable regional workforces and those employed in tourism with minimal training or reskilling.

Infrastructure is also central to improving productivity growth and standards of living. But as an asset class, has difficulty securing private sector finance (Reserve Bank of Australia 2013). The public sector has a key role to play in enabling investment, either through direct investment or risk sharing agreements with the private sector. Infrastructure and natural capital investments can also address market failures related to public goods. Cycling paths and ecosystem improvements are two examples of efforts that contribute to the public good without having clear revenue streams that will attract private sector involvement, without public sector intervention.

Infrastructure is by nature long lasting. Decisions made now as part of recovery efforts need to consider the transition to net zero emissions, as many projects undertaken now will still be in use in 2050. Currently, around 70% of Australia’s emissions are either directly attributable to, or are influenced by, infrastructure (ClimateWorks 2020). Reducing the emissions of Australia’s existing infrastructure is key to the transition, as is the building of new infrastructure that will facilitate low emissions solutions such as electric vehicles and renewable electricity generation.

Table 3 outlines key infrastructure and natural capital investment opportunities that have high job multipliers and are needed to achieve net zero emissions

targets. The job multipliers draw upon leading international and domestic economic analysis conducted for the COVID-19 recovery context.

The table also draws upon the results of a scenario modelled by ClimateWorks that is aligned to net zero emissions by 2050. The scale of uptake and capital investment in each opportunity from that scenario is presented.

In *Decarbonisation Futures* scenarios aligned to 2 degrees of warming, the uptake of, and capital investment in, renewable electricity generation infrastructure is substantial. Investments in electricity transmission is also substantial and has a particularly high job multiplier.

Walking, cycling and electric vehicle infrastructure will generate jobs and enable transformations in the sector with the fastest growing emissions nationwide (Department of Industry, Science, Energy and Resources 2019). The economic multipliers of this infrastructure is high, with estimates for renewable generation and storage above \$3 for each \$1 invested, and above \$2 for active transport infrastructure and transmission upgrades (McKinsey 2020).

Expenditure on these opportunities can deliver or build upon existing state and territory emissions reduction plans, such as New South Wales' Electric Vehicle Infrastructure and Model Availability Program, and state and territory renewable energy policies like Tasmania's Renewable Energy Action Plan.

Table 3: Investment opportunities in infrastructure and natural capital

Investment opportunities	Job multiplier (jobs created per \$1m in spending) ³	Scale of uptake in Australia by 2030 aligned to 2 degrees of warming ⁴	Capital investment required (public and private) in Australia by 2030 in scenario aligned to 2 degrees of warming ⁵
Wind electricity generation	6.7	56-62 TWh (vs 25 in 2020)	\$10.5b
Grid-scale solar electricity generation	6.7	82-106 TWh (vs 8 in 2020)	\$24b
Grid-scale storage	9-12	44-66 GWh storage added between 2020 and 2030 (solar thermal and utility battery storage) ⁶	\$914m (utility battery storage only)
Transmission network upgrades	9-12	6,000 MW of additional interconnector capacity (NEM only)	\$8.42b
Active transport infrastructure	12-15	16% increase in active transport kilometres on 2020 levels	\$370m
Electric vehicle charging infrastructure	12.5	93,000 public chargers and 3,000,000 home chargers to support 3,000,000 electric vehicles	\$3.2b
Natural capital investments (carbon forestry and land conservation)	6.7	~ 5 Mha of carbon forestry (or equivalent 31-45 Mt CO ₂ e of carbon sequestration)	\$11b

³Wind electricity generation, grid-scale solar electricity generation, electric vehicle charging infrastructure, and natural capital investments estimated job multipliers from AlphaBeta (2020); grid-scale storage, transmission network upgrades and active transport infrastructure estimated job multipliers from McKinsey (2020). McKinsey analysis conducted for a European nation, figures converted to AUD from EUR

⁴Transmission network upgrades figure from AEMO (2020); electric vehicle charging infrastructure figure from PwC (2018); all other figures from ClimateWorks (2020a).

⁵Transmission network upgrades figure from AEMO (2020); electric vehicle charging infrastructure figure from PwC (2018); active transport infrastructure figure from Bicycle Network (2020); all other figures from ClimateWorks (2020a).

⁶39-62 GWh of this storage is solar thermal in ClimateWorks' modelling. If this storage need was met with primarily battery storage, the GWh requirement would likely be higher. Various analyses of possible futures for Australia's electricity system have been conducted in recent years. Multiple options secure reliable supply from 100 percent renewables, but have varying associated storage requirements. See, for example, CSIRO and Energy Networks Australia (2017) and Energy Transitions Hub (2019).

Opportunity: Electric vehicle charging infrastructure

ClimateWorks' *Decarbonisation Futures* modelling shows an uptake of approximately three million electric vehicles (EVs) on Australian roads by 2030 in scenarios aligned to 2 degrees of warming.

Analysis by PwC (2018) found the infrastructure needs of three million EVs would be 91,000 public chargers and 3,000,000 home chargers. The associated capital investment is approximately \$300 million per annum. The public chargers can be financed through a combination of government and private sector investment; analysis from the AlphaBeta (2020) estimates \$2 of private co-finance can be leveraged for every \$1 of government spending on electric vehicle charging infrastructure. As EV uptake and resulting demand for charging infrastructure increases, the government investment needed will decrease.

There is historical precedent of co-investment: Western Australia's Electric Highway®, which connects Perth and Augusta with public fast-charging DC stations, was funded by the Royal Automobile Club of Western Australia, but the stations are owned and maintained by eight local governments.

The infrastructure to support three million EVs is estimated to generate a net increase of 13,400 jobs in 2030, compared to 2017 (PwC 2018). The jobs generated would be in construction, electrical trades, administrative roles and in infrastructure manufacturing.

Mechanism for maximising private sector involvement:

Reverse auction for public chargers in which the government contributes a proportion of the capital costs to the private firm able to deliver at the lowest cost. The private firm would then capture the operating fees of charger customers

Structural interventions to achieve lasting change:

Mandate all commercial and residential car parks over a certain size provide charging facilities

Opportunity: Land Restoration Funds

ClimateWorks' *Decarbonisation Futures* modelling estimates that the Australia-wide carbon sequestration task aligned to 2 degrees of warming is equivalent to 4.6-5.4 Mha of carbon forestry plantings by 2030. The capital investment associated with this is in the order of \$1 billion per annum between 2021 and 2030.

Preliminary analysis by ClimateWorks Australia indicates that an additional 4.6-5.4 Mha of carbon forestry plantings by 2030 would generate between 70,000-81,000 job years of direct employment. AlphaBeta (2020) highlights the potential for an additional 12,000 jobs available over the next three years from the restoration/revegetation of existing ecosystems. These jobs would target regional communities impacted by drought conditions, the recent bushfires, and the impacts on tourism from COVID-19. Carbon forestry efforts can also

address the structural unemployment from the ban of native logging, as has been enacted in Victoria.

There are also emerging commercial efforts to better capture and value carbon sequestration from nature-based solutions. These have the potential to maximise the revenue streams for land managers, farmers and traditional owners who provide offsets for companies seeking to meet their emissions reduction requirements. These efforts have the potential to create jobs and economic value from the development and commercialisation of measurement technologies, such as in artificial intelligence and data management. Natural methods of sequestration has been identified as one of four key opportunities for Australian industrial leadership in a low carbon world (Garnaut 2019).

The Queensland Government's \$500m Land Restoration Fund is an exemplar carbon farming fund that leverages government investment to achieve additional co-benefits beyond emissions savings and work creation, such as other natural capital improvements and support for First Nations communities. For more information on natural capital and the need for developing consistent measuring tools, see ClimateWorks' *Natural Capital Roadmap* (2019).

Mechanism for maximising private sector involvement:

Develop a carbon fund that has a built-in mechanism for valuing natural capital in order to capture and quantify a wider range of co-benefits from carbon farming. This can also provide an opportunity to pilot emerging commercial efforts to drive down the cost of measuring natural capital.

Structural interventions to achieve lasting change:

Develop state or territory level strategic plans that provide direction and guidance for transitioning from native forest logging to carbon forestry opportunities.

FOCUS AREA TWO

Reduce business and household costs

Governments can realise multiple dividends by targeting energy efficiency improvements for businesses and households. Energy efficiency upgrades generate economic activity and jobs, while improving long run productivity. Efficiency upgrades reduce energy bills, reduce emissions, and improve health outcomes.

Efficiency upgrades will also reduce the strain on electricity and gas networks. Australia's East Coast gas network faces a supply shortfall due to the rapid growth of LNG exports, which is likely to push up prices (AEMO 2020b). Efficiency measures have largely been overlooked in addressing this, despite there being the potential to cut Australia's gas demand by 25% by 2030 (ClimateWorks 2017).

Energy efficiency upgrades can be quickly implemented as distinct fiscal measures, or as additions to existing building stimulus packages, such as Western Australia's housing construction priority, or New South Wales' \$250 million maintenance investment on public assets like social housing. Efficiency upgrades will stimulate jobs in construction, trades and retail, all of which have been impacted by the crisis.

Improving energy efficiency is fundamental to achieving net zero emissions across all sectors of the economy, and assists in demand management, which reduces exposure to price spikes. The potential for improvement is particularly high in Australia: Australia is ranked 18 out of 25 of the world's top energy consuming nations for energy performance (American Council for an Energy-Efficient Economy 2018). Improving energy efficiency also presents the greatest potential for emissions reductions this decade. In ClimateWorks' scenarios aligned to 2 degrees of warming, the energy performance of residential buildings improves by 44-48% between now and 2030, and 16-25% for commercial buildings. In industrial sectors, there is a decline in energy use of 4-10%, despite increasing levels of production.

Reducing energy demand is the best first port of call for reducing emissions (Finkel 2020) but achieving emissions reductions in line with net zero by 2050 means increased uptake of renewable electricity is also needed. Solar photovoltaic systems, on-site storage, and electric vehicle charging rollouts can all assist in reducing the overall energy use, costs and emissions of a building or business. Scenarios aligned to 2 degrees of warming show a 85-116% increase in solar PV generation between 2020 and 2030. Only 27% of suitable homes in Australia are equipped with solar PV systems (ABS 2020c).

The energy and emissions outcomes of efficiency upgrades can also be strengthened by improved energy management, both via behaviour changes and management technologies. This includes digital platforms for consumer energy trading, sub-metering, emerging demand response opportunities, and the

installation of smart energy systems in all types of buildings (Energy Efficiency Council 2017). The installation of smart systems has a strong job creation multiplier, estimated at 8.5-11.6 per \$1m invested (McKinsey 2020).

Table 4 outlines key opportunities to reduce household and business costs that also have high job multipliers and will improve state and territory preparedness for the net zero transition. The figures draw upon leading international and domestic economic analysis conducted in the COVID-19 recovery context, and ClimateWorks' *Decarbonisation Futures* modelling.

The capital investment between 2020 and 2030 associated with these energy improvements are substantial, especially with regard to upgrades to commercial and residential buildings. The vast majority of this investment can be made by the private sector. For many efficiency upgrades, such as improving ceiling insulation, draft sealing and lighting, the payback period on investment is short (Sustainability Victoria 2016).

The public sector role is to enable the private sector to capture the benefits available. This can be done through financial mechanisms to overcome the initial capital cost barrier and incentive action for middle income households and businesses, and through direct grants and funding for low income households and social housing.

Multiple options exist for states and territories to enable private sector investment, including through existing efficiency schemes, Environmental Upgrade Agreement legislation or matched funding for upgrades.

Existing efficiency schemes include the tradable certificate schemes in NSW and Victoria, and direct obligation schemes in SA and the ACT. The ACT Energy Efficiency Improvement Scheme (2019) delivered \$240 million in lifetime benefits from a \$60 million cost to energy retailers. The program has provided 74,000 homes and businesses reductions to their energy bills. As part of recovery efforts, governments could increase the ambition and scope of these programs to capture a greater number of upgrades and increase the discount to consumers.

Other options include developing and advertising Environmental Upgrade Agreements (if not already in place), or expanding existing EUA legislation to capture a wider range of efficiency options. These allow property owners to pay back costs of renovations at low interest through council rates. Matched funding also has strong precedent; the Victorian Government's gas efficiency grant scheme, for example, mobilised \$2 million in private investment through matched funding, achieving significant cost and emissions reductions in the process (Sustainability Victoria 2020).

The economic multipliers of public sector interventions are high, with estimates of \$2.2 for every dollar invested in improving residential and industrial energy efficiency (McKinsey 2020).

Table 4: Investment opportunities to reduce business and household costs

Investment opportunities	Job multiplier (jobs created per \$1m in spending) ⁷	Scale of uptake in Australia by 2030 aligned to 2 degrees of warming ⁸	Capital investment required (public and private) in Australia by 2030 in scenario aligned to 2 degrees of warming ⁹
Renovations that include energy efficiency and electrification upgrades for existing homes ¹⁰	9.8 - 12.8	41-44% improvement in energy performance vs 2020 levels	\$221b
Construction of new energy efficient electric homes ¹¹	6.6 - 13.7	51-56% improvement in energy performance vs 2020 levels	\$457b
Construction of new energy efficient commercial buildings and renovations that include energy efficiency upgrades for existing buildings ¹²	5.3	16-25% improve in energy performance vs 2020 levels	\$491b
Energy efficiency and electrification for industry	8.5 - 12.2	4-10% decrease in industry energy use on 2020 levels	\$16.5b (\$6b in mining, \$7b in manufacturing, and \$3.5b in other industry)
Solar PV and battery storage	10	22-26 TWh solar PV capacity (85-116% increase on 2020)	\$8.7b for solar PV, \$1.0b for residential storage, \$905m for

⁷ Estimated job multipliers for renovations to existing homes and energy efficiency upgrades for industry from McKinsey (2020) and was analysis conducted for a European nation (figures converted to AUD equivalent from EUR); estimated job multiplier for the construction of new energy efficient electric homes from IEA (2020); estimated job multiplier for commercial building renovations and new construction from AlphaBeta (2020) and refers to public buildings specifically; estimated job multiplier for Solar PV and battery storage rollout from EY (2020)

⁸ ClimateWorks (2020a)

⁹ ClimateWorks (2020a)

¹⁰ Investment figures for residential and commercial buildings capture both the incremental capital costs of energy efficiency and electrification improvements, as well as the underlying business-as-usual cost of construction (for new buildings) and the cost of refurbishment (for existing buildings)

¹¹ See footnote 9

¹² See footnote 9

rollout		levels), 1.2 GW residential storage, 1.1 GW commercial storage	commercial storage
---------	--	--	--------------------

Opportunity: Residential energy efficiency and electrification retrofits

The average Victorian house has an energy rating of just 1.8 stars (Sustainability Victoria, 2019) with similar low standards found across Australia. Poor energy performance costs residents, causes health issues, and generates avoidable emissions.

ClimateWorks' *Decarbonisation Futures* modelling finds that the energy performance of existing housing improves by an average 41-44% in the next decade for Australia to be on track for net zero emissions by 2050. Preliminary analysis by ClimateWorks Australia indicates that a residential energy efficiency/electrification program aligned to this level of improvement could generate 50,000 job years of employment by 2025. The job created would primarily be in the construction and trades sector, which has been heavily impacted by the economic crisis.

The capital investment aligned to net zero by 2050 is substantial - in the order of \$221 billion - but the vast majority of this can be made by the private sector. Small scale retrofits such as improving ceiling insulation, draft sealing and lighting can be paid off through lower utility bills in a short period of time. One economic recovery package approach would be a combination of zero or low interest loan mechanisms for middle and higher income households and businesses (to provide an incentive for action), and direct grants for low income households and social housing.

Household and business investment in loan schemes could be bolstered by government commitments to set energy standards and mandatory energy performance disclosures in the future, increasing the attractiveness of acting now when the cost of borrowing is cheap.

AlphaBeta (2020) estimates that over the next three years, \$1.25 of private investment can be leveraged for every \$1 of public funding in residential building retrofits. This proportion will likely increase as household finances are restored.

Mechanism for maximising private sector involvement:

- Provide grants to low income households and social housing for small scale renovations such as improved insulation, draft sealing and insulation.
- Expand and advertise Environmental Upgrade Agreements (which allow costs to the property owner to pay back costs at low interest through council rates¹³).

Structural interventions to achieve lasting change:

- Commit to mandatory minimum energy standards for residential rental properties to bridge the current energy efficiency gap between leased and owner-occupied properties (Environment Victoria 2017; Morgan 2019).
- Introduce/expand mandatory energy performance disclosure obligations at point of sale/lease for residential buildings.

¹³ See, for example:

<https://www.energy.vic.gov.au/energy-efficiency/environmental-upgrade-agreements>

FOCUS AREA THREE

Support new low-carbon industries

The transition to a net zero emissions world presents an opportunity for Australia to capitalise on comparative and competitive advantages in cheap renewable energy and critical mineral resources such as lithium¹⁴. These advantages can be developed into new industries with global export potential, and can decarbonise existing key export industries (Garnaut 2019).

ClimateWorks, in partnership with Climate-KIC Australia, is currently convening the [Australian Industry Energy Transitions Initiative](#) to identify decarbonisation and new development opportunities across five supply chains that collectively contribute more than a quarter of Australia's annual greenhouse gas emissions and generate exports worth around \$160 billion¹⁵. These include steel, aluminium, liquified natural gas, other metals (such as lithium, cobalt and nickel) and chemicals (including explosives and fertiliser). The initiative is investigating opportunities in renewable hydrogen and ammonia production, green metals and the lithium battery supply chain.

Additional low carbon export opportunities exist in anti-methane livestock solutions, electric vehicle manufacturing, and second and third generation biofuels production. Developing these industries will require a combination of accelerated research, development and demonstration (RD&D), as well as flagship projects that can demonstrate industry potential and market and policy environments that are conducive to growth.

While not an export industry, Australian states and territories also have an opportunity to develop their circular economy industries, which can generate jobs, improve productivity and reduce emissions. For circular economy investments, the jobs created from new facilities can continue indefinitely: 9.2 jobs are generated from every 10,000 tonnes of waste that is recycled, as compared to 2.8 jobs for that which is sent to landfill (Infrastructure Partnerships Australia 2020).

Historically, private sector investment in research and development decreases in times of recession (Harvard Business Review 2009). This is despite the increased need for innovative solutions to improve productivity and generate new markets, industries and jobs. States and territories can quickly mobilise research through world-class universities and facilities such as the CSIRO (Commonwealth Scientific and Industrial Research Organisation), Cooperative Research Centres, and industry-led research initiatives. Governments have highlighted research and innovation as key priorities of COVID-19 stimulus plans, such as the NSW commitment of \$48.2 million for the Tech Central precinct in Sydney.

¹⁴ This competitive advantage is being collaboratively developed at the national level by Resource Ministers through the *National Critical Minerals Development Roadmap*.

¹⁵ For more information on the Australian Energy Transitions Initiative, visit: <https://energytransitionsinitiative.org/>

Increasing public and private investment in research can have high job multipliers. Clean technology research is estimated to generate up to 20 jobs per \$1 million of public investment with the potential to create 2,000 jobs in the next three years (AlphaBeta 2020). Government expenditure can specifically target Australia's current weakness in translating research to industry settings (ACOLA 2015).

Flagship industry projects, such as those for low emissions steel production, would be best targeted at locations with existing large industrial workforces. This includes locations such as the Hunter Valley in NSW and Central Queensland (Grattan Institute 2020). Jobs would be created across a broad range of professions from construction to engineering to factory workers, and can assist with the structural unemployment in these communities related to the transition away from coal.

Once government support has proven the feasibility of new industries and technologies, increasing private investment can be leveraged. Well designed government flagship projects ensure that little to no government support is required into the future. This is evidenced by ARENA's work with large scale solar which advanced commerciality by five years, producing 2,300 jobs with \$92 million committed to 12 projects. After this initial support, grants were no longer required for projects to be commercial (ARENA 2020a).

Table 5 outlines the potential for key low-carbon industries over the medium-to-long term. The opportunities range in size, from 5,000-20,000 jobs by 2050 for renewable ammonia to over 280,000 jobs by 2050 for biofuels¹⁶.

For some of the industries outlined in Table 5, governments have begun movement toward capturing these opportunities, such as Western Australia's \$10 million Renewable Hydrogen Fund. But this is only a fraction of the investment required. Under existing initiatives, Australia is on track to only produce just 0.06% of its potential market by 2025 (Acil Allen Consulting 2018).

¹⁶ Scaling Australia's biofuels industry in a sustainable way relies on ensuring second and third generation feedstocks (which do not compete for land with other land uses) and, in the case of feedstocks sourced from waste streams, do not detract substantially from other uses. See ARENA and CEFC (2019) for more details.

Table 5: Low carbon industry potential in Australia

Low carbon industry	Potential industry size
Renewable hydrogen	2,800 jobs and \$1.7b in value by 2030 (Acil Allen Consulting 2018)
Lithium value chain capture	28,771 jobs and \$297b in value by 2025. This would require approximately \$34.1b in capital investment (RDA 2018)
Cobalt production	Australia produces 4% of global cobalt, despite having 17% of the world's resources (OCE 2019)
Green steel	25,000 jobs and \$65b in exports per annum by 2050 . This would require approximately \$195b in capital investment (Grattan Institute 2020)
Green ammonia	5,000-20,000 jobs by 2050 (Grattan Institute 2020)
Advanced biofuels	22.9-27.8 Gigalitres production, 285,000-345,000 jobs, and \$18-24b of value created per annum by 2050 (ClimateWorks analysis). This would require over \$25-30 billion in capital investment for production facilities (ARENA and CEFC 2019)
Anti-methane livestock solutions	\$1.7b net present value of investment by 2030 (Investor Group on Climate Change 2020), 1200 jobs by 2023 in South Australia alone for anti-methane red seaweed production (CSIRO 2020)
Circular economy	17,000 jobs and \$210b in value by 2048 (KPMG 2020)

Opportunity: Lithium Battery Value Chain

Australia has the world's third largest reserves of lithium and currently produces nine of the ten elements required to produce lithium-ion batteries (Regional Development Australia 2018). Most analysts expect international demand to double by 2025 (Climate Change Authority 2020), but Australia currently earns just 0.53% of the end value of our lithium ore. One tonne of raw lithium has a value of \$750 USD, while the value of the batteries created from that tonne is \$144,000 (Stanford 2020).

It is estimated that by 2025, Australia will capture just \$10 billion of the value chain without government support. However, if Australia expands involvement along the supply chain, an additional \$297 billion could be captured. While over 99% of Australia's lithium deposits are in Western Australia, other states and territories may have comparative advantage in processing lithium and the production of lithium batteries.

The creation of a lithium battery industry in Australia could be facilitated in various ways. One potential lever is the creation of a reservation policy that would stipulate a proportion of lithium mined in Australia be designated for domestic use, giving Australia access to lithium at a rate below export parity. A dedicated co-investment fund between states and territories could also maximise Australia's potential and ensure jurisdictions capture their comparative advantages in the value chain.

Capturing around 12.8% of the end value of lithium is estimated to create 100,698 new energy metals sector jobs, 28,771 of which are direct full time employment, by 2025 (RDA 2018). The International Energy Agency (2020) estimate 5-12 jobs will be created for every US\$1 million invested in battery manufacturing.

Mechanism for maximising private sector involvement:

Co-investment between states and territories in a strategic fund focused on Australia capturing a greater proportion of the lithium value chain.

Structural interventions to achieve lasting change:

For Western Australia: developing a strategic vision for lithium in the state and employ a reservation policy in which a proportion of lithium mined in the state or territory is designated for domestic use.

Opportunity: Green Hydrogen Production

Western Australia, Tasmania, Victoria, Queensland, South Australia and the Federal Government have all released hydrogen strategies. Western Australia has a \$10 million Renewable Hydrogen Fund, and South Australia has allocated \$17 million in grants and \$25 million in loans to four hydrogen production projects.

However, to capture Australia's export potential for green hydrogen (hydrogen produced using renewable electricity and water), efforts need to be accelerated. Australia has the potential to produce 500,000 tonnes of green hydrogen per annum by 2030, capturing 10-20% of Japan and Korea's hydrogen demand. Under existing initiatives however, Australia is on track to produce just 3,000 tonnes by 2025. Australian hydrogen exports could contribute \$1.7 billion and 2,800 jobs to the national economy by 2030 (Acil Allen Consulting 2018).

State and territory guidance can help steer the hydrogen industry toward green hydrogen, such as through the creation of a formal certification system for hydrogen produced with renewable energy. Investments in flagship production projects can accelerate economies of scale, and make progress toward achieving the Federal target of 'H2 under \$2' (the cost of hydrogen to be below \$2 a kilogram) for green hydrogen. Achieving this in a short period of time will be necessary for Australia to remain internationally competitive. The European Union is targeting the current cost difference between fossil-fuel generated hydrogen and green hydrogen, installing 6GW of renewable hydrogen electrolyzers by 2024 and 40GW of renewable hydrogen electrolyzers by 2030 (European Commission 2020).

State and territory spending on end use demonstration projects (such as for industrial heat and heavy road freight transport) will also assist in catalysing demand. Green hydrogen will unlock new Australian industries, such as green steel which the Grattan Institute (2020) estimates could provide 25,000 jobs and \$65 billion in annual exports.

The appetite for government co-investment is evident in ARENA's recent \$70 million renewable hydrogen funding round (ARENA 2020b). The round received over 36 applications

representing over \$3 billion in combined project value. The AlphaBeta (2020) highlights pilot green hydrogen projects as having the highest ratio of leveraged private investment per \$1 of government investment –\$4 – from a list of twelve potential economic recovery measures.

Mechanism for maximising private sector involvement:

Coordinate investments and contracts through the green hydrogen value chain – from production, through distribution and storage, to transport and end users domestically and abroad (such as in Japan and Korea) – to ensure supply and demand can efficiently meet.

Structural interventions to achieve lasting change

Create a formal ‘green’ certification system for hydrogen produced with renewable energy.
Set state or territory green hydrogen production targets.

Opportunity: Research, development, demonstration and extension for anti-methane livestock solutions

Meat and Livestock Australia (2020) have set a target to be carbon neutral by 2030. This goal aims to ensure Australia’s red meat industry stays competitive, both in terms of international exports and domestic demand, as the world undertakes the transition to net zero emissions. The Technology Investment Roadmap (2020) has also outlined reducing agriculture methane emissions as a key priority for 2020 to 2022.

To achieve such a target, or any substantial decrease in livestock emissions, further development of anti-methane solutions is needed. CSIRO (2019) is undertaking research, development and demonstration of one such solution: a red seaweed feed supplement.

Australia has ideal growing conditions for the seaweed, with the potential to become a major export commodity, and generate regional jobs and growth. Despite this, there is no strategic plan in place for industry development (CCA 2020). Jobs created would be in both highly skilled research roles, as well as non-specialised workers on seaweed farms.

In South Australia, a partnership between the SA State Government, seaweed feed business CH4 Global, and the Narungga Nation Aboriginal Corporation, has led to the development of commercial-scale red seaweed cultivation and processing within the Narungga native title. The project, which will employ Narungga people, is expected to generate 1200 new jobs for South Australia (CSIRO 2020).

Mechanism for maximising private sector involvement:

Target investments at linking research programs to private companies that can commercialise and scale red seaweed projects.

Structural interventions to achieve lasting change:

Develop state strategic plans for reducing livestock emissions in line with intentions set by the Federal Government in the Technology Investment Roadmap and with Meat and Livestock Australia’s carbon neutral by 2030 target.

FOCUS AREA FOUR

Invest in education and training

Boosting education and training programs has high job creation effects (as high as 20.1 jobs per \$1m invested (AlphaBeta 2020)). This is especially true in the current crisis due to the significant impact that the pandemic has had on the tertiary and vocational education sectors (Crikey 2020; Universities Australia 2020). Increased and subsidised education offerings will improve the economic situation of both those receiving the training and the institutions providing them. Human capital investments also make significant contributions to boosting an economy's productivity (RBA 2015).

States and territories are looking at education in their COVID-19 recovery plans. In New South Wales a review of TAFE and the Vocational Education and Training (VET) sector is taking place, and in Queensland, the state government will invest \$20 million in a renewable hydrogen Apprenticeships Centre and \$23 million in a renewable energy training facility. The Federal Government's 'job trainer' program presents a timely opportunity for states and territories to receive co-financing for this form of stimulus (The Guardian 2020b).

In 2019, firms were having greater difficulty finding suitable labour than they had at any time since before the Global Financial Crisis (RBA 2019b). This combined with structural unemployment from the COVID-19 recession presents an ideal environment for investment in training that can prepare unemployed or underemployed workers for roles in which skill shortages exist.

As low emissions technologies become more prevalent and cheaper, the skills and knowledge required in many industries will shift. Investments in these new skills ahead of the curve will mean a ready workforce awaits these changes and the opportunities they present.

One sector for which there are current skill shortages is the renewable energy sector. Over 33% of the causes for recruitment difficulty in renewable energy is a lack of specific experience, in roles such as construction managers for large scale projects, electrical engineers, grid engineers, electricians, roofers and electrical trade assistants (CEC 2020). Research from the University of Technology Sydney's Institute of Sustainable Futures (2020) shows that the renewable energy industry could create an additional 20,000 jobs by 2025, or lose 11,000 jobs by 2022 depending on government policies.

There is also evidence of significant knowledge and skills gaps throughout the building value chain around energy management and efficiency (Acil Allen Consulting 2017). Energy efficiency knowledge was deemed insufficient in tradespeople, building certifiers, surveyors, HVAC professionals, builders, architects, designers, real estate agents and strata managers.

Investments in renewable energy and energy efficiency education can build upon existing government offerings, such as the NSW Government's energy

management courses, and the safety courses offered as part of Victoria's Solar Homes program.

Opportunity: Renewable Energy Training

Research from the University of Technology Sydney's Institute of Sustainable Futures (2020) shows that depending on government policies, the renewable energy industry could create an additional 20,000 jobs by 2025, or lose 11,000 jobs by 2022. Achieving a growth of 20,000 people requires addressing key skill shortages.

Net zero emissions aligned training programs have very high job and economic multipliers per dollar spent (AlphaBeta 2020), and can provide targeted funding for vocational and tertiary institutions heavily impacted by COVID-19. States and territories can also maximise the efficacy of the programs by consulting with industry to ensure the offerings meet identified skill shortages and may seek co-investment from the private sector through this process. Governments can also increase the attractiveness of such education offerings by providing longer term confidence in the industry through renewable energy targets and forward planned build outs of renewable generation.

The Victorian Government, as part of its Solar Homes program, currently offers a free accredited training course on working safely in the solar industry with more courses planned. Victoria could develop this further, while other states could establish their own free or subsidised renewable energy training programs.

Mechanism for maximising private sector involvement:

Seek industry co-investment and consultation to tailor education offerings so they meet specific skill shortages.

Structural interventions to achieve lasting change:

Provide policy certainty (through renewable energy targets or planned renewable energy zones) to create an environment that makes renewable energy training a safe and attractive choice for potential employees.

Conclusion

The COVID-19 economic crisis is ongoing and evolving. While states and territories act to mitigate the short term effects of shocks as they arise, they can also lay the foundations for long term recovery to full employment and higher standards of living. Governments can do this by investing in measures that improve productivity and fast track the development of new globally competitive industries that leverage state and territory competitive and comparative advantages.

Government recovery packages will shape the Australian economy between now and 2030, by which point significant emissions reductions are needed in order for states and territories to achieve their net zero commitments by 2050. Considering emissions outcomes in recovery efforts will significantly reduce the cost for states and territories in meeting these long term goals.

This report, along with ClimateWorks' *Decarbonisation Futures* report, demonstrates that net zero by 2050 is doable for states and territories, but it is subject to policy willingness and prudent investments.

This report has identified investment opportunities that meet both recovery and emissions objectives, and makes recommendations as to how to best maximise the potential of the interventions. These investments will address key market failures and generate jobs and exports that set up Australian economies to flourish in a low carbon world.

References

Acil Allen Consulting 2017, *Residential Housing Industry Capabilities: Report to the NSW OEH and Victorian DELWP*

Acil Allen Consulting 2018, *Opportunities for Australia from hydrogen exports*, <https://arena.gov.au/assets/2018/08/opportunities-for-australia-from-hydrogen-exports.pdf>

AEMO 2020, *2020 Integrated System Plan (ISP), appendix 3*, <https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2020-integrated-system-plan-isp>

AEMO 2020b, *2020 Gas statement of opportunities*, https://www.aemo.com.au/-/media/files/gas/national_planning_and_forecasting/gsoo/2020/2020-gas-statement-of-opportunities.pdf

Alan Finkel 2020, 'Chief scientist joins calls for Australia to dramatically boost energy efficiency', *The Guardian* <https://www.theguardian.com/australia-news/2020/jun/21/chief-scientist-joins-calls-for-australia-to-dramatically-boost-energy-efficiency>

AlphaBeta 2020, *Clean Jobs Plan*, <https://www.climatecouncil.org.au/resources/clean-jobs-plan>

American Council for an Energy-Efficient Economy (ACEEE) 2018, *The 2018 International Energy Efficiency Scorecard*, <https://www.aceee.org/sites/default/files/publications/researchreports/i1801.pdf>

Australian Bureau of Statistics (ABS) 2020a, *5206.0 - Australian National Accounts: National Income, Expenditure and Product, Jun 2020*, <https://www.abs.gov.au/ausstats/abs@.nsf/mf/5206.0>

Australian Bureau of Statistics (ABS) 2020b, *6202.0 - Labour Force, Australia, Jul 2020*, <https://www.abs.gov.au/ausstats/abs@.nsf/mf/6202.0>

Australian Bureau of Statistics (ABS) 2020c, *4631.0 - Employment in Renewable Energy Activities, Australia, 2018-19*, <https://www.abs.gov.au/ausstats/abs@.nsf/mf/4631.0>

Australian Council of Learned Academies (ACOLA) 2015, *Australia's competitive advantage*, <https://acola.org.au/wp/PDF/SAF01/SAF01%20full%20lo%20res.pdf>

Australian Financial Review (AFR) 2019, *APRA demands banks, insurers act on climate risk*,
<https://www.afr.com/companies/financial-services/apra-demands-banks-insurers-act-on-climate-risk-20190320-h1cl3l>

Australian Financial Review (AFR) 2020, *'Uneven and bumpy': RBA revises jobless figures to 10pc*,
<https://www.afr.com/policy/economy/uneven-and-bumpy-rba-revises-jobless-to-10pc-20200804-p55ii8>

Australian Government Department of Industry, Science, Energy and Resources 2019, *Quarterly Update of Australia's National Greenhouse Gas Inventory: June 2019*,
<https://publications.industry.gov.au/publications/climate-change/system/files/resources/gas-group-2/nggi-quarterly-updatejun-2019.pdf>

Australian Prudential Regulation Authority (APRA) 2017, *Australia's new horizon: Climate change challenges and prudential risk*,
<https://www.apra.gov.au/news-and-publications/australias-new-horizon-climate-change-challenges-and-prudential-risk>

Australian Renewable Energy Agency (ARENA) 2020a, *Large-scale solar*,
<https://arena.gov.au/renewable-energy/large-scale-solar/>

Australian Renewable Energy Agency (ARENA) 2020b, *More than \$3 billion of hydrogen projects bid for ARENA funding*,
<https://arena.gov.au/blog/more-than-3-billion-of-hydrogen-projects-bid-for-arena-funding/>

Australian Renewable Energy Agency (ARENA) 2020c, *Insights from the first wave of large-scale solar projects in Australia*,
<https://www.cefc.com.au/media/402331/insights-from-the-first-wave-of-large-scale-solar-projects-in-australia.pdf>

Bicycle Network 2020, *Pedalling to a better normal*,
<https://www.bicyclenetwork.com.au/newsroom/2020/05/24/pedalling-to-a-better-normal-a-plan-to-ride-out-of-covid-19/>

Climate Change Authority (CCA) 2020, *Economic recovery, resilience and prosperity after the coronavirus*,
<https://www.climatechangeauthority.gov.au/publications/economic-recovery-resilience-and-prosperity-after-coronavirus>

CEFC and ARENA 2019, *Biofuels and Transport: An Australian opportunity*,
<https://arena.gov.au/assets/2019/11/biofuels-and-transport-an-australian-opportunity.pdf>

Center on Budget and Policy Priorities (CBPP) 2008, *Principles for Fiscal Stimulus Economic Policy in a Weakening Economy*,
<https://www.cbpp.org/research/principles-for-fiscal-stimulus-economic-policy-in-a-weakening-economy>

Center on Budget and Policy Priorities (CBPP) 2020, *Policy Basics: Fiscal Stimulus*, <https://www.cbpp.org/research/economy/policy-basics-fiscal-stimulus>

Clean Energy Council 2020, *Clean Energy at Work*, <https://www.cleanenergycouncil.org.au/resources/resources-hub/clean-energy-at-work>

ClimateWorks Australia 2017, *Solving the gas crisis*, www.climateworksaustralia.org/resource/solving-the-gas-crisis-a-big-problem-deserves-a-big-solution/

ClimateWorks Australia 2019, *Natural Capital Roadmap*, <https://www.climateworksaustralia.org/resource/land-use-futures-natural-capital-roadmap/>

ClimateWorks Australia 2020a, *Decarbonisation Futures: solutions, actions and benchmarks for a net zero emissions Australia*, <https://www.climateworksaustralia.org/resource/decarbonisation-futures-solutions-actions-and-benchmarks-for-a-net-zero-emissions-australia/>

ClimateWorks Australia 2020b, *Reshaping Infrastructure for a net zero emissions future*, <https://www.climateworksaustralia.org/resource/issues-paper-reshaping-infrastructure-for-a-net-zero-emissions-future/>

Commonwealth of Australia 2020, *Technology Investment Roadmap Discussion Paper*, https://consult.industry.gov.au/climate-change/technology-investment-roadmap/supporting_documents/technologyinvestmentroadmapdiscussionpaper.pdf

Crikey 2020, *Pandemic reveals the costly flaws in our vocational education*, <https://www.crikey.com.au/2020/05/04/tafe-vocational-education-covid/>

CSIRO 2019, *FutureFeed*, <https://research.csiro.au/futurefeed/>

CSIRO 2020, *Major methane-busting deal struck with Narungga Aboriginal Nation*, <https://research.csiro.au/futurefeed/major-methane-busting-deal-struck-with-narungga-aboriginal-nation/>

CSIRO and Energy Networks Australia 2017, *Electricity Network Transformation Roadmap*, https://www.energynetworks.com.au/assets/uploads/entr_final_report_april_2017.pdf

Edenhofer, O & Stern, L 2009, 'Towards a Global Green Recovery: Recommendations for immediate G20 action', *Grantham Institute* https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2014/02/GlobalGreenRecovery_April09.pdf

Energy and Climate Intelligence Unit 2020, *Almost half of global GDP under actual or intended net zero emission targets*,
<https://eciu.net/news-and-events/press-releases/2020/almost-half-of-global-gdp-under-actual-or-intended-net-zero-emissions-targets>

Energy Efficiency Council (EEC) 2017, *Save Energy, Cut Bills, Improve Reliability: 2017-18 policy priorities for an energy efficient Australia*,
https://www.eec.org.au/uploads/Documents/Platform%20Documents/eec_priorities_final_web_lowres_200617.pdf

Energy NSW 2020, *Renewable Energy Zones*,
<https://energy.nsw.gov.au/renewables/renewable-energy-zones>

Energy Transition Hub 2019, *Australia's power advantage - Energy transition and hydrogen export scenarios*,
https://www.energy-transition-hub.org/files/resource/attachment/australia_power_advantage_0.pdf

Environment ACT 2019, *Energy Efficiency Improvement Scheme*,
<https://www.environment.act.gov.au/energy/smarter-use-of-energy/energy-efficiency-improvement-scheme>

Environment Victoria 2017, *Bringing rental homes up to scratch*,
<https://environmentvictoria.org.au/2017/09/27/bringing-rental-homes-scratch/>

European Commission 2020, *A hydrogen strategy for a climate-neutral Europe*,
https://ec.europa.eu/energy/sites/ener/files/hydrogen_strategy.pdf

European Council 2020, *Special meeting of the European Council (17, 18, 19, 20 and 21 July 2020) – Conclusions*,
<https://www.consilium.europa.eu/media/45109/210720-euco-final-conclusions-en.pdf>

EY 2020, *Australian renewable export COVID-19 recovery package*,
<https://www.wwf.org.au/what-we-do/climate/renewables/renewable-export-covid-19-recovery-package/securing-australia-s-future-renewable-export-covid-19-recovery#gs.bk458t>

Grattan, M. 2020, 'Victoria will have more people on JobKeeper in December and March quarters than the rest of Australia combined', *The Conversation*,
<https://theconversation.com/victoria-will-have-more-people-on-jobkeeper-in-december-and-march-quarters-than-the-rest-of-australia-combined-145301>

Grattan Institute 2020, *Start with steel*,
<https://grattan.edu.au/report/start-with-steel/>

Harvard Business Review 2009, *How to Market in a Downturn*,
<https://hbr.org/2009/04/how-to-market-in-a-downturn-2>

Hepburn, C, O’Callaghan, B, Stern, N, Stiglitz, J, & Zenghelis, D, 2020, ‘Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change?’, Accepted Manuscript, *Oxford Review of Economic Policy*, <https://academic.oup.com/oxrep/advance-article/doi/10.1093/oxrep/graa015/5832003>

Houser, T, Mohan, S, & Heilmayer, R 2009, ‘A green recovery? Assessing US economic stimulus and the prospects for international coordination’, Policy Brief 09-3, *Paterson Institute for International Economics*, https://wriorg.s3.amazonaws.com/s3fs-public/pdf/green_global_recovery.pdf

ID 2019, *The impact of skills shortages on local economic development*, <https://blog.id.com.au/2019/economic-analysis/the-impact-of-skills-shortages-on-local-economic-development/>

Investor Group on Climate Change (IGCC) 2020, *Mapping Australia’s net zero investment potential*, https://igcc.org.au/wp-content/uploads/2020/10/121020_IGCC-Report_Net-Zero-Investment-Opportunity.pdf?mc_cid=c0e6fe0cd8&mc_eid=ad19cd5116

Infrastructure Partnerships Australia (IPA) 2020, *Putting waste to work: Developing a role for Energy from Waste*, <https://infrastructure.org.au/energy-from-waste/>

Intergovernmental Panel on Climate Change (IPCC) 2018, *Special Report: Global Warming of 1.5 C*, <https://www.ipcc.ch/sr15/>

International Energy Agency (IEA) 2020, *Sustainable recovery*, <https://www.iea.org/reports/sustainable-recovery>

International Monetary Fund (IMF) 2020, *Greening the Recovery*, <https://www.imf.org/en/Publications/SPROLLs/covid19-special-notes>

Ipsos 2020, *Two thirds of citizens around the world agree climate change is as serious a crisis as Covid-19 - Ipsos survey*, <https://www.ipsos.com/en-au/two-thirds-citizens-around-world-agree-climate-change-serious-crisis-covid-19-ipsos-survey>

Jacobs, M. 2012, *Green growth: Economic theory and political discourse*, *Grantham Research Institute on Climate Change and the Environment*, The London School of Economics and Political Science, Working Paper 92, <http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2012/10/WP92-green-growth-economic-theory-political-discourse.pdf>

KPMG 2020, *Potential economic pay-off of a circular economy for Australia*, home.kpmg/au/en/home/insights/2020/05/potential-economic-pay-off-circular-economy-australia.html

McKinsey 2020, *How a post-pandemic stimulus can both create jobs and help the climate*,

<https://www.mckinsey.com/business-functions/sustainability/our-insights/how-a-post-pandemic-stimulus-can-both-create-jobs-and-help-the-climate>

Meat and Livestock Australia 2020, CN30,

<https://www.mla.com.au/research-and-development/Environment-sustainability/cn30/>

Morgan, C 2019, 'More than 43 per cent of Canberra's rentals have an energy efficiency rating of zero', *Canberra Times*

<https://www.canberratimes.com.au/story/6282346/very-unfair-more-than-43-per-cent-of-canberras-rentals-have-an-energy-efficiency-rating-of-zero/>

Network for Greening the Financial System (NGFS) 2020, *NGFS Climate Scenarios for central banks and supervisors*,

https://www.ngfs.net/sites/default/files/medias/documents/820184_ngfs_scenarios_final_version_v6.pdf

NSW Government 2020, *NSW Energy Savings Scheme – Draft Statutory Review Report*, <https://energy.nsw.gov.au/media/2036/download>

Office of the Chief Economist (OEC) 2019, *Outlook for Selected Critical Minerals*, <https://www.industry.gov.au/sites/default/files/2019-10/outlook-for-select-critical-minerals-in-australia-2019-report.pdf>

Organisation for Economic Co-operation and Development (OECD) 2020, *OECD data: Gross Domestic spending on R&D*.

Pacific Coast Collaborative (PCC) 2019, *2019 PCC Report Card*,

<http://pacificcoastcollaborative.org/resources/>

Productivity Commission 2015, *PC Productivity Update 2015 - 2 Contributions to output and income growth*,

<https://www.pc.gov.au/research/ongoing/productivity-insights/2015-/2-contributions-to-output-and-income-growth>

PwC 2018, *Recharging the economy*,

<https://electricvehiclecouncil.com.au/wp-content/uploads/2018/11/Recharging-the-economy.pdf>

PwC 2020, *What fiscal stimulus is required to improve Australia's economy?*,

<https://www.pwc.com.au/government/government-matters/getting-stimulus-right.html>

Regional Development Australia (RDA) 2018, *Lithium Valley*,

<https://www.rdaperth.org/rda-projects/lithium-valley>

Renew Economy 2019, *South Australia's stunning renewable energy transition, and what comes next*,

<https://reneweconomy.com.au/south-australias-stunning-renewable-energy-transition-and-what-comes-next-79597/>

Reserve Bank of Australia (RBA) 2013, *Productivity and infrastructure*,
<https://www.rba.gov.au/speeches/2013/sp-dg-261113.html>

Reserve Bank of Australia (RBA) 2015, *Australian Economic Growth – The How, What and Where*,
<https://www.rba.gov.au/speeches/2015/sp-ag-2015-03-11.html>

Reserve Bank of Australia (RBA) 2019a, *Climate Change and the Economy*,
<https://www.rba.gov.au/speeches/2019/sp-dg-2019-03-12.html>

Reserve Bank of Australia (RBA) 2019b, *The Labour Market and Spare Capacity*,
<https://www.rba.gov.au/speeches/2019/sp-gov-2019-06-20.html>

Reserve Bank of Australia (RBA) 2020a, *Statement by Philip Lowe, Governor: Monetary Policy Decision*,
<https://www.rba.gov.au/media-releases/2020/mr-20-20.html>

Reserve Bank of Australia (RBA) 2020b, *Opening Statement to the House of Representatives Standing Committee on Economics*,
<https://www.rba.gov.au/speeches/2020/sp-gov-2020-08-14.html>

Ross Garnaut 2019, *Superpower*,
<https://www.blackincbooks.com.au/books/superpower>

Ross Garnaut 2020, *RESET Webinar series*,
<https://fbe.unimelb.edu.au/alumni/events/public-lectures/ross-garnaut-reset-lecture-series>

Royal Automobile Club of Western Australia (RACWA) 2019, *RAC Electric Highway®*,
<https://rac.com.au/about-rac/advocating-change/initiatives/electric-highway>

Stanford, J. 2020, *A Fair Share for Australian Manufacturing: Manufacturing Renewal for the Post-COVID Economy*,
https://d3n8a8pro7vhm.cloudfront.net/theausinstitute/pages/3332/attachments/original/1595693276/A_Fair_Share_for_Australian_Manufacturing.pdf?1595693276

Sustainability Victoria 2016, *Energy Efficiency Upgrade Potential of Existing Victorian Homes*,
<https://www.sustainability.vic.gov.au/About-Us/Publications/Retrofit-Trial-Energy-Efficiency-Upgrade-Potential>

Sustainability Victoria 2019, *Comprehensive Energy Efficiency Retrofits to Existing Victorian Houses*,
<https://www.sustainability.vic.gov.au/-/media/SV/Publications/About-us/Research/Household-retrofit-technical-reports/Comprehensive-Energy-Efficiency-Retrofits-to-Existing-Victorian-Houses-PDF.pdf>

Sustainability Victoria 2020, *Gas efficiency grants*,
<https://www.sustainability.vic.gov.au/Grants-and-funding/Gas-efficiency-grants>

Task Force on Climate-related Financial Disclosures (TCFD) 2017, *Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures*, <https://www.fsb-tcf.org/publications/final-recommendations-report/>

The Australia Institute 2020, *G20 analysis: Australian stimulus spending four times more on fossil fuels than clean energy*,
<https://www.tai.org.au/content/g20-analysis-australian-stimulus-spending-four-times-more-fossil-fuels-clean-energy>

The Australian 2020, *Coronavirus: States must lift their game, says Scott Morrison*,
<https://www.theaustralian.com.au/nation/politics/coronavirus-states-must-lift-their-game-says-scott-morrison/news-story/fc0580bf5b45c72d25051165fa32e8cf>

The Guardian 2020a, *Business, unions and green groups call for sustainable Covid-19 recovery with clean energy transition*,
<https://www.theguardian.com/australia-news/2020/may/22/australian-government-urged-to-back-sustainable-covid-19-recovery-with-clean-energy-transition>

The Guardian 2020b, *Coalition to commit \$2bn for jobtrainer scheme if states agree to overhaul of vocational education*,
<https://www.theguardian.com/australia-news/2020/jul/16/coalition-to-commit-2bn-for-training-if-states-agree-to-overhaul-of-vocational-education>

UNEP Finance Initiative 2020, *UN-Convened Net-Zero Asset Owner Alliance*,
<https://www.unepfi.org/net-zero-alliance>

United Nations Framework Convention on Climate Change (UNFCCC) 2016, *The Paris Agreement*,
<https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>

Universities Australia 2020, *COVID-19 to cost universities \$16 billion by 2023*,
<https://www.universitiesaustralia.edu.au/media-item/covid-19-to-cost-universities-16-billion-by-2023/>

University of Technology Sydney Institute of Sustainable Futures (UTS ISF) 2020, *Renewable energy employment in Australia*,
<https://www.uts.edu.au/research-and-teaching/our-research/institute-sustainable-futures/our-research/energy-futures/renewable-energy-employment-australia>

World Bank 2020, *Thinking ahead: For a sustainable recovery from COVID-19*,
<https://www.consilium.europa.eu/media/45109/210720-euco-final-conclusions-en.pdfblogs.worldbank.org/climatechange/thinking-ahead-sustainable-recovery-covid-19-coronavirus>

World Bank 2020, *World Bank Open Data*,
<https://data.worldbank.org/indicator/EN.ATM.CO2E.KT>

World Economic Forum 2020, *Here's how to deliver a green recovery for the G20 economies*,
www.weforum.org/agenda/2020/07/rebuilding-green-g20-economies-after-covid-19/

Contact us

For further information
about this project, contact:

Sarah Fumei
Project Manager
Sarah.fumei@climateworksaustralia.org

ClimateWorks Australia
Level 27 Collins Place
Melbourne Victoria 3000
info@climateworksaustralia.org

Published by
ClimateWorks Australia
Melbourne, Victoria,
September 2020
© ClimateWorks Australia 2020

This work is subject to copyright.
Apart from any use permitted under
the Copyright Act 1968, no part may be
reproduced by any process without
written permission from the publisher.



MONASH
University

MONASH
SUSTAINABLE
DEVELOPMENT
INSTITUTE



THE MYER
FOUNDATION

ClimateWorks Australia is an expert, independent adviser, committed to helping Australia transition to net zero emissions by 2050. It was co-founded through a partnership between Monash University and The Myer Foundation and works within the Monash Sustainable Development Institute.