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LEGISLATIVE COUNCIL
Environment and Planning Committee

Inquiry into renewable energy in Victoria

Parliament of Victoria
Legislative Council Environment and Planning Committee

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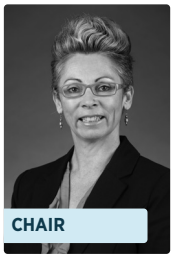

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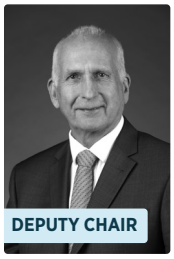

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About the Committee

Functions

The functions of the Legislative Council Environment and Planning Committee are to inquire into and report on any proposal, matter or thing concerned with the arts, environment and planning the use, development and protection of land.

The Environment and Planning Committee may inquire into, hold public hearings, consider and report on any Bills or draft Bills referred by the Legislative Council, annual reports, estimates of expenditure or other documents laid before the Legislative Council in accordance with an Act, provided these are relevant to its functions.

Government Departments allocated for oversight:

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This report is available on the Committee's website.

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Terms of reference

Inquiry into renewable energy in Victoria

On 4 March 2020 the Legislative Council agreed to the following motion:

That this House requires the Environment and Planning Committee to inquire into, consider and report, by July 2021*, on—

(a) measures to enable Victoria to transition its energy supply to 100 per cent renewable energy;

(b) jobs and economic benefits and implications of Victoria transitioning to 100 per cent renewable energy;

(c) investment, both public and private, required to achieve 100 per cent renewable energy generation in Victoria, including investment in grid infrastructure and energy storage;

(d) further opportunities for Victoria to reduce emissions, including through finding alternatives to industrial and household gas consumption;

(e) government investment or action that would be needed to support workers in impacted industries to facilitate a just transition and ensure workers and communities are not left behind as Victoria transitions to 100 per cent renewable energy;

(f) the economic risks of not urgently reducing emissions by transitioning to 100 per cent renewable energy; and

(g) any other related matters.

* The reporting date for this Inquiry was extended to 26 May 2022.

Chair's foreword

The Inquiry into renewable energy in Victoria was referred to the Committee in 2020. The Committee was at that time engaged in two major inquiries and therefore was only able to commence this Inquiry properly at the beginning of 2022.

The Inquiry was never intended to be a full investigation and analysis of renewable energy but more an update on where the renewable energy transition has reached at this point.

The Committee was grateful for the submissions received and the evidence given in its two days of public hearings and believes that Victoria is well placed and is making good progress in transitioning away from fossil fuels.

In the Committee's view, the Victorian government's emission reduction targets and renewable energy targets provide certainty to the market and are a strong indication of Victoria's intention to transition as quickly as possible. Support for both onshore and offshore wind projects, as well as substantial investments in solar and battery technologies, will help relieve the pressure as demand for energy is likely to increase as the community transitions away from fossil fuels to electricity, particularly with an increasing uptake in zero emission vehicles.

The Committee found that the Victorian government has the governance and policy structures in place to meet the increase in demand for energy. Any initiatives such as the government's renewable energy zones, the renewable energy development plan, renewable energy auctions and the creation of VicGrid are all indicators of the strong commitment the government has shown to the transition.

Through its Inquiry, the Committee found that the developing renewable energy sector creates a good source of employment and that there will be significant economic benefits in transitioning away from fossil fuels.

Throughout the Inquiry, all members have taken a collegiate and cooperative approach. While there may be differences of opinion in some areas, the importance of the transition to renewable energy has never been in dispute.

I thank the members for their professional and courteous approach to the Inquiry throughout.

I would also like to thank the committee secretariat. Multiple inquiries, one after the other, have been managed with great skill and diligence by the entire committee secretariat.

In particular, I would like to thank Committee Manager Michael Baker, Inquiry Officer Kieran Crowe, Research Assistant Hong Tran and Administrative Officer Justine Donohue for their efforts in helping the Committee produce this report in a very tight timeframe.

Ms Sonja Terpstra MLC
Chair

Findings and recommendations

3 Measures to transition to 100% renewable energy

FINDING 1: The Victorian Government's emission reduction targets and renewable energy targets provide certainty to the market about Victoria's intention to transition to renewable energy. This assists participants in Victoria's energy system to invest in renewable energy generators. 26

RECOMMENDATION 1: If it has not already done so, the Victorian Government should conduct a strategic land use assessment in Victoria's renewable energy zones to identify suitable sites for generators and transmission infrastructure. Such a land use assessment should take into account agricultural and other land uses, the views of communities as well as the possible environmental and cultural impacts of proposed infrastructure. 32

FINDING 2: Pursuing offshore wind projects will relieve pressure on the amount of renewable energy generators and associated transmission infrastructure that will need to be built in renewable energy zones to meet Victoria's zero emissions target by 2050. These projects should be factored into any review of the renewable energy zone infrastructure requirements. 33

FINDING 3: The demand for energy in Victoria is likely to double by 2050 as gas appliances are changed to electricity and the uptake of zero emissions vehicles increases. 40

FINDING 4: The Victorian Government has the governance and policy structure in place to meet the increase in the demand for energy to 2050 with renewable energy sources. These policy initiatives include renewable energy zones, the renewable energy development plan, renewable energy auctions and the creation of VicGrid. 40

FINDING 5: Victoria's environment is suited to offshore wind generation projects and the Victorian Government's offshore wind policy will support investment in offshore wind to act as a significant source of renewable energy generation up to 2040. 44

RECOMMENDATION 2: That the Victorian Government consider the introduction of a Community Energy Target that includes subsidies for the growth of localised community energy projects. 51

RECOMMENDATION 3: The Victorian Government should monitor the impact of the Australian Energy Market Commission's determination on access, pricing and incentive arrangements for distributed energy resources, and advocate for amendments if the export of power into the grid from distributed energy resources diminishes as a result of the determination. 55

RECOMMENDATION 4: That to enable more distributed energy resources to export power to the grid without risking system stability, the Victorian Government should continue to explore options for more varying feed-in tariffs and progress its Virtual Power Plant Pilot Program to enable statewide delivery. 56

FINDING 6: Access to deep storage firming capability such as pumped hydro is important in a system with high renewable energy generation capacity to mitigate against long duration periods of unfavourable weather and high demand. 63

RECOMMENDATION 5: That the Victorian Government produce a guide for community engagement and consultation for all renewable energy generation and transmission projects in Victoria, not just for those constructed under the renewable energy auction process. The guide should include direction on informing communities about the need for renewable energy zones to tackle climate change and to secure Victoria's renewable energy future, ensuring that traditional owners are integral to any consultation process. 75

RECOMMENDATION 6: That any statewide guide for community and engagement and consultation for renewable energy projects in Victoria should include a community benefits and economic development portion that addresses the need for:

- local procurement, job creation and training
- community benefit funds
- community co-investment and co-ownership. 79

RECOMMENDATION 7: That the Victorian Government consider including provisions for compensation and benefit sharing in any alternative regulatory investment test for transmission infrastructure ordered under the *National Electricity (Victoria) Amendment Act 2020*. 82

RECOMMENDATION 8: That the Victorian Government conduct an education campaign informing the public about the benefits of reducing energy consumption as one measure amongst a range of ways individuals can help to combat climate change and to also play their part in protecting Victoria's energy security as the state transitions to renewable energy. 85

4 A just transition to renewable energy

FINDING 7: The Latrobe Valley Authority has supported ex-power station workers to find new employment and is working to identify and support new industries that will provide economic growth and jobs for the future. 93

RECOMMENDATION 9: That the Victorian Government continue to build on the lessons learnt from the closure of Hazelwood and apply them in the lead up to the closure of Yallourn and later Loy Yang A. This includes the need for a strong Worker Transition Service. Work should be undertaken to identify the supply chain companies that service Yallourn ahead of time to help them to be ready to transition when it closes in 2028. 95

RECOMMENDATION 10: That the Victorian Government in conjunction with the energy sector ensure that new jobs in renewable energy are long term, secure, well paid and underpinned by skills and training provided through TAFE. Workers transitioning from coal-fired power stations should be supported with skills and training development opportunities to help them transition to jobs in the renewable sector. The Victorian Government should, wherever possible, support a position of no forced redundancies in the sector, supporting workers with redeployment and retraining opportunities. 100

5 The benefits and costs of transitioning to 100% renewable energy

FINDING 8: The Committee considers that developing renewable energy creates a good source of employment. Skills and training initiatives must be integral to job creation in the renewables sector along with appropriate regulatory oversight to ensure worker safety. 109

FINDING 9: The economic benefits from reducing health risks associated with burning fossil fuels are significant. These benefits should be included in the calculation of costs and benefits when analysing renewable energy development. 113

FINDING 10: There are a number of significant risks in economic terms if transitioning to renewable energy is delayed. These risks include being left behind other countries resulting in lost markets, lost funding opportunities and the high cost of investment. High energy costs and the loss of skilled workers will potentially lead to the lower competitiveness, as will the costs of negative health impacts caused by the effects of climate change. 116

FINDING 11: Continuing current carbon emission levels will increase the global temperature, accelerate climate change and cause more severe, frequent and extreme weather events, thus endangering people's health and safety. Transitioning to renewable energy will help to mitigate the most severe impacts of climate change. 119

FINDING 12: There are substantial economic costs associated with the rise of carbon emissions in the atmosphere, which cause global warming, climate change and consequential extreme weather events. Transitioning to renewable energy will help to reduce carbon emissions, thus provide the opportunity to mitigate those costs. 121

FINDING 13: Australia's exports are likely to face carbon tariffs and other financial duties and external pressure, and Victoria will add to the country's failure to meet its environmental obligations as part of the nation if it delays the transition. 123

RECOMMENDATION 11: That the Victorian Government ensure the Environment Protection Amendment Regulations 2022 accurately reflects the variability of wind farm noise and the corresponding monitoring allows for assessment of the noise both during the day and at night. 127

RECOMMENDATION 12: That the Victorian Government explore ways that affected residents may be assisted in upgrading the soundproofing of their homes to mitigate against intrusive impacts that may arise from wind farms where they are in reasonably close proximity to residences. 127

RECOMMENDATION 13: That the Victorian Government consider funding further research to determine the best approach for ensuring wind farm developments don't adversely impact native species, particularly Brolgas (Grus Rubicunda). 128

FINDING 14: Recycling schemes need to accommodate for recycling of renewable energy waste. Facilities need to be developed and/or modified so that waste that cannot be recycled can be dealt with in an environmentally sensitive way at the end of a product lifecycle. Manufacturers of renewable energy materials must also take responsibility for disposal options for their products. 134

RECOMMENDATION 14: That the Victorian Government include the solutions for processing renewable energy waste in any of its renewable energy strategies and plans and support the development and deployment of technologies that maximise the possibility of recycling, such as installing recyclable blades or recycling solar PV panels. 134

6 Further opportunities to reduce emissions

RECOMMENDATION 15: That the Victorian Government continue the zero emissions vehicle subsidy program until zero emission vehicle prices reach purchase price parity with internal combustion engine vehicles, along with measures to stimulate the zero emissions vehicle second-hand market to improve accessibility to zero emissions vehicles. 142

RECOMMENDATION 16: That the Victorian Government publicise its zero emissions vehicle policies more broadly so that the public understand and know how to access the support available to them. 142

RECOMMENDATION 17: That the Victorian Government advocate to the Commonwealth Government to pursue national-level policies favourable to zero emissions vehicle uptake, such as ones regarding luxury vehicle tax and vehicle import duties. 142

RECOMMENDATION 18: That the Victorian Government continue to pursue opportunities to work with the other states and territories and the Commonwealth Government to advocate for national vehicles emissions standards for all new vehicles. 144

RECOMMENDATION 19: That the Victorian Government should set its own ambitious vehicle emissions standards similar to that introduced in New South Wales. 144

RECOMMENDATION 20: That the Victorian Government adopt a cut-off date for sales of new internal combustion engine vehicles. This must go in hand with an education campaign about zero emissions vehicles and extensive development of the required infrastructure for zero emissions vehicles, supported by a wide range of zero emission vehicle models available to consumers. 144

RECOMMENDATION 21: That the Victorian Government continue to collaborate with local government authorities, electricity network operators and electric vehicle makers to coordinate and accelerate the roll-out of electric vehicle charging network development along the road, other public facilities and in new and existing residential and commercial buildings, with an emphasis on a regional area rollout. 150

FINDING 15: Transferring heavy freight vehicles to zero emissions vehicles is more challenging compared to light and passenger vehicles given its higher rate of energy consumption and longer travel time, which can exceed the current limited capacity of batteries. 153

RECOMMENDATION 22: That the Victorian Government continue to build active transport infrastructure such as separated cycle paths so that people can safely choose active transport for their journeys and that active transport opportunities form part of any new infrastructure projects that are developed. 154

FINDING 16: Gas usage for cooking, heating and industrial processes constitutes a sizeable source of carbon emissions in Victoria. 157

FINDING 17: Switching Victorian households from gas will contribute significantly to lowering carbon emissions, save household costs and help to avoid the health risk associated with gas. 166

FINDING 18: To move away from gas, households will incur considerable retrofitting costs which are prohibitive to low-income households and other disadvantaged groups. 170

RECOMMENDATION 23: Programs that the Victorian Government has developed to support the move away from gas should be enhanced to ensure that disadvantaged groups who may suffer from financial impediments are not excluded. 170

RECOMMENDATION 24: That the Victorian Government establish a community education campaign about the benefits of gas substitution and to inform householders, retailers and installers of the steps necessary to get them ready for the transition to renewable energy. 173

RECOMMENDATION 25: That the Victorian Government, in cooperation with local government authorities, make available information and consultation services to facilitate residents' access to information who want to transition away from gas. 173

FINDING 19: Current planning, building and plumbing regulations that mandate connection of new buildings to gas infrastructure conflict with the need to transition away from gas. 175

RECOMMENDATION 26: That the Victorian Government consider reviewing and removing the regulations that mandate connection of new buildings to gas infrastructure and consider enacting a moratorium on new residential gas connections. In doing so, consideration should be given to ensuring no disruption to energy supply and that the impact on workers affected by the transition is minimised by ensuring just transitions for workers are factored into any anticipated downturn in gas connections. 175

RECOMMENDATION 27: That the Victorian Government design an education program on gas substitution specific to tenancy landlords and businesses to enhance their understanding of the benefits of the substitution, the alternatives and the support available to them. 176

RECOMMENDATION 28: That the Victorian Government consider updating the minimum standards for rental properties to keep it in line with Victoria's Gas Substitution Roadmap and provide incentives to businesses to encourage them to switch away from gas. 176

FINDING 20: Victoria currently loses a considerable amount of gas and electricity across the transmission network. This needs to be addressed to avoid any unnecessary greenhouse gas emissions and reduce the pressure on energy production. 181

FINDING 21: Energy consumption in buildings in Victoria accounts for a considerable part of the state's greenhouse gas emissions, partly because of the poor energy performance of its building stock. It is therefore important to improve energy efficiency in buildings to lower Victoria's carbon emissions. 183

FINDING 22: Ensuring Victoria's new buildings are up to date with high energy efficiency requirements is necessary to avoid poor energy performance in the future. Upgrading the current energy star rating of new buildings is a measure to achieve this. This also prepares the Victorian building industry for the new requirements under the National Construction Code, which is in the process of being updated. 186

RECOMMENDATION 29: That the Victorian Government update the State Planning Policy Framework to integrate the 7-star standard of the Nationwide House Energy Rating Scheme into its requirement for Environmentally Sustainable Design of new buildings. 186

RECOMMENDATION 30: That, if the Victorian Government integrates the 7-star standard of the Nationwide House Energy Rating, it should have incentives to encourage developers to apply the higher energy efficiency standard. 186

RECOMMENDATION 31: That the Victorian Government consider appropriate incentives to encourage home builders to adopt best energy efficiency practices and introduce necessary measures to ensure that the impact of incentives flows on to home buyers. 187

RECOMMENDATION 32: That the Victorian Government consider expanding current home energy efficiency-related programs (Solar Homes, Victoria Energy Upgrades) to cover energy efficiency improvement practices such as insulating, weather proofing, double glazing and replacing gas with efficient, electric appliances, and focusing on low-income households. 190

FINDING 23: Improving the energy performance of government buildings is important to show the Government can lead the way in energy efficiency. The Victorian Government is working actively on this through the Greener Government Buildings program. 192

FINDING 24: The Committee acknowledges that the Victorian Government is aware of the opportunity to reduce emissions in the agricultural sector. In addition, the Victorian Government has invested in livestock feed that inhibits methane emissions. It has also committed to support farmers with information to help them understand the emissions profile of their operation and technology and practices to reduce emissions on-farm. 194

What happens next?

There are several stages to a parliamentary inquiry.

The Committee conducts the Inquiry

This report on the Inquiry into renewable energy in Victoria is the result of extensive research and consultation by the Legislative Council's Environment and Planning Committee at the Parliament of Victoria.

We received written submissions, spoke with people at public hearings, reviewed research evidence and deliberated over a number of meetings. Experts, government representatives and individuals expressed their views directly to us as Members of Parliament.

A Parliamentary Committee is not part of the Government. Our Committee is a group of members of different political parties (including independent members). Parliament has asked us to look closely at an issue and report back. This process helps Parliament do its work by encouraging public debate and involvement in issues. We also examine government policies and the actions of the public service.

You can learn more about the Committee's work, including all of its current and past inquiries, at: https://www.parliament.vic.gov.au/epc-lc.

The report is presented to Parliament

This report was presented to Parliament and can be found at: https://parliament.vic.gov.au/epc-lc/inquiries/article/4463.

A response from the Government

The Government has six months to respond in writing to any recommendations we have made. The response is public and put on the inquiry page of Parliament's website when it is received at: https://parliament.vic.gov.au/epc-lc/inquiries/article/4464.

In its response, the Government indicates whether it supports the Committee's recommendations. It can also outline actions it may take.

1 About the Inquiry

1.1 The Terms of Reference

On 4 March 2020 the Legislative Council agreed to the following motion:

That this House requires the Environment and Planning Committee to inquire into, consider and report, by July 2021, on—

(a) measures to enable Victoria to transition its energy supply to 100 per cent renewable energy;

(b) jobs and economic benefits and implications of Victoria transitioning to 100 per cent renewable energy;

(c) investment, both public and private, required to achieve 100 per cent renewable energy generation in Victoria, including investment in grid infrastructure and energy storage;

(d) further opportunities for Victoria to reduce emissions, including through finding alternatives to industrial and household gas consumption;

(e) government investment or action that would be needed to support workers in impacted industries to facilitate a just transition and ensure workers and communities are not left behind as Victoria transitions to 100 per cent renewable energy;

(f) the economic risks of not urgently reducing emissions by transitioning to 100 per cent renewable energy; and

(g) any other related matters.

As a result of other inquiries already scheduled at the time of the reference being received, and the Committee's practice of undertaking inquiries in the order in which they are received, the Inquiry into renewable energy was not commenced until the latter part of 2021. At that time, the Committee was finalising two major inquiries and so the Inquiry was further delayed, with the submission deadline closing in December 2021 and the tabling deadline being extended to May 2022.

1.2 Submissions and public hearings

The Committee commenced the Inquiry by writing to a number of stakeholders in October 2021. At the same time, the Committee advertised a call for submissions in *The Age* newspaper and on the Parliament's Facebook page and on its other social media.

By the time submissions closed, the Committee had received 90 submissions from a range of individuals and organisations.

The Committee only held two days of public hearings on 16 and 17 March 2022. At these hearings, the Committee heard from a range of organisations and individuals with expertise in renewable energy. A full list of witnesses is provided in Appendix A, and the transcripts of evidence can be found at https://www.parliament.vic.gov.au/epc-lc/article/4462.

1.3 Scope of the Inquiry

It was not the Committee's intention to undertake a far-reaching and detailed analysis of renewable energy. Firstly, by the time the Inquiry was able to be commenced, there was not time to undertake such a complex inquiry. Secondly, and more significantly, there have been a significant number of such inquiries that have already been completed and are accessible to the public.

The Committee instead decided to undertake an inquiry to provide an update on the renewable energy transition in Victoria. It relies largely on the submissions received and the evidence given at the limited hearings held.

This report is therefore intended to provide the Victorian context for the renewable energy transition and to canvas some of the issues that have been raised during the Inquiry.

2 Renewable energy and Victoria's energy system

2.1 What is renewable energy?

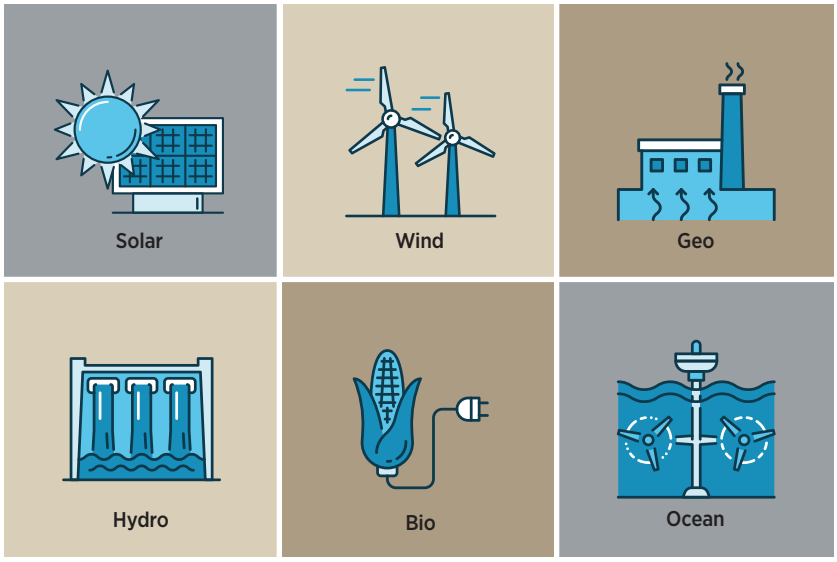
The Australian Renewable Energy Agency defines renewable energy as energy that is 'produced using natural resources that are constantly replaced and never run out.'[1]

This is in contrast to fossil fuels, which are exhaustible combustible carbon-based organic matter, such as coal, gas and oil. The combustion of fossil fuels to generate energy causes carbon emissions.[2]

2.2 The main types of renewable energy

The main types of renewable energy are specified by the Australian Renewable Energy Agency and are shown in Figure 2.1 below.

Figure 2.1 Sources of renewable energy



Source: Adapted from E-education.psu.edu, at https://www.e-education.psu.edu/eme807/node/649.

1 Australian Renewable Energy Agency, *Renewable Energy: What is renewable energy?*, 2022, <https://arena.gov.au/what-is-renewable-energy> accessed 6 December 2021.

2 Origin, *Generation: Our generation portfolio*, 2021, <https://www.originenergy.com.au/blog/fossil-fuels-in-australia> accessed 12 November 2021.

Solar

Solar energy is created by the heat and light of the sun. Solar energy can be converted to electricity and heat (such as hot water, steam or direct process heat).[3]

The Victorian Government identifies two ways to convert solar energy into electricity, solar photovoltaic (PV) and solar thermal:

- Solar PV converts sunlight directly into electricity using technology such as PV panels on rooftops and PV concentrating systems.
- Solar thermal concentrates sunlight using lenses and reflectors to produce electricity from a steam turbine.[4]

Solar energy is set apart from other sources of energy because the use of PV materials allows the production of electricity directly without mechanical conversion. In addition, solar energy can be deployed at different scales, ranging from a single solar panel on a house (rooftop solar), to large-scaled power stations capable of powering hundreds of thousands of homes.[5]

Wind

Wind creates electricity using wind turbines. The energy in the wind turns propeller-like blades on a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity. Like solar energy, wind energy requires no fuel input costs and emits no carbon emissions when generating electricity.[6]

Wind turbines are concentrated in wind farms, which can be either onshore or offshore.

Geothermal

Geothermal energy uses heat that naturally occurs underground. It is a renewable energy source with multiple applications including heating, drying and electricity generation.[7]

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3 Department of Environment, Land, Water and Planning, *Renewable Energy: Solar energy*, 2019, <https://www.energy.vic.gov.au/renewable-energy/solar-energy> accessed 28 January 2022.

4 Ibid.

5 Ibid.

6 The Victorian Government points out that 'each megawatt hour of wind energy generated in Victoria avoids the generation, on average, of one tonne of greenhouse gas emissions. A typical 3.5MW wind turbine can power about 2100 homes and reduce greenhouse gas emissions by about 9,300 tonnes a year, the equivalent of taking around 1860 cars of the road.' See Department of Environment, Land, Water and Planning, *Wind Farms fact sheet: Measurement*, Victorian Government, Melbourne.

7 *Renewable Energy: Geothermal energy*, 13 August 2021, <https://arena.gov.au/renewable-energy/geothermal> accessed 8 November 2021.

Hydropower

Hydropower converts the energy of moving water into electricity via hydroelectric turbines in dams or pumped hydro energy storage, which uses two reservoirs at different heights to store and despatch energy.[8]

Bioenergy and waste to energy

Bioenergy is a form of renewable energy generated from the conversion of biomass (this includes food waste and municipal waste) into heat, electricity, biogas and liquid fuels.[9] Bioenergy is generated using biological methods such as anerobic digestion and fermentation.[10]

Energy from waste can also be generated through incineration, gasification and pyrolysis. The feedstocks for energy generated from incineration can include landfill waste.[11]

Ocean energy

Ocean energy refers to all forms of renewable energy derived from the sea. The three main types of ocean technology are wave, tidal and ocean thermal.[12]

Table 2.1 below summarises how energy is generated from each source of renewable energy.

Table 2.1 An overview of renewable energy sources and method of energy generation

Renewable energy type	Method of energy generation
Solar	Converts sunlight into energy.
Wind	Powers a turbine that produce electricity.
Geothermal	Extracts the heat from the earth for use as energy.
Hydropower	Converts the energy of moving water into electricity.
Bioenergy and waste to energy	Converts biomass or waste into electricity.
Ocean Energy	Converts energy from wave, tidal and ocean thermal into electricity.

Source: Legislative Council Environment and Planning Committee.

8 Australian Renewable Energy Agency, *Hydropower / Pumped Hydro Energy Storage: What is hydropower?*, 28 September 2021, <https://arena.gov.au/renewable-energy/pumped-hydro-energy-storage> accessed 8 November 2021.

9 Australian Renewable Energy Agency, *Bioenergy / Energy from waste: What is bioenergy and energy from waste?*, 26 August 2021, <https://arena.gov.au/renewable-energy/bioenergy> accessed 8 November 2021.

10 Parliament of Parliament of Victoria, Legislative Council Environment and Planning Committee, *Inquiry into Recycling and Waste Management*, 2019, p. 159.

11 Ibid.

12 Australian Renewable Energy Agency, *Renewable Energy: Ocean energy*, 15 March 2021, <https://arena.gov.au/renewable-energy/ocean> accessed 8 November 2021.

Of the current sources of renewable energy, solar and wind are by far the most widely used. Hydropower (particularly pumped hydro) is important as it is not only a renewable source of energy but also acts as a storage solution to provide the needed back-up for intermittent renewable sources.[13] Geothermal, according to the Australian Renewable Agency, has considerable potential in Australia but is not financially viable due to the challenges of identifying suitable sources, producing it at a high rate and overcoming its significant upfront costs.[14] Ocean energy is still at an early stage of commercialisation[15] while bioenergy still has scope to expand.[16]

Hydrogen

In addition to the above-mentioned renewable energy sources, hydrogen has been cited in submissions as an alternative to fossil fuels.[17]

It should be noted that not all types of hydrogen are renewable. Hydrogen is generally classified as brown, blue and green hydrogen. Infrastructure Victoria defines these three types of hydrogen as follows:

- Blue hydrogen refers to hydrogen produced using natural gas through the process of steam methane reforming. CO2 emissions generated during production must be captured and stored via carbon capture and storage for the hydrogen to be considered low or zero emissions.
- Brown hydrogen refers to hydrogen produced using coal gasification. CO2 emissions generated during production are not captured and stored. Brown hydrogen accounts for the majority (approximately 95%) of current global hydrogen production.

...

- Green hydrogen refers to hydrogen produced through electrolysis, using renewable electricity such as wind or solar to split water into hydrogen and oxygen. Green hydrogen production generates no greenhouse gas emissions.[18]

Using the above definitions, only green hydrogen is renewable.

Hydrogen can be used either as an energy carrier or a fuel source. It can act as a dispatchable fuel source for power stations and can be stored for use when needed. It complements wind or solar in that curtailed electricity is used to produce hydrogen to be reserved for periods with continuously low wind and sunshine and for peaking

13 Clean Energy Council, *Hydropower: The backbone of a reliable renewable energy system*, 2021, p. 15.

14 Australian Renewable Energy Agency, *Renewable Energy*; ibid.

15 Australian Renewable Energy Agency, *Renewable Energy*.

16 Australian Renewable Energy Agency, *Bioenergy / Energy from waste*.

17 Graeme James, *Submission 39*, p. 1.

18 Infrastructure Victoria, *Submission 44*, p. 10.

power.[19] Hydrogen can also be used as a fuel for transport and machinery as well as in chemical production.[20]

Nuclear

The Committee has decided not to include nuclear power in the scope of this Inquiry. Nuclear power, while free of carbon emissions, does not generate energy from renewable resources.

2.3 Victoria's energy system

Energy in Victoria is produced by generators which include coal and gas-fired power stations, solar, wind and hydroelectric generators. The electricity produced by generators is sent via high voltage transmission lines to distribution lines in Victoria's towns and cities. The poles and wires that make up Victoria's distribution network provide electricity directly to homes and businesses.

The generators and transmission lines on Australia's eastern seaboard are grouped together to form the National Electricity Market. The Market also plays a role in setting prices for electricity.

There are a number of Commonwealth agencies that regulate the National Electricity Market. This includes the:

- Australian Energy Market Operator (AEMO)
- Australian Energy Market Commission
- Australian Energy Regulator.

Victorian Government agencies also play a role in Victoria's energy system to provide infrastructure, act as a regulator and promote the transition to renewable energy.

2.3.1 The National Electricity Market

The National Electricity Market is one of the world's longest interconnected power systems, with 40,000 km of transmission lines.[21] It operates across the five states and territories on Australia's eastern seaboard. Western Australia and the Northern Territory do not participate.[22]

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19 ANU 100% Renewables group, *Submission 74 - attachment C*, p. 12., Australian Conservation Foundation, Albury Wodonga Region Community Group, *Submission 7*, p. 2.

20 Australian Renewable Energy Agency, *Renewable Energy*.

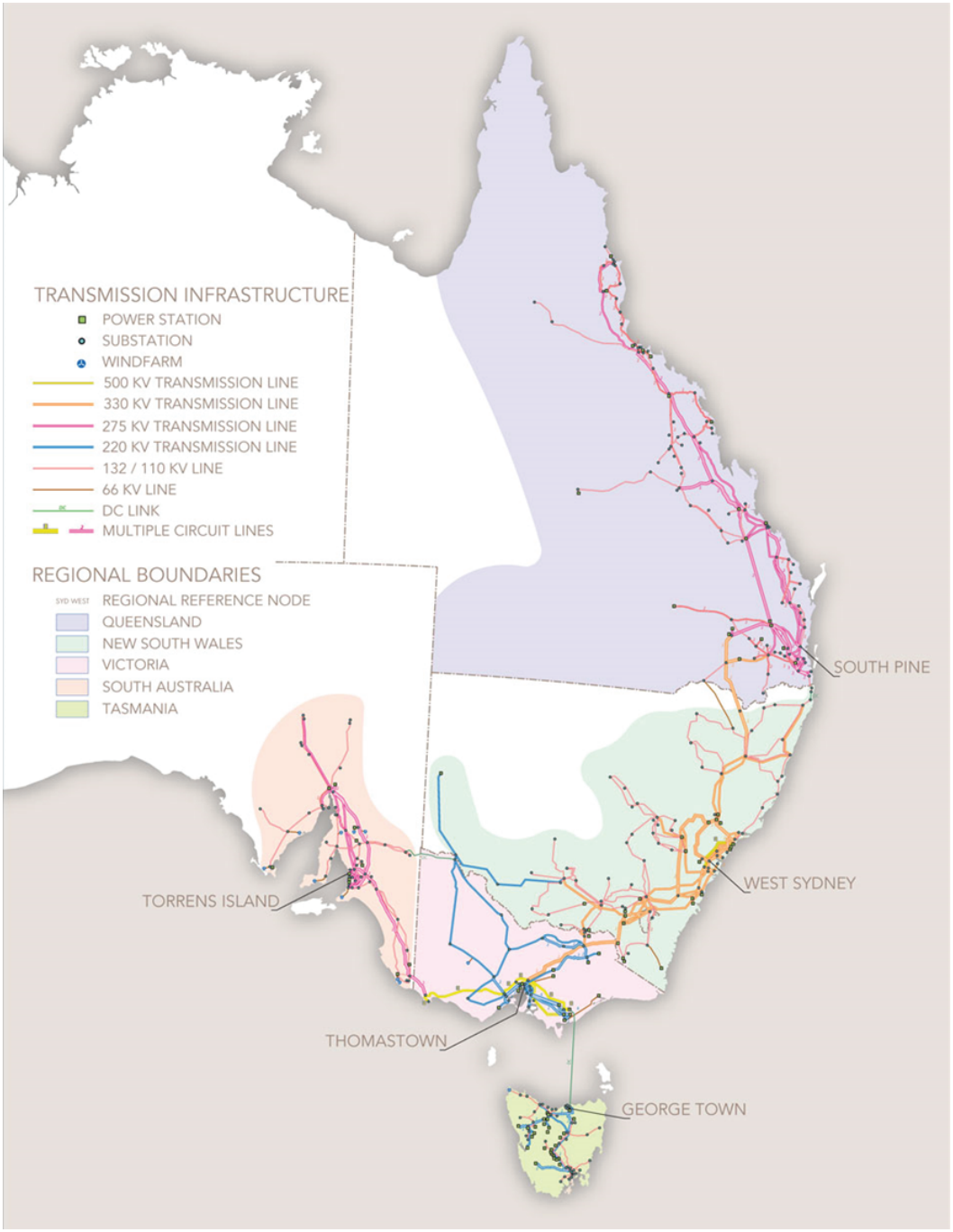
21 Australian Energy Market Operator, *National Electricity Market: fact sheet*, Australian Energy Market Operator Limited, Australia, December 2021, p. 1.

22 Australian Energy Market Operator, *About the National Electricity Market (NEM)*, 2022, <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/about-the-national-electricity-market-nem> accessed 6 December 2021.

Figure 2.2 below shows the regions and transmission infrastructure of the National Electricity Market.

2

Figure 2.2 The regions and transmission infrastructure of the National Electricity Market



Source: Australian Energy Market Commission, *National Electricity Market*, <https://www.aemc.gov.au/energy-system/electricity/electricity-system/NEM> accessed 2 March 2022.

The generation and transport of energy in the National Electricity Market

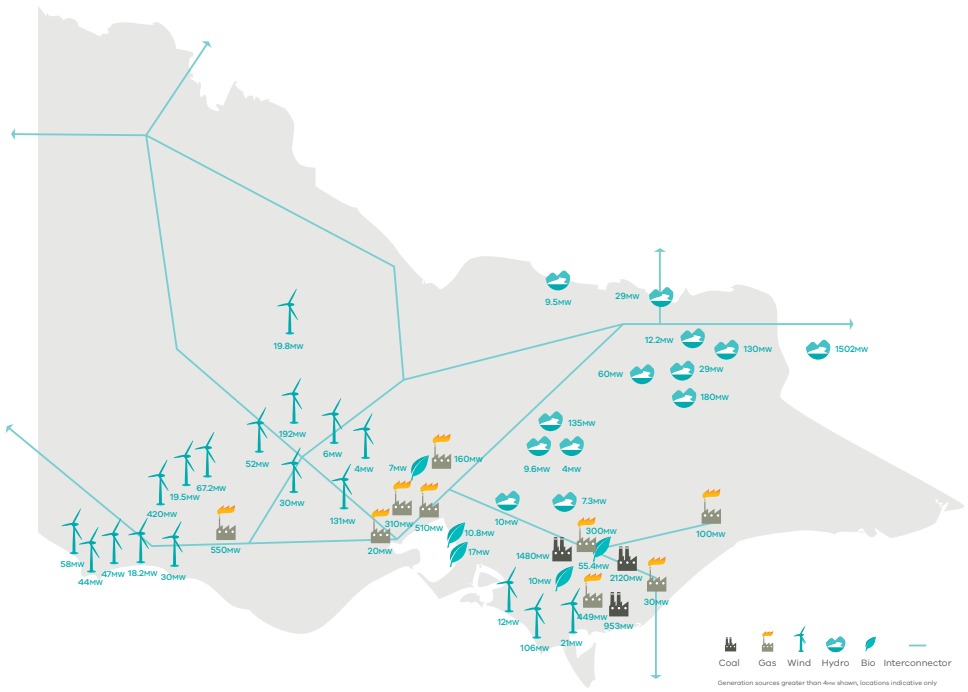
Energy is produced by generators such as the coal-fired power stations in Victoria's Latrobe Valley, or wind farms in Victoria's west.[23] Generators are located throughout the states that participate in the National Electricity Market, which in December 2021 produced a combined electricity generating capacity of 65,252 megawatts (MW).[24]

In Victoria, the major energy generators are the coal-fired power stations located in the Latrobe Valley, close to brown coal deposits. There is further generation capacity in the west and south of the state which has favourable conditions for wind generation and in the north-east, which are suitable for hydroelectric generators. Gas-fired power stations have been built close to Victoria's populated areas and there are some bioenergy generators. Victoria also has a significant uptake of rooftop solar on homes and businesses throughout the state.

Section 2.4 discusses Victoria's current mix of energy generators in more detail.

Figure 2.3 below, from Victoria's *Renewable Energy Action Plan* shows the geographic location of Victoria's energy generators in 2017 and the megawatt output of each type produced at that time.

Figure 2.3 The geographic location of energy generators in Victoria in 2017



Source: Department of Environment, Land, Water and Planning, *Renewable Energy Action Plan*, 2017, pp. 8–9.

23 Department of Environment, Land, Water and Planning, *Renewable Energy Action Plan*, report for Department of Environment, Land, Water and Planning, Victorian Government, Melbourne, 2017.

24 Australian Energy Market Operator, *National Electricity Market*, p. 1.

Energy produced by generators in the National Electricity Market is transported to homes and businesses via:

- transformers—that convert electricity to high and low voltage depending on the use
- transmission lines—to transport the high voltage electricity over long distances
- distribution lines—the poles and wires that transport electricity to individual homes and businesses.[25]

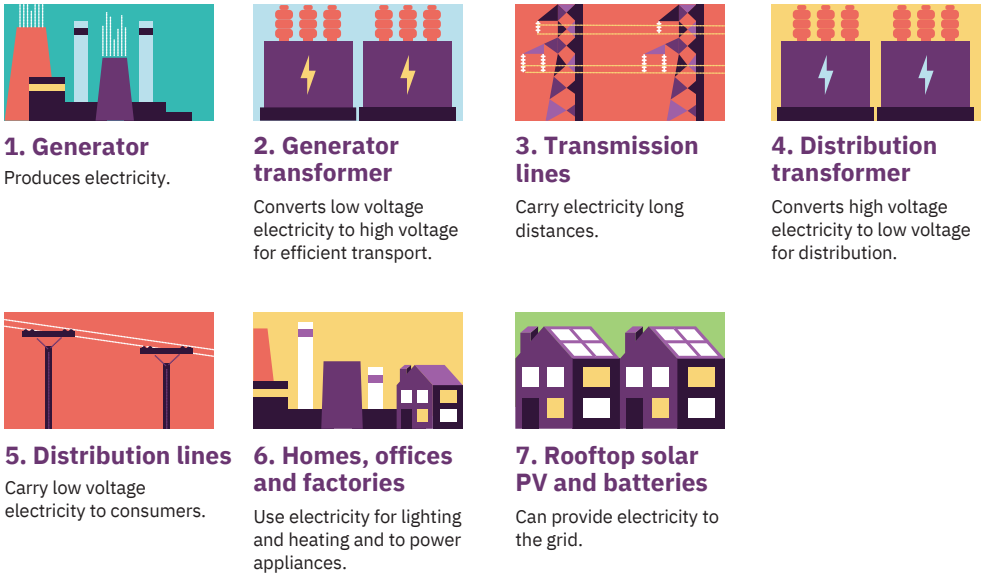
Rooftop solar and community energy projects also act as generators that feed energy into the network.

Transmission lines connect each state in the National Electricity Market so that states which produce excess energy can export it to others when needed. AusNet, a private company, owns and operates the Victorian transmission network.[26] The importance of transmission infrastructure and renewable energy will be discussed in Chapter 3.

In Victoria, there are five companies that operate the distribution networks of poles and wires to deliver energy to customers. They are each responsible for operating the distribution networks in different geographic regions of the state.[27]

Figure 2.4 from AEMO shows the transport of electricity in the National Electricity Market.

Figure 2.4 The transport of electricity in the National Electricity Market



Source: Australian Energy Market Operator, National Electricity Market Factsheet, December 2021, p. 2.

25 Ibid.

26 Department of Environment, Land, Water and Planning, *About the electricity sector*, 2022, <https://www.energy.vic.gov.au/electricity/about-the-electricity-sector> accessed 3 March 2022.

27 Department of Environment, Land, Water and Planning, *Electricity distribution businesses*, 2022, <https://www.energy.vic.gov.au/electricity/electricity-distributors> accessed 2 March 2022.

The decentralisation of generation in the National Electricity Market

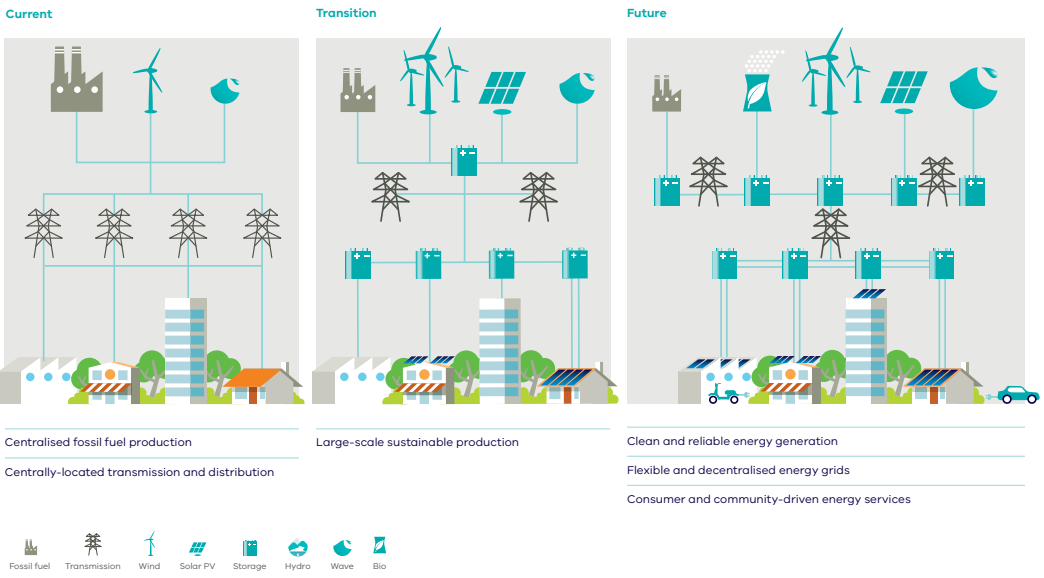
Traditionally, the transport of electricity in the National Electricity Market has been a one-way affair with energy transported from generators, via transmission and distribution lines to homes and businesses. However, the take-up of rooftop solar and batteries in particular, as well as the increasing number of community energy projects, has changed this dynamic. Individuals, communities and businesses are able to generate their own power and feed the excess into the grid or conserve it for later use via batteries.[28]

In addition, the increase in renewable energy generators has added complexity to the National Electricity Market due to the variability of their generating capacity. Renewable energy generators may not generate power when the sun doesn't shine and the wind doesn't blow. This means that a stable flow of power is not able to be delivered by renewable energy generators. As a result, tools such as batteries and catalytic converters may be used to maintain network strength.

These issues are discussed in detail in Chapter 3 of this report.

Figure 2.5 below from Victoria's *Renewable Energy Action Plan* shows how the generation capacity in the national electricity market has been decentralising and how the trend will continue into the future.

Figure 2.5 The decentralisation of generation and transmission in the National Electricity Network



Source: Department of Environment, Land, Water and Planning, *Renewable Energy Action Plan*, 2017, pp. 8–9.

28 Tony Wood and James Ha, *Go for net zero: A practical plan for reliable, affordable, low-emissions electricity*, report prepared by Grattan Insititute, Grattan Insititute, Australia, 2021, p. 8.

The spot market

The physical assets of the National Electricity Market—its generators and transmission lines—are just one aspect of the Market's functions. The sale of electricity also takes place in the National Electricity Market.

The AEMO, in its *The National Electricity Market* factsheet, outlines how the spot market operates as a dynamic wholesale energy market that links energy demand to the cheapest energy generators:

> The NEM is a wholesale commodity exchange for electricity across the five interconnected states. Electricity cannot be stored easily, so the electricity market works as a "pool", or spot market, where power supply and demand is matched instantaneously through a centrally coordinated dispatch process.
>
> Generators offer to supply the market with specified amounts of electricity at specified prices for set time periods and can re-submit the offered amounts at any time.
>
> From all the bids offered, the Australian Energy Market Operator (AEMO) decides which generators will be deployed to produce electricity, with the cheapest generator put into operation first. NEM operation is designed to meet electricity demand (or consumption) in the most cost-efficient way.[29]

The factsheet also notes that spare generating capacity is always kept in reserve in case demand unexpectedly increases and that the market is subject to limitations on the capacity of transmission lines serving generators and consumers.[30]

The price of electricity fluctuates and is determined every five minutes based on demand, and the amount of energy being offered by generators. Regulators have set a maximum price of $15,000 per megawatt hour, and a minimum of $1,000 per megawatt hour.[31]

2.3.2 Governance and operation of the National Electricity Market

The Australian Energy Market Operator

AEMO is a public company that is owned principally by the Governments of the states that participate in the Market and the Commonwealth Government, as well as energy industry members. AEMO's role is to oversee the operation of National Electricity Market on a day-to-day basis, manage the market for buying and selling energy and deal with energy flows around the system.[32] This includes monitoring electricity consumption and the flow of energy across the network and ensuring there is enough

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29 Australian Energy Market Operator, *National Electricity Market*, p. 3.

30 Ibid.

31 Ibid.

32 Australian Energy Market Operator, *Our members: AEMO government members*, 2016, <https://aemo.com.au/about/our-people/our-members> accessed 3 March 2022.

supply to meet demand. AEMO can issue notices for more generation capacity where it is needed. It also monitors the voltage and frequency across the network to make sure the system stays operational.[33]

In its submission to the Inquiry, AEMO explained its role in the National Electricity Market and how it works to deliver electricity to consumers in the most cost-effective way:

> Under its declared network functions, including for Victorian transmission planning, as set out in the National Electricity Law (NEL), AEMO is responsible for planning and directing augmentation on the Victorian electricity transmission Declared Shared Network (DSN). AEMO works closely with stakeholders, including other network service providers (NSPs), industry stakeholders, consumers representatives, and other interested parties, to develop a power system in the most cost-effective way for the benefit of consumers.[34]

AEMO also plays a key role in planning, forecasting and modelling future energy needs. This includes a key role in mapping the transition toward renewable energy such as when and where renewable generators will be needed as fossil fuel generators retire. AEMO also maps out how renewable energy generators will be integrated into the National Electricity Market by planning for transmission infrastructure, batteries and other measures to ensure system stability. Much of this work is outlined in AEMO's two yearly Integrated System Plan (ISP), and in AEMO's Victorian Annual Planning Report (VAPR), which reviews the performance of Victoria's transmission network.[35]

The Australian Energy Market Commission

The Australian Energy Market Commission is an independent statutory body. It makes and amends the National Electricity Rules, National Gas Rules and National Energy Retail Rules, which are provided for under the *National Energy (South Australia) Act 1996*.[36] These rules govern the operation of the National Electricity Market and the regulation of monopoly transmission and distribution networks.

The Australian Energy Market Commission cannot propose new rules. Instead, stakeholders in the National Electricity Market including Governments, industry and customers can request new rules or changes to the rules. The Commission then consults on the proposal and makes a determination about whether the rule change should go ahead, based on whether it is in the long-term best interests of consumers.[37]

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33 Australian Energy Market Operator, *National Electricity Market*, p. 4.

34 Australian Energy Market Operator, *Submission 72*, p. 2.

35 Ibid.; Department of Environment, Land, Water and Planning, *Submission 88*, p. 10.

36 Australian Energy Market Commission, *About Us*, 2022, <https://www.aemc.gov.au/about-us> accessed 21 December 2021.

37 Ibid.

The Australian Energy Regulator

The Australian Energy Regulator regulates the electricity transmission and distribution networks in the National Electricity Market. It enforces the rules made by the Australian Energy Market Commission and monitors the conduct of market participants and the effectiveness of competition.[38]

2.3.3 The role of the Victorian Government in the energy system

The Victorian Government works with AEMO in particular to set policies that ensure the National Electricity Market has the physical infrastructure to function smoothly and to facilitate the transition to renewable energy.

The Victorian Government assists with:

- planning
- environmental policy
- investment facilitation
- community engagement
- resource allocation.[39]

The Department of Environment, Land, Water and Planning (DELWP) is the agency that delivers policy, planning and regulatory services with respect to energy. Chapter 3 of this report gives an overview of the activities of the Victorian Government in transitioning to renewable energy.

Agencies and divisions within the Department deliver various policies and initiatives in relation to energy. This includes Solar Victoria, which delivers the Victorian Government policies in relation to distributed energy resources such as rooftop solar and batteries. VicGrid is a newly created division of the Department that will oversee investment decisions related to the Government's renewable energy zone fund.[40]

Renewable energy zones are discussed in Chapter 3.

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38 Australian Energy Regulator, *About us*, <https://www.aer.gov.au/about-us> accessed 3 March 2022.

39 Adapted from: Department of Environment, Land, Water and Planning, *Who runs our energy system: Figure: Our stationary energy system*, 2022, <https://www.energy.vic.gov.au/about-energy/who-runs-our-energy-system> accessed 30 March 2022.

40 Hon Lily D'Ambrosio MP, Minister for Energy, Environment and Climate Change, *New Projects To Accelerate Victoria's Renewable Energy Zones,* media release, Victorian Government, Melbourne, 3 August 2021.

2.4 The energy generator mix in Victoria and the trend toward renewable energy

2.4.1 The current generator mix

Fossil fuels, particularly Victoria's brown-coal fired generators in the Latrobe Valley, account for most of Victoria's current energy generation capacity.[41] A 2020–21 report by DELWP on the progress towards Victoria's renewable energy targets (see Chapter 3 for more information on renewable energy targets) noted that the proportion of energy generated from fossil fuels was approximately 70%.[42] The vast majority of this generation capacity is provided by Victoria's brown coal power stations in the Latrobe Valley: Yallourn and Loy Yang (A and B).[43]

The Latrobe Valley's coal-fired power stations have historically provided the majority of Victoria's energy needs, owing to the significant brown coal deposits in the Valley, which are located close to the surface. Brown coal differs to black coal because it is younger and has a higher water content. This higher water content means it produces more carbon emissions than black coal when used for energy.[44]

Figure 2.6 from OpenNEM, an initiative from the University of Melbourne's Clean Energy Hub, shows the proportion of the energy generated in Victoria since 2000 by generator type. As can be seen, brown coal (shown in brown) has historically been the largest contributor to Victoria's energy production. However, the proportion of renewable energy generators, shown in yellow (solar), green (wind) and blue (hydro), has increased in recent years.

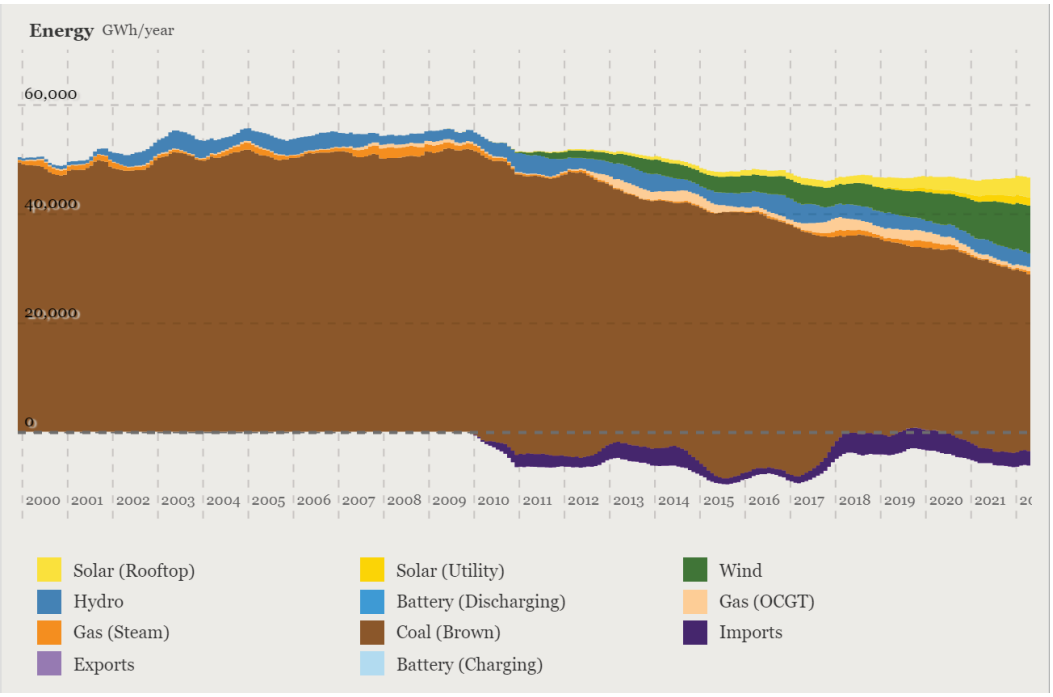
41 OpenNEM, *An Open Platform for National Electricity Market Data*, <https://opennem.org.au/energy/vic1/?range=all-12-mth-rolling&interval=1M> accessed 6 December 2021.

42 Department of Environment, Land, Water and Planning, *Victorian Renewable Energy Target: 2020–21 Progress Report*, Victorian Government Melbourne, 2021, p. 6.

43 Department of Environment, Land, Water and Planning, *Victorian Renewable Energy Target: 2019–20 Progress Report*, Victorian Government Melbourne, 2020, p. 5.

44 Graeme James, *Submission 39*, p. 8.

Figure 2.6 The proportion of energy generated in Victoria from brown coal and other sources since 2000



Source: OpenNEM, <https://opennem.org.au/energy/vic1/?range=all-12-mth-rolling&interval=1M> accessed 12 May 2022.

2.4.2 The decline of coal-fired generation

The National Electricity Market is undergoing what AEMO calls a 'once in a century transition'.[45] This transition is seeing the retirement of large coal-fired generators, including those in the Latrobe Valley, in favour of renewable energy generators located across the state. The emerging system is also characterised by distributed energy resources such as rooftop solar and batteries.

Kane Thornton, CEO of the Clean Energy Council noted that coal-fired generators were closing due to both environmental concerns and the commercial considerations of running and maintaining the ageing generators:

> We have seen across the country the rate at which our old coal-fired generation is closing down. There are very clear climate change drivers that mean those generators do need to phase out the clearly major sources of emissions, but beyond that what we know is that these generators are old, they are getting older and they are becoming less reliable and more expensive to run. So I think we need to be realistic in that the pace of retirement of these generators is only going to accelerate and we do not have time to dither.[46]

45 Australian Energy Market Operator, *Draft 2022 Integrated System Plan For the National Electricity Market*, working paper, Australian Energy Market Operator Limited, 10 December 2021, p. 1.

46 Kane Thornton, Chief Executive Officer, Clean Energy Council, public hearing, Melbourne, 16 March 2022, *Transcript of evidence*, p. 31.

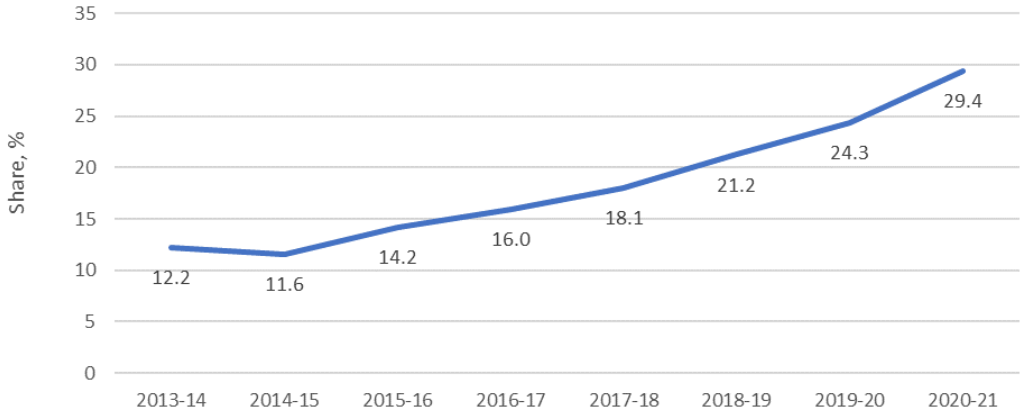
The coal-fired power stations of the Latrobe Valley are expected to close before 2050. Energy Australia announced the closure of Yallourn Power Station for 2028. Loy Yang A will close in 2045.[47]

AEMO has noted in its *Draft 2022 Infrastructure System Plan* that coal-fired power generation is closing two to three times faster than anticipated. It predicts that all brown coal generators in the National Electricity Market, including Victoria's, could close by 2032.[48]

2.4.3 The increase in renewable energy generation

Victoria has been steadily increasing its share of renewable energy generators in recent years, from around 12.2% in 2013–14 to 29.4% over the 2020–21 financial year.[49] This increase is shown in Figure 2.7 below.

Figure 2.7 Victorian renewable electricity generation share, 2013–14 to 2019–20



Source: Department of Environment, Land, Water and Planning, Victorian Renewable Energy Target, *2020–21 Progress Report*, p. 6.

According to DELWP's *Victorian Renewable Energy Target, 2020–21 Progress Report,* the major contributors to renewable generation in Victoria over the 2020–21 financial year were:

- wind generation, which contributed 14.8% of electricity generated in Victoria
- rooftop solar, which contributed 5.7% of electricity generated in Victoria
- hydroelectricity, which contributed 5.3% of electricity generated in Victoria
- utility scale (large scale) solar, which contributed 2.6% of electricity generated in Victoria.[50]

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47 Hon Angus Taylor, Minister for Industry, Energy and Emissions Reduction, *Statement on early closure of Loy Yang A and Bayswater power stations* media release, Commonwealth of Australia, 10 February 2022.

48 Australian Energy Market Operator, *Draft 2022 Integrated System Plan* p. 9.

49 Of the total of 48,719 GWh of electricity generated in Victoria in 2019–20 from all sources.

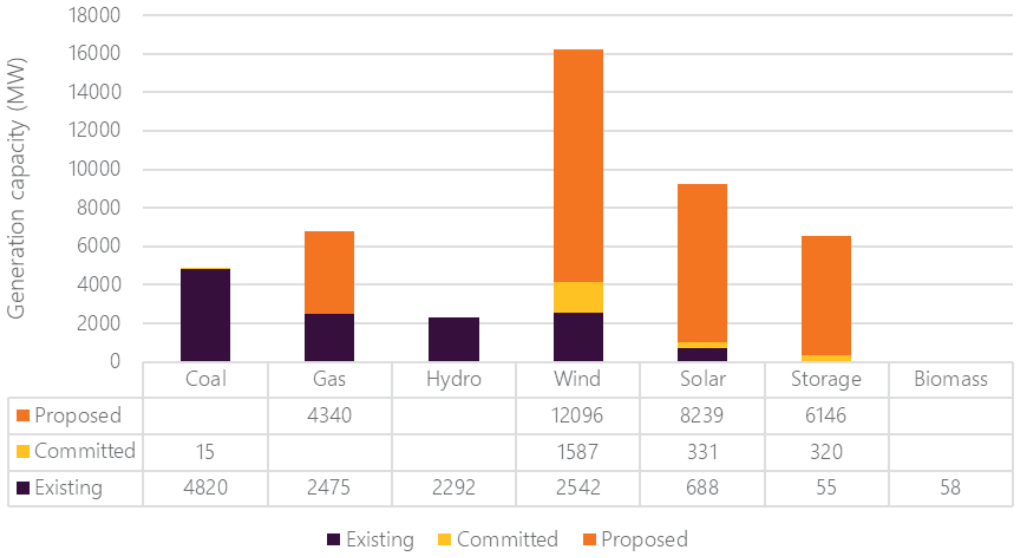
50 Department of Environment, Land, Water and Planning, Victorian Renewable Energy Target, 2020–21 Progress Report, p. 5.

Mr Thornton from the Clean Energy Council described the rapid uptake in renewable energy in Victoria over the past five years:

> What we have seen over the past five years or so is enormous growth in levels of investment in renewable energy in the state of Victoria. I guess, in utility-scale projects we have seen record levels of investment in things like wind farms and solar farms throughout the state of Victoria but also the growth of householders also taking the opportunity to put things like rooftop solar on their house, and now a shift towards household batteries and that sector really starting to grow.[51]

Figure 2.8 from AEMO's *Victorian Annual Planning Report 2021* outlines the existing mix of energy generators, those committed to and those proposed in Victoria. It shows that the vast majority of upcoming energy projects are renewable, and if completed they will provide a far larger energy generation capacity than is currently available with coal.

Figure 2.8 Existing, committed and proposed large-scale generation capacity in Victoria, October 2021



	Coal	Gas	Hydro	Wind	Solar	Storage	Biomass
Proposed		4340		12096	8239	6146	
Committed	15			1587	331	320	
Existing	4820	2475	2292	2542	688	55	58

Source: AEMO, Victorian Annual Planning Report 2021, 2021, p. 5.

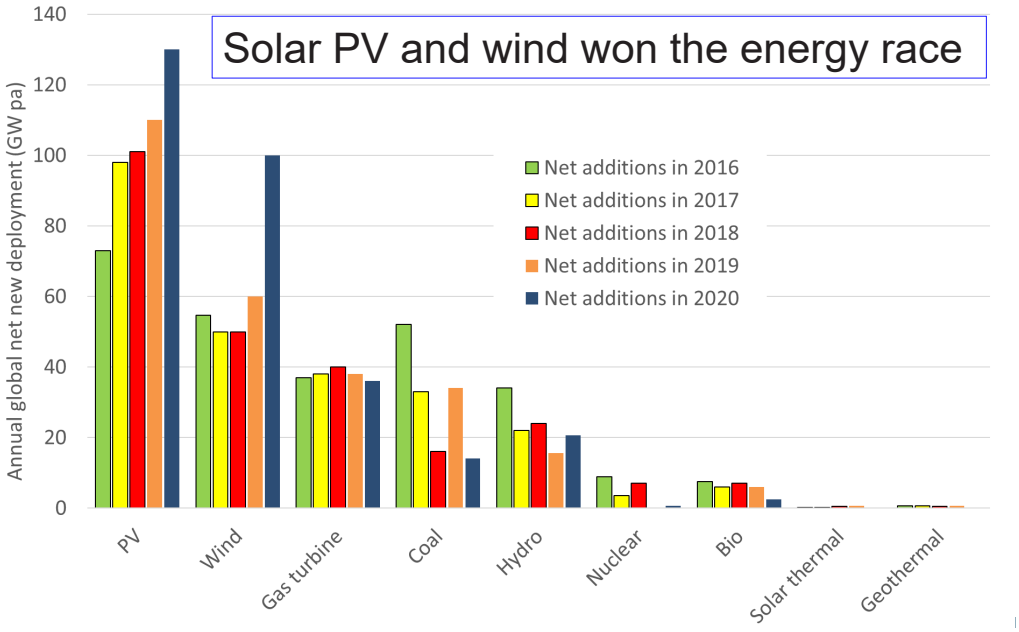
The trend in Victoria towards renewable energy mirrors the transition to renewable energy happening globally. At a public hearing, Professor Andrew Blakers, E2 Professor of Engineering at the Australian National University, presented to the Committee a slide (Figure 2.9) showing the global annual net new generation capacity. He explained that new fossil fuel generation projects are increasingly rare and in Australia 99% of new generator projects are renewable:

> The first point to make is that solar PV and wind won the energy race hands down. This is a graph of a bunch of energy generation technologies—all of them actually—and the size of the bar is the global capacity additions in 2016, 17, 18, 19 and 20. You can see on the left-hand end that solar PV and wind are now three-quarters of global net new

51 Kane Thornton, *Transcript of evidence*, pp. 30–31.

generation capacity, and in Australia they are 99 per cent. All the others—gas, coal, hydro, nuclear, bio, solar thermal, geothermal—are also-rans. Solar and wind just keep growing and growing, and the others keep static or shrinking. So it is solar and wind from now for at least the next few decades. There is nothing in sight that will be able to challenge solar and wind.[52]

Figure 2.9 Global annual net new generation capacity



Source: Professor Andrew Blakers, Australian National University, presentation to the Committee, public hearing, Melbourne, 17 March 2021, p. 2

The Australian Energy Council, a peak body for energy retailers and suppliers, told the Committee they were concerned that the energy sector was carrying the burden for the majority of emissions reductions in Australia. Ben Skinner, General Manager, Policy and Research at the Australian Energy Council noted the amount:

> We are making great strides in reducing carbon. If you just look at the table on page 2 of the submission, which shows how much electricity is reducing its emissions by, projected within eight years to be less than half of what it was at the start of this journey, it is incredible that such an industry, that has been built up over a century with billions of dollars involved, is going through such a transition at such a rate. But in doing so, it is also an incredibly technically complicated industry and an essential service, so in going through at that sort of rate there are huge risks.[53]

The Committee acknowledges the significant efforts being made in Victoria's energy sector to reduce its carbon emissions. As noted by AEMO in its 2022 Draft ISP, the transition underway in the energy sector towards renewable energy is historic.

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52 Professor Andrew Blakers, Institute for Climate, Energy & Disaster Solution, Australian National University, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 1.

53 Ben Skinner, General Manager Policy and Research, Australian Energy Council, public hearing, Melbourne, 16 March 2022, *Transcript of evidence*, p. 12.

The transition will bring economic benefits for consumers, generator operators and most significantly, help to reduce the threats associated with climate change. However, communities where renewable generators will be built have expressed concern about the impacts they might face from the construction of large scale infrastructure. These issues are discussed in the following Chapter.

3 Measures to transition to 100% renewable energy

3.1 Introduction

> **But if I can do one quick plea for Australia's role in this: we have the easiest path of any nation in the world, absolutely. We have the best wind, we have the best solar, we have had the rooftop solar revolution, we have a trained workforce and we are a relatively wealthy country. We could increase the ambition of all of the world on climate by being the country that goes fast and proves the positive economics at household, at community and at state level to the rest of the world.**
>
> Dr Saul Griffith, Founder, Rewiring Australia, *Transcript of evidence*, public hearing, Melbourne, 17 March 2022, p. 9.

A remarkable transition is underway in Victoria to shift its energy generation capability from fossil fuels toward carbon free renewable energy. In the absence of strong coordinated action at the Commonwealth level, the Victorian Government has stepped in to lead the transition by establishing the regulatory structures and investment pathways needed to build its energy future.

Victoria has the natural assets to transition to 100% renewable energy. These assets include strong and reliable wind speeds in the south and west, high solar radiation in the north-west and areas suitable for hydroelectricity, including pumped hydro, in the north-east of the state.

There are many challenges ahead to ensure the transition to renewable energy is coordinated well and the right infrastructure is built at the right time. This is particularly important given the need to build renewable energy generators and transmission infrastructure at a number of locations across the state. Policy makers also need to take into account the variability of renewable energy and the projections for growing energy demand as the transport sector and households electrify their energy use.

One of the key challenges is ensuring community support for the construction of renewable energy generators and transmission infrastructure in the regions they need to be built. These areas, known as renewable energy zones, are the most suitable places to harness Victoria's abundant wind and sun resources. Work is needed to improve community engagement, ensuring the creation of local jobs and sharing the financial benefits of renewable energy projects in these areas. Regional communities have much to gain in the nation-building transition to renewable energy.

3.2 The Victorian Government's emissions reduction targets and renewable energy targets

The Victorian Government has acknowledged the importance of reducing carbon emissions to tackle climate change. It also recognises that because the energy sector is responsible for approximately 70% of Victoria's emissions[1], pursuing renewable energy is one of the most effective ways to reduce overall emissions.

To achieve these aims, the Victorian Government has legislated both:

- emissions reduction targets, under the *Climate Change Act 2017*[2]
- renewable energy targets, under the *Renewable Energy (Jobs and Investment) Act* 2017.[3]

In relation to emissions reduction targets, the *Climate Change Act 2017* sets a legislated long-term goal of net zero greenhouse gas emissions by 2050.[4] It also requires the Victorian Government to set interim emissions reduction targets every five years leading up to 2050.[5]

So far, the Victorian Government has set the following targets:

- in 2025, to have emissions 28–33% below 2005 levels
- in to 2030, to have emissions 45–50% below 2005 levels.[6]

In relation to renewable energy targets, the *Renewable Energy (Jobs and Investment) Act 2017* has legislated the following targets for the proportion of energy generated in Victoria to be from renewable sources:

- 25% by 2020
- 40% by 2025
- 50% by 2030.[7]

In its submission to the Inquiry, the Department of Environment, Land, Water and Planning (DELWP) outlined how the renewable energy targets provide investment certainty and a signal to the market about the need to transition to renewable energy:

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1 Department of Environment, Land, Water and Planning, *Victoria's greenhouse gas emissions and targets: Where Victoria's emissions come from*, 2022, <https://www.climatechange.vic.gov.au/victorias-greenhouse-gas-emissions-and-targets#toc__id_0_where> accessed 25 October 2021.

2 *Climate Change Act 2017* (Vic) ss 6(1), 10.

3 *Renewable Energy (Jobs and Investment) Act 2017* (Vic) s 7.

4 *Climate Change Act 2017* (Vic) s 6(1).

5 Ibid., p. 10.

6 Department of Environment, Land, Water and Planning, *Victorian Government action on climate change*, 2022, <https://www.climatechange.vic.gov.au/victorian-government-action-on-climate-change> accessed 5 March 2022.

7 *Renewable Energy (Jobs and Investment) Act 2017* (Vic) s 7.

> The Victorian Government has legislated strong Renewable Energy Targets which require renewable energy to contribute 25 per cent of Victoria's electricity generation by 2020, 40 per cent by 2025 and 50 per cent by 2030. They are providing a clear, long-term signal to the market about the need to transition.
>
> Victoria comfortably surpassed its 2020 renewable energy target of 25 per cent and will exceed 30 per cent by the end of 2021, meaning that the share of renewables in power generation has nearly tripled since the beginning of 2015.[8]

Greg Foyster, Acting Campaigns Manager at Environment Victoria noted that on current forecasts the Victorian Government is on track to meet its 50% target sooner than 2030, and argues it should revise the target to be more ambitious:

> the Victorian government still has a renewable energy target of 50 per cent by 2030, and by our calculations and forecasts from the Australian Energy Market Operator we are well on track to overachieve that. So one of our recommendations is to significantly increase that target to close to 100 per cent by 2030 if you are just looking at the electric grid—and much further. If you include clean manufacturing or clean renewable export strategy, you would need an even higher target.[9]

In addition to the legislated emissions reduction targets, the Victorian Government has announced targets for offshore wind generators including targets of 4 gigawatts (GW) of generation capacity to be delivered by offshore wind by 2035 and 9 GW by 2040.[10] This is discussed further in Section 3.4.2.

A number of policies to facilitate the construction and integration of renewable energy generators into Victoria's energy system flow from the emissions reduction targets and the renewable energy targets. These include Victoria's renewable energy zones and the creation of VicGrid, as well as programs such as the Solar Homes program which has seen Victoria's share of rooftop solar grow significantly. These programs are discussed in more detail in Section 3.4.3.

3.2.1 Acting ahead of the Commonwealth Government

As discussed in Chapter 2, the National Electricity Market sees the five states and territories on the Australia's eastern seaboard joined together in a regulatory arrangement that includes network planning. However, the Committee heard that because of reluctance on the part of the Commonwealth Government to coordinate the transition to renewable energy at a national level, State Governments including Victoria are choosing to act alone.

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8 Department of Environment, Land, Water and Planning, *Submission 88*, p. 4 (with sources).

9 Greg Foyster, Acting Campaigns Manager, Environment Victoria, public hearing, Melbourne 17 March 2022, *Transcript of evidence*, p. 13.

10 Premier Hon Daniel Andrews MP, *Victoria Launches Australia's First Offshore Wind Targets*, media release, Victorian Government, Melbourne, 4 March 2022.

Kane Thornton, CEO of the Clean Energy Council told the Committee that State Governments have stepped up to fill the void in leadership created by the absence of action on climate and energy policy at the Commonwealth level:

> We know that particularly the federal political environment has been very difficult as far as climate and energy for quite a few years, and very clearly there is a role for state governments to step up and fill that void and provide the sort of leadership that is necessary to make sure we continue the transition and take advantage of those opportunities in front of the state of Victoria.[11]

Professor Bruce Mountain, Director of the Victoria Energy Policy Centre said that Victoria was a leader amongst State Governments on renewable energy policy and gave a list of the programs that the Government had pursued in lieu of action from the Commonwealth Government:

> I guess the main point I would make—and perhaps it is dearest to my heart—is about the institutional arrangements, which I have characterised as Victoria going its own way. Arguably it has been a leader in energy in terms of going its own way. Other states are not far behind; they have all announced substantial policies to develop their own clean energy infrastructure. They have all realised that the quasi-national arrangements are not serving them well, and the lack of agreement at the federal level has meant that states need to take it into their own hands. And I point out major policy and implementation issues that show this: first of all, in 2018 Solar Homes and the Solar Victoria institution that actually implements that; the Victorian default offer in retail markets; the Victorian government's recent decision to say no to a solar tax on exports; VicGrid—the formation of an institution to plan the distribution and transmission infrastructure; the Victorian government saying recently that it is not going to allow payments to coal generators to be available, to be actually part of a national scheme, which I think is also landmark; and finally, offshore wind. I think all of these are positive decisions, but I would encourage the government to go further in developing the institutions to execute the regionalisation, which makes very good economic sense but to execute it more thoroughly and more deeply and perhaps more quickly.[12]

Mr Thornton said that the Victorian renewable energy targets have created certainty for renewable energy generator investors in comparison to uncertainty at the Commonwealth level:

> Look, the VRET [Victorian Renewable Energy Target] program, as I said, has been absolutely crucial to providing certainty for investors in the state of Victoria. I guess ultimately what we are talking about are big projects; they cost often many hundreds of millions of dollars. What we know is that investors are very enthusiastic to build and develop these projects. We know that they are the lowest cost form of new generation to build, so they are cheaper than any of the alternatives, but nevertheless, in part because of the uncertainty at a federal policy level—'Do we have a price on carbon or

11 Kane Thornton, Chief Executive Officer, Clean Energy Council, public hearing, Melbourne, 16 March 2022, *Transcript of evidence*, pp. 33–34.

12 Professor Bruce Mountain, Director, Victoria Energy Policy Institute, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, pp. 32–33.

> do we not?', 'Will the federal government be building new generation or not?—policies chop and change. All of that means that investors have been hesitant to make these big investments. That is where the state governments do play and have played a very important role.[13]

The Committee notes that the Commonwealth Government has produced a policy, *Australia's Long-term Emissions Reduction Plan, A whole-of-economy Plan to achieve net zero emissions by 2050* that supports net zero emissions by 2050.[14] However, there remains uncertainty and scepticism amongst inquiry stakeholders about the Commonwealth Government's previous record on renewable energy and willingness to lead energy reform at a national level.[15]

The Australian Energy Council, a peak body for energy retailers and suppliers, presented a contrary view. They argued that the Victorian Government should be less active in relation to emissions reduction and renewable energy targets and wait for the Commonwealth Government to lead reform at a national level. This is because states pursuing their own policies in a national system can lead to inefficiencies, which may ultimately be costly. Their submission said:

> The AEC [Australian Energy Council] firmly believes emissions abatement is a policy that should be engaged at the national rather than sub-national level. Actions taken at the sub-national level are inherently less efficient, ultimately costing the Victorian economy more and can lead to investor disruption, increases in customer prices and falling energy supply reliability. They can even be environmentally ineffective due to "carbon leakage" effects.
>
> The AEC also recognises that Victoria has greater environmental ambition than those presently adopted at the Commonwealth level. The AEC recommends that instead of "going it alone", the Victorian government should be prosecuting its view at the national level. This should be directly to the Commonwealth, and to all jurisdictions via the National Cabinet. By working at that level, it may be possible to achieve the decarbonisation in a way that is lower cost, less risky to Victorians and ultimately more environmentally effective.[16]

Ben Skinner, General Manager, Policy and Research at the Australian Energy Council also argued that renewable energy underwriting arrangements pursued by the Victorian Government could lead to inefficiencies and put investment risk onto taxpayers:

> we talk a bit about renewable energy underwriting arrangements. Victoria, and to some extent New South Wales, have gone into unilateral underwriting arrangements with large-scale renewable energy. We believe it is problematic on many fronts to go down that path. Firstly, it distorts the market signals of what should be the most efficient

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13 Kane Thornton, *Transcript of evidence*, pp. 33–34.

14 Australian Government Department of Industry, Science, Energy and Resources, *Australia's whole-of-economy Long-Term Emissions Reduction Plan: A whole-of-economy Plan to achieve net zero emissions by 2050*, report prepared by Department of Industry, Science, Energy and Resources, Commonwealth of Australia, 2020, p. 39.

15 See for example; Greg Foyster, *Transcript of evidence*, p. 12.; Kane Thornton, *Transcript of evidence*, pp. 33–34.

16 Australian Energy Council, *Submission 63*, p. 3.

> investments that should arise in a market in the most efficient locations. Secondly, it tends to move risks downstream from investors to taxpayers or customers. With the Victorian renewable options, the risks are being put on Victorian taxpayers.[17]

However, Mr Thornton believed that Victorian Government taking on some of the commercial risks meant that investors had certainty and were more likely to bid to build the infrastructure:

> VRET is the Victorian renewable energy target, which is basically a mechanism that has been designed to provide some certainty to those investors. It means essentially offering a contract for the output of the project. These projects get built, and as I said they are quite capital intensive. They will then operate for 20, 25, 30 years, and investors need some level of certainty about the revenue they will get by selling the energy. In difficult times, as we have seen over the last five years, having the Victorian government essentially as an offtake partner prepared to enter into a contract that gives that investor some certainty about the revenue they will receive allows the investor to go ahead and essentially make a commitment to the project, construct the project and have it come into operation. Noting what we have seen is that this comes at very little cost to the Victorian government and taxpayer because ultimately the Victorian government is purchasing that electricity on a contract but essentially then gets to utilise or sell off that electricity at very little cost. In some cases we have actually seen those contracts being quite profitable for the taxpayers of Victoria because of the nature of them. But from an industry perspective they provide some of that assurance and confidence to be able to go ahead with the projects. [18]

While the Committee agrees there are risks involved with pursuing emissions reduction and renewable energy policy in a way that is not nationally coordinated, there are also risks with not acting. As noted in Chapter 5, the IPCC report on climate changes highlights the serious dangers to Australia's climate of not reducing emissions urgently. In this light, the Committee believes the Victorian Government's actions to progress the transition to renewable energy without national coordination from the Commonwealth Government are prudent.

The Committee commends the Victorian Government's emission reduction targets and renewable energy targets. They provide certainty for participants in Victoria's energy system about the Victorian Government's intention to encourage the transition to renewable energy. This certainty reduces financial risk and encourages investment.

FINDING 1: The Victorian Government's emission reduction targets and renewable energy targets provide certainty to the market about Victoria's intention to transition to renewable energy. This assists participants in Victoria's energy system to invest in renewable energy generators.

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17 Ben Skinner, General Manager Policy and Research, Australian Energy Council, public hearing, Melbourne, 16 March 2022, *Transcript of evidence*, p. 13.

18 Kane Thornton, *Transcript of evidence*, p. 34.

3.3 Renewable energy zones and renewable energy auctions

To assist with the transition to renewable energy the Victorian Government has worked in partnership with AEMO to identify six renewable energy zones across the state.[19] The zones are in areas which are suitable for renewable energy generators and located close to existing transmission infrastructure. However, a number of submitters called for clarity in relation to land use planning in the renewable energy zones.

To encourage the establishment of renewable energy generators in these areas, the Victorian Government has held renewable energy auctions which call for bids from commercial renewable energy project proponents to build generators.

3.3.1 Renewable energy zones

AEMO has worked with participating State Governments in the National Electricity Market, including the Victorian Government, to identify renewable energy zones. In it's *2020 Integrated System Plan*, AEMO outlined how the establishment of renewable energy zones is designed to reduce costs and optimise the mix of renewable generators, storage and transmission infrastructure to deliver higher generation capacity and minimise the risks associated with the variability of renewable energy. The document said:

> If well located, REZs [renewable energy zones] can materially reduce total system and transition costs. They can:
>
> - reduce the need to build transmission into new areas
> - reduce project connection costs and risks
> - optimise the mix of generation, storage and transmission investment across multiple connecting parties
> - co-locate and optimise the otherwise 'lumpy' investments in network and system support infrastructure
> - co-locate and optimise weather observation stations to improve real-time forecasting
> - realise benefits of capital scale in all those investments
> - promote regional expertise and employment at scale, and
> - create investable, low risk opportunities for the private sector to invest in Australia's energy system.[20]

19 Department of Environment, Land, Water and Planning, *Victorian Renewable Energy Zone Development Plan Directions Paper*, Victorian Government, Melbourne, February 2021, p. 2.

20 Australian Energy Market Operator, *Submission 72, Attachment 2*, p. 45.

AEMO worked with the Victorian Government to identify six renewable energy zones in Victoria. They are located in:

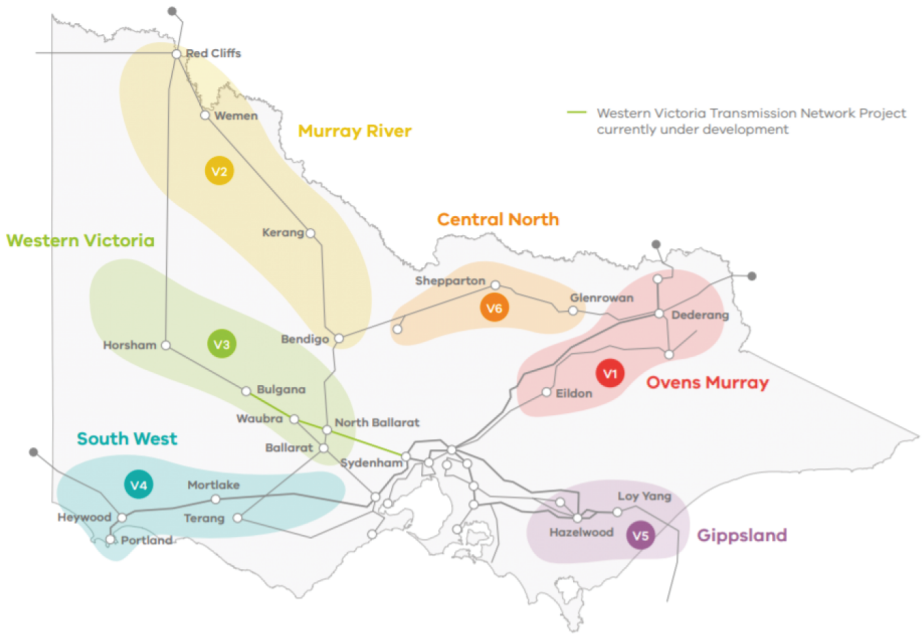
1. Ovens Murray
2. Murray River
3. Western Victoria
4. South West
5. Gippsland
6. Central North.

Victoria's renewable energy zones are placed in areas which the weather conditions are suitable for renewable energy generators, for example, the south-west has high average wind speed for wind turbines. The natural features of renewable energy zones are another consideration. For example, the Ovens Murray has mountainous terrain and bodies of water that are suitable for hydroelectric generators.[21]

The renewable energy zones identified are also on established transmission corridors, lessening the cost of transmission infrastructure, although some transmission network upgrades will be required. Section 3.6 discusses transmission infrastructure.

Figure 3.1 below shows Victoria's renewable energy zones and the associated transmission infrastructure.

Figure 3.1 Victoria's renewable energy zones and associated transmission infrastructure



Source: Energy Victoria, Renewable Energy Zones, <https://www.energy.vic.gov.au/renewable-energy/renewable-energy-zones> accessed 17 December 2021.

21 Ibid., p. 48.

The submission from DELWP outlined how the Victorian Government has advanced the development of Victoria's renewable energy zones through the establishment of a fund to invest in transmission upgrades. In addition, the Government has created a new division within DELWP called VicGrid to oversee the planning and upgrade of the network. The submission said:

> the Victorian Government has established a $540 million Renewable Energy Zone Fund to invest in upgrades to the transmission network within the REZs and created a new body, VicGrid, to actively plan and develop Victoria's REZs and unlock new renewable electricity investment ...
>
> ... This funding will support existing and future renewable generation development in Victoria's REZs by enabling near-term investments to reduce existing constraints and support the connection of Victoria's pipeline of large-scale renewable energy projects. These investments, together with funding of REZ projects, will enable a step-change in our transition to renewable energy by modernising our electricity grid infrastructure and supporting the development of REZs across the state.[22]

The Victorian Government has also published a *Renewable Energy Development Plan* and has directed AEMO to procure and deliver six projects outlined in Phase 1 of the plan.[23] The projects include three system strengthening initiatives and three transmission upgrades.[24]

Infrastructure Victoria is supportive of the Government's funding to develop renewable energy zones and the creation of VicGrid. It believes VicGrid should play an ongoing role in Victoria's renewable energy transition by coordinating transmission investments and facilitating community consultation.[25] However, Infrastructure Victoria urged the Government to conduct an assessment of exactly where renewable energy generators and transmission infrastructure will be located in the renewable energy zones. The submission says:

> The Victorian Government is providing significant funding to develop Victoria's Renewable Energy Zones, supported by a new body called VicGrid to actively plan and develop them. VicGrid should identify the most appropriate locations for these zones in the next year, coordinated with transmission infrastructure. A strategic land use assessment would identify more specific locations for renewable energy generation, taking into consideration other land uses, such as agriculture, and potential environmental, cultural and community impacts. This helps streamline land use planning and environmental approvals to encourage faster investment and align the Renewable Energy Zones with transmission development.[26]

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22 Department of Environment, Land, Water and Planning, *Submission 88*, p. 3.

23 Australian Energy Market Operator, *Submission 72, Attachment 1*, p. 106.

24 Ibid., pp. 106–107.

25 Infrastructure Victoria, *Submission 44*, p. 13.

26 Ibid. (with sources).

Land use considerations in renewable energy zones

The renewable energy zones identified by AEMO and DELWP do not sit on vacant land. They comprise some of the state's most productive agricultural land and areas of natural beauty. There are also a number of towns and cities located within the renewable energy zones. Clearly, the Victorian Government cannot set aside all the land in the zones to host generators and transmission infrastructure. Consideration needs to be given to how the zones will fit into existing agricultural, residential and commercial uses of the land.

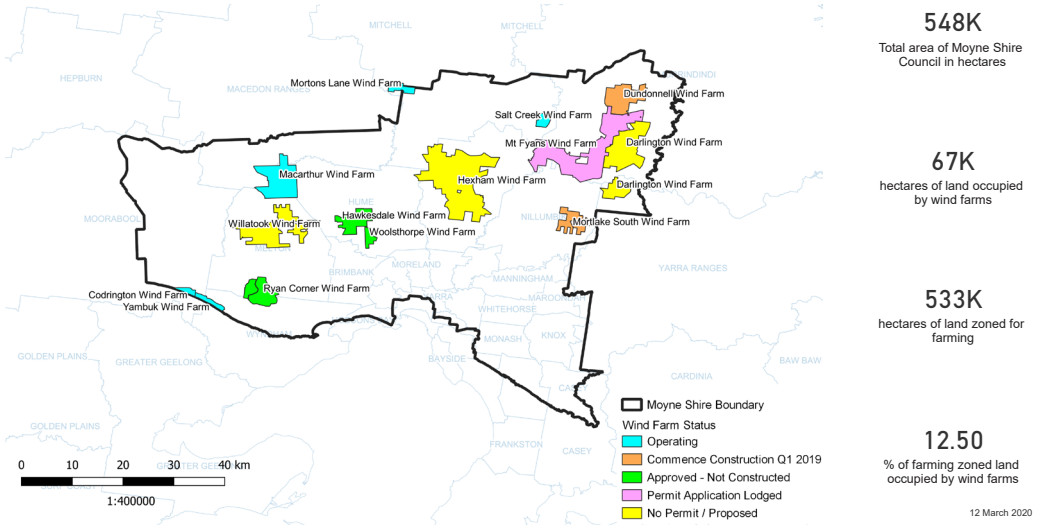
The Victorian Farmers Federation provided the Committee with its submission to the Victorian Government's *Renewable Energy Development Plan Directions Paper*. The submission outlined its concerns about the Government's creation of renewable energy zones, noting that the Renewable Energy Development Plan is silent on existing uses of the land, which include highly productive agricultural regions outside Ballarat and Shepparton:

> In Victoria the term 'zone' has a common meaning in the community. At face value this proposal is contrary to the existing community understanding of zoning of land, and has failed to consider any impacts on existing state planning policy and sector principles. For instance, the Green Wedges and Agricultural Land proposal seek to prioritise agricultural uses surrounding Melbourne. It talks about soil, water and protecting industrial jobs. All of this is relevant in the Ballarat to Melbourne corridor, however the directions document is silent on these considerations. It is unclear whether the REZ (define) for that area considers the high quality volcanic soils with artesian and catchment irrigation supporting McCains and Mars factories at Ballarat. Similarly it is unclear whether the Shepparton REZ considers Government investment in modernising irrigation in this "food bowl" and impacts on the viability for food processing.[27]

The Committee was informed that renewable energy projects can take up a lot of space. Moyne Shire Council said that if the 3 GW of existing and proposed wind farms in its council area are approved and constructed, they would take up 12.5% of its agricultural zoned land. The Council provided a map of the current and proposed projects overlaid on a map of metropolitan Melbourne to illustrate the geographic size of the projects (see Figure 3.2 below).

27 Victorian Farmers Federation, *Submission 49, Attachment 3*, p. 2.

Figure 3.2 **A map of current and proposed wind farm sites in Moyne Shire Council overlayed on a map of metropolitan Melbourne**



Source: Moyne Shire Council, *Submission 61, Attachment 5,* p. 1.

Joy Howley, a submitter, told the Committee that to simply declare renewable energy zones and encourage development within them would be unjust for residents and bad for the environment:

> To overlay a map with Renewable Energy Zones and then let developers rip with unregulated, mismanaged or corrupted planning conditions is bad for the environment and unjust and cruel to everyone and everything living with them and has already caused huge heartache for families and communities.
>
> The amenity, economic capacity and enjoyment of rural lifestyle needs to be seriously considered in the broader planning for renewable energy development.[28]

Building community support or 'social licence' for renewable energy generation projects and transmission lines is discussed in Section 3.7.

The Victorian Farmers Federation in their submission to the *Renewable Energy Development Plan Directions Paper* urged more work to be done in relation to land use planning that would consider the existing uses of the land, including agricultural use:

> VFF believes that the directions paper is premature. Land Use planning work needs to be undertaken for each corridor. The existing land uses, capability and resilience of the areas, impacts on food security / processing importance of the areas, and how renewable energy could be delivered without impact on agricultural use and versatility need to be considered. The process of consideration, like any land use strategy, should be public and consultative.[29]

28 Joy Howley, *Submission 16*, p. 2.

29 Victorian Farmers Federation, *Submission 49, Attachment 3*, p. 2.

This view was shared by Infrastructure Victoria, who said that a strategic land use assessment would take into account existing uses of the land as well and community views and environmental or cultural impacts. Based on this, the assessment should identify specific locations for renewable energy generators and transmission:

> Achieving net zero emissions will have significant land use implications. Renewable energy generation, particularly largescale solar, requires significant land with good sun or wind resources. This land use, particularly for large-scale solar may not be compatible with existing uses such as agriculture. There may also be local environmental, cultural and community impacts in establishing new renewable energy generation sites. A strategic land use assessment would identify more specific locations for renewable energy generation, taking into consideration other land uses, such as agriculture, and potential environmental, cultural and community impacts. This helps streamline land use planning and environmental approvals to encourage faster investment and align the Renewable Energy Zones with transmission development.[30]

The Committee agrees that it is important for land owners and regional communities in renewable energy zones to have more clarity on exactly where renewable energy generators and transmission infrastructure should be sited. A strategic land use assessment should be conducted in each renewable energy zone that takes into account agricultural and other land uses and the views of communities. In addition, environmental and cultural impacts should be assessed. Any such assessment should include consultation with the affected communities.

RECOMMENDATION 1: If it has not already done so, the Victorian Government should conduct a strategic land use assessment in Victoria's renewable energy zones to identify suitable sites for generators and transmission infrastructure. Such a land use assessment should take into account agricultural and other land uses, the views of communities as well as the possible environmental and cultural impacts of proposed infrastructure.

The Victorian Government released its *Offshore Wind Policy Directions Paper* in March 2020. The paper expressed concerns about meeting the 2050 target of net zero emissions with onshore renewable energy generators only. It said that to provide 60 GW of renewable generation capacity, (which is far higher than Victoria's current generation capacity, but may be needed by 2050) it could require the use of up to 70% of Victoria's agricultural land. The Directions Paper states:

> Analysis indicates that to meet net-zero targets using onshore renewables could require up to 70 per cent of Victoria's agricultural land to host wind and solar farms.[31]

And further:

> Given Victoria's low agricultural land area relative to other states, achieving full energy decarbonisation with only onshore renewables is an implausible prospect. For example,

30 Infrastructure Victoria, *Submission 44*, p. 18.

31 Department of Environment, Land, Water and Planning, *Victorian Offshore Wind Policy Directions Paper*, Victorian Government, Melbourne, March 2022, p. 18.

> achieving 60GW using only onshore wind and largescale solar could require up to 70 per cent of agricultural land, or four times the area of Greater Melbourne.[32]

This issue was discussed by Erin Coldham, Chief Development Officer of Star of the South, a large proposed offshore wind project off the coast of Gippsland. Ms Coldham noted that offshore wind projects did not impact on other land uses such as agriculture and urban development:

> We also do not face the same space constraints, naturally, with other competing users of land, enabling some hundreds of turbines to be installed that do not impact on some of those uses such as agricultural use and urban development that we see in other areas.[33]

In recognition of this, the Government is supporting a number of large-scale offshore wind projects. These projects in the coastal waters around Victoria have less land use considerations than those in Victoria's renewable energy zones and it is likely they will face fewer constraints.[34] Victoria's Offshore Wind Policy is discussed further in Section 3.4.2.

FINDING 2: Pursuing offshore wind projects will relieve pressure on the amount of renewable energy generators and associated transmission infrastructure that will need to be built in renewable energy zones to meet Victoria's zero emissions target by 2050. These projects should be factored into any review of the renewable energy zone infrastructure requirements.

3.3.2 Renewable energy auctions

The Victorian Government has begun renewable energy auctions to build generators in renewable energy zones. The auctions ask for bids from proponents of renewable energy generation projects to encourage competition and to ensure the State is getting good value for money.[35]

The first auction was held in 2017 with the goal of providing 650 megawatts (MW) of renewable energy generation capacity.[36] The results of the auction were announced in 2018, with six successful projects including three solar farms and three windfarms that together provide a generation capacity of 928 MW.[37] Figure 3.3 below shows the locations and generation capacity of the successful projects from the first auction.

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32 Ibid., p. 19.

33 Erin Coldham, Chief Development Officer, Star of the South, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 23.

34 Department of Environment, Land, Water and Planning, *Victorian Offshore Wind Policy Directions Paper*, p. 19.

35 Department of Environment, Land, Water and Planning, *VRET 2017 Reverse Auction Outcomes, Question and Answers*, Victorian Government, Melbourne, 2017, p. 1.

36 Department of Environment, Land, Water and Planning, *Victorian Renewable Energy Auction Scheme*, 2022, <https://www.energy.vic.gov.au/renewable-energy/victorian-renewable-energy-auction-scheme> accessed 9 March 2022.

37 Department of Environment, Land, Water and Planning, *VRET 2017 Reverse Auction Outcomes, Question and Answers*, p. 1.

Figure 3.3 Successful projects from Victoria's first renewable energy auction in 2017

Source: Department of Environment, Land, Water and Planning, Victorian Renewable Energy Auction Scheme, <https://www.energy.vic.gov.au/renewable-energy/victorian-renewable-energy-auction-scheme> accessed 9 March 2022.

In 2021, the Government opened the second renewable energy auction, aiming to deliver at least 600 MW of new renewable generation.[38] AEMO's *2021 Victorian Annual Planning-Report* gave an overview of the second auction, noting that the projects will be evaluated against their ability to connect to the grid in 'healthier' areas of the network, as well as invest in local areas:

> On 31 August 2021, the Victorian Government opened VRET2, which aims to bring online at least 600 MW of new renewable energy capacity in Victoria by 30 December 2024.
>
> The Victorian Government intends to support new generation by entering into Support Agreements with successful proponents of the VRET2 Auction. The Support Agreement is expected to include a 10-year Contract-for-Difference (CfD) payment mechanism designed to encourage new renewable generation connections by reducing wholesale electricity price risk for proponents, while also reducing Government exposure to electricity price risk.
>
> The Support Agreement will also see the Victorian Government receive all Large-scale Generation Certificates (LGCs) generated by VRET2 projects, which will in turn be voluntarily surrendered to the Clean Energy Regulator (CER) so the projects contribute to offsetting greenhouse gas emissions.
>
> The VRET2 evaluation criteria will have strengthened network requirements to evaluate the project's impact on the existing electrical network infrastructure and incentivise grid connections in healthier areas of the network, aligned with stronger locational investment signals (see Section 6.3.3).

38 Department of Environment, Land, Water and Planning, *Victorian Offshore Wind Policy Directions Paper*, p. 3.

> The Victorian Government expects to announce the successful VRET2 projects mid-2022.[39]

DELWP's submission says that the policy objective of the renewable auctions 'is to support projects committed to delivering jobs and economic development opportunities for local communities and leading-practice community engagement and benefit sharing initiatives.'[40]

However, the submission from the Australian Energy Council, the peak body for energy retailers and other market participants, said that the renewable energy auction scheme acts to subsidise renewable energy generators, which impacts on existing generators and can lead to their early closure:

> The Victorian Renewable Energy Auction Scheme's Contract for Differences model removes important short and long-term market signals from these generators. For example, it removes from these generators important market incentives to supply generation at the time of high prices, which reflect the time of greatest market need.
>
> In turn, subsidised variable renewable generators, pushed into the Victorian market at large scale, can have major consequential impacts on the operability and viability of existing plants leading to their early, and potentially disorderly, closure. Such closures inevitably result in a major bounce in wholesale electricity prices and place the overall reliability and security of the grid at risk.[41]

At a public hearing, Mr Skinner from the Australian Energy Council also said that the renewable energy auctions could promote renewable energy projects in areas where they may not offer the most efficiency. In addition, he said the Victorian taxpayer was taking on the risk for the investments rather than private companies:

> Victoria has undertaken two very large Victorian renewable energy auctions, which commit the Victorian taxpayer to effectively the market exposure to very large amounts of generation. Now, one has to think about what the counterfactual is if that was not in place. There is already a great deal of renewable energy being invested in by the market generally just because the prices of renewable energy have fallen and the challenges of continuing to invest in fossil fuel are substantial. So that was happening anyway, and the market would produce that. Now, it may not produce quite as much in Victoria, because let us be honest, Victoria is not the sunniest part of Australia, okay? And so the only way we get solar farms here is, you know, basically as a misallocation of resources. Really, they should be being built in Queensland and the output wheeled down here.
>
> Now, Victoria is quite good in terms of wind, although it is still not as strong as South Australia or Tasmania. Now, there is certainly a role, for example, in wind generation. There were wind generators being built before the first renewable energy auction and there are transport costs as well, so even if we may not have quite as good a wind

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39 Australian Energy Market Operator, *Victorian Annual Planning Report*, Australian Energy Market Operator Limited, 2021, p. 108 (with sources).

40 Department of Environment, Land, Water and Planning, *Submission 88*, p. 8.

41 Australian Energy Council, *Submission 63*, pp. 3–4.

> resource as South Australia we would still expect a substantial amount of wind to be built here, and it would have been built here with the investors taking full market risk without the state having to take the exposure. Those particularly stand out.[42]

As discussed in Chapter 5, the Committee notes that the economics of renewable energy can have an impact on the viability of existing generators in Victoria, particularly the coal-fired power stations of the Latrobe Valley. It also notes there may be locations for renewable energy generators in other states that would produce energy more efficiently. However, the Committee supports the Victorian Government's renewable energy targets and measures such as renewable energy auctions to help the state reach its targets. Relying on other states to provide generation capacity or waiting for a nationally coordinated approach may compromise Victoria's ability to meet its renewable energy and emissions reduction targets.

3.4 Renewable energy generators

To reach 100% renewable energy generation, Victoria will not only have to replace the generation capacity currently provided by fossil fuel generators, it will need to cater for growing energy demand. Key sources of demand in the coming decades are likely to include the replacement of gas and the uptake of zero emissions vehicles.

Victoria's environment is favourable to renewable energy generators, with excellent conditions for wind in the south and southwest of the state.[43] There are also areas of high solar radiation in the north-west[44]. Mr Thornton, from the Clean Energy Council described Victoria's high suitability for renewable energy generation:

> particularly for a state like Victoria, which is blessed with some of the world's best renewable resources. In fact there are very few other jurisdictions anywhere in the world that have the combination of wind resource, both onshore and offshore, solar resources, particularly towards the north of the state, and also hydropower resources and ocean resources, that Victoria does.[45]

Projects for carbon neutral hydrogen production are also underway. If realised, they will provide a significant source of hydrogen for domestic consumption and overseas export.[46]

Significantly, Victorians have also shown their support for renewable energy by exceptionally high take-up of rooftop solar. Australia and Victoria are world leaders in the installation of rooftop solar. Community energy projects with small scale generators will also play an important role in Victoria's energy future. [47]

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42 Ben Skinner, *Transcript of evidence*, pp. 17–18.

43 Department of Environment, Land, Water and Planning, *Renewable Energy Action Plan*, report for Department of Environment, Land, Water and Planning, Victorian Government, Melbourne, 2017, p. 12.

44 Ibid.

45 Kane Thornton, *Transcript of evidence*, p. 30.

46 Department of Environment, Land, Water and Planning, *Submission 88*, p. 6.

47 Ibid.

3.4.1 The generation capacity needed to transition to 100% renewable energy

According to AEMO's 2021 *Victorian Annual Planning Report*, Victoria currently has 'large-scale generation capacity of 12.9 GW and distributed generation capacity (installed behind the meter by households and businesses) is 3.1 GW.'[48] This takes Victoria's total current energy generation capacity to 16 GW in 2021.

According to the *Victorian Renewable Energy Target 2020/21 Progress Report*, as of 30 June 2021, 8.3 GW of Victoria's total energy generation capacity is from renewable sources, including rooftop solar.[49] This shows that in 2021, over half of Victoria's energy generation *capacity* was provided by renewable energy.

However, when considering how much energy was delivered to Victorians from various sources in Gigawatt hours (GWh), rather than the capacity (GW) of the generation sources, the picture changes. In 2020–21 Victoria generated 51,193 GWh of electricity. Of that, 15,066 GWh or 29.4% was from renewable sources and the rest was from fossil fuel generators, the largest proportion of which was brown coal-fired generators at 66.7%. Table 3.1 below provides a breakdown of the energy generated in Victoria by source in the 2020–21 financial year.

Table 3.1 Victorian energy generation (GWh) by source, 2020–21

Source	GWh	Share (%)
Brown coal	34,122	66.7
Gas	1,741	3.4
Renewable energy		
• Wind	7,560	14.8
• Solar (rooftop PV)	2,911	5.7
• Hydroelectricity	2,701	5.3
• Solar (large scale)	1,313	2.6
• Bioenergy (renewable energy sources eligible under VRET)	582	1.1
Other (renewable energy sources eligible under VRET)	265	0.5
Total eligible renewable energy	**15,066**	**29.4**
Total all renewable energy	**15,330**	**29.9**
Total	**51,193**	**100.0**

Source: Department of Environment, Land Water and Planning, *Victorian Renewable Energy Target 2020/21 Progress Repot*, 2021, p. 6.

48 Australian Energy Market Operator, *Victorian Annual Planning Report*, p. 3.

49 Department of Environment, Land, Water and Planning, *Victorian Renewable Energy Target: 2020–21 Progress Report*, Victorian Government Melbourne, 2021, p. 6.

Paul Beaton, Senior Energy Policy Analyst at Environment Victoria said that there is a disconnect between the proportion of renewable and fossil fuel generation capacity and the sources of the power that is actually generated and delivered to consumers. However, he said that by 2030, the vast majority of energy generated will come from renewable sources:

> I just want to point to one particular thing in terms of generation, because this is a lot about generating capacity but actual power generated is a different matter. In all of these scenarios, even from that conservative stance, they anticipate by 2030 that at least 90 per cent of Victoria's power generated will come from renewables.[50]

The Committee believes it is important not only to build up the capacity of Victoria's renewable energy generators, but also to ensure that the delivery of energy is from renewable sources.

Future projections of energy demand in Victoria

AEMO predicts a significant growth in the demand for energy to 2050 across the states that make up the National Electricity Market, including Victoria. In its *Draft 2022 Integrated System Plan,* AEMO notes that presently, the National Electricity Market delivers 'just under 180 terawatt hours (TWh) of electricity to industry and homes per year.'[51] It believes it will need to double that delivery capacity by 2050 'to replace much of the gas and petrol currently consumed in transport, industry, office and domestic use.' [52] The replacement of gas with electricity and the electrification of transport is discussed in Chapter 6.

AEMO adds that the needs of proposed hydrogen production, if supplied from the grid, would be additional to this growth.[53]

Under what AEMO considers the most likely scenario for future energy generation (a 'step change scenario'), the generation capacity of the National Electricity Market will more than double by 2050. The vast majority of this capacity will come from renewable sources. The only fossil fuel generation capacity in this scenario will be from gas-fired power stations to provide firming power during periods of unfavourable weather for renewable energy. This scenario is illustrated in Figure 3.4 below.

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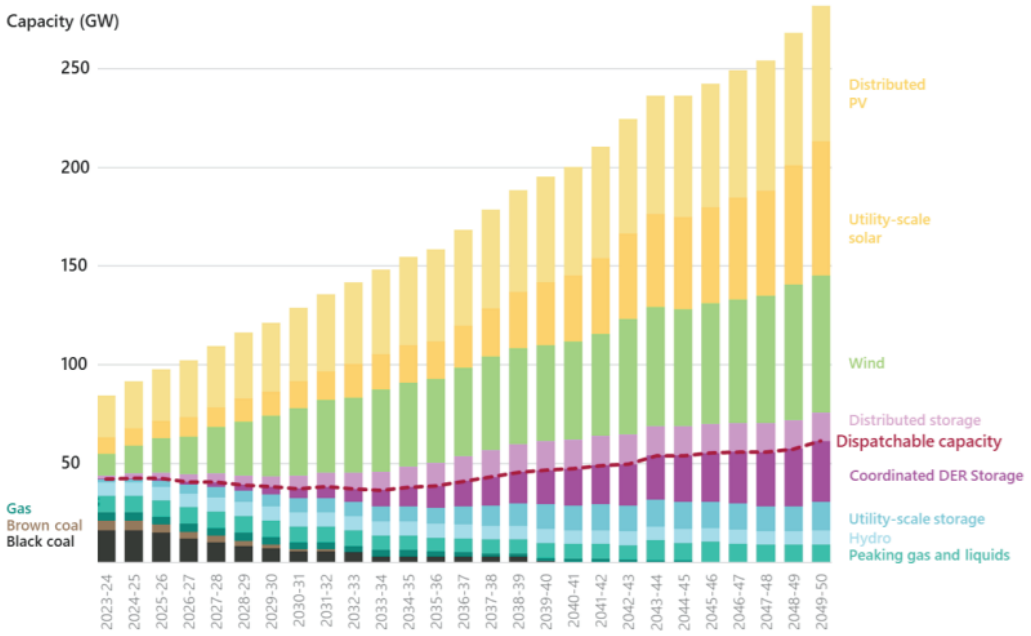
50 Paul Beaton, Senior Energy Policy Analyst Environment Victoria, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 12.

51 Australian Energy Market Operator, *Draft 2022 Integrated System Plan For the National Electricity Market*, working paper, Australian Energy Market Operator Limited, 10 December 2021, p. 9.

52 Ibid.

53 Ibid.

Figure 3.4 Forecast generator mix in the National Electricity Market under a 'step change scenario' 2023–24 to 2049–50



Source: Australian Energy Market Operator, *Draft 2022 Integrated System Plan,* p. 9.

Professor Andrew Blakers, the E2 Professor of Engineering at the Australian National University (ANU), provided a similar breakdown of Victoria's future energy demand. He noted that the amount of energy generated will have to double to enable the replacement of gas with electric heating and the increasing uptake of electric vehicles:

> Currently, Victoria consumes about 45 Terawatt-hours (TWh) per year of electricity, about 35% of which comes from renewables (mostly solar & wind, with some hydro). Electricity demand must double to 90 TWh per year to eliminate oil from land transport and gas from heating. Thus, solar & wind generation must rise from about 16 TWh per year at present to above 80 TWh per year—which is 5 times more.[54]

To meet this future demand, a number of renewable energy projects have been committed to in Victoria and a large number have been proposed.

The submission from AEMO bears out this increase in generation capacity for Victoria, outlining how it is currently procuring investments to enable an extra 10 GW of renewable energy generation capacity into Victoria's renewable energy zones, taking the total renewable energy capacity to 16 GW.[55]

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54 Professor Andrew Blakers, Institute for Climate, Energy & Disaster Solution, Australian National University, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 6.

55 Australian Energy Market Operator, *Submission 72*, p. 3.

Dr Dylan McConnell, a Research Fellow at the Energy Transition Hub, University of Melbourne gave an estimate of the investment required to build generators as Victoria transitions to renewable energy:

> I guess, just drawing out some interesting findings in the context of this inquiry from that, what that means in terms of investment is there are some pretty big numbers. There, just looking at wind, solar and storage, we are talking about investment in the state of Victoria in the vicinity of $10 billion out to 2030 or, in that sort of expanded scenario where we decarbonise faster, close to $18 billion. I should say this is investment only in wind, solar and storage, including rooftop PV. It does not include things like transmission and other related industries.[56]

The submission from DELWP explained that Victoria now has the tools to meet the projected increase in energy demand with renewable energy. The establishment of the renewable energy zones, the renewable energy development plan, renewable energy auctions and the creation of VicGrid will provide the structure for a scaleable transition to renewable energy that can meet future demand.[57]

FINDING 3: The demand for energy in Victoria is likely to double by 2050 as gas appliances are changed to electricity and the uptake of zero emissions vehicles increases.

FINDING 4: The Victorian Government has the governance and policy structure in place to meet the increase in the demand for energy to 2050 with renewable energy sources. These policy initiatives include renewable energy zones, the renewable energy development plan, renewable energy auctions and the creation of VicGrid.

Coal-fired power stations closing two to three times faster than anticipated may have unforeseen consequences if the transition to renewables proceeds before local adequate manufacturing is in place, before appropriate mechanisms for recycling of components are in place and before new transmission infrastructure are in place.

Currently solar and wind generation rely heavily on imported components, and there is a need to develop a local manufacturing base as renewables expand.

There is also a risk of discarded components inappropriately going to landfill, until dedicated recycling is in place.

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56 Dr Dylan McConnell, Research Fellow, University of Melbourne, Energy Transition Hub, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 14.

57 Department of Environment, Land, Water and Planning, *Submission 88*, pp. 3, 8.

3.4.2 Developments and considerations with utility scale renewable energy generators

Utility scale generators are large scale power plants of a commercial size. The Committee was informed that Victoria has a number of new renewable energy new projects proposed or committed to for each generation type. This includes wind, solar, hydrogen and potentially geothermal.

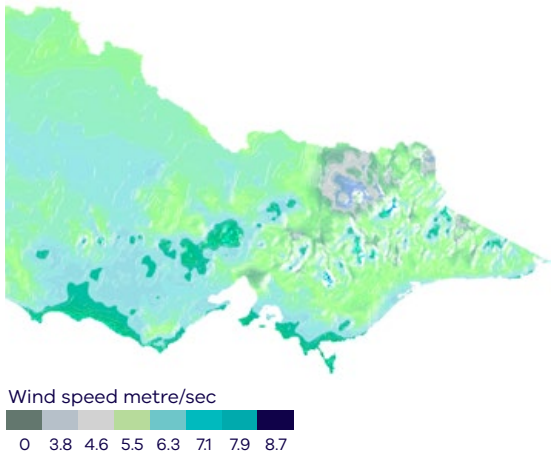
Wind

Victoria currently has a significant amount of onshore wind generators. These are primarily located in the west of the state. The Victorian Government has plans to begin an offshore wind industry in Victoria, with a number of large-scale projects proposed in Victoria's coastal waters.[58]

Victoria is already home to a number of onshore wind farms. In 2018 the state had 25 operating wind farms which produced around 9% of the state's electricity.[59] According to DELWP, the farms are located on 'sites that have steady winds throughout the year, good road access and proximity to the electricity grid where there is capacity to transmit the energy produced.' [60]

There are a number of wind farms in the state's south-west, which offers high average yearly wind speed. Figure 3.5 below shows the average yearly wind speed across the state. Areas in the southwest and south Gippsland offer high suitability for wind farms.

Figure 3.5 Average yearly wind speed in Victoria



Source: Department of Environment, Land, Water and Planning, *Renewable Energy Action Plan*, 2017, p. 12.

58 Ibid., p. 6.

59 Department of Environment, Land, Water and Planning, *Wind Farms fact sheet: Measurement*, Victorian Government, Melbourne, p. 1.

60 Ibid.

As noted in Section 3.3.2, the first round of Victoria's renewable energy auctions saw the commissioning of three onshore wind projects. It can be expected that additional onshore wind projects will be announced in the coming years as part of that process.

Offshore wind

The Victorian Government released its *Offshore Wind Policy Directions Paper* in March 2022. It outlines the Government's aim to be the first state in Australia to host an offshore wind facility.

As noted in Section 3.3.1, the policy explains the need to pursue offshore wind projects because the amount of land required for onshore renewable generators to meet Victoria's net zero target by 2050 'could require up to 70 per cent of Victoria's agricultural land to host wind and solar farms.'[61]

The policy sets out the Victorian Government's commitments to deliver:

- 2 GW of offshore wind capacity by 2032
- 4 GW of offshore wind capacity by 2035
- 9 GW by 2040.[62]

These targets will be reached through a procurement process through renewable energy auctions. The first offshore wind tranche will be procured in the mid-2020s, aiming for the first power by 2028. [63]

Professor Mountain from the Victoria Energy Policy Centre gave an estimate of the number of towers that would be in place with the target of 9 GW by 2040:

> It will translate into roughly 1700 towers, each with their own hubs and blades, which between now and 2040 is 100 per year or eight per month, which if you put it that way translates to an enormous expansion of electricity production …[64]

Ms Coldham from Star of the South told the Committee that the Government's offshore wind policy provided certainty and was a strong signal to attract investment in offshore wind:

> So what we have seen from the Victorian government is a signal around the capacity of offshore wind that it is seeking to achieve as well as the timing, and that helps enable our decisions in terms of the ongoing investment in the development of this project to meet those targets and time frames. It has been so important to see that, because not only are we competing for that investment and the interest from the relevant suppliers and workers here in Australia but globally offshore wind is one of the fastest growing energy technologies. So a lot of the companies look for these signals from government

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61 Department of Environment, Land, Water and Planning, *Victorian Offshore Wind Policy Directions Paper*, p. 18.

62 Ibid., p. 24.

63 Ibid.

64 Professor Bruce Mountain, *Transcript of evidence*, pp. 31–32.

> to see if it is a government that is going to help and partner with the private sector to enable these outcomes, and it is something that we believe has been very well received, I can say, on the global stage as well as here locally. There has been a lot of attention on Victoria since that announcement. [65]

Victoria's offshore wind policy complements existing offshore wind proposals supported by the Victorian Government through its Energy Innovation Fund.[66] The Submission from DELWP detailed the Governments funding commitments in respect of these projects:

> Offshore wind is a viable and growing source of renewable energy. It is commercially operated at large scale in Europe and expected to play a key role in Victoria's clean energy transition. Developing Victoria's offshore wind resources will complement current renewable sources, such as onshore wind and solar, and batteries and will help provide reliable access to cleaner and cheaper energy into the future.
>
> In November 2021, the Victorian Government announced funding of $37.9 million to be provided to three offshore wind projects.
>
> - The Star of the South will receive $19.5 million to support pre-construction development activities for an offshore wind farm off the Gippsland coast. If built to its full, proposed scale, it would have up to 2.2GW of capacity—enough power to provide nearly 20 per cent of Victoria's energy needs.
> - Macquarie Group will receive $16.1 million to facilitate initial development stages of a 1GW offshore wind farm off the Bass Coast.
> - Flotation Energy will receive $2.3 million for scoping studies and surveys for a 1.5GW offshore wind farm off the coast of Gippsland.
>
> The projects are expected to bring forward the investment required to maximise the potential for a competitive offshore wind sector in Victoria. This will support the post-2025 energy transition and deliver value for money outcomes for Victorian energy consumers.[67]

Neil Andrews, a submitter, noted the large energy generation capacity of these upcoming offshore wind projects and pointed out that they have the potential to replace the generation capacity of retiring coal-fired power stations in the Latrobe Valley:

> Currently, there are at least four proposals for offshore wind projects off the Victorian coast (Star of the South, 2.2GW, Latrobe Valley; Floatation Wind, 1.5GW, Gippsland; Macquarie Group, 1GW, Bass Coast; and Victoria Offshore WindFarm Project, 495MW, Portland).
>
> The first three of these projects, being GW scale, have the potential to replace retiring brown coal-fired generators in the Latrobe Valley. And, clearly these projects can feed into the strong electricity grid in this area. Timing will be an issue—hopefully at

65 Erin Coldham, *Transcript of evidence*, p. 25.

66 Department of Environment, Land, Water and Planning, *Submission 88*, p. 6.

67 Ibid.

> least one of these projects will be operational before the Yallourn power station is decommissioned in 2028. Pleasingly, each of these three projects has received funding from Victoria's Energy Innovation Fund to support the completion of feasibility and pre-construction activities.[68]

Ms Coldham said that offshore wind resources, including that in the Bass Strait where the Star of the South will be located, are more constant and reliable than onshore wind:

> The reason many countries have been going offshore is that not only is the wind stronger, and I can attest to that having been out in Bass Strait on a boat on numerous occasions, it is more consistent, it is more reliable than what we see in other locations, particularly onshore where there might be obstacles.[69]

The submission from Star of the South discussed the energy security it can provide to the grid and noted its ability to connect to underutilised existing transmission infrastructure in the Latrobe Valley:

> Star of the South and offshore wind in the Gippsland region could provide strong, reliable, and renewable electricity to the Victorian grid while also connecting to existing, underutilised transmission infrastructure. The project is expected to supply up to 20% of Victoria's current electricity needs, further advancing the state towards a zero emissions grid. [70]

The Committee supports the efforts of the Government to establish Australia's first offshore wind facility and grow the sector. The large generation capacity that can potentially be provided by offshore wind will be important to meet Victoria's energy needs into the future.

FINDING 5: Victoria's environment is suited to offshore wind generation projects and the Victorian Government's offshore wind policy will support investment in offshore wind to act as a significant source of renewable energy generation up to 2040.

Large scale solar

Victoria has abundant solar resources. Professor Blakers told the Committee that Victoria has excellent solar by world standards:

> Victoria has got pretty good solar by Australian standards and fantastic solar by world standards, and the worst place in Victoria is better than all of northern Europe. Obviously up in the north-west is even better than the south-east. If you live up in the north-west, you are really sitting pretty for a lot of influx—of population and people and businesses—to build solar farms.[71]

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68 Neil Andrews, *Submission 45*, pp. 12–13 (with sources).

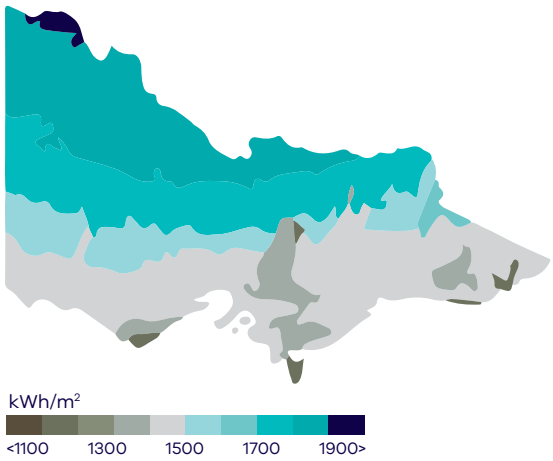
69 Erin Coldham, *Transcript of evidence*, p. 23.

70 Star of the South, *Submission 86*, p. 4.

71 Professor Andrew Blakers, *Transcript of evidence*, p. 2.

Figure 3.6 below from Victoria's *Renewable Energy Action Plan* shows Victoria's solar radiation data. The most suitable areas for solar farms correspond to higher solar radiation.

Figure 3.6 Solar radiation in Victoria



Source: Department of Environment, Land, Water and Planning, *Renewable Energy Action Plan*, 2017, p. 12.

Victoria's large scale solar generators contribute a relatively small amount of energy to Victoria's grid in comparison to other types of renewables such as wind. The *Victorian Renewable Energy Target 2020/21 Progress Report* showed that presently large scale solar contributes 2.6% to the energy that is generated in Victoria. This is in contrast to 14.8% generated by wind.[72]

Victoria's relatively small utility-scale solar generation capacity is in contrast to rooftop solar, for which Australia leads the world in uptake and contributes a significant proportion of the energy generated in Victoria each year. Rooftop solar is discussed later in this Section.

According to the *Renewable Energy Action Plan*, Victoria's renewable energy auctions include a target for 20% of the auctions to be dedicated to solar.[73] The Committee welcomes the Victorian Government's ongoing commitment to large scale solar, given the importance of diversifying the mix of renewable energy generators in Victoria's energy system. This issue is discussed further in Section 3.5.

Hydrogen

As discussed in Chapter 2, hydrogen is not necessarily a renewable energy generation source, but it is a fuel that can be made using renewable energy and used as a feedstock for applications such as power stations and transport. The Victorian Government terms

72 Department of Environment, Land, Water and Planning, *Victorian Renewable Energy Target*, p. 5.

73 Department of Environment, Land, Water and Planning, *Renewable Energy Action Plan*, p. 9.

hydrogen made from renewable energy, renewable hydrogen. This type of hydrogen is also known as 'green hydrogen'.[74] Crucially, hydrogen does not result in carbon emissions when combusted to make energy.

The Victorian Government is pursuing the creation of a renewable hydrogen industry and has produced a *Victorian Renewable Hydrogen Industry Development Plan*, that sets out how the Government intends to realise 'renewable hydrogen's economic opportunity'[75], including creating long-term jobs and enabling the state's transition to net-zero emissions.[76] The submission from DELWP outlines the financial commitment made by the Government to help the sector grow:

> The Renewable Hydrogen Industry Development Plan is complemented by grants to support early-stage uptake of renewable hydrogen across Victoria, through the Renewable Hydrogen Business Ready Fund and the Renewable Hydrogen Commercialisation Pathways Fund.[77]

A hydrogen production and export pilot project is underway in the Latrobe Valley, which if realised at commercial scale will help deliver significant economic investment and jobs in the region. The Hydrogen Energy Supply Chain is a project that seeks to produce hydrogen in the Latrobe Valley using brown coal and capture the emissions using carbon capture technology. The hydrogen produced will be exported to East Asia and used in the domestic market. The Victorian and Commonwealth Governments have each contributed $50m for the delivery of the pilot.[78]

The submission from DELWP described the pilot project and the potential economic benefits if it is scaled to a full commercial operation:

> The HESC Pilot Project is a world-first international hydrogen export demonstration project. The HESC pilot will assist in establishing local skills, capabilities and infrastructure that will provide a platform for the development of a broad hydrogen industry in Victoria and Australia. A full commercial operation could generate thousands of jobs across metropolitan and regional Victoria, in addition to providing a source of low emissions hydrogen for export and domestic use contributing to local and global carbon reductions.[79]

The submission also states that over time hydrogen has the potential to replace natural gas, transport fuels and industrial processes. The large-scale use of which has the potential to realise significant emissions reductions, as well as provide an important export commodity for Victoria.[80]

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74 Infrastructure Victoria, *Submission 44*, p. 10.

75 Department of Environment, Land, Water and Planning, *Renewable hydrogen: Victorian hydrogen technology clusters network*, <https://www.energy.vic.gov.au/renewable-hydrogen/renewable-hydrogen> accessed 10 March 2022.

76 Ibid.

77 Department of Environment, Land, Water and Planning, *Submission 88*, p. 6.

78 Submission to the Legislative Council Economy and Infrastructure Committee's Inquiry into the closure of Hazelwood and Yallourn Power Stations, Hydrogen Energy Supply Chain, Submission 29, pp. 1–4.

79 Department of Environment, Land, Water and Planning, *Submission 88*, p. 6 (with sources).

80 Ibid., p. 7.

The Committee notes the work of the Victorian Government in supporting the establishment and growth of a renewable hydrogen industry in Victoria. This important work should continue so that the economic potential of hydrogen production in Victoria can be realised, including the creation of long-term jobs. This is particularly crucial for the Latrobe Valley as its coal-fired power stations close in the coming decades and its workforce looks to transition to other industries.

Geothermal

Victoria's brown coal deposits in the Latrobe Valley sit atop aquifers that are insulated and warmed by coal above them, leading to high temperature water at a comparatively shallow depth. The submission from Latrobe City Council explained the geothermal assets in the Latrobe Valley:

> Globally it is interesting and significant to note how shallow the hot water is beneath the Latrobe Valley; only 650 m for 65°C. The thermal blanketing effect of the world's thickest brown coal deposit results in a truly world class geothermal energy resource that has, until now, been largely under-utilised. Drilling is a major cost factor for geothermal energy, so these costs should be relatively low in the Latrobe Valley.[81]

Further work should be undertaken by the Victorian Government to investigate the potential of geothermal power in the Latrobe Valley.

3.4.3 Developments and considerations with distributed energy resources

Distributed energy resources are non-commercial scale energy generators such as rooftop solar or community energy projects. They may be accompanied by home solar batteries or larger community batteries which are used for energy storage, or to feed power into the grid.

Rooftop solar and solar batteries

Australia and Victoria have one of the world's highest uptakes of rooftop solar, and a large uptake of solar batteries. Rooftop solar and batteries give their owners the ability to generate energy for private use and allow them to feed energy into the grid to earn a payment, known as a feed-in tariff.[82]

To encourage the uptake of rooftop solar, The Victorian Government's Solar Homes Program provides:

- $1,400 rebate for solar panel (PV) system installation, for homeowners and rental properties
- $3,500 rebate for the installation of solar batteries

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81 Latrobe City Council, *Submission 14*, p. 5.

82 Department of Environment, Land, Water and Planning, *Renewable energy: Minimum feed-in tariff*, <https://www.energy.vic.gov.au/renewable-energy/victorian-feed-in-tariff/current-feed-in-tariff> accessed 16 March 2022.

- rebate of up to $1000 for solar hot water systems
- rebate of 50 per cent of the cost of a solar PV system, capped at $3500.[83]

The Solar Homes Program has been running since 2018 and has supported the installation of 167,000 solar systems in Victorian homes and businesses. The submission from DELWP outlined the successful take-up of the program:

> The Victorian Government's 10-year, $1.3 billion Solar Homes Program will support 778,500 Victorian households to install solar photovoltaic (PV) panels, solar or heat pump hot water systems, or solar batteries at their home. This program is demonstrating the economic and environmental benefits of empowering consumers, helping households save hundreds of dollars on their energy bills each year while also reducing household emissions. Since its launch in August 2018, the Solar Homes program has supported over 174,000 installations, including over 167,000 PV systems. These systems have contributed nearly a gigawatt (GW) of additional capacity. [84]

The enthusiasm shown by Victorians for rooftop solar and solar batteries has been one of the success stories of Victoria's transition to renewable energy. The subsidies offered for the installation of home solar and batteries by the Victorian Government through the Solar Homes Program is one of the factors behind the popularity of rooftop solar. The submission from the Australian Energy Council described Australia's high take-up of rooftop solar:

> Rooftop PV has been more popular in Australia than any other country, and Victoria is no exception with over 500 MW a year presently being invested. Australian customers' preparedness to invest in their roofs is certainly one of the major successes of decarbonisation.[85]

Mr Thornton from the Clean Energy Council praised the Solar Homes Program at a public hearing, noting it was a national leader in ensuring quality outcomes:

> Again, I want to recognise the Victorian government and particularly the Solar Homes program as really a very innovative and powerful way for the Victorian government to support householders and small businesses to move towards rooftop solar and now household batteries—but also doing it in a way that is safe, is reliable and ensures quality outcomes for those householders. The Solar Homes program I think is a real leader across the nation as far as the way in which it does that.[86]

Rooftop solar is now providing an appreciable contribution to the amount of energy generated in Victoria. In 2020, it provided 1.3% of the energy generated. The submission from DELWP forecast that by 2030 it will provide 20% of Victoria's 50% renewable energy target:

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83 Department of Environment, Land, Water and Planning, *Submission 88*, p. 4.

84 Ibid.

85 Australian Energy Council, *Submission 63*, p. 6 (with sources).

86 Kane Thornton, *Transcript of evidence*, p. 31.

> In 2020, the Solar Homes program contributed around 1.3 per cent of Victoria's electricity generation which was around five per cent of Victoria's 2020 renewable energy target of 25 per cent renewable generation. The Solar Homes program is forecast to contribute 15 per cent of Victoria's 40 per cent renewable energy target by 2025 and 20 per cent of Victoria's 50 per cent renewable energy target by 2030. The Solar Homes program has already abated 820,000 tonnes of greenhouse gas emissions, and by 2027/28, is expected to reduce Victorian electricity sector emissions by around 1.8 million tonnes of carbon dioxide equivalent per annum and reduce National Electricity Market emissions as a whole by around 3.0 million tonnes of carbon dioxide equivalent per annum, below what they would otherwise have been.[87]

The popularity of solar batteries has also benefited from the Solar Homes Program. The submission from Tesla Australia noted:

> Victoria has seen a rapid uptake of rooftop solar PV with now more than 1GW of capacity, distributed across 165,000 homes. This creates both opportunities and challenges for the distribution grid and system operators. Whilst the uptake of home batteries is at a more nascent stage, the expansion of Solar Victoria's battery grant program is providing a strong incentive to accelerate uptake.[88]

The Committee commends the Solar Homes Program and its success in enabling hundreds of thousands of ordinary Victorians to contribute to Victoria's renewable energy future. However, there are issues associated with Victoria's distribution network and the export of power generated by rooftop solar and batteries. This is discussed in Section 3.4.4.

Community energy projects

Community energy projects are small to medium size renewable energy generator projects that are typically undertaken by community groups.

The submission from Coalition for Community Energy described the typical scale of community energy projects and the benefits for community members:

> There is an opportunity to facilitate mid-scale community projects on distribution and low voltage networks to continue progress towards the state's renewable energy targets and build social licence. Such projects would be between 1-10MW and, at this scale, would not need to wait for new transmission infrastructure. As community projects, they would be designed and developed by or with the community, providing proportionately larger benefits to community members, generating goodwill among those affected by any moderate amenity or social impacts. These projects also give community members greater ownership over their energy system and champion best practice community engagement, pioneering new tools to improve social outcomes and the reputation of the industry.[89]

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87 Department of Environment, Land, Water and Planning, *Submission 88*, p. 4.

88 Tesla Motors Australia, *Submission 41*, pp. 2–3.

89 Coalition for Community Energy, *Submission 50*, p. 3.

The submission from the City of Melbourne gave an example of a smaller-scale initiative it is supporting called 'Power Melbourne,' a battery scheme:

> The City of Melbourne is seeking to unlock more investment in local storage and enable more renewable energy into the city through the Power Melbourne initiative. Power Melbourne will see the installation of a battery network across the city, with a focus on City of Melbourne existing infrastructure initially, with the potential to scale beyond the municipality through partnerships with neighbouring local governments as part of M9, universities, government and investors.
>
> Power Melbourne would encourage greater uptake of renewables, create new opportunities for research, training and jobs in the green technology sector, and help build Melbourne's reputation as a centre for clean energy innovation.[90]

The Coalition for Community Energy advocated for a community energy target for mid-sized community energy projects. Such a target would include incentives would be similar to the Solar Homes Program, but would offer subsidies to community groups for medium size energy projects:

> Community energy projects (mid-scale, batteries, micro-grids) will improve the social licence of the wider renewable energy sector, by ensuring community members benefit from local renewables. But unlike large scale renewables which are supported by the VRET auctions, or rooftop solar subsidies, mid-scale projects do not have an appropriate financial mechanism enabling uptake. Subsequently, we recommend the Victorian State Government implement a Community Energy Target, with an associated financial mechanism.
>
> ...
>
> A Community Energy Target and mechanism would address this current gap in policy and market incentives for mid-scale community energy projects, and enable a broader range of communities to deliver and benefit from renewables. Without such a mechanism, we are unlikely to see these projects take shape. This would be a significant missed opportunity, as mid-scale community projects are unique in their suitability for distribution and low voltage networks, enabling their quick deployment during a climate critical decade.[91]

This sentiment was echoed by Friends of the Earth:

> after the introduction of the Victorian Renewable Energy Target in 2016 it became clear that while there was support for large scale renewables, community generators were typically too small to benefit from this policy. Likewise, households and businesses are able to access grants and loans for rooftop solar available through the Solar Homes program. This leaves a gap in the market for mid-scale renewable energy generators of 1-10MW, which could be established, owned and run by community groups. This position

90 City of Melbourne, *Submission 18*, p. 4.

91 Coalition for Community Energy, *Submission 50*, p. 4.

> was echoed in the State Government's Inquiry into Tackling Climate Change in Victorian Communities, which recommended the introduction of a Community Energy Target.[92]

The submission from DELWP informed the Committee of a program in this area, the Neighbourhood Battery Initiative. The initiative provides grants to fund pilots of community scale batteries to demonstrate a range of ownership and operational models.[93] The submission said:

> At a more local level, the Victorian Government's $10.92 million Neighbourhood Battery Initiative is trialling new electricity storage technology and business models, from feasibility through to implementation. The initiative will support our understanding of the role neighbourhood scale batteries can play in supporting more homes to connect solar PV into our electricity system and help manage localised network issues in Victoria's electricity system.[94]

The Committee acknowledges the programs the Victorian Government is implementing to explore community scale renewable energy projects. However, given the success of the Solar Homes Program, the Committee believes it would be advantageous for the Victorian Government to introduce a target and subsidies for community energy projects. The Coalition for Community Energy note that providing energy supply options close to the source of demand should represent a cheaper outcome that does not require substantial grid upgrades.[95]

RECOMMENDATION 2: That the Victorian Government consider the introduction of a Community Energy Target that includes subsidies for the growth of localised community energy projects.

3.4.4 Distributed energy resources and Victoria's distribution network

The greater take up of distributed energy resources such as rooftop solar and solar batteries has led to problems with system stability, including voltage management and frequency control. This is due to the limitations of a network that was not designed for the two-way flow of energy and less output from utility scale synchronous generators, such as coal power stations, which traditionally impart system stability properties (this problem is known as minimum demand).[96] To deal with this issue, incentives are being put in place to encourage rooftop solar and solar battery owners to export power into the grid at the right time. This will enable more energy to flow into the network from

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92 Friends of the Earth, *Submission 85*, p. 5.

93 Department of Environment, Land, Water and Planning, *New energy technologies*, <https://www.energy.vic.gov.au/new-energy-technologies> accessed 16 March 2021.

94 Department of Environment, Land, Water and Planning, *Submission 88*, p. 7 (with sources).

95 Coalition for Community Energy, *Submission 50*, p. 3 and 6.

96 Australian Energy Market Operator, *Record minimum demand levels across Australia*, <https://aemo.com.au/en/newsroom/media-release/record-minimum-demand-levels-across-australia> accessed 14 March 2022.

rooftop solar and batteries and encourage greater uptake. The Committee heard that more can be done to coordinate the export of energy into the grid and put in more appropriate price signals.

The increasing uptake of distributed energy resources like rooftop solar, which is close to the point of use, is favourable because it does not require large scale transmission infrastructure and there are less land use considerations associated with it. This was illustrated by Professor Mountain who said:

> Victorian governments have a policy to decentralise electricity supply, most notably in solar homes and businesses. I think that is an excellent policy. The cheapest electricity available is electricity produced at the point of use. The economics are very attractive because of the co-benefits of using infrastructure and so on.[97]

However, the Committee was informed that Victoria's distribution network was not designed for the export of power to the grid from distributed energy generators, as well as to receive power from traditional utility scale generators. A paper from the Australian Energy Market Commission on this issue outlined the strain on the grid caused by distributed energy generators:

> This significant uptake in DER [Distributed Energy Resources] offers considerable opportunities but also presents technical challenges for the existing electricity network. If changes are not made, it will not be able to cope. Distribution networks that were built to bring electricity one-way to consumers are now being used by consumers to export their surplus generation to the grid. While a network built for one-way traffic has a basic level of capacity to support exports, this capacity is rapidly being exhausted.[98]

As a response to this issue, the Committee heard that the export of power to the grid from distributed energy generators could be curtailed by distribution network operators. This suspension of the ability to feed energy into the grid is typically undertaken temporarily at times of high solar radiation when rooftop solar generators are producing energy.[99] Powerledger, a company that develops software to track energy use described this issue in its submission:

> High penetration of variable renewable energy (VRE) has put strain on the electricity grid, in particular, during times of high solar electricity generation and low demand. The 'quick fix', currently utilised by the DNSPs [Distributed Network Service Providers], is the curtailment of DERs.[100]

Powerledger added that the practice of curtailment should be seen as a form of market failure.[101]

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97 Professor Bruce Mountain, *Transcript of evidence*, p. 32.

98 Australian Energy Market Commission, *Rule determination 2021 Access, pricing and incentive arrangements for distributed energy resources*, Australian Energy Market Commission, Sydney, 12 August 2021, p. i.

99 Powerledger, *Submission 65*, p. 2.

100 Ibid, pp. 2–3.

101 Ibid., p. 1.

Another key consideration with the increase in distributed energy generators is the 'minimum demand' issue. This issue relates primarily to the high uptake of rooftop solar and arises during sunny periods particularly in the summer months. Because a large number of rooftop solar users are both supplying their own energy and feeding energy into the grid, there is less demand for energy generated by traditional utility scale power stations. This can cause problems with stable voltage and frequency in the grid. AEMO's *2021 Victorian Annual Planning Report* gave an overview of this issue:

> The increasing uptake of rooftop PV in Victoria has resulted in a reduction in operational demand during daylight periods. Record low demand is being observed in the early afternoon, when the sun is at its strongest. This poses significant challenges in operating the network within voltage limits and meeting minimum system strength requirements.[102]

The submission from Tesla Australia advocated that solar batteries could be part of the solution to help manage minimum demand issues, and ultimately may be able to provide coordinated export of power to the grid when it is needed:

> Attaching storage to solar systems provides significant benefits – not just bill savings to home-owners, but broader system stability services. For example, adding distributed storage and Virtual Power Plant (VPP) functionality to existing solar reduces site imports during peak energy periods and provides mitigation in reducing solar export. This will also help manage emerging minimum demand issues, and avoid having to use more 'blunt' back-stop mechanisms such as complete solar curtailment (which inevitably leads to a bad customer experience). Instead, AEMO is provided flexible 'turn-up capacity' as currently being explored as part of various ARENA and AEMO trials. Ultimately, by continuing to incentivise the uptake of storage to be paired with otherwise 'passive' household solar, Victoria can increase overall solar generation and enable higher renewable penetration at lower cost.[103]

Enabling more export to the grid, price signals and virtual power plants

The Australian Energy Market Commission has considered the issue of how to enable more export to the grid from distributed energy resources including rooftop solar and batteries. It has made a determination that distribution companies should work to enable more two-way flow of power in their distribution networks.[104] To do this without risking system stability, network upgrades may need to take place.

The submission from CitiPower, Powercor and United Energy, three of Victoria's largest distribution network operators, gave an example of the kind of upgrades taking place to enable more export to the grid from distributed energy resources:

> Our solar enablement program encompasses a range of activities to enable increase solar exports. This includes changing the settings on, or replacing, the transformers

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102 Australian Energy Market Operator, *Victorian Annual Planning Report*, p. 61.

103 Tesla Motors Australia, *Submission 41*, pp. 2–3.

104 Australian Energy Market Commission, *Rule determination 2021* p. i.

> connected to our low-voltage network; re-balancing of phases to more evenly spread customers across network assets; or augmenting the low voltage network to enabler greater solar exports.
>
> To assist with the implementation of the solar enablement program, we will also undertake our digital network program. This program enables implementation of more sophisticated analytical, monitoring and management capabilities in order for us to operate the network more dynamically in real time.[105]

At a public hearing, Dr Saul Griffith, founder of Rewiring Australia, said that the existing distribution grid has the capacity to handle exports from distributed energy resources with appropriate digital management:

> we have now motivated the incumbent players who own that infrastructure to charge for every electron going backwards and forwards. As I told you, in this romance novel of Victorian decarbonisation you are going to need 250 to 300 per cent more electricity moving over those distribution wires. If we are charging the same distribution cost for all of those that we are for the existing grid, that is going to ruin the economics. There is enough capacity on the local distribution grid to run all of those electrons and more, with appropriate digital management. So we are not constrained—it can handle it; it will handle it—but we could ruin the economics unless we change the rules of the distribution grid: we make it bidirectional and we make sure that households have something like equal rights to generators on the grid.[106]

The Committee was told of two key tools to manage the coordination of export of power from distributed energy resources to the grid at appropriate times. They are:

- price signals to encourage export of power at appropriate times
- virtual power plants to coordinate the export of power at appropriate times.

As part of its determination on enabling more export to the grid from distributed energy resources, the Australian Energy Market Commission has enabled distribution companies to include pricing signals to encourage export into the grid at the right time.[107] One of the tools to encourage export at the right time will be the new option for distribution companies to charge customers to export to the grid.[108] The Australian Energy Market Commission sees this as part of a flexible tool that will see incentives and disincentives used to encourage the most efficient use of distributed energy resources.[109]

However, the submission from Powerledger was critical of the determination of the Australian Energy Market Commission to allow distribution companies to charge distributed energy owners to feed power into the grid. They saw it as punitive and argued that it would discourage the purchase of batteries big enough to feed into the

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105 Citipower, Powercor and United Energy, *Submission 54*, p. 3.

106 Dr Saul Griffith, Founder, Rewiring Australia, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 8.

107 Australian Energy Market Commission, *Rule determination 2021* p. ii.

108 Ibid.

109 Ibid., p. v.

network and instead lead to the purchase of small batteries for personal use only. The submission said:

> Many stakeholders have seen this as a punitive, ex-post tax, which will lead to perverse outcomes such as encouraging households to install batteries which are only sized for self consumption. This will lead to a reduction in utilisation of electricity grids, which will push up network prices for everyone else. Ironically, this rule was intended to protect lower income households from paying more for grid access. Charging to export is not necessary, i.e it is possible to address grid congestion using market mechanisms, rather than punitive taxing[110]

The submission added:

> The Determination has been structured with the intent for new pricing signals to push customers towards buying batteries for energy storage, and encourage self consumption over export. [111]

The Committee notes that the Victorian Government provided a submission to the Australian Energy Market Commission's discussion paper on the determination that was critical of the proposal to charge owners of distributed energy resources to export to the grid.[112]

RECOMMENDATION 3: The Victorian Government should monitor the impact of the Australian Energy Market Commission's determination on access, pricing and incentive arrangements for distributed energy resources, and advocate for amendments if the export of power into the grid from distributed energy resources diminishes as a result of the determination.

In conjunction with the work of the Australian Energy Market Commission, the Victorian Government has introduced a time-varying feed-in tariff for the export of power to the grid from distributed energy resources.[113] The tariffs are determined by the Essential Services Commission and the time-varying feed-in tariff varies from 6.7 cents per kilowatt hour for off peak, to 6.1 cents in the shoulder period to 10.9 cents per kilowatt hour in the peak period. The varying tariff offers rooftop solar and particularly solar battery owners an incentive to schedule the export of power to the grid at a time when demand is highest.[114]

Powerleger notes the Victorian Government's varying feed-in tariff and argues that it should be more reflective of the changes in peak demand, as is the case in New South Wales. Further, they advocate for price signals to be geographically varied to reflect the demand in different parts of the network. [115]

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110 Powerledger, *Submission 65*, p. 1.

111 Ibid., p. 2.

112 Australian Energy Market Commission, *Rule determination 2021* p. 66.

113 Department of Environment, Land, Water and Planning, *Renewable energy*: *Minimum feed-in tariff,* accessed 16 March 2022

114 Ibid.

115 Powerledger, *Submission 65*, p. 4.

Another method to coordinate the export of power from distributed energy resources is virtual power plants. A virtual power plant is a network of individual rooftop solar and batteries that are aggregated together to coordinate how they feed energy into the grid to ensure efficiency. The Victorian Government is conducting a Virtual Power Plant Pilot Program.[116]

Tesla Australia noted that maintaining a good ratio of solar batteries in the network lessens network stability risks and the battery aggregation program, (now called the Virtual Power Plant Pilot) will provide smarter, controllable power to the grid:

> Tesla was pleased to see the Victorian Government expand the total amount of solar battery subsidies available from Solar Victoria last year, and the launch of Battery Aggregation program earlier this year. Maintaining a good ratio of battery to solar subsidies will be critical in achieving a higher penetration of renewable energy without creating major minimum demand or broader network risks. Therefore, continued expansion of the battery aggregation program (targeting 300MW to match the 1GW of solar) will be important in incentivising smarter, more dispatchable DER into to the market, rather than passive, uncontrollable rooftop solar. [117]

Dr Kelvin Say, Research Fellow at the University of Melbourne's Energy Transition Hub noted the infancy of virtual power plants and aggregation of distributed energy resources. He encouraged further development in the field:

> There is a role in actually putting the requests in such that AEMO actually can deal with that resource, and in the form of retail aggregators, for example, which actually act as a body of coordination across the rooftop PV fleet to engage with the electricity market. That is still nascent as a sector. Its institutional strength is still very small, but that is the natural home for that form of operation and to actually engage that level of engagement.[118]

The Committee is supportive of measures that encourage owners of distributed energy resources such as rooftop solar and batteries to export power into the grid at the right time. The Committee believes the Victorian Government should continue to explore options for more varying feed-in tariffs and progress its Virtual Power Plant Pilot Program to enable statewide delivery. This work will enable the connection of more distributed energy resources into the grid without risking system stability issues.

RECOMMENDATION 4: That to enable more distributed energy resources to export power to the grid without risking system stability, the Victorian Government should continue to explore options for more varying feed-in tariffs and progress its Virtual Power Plant Pilot Program to enable statewide delivery.

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116 Solar Victoria, *Virtual Power Plant (VPP) pilot program*, <https://www.solar.vic.gov.au/virtual-power-plant-pilot> accessed 16 March 2022.

117 Tesla Motors Australia, *Submission 41*, pp. 2–3.

118 Dr Kelvin Say, Research Fellow, University of Melbourne, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 20.

3.5 The variability of renewable energy and measures to offset it

One of the key considerations with renewable energy is that the power generated can be variable. If the sun is not shining and the wind is not blowing then two key sources of renewable energy generation, solar and wind, do not provide energy. Without strategies to mitigate against this variability, the supply can be threatened during periods of unfavourable weather and high demand. This problem becomes more acute the longer the energy shortfall lasts.

A key technique to tackle the variability of renewable energy generators is through 'firming'. This is the use of tools to provide additional stored energy to the grid for short periods of time when supply does not meet demand. Firming is also referred to as dispatchable energy.

The submission from AEMO noted that in its 2020 ISP, it called for six to 19 GW of firming capacity across the National Electricity Market to be built in the next two decades.[119]

However, renewable firming tools such as pumped hydro and particularly utility scale batteries do not cover energy shortfalls for long periods of time.[120] Gas power stations can be used for firming for longer periods, but produce carbon emissions.[121] This issue was noted by Mr Skinner from the Australian Energy Council, who said:

> As many experts have shown, actually a much better way of decarbonising is to target a high level of renewable energy—it might even be in the 90s—but to be prepared on occasion to call on fossil fuel sources as backup, such as natural gas or even liquid fuel, and even, if necessary, use carbon sequestration to offset those emissions.[122]

The Terms of Reference for this Inquiry ask the Committee to consider 100% renewable energy and as such, this Section will consider renewable energy firming tools only.

Firming is not the only strategy available to deal with possible renewable energy generation shortfalls during periods of unfavourable weather and high demand. The Committee was informed of other strategies to reduce risks inherent with the variability of renewable energy generators. These include:

- ensuring an appropriate geographic spread of renewable energy generators to hedge against unfavourable weather conditions in one part of the network
- ensuring there is an appropriate balance of wind, solar and other renewables to spread the risk when one type of generator is not performing

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119 Australian Energy Market Operator, *Submission 72*, p.3.

120 Grattan Institute, *Go for net zero: A practical plan for reliable, affordable, low-emissions electricity*, 2021, p. 30.

121 Ibid.

122 Ben Skinner, *Transcript of evidence*, p. 14.

- ensuring adequate transmission infrastructure so that different parts of the network can support each other.[123]

3.5.1 Firming and dispatchable power

AEMO foresees that dispatchable power will be an important part of stabilising the grid in the coming years:

> Additionally, the concept of "dispatchable capacity" has become an increasingly important consideration. AEMO's 2020 ISP called for six to 19 gigawatts of new dispatchable capacity to be built in the next two decades, to assist in stabilising the grid. This currently consists of battery storage, pumped hydro and gas firming plants, which are an invaluable part of the energy system as large parts of our thermal generation fleet retire. This includes the Victorian Big Battery in Geelong.[124]

The key renewable tools for providing dispatchable power are utility scale batteries, and pumped hydro. AEMO predicts there will also be a role for distributed energy storage resources used in a coordinated way such as virtual power plants or using the batteries in electric vehicles.

Utility scale batteries

Utility scale batteries play an important role in firming. They are able to store excess energy and instantly provide power back into the grid during periods of high demand or low supply. They can also play a role in system stability.[125] However, these large batteries have limited storage and can only supply power for short periods, up to four hours. This makes them less ideal for long periods of reduced supply and high demand.[126]

The Committee heard that there has been technological change in the battery sector that has resulted in price reductions, making them more commercially viable as an important tool for firming. Mr Thornton explained the role of utility-scale batteries in a future energy system:

> the energy system of the future is going to be dominated by wind and solar as far as the sources of generation go, and then complemented by energy storage, both in the form of traditional hydropower and pumped hydropower and now also batteries at all scales—everything from residential-scale batteries through community-scale and utility-scale batteries. I think this is the area from a technology perspective that has moved the quickest in the last couple of years. The pace of development of batteries has been extraordinary. We have seen enormous cost reductions, to the point that these projects are now going ahead around the country free of any subsidy, just based on the commercial market reality.[127]

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123 Australian Energy Market Operator, *Renewable Integration Study Stage 1 Appendix C: Managing variability and uncertainty*, 2020, pp. 46–60.

124 Australian Energy Market Operator, *Submission 72*, pp. 3–4.

125 Department of Environment, Land, Water and Planning, *Large Scale Batteries*, Fact Sheet, p. 1.

126 Grattan Institute, *Go for net zero*, p. 30.

127 Kane Thornton, *Transcript of evidence*, p. 34.

The Victorian Government recently invested in Australia's largest battery in Moorabool near Geelong, known as Victoria's big battery. The submission outlined the capacity of the battery:

> Developing Victoria's Big Battery – a 300 MW/450 MWh grid-scale battery at Moorabool that will help support renewable generation and increase transfer capacity of the Victoria-New South Wales interconnector by up to 250 MW at peak times.[128]

The submission also noted that Energy Australia is planning to build a utility scale battery close to the site of its Yallourn coal-fired power station, which is due to close in 2028. The battery will be one of the world's largest at 350 MW and is due to be installed by December 2026.[129]

The submission from Tesla Australia noted the other strengths of battery storage, playing a role in system strength and inertia:

> Additional battery applications crucial to ensure efficient REZ design and deployment include provision of essential system services (inertia, system strength, voltage control), and grid protection and resiliency benefits. Storage can also complement and/or defer network capacity upgrades – providing optionality benefits and cost savings. Battery storage can immediately address system strength and grid-connection issues, whilst also offering a centrally coordinated, scale efficient solution to integrate renewables over the medium-term. Battery projects also lead to greater investment in local economies, more local jobs, and greater benefits to local supply chains than comparable syncon installations.[130]

They added that in their view utility scale batteries were now cheaper and more cost effective as a tool for firming than gas power plants:

> There is no need for gas plants in the electricity system to maintain reliability or system security – battery storage is now lower cost, faster, and more useful than gas-fired generators as a form of 'peaking power' or back-up spinning reserve in the electricity system. Rapid and continuing reductions in battery costs continue to improve this position.[131]

The Committee supports the development of utility scale batteries where necessary to provide firming services for renewable energy generators and system stability services to the grid.

Virtual power plants and electric vehicles

AEMO's Draft 2022 ISP sees a role for 'coordinated DER [Distributed Energy Resources] storage' such as virtual power plants and coordinated use of electric vehicle batteries.[132]

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128 Department of Environment, Land, Water and Planning, *Submission 88*, p. 5.

129 Ibid., p. 10.

130 Tesla Motors Australia, *Submission 41*, p. 4.

131 Ibid.

132 Australian Energy Market Operator, *Draft 2022 Integrated System Plan*, p. 50.

In AEMO's forecasts coordinated distributed energy resources will play a role in providing energy into the grid during peaks, most notably the late afternoon when energy demand is highest. AEMO believe that without tools such as virtual power plants in future scenarios 'there would be greater need for traditional hydro and gas-fired generators, as well as utility-scale shallow storage, to meet higher peaks of demand.'[133]

AEMO notes that the effectiveness of distributed energy resource storage depends on it being well coordinated, for example in a virtual power plant. This relies on the uptake of these technologies and will be assisted with the support of retailers and other energy market participants:

> The effectiveness of this DER storage depends on it being well coordinated, for example through VPPs. Increasingly active management of consumer devices (through smart, cloud-connected and rule-based devices) will reduce the scale of utility-scale investment needed to maintain the reliability and security of the system. This in turn depends on greater consumer adoption of those smart technologies, with support of retailers, networks and other market participants. [134]

The Committee was informed that electric vehicles have the potential to feed their excess energy into the grid in a similar fashion to solar batteries. The submission from Australian Parents for Climate Action outlined electric vehicles might be used in this way:

> An EV [electric vehicle] battery is typically around 60kWh and substantially cheaper (on a kWh basis) than home battery systems. Just as we are used to driving with a less than full petrol/diesel tank, EV owners could be persuaded to make a nominated proportion of their battery capacity available to support grid capacity requirements and provide frequency control, etc., in return for appropriate compensation and assurances that warranties and battery longevity will be preserved.[135]

Banyule Clean Energy group informed the Committee in its submission that trials have taken place in South Australia and the ACT on 'vehicle-to-grid' projects to demonstrate the ability of electric vehicles to provide stability and firming services. In relation to the trial in the ACT, Banyule Clean Energy Group explained:

> In 2020 a vehicle-to-grid (V2G) trial was implemented in the Australian Capital Territory employing 51 Nissan Leaf battery electric vehicles (BEV). When not in use as transport the Leafs will be plugged in to provide electricity back into the grid. The Leafs provide Frequency Control Ancillary Services (FCAS) to the National Electricity Market to keep a power grid operating at its optimum levels at times of fluctuating demand, with injection or reduction of power. Vehicle to the home (V2H) technology already exists that allows an EV's battery to operate within a household's electricity system giving enhanced payback when EVs are coupled with local generation.[136]

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133 Ibid.

134 Ibid., p. 51.

135 Australian Parents for Climate Action, *Submission 42*, p. 4.

136 Banyule Clean Energy Group, *Submission 64*, p. 13.

The Committee notes the Victorian Government's Virtual Power Plant pilot project already underway. In addition, as outlined in the Victorian Government's *Zero Emission Vehicle Roadmap*, the state is a participant in an ANU study into vehicle-to-grid technology. It anticipates the deployment of this technology later in the 2020s.[137] The Committee supports the ongoing development of these important initiatives.

Pumped hydro

Pumped hydro involves the use of gravity between two bodies of water, one higher than the other to generate energy. Water is pumped from the lower to the upper reservoir, then released through a turbine to the lower reservoir when energy is needed.[138] Pumped hydro provides longer duration firming support to the grid than batteries, this is known as 'deep storage'.[139]

Professor Blakers provided the Committee an example of a pumped hyrdo facility at a public hearing (see Figure 3.7):

> This is the Tumut 3 pumped hydro system in the Snowy Mountains. Water can go both up and down. On a sunny and windy day the water is pumped up. It comes back down through the turbines at night to recover that energy.[140]

Figure 3.7 The Tumut 3 pumped hydro system in the Snowy Mountains

Source: Professor Andrew Blakers, ANU, presentation to the Committee, public hearing, Melbourne, 17 March 2022, p. 10.

137 Department of Environment, Land, Water and Planning, *Victoria's Zero Emissions Vehicle Roadmap*, p. 71.

138 Department of Environment, Land, Water and Planning, *Renewable energy: Pumped Hydro*, <https://www.energy.vic.gov.au/renewable-energy/pumped-hydro> accessed 16 March 2022.

139 Hydro Tasmania, *Submission 62*, p. 4.

140 Professor Andrew Blakers, *Transcript of evidence*, p. 2.

Hydro Tasmania explained the need for pumped hydro as a firming tool in a grid with a high proportion of renewable energy generators. It noted that pumped hydro provides deep storage capability for events such as long periods of unfavourable weather or high demand:

> Supporting a renewables-based energy grid will require energy storage options of different durations. Shorter duration storage through chemical batteries will provide important system services and support.
>
> However, as the proportion of renewable energy increases and ageing thermal generation retires, long-duration "deep" storage will be required to ensure reliability and security of energy supply as well as for meeting forecasting uncertainties and lower probability events.[141]

Figure 3.8 below from Hydro Tasmania outlines the type of events that are capable of being supported by shallow storage, including batteries and other firming tools, and deep storage provided by pumped hydro. Crucially, pumped hydro can provide firming services for a number of days, rather than a number of hours.

Figure 3.8 A comparison of the suitability of shallow storage and deep storage tools to support the grid

Challenges to system supply-demand balance	Indicative duration of impact	
Brief variations in load or supply	0-1 hrs	Shallow storage
Contingency events causing brief spikes in supply-demand imbalance	0-2 hrs	
Managing load uncertainty and supply constraints (transitional)	6-8 hrs	
Daily balancing of solar cycle	**10-14 hrs**	Deep storage
Large cloud bands in a system with substantial solar reliance	**24-48 hrs**	
Successive days of minimal wind generation	**24-72 hrs**	

Source: Hydro Tasmania, *Submission 62*, p. 5.

Professor Blakers informed the Committee that Victoria possessed excellent natural resources for pumped hydro in the north-east of the state, including two pairs of reservoirs that alone that could support 100% renewable energy across Australia:

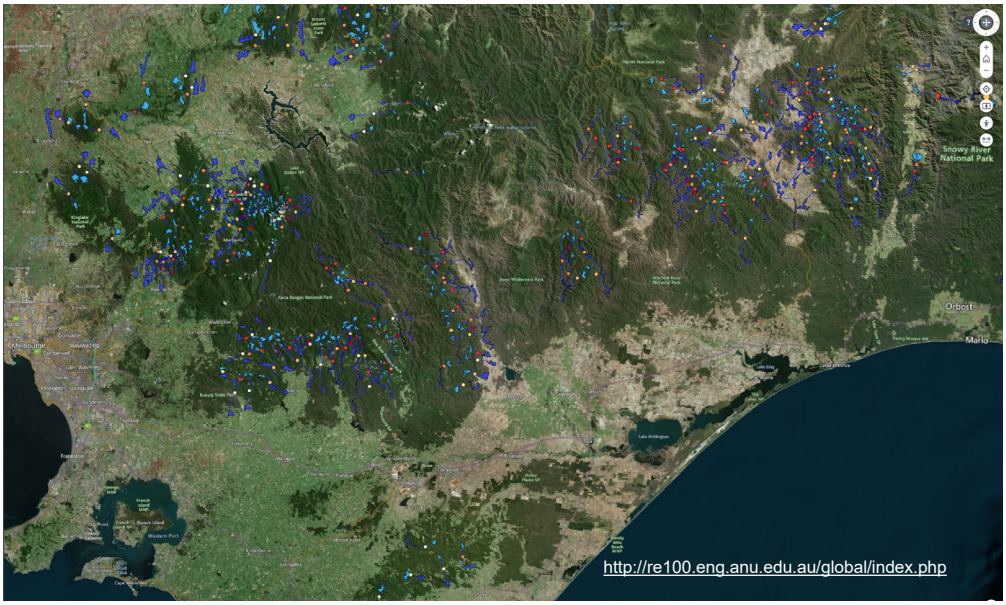
> Victoria has got large numbers. Each of those dots represents a really good pumped hydro site—most of them obviously in the alps, a few down near the Otways. If you zoom in on the atlas, those dots start to resolve into upper and lower reservoirs. This shows a couple of potential reservoir sites near Bullioh. Together, that pair of pairs has enough storage to support 100 per cent renewable electricity for the whole of Australia, and there are 4000 other good sites.[142]

141 Hydro Tasmania, *Submission 62*, p. 4.

142 Professor Andrew Blakers, *Transcript of evidence*, p. 2.

Figure 3.9 below shows the sites identified by Professor Blakers' team at ANU as suitable sites for pumped hyrdo in Victoria. Each dot represents a potential site.

Figure 3.9 Sites in Victoria identified as suitable for pumped hydro in Victoria



Source: Professor Andrew Blakers, ANU, presentation to the Committee, public hearing, Melbourne, 17 March 2022, p. 10.

Professor Blakers gave an assessment of the number of pumped hydro assets Victoria needs: 'Victoria needs one or two pumped hydro systems to match Snowy 2.0 and Kidston and the others that are being built or already exist. Pumped hydro and batteries just take care of storage.' [143]

Hyrdo Tasmania informed the Committee that it is working to enable to bring firmed energy from Tasmania's hydroelectric assets to Victoria via a proposed high capacity undersea transmission cable known as Marinus Link.[144] The submission stated:

> Based on AEMO data, Hydro Tasmania has undertaken significant modelling with a range of sensitivities on options to deliver 750MW of firmed energy to Victoria. At the time of writing the white papers, the solutions unlocked by Marinus Link backed by hydro and pumped hydro were 15–35% lower in cost than other options available.[145]

The Committee supports the development of pumped hydro firming capability either based in Victoria or provided via transmission from interstate. Deep storage capability is important in a grid with 100% renewable energy generators for system security.

FINDING 6: Access to deep storage firming capability such as pumped hydro is important in a system with high renewable energy generation capacity to mitigate against long duration periods of unfavourable weather and high demand.

143 Ibid.

144 Hydro Tasmania, *Submission 62*, p. 1.

145 Ibid., p. 5.

3.5.2 Diversity of generator type, geographic spread of generators and transmission

The Committee was informed of three other methods to mitigate against the variability of renewable energy that does not involve firming. These methods are:

- diversifying the type of renewable energy generators
- diversifying the geographic spread of renewable energy generators
- relying on transmission infrastructure to bring in energy from other jurisdictions.

These three methods involve spreading the risk of unfavourable weather patterns. For example, if the sun is not shining then wind generators may still be active. Spreading the risk across geographic areas is also key. Cloud cover in one part of the state may prevent some solar farms from operating well, but they will still be operating in parts of the state without cloud cover.[146] Transmission lines from other states can bring in energy if weather patterns in Victoria result in supply not meeting demand.[147]

Professor Blakers gave an overview of these mitigation techniques:

> Stabilising 100 per cent renewable electricity—solar and wind together are better than either alone. Spread it out over a large area to reduce local weather effects. Obviously shifting those from night to day is good.[148]

The submission from Star of the South outlined the importance of geographic spread of renewable energy generators. They provided a figure (Figure 3.10) which showed the diversity benefit of a combination of different technologies in different locations around the state:

> [The figure] shows the percentage of time periods when onshore wind (green), offshore wind in Gippsland (blue) and solar (yellow) are operating above 50% capacity factor while the other technologies operate below 25% capacity factors. Having a combination of technologies in different locations around the state strengthens the electricity reliability in a 100 per cent renewable system, with offshore wind in Gippsland bringing the largest diversity benefit to Victoria.[149]

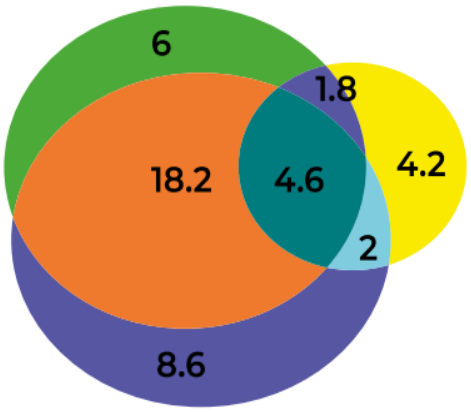
146 Star of the South, *Submission 86*, p. 4.

147 Professor Andrew Blakers, *Submission 15*, p. 6.

148 Professor Andrew Blakers, *Transcript of evidence*, p. 2.

149 Star of the South, *Submission 86*, p. 4.

Figure 3.10 The benefit of diversifying generator type and geographic spread



Source: Star of the South, *Submission 86*, p. 4.

The submission from Professor Blakers outlined the importance of transmission in mitigating variability and argued that it lessens the need for firming tools:

> ... Another very important requirement is building much stronger transmission to South Australia and New South Wales (and maybe Tasmania). Interstate power transfer smooths out local weather and hugely reduces storage requirements (which saves money). When its sunny and windy in Victoria, power is exported. When its still and gloomy in Victoria, power is imported.[150]

The Committee notes that Victoria's renewable energy zones are located across the state and are expected to mitigate against unfavourable weather conditions in one part of the state. Victoria's renewable energy auctions, which is the process by which generators will be built in the renewable energy zones, include a target for 20% of the auctions to be dedicated to solar.[151] This will contribute to the diversity of generator type. The Committee is also aware that Victoria is linked to South Australia, Tasmania and New South Wales via transmission, although upgrades in capacity may be needed in the future.

3.6 Transmission infrastructure and renewable energy

> **In my view the number one problem is transmission. Number two is also transmission and number three is also transmission.**
>
> Professor Andrew Blakers, Australian National University, *Transcript of evidence*, 17 March 2022, p. 9.

With the transition to renewable energy, Victoria is undergoing a significant change in the location of its generators. Until recently, the vast majority of Victoria's energy generation capacity was located in the Latrobe Valley, close to the sources of brown coal. Much of Victoria's transmission network was built to transfer the energy generated in the Latrobe Valley onto the rest of the state.

150 Professor Andrew Blakers, *Submission 15*, p. 6.

151 Department of Environment, Land, Water and Planning, *Renewable Energy Action Plan*, p. 9.

As discussed in Section 3.3.1 renewable energy generators are better suited to other parts of the state that have weather attributes that allow for more efficient energy generation. The six Renewable Energy Zones that will host renewable energy generators are spread geographically across the state, and transmission infrastructure will be required to connect the generators to consumers in major population centres.

Dr Jonathan Spears, CEO of Infrastructure Victoria outlined the change in transmission infrastructure posed by the transition to renewable energy:

> We have obviously got a very big change going on with the staged closure of the centralised Latrobe Valley electricity generation, where we have for decades had centralised generation and transmission of that electricity. What we are seeing now as we move to renewables is that there are lots of renewable energy opportunities throughout the state, but the development of those, the coordination of that renewable development and its connection and transmission to the places where it is being most used is something that we are really working through now and will in coming years.[152]

Professor Blakers also discussed the need for adequate transmission across the state to connect the generators in the renewable energy zones, and other states, to consumers:

> The one thing that we do not have is adequate transmission, so we badly need to strengthen transmission to get the new solar and wind into the cities—wind from the west, solar and wind from the north-west, pumped hydro from the north-east, offshore wind from the south and then connecting in Tasmania, and then strong interconnection into South Australia and New South Wales so when the weather is good in Victoria we can export solar and wind, and when the weather in Victoria is bad we can import solar and wind. So a strong interconnection interstate is also quite important.[153]

The Committee notes that there is already significant transmission infrastructure in the Latrobe Valley to accommodate renewable energy projects owing to its existing energy generation infrastructure.[154] The submission from Latrobe City Council noted that despite these existing assets only one renewable energy zone is located in Gippsland to take advantage of the transmission infrastructure of the Latrobe Valley. However, Professor Blakers from ANU said the reason for this is that 'coal fields are usually not the best places for solar and wind farms.'[155]

3.6.1 Developments with transmission infrastructure

The Committee was informed that AEMO is responsible for planning Victoria's transmission requirements as it transitions to renewable energy. Mr Thornton from the Clean Energy Council discussed the role of AEMO in planning the transmission network:

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152 Dr Jonathan Spear, Chief Executive Officer, Infrastructure Victoria, public hearing, Melbourne, 16 March 2022, *Transcript of evidence*, p. 2.

153 Professor Andrew Blakers, *Transcript of evidence*, p. 2.

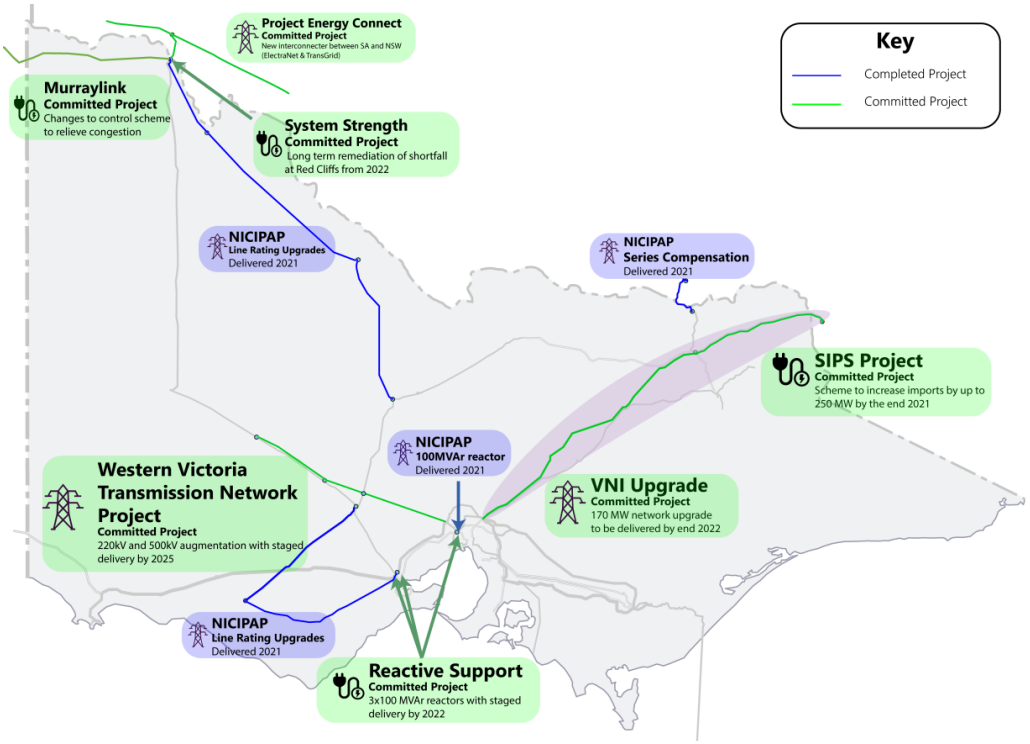
154 Latrobe City Council, *Submission 14*, p. 4.

155 Professor Andrew Blakers, *Submission 15*, p. 5.

> in terms of the transmission infrastructure, look, we really rely heavily on the Australian Energy Market Operator. They are really the experts in both managing the grid but also forecasting what the future energy system should look like. The integrated system plan that they prepare and now publish every two years I think really is the oracle as far as what the electricity grid should look like into the future. It is not for me or, to be frank, anyone else to really critique that. They go through a very, very rigorous process, extensive consultation and analysis that informs that, and I think that ISP really gives us a very strong view around what the transmission system should look like.[156]

AEMO provided the Committee with their *2021 Victorian Annual Planning Report*, which includes its transmission development plan for Victoria. The plan outlines the recently delivered transmission projects and those that have been committed to. These projects are shown in Figure 3.11 below. Some of the projects are upgrades to enable additional capacity on existing lines. Others, such as the Western Victoria Transmission Network, (which is discussed in Section 3.7.) are new stretches of transmission infrastructure.

Figure 3.11 Transmission projects recently completed and committed to as part of AEMO's transmission development plan for Victoria

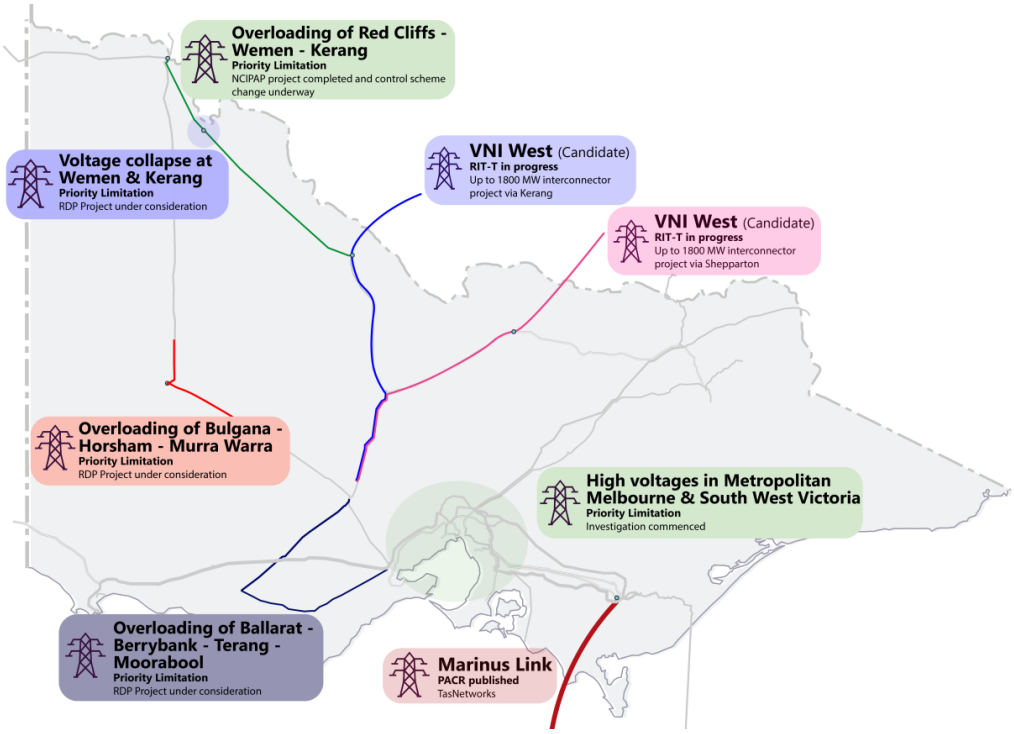


Source: AEMO, *2021 Victorian Annual Planning Report*, Section 3.3, p. 53.

The transmission development plan also outlines future transmission projects that AEMO has identified for Victoria. They include transmission upgrades and new stretches of transmission infrastructure. Figure 3.12 below shows the future projects.

156 Kane Thornton, *Transcript of evidence*, p. 34.

Figure 3.12 Future projects outlined as part of AEMO's transmission development plan for Victoria



Source: AEMO, *2021 Victorian Annual Planning Report*, Section 3.3, p. 53.

One of the future projects the Committee was informed of is VNI West, a transmission line that will enable connection to the Snowy 2.0 project in New South Wales. The submission from Snowy Hydro urged the Victorian Government to press ahead with VNI West so that Victoria can be connected to Snowy Hydro 2.0 and its firming capability:

> The risks are too high to delay VNI West, which addresses the identified transmission network limitations to ensure the power system continues to deliver least-cost, secure and reliable energy to consumers. The interconnector will enable Victorian consumers to access least cost generation across the State, enabling the connection of new generators that will replace those power stations scheduled to retire, and improve the reliability of supply. It will also facilitate access to the firming and storage capacity of Snowy 2.0, the largest storage facility in the NEM.[157]

Infrastructure Victoria also advocated for VNI West to go ahead and that it be completed by 2028 in time for the closure of the Yallourn coal-fired power station.[158]

TasNetworks and Infrastructure Victoria also noted the importance of Marinus Link in connecting Victoria to the Hydro power generators and the provision of firming capability.[159]

157 Snowy Hydro Ltd, *Submission 52*, p. 1.

158 Infrastructure Victoria, *Submission 44*, p. 12.

159 TasNetworks, *Submission 60*, p. 2; Infrastructure Victoria, *Submission 44*, p. 12.

AMEO notes that the projects identified in its transmission development plan are designed to maintain energy supply and minimise overall costs to consumers:

> The projects will facilitate the connection of new generation, increase network capacity to transfer power between new supply centres and demand, and manage emerging operational challenges before they arise. It has been designed to efficiently deliver system security requirements, maintain supply reliability, and minimise overall costs to consumers in the context of Victorian Government policy and regulatory settings.[160]

Alongside AEMO's work in planning the larger and long-term aspects of the grid, the Victorian Government is helping to commission smaller transmission upgrades to unlock capacity on the grid. This work is being undertaken in six projects as part of phase one of Victoria's Renewable Energy Zone plan. A media release from Hon Lily D'Ambrosio MP, Minister for Energy, Environment and Climate Change, outlined this work:

> These six projects include three pieces of infrastructure that will work like 'shock absorbers' to smooth out higher and lower rates of energy flowing through the lines, making it easier for renewable energy to enter the grid.
>
> There are also three projects that will upgrade the transmission network, to increase the capacity of existing lines, so they can carry higher energy loads, pumping more renewables across Victoria.[161]

In its submission, Infrastructure Victoria noted the importance of technical upgrades so that the transmission can accommodate renewable energy generators, as well as upgrading capacity:

> Transmission lines in some parts of regional Victoria are already experiencing significant congestion with some renewable energy generators having trouble exporting their electricity. The transmission infrastructure in these places is not designed for high generation volumes, or to accommodate the technical requirements of renewable energy generation. Victoria needs new transmission infrastructure to improve capacity and unlock the potential of renewable energy resources. [162]

The submission from Energy Grid Alliance argued that the amount of transmission infrastructure required to transition to renewable energy had not been built for close to 40 years:

> It is important to recognise that transmission line projects, the scale we are about to experience, have not been built in Victoria for close to four decades. As such, there is a notable lack of planning policy for new transmission.[163]

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160 Australian Energy Market Operator, *Victorian Annual Planning Report*, p. 52.

161 Hon Lily D'Ambrosio MP, *New Projects to accelerate Victoria's Renewable Energy Zones*, media release, Victorian Government, Melbourne, 3 August 2021.

162 Infrastructure Victoria, *Submission 44*, p. 11 (with sources).

163 Energy Grid Alliance, *Submission 2*, p. 1.

The Committee heard that the construction of transmission infrastructure is likely to require significant investment. Dr McConnell from the University of Melbourne gave an estimate of the necessary investment:

> If you follow the pathways that are laid out in the integrated system plan, there needs to be a substantial investment in transmission. In those least-cost scenarios we are talking in the vicinity of—depending—$4 billion to $5 billion to develop the six renewable energy zones in Victoria, and if you are going to develop all of those, that is quite a substantial amount of investment, keeping in mind that the regulator as a base of the entire transmission system in Victoria at the moment is about $3.5 billion. So we are talking about significant transmission investments in those scenarios.[164]

Infrastructure Victoria stressed that the construction and timing of Victoria's transmission infrastructure will require complex coordination to ensure each part of the system was able to progressively cope with the added renewable energy generation capacity:

> A major challenge in the energy transition is coordinating generation development and transmission infrastructure for a reliable, sustainable and affordable electricity supply. Renewable energy investments are geographically disparate, making it difficult to create beneficial economies of scale without some coordination. New transmission infrastructure should align with high concentrations of renewable energy, such as in priority Renewable Energy Zones where largescale renewable energy can be efficiently developed. Victoria will need to better coordinate new transmission and generation infrastructure to help bring new renewable electricity online in the right place at the right time.[165]

The Committee commends the work of the Victorian Government and AEMO in setting down the path of transmission upgrades and constructing new transmission for Victoria's energy transition. As outlined by stakeholders, transmission will be crucial in a scenario of 100% renewable energy and there is an urgency for it to be constructed as soon as possible to enable new renewable generators to come online.

3.7 Social licence for renewable energy generators and transmission infrastructure

As outlined in Section 3.3.1, Victoria's renewable energy zones overlay some of Victoria's most productive agricultural land and areas of natural beauty. Construction of renewable energy generators and transmission infrastructure understandably causes apprehension from some members of regional communities who have concerns about impacts to the environment and private properties.

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164 Dr Dylan McConnell, *Transcript of evidence*, p. 14.

165 Infrastructure Victoria, *Submission 44*, p. 11 (with sources).

The Energy Grid Alliance gave an example of how communities can object to renewable energy projects on environmental grounds:

> Push-back from communities, concerned about the cumulative environmental effects of overhead transmission, is fast becoming recognised as a major contributor to material project delays, increased project costs and likelihood projects may not even proceed.[166]

A paper from RE-Alliance, titled *Community Benefits Handbook: How Regional Australia can Prosper from the Clean Energy Boom,* gives examples of the kinds of grievances regional communities might have against the construction of renewable energy generators and transmission:

- Visual amenity impacts
- Noise concerns
- Property price concerns
- Lack of genuine consultation and access to decision-making
- Changes of project ownership
- Disruption of community cohesion
- Land-use conflicts (real or perceived) with agriculture.[167]

Dr McConnell told the Committee that there had been recent public opposition to the Western Victoria Transmission Network in particular:

> there is a big question around how that transmission will be developed and will roll out, particularly when we have issues like we are seeing in the western Victoria integration project, which you probably have heard about. It is actually quite a small upgrade in the scheme of things. It is I think a $350 million-odd project, a couple of hundred kilometres, and it has a substantial amount of local objection. It has been in development since about 2018 I think. So if you are thinking about the lead times, costs and social licence issues, there are some real challenges …[168]

Mr Thornton from the Clean Energy Council acknowledged that there will be community opposition, and outlined the processes needed to ensure social licence can be sought from communities. Social licence in this context refers to community consent to construct a renewable energy project:

> We acknowledge that for some members of the community they will not like these projects in their vicinity. I think we accept that, but I think what we need to do is then reflect on, well, what is the process we go through, and how can we build and design these projects in a way that minimises the impact on community? How do we make sure that the planning and regulatory processes allow open consultation, a lot of

166 Energy Grid Alliance, *Submission 2*, p. 2.

167 Re-Alliance, *Community Benefits Handbook: How Regional Australia can Prosper from the Clean Energy Boom*, 2021, p. 6.

168 Dr Dylan McConnell, *Transcript of evidence*, p. 15.

> transparency and responsiveness to the community where that can be catered for? And I think that also needs to include reflection on the way in which community members might be compensated and any impacts recognised.[169]

The submission from RE-Alliance noted that the construction of renewable energy projects can be beneficial for the economies of regional communities, but that without social licence the projects may face delays:

> Social licence for renewable projects is essential to our energy transition. When planned well, renewable projects build stronger, more resilient regional communities and economies. On the flipside, when local communities are not included in development or the rationale for the transition and there's a lack of local by-in, there can be significant delays to new transmission and renewable generation infrastructure.[170]

Engagement and partnership with regional communities is important to build social licence for the construction of renewable generators and transmission. Measures to ensure social licence include consultation and communication on the part of project proponents as well as ensuring local communities benefit from projects in the form of local procurement and investment. Where appropriate, improved compensation for those hosting transmission infrastructure should also be considered. In addition, the use of underground transmission lines can address community concerns, although the expense is considerable.

3.7.1 Improving consultation and communication

The Committee heard evidence that consultation and communication on the part of renewable energy project proponents has been deficient in the past and that measures are being taken to improve community engagement in the earlier stages of a project.

The Committee was provided an example from a submitter who considered the community engagement for the Western Victoria Transmission Network Project had been non-consultative and unequal. Brendan Toohey said:

> As part of the requirement for the WVNTP tender Ausnet have had to engage local communities affected by the project through consultation meetings. Those meetings have been dismissed by the people attending as just 'box ticking exercises. In fact, Ausnet have now abandoned community meetings in favour of pre-arranged one on one appointments. Leaving individuals attempting to negotiate with Ausnet in an extremely unequal power dynamic.
>
> Community consultation by Ausnet has consisted mostly of telling people what Ausnet are going to do, why they cannot do anything about it and why Ausnet is not required to compensate people in any fair or meaningful way.[171]

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169 Kane Thornton, *Transcript of evidence*, pp. 38–39.

170 Re-Alliance, *Submission 71*, p. 6.

171 Brendan Toohey, *Submission 5*, pp. 2–3.

Mr Toohey added that he believed that the project proponents had 'squandered any community good will and have alienated the local population all along the proposed line …'[172]

This was echoed by Tony Goodfellow, Victoria/Tasmania Coordinator for RE-Alliance, who said the reasons for constructing the Western Victoria Transmission Network were not sufficiently explained to the community at the start of the project:

> The current western Vic transmission line and this other line in New South Wales are the first lines in quite a long time, and they are the first of quite a few more that will be rolled out. So the frameworks that have been used in terms of engagement and benefit-sharing are not up to scratch for that, and with the western Vic transmission line it kind of just came out of the sky to the local community. There was not much explanation as to why it is needed or communication as to what is happening and that kind of thing …[173]

Mr Thornton explained that community engagement practices of renewable energy proponents in the past were not up to the standard expected by the public and that they have since improved:

> I think it is fair to say quite a few years ago we saw some of the practices of the wind industry here in Victoria not up to the standard that community and, to be honest, we as the peak body and I suspect governments expected, and we saw quite a bit of reform and change come with that. If you think about what that involved, it was about education and cultural change in the businesses that were developing these projects, it was about changes in the way they engage and interact with local communities, it was about refinement and development of models for sharing the benefits of the projects with those local communities and it was about reform of things like the planning and regulatory processes that related to those projects. And I think it is fair to say that we now see in Victoria much stronger and broader community support for wind projects.[174]

AEMO, in its *Draft 2022 ISP* noted that the sector underestimated the need for community consultation and that it should focus on larger land use issues and the benefits of decarbonisation:

> proactive engagement and integrated land-use planning is also needed at a jurisdictional level. The sector continues to underestimate the time and money that community consultation requires, with the rules placing it 'at the back end' rather than the front of the process. Where consultation does occur, it tends to focus on individual transmission projects, rather than on integrated land use planning, and even on the benefits of decarbonisation itself.[175]

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172 Ibid., p. 4.

173 Tony Goodfellow, Victoria/Tasmania Coordinator, RE Alliance, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 37.

174 Kane Thornton, *Transcript of evidence*, p. 38.

175 Australian Energy Market Operator, *Submission 72, Attachment 5*, p. 89.

The Victorian Government has sought to improve the community engagement practices of renewable energy proponents. In 2021, it released a paper titled *Community Engagement and Benefit Sharing in Renewable Energy Development in Victoria: A guide for renewable energy developers* (the guide). The guide is intended for successful bidders in the second round of Victoria's renewable energy auctions. It lays out:

- understanding community engagement
- understanding community benefit sharing
- tools for enhancing social licence outcomes.

Mr Goodfellow told the Committee that the guide was a good example of industry best practice in community consultation. However, he argued that a more strategic approach was needed for consultation statewide, rather than just focussing on single projects:

> There are best practices, and you can embed the need for community engagement and benefit sharing in the actual rollout. With VRET 2 [the second round of Victorian renewable energy target auctions] the guide actually does that quite well. That is basically an industry standard, but the VRET projects are the only ones that actually need to adhere to that. So embedding those necessary steps for all projects at a regional level would actually help. Right now it is project by project, and it is kind of an old way of thinking. When there were a couple of wind farms here and there, it was okay to think like that, but now, because of the renewable energy zones, that thinking has to change to a regional level.[176]

He added:

> Currently the VRET projects are guided by this community engagement benefit-sharing guide. There could be a similar REZ-level guide for all projects, considering the public funds which are invested in making REZs possible—for example, VicGrid. So far it is just project by project, so we suggest a more systematic approach.[177]

The submission from RE-Alliance also noted the importance of consulting with traditional owners to engage and establish consent for the construction of renewable energy projects:

> Frameworks [should be] established so developers make meaningful efforts to engage with relevant Traditional Owners and other Aboriginal Organisations and that self determination principles guide engagement with Traditional Owners and Aboriginal Victorians. These can build on the Pupangarli Marnmarnepu 'Owning Our Future'. Aboriginal Self-Determination Reform Strategy 2020–2025 and DELWP's Aboriginal Energy. Such frameworks must embody the principles of free, prior, and informed consent.[178]

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176 Tony Goodfellow, *Transcript of evidence*, p. 38.

177 Ibid., p. 34.

178 Re-Alliance, *Submission 71*, p. 7.

The Committee agrees that there needs to be more of a strategic focus on community engagement and consultation in the construction of renewable energy generators and transmission. The current guide is intended for use by projects built under the renewable energy auctions only. Many large projects are being proposed to be built outside of this framework. For example, the Star of the South.

The Committee heard that renewable energy generators and transmission need to be built not only to act on climate change, but also to provide enough generation capacity for the state as coal-fired power stations close.[179] Support for the transition to renewable energy is popular[180] amongst Australians overall, but earning the support of those living where the generators and transmission lines need to be built is essential.

RECOMMENDATION 5: That the Victorian Government produce a guide for community engagement and consultation for all renewable energy generation and transmission projects in Victoria, not just for those constructed under the renewable energy auction process. The guide should include direction on informing communities about the need for renewable energy zones to tackle climate change and to secure Victoria's renewable energy future, ensuring that traditional owners are integral to any consultation process.

3.7.2 Local benefits and procurement

The construction of renewable energy generators and transmission lines in Victoria's renewable energy zones has a chance to provide benefits to local communities in terms of jobs and economic growth. In addition, schemes such as community enhancement funds, community co-ownership and co-investment can deliver financial benefits to landholders and groups impacted by renewable energy generation and transmission projects.

Mr Goodfellow outlined some of the benefits for regional communities that host renewable energy generators:

> Rural communities are set to be major beneficiaries of investments in renewables, with new jobs, lease payments for farmers, indirect jobs in manufacturing and additional community benefit programs.[181]

The *Community Benefits Handbook* by RE-Alliance gives an overview of their assessment of the community benefits that can come with renewable energy projects (see Figure 3.13).

179 Greg Foyster, *Transcript of evidence*, p. 17; Kane Thornton, *Transcript of evidence*, pp. 38–39.

180 Greg Foyster, *Transcript of evidence*, p. 13.

181 Tony Goodfellow, *Transcript of evidence*, p. 34.

Figure 3.13 The benefits of renewables for regional communities

Source: RE-Alliance, *The Community Benefits Handbook How Regional Australia can Prosper from the Clean Energy Boom*, 2021, p.5.

The submission from RE-Alliance described the job creation opportunities that have been modelled by other organisations as a result of a national transition to renewable energy:

> The Clean Energy Council has estimated that "in 2019, at least 25,000 people were employed across the renewable energy industry and almost 10,000 of those jobs were in small-scale rooftop solar. By 2025 the renewable energy sector could employ as many as 44,000 people under AEMO's Step Change Scenario. More ambitious scenarios, dependent on policy settings, could result in an even larger workforce".
>
> Beyond Zero Emissions Million Jobs Plan suggests that there can be 1.8 Million jobs created by moving Australia to a low-carbon economy. There could be 8,000 peak construction jobs and 1,200 ongoing jobs associated with expanding the transmission

network over a 5-year period. Modelling by the Climate Council shows that installing utility-scale renewable energy is the biggest job creator intervention.[182]

However, Viva-Lyn Lenehan, a submitter, was sceptical about the prospect of jobs in regional areas being created by wind farms. She argued that the jobs only materialise at construction stage. Further, she said that once built, the generator's operation is controlled remotely from major cities and most workers are sourced from major cities:

> Wind farms provide jobs during the construction phase of the wind farm only.
>
> I understand that the owner of the Mortlake South Wind Farm engaged large contracting firms from Adelaide by housing the inter-state contractors in rented houses in the local area to claim they were locally sourced.
>
> Once the wind farm is up and running there is only one maintenance manager on site.
>
> The operation of the wind farm is controlled remotely from the city office, and most workers are specialised consultants sourced from major cities.[183]

The Committee notes that the Victorian Government's guide on community engagement and benefit sharing includes information about how renewable energy proponents can ensure local jobs and procurement opportunities. The guidance includes:

- Providing briefings or training to support local suppliers' ability to be part of the development.
- Discussing with local providers how to develop education opportunities to encourage skill development.
- Training local people for ongoing employment in maintenance and operation of projects.[184]

The Committee supports strong measures to ensure local job creation and local procurement for renewable energy projects and commends the Victorian Government's inclusion of local procurement and job creation measures in its community engagement and benefit sharing guidelines.

In addition to jobs and associated economic benefits, the Committee heard that some proponents of renewable energy projects direct a proportion of profits to a fund for use by the local community. These are known as community benefit funds or community enhancement funds. The funds are explained in RE-Alliance's *Community Benefits Handbook*:

> The most straightforward action energy companies often take to create benefits in host communities is to carve out a stream of profits for that purpose. Many wind farms and a growing number of solar farms in Australia have Community Enhancement Funds

182 Re-Alliance, *Submission 71*, p. 13 (with sources).

183 Viva-Lyn Lenehan, *Submission 11*, p. 5.

184 Department of Environment, Land, Water and Planning, *Community Engagement and Benefit Sharing in Renewable Energy Development in Victoria: A guide for renewable energy developers*, 2021, p. 23.

> (CEFs)—voluntary payments made by renewable energy companies for distribution to community groups, programs or projects. CEFs are currently the most common avenue through which regional communities have sought to benefit from renewable energy projects located in their backyards[185]

The submission from Moyne Shire Council supported community benefit funds and argued they should be put in place as part of the planning permit for renewable energy projects:

> To ensure maximum community confidence in renewable energy, including transmission line development, Government should develop mechanisms to lock in developer (transmission and generation) proposed community benefits schemes under the planning permit or other suitable instrument.[186]

The Victorian Government's *Community Engagement and Benefit Sharing Guide* gives direction on community benefit funds for bidders in the second round of the renewable energy auctions. It notes that successful funds involve community members in its management and governance.[187]

Finally, the Committee was told that communities in renewable energy zones could benefit more directly from renewable energy projects. Mr Goodfellow from RE-Alliance discussed co-ownership and co-investment of community energy projects as a way of sharing in the financial gains associated with renewable energy. He said:

> Co-investment refers to models whereby citizens, in this case within a particular area, have pathways to share in the profits of the project. This could look like offering or gifting shareholdings to project neighbours. Co-ownership refers to models where citizens are invited not just to benefit financially but also to have decision-making power as co-owners of a project or part of a project. Overseas community ownership, community co-ownership and community co-investment are commonplace for wind farms, and these models enjoy a high level of community support. For example, in Denmark in 2001, 86 per cent of wind turbines in the country were cooperatively owned. In the Danish private sector there has been a long-established requirement of all new developments that a minimum of 20 per cent ownership is offered to the local community. The support for and engagement with renewable energy projects that incorporate co-ownership and/or co-investment opportunities show that the benefits of renewable energy go far beyond a cleaner environment and can be enjoyed by a wide cross-section of stakeholders when an emphasis is placed on inclusion of all stakeholders and community-led development.[188]

Again, the *Community Engagement and Benefit Sharing Guide* encourages this method of sharing the benefits of renewable energy projects. It gives an example of a wind farm in Victoria that has used a co-investment model:

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185 Re-Alliance, *Community Benefits Handbook*, p. 12.

186 Moyne Shire Council, Submission 61, p. 7.

187 Department of Environment, Land, Water and Planning, *Community Engagement and Benefit Sharing in Renewable Energy Development in Victoria*, p. 23.

188 Tony Goodfellow, *Transcript of evidence*, p. 34.

> The Sapphire Wind Farm case study highlights the significant impact co-investment models can make. The success of the Sapphire Wind Farm has led several renewable energy developers to actively explore this innovative model.[189]

The Committee commends the Victorian Government for addressing local procurement, community benefit funds and co-investment and co-ownership in its *Community Engagement and Benefit Sharing Guide* for the second round of the Victorian renewable energy auctions. These important initiatives for ensuring local communities in renewable energy zones should be applied to all renewable projects and the Committee recommends they be included in any larger state-wide guidance paper, along with community engagement and consultation.

RECOMMENDATION 6: That any statewide guide for community and engagement and consultation for renewable energy projects in Victoria should include a community benefits and economic development portion that addresses the need for:

- local procurement, job creation and training
- community benefit funds
- community co-investment and co-ownership.

3.7.3 Compensation for transmission infrastructure

The Committee was told that one of the hurdles for community acceptance of transmission infrastructure is that the compensation arrangements only apply to the landholders hosting the transmission line, not their neighbours. In addition, the compensation is in the form of a relatively small one-off payment. Professor Blakers explained:

> There is a huge failure; that is that if you agree to allow a wind turbine tower on your land, you might get $10 000, $20 000 per year—per year—for the life of that turbine, 20 to 25 years. If a transmission company puts a transmission tower on your land, you get that once, up-front maybe.[190]

Gerald Conroy, a submitter, also put forward the view that landholders are not adequately compensated for transmission infrastructure:

> A landowner who are hosting or leasing land for generating renewable energy is being compensated by the energy companies, but the landowners along the transmission easements are expected to give up their land for nothing.[191]

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189 Department of Environment, Land, Water and Planning, *Community Engagement and Benefit Sharing in Renewable Energy Development in Victoria*, p. 24.

190 Professor Andrew Blakers, *Transcript of evidence*, p. 5.

191 Gerald Conroy, *Submission 13*, p. 1.

Professor Blakers argued that if landholders were provided compensation for transmission that was closer in nature to that provided for wind farms, then opposition to transmission would lessen:

> There is no reason why the payment made to landholders for transmission towers should not be benchmarked to wind turbine payments, but that is not allowed under current rules for constructing transmission. That needs to change, and just like with wind farms, if you do change it, suddenly community opposition to transmission melts away. If there is one recommendation to come out of this committee, I would recommend that Victoria goes it alone, tells the federal government where to go and makes sure that the compensation to landowners per transmission tower is pegged to the compensation paid per wind turbine.[192]

Professor Blakers added that there could even be competition amongst landholders to host transmission lines if the compensation settings were changed:

> but I really think that if the transmission is compensated in the same way as wind towers, which is not just the owners of land but also the people next to the owners of land, just like wind turbines are compensated, a lot of the opposition will evaporate and we might even have competition: 'I want those towers on my land, because I'm going to droughtproof my farm'. It is just amazing how much difference it makes. These farmers are seeing their neighbours with the wind turbines getting lots of money and they are stuck with the transmission and getting a lot of less money—why? [193]

However, the Committee heard that compensation arrangements are impeded by the Commonwealth Government's mandated Regulatory Investment Test for Transmission (RIT-T). Transmission project proponents must complete an RIT-T before construction can begin. The RIT-T emphasises efficiency and price over other considerations to ensure that energy consumers get the best deal. This leaves little room for the provision of additional compensation for landholders affected by the construction of transmission on their land or benefit sharing.[194]

The submission from RE-Alliance outlined the difficulty with the RIT-T:

> Transmission companies are limited by the federal regulations including the RIT-T in terms of how much they can spend on payments to landowners and benefit-sharing measures.
>
> Changes to regulations at state and federal levels, outlined in our report, would insert deeper community engagement and improved landholder compensation into the infrastructure pipeline outlined in the ISP.[195]

Professor Blakers suggested that in order to overcome the issues with the RIT-T impeding arrangements for compensation, the Victorian Government should consider

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192 Professor Andrew Blakers, *Transcript of evidence*, p. 5.

193 Ibid., p. 6.

194 Re-Alliance, *Building Trust For Transmission: Earning the social licence needed to plug in Australia's Renewable Energy Zones*, 2021, p. 21.

195 Re-Alliance, *Submission 71*, p. 11.

'going it alone'. This may involve making its own arrangements for transmission approval:

> In a nutshell, dump the RIT-T, which is the federally mandated test for the economics of a transmission system. Victoria just needs to tell the federal government to go away and to do it itself. Victoria can get the approvals five times faster if it just says, 'We're going to just do this'.[196]

He added:

> It is slowing things down basically. It is a backward-looking test, which is totally inappropriate for fast-moving solar and wind transmission. It is appropriate for a coal system where almost nothing changes from decade to decade. It is way past being fit for purpose. Victoria just needs to go it alone.[197]

RE-Alliance's paper *Building Trust for Transmission* outlined that the Victorian Government had introduced legislation to allow it to conduct its own regulatory investment test. It said:

> In February 2020, the Victorian Government passed the National Electricity (Victoria) Amendment Bill 2020 which allows the Victorian Government by order published in the Government Gazette to specify an alternative regulatory investment test.[198]

The intention of the *National Electricity (Victoria) Amendment Act 2020* is to expedite the construction of transmission where it is deemed necessary. This includes modifying or disapplying the need for an RIT-T.[199] The Act allows the Minister to specify an alternative test in place of the RIT-T.[200]

RE-Alliance advocates for any alternative RIT-T to have the means to facilitate 'increased landholder compensation, neighbour compensation, and funding community benefit sharing in the transmission sector to enhance social licence and facilitate the success of the REZs.'[201]

The Committee agrees now that the Victorian Government has legislated to have the freedom to specify its own alternative RIT-T, it would be a missed opportunity if it does not include provisions for increased compensation and benefit sharing arrangements for transmission infrastructure. The need for transmission infrastructure as Victoria transitions toward renewable energy is great and the Victorian Government needs all the tools at its disposal to ensure the necessary infrastructure can be built in a way that is accepted by the community.

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196 Professor Andrew Blakers, *Transcript of evidence*, p. 8.

197 Ibid.

198 Re-Alliance, *Building Trust For Transmission*, p. 21.

199 Victoria, Legislative Assembly, 19 February 2020, *Parliamentary debates*, p. 378.

200 Ibid.

201 Re-Alliance, *Building Trust For Transmission*, p. 25.

RECOMMENDATION 7: That the Victorian Government consider including provisions for compensation and benefit sharing in any alternative regulatory investment test for transmission infrastructure ordered under the *National Electricity (Victoria) Amendment Act 2020*.

3.7.4 Underground transmission

Some stakeholders suggested that opposition to transmission infrastructure could be mitigated if it was put underground, rather than on overhead transmission towers.

However, the Committee heard this option is not preferred by renewable energy project proponents because of its cost. Professor Blakers explained 'Undergrounding costs 10 times more, so going 500 kilometres underground is really quite prohibitive.'[202]

Dr McConnell from the University of Melbourne also reflected on the costs associated with underground transmission. He noted that undergrounding of transmission was recommended by the Bushfire Royal Commission, but had not taken place because of its cost:

> I would say that I think it is quite simply a cost question. The bushfire royal commission actually looked at the cost of undergrounding the distribution network in high-risk zones about a decade ago, and if I recall correctly, the cost of doing that in all bushfire risk regions was in the vicinity of $10 billion. I think they made three recommendations of what to do within that inquiry. That was the most expensive and the one that was not taken up, but from a bushfire risk perspective there were other options that were considered cheaper and more effective at the time. But basically it is a cost question. Ten billion dollars is not a small amount of money. To underground the entire network—that is I guess a public policy question: the cost trade-off of doing that. There is a cost of doing it, and that is why we have not done it.[203]

However, the Committee heard from Star of the South, who explained that they had chosen to place the transmission lines for their project underground when it is built. While it is more expensive, Ms Coldham explained that upon consulting with the local community on different options, their preferred option was undergrounding:

> Our project has committed to underground cable infrastructure, which has been well-received, due to the concerns that we heard again through our early stages of consultation. We have been consulting with the community on this project even going back to 2016 and 2017 and have seen those challenges in that region, so we are working through that process, and we look forward to continuing that process and doing that in step with our landholders on this project.[204]

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202 Professor Andrew Blakers, *Transcript of evidence*, p. 6.

203 Dr Dylan McConnell, *Transcript of evidence*, p. 21.

204 Erin Coldham, *Transcript of evidence*, p. 26.

> Certainly undergrounding is more expensive. It is something that might range in terms of the factor of how many times more expensive it is depending on the exact nature. But certainly from our perspective, as I mentioned, cost was one element that we brought into this multicriteria analysis with the others weighing up certainly the risk of the project going through. If I can say, in the Gippsland region as well there have been precedents. I note the Basslink cable through its planning process did have, I believe, some 7 kilometres of its route undergrounded. We also note that the desalination plant has an underground cable, and I do believe the Marinus Link is also going underground. So for us in this particular situation it is something that we felt was an important commitment to make to enable a smooth process going forward, notwithstanding the additional cost that would come with that. [205]

The submission from Energy Grid Alliance gave a novel example of reducing the costs of underground transmission in the US. In its example, an underground cable was placed next to railway lines, eliminating the need to clear trees and disrupt the environment:

> As the first underground long-distance HVDC project in the United States, the SOO Green HVDC Link is pioneering a new model for sustainable transmission development that avoids environmental impacts associated with traditional aboveground transmission lines. By installing the conductor cable underground along existing railroad right-of-way and other transportation corridors, SOO Green reduces the need for tree clearing and eliminates threats to sensitive species such as migratory birds, bats or native plants. [206]

The Committee believes that when assessing the costs of undergrounding transmission infrastructure, project proponents should take into account the views of community members and other indirect costs of overhead transmission.

3.8 Demand reduction

Ensuring an adequate supply of energy as Victoria transitions to renewable energy is critical. However, the Committee heard there are a number of measures that can be taken to reduce the demand for energy, and thus the amount that needs to be supplied.

Alan Pears AM, Senior Industry Fellow at RMIT University and Fellow, Climate & Energy College at the University of Melbourne argued that reducing demand for energy is too often ignored in favour of ensuring there is enough supply:

> The culture of Australian energy policy, market design and operation is heavily dominated by supply side considerations and market operational issues that ignore fundamentals. For example, why does AEMO not publish an annual 'Demand Side Statement of Opportunities' to complement its gas and electricity publications? What proportion of energy market agency resources is allocated to demand side action, especially energy efficiency and productivity?[207]

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205 Ibid.

206 Energy Grid Alliance, *Submission 2*, p. 4.

207 Alan Pears, *Submission 35*, p. 2.

Mr Pears believed more could be done to identify and persuade the residential customers that use the highest amount of electricity and gas to reduce their use. He said:

> Demand side energy productivity measures are poorly targeted. For example, the highest 5% of residential electricity and gas consumers use around 15% of the sector's gas and electricity. Yet no programs specifically target this group. Energy retailers know who these consumers are, and the state government regulates their behaviour. Retailers should be required to help high consumers to cut their energy use.[208]

Mr Pears also suggested that Victorian businesses could reap reputational benefits by managing their energy demand:

> Victoria's economy is dominated by low emission intensity industries and businesses. They are influenced much more by the need to maintain reputation, 'license to operate' and capacity to attract investors than by energy policy. In most cases, energy is a minor proportion of input costs so, as long as energy supply is reliable, reasonably prices and pricing is reasonably stable it is not a significant driver of behaviour. At the same time, energy dominates Victoria's carbon footprint and, increasingly, climate issues drive corporate decision-making. However, business decision-making on energy issues is generally poorly informed so businesses fail to capture the multiple productivity and reputation benefits available through management of energy demand. [209]

Other submitters argued that there needs to be more of a focus on community education to reduce energy use amongst residential users overall. Janet Chimonyo, a submitter advocated for an education campaign about the actions needed to transition to renewable energy:

> Members of the community will need to make a broad range of changes at a personal level if the transition to renewable energy is to be successful within the limited time now available to us. If the community is to do this well it will need to know and understand what is being done, what the targets are and what role they can play.
>
> There are already a range of projects underway across the state, but I think it is generally the case that the community at large does not have a good sense of what that action is and what progress has been made. The information we do receive is piecemeal. It does not create a clear sense of the Government's overall strategy. One example of this is the current suite of initiatives to support the uptake of electric cars in Victoria. We don't have a clearly identifiable state 'story' about EVs.
>
> Intelligent information campaigns, combined with meaningful and actionable state-wide targets would all help to give individual community members a sense of the Government's strategy. This would be a useful investment by the Government.[210]

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208 Ibid., p. 3.

209 Ibid., p. 4.

210 Janet Chimonyo, *Submission 34*, p. 2.

Peter Moraitis, an adult educator, told the Committee that the Victorian Government should play a role in informing the public about the need to transition from household gas to electrified alternatives:

> State Government's educational role in convincing the population of Victoria of the need for a rapid transition away from gas use to a renewably based energy system needs greater emphasis in government planning for the transition. There is an urgent need to widely disseminate why the switch away from gas is necessary and how this can be done.[211]

Finally, Citipower, Powercor and United Energy advocated for education for energy users on how they can reduce use at peak times as well as energy efficiency education for children:

> Finally, education should form a large part of any Victorian Government program to transition to 100% renewables.
>
> For example, consumer education could encourage usage of DER, particularly in residential homes with rooftop solar, at times of high solar exports to assist the transition. That is, customers should be encouraged to turn on their washing machines, air-conditioners and heat their hot water during the middle of the day. This will maximise the use of electricity when it is produced and reduce the reliance on storage.
>
> Education of how electricity is produced and how it is used should start in the early years. Children can be the biggest advocates for change, as they can encourage behaviour changes in their parents/carers driving to more efficient use of electricity at the household level.[212]

The Committee believes demand reduction is an important and underappreciated part of Victoria's transition to renewable energy. Reducing the amount of energy used will translate into less requirement for energy generation and could result in savings for consumers and the Victorian Government.

RECOMMENDATION 8: That the Victorian Government conduct an education campaign informing the public about the benefits of reducing energy consumption as one measure amongst a range of ways individuals can help to combat climate change and to also play their part in protecting Victoria's energy security as the state transitions to renewable energy.

3.8.1 Demand management

Section 3.4.4 discussed the management of supplying energy into the grid from rooftop solar and solar batteries. The tools involved included variable pricing and smart technology to coordinate export to the grid. The same tools can be used when households use energy.

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211 Peter Moraisis, *Submission 58*, p. 1.

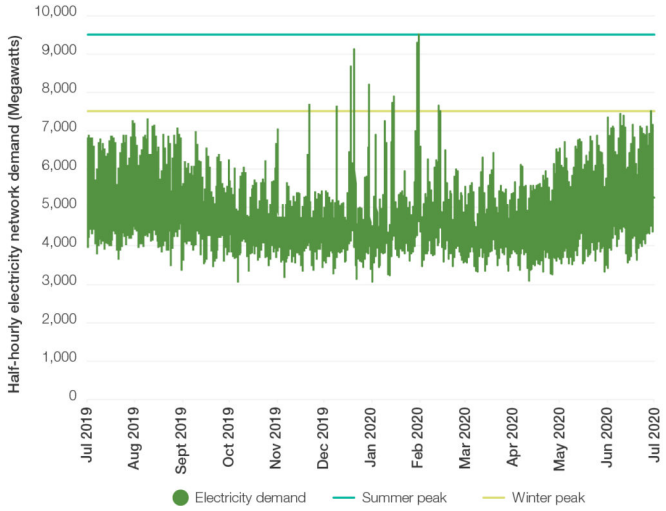
212 CitiPower, Powercor and United Energy, *Submission 54*, p. 7.

The submission from Infrastructure Victoria outlined how Victoria's energy network is built to provide enough capacity to supply the peaks in demand a few times a year during summer. The rest of the time there is much unused capacity in the network. Reducing the peaks in demand will result in less unused capacity and make for a more efficient system:

> Electricity infrastructure must generate and transmit enough energy to meet the highest peak of electricity demand to avoid blackouts. But as Figure 1 [Figure 3.14] shows, Victoria only needs this much electricity a few times each year – usually on the hottest summer evenings when people return home and turn on their appliances, especially air conditioners. This electricity capacity lies idle the rest of the time. Reducing demand peaks lessens the generation and network infrastructure Victoria needs, reduces the emissions generated and makes the investment pathway easier to achieve.[213]

Figure 3.14 below shows Victoria's summer and winter peak energy consumption rates.

Figure 3.14 Victoria's summer and winter peak consumption rates



Source: Infrastructure Victoria, *Submission 44*, p. 8.

At a public hearing, Dr Spears from Infrastructure Victoria advocated for the use of more price signals at peak times as a means of reducing consumption to lessen the peaks in demand during summer:

> there are a number of opportunities for us to make sure that the prices we pay when we use electricity are giving us a bit of a signal as to when it is good for us to be reducing our energy consumption versus times to be using it. What I mean by that is we have quite peaky consumption of our electricity in Victoria. There are a number of days—we build the network to meet those peaks, which are often very hot summer peaks, and the more we can have price signals but also technology that enable people to reduce their energy consumption where they can at those peak periods, not only does that

213 Infrastructure Victoria, *Submission 44*, p. 7.

> save them money but it also means we can save many millions of dollars on additional electricity infrastructure investment costs.[214]

CitiPower, Powercor and United Energy provided an example of an initiative called the Summer Saver Program, which provides financial incentives for users to reduce their power during peak times:

> Since 2014, United Energy have successfully delivered the Summer Saver program, a demand response initiative. The program works by asking participants to reduce demand by taking simple measures like turning their air conditioners' temperature up and avoiding high energy appliances like dishwashers and dryers. Customers that participated in the 2020 program received between $15 and $456 depending on the demand reduction achieved. [215]

However, the submission noted that demand management tools were not as useful for energy security and reliability in the long term as network upgrades:

> Demand management programs such as Summer Saver benefit consumers and assist with overall network demand management in the short term. The only way to ensure long term security and reliability is through upgrades to the network.[216]

The Committee encourages measures to lessen Victoria's peaks in energy demand in the summer months. Victoria's distribution networks and energy retailers can play a role in demand reduction with variable pricing initiatives such as the Summer Saver Program. The Committee notes the guidance from CitiPower, Powercor and United Energy that demand management programs should not be taken in isolation to network upgrades. Instead, demand management work should complement network upgrades as one of several measures to ensure the security of Victoria's energy supply as it transitions to renewable energy.

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214 Dr Jonathan Spear, *Transcript of evidence*, p. 2.

215 CitiPower, Powercor and United Energy, *Submission 54*, pp. 5–6.

216 Ibid.

4 A just transition to renewable energy

4.1 A just transition

Terms of reference (e) ask the Committee to consider 'government investment or action that would be needed to support workers in impacted industries to facilitate a just transition and ensure workers and communities are not left behind as Victoria transitions to 100 per cent renewable energy'.

According to the International Labour Organisation, 'A Just Transition means greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind.'[1]

The submission from the Community and Public Sector Union argued that in the past, Australia's record of supporting the transition of industries in decline had room for improvement:

> Transitioning an industry in Australia has proven to be a massive economic and social disruption. Historically, workers and communities within transitioning industries suffered hardship, unemployment, and generations of social and economic depression.
>
> Research into textiles, clothing and footwear, and car manufacturing highlights the substantial dislocation caused by poorly managed industry transitions in Australia. Of the retrenched workers within these industries, only a third found full-time equivalent work. Of the remaining two thirds, a third moved to lower quality jobs (lower wage, lower job status or into part-time and casual work) and one third did not re-enter the workforce. Ensuring this is not the experience of the fossil fuel workers must be a key focus.[2]

The Victorian Government has set out a number of initiatives to assist the transition of coal-fired power station workers, their families and supply chain industries in the Latrobe Valley as the coal-fired power stations begin to close. This includes the $266 million Latrobe Valley Support package, which has been supported by the creation of the Latrobe Valley Authority to work with the community to support those affected by the transition and map out the region's economic future.

Work is also taking place to map out the skills and training needed for Victoria's renewable energy future. The Committee was told that significant opportunities exist in the renewable energy industry and associated supply chain. There are already

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1 International Labour Organization, *Climate change and financing a just transition* 2022, <https://www.ilo.org/empent/areas/social-finance/WCMS_825124/lang--en/index.htm> accessed 4 May 2022.

2 Community and Public Sector Union (CPSU), Victorian Branch, *Submission 59*, p. 9 (with sources).

skills gaps and a concerted effort will be needed to engage the vocational sector and industry to find out what skills are needed and provide training courses to meet those needs.

4.2 Measures to pursue a just transition in the Latrobe Valley

In November 2016, Engie, the owners of Hazelwood Power Station in the Latrobe Valley announced they would close the power station and associated mine on 31 March 2017.

Engie explained that its decision to close Hazelwood aligned with its strategy to transition to low-carbon power generation projects and was informed by increasingly challenging energy market conditions. Engie said in a media release:

> The closure of Hazelwood is in line with Engie's strategy to gradually end its coal activities. This is laid out in the Group's transformation plan that aims at concentrating solely on low-carbon projects for power generation, renewable energy and natural gas. In 2016, Engie has already sold or closed coal assets which represent more than 5 GW of capacity …
>
> … Besides, Hazelwood power station has been operating in difficult market conditions, with lower electricity prices and a surplus of electricity supply in Victoria State.[3]

Other factors, including the Hazelwood mine fire, an increase in coal royalties and a determination by WorkSafe Victoria to repair and upgrade boiler units were cited in a paper by academics at the Crawford School of Public Policy at Australian National University as contributing reasons for the closure.[4]

Both the Victorian and Commonwealth Governments promised support for the Latrobe Valley community following the announcement of the closure of Hazelwood. The most significant financial input came from the Victorian Government, which committed a $266 million support package for the region, encompassing workers assistance, initiatives aimed at promoting economic growth and the establishment of the Latrobe Valley Authority to lead the region's economic transition.[5]

The Commonwealth Government provided a $43 million support package which incorporated a local infrastructure fund and initiatives aimed at diversifying the regional economy.[6]

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3 ENGIE, *Hazelwood power station in Australia to close at the end of March 2017*, media release, ENGIE, 3 November 2016. (retrieved 28 October 2021)

4 Frank Jotzo et al, *Coal transition in Australia: an overview of issues: CCEP Working Paper 1811*, Crawford School of Public Policy, Australian National University, 2018, p. 21.

5 Department of Environment, Land, Water and Planning, *Submission 88*, p. 12.

6 Frank Jotzo et al, *Coal transition in Australia: an overview of issues*, p. 21.

4.2.1 The work of the Latrobe Valley Authority following the closure of Hazelwood Power Station

The announcement of the closure of Hazelwood in November 2016 allowed the Victorian Government only five months to prepare for the closure date of 31 March 2017. The Latrobe Valley Authority was established in this time and immediately set to work offering a Worker Transition Service to support Hazelwood workers, their families and businesses directly impacted by the closure of Hazelwood Power Station.

The Worker Transition Service supported Hazelwood workers to transition to new jobs, undertake training, access personal and financial counselling or retire. The submission from the Department of Environment, Land, Water and Planning (DELWP) gave an overview of the program:

> Included in the initial response was the development of the Worker Transition Service, which connects workers and their families to the services required for training, upgrading skills, career advice, assistance to take up new employment and the provision of personal and mental health support. This service is delivered by the Latrobe Valley Authority (LVA) and has operated in partnership with the Gippsland Trades and Labour Council and in close collaboration with TAFE Gippsland's Skills and Jobs Centre funded through the Department of Education and Training since 2017.[7]

A submission to the Legislative Council's Economy and Infrastructure Committee from the Department of Jobs, Precincts and Regions as part of its Inquiry into the Closure of Hazelwood and Yallourn Power Stations gave an overview of the success of the program. As of 2021, the Worker Transition Service has assisted 736 workers impacted by the closure of Hazelwood.[8] The outcomes of the former Hazelwood workers were:

- 79% were employed
- 16% were looking for work
- 5% per cent had retired.[9]

Another key program following the closure of Hazelwood was the Work Transfer Scheme. This facilitated the redeployment of former Hazelwood workers into jobs at other power stations in the Latrobe Valley through an early retirement scheme. It helped 90 Hazelwood workers to transition to ongoing employment at other power stations in the region.[10]

Following its support to Hazelwood workers in the immediate aftermath of the closure, the Latrobe Valley Authority moved toward building capability among affected workers and the wider community. These capability building programs include initiatives such as

7 Department of Environment, Land, Water and Planning, *Submission 88*, p. 12.

8 Department of Jobs, Precincts and Regions, *Submission 62*, submission to Legislative Council, Economy and Infrastructure Committee, Inquiry into the Closure of Hazelwood and Yallourn Power Stations, 2022, p. 21.

9 Ibid., p. 10.

10 Ibid., p. 21.

Growing Regional Opportunities for Work in Gippsland (GROW Gippsland), which supports local businesses to win tenders for contract and procurement opportunities in Gippsland.[11]

Erin Coldham, Chief Development Officer at Star of the South told the Committee that the GROW program had helped them identify local companies that may be able to tender for contracts once construction begins:

> If I can just touch on, for example, the Latrobe Valley Authority and the work of GROW Gippsland. That has been a wonderful help to our team in terms of providing us examples of what has been achieved through other major projects being delivered in the region and which businesses can help with those aspects for our workforce as well as our contracts when we get to a point of major construction. So it is something that we will continue to plan for. [12]

Another key program was the Access New Industries Program. This identifies industries that need qualified workers and sources training courses in Gippsland for participants. In an interview with the Colorado School of Mines, Karen Cain, the previous CEO of the Latrobe Valley Authority, gave an example of the Access New Industries Program. The Authority worked with a number of ex-Hazelwood electricians to train them in solar panel skills to meet the needs of a growing local solar panel company. To do this, the Authority organised for a TAFE course on solar electrics to be taught at TAFE Gippsland. The company then employed the electricians and has been able to grow its business.[13]

To transition the Latrobe Valley's economic prospects in the long term, the Latrobe Valley Authority has adopted an approach taken by the European Union known as 'smart specialisation'. This approach looks to the Gippsland region and seeks to understand its unique economic strengths and add to them.

So far, the Latrobe Valley Authority has worked with the University of Melbourne and RMIT to map those strengths and develop a smart specialisation strategy to foster them. These strengths have been identified through community consultation, as well as consultation with government, business, research, the education sector, and the wider local community.

The sectors the Latrobe Valley Authority has identified in Gippsland as strengths are:

- Energy
- Food and fibre

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11 Latrobe Valley Authority, *GROW Gippsland*, 2022, <https://lva.vic.gov.au/business-and-worker-support/grow-gippsland> accessed 28 March 2022.

12 Erin Coldham, Chief Development Officer, Star of the South, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 24.

13 Brad Handler, *Payne Institute and University of British Columbia Just Transition podcast series: Economic Development Organization Perspective*, (n.d.), <https://payneinstitute.mines.edu/wp-content/uploads/sites/149/2021/05/Just-Transitions-Economic-Development-Organization-Perspective.pdf> accessed 9 December 2021.

- Tourism
- Health and wellbeing.[14]

Work is continuing to identify growth strategies and industries to support in each sector as part of the smart specialisation strategy. For example, amongst the food and fibre sector, the smart specialisation strategy has identified the following growth strategies including:

- a collective malting and distilling facility
- a vegetable processing hub—'for growth markets in functional foods and nutraceuticals'[15]
- a Gippsland Trusted Provenance Trademark—for use by regional food producers to brand and market their produce
- Sustainable Emerging Commodities, Insects and Seaweed—for commercial insect and seaweed farming industries in Gippsland.[16]

The Committee commends the work of the Latrobe Valley Authority following the closure of Hazelwood. Its personalised services for affected workers had a high success rate in relation to re-employment. The ongoing efforts to build the capacity of the Gippsland regional economy has seen local businesses given greater opportunities to win tendering contracts and attract trained staff. Finally, the ongoing efforts at transitioning the long-term economy of the region will help to ensure ongoing economic prosperity in new areas once the remaining coal-fired power stations close in the first half of this century.

FINDING 7: The Latrobe Valley Authority has supported ex-power station workers to find new employment and is working to identify and support new industries that will provide economic growth and jobs for the future.

4.2.2 Preparing for the closure of Yallourn and Loy Yang A

In March 2021, the operator of Yallourn Power Station, Energy Australia, announced that it would close Yallourn in 2028, four years earlier than the station's original planned date of closure in 2032.[17] The announcement, 7 years ahead of its closure will give Yallourn workers and the Latrobe Valley community time to prepare and to apply the lessons from Hazelwood.

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14 Leo Goedegebuure et al, *Gippsland Smart Specialisation: Developing and implementing an approach to regional innovation and development in Gippsland, Victoria (2018–2020)*, University of Melbourne and RMIT University, Melbourne, 2020, pp. 44–49.

15 Neutraceuticals are products derived from food sources that have perceived health benefits. This includes foods such as fish oils that are sold in tablet form that are marketed to have health benefits.

16 Latrobe Valley Authority, *Food and Fibre*, 2022, <https://lva.vic.gov.au/growth-sectors/food-and-fibre> accessed 28 March 2022.

17 EnergyAustralia, *Reducing our carbon footprint: fact sheet*, EnergyAustralia, March 2021.

The submission from Latrobe City Council, the Local Government area that hosts the Latrobe Valley's power stations, gave an overview of the economic contribution of Yallourn in terms of jobs and economic output:

> more than 500 permanent workers on site plus many more in the associated supply chain. During some years, for three to four months, the Yallourn workforce increases to 1000 when major unit outages are undertaken, along with four yearly integrity maintenance works adding an extra 150–200 workers. Each Yallourn worker is estimated to generate an additional four to five jobs in the Latrobe Valley. In addition, at any given time, Yallourn has at least 15 apprentices on site. The Yallourn Power Station and associated Mine contracts with over 240 small businesses and contributes over $25 million in royalties and $3 million in payroll tax to the state of Victoria annually.[18]

The significant number of jobs and economic output associated with Yallourn illustrates the importance of not only support for workers, but also the support needed to diversify the economy and assist supply chain businesses and contractors. The submission from DELWP outlined the measures the Government is taking to prepare for the closure of Yallourn:

> With the planned closure of Yallourn, the Victorian Government committed to developing dedicated Yallourn workers transition and support services to extend functions provided by the LVA. The government will consult with impacted workers, relevant unions and the local community to develop tailored worker and supply chain transition programs and an economic diversification program prior to Yallourn's closure.[19]

Energy Australia has provided $10 million to help workers with training and skills development, career planning, assistance for redeployment, and financial counselling.[20] Workers will decide how the money will be spent.[21] The company is also open to working with the remaining coal-fired power stations at Loy Yang to facilitate a worker transfer scheme. The scheme, similar to the Hazelwood worker transfer scheme, would allow Yallourn workers to take up positions where Loy Yang workers agree to voluntary redundancies.[22]

In February 2022, AGL, the operator of Loy Yang A power station announced that it would bring forward its planned closure date 2048 and close the station by 2045.[23] The submission from Latrobe City Council gave an overview of the considerable number of jobs associated with Loy Yang A and B, as well as the economic output:

> The AGL Loy Yang A Power Station and associated Mine and nearby Alinta Loy Yang B Power Station, on the other hand, have licences expiring by 2048. The AGL Loy Yang A

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18 Latrobe City Council, *Submission 14*, pp. 6–7.

19 Department of Environment, *Submission 88*, p. 12 (with sources).

20 EnergyAustralia, *Supporting the workforce and community: fact sheet*, EnergyAustralia, March 2021.

21 EnergyAustralia, *Submission 25*, submission to Legislative Council, Economy and Infrastructure Committee, Inquiry into the Closure of Hazelwood and Yallourn Power Stations, 2022, p. 2.

22 Ibid., p. 3.

23 Hon Angus Taylor, Minister for Industry, Energy and Emissions Reduction, *Statement on early closure of Loy Yang A and Bayswater power stations,* media release, Commonwealth of Australia, Canberra, 10 February 2022.

> employs approximately 600 FTE and 300 contractors, and is estimated to contribute millions of dollars every week to the local community through procurement, labour and the hiring of contractors. At 30 June 2020, Loy Yang B employed 162 people 2 as well as estimated up to 50 contractors 3 Loy Yang B's total FY20 economic value distributed was approximately $339 million, including the value generated through suppliers, employees, financiers, owners and the Government.[24]

Dr Dylan McConnell, Research Fellow at the Energy Transition Hub at the University of Melbourne told the Committee that it was likely that coal-fired power stations would close earlier than stated by the private companies participating in the sector. He said given the likely early closure, it was important that the Victorian Government continue to plan for the Latrobe Valley's economic transition:

> the coal closure time line is much earlier than you would be led to believe by the various private companies that are participating in the sector. So this is one area where I think there is a bit of a role for state involvement in terms of planning, because this is going to have significant impacts particularly in the Latrobe Valley—I guess most obviously in the Latrobe Valley—and there is a real role for the government to plan for the transition away from brown coal in that area.[25]

Greg Foyster, Acting Campaigns Manager at Environment Victoria advocated for the continued funding of the Latrobe Valley Authority until the closure of the last coal-fired power station. This is so that the community will have certainty on who to turn to for assistance and that the transition of the economy will be community led:

> So we need to acknowledge that while the transition to renewables should be as fast as possible to deal with the worst impacts of climate change it also needs to be fair to people in affected regions, and those two things go hand in hand. That is why we also make the recommendation that the Victorian government should extend funding for the Latrobe Valley Authority until the last power station closes and give certainty to the community that there will be a government authority that is helping that transition, and also that that transition should be community led. It has to be led by the community as much as possible, and it should focus on regional strengths. A lot of work has been done by the University of Melbourne into this, which I am sure others can speak to, but there is still the lack of a very long term transition plan for the Latrobe Valley region.[26]

RECOMMENDATION 9: That the Victorian Government continue to build on the lessons learnt from the closure of Hazelwood and apply them in the lead up to the closure of Yallourn and later Loy Yang A. This includes the need for a strong Worker Transition Service. Work should be undertaken to identify the supply chain companies that service Yallourn ahead of time to help them to be ready to transition when it closes in 2028.

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24 Latrobe City Council, *Submission 14*, p. 7.

25 Dr Dylan McConnell, Research Fellow, University of Melbourne, Energy Transition Hub, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 14.

26 Greg Foyster, Acting Campaigns Manager, Environment Victoria, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 13.

4.3 The workforce needs for Victoria's renewable energy future

The Committee was told that the Victorian Government needs to prepare now for the energy workforce of the future. Jobs will be generated in Victoria's regions in both the construction of renewable energy generators and in their ongoing operation. Work needs to be undertaken particularly in the TAFE sector to map out and fund courses that will be suitable for the renewable energy industry and to encourage students to take up study.

The Committee heard that the jobs available in the renewable energy industry are transferrable from existing jobs in the coal-fired energy sector. Erin Coldham from Star of the South told the Committee they were working with Energy Australia to identify how existing workers and supply chain companies at Yallourn will be able to contribute to Star of the South once construction starts. They added that their work also involves identifying skills and training needed for the Yallourn workforce to transition to the offshore wind industry:

> Speaking on behalf Star of the South, we are working very closely with Energy Australia, the owner of the Yallourn power station, which is scheduled to close in 2028, to understand, as part of their transition planning and jobs mapping, what those jobs are that currently exist in the region in those facilities—not just the direct jobs with that workforce but also the contractors and the suppliers from the region—and how they can transfer into an offshore wind industry. So they are the conversations that we are having at the moment, and certainly as we go through we will look to publish a lot of that information and engage with those workers and all of those relevant agencies to ensure that people can understand that opportunity and, importantly, see what other skills gaps there might be and what training pathways could be needed to complement those existing skills into a new offshore wind sector.[27]

Ms Coldham also discussed how Star of the South are working with Federation University and Gippsland TAFE to map the skills needed for the offshore wind industry and to investigate training programs to deliver a skilled workforce:

> The types of skills we would look for in terms of construction and the long-term proposition are mechanical skills, electrical skills, marine crew, boilermakers, welders and all those typical trades. A lot of those opportunities exist, and we are in conversations, particularly with the regional training and educational facilities such as Federation University and TAFE Gippsland, to really present to them—I mean, one of the things we are doing at the moment is putting together some typical job descriptions for offshore wind so we can provide those to the facilities and identify exactly what additional needs there might be and, importantly, feed that back into the relevant areas of government as well. [28]

27 Erin Coldham, *Transcript of evidence*, p. 24.

28 Ibid.

The submission from Latrobe City Council argued that its workforce are ideally placed to take advantage of new renewable energy and advanced manufacturing sectors. They recommended that the Government work with TAFE Gippsland and Federation University to provide training and incentives for power station workers to upskill in these areas:

> In relation to securing Victoria's Energy Future, Latrobe City is ideally placed to embrace emerging new industries and leading-edge innovation such as new clean energy industries, hydrogen, circular economy, automotive technologies, carbon innovation, advanced manufacturing and defence ...
>
> With this in mind it is recommended that the state government consult with the community through Latrobe City Council on providing training and incentives, that would assist current employees transition to new skills in collaboration with the local education sector such as TAFE Gippsland and Federation University.[29]

The submission from the Community and Public Sector Union cautioned however, that the jobs in renewable energy sector may be insecure and less well-paid than the previous jobs held by coal-fired power station workers. They said concerted efforts are required to ensure that secure well-paid jobs are not replaced with casual or low paid work:

> CPSU is concerned that many renewable energy jobs have been short-term, insecure, and poorly paid in comparison to permanent, secure, well-paid, and unionised jobs in coal, oil and gas that often underpin regional economies. CPSU supports VTHC's proposal of a Just Transition for the fossil fuel workers that advocates for redeployment across sites and energy employers while ensuring there are no forced redundancies and adequate training is provided. Concerted Government, business and union efforts need to be made to ensure that secure, well-paid jobs are not replaced with casual, low-paid, and low-skill work.[30]

4.3.1 Mapping out the skills needed for Victoria's renewable energy future

Arron Wood, Director of External Affairs at the Clean Energy Council gave an overview of the areas of the renewable energy sector for which there are skills gaps and the kinds of training programs that would be necessary to meet skills shortages:

> what we have got to do is continue to close that link between our TAFE sector and those skills gaps that we are seeing. I think if you look at the electric vehicle sector—a huge, yawning skills gap there. One of the companies alone, the AAAA, does a lot of after-sales retrofitting of vehicles—4000 workshops across the nation, 40 000 technicians. All of those will have to go undergo electrical safety training just to work on vehicles into the future. So that is just one example of the sort of yawning skills gap you have got just in EVs [electric vehicles]. A similar sort of thing in

29 Latrobe City Council, *Submission 14*, p. 7.

30 Community and Public Sector Union (CPSU), *Submission 59*, p. 15.

> renewable energy as well—so I think where we want to see JobTrainer and free TAFE lining up to those particular skills areas. The other thing too is looking at things like essentially double qualifications, where you are getting a mechanical and electrical apprenticeship, which is currently being looked into at the moment by ASQA and a lot of the regulatory authorities in the TAFE sector as well. So I think what we want to do is we want to demonstrate that these pathways lead to good jobs. We want to continually reinforce the sheer magnitude of the transition that is underway with our transition to 100 per cent renewables …[31]

Mr Wood added that it was important to consider training not only for jobs directly in renewable energy, but the associated supply chain industries. He said:

> I think the depth of the supply chain that we are talking about and all the skills shortages across all those categories as well. So when you talk about our ability to export our renewable energy around the world, whether that is ammonia or hydrogen or whichever medium we choose, you are talking about shipping, you are talking about ports, you are talking about major infrastructure constructions.[32]

Erin Coldham from Star of the South discussed how the growth of the renewable energy industry is providing job opportunities for young people in regional areas that allows them to stay connected to their communities and boost the local economy:

> I spend a lot of time in Gippsland, and people say to me, 'There are no job opportunities here. When our kids turn 18 we know they're going to move to the city because there's nothing really here that they can see as a long-term career opportunity'. That is why we are engaging early through programs such as Broadening Horizons with the local secondary colleges and also with the universities, as I mentioned earlier, to help paint that picture of what that industry could look like and not waiting until we get to the point of construction. We have a wonderful story right now where again a young local in Yarram moved away to Melbourne—no jobs—and I am really happy to say she is now employed with us on Star of the South in our Yarram office and has been able to move home, close to her family, and go back to her footy club and her netball club because there is a job there for her in the region and in a field that she is very excited about. So throughout all stages of the project we are looking at how we can really help boost those local economies and provide those opportunities for local workers, young workers, with a range of different, diverse angles.[33]

The submission from DELWP outlined the initiatives that the Victorian Government is taking in relation to workforce needs in the renewable energy sector. This includes large investments in the TAFE sector and the launch of a Clean Economy Workforce Capacity Building Fund and a Clean Economy Workforce Strategy. The submission said:

> The Victorian Government is taking other action to support workers through the transition, including by providing upskilling opportunities and investigating future

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31 Arron Wood, Director, External Affairs, Clean Energy Council, public hearing, Melbourne, 16 March 2022, *Transcript of evidence*, p. 35.

32 Ibid.

33 Erin Coldham, *Transcript of evidence*, p. 24.

> workforce capability needs. The 2020–2021 state budget, for example, included an investment of up to $1 billion in our TAFE sector, including upgrades to campuses and up to 80,000 new training places over four years. It also included a $6 million Clean Economy Workforce Capacity Building Fund to provide grants to enhance VET workforce capability, curriculum design, learning resources and collaborative learning platforms. This initiative, as well as the $2 million Clean Economy Workforce Strategy, will support government investment in the Victorian TAFE and Training system so that, for example, the gas workforce continues to have the skills it will need as the sector decarbonises.[34]

In July 2021, The Victorian Government created the Victorian Skills Authority. The aims of the Authority are to:

- match Victoria's employment demands with training
- ensure Victorian employers and communities can find workers with the skills they need, when and where they need them
- ensure Victorians can get training that will help them find a job and build a career.[35]

A statement from Ms Gayle Tierney MLC, Minister for Training and Skills and Minister for Higher Education on the work of the Victorian Skills Authority said that one of the first duties of the authority would be to develop a 10-year workforce strategy for the renewable energy sector:

> One of the first duties of the VSA is the Clean Economy Skills and Jobs Taskforce, which is supported by a $10 million investment in the clean economy workforce. VSA will help prepare Victoria's clean energy future and net zero emissions by 2050. This task force will develop a 10-year workforce strategy exploring renewable energy, circular economy practices and climate change adaptation.[36]

The Committee believes it is crucial to map out the needs of the renewable energy workforce so that skills gaps can be identified and appropriate vocational courses can be sourced for the needs of the future renewable energy workforce.

The Victorian Government's significant investment in TAFE, including free TAFE courses assists to make vocational education attractive for prospective students. The Clean Economy Workforce Capacity Building Fund, noted by DELWP's submission, will encourage greater engagement with industry to help the vocational sector learn about the needs of industry as it transitions towards a clean industry future.[37]

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34 Department of Environment, Land, Water and Planning, *Submission 88*, p. 12.

35 Victorian Skills Authority, *Victorian Skills Authority*, 2022, <https://www.vic.gov.au/victorian-skills-authority> accessed 28 March 2022.

36 Victoria, Legislative Council, 12 October 2021, *Parliamentary debates*, p. 3669.

37 Hon Daniel Andrews MP, Premier, *New Fund To Expand Victoria's Clean Economy Workforce*, media release, Victorian Government, Melbourne, 25 October 2021.

RECOMMENDATION 10: That the Victorian Government in conjunction with the energy sector ensure that new jobs in renewable energy are long term, secure, well paid and underpinned by skills and training provided through TAFE. Workers transitioning from coal-fired power stations should be supported with skills and training development opportunities to help them transition to jobs in the renewable sector. The Victorian Government should, wherever possible, support a position of no forced redundancies in the sector, supporting workers with redeployment and retraining opportunities.

5 The benefits and costs of transitioning to 100% renewable energy

The Terms of Reference ask the Committee to consider a transition to 100% renewable energy. This Chapter discusses the benefits and costs of this transition, which forms an important part of the consideration.

5.1 The benefits of transition and the risks of not doing so

5.1.1 Economic benefits

According to many submissions to this Inquiry, transitioning to renewable energy brings economic benefits to different stakeholders, including generators, consumers and the community and accelerates economic growth. Furthermore, there will be significant risks if the transition is delayed.

Renewable energy and generator profits

Beyond Zero Emissions and Environment Victoria told the Committee that low maintenance and zero fuel costs allow renewable energy to be profitable even when being sold at low prices:

> Renewable energy has proven in the National Energy Market to be able to sell at very low prices whilst still being profitable. Coal-fired power plants have a high baseline cost to operate due to maintenance and personnel while renewable energy requires far less maintenance and incurs essentially nil fuel costs because the sun shines for free and the wind blows for nothing.[1]

Professor Andrew Blakers, E2 Professor of Engineering at Australian National University said that there are 'compelling economics'[2] of switching to renewable energy:

> The solar and wind revolution is rapid and is happening almost everywhere simultaneously. The compelling economics of solar and wind are pushing coal and gas out of electricity generation; electric vehicles are pushing oil out of land transport; and electric heat pumps and heaters are pushing gas out of heating.[3]

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1 Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 5.

2 Professor Andrew Blakers, Institute for Climate, Energy and Disaster Solution, Australian National University, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, pp. 2, 4.

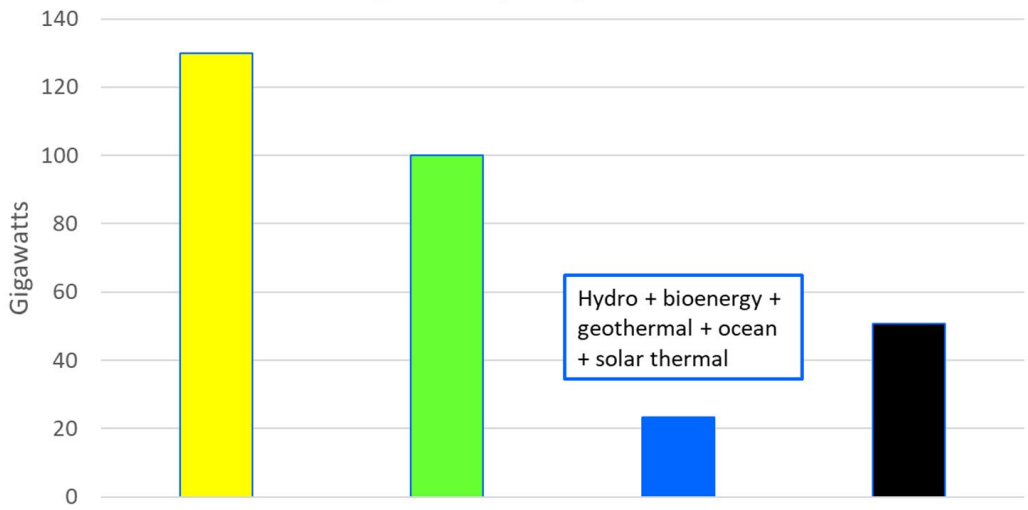
3 Ibid., p. 2.

He pointed out that this compelling economics has been underpinning the global trend toward renewable energy:

> The fastest energy change in history is in progress. This entails the replacement of most fossil fuels with solar and wind energy in almost every country well before 2050. Solar and wind power now constitute 3/4 of global net generation capacity additions … and 99% in Australia. Electrification of nearly everything allows cheap solar and wind to eliminate most greenhouse emissions.[4]

This trend is illustrated in Figure 5.1 below.

Figure 5.1 Solar and wind constituted ¾ of global net generation capacity additions in 2020



Source: Professor Andrew Blakers, *Submission 15*, p. 2.

Stakeholders also pointed out that switching to renewable energy enhances generator's access to finance. Latrobe City Council told the Committee that 'An economic benefit for Victoria will be more and more financial institutions will consider the potential green content of any investor …'[5]

Renewable energy, investment and job creation

The Committee has heard evidence that renewable energy can attract investment and create employment.

In the *Victorian Renewable Energy Target 2019–2020 Progress Report*, the Department of Environment, Land, Water and Planning (DEWLP) estimated that:

> The large-scale renewable generation projects in development in Victoria during the financial year 2019–20 generated $2.24 billion in capital expenditure and 1,472 jobs over the 2019–20 financial year. Over the whole period from project commencement to

4 Ibid.

5 Latrobe City Council, *Submission 14*, p. 3.

completion, these projects are estimated to support $5.96 billion in capital expenditure and 3,919 jobs.[6]

Table 5.1 below shows the capital expenditure and jobs associated with Victoria large-scale renewable energy projects in development in 2019–20.

Table 5.1 Estimated capital expenditure and jobs associated with Victoria large-scale renewable energy projects in development in 2019–20

	Capacity (Megawatts)	Capex ($ million)		Jobs (number)	
		In 2019–20	Over project life	In 2019–20	Over project life
Wind	2,461	1,769	4,616	828	2,221
Solar	759	469	1,348	644	1,698
Total	**3,220**	**2,238**	**5,964**	**1,472**	**3,919**

Source: Department of Environment, Land, Water and Planning, *Victorian Renewable Energy Target 2019–2020 Progress Report.*

DELWP also confirmed that the renewable energy sector in Victoria has created 7,800 jobs in 2020, or 30% of total jobs in the renewables sector in Australia.[7]

The Clean Energy Council said transitioning to 100% renewable energy will bring about billions of dollars of investment, long-term jobs and supply-chain development:

> From 2017 to 2020, the share of renewable energy in Victoria climbed from 16 per cent to 27.7 per cent with $7.91 billion of new large-scale clean energy investment being delivered to (mostly) regional communities across the state.[8]
>
> Achieving 100 per cent renewables not only provides billions of dollars-worth of investment in regional communities, but also an opportunity to strengthen long-term employment opportunities and supply chain development by providing greater concentration of skilled workers and suppliers. With current capacity needing to approximately triple to reach 100 per cent renewable energy, the CEC estimates that over 15,000 renewable energy jobs would be created, with many of these jobs filled through local employment for regional communities.[9]

ClimateWorks stated in its submission that investment in renewable energy will leverage spending and create jobs:

> The transition to 100 per cent renewable energy in Victoria has the potential to create substantial jobs and economic benefits. Recent analysis shows that for every $1 of public spending on renewables, $3 of private spending can be leveraged, increasing economic

6 Department of Environment, Land, Water and Planning, *Victorian Renewable Energy Target: 2019–20 Progress Report*, Victorian Government Melbourne, 2020, p. 13.

7 Department of Environment, Land, Water and Planning, *Victorian Renewable Energy Zone Development Plan Directions Paper*, Victorian Government, Melbourne, February 2021, p. 3.

8 Clean Energy Council, *Submission 80*, p. 5 (with sources).

9 Ibid.

> output (Climate Council 2020). There is also a high job multiplier for investments in renewables. AlphaBeta and the Climate Council (2020) found that utility scale renewable investments in solar and wind have a job multiplier of 6.7 jobs per $1m spent, which include jobs in specialised occupations (such as large-haul drivers and grid design engineers) as well as in construction.[10]

Regarding employment, a number of submitters emphasised the job opportunities created by renewable energy. Victorian Trades Hall Council highlighted 'the job growth and economic benefits that could be reaped from the decarbonisation of the Victorian economy.' It said that there are 'opportunities for employment growth in construction, transport, manufacturing, health care, agriculture, education, public services and more.'[11]

The Clean Energy Council pointed out that with transitioning to renewable energy, there are six avenues to create local jobs:

1. Direct employment in the construction of a project by the project proponents (often the principal contractor);
2. Direct employment in the operation and maintenance of a project by the project proponents (often the asset manager);
3. Indirect employment through local subcontractors;
4. Induced employment through the expenditure of construction workers in the region;
5. Employment enabled through renewable energy generation, such as green hydrogen, green steel or clean manufacturing; and eventually,
6. Employment in the reuse, recycling, or end-of-life management of components and equipment.[12]

The Community and Public Sector Union Victoria (CPSU) also believed that Victoria will see more jobs in renewable energy sector than in fossil fuel:

> Fossil fuel industries are not a major source of employment in Australia accounting for only 1% of jobs nationally and even fewer in Victoria. Fortunately, there will be more jobs created than lost as fossil fuel industries close in the transition to a clean economy. Victoria will experience a net increase in employment during the transition to renewable energy. When Victoria reaches the 50% renewable energy target by 2030, there will be a net increase of 4,000 jobs.[13]

This view was shared by ClimateWorks:

> The direct and indirect job creation from renewable energy is estimated to be more than two and a half times that of fossil fuel generation investment (McKinsey 2020). Transgrid's recent Energy Vision (2021) for the National Electricity Market models two

10 Climateworks Australia, *Submission 43*, p. 4 (with sources).

11 Victorian Trades Hall Council, *Submission 81*, pp. 3–4.

12 Clean Energy Council, *Submission 80*, p. 5.

13 Community and Public Sector Union (CPSU), Victorian Branch, *Submission 59*, p. 10 (with sources).

> scenarios with high renewable uptake: a Deep Decarbonisation scenario and a Clean Energy Superpower scenario. In these pathways, there are 45 per cent and more than 50 per cent more jobs, respectively, over the next ten years than in their Current Trends scenario.[14]

Star of the South stated that 'Offshore wind offers a unique transition pathway for workers in declining sectors such as offshore oil and gas and coal.'[15]

The Committee was also told that renewable energy will be able to leverage other channels of job creation. Beyond Zero Emissions and Environment Victoria said in their submission that accelerating deployment of large-scale renewable energy and a resurgence of Australian manufacturing powered by renewable energy will bring a good source of employment. Beyond Zero Emissions estimated that a total of 87,176 jobs will be created if Victoria deploys large-scale renewable energy of 90 gigawatts (GW) over the next five years,[16] as demonstrated in Table 5.2 below:

Table 5.2 Estimates of job creation by Beyond Zero Emissions in the scenario of 90 gigawatts renewable energy deployment

Job type	Jobs over five years
Renewable construction	28,411
Renewable operations	5,948
Wind manufacture	9,879
Battery manufacture	2,455
Battery installation	5,421
Transmission (Construction)	15,135
Transmission (Operations)	1,401
Electrifying Industry	15,783
Total job allocation	**87,176**

Source: Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 9.

A number of stakeholders were positive about job opportunities for local people in both urban and rural areas. The City of Melbourne stated in its submission that:

> A steady investment stream in renewable energy in Australia and Victoria will support development of local industry and increase the economic benefits that could flow to Melbourne and Victoria in the transition. This translates to jobs in the entire supply chain, from engineering, finance, technology companies and manufacturing. Building the generation and storage infrastructure to deliver a Victorian grid powered by 100 per cent renewable energy would create an estimated 123,000 jobs.[17]

14 Climateworks Australia, *Submission 43*, p. 4 (with sources).

15 Star of the South, *Submission 86*, p. 5.

16 Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 9.

17 City of Melbourne, *Submission 18*, p. 4.

Similarly, the Clean Energy Council pointed out that many renewable energy projects are located in rural and regional areas and that the jobs provided by these projects and flow on economic benefits have the potential to bring prosperity to regional areas.[18]

In November 2021, the Australian Conservation Foundation Community Geelong and Geelong Sustainability commissioned Ironbark Sustainability to model at a regional level the new jobs potential in a zero-emission economy. Citing Ironbark Sustainability report, the Australian Conservation Foundation said that:

> Across all sectors, with ambitious policy and investment towards renewable energy and decarbonisation, over 24 000 Zero emissions job years (defined as one FTE job over one year) could be created over five years over the five Councils included within the G21 region.
>
> Almost 5000 of these jobs would be created within the renewable energy sector, with over 1800 ongoing jobs and over 3000 temporary jobs created within just five years with strong policies focussed in this area. It is important to recognise that additional jobs are to be found in industries related to the transition, eg Electric Buses (1900 job years), Clean tech Manufacturing (1800 job years).
>
> This is consistent with the International Energy Agency's recent prediction of more future jobs in renewables compared to fossil fuel sectors.[19]

Some other stakeholders, however, were sceptical about job opportunities for local communities. Joy Howley in her submission suggested that wind farm construction creates less job than the agriculture:

> There are one or two local companies who have gained from ground works relating to towers and turbine and blade maintenance but the reality is that very few locals are employed on tower construction or maintenance. Demand for Australian built blades has dried up. Those once employed on blade construction in Portland are now working at Alcoa. Agriculture employees 60% + in the district. Renewables will never employ to that level, yet it is prioritised over agriculture??[20]

Bart Wissink also believed that employment in renewable energy is short term and not locally sourced:

> Are there job opportunities in the renewable industry?. There is employment in construction, which is short term and generally not sourced from where the construction is taking place. The maintenance like wise will not be sourced locally and the management of the installation can easily be remote. So local job opportunities are limited. Sourcing of the turbines and generators is offshore and design of the plant is also offshore.[21]

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18 Clean Energy Council, *Submission 80*, p. 5.

19 Australian Conservation Foundation Community Geelong, *Submission 56*, p. 2 (with sources).

20 Joy Howley, *Submission 16*, p. 4.

21 Bart Wissink, *Submission 28*, p. 8.

Moyne Shire Council said that in their area, wind farms provided jobs and benefits to the local community during the construction. However, these opportunities reduced significantly when the projects came into operation:

> The experience of Moyne is that renewable energy development provides significant jobs and economic benefit locally when in construction, generally over a two year period.
>
> The sustained employment opportunities during operation of wind farms is significantly reduced only leading to ongoing employment for 10 persons per 50 turbines.[22]

The Clean Energy Council shared the concern that jobs in renewable energy projects are short-term:

> Clean energy projects employ several hundred people during the construction phase. A solar farm takes around a year to build, and a wind farm takes one-to-two years to construct. However, many of the roles and tasks that are available during that construction phase are only a few weeks or months. It is thus the nature of clean energy projects that there is mainly short-term employment available during the construction period. There exists a structural tension between local jobs and secure work.[23]

Based on its research, it pointed out that the proportion of local employment is still low in the current supply chain:

> As shown ... below, extracted from research commissioned by the CEC in 2020, for every megawatt of installed wind power 1.7 job-years are created in supply chain, yet only 0.4 of these job-years are based in Australia. For utility-scale solar, 4.4 job-years support each installed megawatt, yet only 0.1 of these job-years are in Australia.[24]

The Clean Energy Council provided the Committee with an overview of renewable energy jobs, broken down by types of renewable energy projects across stages in Table 5.3 below.

22 Moyne Shire Council, *Submission 61*, p. 4.

23 Clean Energy Council, *Submission 80*, p. 6.

24 Ibid., p. 7.

Table 5.3 Jobs in renewable energy projects

	Construction/ installation	Manufacturing		Operations & maintenance
		All	Onshore	
Job-years per megawatt				**Jobs per megawatt**
Wind	2.8[a]	1.7[c]	0.4	0.2[a]
Utility Solar	2.3[a]	4.4[c]	0.1	0.1[a]
Rooftop PV	5.8[a]	4.4[c]	0.2	0.2[a]
Utility batteries	4.7[a]	6.6[a]	0.3[d]	1.2[a]
Distributed batteries	5.6[a]	6.6[a]	0.3[d]	0.3[a]
Hydro	7.4[b]	3.5[b]	0.7[e]	0.1[a]
Pumped hydro	11.1[a]	3.5[b]	0.7[e]	0.2[a]
Jobs-years per system				
Solar water heating	0.015	n/a	0.0021[f]	–

Notes: a. Factor derived in this study; b. Factor from Rutovitz et al, 2015; c. Factor from IRENA 2017 & 2017a; d. Assumed 5% occurs on shore; e. Assumed 20% occurs onshore; f. ABS, 2019.

Source: Clean Energy Council, *Submission 80*, p. 7.

Despite this, the Clean Energy Council suggested that there are job opportunities in operation and maintenance phases and these jobs are more secure and sustainable. It suggested that to seize the opportunities, the Government needs to assist in addressing skills shortages:

> The operation and maintenance of a solar or wind farm requires far fewer employees but is secure, sustainable, and skilled employment. Wind technicians, both turbine and blade technicians, are in short supply and demand for them is increasing. The Victorian Government can assist in addressing this skills shortage by providing support to incentivise individuals embarking on a technical career in wind power.[25]

The Clean Energy Council also suggested that the problem of short-term employment can be addressed if the Government introduces measures that facilitate a pipeline of jobs:

> there are several construction roles that can be filled by local workers, and through a strong 100 per cent target and schemes such as the development of REZs, there are ways that the Victorian Government can maximise this type of local employment while supporting secure employment outcomes. Central to this is facilitating a pipeline of jobs, rather than one-off opportunities.[26]

It also said that the Government could help remove the barriers facing Aboriginal and Torres Strait Islander employees by supporting mobile training and indigenous apprenticeships:

25 Ibid., p. 6.

26 Ibid.

> The CEC's working group on Clean Energy Workforce has identified several barriers to the employment and retention Aboriginal and Torres Strait Islander employees, including duration of jobs and succession planning, as well as remote locations causing difficulties for training and upskilling opportunities. The Government could address some of these barriers by providing mobile training facilities in these remote locations, as well as opportunities for indigenous apprenticeships.[27]

Banyule Clean Energy Group also emphasised the role of the Government. Its submission stated that:

> VRET2 and other major wind and solar will deliver positive employment outcomes through the Local Jobs First Act 2003 and by setting requirements for local apprentices, trainees and cadets, and encouraging competition to support increased skills and workforce development through the Major Projects Skills Guarantee (MPSG). This ensures Victorians benefit directly from major infrastructure projects undertaken in the state and ensures continued growth of the next generation of skilled workers.[28]

A 2020 report prepared by Sydney University of Technology for the Clean Energy Council suggested that the renewable energy sector can play a meaningful role in creating alternative employment:

> Renewable energy will create employment across regional Australia including coal regions. The occupational mix and location of renewable energy jobs indicates the sector can play a meaningful role in creating alternative employment as the global transition out of coal accelerates - but only within comprehensive industry plans and investment to diversify these regional economies.[29]

In addition, Professor Blakers pointed out that full scale development of renewable energy will provide long-term jobs. He told the Committee in a public hearing:

> What does Victoria get by going down that path? Thousands of long-term jobs in regional Victoria. In particular in the west and the north-west we are talking about thousands of jobs to support solar farms, wind farms, pumped hydro and transmission—good jobs, long-term jobs. This transition will take 20 or 30 years, and when the solar and wind farms are all built, in 20 or 30 years you have got to rebuild them because that is their lifetime, so these are long, long, long-term jobs in regional Victoria.[30]

FINDING 8: The Committee considers that developing renewable energy creates a good source of employment. Skills and training initiatives must be integral to job creation in the renewables sector along with appropriate regulatory oversight to ensure worker safety.

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27 Ibid.

28 Banyule Clean Energy Group, *Submission 64*, p. 17 (with sources).

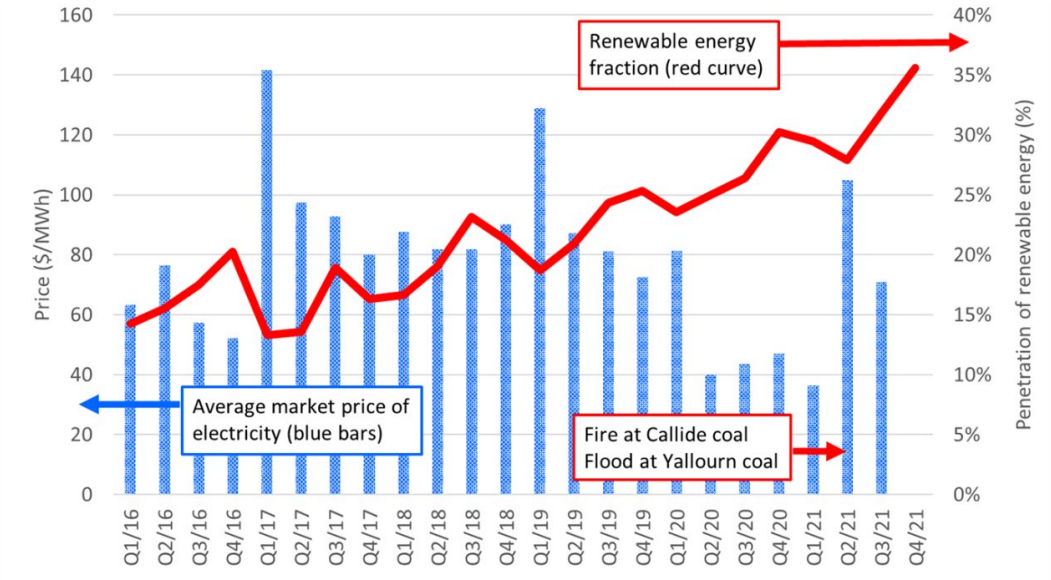
29 Chris Briggs et al, *Renewable Energy Jobs in Australia: Stage One,* report prepared by institute for Sustainable Futures, University of Technology Sydney, report for Clean Energy Council, Institute for Sustainable Futures, Sydney, 2020, p. 4.

30 Professor Andrew Blakers, *Transcript of evidence*, pp. 2–3.

Reduced energy prices for consumers

In terms of electricity costs, Professor Blakers advised the Committee that 'The entry of large amounts of solar and wind into the market into the market reduced electricity prices'.[31] He illustrated this by showing the changes in electricity prices in the National Electricity Market during the period from 2016 until the 3rd quarter of 2021, which is overlain with the increasing proportion of renewable energy generators coming online (Figure 5.2 below). This suggested a correlation between lower prices and more renewable energy.[32]

Figure 5.2 **The cost of energy in the National Electricity Markey and the take-up of renewable energy**



Note: The spike in prices in the 2nd quarter of 2021 coincided with a fire at the Callide coal power station and a flood at the Yallourn coal power station.

Source: Professor Andrew Blakers, *Submission 15*, p. 5.

Based on an Australian Energy Market Commission report, Beyond Zero Emissions and Environment Victoria pointed out that electricity prices for households and businesses continue to reduce with the increasing penetration of renewable energy:

> As the AEMC has reported each year for the past several years, increasing generation from renewable energy continues to reduce the price of power for households and businesses. As the amount of renewably generated power increases, this continues to create a downward cost trajectory reducing the cost of living.5 The 2021 price trends report found an influx of renewables and battery storage is expected to reduce wholesale electricity prices by around 39% or $207 in Victoria by 2024.[33]

31 Professor Andrew Blakers, *Submission 15*, p. 5.

32 Ibid.

33 Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 5 (with sources).

The Australian Conservation Foundation Albury Wodonga Region Community Group also stated in its submission that rooftop solar allows householders to cut down their electricity bills:

> Best of all, renewable energy is cheaper. We need as many people as possible to instal Solar PV and match this with the appropriate amount of storage. We mustn't forget those who cannot instal Solar PV and we need to share the benefits with them.[34]

Similarly, Australian Parents for Climate Action, stated that:

> Renewable electricity is already the cheapest form of energy in Australian on a levelised cost of energy (LCOE) basis , and will undercut fossil-generators because their marginal cost of generation is effectively $ 0/MWh[35]

Many other stakeholders to this Inquiry cited Rewiring Australia's modelling which shows that electrification, renewable energy and getting off fossil fuels saves up to $5400 per home in Australia.[36]

However, not all stakeholders agreed that renewable energy would deliver low prices. Andrew Macmeikan said that 'battery storage in conjunction with turbines and solar panels is unaffordable and ineffective'.[37] Mr Wissink thought that prices would increase:

> We are promised lower prices for power as we move to renewable power. Yes at times the prices, wholesale, are negative, but then again they reach stratospheric heights soon after. We need to look at the average price over a reasonable time period. It is interesting that the 2 EU countries with the highest penetration of renewables also have the highest power prices.
>
> The old adage that one can always be certain of death and taxes, may be extended to power prices, yes there will be occasional downward trends, but overall increases will come.[38]

In the Committee's view, the evidence suggests that renewable energy will lead to lower energy costs overall and that as renewable energy becomes more central to energy generation, economies of scale will further reduce energy prices.

Renewable energy and economic competitiveness

The Committee was told that renewable energy can support industry through providing it with cheaper energy costs.[39] The Centre for Future Work at the Australia Institute calculated that if Australia's current coal and gas-fired electricity was replaced with renewables (allowing for six hours of pumped hydro storage), the

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34 Australian Conservation Foundation Albury Wodonga Region Community Group, *Submission 7*, p. 2.

35 Australian Parents for Climate Action, *Submission 42*, p. 4.

36 For example: Meredith Kefford, *Submission 29*, p. 1; Yarra Climate Action Now, *Submission 33*, p. 1; Australian Parents for Climate Action, *Submission 42*, p. 5.

37 Andrew Macmeikan, *Submission 10*, p. 1.

38 Bart Wissink, *Submission 28*, p. 7.

39 Graeme James, *Submission 39*, p. 6.

Australian manufacturing sector could save $1.6 billion per year, or 23% in energy costs. Over time, those savings would get even larger. By 2050, such a transition would save manufacturers $2.2 billion per year (in constant dollar terms), or 33% of their energy bills.[40]

Some other stakeholders including Dr Leanne Morrison and Carol Bond from RMIT and the Australian Conservation Foundation Albury Wodonga Region Community Group acknowledged that renewable energy enhances Victorian businesses' competitiveness because it frees them from the carbon duties that are likely to be imposed on high emissions products.[41] The carbon tariff will be further discussed in the following Section.

Economic benefit from reducing health risks associated with fossil fuels

Stakeholders also told the Committee that there are economic benefits to be gained when health risks from fossil fuels are mitigated due to transitioning to renewable energy.

There are considerable health risks from fossil fuels which will lead to huge costs to the economy. Voices of the Valley shared its experience of the problem:

> Living in an area surrounded by some of these power stations, we have experienced the health risks associated with coal-burning. Poor health is a cost to individuals and to the economy of the area in which they live.[42]

Margaret Phillips, who has background in nursing and epidemiology said that there are 'considerable health and social risks posed to our communities by the continued burning of fossil fuels'.[43]

Australian Parents for Climate Action believed that transitioning to renewable energy will reduce these risks, and the gained benefit will outweigh the costs incurred from transitioning:

> Electrification of buildings, transport and switching to 100% renewable electricity generation will also deliver substantial health benefits from greatly reduced air pollution. It is estimated that around 3,000 people in Australia die each year from air pollution, with orders of magnitude more either hospitalised or relying on medication to control a range of respiratory and other condition. The economic benefits from reducing this health burden will be immense and may defray some of the public investment required to kick start it.[44]

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40 Dan Nahum, *Powering Onwards: Australia's opportunity to reinvigorate manufacturing through renewable energy*, Centre for Future Work at the Australia Institute, 2020, p. 4.

41 Dr Leanne Morrison and Carol Bond, *Submission 68*, p. 4; Australian Conservation Foundation Albury Wodonga Region Community Group, *Submission 7*, p. 4.

42 Voices of the Valley, *Submission 83*, p. 6.

43 Margaret Phillips, *Submission 46*, p. 2.

44 Australian Parents for Climate Action, *Submission 42*, p. 4 (with sources).

FINDING 9: The economic benefits from reducing health risks associated with burning fossil fuels are significant. These benefits should be included in the calculation of costs and benefits when analysing renewable energy development.

The economic risks of not urgently transitioning to renewable energy

In addition to the benefits, stakeholders raised with the Committee a number of economic risks if transition to renewable energy is delayed.

In its submission, Aurecon pointed out the risk of being left behind in the growing cleantech market:

> Not embracing and preparing for the transition may mean the economy is left behind other jurisdictions, with even a decline in prosperity. Australia already faces competition as other countries race to transition their energy systems and establish new industries such as hydrogen. Globally, regions such as China, the European Union and likely soon the US, all plan to decarbonise their economies by the middle of the century.
>
> More than 70 per cent of Australia's current trading partners (by volume) now have a net zero 2050 target. Europe is the most advanced on carbon border tariffs, but it's likely that it will become more commonplace globally. Not only relevant to manufacturing, it touches on all sectors.[45]

Beyond Zero Emissions and Environment Victoria highlighted the likelihood of losing markets as most key trading partners are moving fast on the transition:

> Australia's export profile is highly exposed to demand collapse as the world rapidly pivots to a zero-emissions future. Current climate targets of Australia's key trading partners will wipe $128 billion a year off Australia's exports unless we invest in alternatives. Currently 39% of Australia's total commodity exports are fossil fuels in the form of thermal coal, metallurgical coal, crude oil and LNG. However, Australia's top five export markets (China, Japan, South Korea, US and the EU) have all set net zero targets and are implementing ambitious policy settings that will drive down demand faster.[46]

They believed that Australia will lose its advantage if it does not take quick action:

> Australia is well positioned to pivot our export strategy and capitalise on these emerging green export market trends. Beyond Zero Emissions research shows that Australia can grow its revenue from new green exports to $333 billion by 2050. But we have to move quickly. The global race has started and our competitors are already moving fast to attract investment and secure market share.[47]

45 Aurecon, *Submission 79*, p. 15.

46 Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 14.

47 Ibid.

ClimateWorks agreed that delayed transition will lead to lost markets as other jurisdictions are trying to reduce emissions in the supply chain of their imported goods:

> Countries around the world, and states and territories in Australia, are beginning to target reductions in the supply chain emissions of their imported goods. If Victoria's electricity grid continues to have high emissions associated with it, there is the potential for Victorian businesses and industries powered by electricity from the grid to have lower demand due to the emissions associated with their products.[48]

Aurecon identified a further potential cost in delaying the transition as the loss of funding, leading to high costs of investment:

> An immediate risk to the state is not attracting investment in emerging industries, markets and technologies. The risk is that the capital investment will flow to other jurisdictions, or other parts of the world, that may be more progressed in their transitional thinking. Potentially, this means that the cost of capital could rise in the state in the future.
>
> On top of that, lending institutions are looking at how they can use their funding to drive sustainability outcomes by considering the lending rates they offer to companies, states and countries based on sustainability performance. The long-term risk is a reduction in revenue (from industry and business) which in turn could affect the state's debt drawdown and threaten its international credit rating.[49]

This view was echoed by Hydro Tasmania in its submission, which pointed out the possibility of failing investors' environment test and thus losing funding and investment:

> There is an increasing trend for banks and investors to make investment decisions with environmental, social and governance (ESG) factors, including climate-related risks and 'green' credentials, in mind. There is a risk of losing out on these investments if the NEM, including Victoria, does not focus on transitioning to renewables.[50]

The submission recognised the adverse impact on energy affordability:

> AEMO's ISP identifies optimal investment choices and essential actions to minimise the costs of the energy transition, while also maintaining the reliability and security of the power system. If investment does not occur in these least-cost solutions, then less efficient and poorly timed investments are likely – resulting in adverse impacts on energy affordability.[51]

The Australian Conservation Foundation - Albury Wodonga Region Community Group also acknowledged the chance of incurring high energy costs, which will result in 'higher production costs with a lower ability to export.'[52]

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48 Climateworks Australia, *Submission 43*, p. 11 (with sources).

49 Aurecon, *Submission 79*, p. 15.

50 Hydro Tasmania, *Submission 62*, p. 8.

51 Ibid.

52 Australian Conservation Foundation Albury Wodonga Region Community Group, *Submission 7*, p. 3.

ClimateWorks identified many risks arising from delaying transition, including a disruptive change and loss of economic opportunities and benefits. It stated that 'Communities supported by coal mining and coal fired power plants will face steeper, more disruptive change if phase outs of coal assets are not planned soon'. It further suggested that 'Victoria may miss the opportunity to develop low-carbon industries such as renewable hydrogen production and export' because 'Other states and territories in Australia, and other nations, who transition faster will have greater opportunity to develop their competitive and comparative advantages in these industries'.[53] In addition, the missed benefits from renewable energy, including lower energy prices and improved air quality and other health outcomes all have economic implications. Moreover, ClimateWorks pointed out that delaying transition will worsen Victoria's human capital shortage, since skilled and experienced workers move to other states and territories where there is greater investment thanks to faster transition.[54]

Latrobe City Council also showed the concern about loss of skilled workers. It believed that delaying transition would cost the city heavily:

> the risk to Latrobe City by not transitioning to renewables is with our highly skilled workforce leaving the area in search of alternative employment potentially interstate. Any loss of our skilled labour force will be a barrier to new investors in the high-tech industries such as renewables who need a readily available skilled labour force.[55]

Victorian Trades Hall Council also stated numerous risks arising from the lack of a clear plan for transition. They include loss of investment opportunities and associated employment, stranded assets, reduced competitiveness[56] and expensive and unreliable electricity supply:

> Lack of certainty about the plan for energy system decarbonisation threatens investment and creates risk. It increases the possibility of a mismatch between supply and demand and brownouts and blackouts. It also creates more expensive and unreliable electricity supply, flowing through to all consumers.[57]

Voices of the Valley said that there will be unstable electricity supply and adverse health impacts associated with delayed transition, resulting in economic loss:

> Power station operators, knowing that their businesses will not last, make the business decision that repairs are not financially sensible, or that the machinery is so close to the end of its life that it is no longer repairable. Result? Breakdowns, outages, industrial accidents, potentially loss of life. Continuing health risks associated with use of fossil fuels (gas, coal, oil) include respiratory illnesses, cancers, and heart disease leading to greater pressure on the healthcare system as well as personal costs of illness and a limited capacity to work.[58]

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53 Climateworks Australia, *Submission 43*, p. 11.

54 Ibid.

55 Latrobe City Council, *Submission 14*, p. 3.

56 Victorian Trades Hall Council, *Submission 81*, p. 10.

57 Ibid.

58 Voices of the Valley, *Submission 83*, p. 6.

Brotherhood of St Laurence echoed these views. It listed a number of risks associated with delayed transition, including being left behind and missing economic and job opportunities. According to Brotherhood of St Laurence, as the transition is unavoidable, delaying it will lead to unplanned and dramatic shifts.[59]

FINDING 10: There are a number of significant risks in economic terms if transitioning to renewable energy is delayed. These risks include being left behind other countries resulting in lost markets, lost funding opportunities and the high cost of investment. High energy costs and the loss of skilled workers will potentially lead to the lower competitiveness, as will the costs of negative health impacts caused by the effects of climate change.

5.1.2 Environmental benefits

The Committee heard evidence about the environmental benefits from transitioning to renewable energy. These benefits include:

- avoiding the environmental risks of not transitioning
- avoiding the economic costs of environmental damage and other adverse social impacts
- contributing to Australia's fulfillment of its international obligations and avoiding trade tariffs imposed on high carbon exports.

The IPCC report and the environmental risks of not transitioning to renewable energy

Victoria's energy sector is the most emissions-intensive part of the economy, accounting for 70% of Victoria's carbon emissions.[60] At a broader level, the Intergovernmental Panel on Climate Change (IPCC) reports that Australia will experience significant climate change if global carbon emissions are not reduced, leading to severe consequences of ecosystem degradation and extreme weather phenomena. This could have economic and social consequences.[61] The report indicates that in order to limit global warming to 1.5°C, transitions in all aspects of society are required to reduce carbon emissions.[62] Australia is calculated to emit 1.3% of global emissions each year, despite having just 0.3% of the global population, making us one of the world's biggest emitters on a per capita basis.[63] The Victorian Government can assist in limiting emissions by converting its energy sector to renewable energy.

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59 Brotherhood of St Laurence, *Submission 82*, p. 6.

60 Department of Environment, Land, Water and Planning, *Victoria's greenhouse gas emissions and targets: Where Victoria's emissions come from*, 2022, <https://www.climatechange.vic.gov.au/victorias-greenhouse-gas-emissions-and-targets#toc__id_0_where> accessed 6 December 2021.

61 Valérie Masson-Delmotte et al, *Global Warming of 1.5°C.: An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty,* report prepared by Intergovernmental Panel on Climate Change, 2019, pp. 175–283.

62 Ibid., p. v.

63 Ibid.

This stance is supported by a number of submissions which highlighted the catastrophic damage if global warming can't be slowed down. Voices of the Valley believed that the responsibility to future generations should be considered:

> If we do not continue to reduce emissions, we will be contributing to the problems of climate change rather than doing our part in reducing the effects. We have to think about our responsibility to future generations.[64]

Australian Conservation Foundation - Albury Wodonga Region Community Group emphasised that extreme weather events will become more severe and occur more often if urgent transitioning does not happen:

> It is becoming clear that not urgently transitioning to 100 per cent renewable energy will have many impacts including:
>
> - higher average temperatures, more bushfires, more floods, higher sea levels resulting in loss of land, damage to infrastructure, and damaging winds.[65]

The CPSU suggested in its submission that Australia has suffered from climate change and that the problem will worsen if no action is taken:

> Australia has already experienced some of the fastest and most intense consequences of climate change seen in many forms: extreme heat, droughts, floods, and catastrophic bushfires. Frequent climate-related disasters are costly, and we are already paying for it in soaring insurance premiums, and measurable health costs. Without urgent action, climate related events will be worse than the previous disasters[66]

It was also concerned about the risks to workers' occupational health and safety:

> In addition to the economic and environmental impacts of climate inaction, CPSU is concerned with the disproportionate OHS risk climate change poses to many workers. Climate-related events create hazardous work conditions and amplify existing risk factors ultimately increasing the number of people in need of medical treatment[67]

School Strike for Climate highlighted the potential mental health damage triggered by climate change:

> At present, climate change triggers mental illness in many, particularly for young people. The sense of hopelessness is profound without any seemingly impactful action being taken. Climate anxiety and stress from this has been immense, accelerating healthcare costs for hospitals and mental health services across the country. From first-hand experience, the majority of high school students experience some level of climate anxiety.[68]

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64 Voices of the Valley, *Submission 83*, p. 6.

65 Australian Conservation Foundation Albury Wodonga Region Community Group, *Submission 7*, p. 3.

66 Community and Public Sector Union (CPSU), *Submission 59*, p. 6 (with sources).

67 Ibid.

68 School Strike for Climate, *Submission 67*, pp. 5–6.

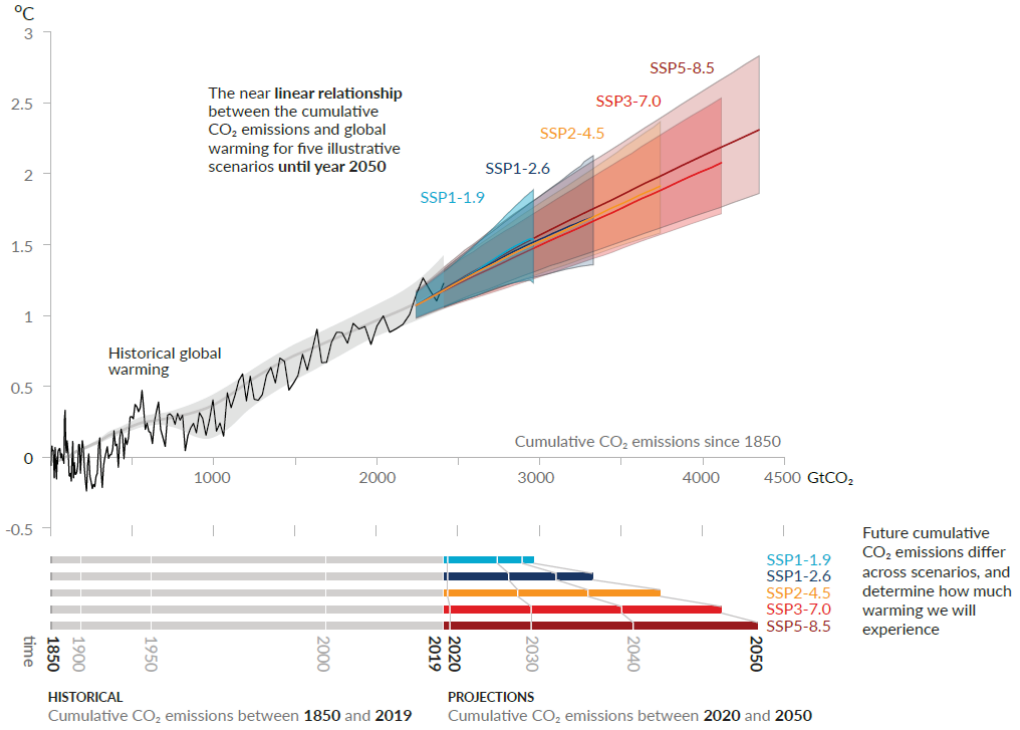
Brotherhood of St Laurence was concerned that disadvantaged people will suffer even more:

> Climate change disproportionately impacts people facing disadvantage, who may live in more vulnerable areas and are often less able to adapt – for example, because of ill health, low income or employment in fields threatened by climate.[69]

Mr Alan Pears AM from RMIT stated that the cumulative emissions in the atmosphere are the key cause of global warming. Thus, delaying action will exacerbate the problem:

> IPCC SPM (p.37) shows global cumulative carbon emissions correlate with temperature increase. This means that the speed of our climate response matters. Delaying action in the hope that future technology developments, such as cheap green hydrogen or Carbon Capture and Storage will cut emissions is a problem, not a solution. Delay reduces our already small available carbon budget.[70]

Figure 5.3 Global cumulative carbon emissions in correlation with temperature increase



Source: Alan Pears AM, *Submission 35*, p. 4.

Mr Pears pointed out that cumulative carbon emissions dictate the modest CO^2 budget of each country, including Australia:

> Table SPM2, p. 41 [29] shows how sensitive our global carbon budget is to both the temperature increase we are prepared to accept, and the probability of achievement

69 Brotherhood of St Laurence, *Submission 82*, pp. 6–7.

70 Alan Pears AM, *Submission 35*, p. 4.

> we accept. If we assume Australia is entitled to our population's share of global population, and we want to achieve an 83% chance of limiting temperature rise to 1.5C, Australia's share of our global 300 GT CO2 budget would be 940 Mt CO2e. That's about two years of our present emissions. If we aimed to simply maintain our present share of global emissions, our budget would be 3900 Mt CO2, about 10 years of our present CO2 emissions. That is why global experts suggest Australia needs to cut its emissions by over 70% by 2030.[71]

Mr Pears provided Table SPM2 from the IPCC report (Table 5.4 below).

Table 5.4 Estimates of historical carbon dioxide (CO2) emissions and remaining carbon budgets

Approximate global warming relative to 1850–1900 until temperature limit	Additional global warming relative to 2010–2019 until temperature limit	Estimated remaining carbon budgets from the beginning of 2020 ($GtCO_2$) Likelihood of limiting global warming to temperature limit					Variations in reductions in non-CO_2 emissions
(°C)	(°C)	17%	33%	50%	67%	83%	
1.5	0.43	900	650	500	400	300	Higher or lower reductions in accompanying non-CO_2 emissions can increase or decrease the values on the left by 220 $GtCO_2$ or more
1.7	0.63	1,450	1,050	850	700	550	
2.0	0.93	2,300	1,700	1,350	1,150	900	

Source: Alan Pears AM, *Submission 35*, p. 4.

He thus emphasised that urgent action is required before that budget is used up. He warned the Government not to rely on the uncertain future technologies such as Carbon Capture and Storage.[72]

FINDING 11: Continuing current carbon emission levels will increase the global temperature, accelerate climate change and cause more severe, frequent and extreme weather events, thus endangering people's health and safety. Transitioning to renewable energy will help to mitigate the most severe impacts of climate change.

The economic costs of environmental damage

Stakeholders told the Committee of huge economic costs which will happen to different levels of the economy if global warming cannot be mitigated. They pointed out that transitioning to renewable energy is imperative to avoid those catastrophic costs.

71 Ibid.

72 Ibid.

At the national level, the submission from Neil Andrews detailed the estimated long-term costs of various levels of global warming (changes in GDP per year to 2100, measured in US$). For Australia, the estimates were:

- With +2°C: -US$23.7 billion per year
- With +3°C: -US$36.9 billion per year
- With +4°C: -US$117.4 billion per year[73]

Mr Pears cited the report *Living on Borrowed Time* of the Business Council of Australia to say of the costs that Australia will suffer if climate change is unchecked:

> the Business Council of Australia Living on Borrowed Time (2020) estimates unchecked climate change could cut Australian GDP by 6%, a loss of $34 trillion and over 880,000 jobs over the next 50 years, while effective action would grow the economy by 2.6% ($680 billion) and create over 250,000 jobs.[74]

At the state level, the Victorian Government quantified the damages caused by the recent climate change-linked extreme weather events in the state:

- The Black Saturday bushfires in 2009, estimated to have cost the state economy $7 billion.
- The 2019–20 bushfires, which a Royal Commission estimated to have resulted in national costs of $10 billion. However, new research suggests that figure may have understated the full costs, with smoke-related health costs estimated at $486 million for Victoria alone.
- Heatwaves, estimated to cost the Victorian economy an average of $87 million per year.
- The 2010–11 Victorian floods, estimated to have cost the Victorian economy $1.3 billion.[75]

Based on modelling, the City of Melbourne estimated the cost that the impact of climate change and missed economic opportunities would have on the municipality:

> The benefits of mitigating the impacts of climate change and its damages far outweigh the cost. Supported by economic modelling by EY, the City of Melbourne has estimated that the impacts of climate change and missed economic opportunities of transitioning to a low carbon economy will cost AU$12.6 billion to the municipality's economy by 2050.[76]

Hydro Tasmania identified the costs in terms of infrastructure damage, health costs and lost productivity:

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73 Neil Andrews, *Submission 45*, p. 16 (with sources).

74 Alan Pears AM, *Submission 35*, p. 2.

75 Department of Environment, Land, Water and Planning, *Submission 88*, p. 13.

76 City of Melbourne, *Submission 18*, p. 4.

> There are direct economic risks associated with climate change and climate change resilience. As a hydropower and wind generator, Hydro Tasmania is particularly vulnerable to future climate risks … the electricity sector itself is threatened by extreme weather events, particularly where these compound (i.e. heatwaves causing high demand co-incident with bushfire risk and potentially still days). These climate risks have economic costs, particularly associated with extreme weather events and natural disasters, including infrastructure damage, health costs and lost agricultural and labour productivity.[77]

Victorian Trades Hall Council said of economic damage in terms of lost workdays and agricultural losses:

> Victoria has already suffered substantial economic damage from climate disasters, including the 2019–20 bushfire season, storms causing lengthy power outages, and floods. Lives are also put at risk or lost during these events. Economic damage from lost work days due to extreme heat and other extreme weather will increase as global heating continues. Agricultural losses from droughts and long-term ecosystem changes are likely to be substantial unless we can keep temperature rises as low as possible.[78]

Clare Morrissey, a farmer from Gippsland told the Committee about her own losses caused by consecutive extreme weather events in the region:

> I am a farmer in Gippsland who has come out of 10 years of drought and has just had all my bridges washed away by floods this year. We need to do something to stop these drastic weather events. We have to stop using coal based electricity. We need more vision to wean us off coal and gas and move to 100% renewables.[79]

In its submission, the Animal Justice Party also discussed the huge 'economic 'cost' of a range of climate change-induced impacts such as emerging diseases, biodiversity loss, coastal inundation'.[80] It suggested that further study be conducted to fully understand the impact.

Stakeholders emphasised the urgency of transitioning to renewable energy to avoid the worst of the impacts of climate change. Powerledger said that 'With the cumulative damages increasing over time, it is imperative to act now to reduce emissions and transition to 100% renewable energy generation.'[81]

FINDING 12: There are substantial economic costs associated with the rise of carbon emissions in the atmosphere, which cause global warming, climate change and consequential extreme weather events. Transitioning to renewable energy will help to reduce carbon emissions, thus provide the opportunity to mitigate those costs.

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77 Hydro Tasmania, *Submission 62*, p. 8.

78 Victorian Trades Hall Council, *Submission 81*, p. 11.

79 Clare Morrissey, *Submission 32*, p. 1.

80 Animal Justice Party, *Submission 87*, p. 28.

81 Powerledger, *Submission 65*, p. 5 (with sources).

Trade tariffs and other international pressures

Stakeholders also discussed the issues of trade tariffs and other external pressures that Victoria will face if it delays the transition.

According to stakeholders, the risk of having to pay a carbon tariff is real as countries are seeking to impose such tariffs on their imports. Beyond Zero Emissions and Environment Victoria suggested that:

> not taking measures to ensure that Victoria's power supply comes from renewables will expose exports to carbon border tariffs. The European Union has recently passed a border tax to come into effect in 2023 and the Biden Administration in the United States has made serious motions to push for one, too. At their current carbon intensity, exports from Victoria would suffer under these policies.[82]

Other stakeholders such as Lighter Footprints,[83] Professor Blakers,[84] Tesla Australia,[85] and Mr Benjamin Cronshaw[86] also discussed the likelihood of Victorian exports being exposed to carbon tariffs. In its submission, Tesla Australia said that transitioning from fossil fuel will help to avoid the problem:

> Transitioning away from fossil-fuel inputs also positions the Victorian economy for the future, mitigating potential impacts of carbon border tariffs or taxes that are already being discussed internationally.[87]

Mr Wissink recognised in his submission the pressure from trading partners to move to low carbon emissions:

> If we do not move to a low carbon emission nation voluntary, our trading partners will, with time demand that we do so. If it comes to that stage our trading partners will be instructing us what to do and when to do it, ie it will be out of our control, but the cost will be borne by us.[88]

Dr Leanne Morrison and Carol Bond from RMIT said of the possibility of being excluded from various markets:

> As a country, Australia will likely encounter market exclusion, including through financial penalties imposed by countries importing our goods, through carbon duty mechanisms likely to be introduced in the near future. This represents not only a reduced competitiveness in global markets (through increased pricing), but also a loss of revenue (duties paid to other countries, rather than retained domestically as a carbon price).[89]

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82 Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 15.

83 Lighter Footprints, *Submission 76*, p. 16.

84 Professor Andrew Blakers, *Submission 15*, p. 7.

85 Tesla Energy, Submission 41, p. 3.

86 Benjamin Cronshaw, Submission 31, p. 1.

87 Tesla Energy, *Submission 41*, p. 3.

88 Bart Wissink, *Submission 28*, p. 9.

89 Dr Leanne Morrison and Carol Bond, *Submission 68*, p. 4 (with sources).

They also suggested the risk that Australia may be disadvantaged by the looming international reporting standard on climate change:

> Some of the announcements made at COP26 include the establishment of an International Sustainability Standards Board, as part of the International Financial Standards Board. One of the purposes of this important new institution is to establish a set of reporting standards which reflect the structure of existing financial reporting standards. In this context, the goal is to mandate climate change reporting to similar levels of regulation as financial reporting by Q4, 2022. At this point in time, the public visibility of reported action on climate change will be profoundly heightened. An important consequence of this change will be the market pressure for low impact and low emissions operations. Without preparation for this change, Victorian businesses will be at significant disadvantage, arising from the probable reduction in investor interest for businesses with comparatively higher emissions patterns.[90]

ClimateWorks pointed out that only a swift transition will help Australia meet its Paris Agreement commitment:

> A swift transition to 100 per cent renewable energy is critical to Australia meeting its commitments under the Paris Agreement, and critical to Victoria achieving its emissions targets and facilitating emissions reductions across all sectors. By acting now, Victoria can capture a range of long-term economic benefits, and avoid the risks of delay.

It also suggested that the Government's action can help minimise the mentioned risks and capture the opportunities:

> Victoria can minimise the state's exposure to these risks and capture the opportunities of the renewable energy transition. It can do this by setting a clear near-term date for achieving 100 per cent renewable energy, preferably by 2030, and pairing this with a clear, transparent strategy for achieving this target that consults stakeholders from across the economy, including workers, businesses, communities and trading partners.[91]

FINDING 13: Australia's exports are likely to face carbon tariffs and other financial duties and external pressure, and Victoria will add to the country's failure to meet its environmental obligations as part of the nation if it delays the transition.

5.2 The costs of transitioning to renewable energy

The Committee has also heard about the costs of transitioning to renewable energy.

Stakeholders acknowledged that renewable energy is not free of environmental and other adverse impacts. The Animal Justice Party stated that 'all energy-harvesting technologies generate pollutants during their life-cycles'[92] and that 'Understanding the

90 Ibid., p. 5.

91 Climateworks Australia, *Submission 43*, p. 10.

92 Animal Justice Party, *Submission 87*, p. 5.

full consequences of energy production systems is necessary for meeting demand while also safeguarding the ecological systems on which we depend.'[93]

Submissions to the Inquiry suggested to the Committee the following adverse impacts of renewable energy:

- noise, health and environmental impacts of wind farms
- aesthetic and land impact of transmission networks
- issues of remediating the sites after power plant end of life
- material use and renewable energy waste issues.

5.2.1 Noise, health and environmental impacts of wind farms

Some stakeholders expressed their concerns about the wind farm noise and its possible health impacts. Viva-Lyn Lenehan in her submission suggested that windfarms are harmful for human health because they are noisy and that:

> The current wind farm permit conditions and noise regulations do not adequately protect people from harm. The Government, together with the wind industry, is ignoring a minority group of vulnerable people living near wind farms in favour of large companies and political agendas.
>
> Wind farms cause harm to human health, and as more wind farms are built and the harm becomes more apparent, the less socially sustainable wind farms will be. [94]

Similarly, Ms Howley said that wind farms are not compliant with the noise levels and operators are not responding to local residents' complaints:

> Clearly the Macarthur Wind Farm is often well over accepted noise levels and yet is deemed compliant … it often breaches compliant requirements. Neighbours are asking for compliance and yet the responsible authorities ignore them and many have been forced to leave their homes.
>
> Generally there has been no co-operation from wind farm operators to turn off or down the turbines in known times with excess noise or flicker. This is not difficult or particularly disruptive for the turbines to be controlled to stop excessive disruption to neighbours.[95]

Fiona Maskell stated in her submission that 'residents can detect whether turbines are running or not in the absence of sound above the audible threshold' and thus, require further investigation into the issue.[96]

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93 Ibid., p. 6.

94 Viva-Lyn Lenehan, *Submission 11*, pp. 1–2.

95 Joy Howley, *Submission 16*, p. 3.

96 Fiona Maskell, *Submission 6*, p. 1 (with sources).

According to Flinders University research, windfarm noise is mostly caused by the amplitude modulation, or the swooshing of the blades. The research indicates that this swooshing varies. It occurred 2 to 5 times more often in the night-time than in the daytime and it occurred most often during downwind and crosswind conditions. Its prevalence was also associated with sunset and sunrise.[97] This research suggests that windfarm noise at times can be more disturbing than other times. This factor needs to be taken into consideration in wind farm regulation.

Stakeholders also believed that current wind farm noise-related regulations are flawed. Ms Lenehan argued that current regulations on wind turbine noise based on road traffic noise, not wind turbine noise:

> The wind turbine noise regulations defy common sense. The basis on which its standard is based is flawed. The NZS 6808 noise levels are derived from city road traffic noise – not from wind turbine noise in quiet rural and regional settings.[98]

Ms Maskell suggested that wind farms should not be close to human dwellings and set-back distances should be based upon multiple factors and be considered on an application-by-application basis, rather than applying a blanket rule.[99]

Graeme James argued that 'turbine sizes have increased (and continue to do so) both in height and rotor diameter' while 'the siting regulations and the standards for the predictive noise levels have not.'[100] He said that turbine setback distance is currently recommended based on their height. He believed that it is inappropriate as tip height only determines the distance from which the turbines may be seen, while the visual intrusion and the sound levels are determined by the rotor diameter:

> The air stream behind the turbine rotor has both positive and negative shear factors which "tunnels" sound (that should either escape into space or be absorbed by the ground) until such time that normalising airflow allows the sound to escape downwards. This leads to higher than predicted sound levels downwind of turbines, and many residents have had to abandon their homes as a result.[101]

Mr James therefore suggested that the setback distance should be calculated by the formula of 'Setback distance = 10 x rotor diameter'.[102]

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97 Phuc D. Nguyen et al, 'Long-term quantification and characterisation of wind farm noise amplitude modulation', *Measurement*, vol. 182, September 2021, p. 182.

98 Viva-Lyn Lenehan, *Submission 11*, pp. 1–2.

99 Fiona Maskell, *Submission 6*, p. 1.

100 Graeme James, *Submission 39*, p. 3.

101 Ibid.

102 Ibid.

Regarding the sound monitoring in Victoria, Mr James raised doubts over the accuracy of the current method:

> Currently, the Audio Engineers contracted by the Wind Companies in Victoria are permitted to choose the input parameters for their predictive modelling and always choose a set that under predicts the actual noise levels ...[103]

Notably, some wind farm neighbours had sued wind farm operators in the courts. In its judgement on 25 March 2022, the Victorian Supreme Court ruled that the Bald Hills Wind Farm, located in Gippsland, had not complied with its noise permit conditions. The court acknowledged that the wind farm generates renewable energy, which is 'a socially valuable activity and it is in the public interest for it to continue', but also stated that it should not be 'a binary choice between the generation of clean energy by the wind farm and a good night's sleep for its neighbours', and that 'It should be possible to achieve both'. The court thus gave the wind farm an initial three-months to take measures to abate emitting loud noise at night. Otherwise, the wind farm will not able to operate at night. The court also ordered the wind farm to pay two plaintiffs $260,000 in damages.[104]

This decision demonstrates that wind farm noise is a problem not only to local residents, but also to wind farm operators. Its variation, as pointed out by Flinders University research, leads to the situation that wind farms may be compliant during the daytime but not during the night time. It disturbed people's night sleep and exposed wind farms to litigation costs. This suggests that more appropriate regulation on monitoring is required to reflect the variability of wind farm noise and to ensure that wind farms strictly comply with the noise standard to avoid possible conflict.

The Committee acknowledges that the Victorian Government is working on the Environment Protection Amendment Regulations 2022 to replace the Environment Protection Amendment (Interim) Regulations 2021. The Government has proposed some changes in response to public consultation in 2021. These changes include greater flexibility in periodic monitoring of wind turbine noise and stakeholder agreements with farm operators. Relying on the current noise standards, the Government has also proposed to specify requirements for compliance. It has identified the following measures to address the issue of wind farm noise:

- Complying in an ongoing manner with the relevant noise standard
- Implementing a noise management plan, including a complaints management plan
- Providing an annual statement of actions taken to ensure compliance
- Completing a post-construction noise assessment
- Undertaking noise monitoring every five years.[105]

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103 Ibid.

104 Emma Field, 'Bald Hills Wind Farm ordered to stop emitting night-time noise, pay neighbours damages in landmark ruling', *ABC*, 25 March 2022, <https://www.abc.net.au/news/2022-03-25/bald-hills-wind-farm-to-pay-damages/100938656> accessed 28 March 2022.

105 Engage Victoria, *Changes to the regulation of wind farm noise: Have your say about proposed regulations for wind farm noise in Victoria*, 2022, <https://engage.vic.gov.au/changes-regulation-wind-farm-noise> accessed 3 April 2022.

The Committee acknowledges that some local residents are suffering significant negative impacts to their lives which they attribute to noise from rotating turbines which has contributed to disturbed sleep. The Committee considers that there should be measures to ensure wind farm operation complies with accurate and meaningful noise standards. The Committee also recognises that the Victorian Government is currently working to improve the regulation regarding wind farm noise in consultation with relevant stakeholders.

RECOMMENDATION 11: That the Victorian Government ensure the Environment Protection Amendment Regulations 2022 accurately reflects the variability of wind farm noise and the corresponding monitoring allows for assessment of the noise both during the day and at night.

RECOMMENDATION 12: That the Victorian Government explore ways that affected residents may be assisted in upgrading the soundproofing of their homes to mitigate against intrusive impacts that may arise from wind farms where they are in reasonably close proximity to residences.

In addition to the issue of wind farm noise, some stakeholders expressed their concerns about the adverse effects on the eco-system and the habitats of some species. Ms Howley and Hamish Cumming said that existing windfarms would harm the Brolga, which was described as 'the only "pure" Grus rubicunda' in Western Victoria.[106] According to Mr Cumming, 'the turbines displace Brolga for a minimum of 5km, and the Breeding home range of Brolga is also a minimum of 5km.'[107] Similarly, residents living along the coast line of Nooramunga Marine and Coastal Park were concerned that windfarms may adversely affected the fragile ecosystem there. They suggested that 'all land within five kilometres of the high water mark of the coastline of Nooramunga be protected from the development of Wind Energy Facilities.'[108]

In regard to onshore wind farms, Graeme James, a submitter proposed extending:

> the existing Turbine exclusion zone (5km inland from the high water mark for coastal regions) to include the entire Victorian Coastline rather than from Warnambool to Wilsons Promontory'.[109]

Mr James explained that there are sensitive areas there, with some having 'Ramsar overlays to protect endangered migratory birds', the communities there 'value their visual outlook and amenity', and that 'there is a high dependence on tourism.'[110]

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106 Joy Howley, *Submission 16*, p. 4.; Hamish Cumming, *Submission 9*, p. 1.

107 Hamish Cumming, *Submission 9*, p. 1.

108 Nooramunga Coastal Communities, *Submission 36*, p. 1.

109 Graeme James, *Submission 39*, p. 3.

110 Ibid.

To address this issue, Erin Coldham, Chief Executive Officer of Star of the South told the Committee in a public hearing that the project has conducted thorough research and proposed necessary measures to minimise the impact on the environment:

> this is the first offshore wind farm for Australia—we have a unique marine environment. We have spent the best part of two years undertaking one of the biggest research programs in Bass Strait's history. We have had scientists involved from a number of universities and from CSIRO looking at species. We have monthly surveys that look at the bird data, the whales; we have got microphones on the sea floor—every study imaginable so that we can understand what the current environment looks like.
>
> We can then overlay an offshore wind farm in that environment, what changes we can expect through those construction techniques, and then we identify ways that we can minimise and reduce any impacts.[111]

Under the *Environment Effects Act 1978* (Vic), any developments potentially affecting the environment are required to conduct an Environment Effects Statement (EES). The EES needs to examine the possible environmental impacts of the development and provides a program for minimising, managing and monitoring the impacts. The legislation also requires that the EES process be conducted in consultation with the public. The Committee considers that complying with these requirements is not only a legal requirement but is an effective way to address the environmental concerns associated wind farm development.

RECOMMENDATION 13: That the Victorian Government consider funding further research to determine the best approach for ensuring wind farm developments don't adversely impact native species, particularly Brolgas (Grus Rubicunda).

5.2.2 Impact of transmission networks

Stakeholders also expressed their concerns about the impact of transmission networks for renewable energy. These impacts include those on the environment, landscapes and property values.

Environmental and aesthetic impacts

Moyne Shire Council told the Committee in its submission that:

> Greater visual and land use impacts from high voltage powerlines will be experienced by REZ communities as a result of accelerated REZ development. This includes further easements on private and public land; difficulties in managing fuel loads for bushfire prevention; concerns about aerial firefighting near powerlines and turbines; possible traffic hazards; more powerlines interrupting landscape views from people's residences

111 Erin Coldham, Chief Development Officer, Star of the South, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 26.

> and tourist roads. Under grounding transmission lines resolves many of these issues and should be implemented where technically feasible with extra cost placed on all consumers, largely city dwellers that do not experience these power line impacts.[112]

Greg Foyster, Acting Campaigns Manager at Environment Victoria was concerned about the pressure of the grid upgrade to accommodate the quick roll-out of renewable energy. He emphasised the need of a balancing act to minimise impact on the environment:

> We need these upgrades to the grid and we need to roll out renewables as fast as possible to reduce the impacts of climate change, and that has to happen across the world. But we need to do it in a way that obviously minimises local environmental impacts and makes the best use of agricultural land. It is a balancing act that needs to be performed here, and it is a relatively new thing for us to all work out. But I just want to stress that it can be done right and there is more research that need to be done there. I would just say that the overarching imperative to act on climate change is an important factor here.[113]

The submission from Energy Grid Alliance pointed out that Victoria's relevant regulatory framework is currently outdated and unable to address the environmental issues arising from new transmission building:

> Forty years ago, transmission planning policies did not fully appreciate ecological, biological, social, economic, cultural or communities impacted by electricity transmission lines. Instead, project proposals stumbled upon regulatory intervention, community opposition, and last-minute litigation because impact considerations had been left until the final siting phase. Most existing planning policy and resilience framework has a strong focus on activities around existing infrastructure, not new. Adopting this historical framework will result in reactive planning and mitigation measures rather than a proactive approach.[114]

According to Energy Grid Alliance, under the current policy framework, transmission projects may not fully address the environmental impacts, thus may fail to secure the necessary social license, leading them to incur significant extra costs. It used the case of Western Victoria Transmission Network Project (WVTNP) to demonstrate its point.

The WVTNP proposes a new high-voltage transmission line starting at Bulgana in Victoria's west and covering approximately 190km to Sydenham in Melbourne's north-west. The project is intended to enable the connection of new renewable energy generated in Western Victoria into the National Electricity Market and increase the Victorian transmission capacity.

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112 Moyne Shire Council, *Submission 61, Attachment 3*, p. 4.

113 Greg Foyster, Acting Campaigns Manager, Environment Victoria, public hearing, Melbourne 17 March 2022, *Transcript of evidence*, p. 18.

114 Energy Grid Alliance, *Submission 2*, p. 2.

According to the Energy Grid Alliance's submission, the current planning framework did not require the Australian Energy Market Operator (AEMO) to consider environmental or socioeconomic impacts during the Regulatory Investment Test for Transmission (RIT-T). Otherwise, it allowed the WVTNP to enter the 'safe haven' of the EES process, the primary purpose of which is to avoid impacts in the first place. As AusNet Services (the proponent) can no longer avoid impacts, they will only be required to minimise them.[115]

The submission stated that the WVTNP has experienced considerable push-back from communities and concern among industry stakeholders, investors, and energy consumers about the project's viability. The project's gross market benefit was estimated at $670 million through the RIT-T. The submission stated that due to the greenfield site, cumulative environmental impacts and challenging topography, it is highly likely that project costs, once determined, will exceed market benefit. This is said to result in a 'dead weight' loss to the Victorian economy.[116]

The submission suggested that the current policy framework for transmission planning needs to change significantly:

> Energy regulators have an opportunity to develop transmission policy relating to setbacks, resilience, environmental protection, and to adopt an innovative community guided approach that seeks to mitigate socio-economic and environmental impacts and expedite project delivery.[117]

Property values

Building transmission networks potentially brings down the values of properties in the surrounding areas. In his submission, Brendan Toohey, expressed his concern that 'The construction of 85meter high transmission towers will reduce property values and amenity to both to those directly affected and those neighbouring the proposed line.'[118]

Landowners affected by transmission line development felt that they were not entitled to a fair compensation process. Unlike wind farms, transmission lines belong to 'public goods'. Developers can therefore rely on the *Land Compensation and Acquisition Act 1986* to propose payment only to landowners who have towers built or line easements on their property but not to ones who have adjacent land or otherwise affected. Mr Toohey pointed out that this was the case with Ausnet's West Victoria Transmission Network Project. [119] Gerald Conroy also said in his submission that 'the landowners along the transmission easements are expected to give up their land for nothing.'[120] He contrasted with wind farms, where landowners on adjacent properties

115 Ibid.

116 Ibid.

117 Ibid.

118 Brendan J Toohey, *Submission 5*, p. 4.

119 Ibid., p. 3.

120 Gerald Conroy, *Submission 13*, p. 1.

can have compensation paid to them in the form of the provision of free electricity or landscaping or sound mitigation.[121]

Mr Toohey believed that because of this problem, it is difficult for transmission developers to gain social licence, or 'community consent'.[122]

The Committee recognises that the government is working on the measures to secure local community support for renewable generation and transmission. The measures to obtain social licence, including the issue of compensation are discussed in Chapter 3 of this report.

5.2.3 Remediation after power plant end of life

Stakeholders raised with the Committee the issue of rehabilitating the land and environment at the end of a project cycle. Victorian Farmers Federation emphasised that developers must take responsibility for decommissioning and remedial works:

> The VFF believes that when establishing statutory processes governing renewable energy developments, government must consider all issues concerning their eventual impacts on land use and rehabilitation including decommissioning. Developers, not landowners should be held responsible for all decommissioning and remedial works. This includes placing requirements on developers to recycle or reuse any materials at the end of the development's life cycle. Where the developer is unable to meet these obligations, the government must be responsible for costs associated with carrying out all decommissioning and remedial works.[123]

In her submission, Ms Howley cited Australian Energy Infrastructure Commissioner Andrew Dyer, who pointed out that wind turbine decommissioning is a costly process and should be considered in combination with the leasing fees paid to land owners:

> While there are no documented examples of costs to decommission a contemporary wind turbine or farm in Australia, some published decommissioning plans have calculated costs that are close to $400,000 per turbine. Many of these decommissioning plans are reliant on balancing decommissioning costs by recycling the recovered materials – however, there appears to be a lack of sufficient evidence to confirm this approach. To put these costs into perspective, the fees earned for hosting the turbine for 25 years could be in the range of $250,000 - $625,000 (depending, typically, on the turbine capacity and when the wind farm commenced operations). It is therefore possible that the costs to decommission a turbine could be equal to greater than the total income generated for the landowner over the 25 year lease period.[124]

She therefore suggested that 'There needs to plans for how towers are to be dismantled and recycled if the industry is to be creditable.'[125]

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121 Brendan J Toohey, *Submission 5*, p. 4.

122 Ibid.

123 Victorian Farmers Federation, *Submission 49, Attachment 1*, pp. 2–3.

124 Joy Howley, *Submission 16*, p. 5 (with sources).

125 Ibid., p. 5.

5.2.4 Material use and waste from renewable energy generation

Renewable energy infrastructure and equipment uses a large volume of materials. This potentially impacts the environmental because these materials need to be supplied and there will be a large amount of waste being discharged into the environment at the end of a project's life cycle.

The Animal Justice Party (AJP) suggested in its submission that 'Renewables such as wind and solar, for example, require considerable materials to be mined.'[126] This has adverse environmental and social impact, as illustrated through the use of cobalt. Cobalt is needed to make electric vehicle batteries, and there are allegations that this industry uses child labour in Congo to mine the Cobalt.[127] AJP stated that the demand for minerals to build renewable energy is high:

> The amount of mined and processed materials in 1 gigawatt of solar panels is between 70,000 and 100,000 tonnes and the panels have a lifespan of just 25 years, meaning that about 60 percent will fail before this. The batteries required to firm up this gigawatt currently have an energy density of about 150 wh/kg. So to store 8 gigawatt hours would require some 50,000 tonnes of mined and processed materials. These batteries have a much shorter lifespan. The tonnage material in a solar farm such as frames and sometimes foundations is typically of a similar weight to the panels; this is an extraordinary amount.[128]

In addition to the materials that go into renewable energy infrastructure, as renewable energy projects retire the waste will need to be processed. Waste from renewable energy projects poses a considerable challenge.

Freja Leonard said that in Australia the waste issue is still overlooked and recycling schemes for renewable energy are inadequate:

> One of the often-overlooked elements of a comprehensive transition to renewables – or any industry - is the waste element. Alongside embracing a 100% renewable energy economy it is beholden to the State Government to implement a zero-waste strategy to manage the end of life for all clean energy facilities. Currently in Australia only one recycling plant exists, in South Australia, to tackle renewables once they have finished their useful life. This is hopelessly inadequate and completely avoidable. The Victorian Government is to be commended for finally addressing the waste problems of this state and would be wise to be on the front foot for implementing a strategy to tackle all renewables waste – whether panels, turbines or batteries – within Victoria from the moment of installation.[129]

126 Animal Justice Party, *Submission 87*, pp. 5–6 (with sources).

127 Ibid., pp. 6–7.

128 Ibid., p. 7.

129 Freja Leonard, *Submission 75*, p. 7.

Regarding waste from solar PV, Sustainability Victoria emphasised that processing facilities are critical to prevent materials from leaching into the ground:

> At the moment solar panels in particular present a problem because they can contain materials that leach into the ground if managed poorly. Facilities to process solar panels are necessary, particularly as the large numbers of home solar panels have a limited life cycle and will need to be replaced. There are currently only a limited number of facilities in Australia that process solar panel waste.[130]

Mr Wissink told the Committee that most renewable energy waste still does not have a solution to recycle. On wind turbine waste, he said that 'The disposal of damaged, past life Turbine blades is not satisfactory' and on solar PV, he said that 'The current approach to PV panels is to dispose of them as general waste.'[131] Mr Wissink, however, suggested that there is an opportunity for investment and job created in processing renewable energy waste:

> The areas which should be addressed and will also provide an opportunity for investment is recycling of batteries, recycling of turbine blades and photovoltaic waste.[132]

However, Professor Blakers said that solar PV panels are recyclable and that 'The amount of solar PV materials to be recycled will remain comfortably below existing waste and recycling streams.'[133]

The Committee recognises that Victoria has witnessed some progress in processing solar PV waste. In September 2020, Lotus Energy completed building Australia's first solar PV recycling facility in Melbourne, which it claimed 'to recycle 100% of end-of-life solar PV modules and all associated materials recovered – inverters, cables, optimisers, mounting structures – using no chemicals.'[134] Ojas Group, an industrial manufacturing company, has also partnered with RMIT and the University of Melbourne to establish Elecsome. Which is described as 'a national network of collection points and facilities to provide cost-effective and environmentally sustainable PV solar panel upcycling services in Australia.' In September 2020, Ojas Group won a $3 million Commonwealth Government grant to open the first ever solar panel upcycling (or creative reuse) plant, which is part of the above-mentioned plan.[135]

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130 Sustainability Victoria, *National approach to manage solar panel, inverter and battery lifecycles: The growing issue of PV system waste*, 2021, <https://www.sustainability.vic.gov.au/research-data-and-insights/research/recycling-and-reducing-waste/national-approach-to-manage-solar-panel-inverter-and-battery-lifecycles> accessed 12 December 2021.

131 Bart Wissink, *Submission 28*, p. 8.

132 Ibid., p. 8 (with sources).

133 Andrew Blakers, *Renew Economy: Solar PV panel waste will not become a significant problem*, 2020, <https://reneweconomy.wpengine.com/solar-pv-panel-waste-will-not-become-a-significant-problem-98181> accessed 4 April 2022.

134 Sophie Vorrath, *Renew Economy: Australia's first solar panel recycling plant swings into action*, 2021, <https://reneweconomy.com.au/australias-first-solar-panel-recycling-plant-swings-into-action> accessed 4 April 2022.

135 Sophie Vorrath, *Renew Economy: "First of its kind" solar panel upcycling plant on cards after federal grant win*, 2020, <https://reneweconomy.com.au/first-of-its-kind-solar-panel-upcycling-plant-on-cards-after-federal-grant-win-58825> accessed 4 April 2022.

By comparison, recycling wind turbines appears to be more challenging. Its main problem lies with their hard-to-decompose fiberglass blades, which currently mostly go to landfills at end-of-life.[136] Scientists and the industry around the world are looking for possible solutions to recycle wind turbine blades. In September 2021, Siemens Gamesa announced its launch of the world's first fully recyclable wind turbine blades. The production line was rolled out in a factory in Denmark and recyclable turbine blades will be installed and tested at an offshore wind farm in Germany.[137] Other opportunities are being examined include grinding wind turbine blades to dust, looking for chemicals to extract or breaking down blades and pressing them into pellets and fiber boards to be used for flooring and walls. There is also an experiment in Europe which burned turbine blades in kilns that created cement or was used in power plants.[138]

The Committee acknowledges that recycling waste is a big challenge to the renewable energy industry. This problem will become substantial when more renewable energy projects approach the end of their life cycle. Though the environmental impact caused by renewable energy waste is less severe than fossil fuel, it is essential to develop more advanced technologies that can recycle the waste or process it in an environmentally friendly manner. Victoria is making progress recycling PV panels. It needs to continue to develop its processes to prepare for the end-of-life phase of all types of its renewable energy projects.

FINDING 14: Recycling schemes need to accommodate for recycling of renewable energy waste. Facilities need to be developed and/or modified so that waste that cannot be recycled can be dealt with in an environmentally sensitive way at the end of a product lifecycle. Manufacturers of renewable energy materials must also take responsibility for disposal options for their products.

RECOMMENDATION 14: That the Victorian Government include the solutions for processing renewable energy waste in any of its renewable energy strategies and plans and support the development and deployment of technologies that maximise the possibility of recycling, such as installing recyclable blades or recycling solar PV panels.

136 Chris Martin, 'Wind Turbine Blades Can't Be Recycled, So They're Piling Up in Landfills', *Bloomberg*, 5 February 2020, <https://www.bloomberg.com/news/features/2020-02-05/wind-turbine-blades-can-t-be-recycled-so-they-re-piling-up-in-landfills> accessed 4 April 2022.

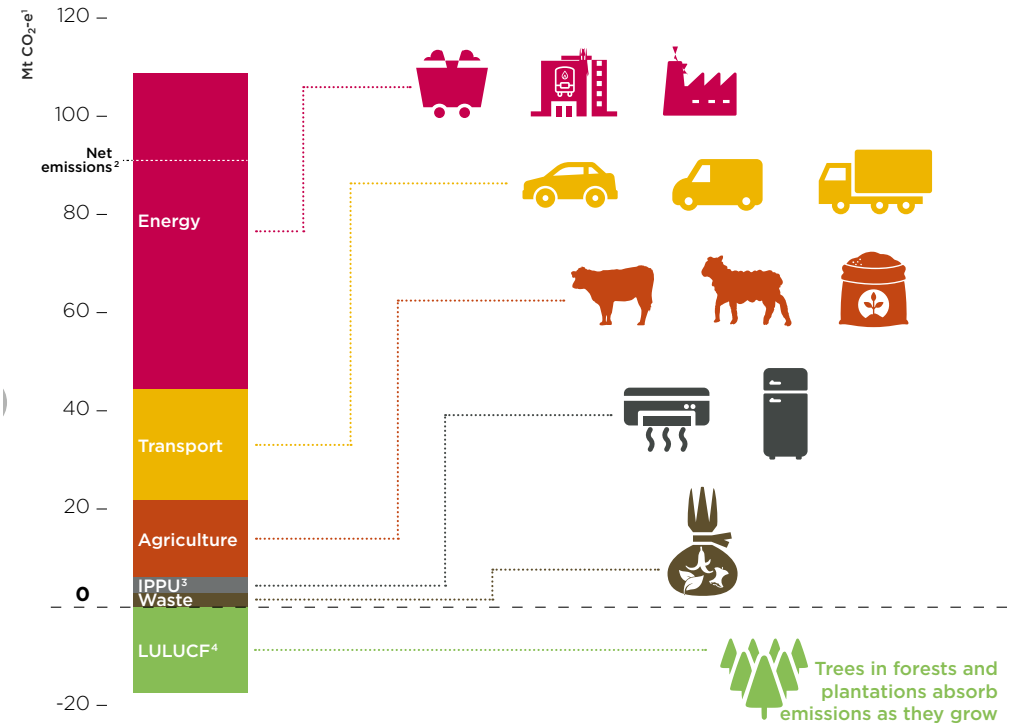
137 Sophie Vorrath, *Renew Economy: World's first "fully recyclable" wind turbine blades roll off production line*, 2021, <https://reneweconomy.com.au/worlds-first-fully-recyclable-wind-turbine-blades-roll-off-production-line> accessed 4 April 2022.

138 Chris Martin, 'Wind Turbine Blades Can't Be Recycled, So They're Piling Up in Landfills'.

6 Further opportunities to reduce emissions

In addition to energy generation, other sectors contribute to Victoria's total carbon emissions. In 2019 energy was responsible for 70% of Victoria's carbon emissions, while the transport sector made up 25% of emissions, agriculture 17%, industrial processes and product use represented 4%. The waste sector accounted for the remaining 4% of Victoria's emissions.[1] Reducing emissions in other sectors presents further opportunities to reduce emissions. Figure 6.1 below gives an overview of greenhouse gas emissions by sector in Victoria in 2019.

Figure 6.1 Victoria's greenhouse gas emissions by sector in Victoria in 2019



Victoria's greenhouse gas emissions by emissions sector in 2019
1 Million tonnes of carbon dioxide equivalent emissions
2 Victoria's net emissions are total emissions less the emissions absorbed in the LULUCF sector
3 Industrial processes and product use
4 Land use, land use change and forestry

Source: Department of Environment, Land, Water and Planning, *Victorian Climate Change Strategy*, 2021, p. 10.

1 Department of Environment, Land, Water and Planning, *Victoria's greenhouse gas emissions and targets: Where Victoria's emissions come from*, 2022, <https://www.climatechange.vic.gov.au/victorias-greenhouse-gas-emissions-and-targets#toc__id_0_where> accessed 25 October 2021.

This Chapter discusses the opportunities for reducing emissions, which include:

- decarbonising transport
- moving away from natural gas
- solving leakage in energy transmission
- improving energy efficiency in buildings
- reducing carbon emissions in the agricultural sector
- introducing renewable energy in areas other than electricity generation
- carbon capture and storage.

6.1 Decarbonising transport

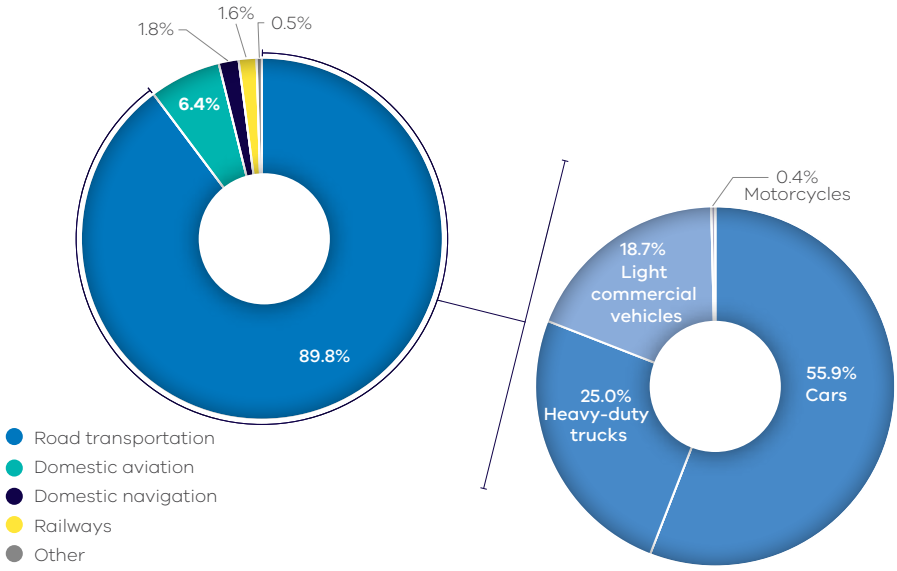
In 2019, transport accounted for 25% of carbon emissions, making it the second-largest source of emissions in Victoria. Up to 90% of these emissions came from road transport, with almost 56% of this total coming from light passenger vehicles.[2] Decarbonising transport presents itself as a significant opportunity to reduce total emissions. Aurecon in its submission said that 'The sector must navigate away from how it operates today, to a fuel and mobility model that achieves a net zero emissions pathway over the next thirty years, or sooner.'[3]

Figure 6.2 below from the Department of Environment, Land, Water and Planning's (DELWP) *Victoria's Zero Emissions Vehicle Roadmap* gives a breakdown of transport sector carbon emissions in Victoria.

2 Department of Environment, Land, Water and Planning, *Victoria's Zero Emissions Vehicle Roadmap*, Victorian Government, Melbourne, 2021, p. 11.

3 Aurecon, *Submission 79*, pp. 13–14.

Figure 6.2 Transport sector carbon emissions in Victoria



Source: Department of Environment, Land, Water and Planning, *Victoria's Zero Emissions Vehicle Roadmap*, p. 11.

To this end, DELWP said that shifting to zero emission vehicles (ZEV), including electric vehicles, and accelerating the use of lower-emissions transport modes (such as public and active transport), along with promoting more efficient use of the transport network, is among the key methods to reduce carbon emissions.[4]

In addition to emission reduction, decarbonising transport will also lead to health benefits. Doctors for the Environment pointed out that electrification of transport helped avoid the toxic particulate matters and gaseous oxides generated from internal combustion engines, which is among the causes for asthma, other respiratory disorders, and heart disease.[5]

The Committee's *Inquiry into the Health Impacts of Air Pollution in Victoria* tabled in November 2021 showed that vehicle emissions are one of the largest sources of air pollution in Victoria, which exacerbates asthma, other respiratory illnesses and cardiovascular diseases.[6]

This Section discusses key measures to decarbonise the transport sector, including transferring to ZEV and encouraging active and public transport. It looks at what has been done to date and what further needs to be done.

4 Department of Transport, *Transport sector emissions reduction pledge*, 2022, <https://transport.vic.gov.au/our-transport-future/climate-change/transport-sector-emissions-reduction-pledge> accessed 1 April 2022.

5 Doctors for the Environment Australia, *Submission 30*, p. 8.

6 Parliament of Victoria, Environment and Planning Committee, *Inquiry into the Health Impacts of Air Pollution in Victoria*, February 2022, p. 30.

6.1.1 Transferring to zero emission vehicles

The Committee received a number of submissions proposing a shift to ZEV in order to decarbonise transport. This Section discusses what ZEV are, how they help reduce carbon emissions and what will be necessary to increase ZEV uptake in Victoria.

Infrastructure Victoria defines ZEV as the types of vehicles that 'emit no emissions from the tailpipe, charging or fuel source.'[7] DELWP has identified battery electric vehicles and hydrogen fuel cell vehicles as examples of zero emissions vehicles.[8] They are different from the conventional internal combustion engine vehicles which are powered by a standard internal combustion engine using petrol, diesel or gas.[9]

Battery electric vehicles, commonly known as electric vehicles (EVs), are powered by a rechargeable in-built battery, which is charged by an external power source. They are distinct from plug-in hybrid vehicles, which have an electric motor powered by a lithium-ion battery and at the same time, have a 'range-extending' petrol based internal combustion engine. Battery electric vehicles are currently commercially available in Victoria, while hydrogen fuel cell vehicles are still emerging.[10]

As ZEV do not use petroleum fuels and have no carbon emissions, they help reduce carbon emissions significantly, especially when running on renewable energy. Infrastructure Victoria stated in its submission that:

> if all vehicles on Victorian roads were ZEVs, around 27 million tonnes of greenhouse gas emissions would be eliminated in Victoria in the year 2046, equivalent to around 25% of today's total emissions.[11]

Infrastructure Victoria also discussed the health benefits of transitioning to zero emissions vehicles:

> Air pollutants emitted by ICE vehicles have negative human health impacts including increases in morbidity and mortality related to respiratory disease, cardiovascular disease, cardiac disease, pneumonia, and bronchitis. Infrastructure Victoria has previously estimated that the transition to ZEVs could create health benefits, from avoided morbidity and mortality and morbidity, of over $700 million annually by 2046.[12]

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7 Infrastructure Victoria, *Submission 44*, p. 28.

8 Solar Victoria, *Zero Emissions Vehicle (ZEV) Subsidy*, 2022, <https://www.solar.vic.gov.au/zero-emissions-vehicle-subsidy> accessed 23 February 2022.

9 Australian Energy Market Operator and Energeia, *AEMO Insights: Electric Vehicles*, Australian Energy Market Operator, August 2016, p. 6.

10 Solar Victoria, *Zero Emissions Vehicle (ZEV) Subsidy: What are zero emissions vehicles?*, 2022, <https://www.solar.vic.gov.au/zero-emissions-vehicle-subsidy#what-are-zero-emissions-vehicles> accessed 23 February 2022.

11 Infrastructure Victoria, *Submission 44, Attachment 4*, p. 14 (with sources).

12 Ibid.

In its submission, Aurecon said of the shift to ZEV:

> This will require electrification: electric vehicles (both private and commercial), hydrogen fuelled vehicles, and electrification of the public transport network, which is likely to increase the pressure on the electrical distribution network. In addition, cars and freight will shift to alternative fuels as well, for example hydrogen and biofuels, in addition to electrification.[13]

DELWP has also set a target for ZEV uptake in *Victoria's Climate Change Strategy*:

> In addition to setting a strong target of 50 per cent new light vehicles sales to be ZEVs by 2030, the Government will add hundreds of ZEVs to its own vehicle fleet over the next two years, and all new public transport buses will be zero emissions from 2025.[14]

This target was supported by Professor Bruce Mountain, Director of the Victoria Energy Policy Centre, adding that it will not cause a burden on the grid:

> I think the grid expansion for charging infrastructure will not be an enormous undertaking, and I do not believe that the electrical demands on the grid will be so large as to be a problem. I think it will be possible to sequence the charging of the vehicles to ensure that the grid impacts are not huge. And in terms of energy consumption, I would point out the typical household consumes more energy heating water that they use in their showers than they would use to travel the typical distance that a car travels in this state. So the electrical consumption in fact is not huge.[15]

Another stakeholder even suggested the transfer needs to be quicker if Victoria is to keep up with its targets to lower carbon emissions:

> Passenger motor vehicles tend to stay on the road for an average of 15 to 20 years. So, working back from 2050, if we are to get to zero emissions just on cars, we need to stop selling new internal combustion engine vehicles (ICEs) and hybrids by 2030, or 2035 at the latest. So, while the Victorian Government's commitment to a target of 50 per cent new light vehicles sales to be zero emissions vehicles (ZEVs) by 2030 is highly commendable, it probably is insufficient and ideally would be made even stronger in the future.[16]

There are some solutions that stakeholders put forward to increase the uptake of ZEV in Victoria, including:

- incentives to encourage uptake of ZEV
- a more appropriate approach to road user charge
- developing the charging system.

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13 Aurecon, Submission 79, p. 13–14.

14 Department of Environment, Land, Water and Planning, Victoria's Climate Change Strategy (2021), p. 28.

15 Professor Bruce Mountain, Victoria Energy Policy Centre, public hearing, Melbourne 17 March 2022, p. 32.

16 Neil Andrews, *Submission 45*, p. 17.

Incentives to encourage take-up of zero emissions vehicles

The Committee recognises that the Victorian Government has been active in accelerating the transfer to ZEV. Notably, the Government has established a funding program of a $100 million package, including:

- $46 million for a subsidy program to help Victorians buy ZEV
- a $5 million ZEV Innovation Fund to support greater uptake of ZEV commercial vehicles
- $19 million to establish a coordinated fast-charging network at key tourist and community destinations and at high-use locations, and to support the rollout of charging infrastructure for commercial and government fleets.[17]

It has also launched the Zero Emissions Vehicle Subsidy which provides Victorians $3,000 to reduce the upfront costs when they buy a new zero emission vehicle.[18] This program provides an important incentive that encourages the uptake of ZEV in Victoria. The Government has acknowledged the lack of a retail market for ZEV, which limits the availability of affordable vehicles in Victoria.[19]

Stakeholders such as ANU's 100% Renewables Group and Doctors for the Environment have commended the Victorian Government's EV incentives. For example, Doctors for the Environment said in its submission that:

> DEA ... commends the Victorian government for the multiple measures to incentivise uptake of zero emissions vehicles (ZEVs), including cars, buses, light transport vehicles and government fleet, as well as the necessary infrastructure.[20]

The submission from ANU 100% Renewables Group, at the same time, pointed out that there is still a long way to go:

> In Australia in 2020, electric vehicle purchases were just 0.7% of total car sales ... The transition is happening much faster in European countries. Norway is fast approaching 100% electric plug-in hybrid, and hybrid. In December 2012, 72% of new cars in the Netherlands were electric, and 49% of those in Sweden. Although we welcome the Victorian Government EV incentives, there is still a long way to go to match Norway and the EU.[21]

Stakeholders acknowledged that state governments are limited in what they can do, and that more needs to be done at the Commonwealth level. However, they still noted considerable room for the Victorian Government to encourage ZEV uptake:

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17 Department of Environment, Land, Water and Planning, *Victoria's Climate Change Strategy,* Victorian Government, Melbourne, May 2021, p. 28.

18 Solar Victoria, *Zero Emissions Vehicle (ZEV) Subsidy*.

19 Department of Environment, Land, Water and Planning, *Victoria's Zero Emissions Vehicle Roadmap*, p. 34.

20 Doctors for the Environment Australia, *Submission 30*, p. 8.

21 ANU 100% Renewables group, *Submission 74*, p. 6.

> most of the policy levers that could be used to encourage the sale of ZEVs rests with the Commonwealth. These include exemptions from the luxury vehicle tax and import duties for ZEVs; tax incentives for fleet owners to switch to ZEVs; and introducing emissions standards for the sale of new vehicles. The States have only a limited toolkit, such as waiving stamp duty, subsidies to ZEV buyers, switching its own car fleet to ZEVs and rolling out charging infrastructure.[22]

ClimateWorks urged the Government to act within its available options:

> Increasing the uptake of zero emissions vehicles in passenger and freight transport, through actions such transitioning the government vehicle fleet, subsidies and other incentives for community uptake, and interventions to address supply side barriers like working with vehicle manufacturers to increase model availability and advocating for national vehicle emissions standards.[23]

Stakeholders pointed to the fact that ZEV's high upfront costs can be a barrier to new buyers[24] and emphasised the Government's subsidies. Infrastructure Victoria asserted that 'Subsidies are particularly effective before ZEV reach purchase price parity with internal combustion engine vehicles, which will potentially occur as early as 2023.'[25] Based upon this forecast, Infrastructure Victoria suggested that 'Over the next five years, the Victorian Government should regularly monitor and review these subsidies, so they are operating effectively.'[26] School Strike for Climate affirmed the need for subsidies which target low-income householders as they said 'While there is push for electric vehicles by consumers regardless, subsidies are necessary to include lower-income households in a renewable future.'[27] Another stakeholder highlighted the lack of incentives at the Commonwealth level:

> At a Federal level, I would like to see some sort of tax incentive for car fleets to go to ZEVs. This might be some sort of depreciation allowance or some other tax break. The incentive would reduce to zero over time (for example by 2030 or 2035) to encourage ZEV uptake sooner rather than later.
>
> I don't see that happening any time soon at the Federal level! But is there an opportunity for the Victorian Government to something similar (probably with additional direct subsidies through the ZEV Innovation Fund rather than tax breaks).[28]

Stakeholders recognised the Victorian Government's current subsidies help overcome ZEV's upfront cost barrier, which are 'early, time-limited, targeted, one-off financial incentives'.[29] However, Banyule Clean Energy Group said that they are limited and not

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22 Neil Andrews, *Submission 45*, p. 17 (with sources).

23 Climateworks Australia, *Submission 43*, p. 8.

24 Neil Andrews, *Submission 45*, p. 18.

25 Infrastructure Victoria, *Submission 44*, p. 15 (with sources).

26 Ibid., p. 15.

27 School Strike for Climate, *Submission 67*, p. 4.

28 Neil Andrews, *Submission 45*, pp. 18–19.

29 Infrastructure Victoria, *Submission 44*, p. 15 (with sources).

widely known. The group asked for further incentives which are to be more broadly publicised:

> The Government should increase and publicise the existence of incentives for the purchase of BEVs. There is a miniscule Zero emissions vehicle (ZEV) subsidy but it is not promoted by dealers.[30]

Other stakeholders also suggested diverse forms of subsidies to address ZEV upfront costs. In addition to cash incentives, the Tesla Owners Club of Australia proposed a rolling fund to provide interest-free loans for new and second-hand EV purchases which would be similar to HECS debts—the Commonwealth loans provided to students.[31] Regarding the registration fees (or stamp duty), which are currently set the same for ZEV and internal combustion engine cars, some stakeholders including the Tesla Owners Club of Australia, Australian Parents for Climate Action, and Doctors for the Environment proposed to waive or reduce ZEV registration fees.[32]

The above suggested incentives are supported by the Grattan Institute's report titled *Towards net zero: Practical policies to reduce transport emissions*. This report recommends removing import duties and stamp duty on zero-emissions vehicles, and waive luxury car tax on such vehicles for the rest of the decade.[33] While import duties and luxury car tax are a Commonwealth Government responsibility, the Victorian Government can waive the stamp duty in part or entirely to send the message that ZEV are strongly encouraged.

The Committee shares stakeholder concerns that the high costs of zero emissions vehicles may act as a barrier to their uptake.

RECOMMENDATION 15: That the Victorian Government continue the zero emissions vehicle subsidy program until zero emission vehicle prices reach purchase price parity with internal combustion engine vehicles, along with measures to stimulate the zero emissions vehicle second-hand market to improve accessibility to zero emissions vehicles.

RECOMMENDATION 16: That the Victorian Government publicise its zero emissions vehicle policies more broadly so that the public understand and know how to access the support available to them.

RECOMMENDATION 17: That the Victorian Government advocate to the Commonwealth Government to pursue national-level policies favourable to zero emissions vehicle uptake, such as ones regarding luxury vehicle tax and vehicle import duties.

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30 Banyule Clean Energy Group, *Submission 64*, p. 14 (with sources).

31 Tesla Owners Club of Australia, *Submission 47*, p. 2.

32 Ibid., Australian Parents for Climate Action, *Submission 42*, p. 6; Doctors for the Environment Australia, *Submission 30*, p. 8.

33 Tony Wood et al, *Towards net zero: Practical policies to reduce transport emissions*, Grattan Institute, Australia, 2021, p. 4.

Regarding the costs, some stakeholders would like the Victorian Government to stimulate the ZEV second hand-market to reduce the high costs of ZEV through the Government and commercial fleets.[34] The Committee will discuss this measure later in relation to converting the Government and commercial fleets to ZEV.

Stakeholders also raised with the Committee the issue of vehicle emissions standards, which they believed can act as another avenue to encourage ZEV uptake. According to Infrastructure Victoria, without vehicle emissions standards, consumers still choose high emissions cars. This keeps Australia behind many other countries in terms of road emissions reduction:

> Australia is among a small minority of countries without mandatory greenhouse gas emissions or fuel efficiency standards for cars. On average, new cars sold in Australia emitted 43% more carbon dioxide for each kilometre travelled, compared with those in Europe in 2015.[35]

Since vehicle emissions standards fall within the Commonwealth Government's responsibility, Infrastructure Victoria advised that the Victorian Government 'continue to advocate for the Australian Government to use national policy changes to encourage faster uptake of zero emissions vehicles.'[36] This was shared by Banyule Clean Energy Group, saying that Victorian Government 'advocate strongly with the federal government for vehicle emission standards.'[37]

The Committee understands that the Victorian Government are promoting vehicle emissions standards by working with other states and territories. The Government stated in *Victoria's Climate Change Strategy* that:

> Victoria will also work with other states and territories to look at options for developing a harmonised approach to vehicle emissions standards, given the lack of action at the national level.[38]

The Committee supports the Government's efforts to look for different options to promote vehicle emissions standards. However, the Committee believes vehicle emissions standards at a national level are essential. The Committee encourages the Victorian Government to work with other states and territories to persuade the Commonwealth Government to take necessary action on this.

There has been a suggestion that 'a vehicle emission standard could be implemented at a state/territory level that does not require the federal government.'[39] Mr Liron Lightwood proposed a kind of vehicle carbon credit system in which the Victoria Government sets a target emission based on vehicle categories. People registering new underpolluting vehicles would get credits commensurate with the level of polluting.

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34 Brotherhood of St Laurence, *Submission 82*, pp. 3–4; Neil Andrews, *Submission 45*, p. 18 (with sources).

35 Infrastructure Victoria, *Submission 44*, p. 15 (with sources).

36 Ibid.

37 Banyule Clean Energy Group, *Submission 64*, p. 14.

38 Department of Environment, Land, Water and Planning, *Victoria's Climate Change Strategy* p. 28.

39 Liron LIghtwood, *Submission 66*, p. 3.

Those credits could be sold to ones who wish to buy a new overpolluting vehicles. The credit price could be set either by an independent reserve bank style body or by a market-based approach.[40]

The Committee considers that the success of such a scheme would depend on whether there is a vehicle carbon tax in place. This, again, is an issue for which the Commonwealth Government has responsibility.

RECOMMENDATION 18: That the Victorian Government continue to pursue opportunities to work with the other states and territories and the Commonwealth Government to advocate for national vehicles emissions standards for all new vehicles.

RECOMMENDATION 19: That the Victorian Government should set its own ambitious vehicle emissions standards similar to that introduced in New South Wales.

Stakeholders also suggested administrative measures to accelerate the switch toward ZEV. Infrastructure Victoria has advised the Victorian Government to indicate its determination to move away from internal combustion engine cars by setting a timeline to cease registering internal combustion engine vehicles:

> The Victorian Government should reinforce this target by committing to no longer registering new petrol and diesel vehicles by 2035 at the latest. This sends a strong market signal and helps achieve the 50% sales target, and emissions reduction targets. By setting a date now, the Victorian Government can provide confidence to consumers, industry, and vehicle manufacturers to start transitioning.[41]

The Committee considers that this measure will enable the new car market to move to 100% ZEV by 2035, provided that it aligns with the equivalent increase in availability of ZEV and the relevant infrastructure.

RECOMMENDATION 20: That the Victorian Government adopt a cut-off date for sales of new internal combustion engine vehicles. This must go in hand with an education campaign about zero emissions vehicles and extensive development of the required infrastructure for zero emissions vehicles, supported by a wide range of zero emission vehicle models available to consumers.

The road user charge

One poorly understood issue relating to the increase of electric vehicles in Victoria is the introduction of a road user charge (or distance-based tax) for zero emission vehicles.

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40 Ibid.

41 Infrastructure Victoria, *Submission 44*, p. 15.

The Victorian Government introduced the *Zero and Low Emission Vehicle Distance-based Charge Act 2021* which legislated the road user charge in March 2021, effective from 1 July 2021.[42] Under the legislation, owners of ZEV pay a distance-based tax of 2.5 cents per kilometre and hybrid vehicles 2 cents per kilometre. This, according to the Victorian Government, is to ensure all motorists pay their fair share towards the development of charging infrastructure and help fund the ZEV Subsidy. This is an alternative to the fuel excise paid by owners of vehicles with internal combustion engines, which is intended to maintain roads and is charged up to 42% of the fuel cost for some fuels, meaning that ZEV owners pay less.[43]

At the time it was suggested, the levy sparked considerable debate. There was support from some stakeholders, such as RACV, who said that the levy 'lays the foundation for a fair and efficient user-pays system to replace existing federal and state road taxes' and pointed out that electric vehicle drivers pay less than conventional petrol-fuelled car drivers.[44] However, many others disagreed. Professor John Quiggin from the University of Queensland pointed out that in fact, ZEV drivers pay as much or even more than fuel-efficient cars. He estimated that, 'Conventionally-powered car typically pay about 4.2 cents per kilometre through fuel excise and fuel-efficient cars about 2.1 cents.'[45] Electric vehicle drivers also expressed the view that the levy actively discouraged the uptake of ZEV. An electirc vehicle driver agreed that drivers should pay their share of road maintenance costs, but 'how that is administered, and how it is collected and who is going to get it and why, is an issue.'[46]

Concern was also raised about the way the tax is calculated. ZEV owners must keep a record of the kilometres they travel through odometer readings and report it to the authority at the end of the registration period.[47] The tax applies to kilometres covered on public roads only and drivers are responsible for proving the part of the mileage covered on private roads if any.[48] Plug-in hybrid cars pay both fuel excise and distance-based charge simultaneously.[49]

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42 Hon Tim Pallas MP, Treasurer, *Ensuring Drivers Pay Their Fair Share To Use Our Roads*, media release, Victorian Government Melbourne, 17 March 2021.

43 Department of Environment, Land, Water and Planning, *Renewable energy: ZEV Facts*, 2022, <https://www.energy.vic.gov.au/renewable-energy/zero-emissions-vehicles/zev-facts> accessed 22 February 2022.

44 Sue Hewitt, 'Why Victoria's new EV tax is a win for road users', *RACV Royal Auto*, 1 December 2020, <https://www.racv.com.au/royalauto/news/racv-welcomes-electric-vehicle-tax.html> accessed 22 February 2022.

45 John Quiggin, 'Victoria's electric vehicle tax and the theory of the second-best', *The Conversation*, 9 December 2020, <https://theconversation.com/victorias-electric-vehicle-tax-and-the-theory-of-the-second-best-150936> accessed 22 February 2022.

46 ABC Central Goldfields, *Victorian government tax on electric vehicles a 'disincentive' to go green, users say*, 2021, <https://www.abc.net.au/news/2021-03-18/electric-vehicle-tax-a-disincentive-to-go-green/13258232> accessed 23 February 2022.

47 *Zero and Low Emission Vehicle Distance-based Charge Act 2021* (Victoria) s 11.

48 James Fernyhough, '"Pay up or lose your rego": Victoria's EV road tax passed into law', *The Driven*, 26 May 2021, <https://thedriven.io/2021/05/26/pay-up-or-lose-your-rego-victorias-ev-road-tax-passed-into-law> accessed 23 February 2022.

49 Ben Zachariah, 'Victoria passes road-user tax for electric vehicles, industry reacts', *Drive*, 26 May 2021, <https://www.drive.com.au/news/victoria-passes-road-user-tax-for-electric-vehicle-owners-industry-reacts> accessed 23 February 2022.

The Tesla Owners Club of Australia argued that this levy is a disincentive to electric vehicles and that Victoria is the only state applying it:

> the Victorian EV Road Tax is very inefficient to collect and makes Victoria a laughing stock while NSW, SA & Tas are suspending such taxes until 2027 at least.[50]

Doctors for the Environment pointed out that the road usage levy imposed on ZEV's was unreasonable and unequal compared to internal combustion engine cars:

> it is difficult to comprehend the announcement of a road usage levy on the basis that ICE vehicles already pay through fuel excise. As this excise enters a general pool of federal funds and is not specifically allocated to roads, one could argue that it is paying for health costs from ICE exhaust pollution. Therefore, if there is to be a road usage charge, it should apply to all vehicles, whether ICE or ZEVs, equally.[51]

Stakeholders thus proposed to abolish (or defer) this levy.[52] There was also the suggestion to replace it with congestion charge, which is payable by vehicle users when driving into designated congested areas in particular time of the day.[53] Australian Parents for Climate Action suggested this approach, proposing to replace 'the introduction of per-km EV road user charges with a congestion charge for all private motor vehicles'.[54]

Infrastructure Victoria also believed that the road user charge should be replaced by a more effective user pays system:

> Phase out fixed road user charges and introduce user pays charging. Replace fixed road user charges with variable distance-based and congestion charges over the next 10 years, by gradually expanding and reforming the existing electric vehicle charge. Ensure user pays charging reflects the relative costs of road use, encouraging people to adopt beneficial travel behaviour.[55]

Charging infrastructure

Just like internal combustion engine vehicles, ZEV need recharging to keep them on the road. As pointed out by Infrastructure Victoria, decarbonising transport at the moment largely depends on electric vehicles, which are 'the most mature and proven technology for rapidly reducing transport emissions'.[56] This highlights the importance of charging infrastructure. The Australian Energy Market Operator (AEMO) highlighted the importance of charging infrastructure in ZEV uptake growth, saying that 'Growth

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50 Tesla Owners Club of Australia, *Submission 47*, pp. 1–2.

51 Doctors for the Environment Australia, *Submission 30*, p. 8.

52 Clare Morrissey, *Submission 32*, p. 1; Yarra Climate Action Now, *Submission 33*, p. 1; Banyule Clean Energy Group, *Submission 64*, p. 14.

53 Rachel Clayton, 'Congestion charge the cheapest, most effective way to reduce traffic jams in Australia, report finds', *ABC News*, 14 October 2019, <https://www.abc.net.au/news/2019-10-13/should-australia-have-a-congestion-charge/11597022> accessed 17 February 2022.

54 Australian Parents for Climate Action, *Submission 42*, p. 6.

55 Infrastructure Victoria, *Submission 44*, p. 22.

56 Ibid., p. 15 (with sources).

in uptake of electric vehicles may remain constrained until a fuller product/style range is available and public charging infrastructure is developed.'[57] Infrastructure Victoria compared how an electric vehicle can be refuelled with that for a conventional car to emphasise that charging infrastructure is critical:

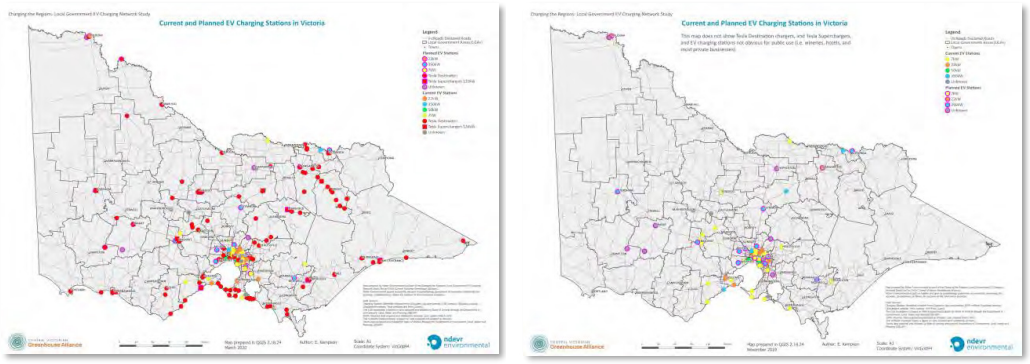
> Drivers currently drive to a petrol station to refuel their car, with a refill taking a matter of minutes. Battery electric vehicles generally take much longer to charge than filling a tank with petrol. However, drivers may have many opportunities to 'top up' their car, whether at work, at home, at the local shopping centre or along the road, which could potentially deliver time savings. But for all of these opportunities to actually materialise, a lot of new charging infrastructure will be needed.[58]

Developing charging infrastructure is also required to diversify charging options for electric vehicle drivers, thus helps reduce the pressure that electric vehicle charging puts on the grid if commuters mostly rely on home charging. DWELP told the Committee that:

> the most pressing challenge for the energy grid is when commuters return home at the end of the day and charge up their BEVs. The charging unit for a BEV can draw up to 6–10 kW, making it the highest energy consuming device in most homes.[59]

Public charging systems are currently underdeveloped in Victoria. As shown in Figure 6.3, most of the electric vehicle charging stations were installed by Tesla, which are for Tesla vehicles only, leaving non-Tesla drivers short of charging accessibility.[60]

Figure 6.3 Maps of charging station including Tesla (left) and excluding Tesla (right)



Source: Ndevr Environmental, *Charging the Regions: Local Government EV Charging Network Study*, Component 5 – Outcomes Report for Central Victorian Greenhouse Alliance, 2020, p. 2.

Stakeholders to this Inquiry emphasised the importance of planning in securing the appropriate development of charging infrastructure. They also suggested actions that the Government can undertake to accelerate the coverage of charging points in Victoria.

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57 Australian Energy Market Operator and Energeia, *AEMO Insights*, p. 3.

58 Infrastructure Victoria, *Submission 44, Attachment 3*, p. 117.

59 Department of Environment, Land, Water and Planning, *Victoria's Zero Emissions Vehicle Roadmap*, p. 36.

60 Ndevr Environmental, *Charging the Regions: Local Government EV Charging Network Study Component 5 – Outcomes Report*, report for Central Victorian Green house Alliance, Ndevr Environmental Pty Ltd Australia, 2020, p. 2.

The Tesla Owners Club of Australia suggested planning law should legislate solar power generation and charging infrastructure in residential building and workplaces.[61] Another stakeholder to the Inquiry proposed further development of on-street charging stations and the need for cooperation between the State, the Commonwealth Government and private sector in the charging infrastructure roll-out:

> consideration needs to given to fund on-street charging points in city locations where there are apartment buildings with little of no off-street parking … the lack of off-street parking and therefore the lack of off-street charging facilities is likely to be a factor which can limit the uptake of electric vehicles.
>
> The rollout of charging infrastructure will need to be co-ordinated between the State Government, the Federal government (which has charging infrastructure funding associated with its Future Fuels Strategy) and private rollout through organisations such as the RACV.[62]

ANU 100% Renewables Group suggested that the Government require new buildings with parking be ready for electric vehicles:

> Requiring all new residential and commercial buildings with parking to design for electric vehicles, for example by installing conduits for electric vehicle charging and upgrading switchboards/grid connections if necessary.[63]

The Committee also heard evidence that suggested the increasing electrification of the transport sector is not without its challenges. CitiPower, Powercor and United Energy told the Committee in their joint submission that electric vehicles will place extra demand on the grid and these network operators are co-working on trials to understand consumers' charging behaviours:

> Electric vehicles (EV) have the potential to become a major energy user during peak times. Importantly, as with Demand Enabled Response (DRED) appliances, EVs need to be integrated into the grid to ensure demand can be managed within the capabilities of the network around peak times. We are currently participating in four trials into EV's technology to further develop industry understanding of residential and business customer behaviour, use of tariff incentives and charging behaviour in collaboration with industry partners.[64]
>
> EVs will also be an enabler of demand management. Without integrated planning, increases in EVs market share will result in a major increase in demand, and without associated increases in network capacity, reliability of the grid will be compromised.[65]

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61 Tesla Owners Club of Australia, *Submission 47*, p. 2.

62 Neil Andrews, *Submission 45*, p. 19.

63 ANU 100% Renewables group, *Submission 74*, p. 6.

64 Citipower, Powercor and United Energy, *Submission 54*, p. 6.

65 Ibid., p. 7.

Despite the challenges, Aurecon suggested that early infrastructure planning for electric vehicle charging stations can encourage investment:

> Early infrastructure network planning for electric vehicle charging stations (for private and freight vehicles), together with a network of hydrogen refuelling infrastructure, will encourage investment in these technologies and vehicles in the state.[66]

The importance of widespread planning for electric vehicle charging was also stressed by other submitters. Ms Freja Leonard said in her submissions that civil planning must satisfy the charging requirement, and that 'All carparks must be mandated to be sheltered by solar panels feeding electric vehicle recharge stations.'[67]

Moreland City Council also recognised the role of planning provisions in encouraging electric vehicle charging development. It said that:

> EV charging should be encouraged through planning provisions for new developments, which could draw from the Council Alliance for a Sustainable Built Environment (CASBE) Elevating ESD Targets Planning Policy Amendment Project.[68]

The Victorian Government has acknowledged that in addition to consumers' concern about available range of electric vehicle models, the battery life, the recharging time, and the accessibility to charging infrastructure are among key barriers to accelerating electric vehicle uptake.[69] Thus, it has put charging infrastructure development as a focal point in Victoria's ZEV Roadmap. The Government has committed to invest '$19 million to accelerate the rollout of electric vehicle charging infrastructure across regional Victoria'.[70] The Government also indicated its support for changes to the National Building Codes to facilitate the installation of charging infrastructure in new buildings to avoid future retrofitting costs and to look for options to enable electric vehicle charging in existing buildings.[71] In practice, in December 2021, as part of its Acceleration Zero Vehicle Adoption Program, the Victoria Government rolled out the Electric vehicle Charging for Business Fleets (EVCBF) which provides $1.5 million in grants to increase electric vehicle charging infrastructure in Victoria.[72]

Notably, local government authorities in Victoria are taking an active role on developing charging infrastructure. The Eastern Alliance of Greenhouse Action, one of the eight formal partnerships of local governments to drive climate change action in Victoria, said that 'Councils have been working together to understand their role in providing or facilitating public EV charging infrastructure.'[73] It also revealed that 'Many councils

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66 Aurecon, *Submission 79*, p. 14.

67 Freja Leonard, *Submission 75*, p. 3.

68 Moreland City Council, *Submission 57*, p. 4.

69 Department of Environment, Land, Water and Planning, *Victoria's Zero Emissions Vehicle Roadmap*, p. 33.

70 Ibid., p. 7.

71 Ibid., p. 45.

72 Department of Environment, Land, Water and Planning, *EV Charging for Business Fleets*, <https://www.energy.vic.gov.au/grants/ev-charging-business-fleets> accessed 11 March 2022.

73 Eastern Alliance for Greenhouse Action, *Charging the regions*, <https://eaga.com.au/projects/charging-the-regions> accessed 4 April 2022.

have already begun to install and encourage EV charging points in their communities.'[74] In practice, local councils such as Moreland City and Knox City have invested in public charging stations and offered free of charge to electric vehicle drivers. Moreland City built 10 stations and Knox City built two, one for public use and the other for council use.[75] In 2020, Central Victorian Greenhouse Alliance on behalf of 55 councils and the Electric Vehicle Council of Australia commissioned a study on how local governments can work on this issue, with funding from council contributions and DELWP.[76] This study, undertaken by Ndevr Environmental, provides some insights on policies toward electric vehicle charging infrastructure. About the question of whether public charging stations should be free, the study pointed out that:

> Many case studies had initially provided free charging in the form of a free trial roll-out but found that it sometimes led to strange charging behaviour and that it was difficult to start charging for something that was previously free.[77]

With respect to investment in charging stations, the Ndevr Environmental report looked into a City of Adelaide case study and suggested that an incentive-based model in which government provides incentives for private investment in public charging would bring more value than a council ownership model.[78]

The Committee acknowledges the efforts the Government is making in rolling out charging stations across Victoria to enable further ZEV uptake. The Committee also acknowledges other stakeholders' commitments and the significant roles they are playing in the roll-out of electric vehicle charging infrastructure, including network operators, electric vehicle makers and local governments. The Committee considers that involving all stakeholders in the development of electric vehicle charging system in Victoria will be of significant benefit and will help ensure the success of this program.

RECOMMENDATION 21: That the Victorian Government continue to collaborate with local government authorities, electricity network operators and electric vehicle makers to coordinate and accelerate the roll-out of electric vehicle charging network development along the road, other public facilities and in new and existing residential and commercial buildings, with an emphasis on a regional area rollout.

Converting the Government and commercial vehicle fleet to ZEV

Converting the Government and commercial fleets to ZEV is an important part of the strategy to decarbonise Victorian transport. The uptake of ZEV in the commercial car fleets not only speeds up the conversion but also enables a second-hand ZEV market to develop, which will help more consumers access affordable ZEV.

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74 Ibid.

75 Ndevr Environmental, *Charging the Regions: Local Government EV Charging Network Study* pp. 33–36.

76 Ibid.

77 Ibid., p. 3.

78 Ibid., pp. 31–32.

In its submission, Brotherhood of St Laurence suggested that the Government's ZEV fleet can accelerate the second-hand car market:

> electric cars are currently unaffordable for many households. We recommend that the Victorian Government adopt policies to increase the affordability of electric cars, such as government fleet purchasing of electric vehicles to stimulate the second-hand market.[79]

Another stakeholder submitted this view and highlighted the role of commercial car fleets in familiarising people with ZEV:

> The eventual knock-on effect of reducing ZEV prices in the second-hand market will hopefully stimulate ZEV uptake into the future. It would be great if car hire businesses, such as Avis or Budget, offered a range of ZEVs (probably electric vehicles rather than hydrogen fuel cell vehicles) so that a wider range of Australians could get at least some experience driving an electric vehicle.[80]

The Victorian Government has acknowledged the importance of converting its own fleet to ZEV. In *Victoria's Climate Change Strategy*, the Government indicated that it will invest $10 million in its own vehicle fleet, adding 400 ZEV over the next two years.[81] The Government has also committed to invest $20 million for a ZEV bus trial to prepare for all public transport buses to be ZEV from 2025. For commercial fleets, the Government has established a package of $5 million to set up the Commercial Sector Zero Emissions Vehicle Innovation Fund to facilitate commercial fleets to move to ZEV.[82]

However, stakeholders suggested that they want the Government to move faster converting its own fleet to ZEV. A submitter, who stated that 'the whole fleet will need to be transitioned as quickly as possible', suggested the step the Government should take to convert its fleet to ZEV:

> I am assuming that most, if not all, of the Victorian Government's car fleet is leased. I would advocate transitioning the existing car fleet to ZEVs as current leases expire, providing a suitable ZEV model is available in Australia.[83]

The Committee recognises the importance of accelerating the uptake of ZEV in the government and commercial vehicle fleets. The Committee supports the Government's investment in converting its fleets to ZEV and providing incentives to convert commercial fleets to ZEV. The Committee acknowledges that the Government's timeline to convert its fleet to ZEV needs to be in line with the expiry time of its current leases to prevent any disruption to the running of its fleet and to avoid stranded assets and wastage of public funds.

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79 Brotherhood of St Laurence, *Submission 82*, pp. 3–4.

80 Neil Andrews, *Submission 45*, p. 18 (with sources).

81 Department of Environment, Land, Water and Planning, *Victoria's Climate Change Strategy* p. 28.

82 Department of Environment, Land, Water and Planning, *Victoria's Zero Emissions Vehicle Roadmap*, p. 66.

83 Neil Andrews, *Submission 45*, p. 18 (with sources).

Issues with decarbonising heavy vehicles

The above measures are in relation to light and passenger vehicles, and further solutions are required to decarbonise heavy vehicles. In his submission, Mr Bart Wissink, an engineer, told the Committee about challenges with heavy vehicles and that the solutions are still in experiments:

> Heavy vehicles would require batteries or fuel cells of sufficient capacity to allow for a reasonable range between refueling, and a quick refueling process. Siemens have trialled an electric vehicle, with limited battery capacity, due to weight limitations, with pantographs providing power from overhead wires. The batteries supply a limited power for emergency.[84]

He suggested:

> Perhaps we should move all heavy duty long distance transport to rail, with heavy vehicles only operating over the final delivery mile and therefore may be battery or Hydrogen powered.[85]

He also suggested running trains on hydrogen, which may be more economical than the infrastructure for electric trains. As power requirements for moving heavy freight trains can be considerably larger than that required to power passenger services, smaller trains are recommended, with suitable arrangements of rail networks and intermodal depots:

> Siemens have been trialling a hydrogen powered train, perhaps this would be more economical than the infrastructure for electric trains. Perhaps we would be utilising smaller trains, with lower power requirements, but providing more frequent services. This would require a very large investment in regional and interstate rail networks, providing multiple tracks for all services allowing passing and slower all stop services with a mix of higher speed express services. We would need a large investment in the quantity of railway rolling stock, both prime mover or power units and freight and passenger carriages. We would also require intermodal depots, where rail may unload and road deliver the final km. The system would need to be designed to allow quick, efficient transfer at intermodal hubs.[86]

At this stage, the decarbonisation of heavy transport is significantly behind developments in light passenger vehicles. The power needs of heavy transport tend to make battery storage impractical and so alternatives will be needed, and these alternatives are not yet commercially viable.

It is hoped that technological advances, particularly the development of hydrogen as a viable fuel source, will enable heavy vehicles to transition to low emission operation in the next few years.

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84 Bart Wissink, *Submission 28*, p. 6.

85 Ibid.

86 Ibid., pp. 6–7.

FINDING 15: Transferring heavy freight vehicles to zero emissions vehicles is more challenging compared to light and passenger vehicles given its higher rate of energy consumption and longer travel time, which can exceed the current limited capacity of batteries.

6.1.2 Encouraging active and public transport

Active transport such as walking and cycling and increasing the use of public transport have also been suggested as ways of decarbonising the transport sector. Australian Parents for Climate Action believed that 'Policies should promote reduced private vehicle ownership and prioritise active (walking, cycling, eBikes) and public transport.'[87] They identified the benefits brought about by these means of transportation:

> Increasing active and public transport modal share rather than simply electrifying private cars has many benefits beyond improving air and climate pollution … A new electric VW Golf purchased in the EU would have 10.5 tonnes of embodied emissions … By reducing car ownership and moving straight to riding electric bikes for transport, we can avoid these emissions[88]

ANU 100% Renewables Group also said in its submission that 'Active transport can lower emissions in the very short term, without the need for residents to purchase expensive new vehicles'.[89] The Group suggested the Government 'act to encourage and incentivise the use of active and (electric) public transport rather than private vehicles'.[90]

In *Victoria's Zero Emissions Vehicle Roadmap*, the Government says that it is working on a future transport system which has 'a metropolitan public transport network that is easy to use and that provides simple, connected journeys, with expanded rail capacity, better, more integrated bus services and more seamless payment systems' to encourage people to use public transport. This transport system also includes 'better integrated land use and transport planning that will enable and encourage more people to choose active transport'.[91]

However, stakeholders pointed out that facilities for active transport, especially cycling, have long suffered from under-investment. Australian Parents for Climate Action cited University of Queensland research in 2015/2016 financial year saying that Victoria's state funding for cycling only accounted for 0.9% of roads funding, far below the UN recommended rate of 20%.[92] Research by Monash University in 2021 highlighted the lack of safe lanes for bikes in Victoria and found that '99% of existing on-ride bike

87 Australian Parents for Climate Action, *Submission 42*, p. 4 (with sources).

88 Ibid., p. 5.

89 ANU 100% Renewables group, *Submission 74*, p. 5.

90 Ibid., p. 6.

91 Department of Environment, Land, Water and Planning, *Victoria's Zero Emissions Vehicle Roadmap*, p. 16.

92 Dorina Pojani et al, 'Cycling and walking are short-changed when it comes to transport funding in Australia', *The Conversation*, 20 March 2018, <https://theconversation.com/cycling-and-walking-are-short-changed-when-it-comes-to-transport-funding-in-australia-92574> accessed 23 February 2022.

infrastructure in Melbourne is made up of painted bike lanes, which result in closer motor vehicle passes and do not protect cyclists from potential injury.'[93] The lack of safe bike lanes has discouraged people from riding to work, school or other destinations. Currently, only 1.7% of trips in Melbourne are made by bike. The research showed that 3 in 4 people indicated their interest in riding a bike, but only when they could ride separated from cars such as off-road paths or on protected bike lanes.[94]

The high rate of people showing an interest in using bikes suggests a considerable opportunity to reduce carbon emissions by reducing the number of cars on road. On this, Australian Parents for Climate Change suggested that the Government should invest further in the infrastructure for cycling, so to ensure that 'there are safe, connected, and separated spaces for them to ride.'[95] They also wanted to see more incentives for active transport from the Government, such as 'subsidies for electric bicycles'.[96] In addition, they thought that the Government could encourage people to use public transport by providing 'More frequent, convenient and accessible electrified public transport with lower fares', believing that this could be paid off by 'the benefits in avoided air, climate, and noise pollution when private vehicles are not used.'[97]

RECOMMENDATION 22: That the Victorian Government continue to build active transport infrastructure such as separated cycle paths so that people can safely choose active transport for their journeys and that active transport opportunities form part of any new infrastructure projects that are developed.

6.2 Moving away from natural gas in heating, cooking and industrial processes

6.2.1 The chance to reduce carbon emissions by shifting from natural gas

Though natural gas is regarded as a cleaner fossil fuel than coal and oil, it still emits a significant amount of carbon dioxide. The US Energy Information Administration calculates that one million thermal units of natural gas produce 117 pounds of carbon dioxide, while those of coal and distillate fuel oil produce 200 pounds and 160 pounds respectively.[98] ANU 100% Renewable Group also told the Committee how natural gas worsens carbon emissions:

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93 Lauren Pearson and Ben Beck, '3 in 4 people want to ride a bike but are put off by lack of safe lanes', *The Conversation*, 12 January 2022, <https://theconversation.com/3-in-4-people-want-to-ride-a-bike-but-are-put-off-by-lack-of-safe-lanes-172868> accessed 23 February 2022.

94 Ibid.

95 Australian Parents for Climate Action, *Submission 42*, p. 5.

96 Ibid., p. 6.

97 Ibid.

98 US Energy Information Administration, *Natural gas explained: Natural gas and the environment*, 24 September 2020, <https://www.eia.gov/energyexplained/natural-gas/natural-gas-and-the-environment.php> accessed 26 October 2021.

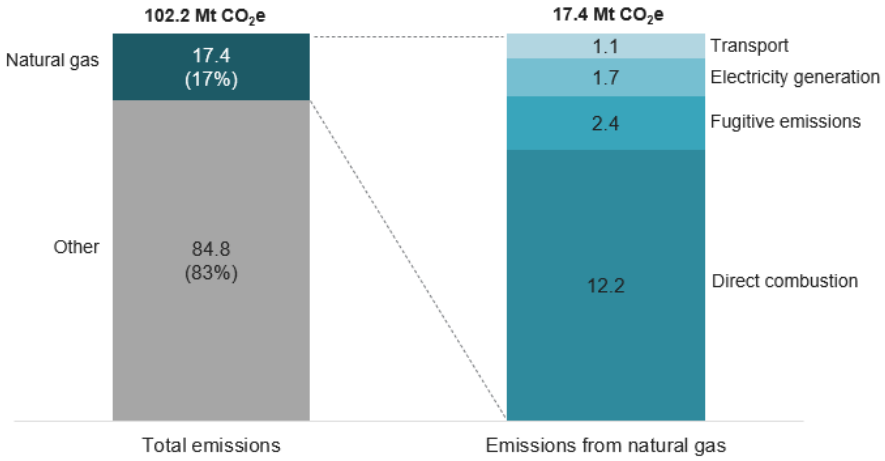
> Methane is the main component of natural gas. According to the most recently published report from the Intergovernmental Panel on Climate Change, methane has 30 times the global warming potential of carbon dioxide over a century, i.e. one unit of methane has the same climate impact as 30 units of carbon dioxide. If the time frame is shortened to just 20 years, it has 83 times the impact of carbondioxide. This is because methane is converted to carbon dioxide via oxidation, generally within 12 years.[99]

Victoria is currently the largest gas-consuming state in Australia.[100] According to the Australian Petroleum Production and Exploration Association (APPEA), 'today there are more than 2 million residential gas customers in Victoria, nearly 65,000 commercial gas customers and more than 600 large industrial users of natural gas in Victoria'.[101]

Victoria's enormous gas consumption means a high volume of carbon emissions coming from it. Infrastructure Victoria reported that of Victoria's total emissions of 102.2 Mt CO2e in 2017–18, natural gas is responsible for 17%, as seen in Figure 6.4 below. Infrastructure Victoria's report, *Toward 2050: Gas infrastructure in a zero emissions economy (interim report)*, noted that direct combustion from natural gas was the largest source of those emissions. This includes gas burning for heating, hot water, cooking and for industrial processes:

> The largest source of natural gas emissions was direct combustion (12.2 Mt CO_2e, around 70%), which included burning gas for heat, steam and pressure for industrial operations and for space heating, hot water and cooking in households and businesses.[102]

Figure 6.4 Greenhouse gas emissions in Victoria, Mt CO_2e (2017–18)



Source: Infrastructure Victoria, *Toward 2050: Gas infrastructure in a zero emissions economy* (interim report), p. 13 (with sources).

99 ANU 100% Renewables group, *Submission 74*, p. 7 (with sources).

100 Tom Cowie, 'How Victoria got hooked on gas, and why the heat's on to find new fuel', *The Age*, 9 May 2021 <https://www.theage.com.au/national/victoria/how-victoria-got-hooked-on-gas-and-why-the-heat-s-on-to-find-new-fuel-20210507-p57pql.html> accessed 25 October 2021.

101 Andrew McConville, Chief Executive Officer, Australian Petroleum Production and Exploration Association, public hearing, Melbourne 16 March 2022, *Transcript of evidence*, p. 23.

102 Infrastructure Victoria, *Towards 2050: Gas infrastructure in a zero emissions economy: Interim report*, Melbourne, 2021, pp. 12–13.

Infrastructure Victoria stated that Victoria needs to move away from gas within 30 years to achieve its emissions reduction targets:

> Burning natural gas emits greenhouse gases, meaning Victoria will need to transition from natural gas to other energy sources during the next 30 years to achieve its net zero emissions goal.[103]

The Committee was also told that this needs to be a complete transition as blending gas with other liquid fuel is not an option. Lighter Footprints said:

> A pathway to maximum 20% hydrogen (80% methane) is not preferred for one key reason – it is not substantively taking us towards 50% reductions by 2030.
>
> Worse, it could delay many homes moving off gas by 10 to 15 years as new gas appliances typically last 10 to 15 years.[104]

The phasing out of gas may be supported by available technologies that make this process possible. Lighter Footprints pointed out that Victoria is 'uniquely positioned in Australia because of this state's declining gas reserves and the technology opportunities available to drive reduction of gas use.'[105]

This view was contradicted by APPEA who told the Committee that it is 'unrealistic' to phase out natural gas in preference to electrification, as 'massive investments would be required to build new electricity infrastructure and meet seasonal demand.'[106] It also said that continuing to use natural gas for residential heating in Victoria will deliver lower emissions because:

> continuing to use natural gas for residential heating in Victoria will deliver lower emissions by enabling renewables compared to the alternative of phasing out natural gas in preference to electrification. That will have to be underpinned for the foreseeable future by brown coal electricity generation. To put this into some form of perspective, Victoria generated 21 per cent of its 2018–19 electricity from renewable generation, or an equivalent of just 4 per cent of its energy consumption, including transport and gas energy. Power generation still includes brown coal, resulting in the highest electricity emission intensity in Australia. And while Victoria has legislated a 50 per cent renewable energy target by 2030, the definition in the Act indicates that it only applies to electricity generation. If gas and transport energy consumption remain at current levels, the 50 per cent renewable energy target in Victoria will cover just 10 per cent of Victoria's total energy use.[107]

Dr Dylan McConnell, Research Fellow at the University of Melbourne's Energy Transition Hub told the Committee in a public hearing that seasonal demand is not an issue as the current electricity system can readily accommodate it:

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103 Infrastructure Victoria, *Submission 44*, p. 14.

104 Lighter Footprints, *Submission 76*, pp. 11–12.

105 Ibid., p. 10.

106 Andrew McConville, *Transcript of evidence*, p. 24.

107 Ibid., pp. 23–24.

> the industry pointed out there is a big seasonal mismatch or a big demand for gas in winter, and that actually works quite well with our electricity system in that we have actually a summer peaking electricity system versus a winter peaking gas system. So you actually end up utilising the electricity infrastructure—the transmission and the poles and wires and the distribution network—much more efficiently if you end up moving that load across to the electricity system.[108]

The Victorian Government has indicated its intention to substitute gas to lower the state's carbon emissions.[109] While committing to gas security in the meantime, it is actively looking for alternatives. It said in the *Victorian Climate Change Strategy* that:

> The Victorian Government is committed to ensuring that gas reliability and security are maintained for all Victorians, and is also exploring sustainable alternatives and pathways for the sector to assist Victoria's transition to net-zero emissions.[110]

To carry out this strategy, the Victorian Government is developing Victoria's Gas Substitution Road Map. At the time of writing, a draft road map had been made available for public consultation.[111] The Victorian Government has also asked Infrastructure Victoria to provide advice relating to Victoria's gas transmission and distribution networks under a range of 2050 energy sector scenarios.[112]

FINDING 16: Gas usage for cooking, heating and industrial processes constitutes a sizeable source of carbon emissions in Victoria.

The phasing out of gas will not be a simple process. As pointed out by APPEA, natural gas is present in many aspects of economic and social life, not only in households but in electricity generation, manufacturing and commercial services:

> On a national level today, natural gas is used in electricity generation, around 35 per cent; mining, around 24 per cent; manufacturing, around 24 per cent; residential use, about 11 per cent; and also in commercial services, transport and construction sectors.
>
> Natural gas is an essential raw material for the manufacturing of everyday products that we take for granted, like glass; ceramics; bricks; cement; plastic packaging for food and beverages; fertiliser; antifreeze; metals, like aluminium, copper, zinc and tin; and in processes for food preparation, fermentation and brewing. Crucially natural gas accounts for 42 per cent of all energy currently consumed in the manufacturing sector, and in most cases there is no readily available substitute for gas. In Victoria industrial

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108 Dr Dylan McConnell, Research Fellow, University of Melbourne, Energy Transition Hub, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, pp. 19–20.

109 Infrastructure Victoria, *Towards 2050: Gas infrastructure in a zero emissions economy*, p. 12.

110 Department of Environment, Land, Water and Planning, *Victoria's Climate Change Strategy* p. 27.

111 Engage Victoria, *Help Us Build Victoria's Gas Substitution Roadmap*, <https://engage.vic.gov.au/help-us-build-victorias-gas-substitution-roadmap> accessed 23 February 2022.

112 Infrastructure Victoria, *Infrastructure Victoria advice on gas infrastructure*, 2021, <https://www.infrastructurevictoria.com.au/project/infrastructure-victoria-advice-on-gas-infrastructure> accessed 23 February 2022.

> processing accounts for around 30 per of all gas consumption, while gas as an industrial feedstock for light industry accounts for about 1 per cent of total gas consumption in Australia.[113]

Switching off gas will create a surge in electricity demand, which increases pressure on the grid. According to AEMO, the demand for electricity will double by 2050 with the phasing out of gas and petrol:

> Today the NEM delivers just under 180 TWh of electricity to industry and homes per year. The NEM would need to nearly double that by 2050 to replace much of the gas and petrol currently consumed in transport, industry, office and domestic use.[114]

The Committee acknowledges that moving away from gas helps significantly lower the carbon emissions level. However, it will be a long and complex process.

6.2.2 Suggested methods for transitioning from gas

Methods suggested to the Committee for transitioning from gas focus on the alternatives to gas and measures to accelerate the transition.

The alternatives to gas

There are currently three options for gas substitution, which are electricity, hydrogen and biogas, of which electrification is the most dominant. Dr Saul Griffith, Founder of Rewiring Australia, told the Committee in a public hearing that electrification is the best option:

> Basically we can nevermore allow new fossil fuel appliances or vehicles to enter into our economy, starting this year or as soon as possible. Every time somebody's car retires, it needs to be replaced with an electric vehicle. Every time somebody's water heater retires, it needs to be replaced with an electric heat pump. That is the schedule required to hit our climate targets. That is the schedule that will enable these community savings.[115]

Dr Griffith provided the Committee with a breakdown of actual and potential energy consumption at a household level (Figure 6.5).

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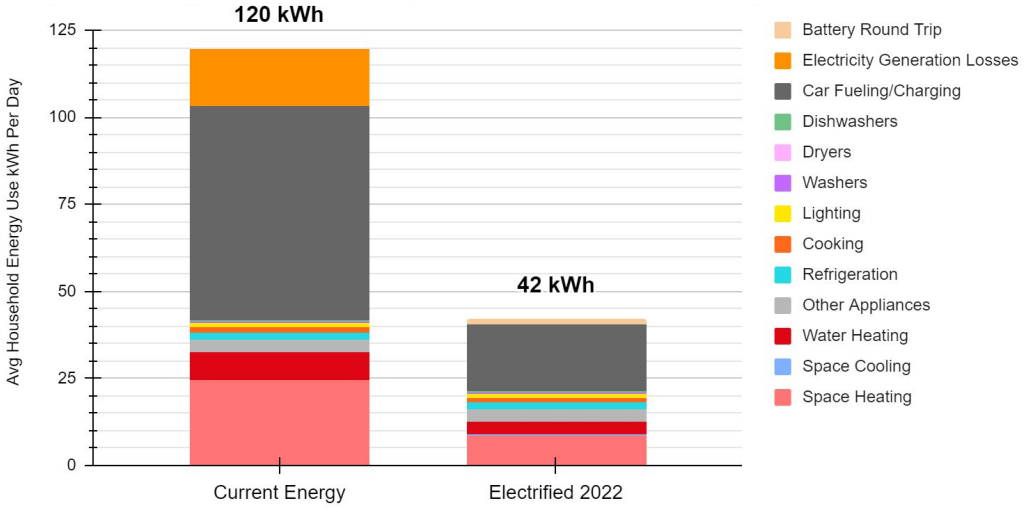
113 Andrew McConville, *Transcript of evidence*, p. 23.

114 Australian Energy Market Operator, *Draft 2022 Integrated System Plan For the National Electricity Market*, working paper, 10 December 2021, p. 9.

115 Dr Saul Griffith, Rewiring Australia, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 4.

Figure 6.5 Victoria's typical household use of energy vs. projected electrified household energy usage



Source: Dr Saul Griffith, Rewiring Australian, presentation to the Committee, *public hearing,* Melbourne, 17 March 2022.

The opportunity to reduce emissions by converting energy to electricity was suggested by a number of stakeholders to this Inquiry. Aurecon said of electrification:

> Currently, the quickest and most viable option to reduce gas consumption is via electrification – switching from gas to electric appliances which are readily available today and often provide a cheaper alternative (for some users). This is in addition to supporting Renewable Energy Zones (REZ) development and renewable energy for the electricity grid.[116]

Beyond Zero Emissions and Environment Victoria also supported this approach. They recommended that the Government 'undertake an ambitious program to upgrade every single residential gas appliance to a superior, safer and more efficient electric appliance.'[117]

Local government bodies also supported electrification. The City of Melbourne suggested that:

> By far the most established technological alternative to gas is electrification. Electric alternatives exist for the majority of gas services. Electrifying the heat used in homes and commercial buildings is a huge opportunity for savings. For low temperature heat services, well–developed heat pump technology is commercially available and can significantly outperform existing gas boilers, offering more than three times as much heating or cooling per unit of energy input.[118]

116 Aurecon, *Submission 79*, p. 12.

117 Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 11.

118 City of Melbourne, *Submission 18*, p. 6.

A number of submitters identified significant concerns about alternatives to electrification. The ANU 100% Renewables Group believed that biomethane has the same problem as natural gas and therefore is not a viable alternative:

> Biomethane has almost the same global warming potential as fossil methane, and the same impact on air quality. Use of biomethane should be minimised, with electrification being the preferred option.[119]

Tesla Australia echoed the view that the alternatives to electrification are not viable options:

> Electrification across all sectors is the most effective and lowest cost pathway for emissions reduction, advantaged by ongoing decarbonisation in the electricity generation sector. This pathway is also more proven than transitioning to 'clean gas' alternatives such as hydrogen or biogas, which may be delayed, or come at much higher cost than currently forecast.[120]

Similarly, Dr Saul Griffith argued that hydrogen is not as effective at reducing emissions:

> The problem with pipelines and steel is the hydrogen diffuses into it and makes it brittle, and then it cracks. The maximum safe amount that the most ambitious people believe you could blend hydrogen into gas is at about a ratio of 20 per cent, but that is not a lot of emissions reduction.[121]

Some stakeholders mentioned heat pump technology, which is an energy-efficient electrified solution for heating and cooling, especially for heating water. Energy Rating, a joint initiative of Australian, State and Territory and New Zealand Governments, explained the way heat pumps work:

> Heat pump water heaters absorb warmth from the air and transfer it to heat water. Hence they are also referred to as 'air-source heat pumps'. They operate on electricity but are roughly three times more efficient than a conventional electric water heater.[122]

Australian Energy Council said that 'highly efficient heat pumps can economically and environmentally replace natural gas for space and water heating.'[123] Lighter Footprints agreed that 'the conversion of electricity to transfer of heat (heat pump) has a co-efficient of performance (COP) of 4.0 to 5.0.'[124] This organisation suggested that 'electrification is able to be implemented far quicker, deploying reverse-cycle air conditioning (RCAC), heat pump hot water units, and induction cooktops.'[125]

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119 Aurecon, *Submission 79*, p. 7 (with sources).

120 Tesla Energy, *Submission 41*, p. 3.

121 Dr Saul Griffith, *Transcript of evidence*, p. 6.

122 Energy Rating, *Heat Pump Water Heaters*, <https://www.energyrating.gov.au/products/water-heaters/heat-pump-water-heaters> accessed 28 March 2022.

123 Australian Energy Council, *Submission 63*, p. 2.

124 Lighter Footprints, *Submission 76*, p. 12.

125 Ibid., p. 9.

Professor Bruce Mountain, Director of the Victoria Energy Policy Centre told the Committee that the use of heat pumps for space conditioning and water heating reduces energy consumption and results in financial savings. He did, however, highlight the costs of such transition:

> Households, for space conditioning and secondly for water heating, consume about half of all the gas that is used in Victoria. So converting those to heat pumps for space conditioning and for heating water will mean much lower energy consumption and saving. But there is a transition cost in changing the appliances and it will be quite a big program of activity, roughly 1.9 million homes. I do not expect there will be any potential market for hydrogen in use in the existing distribution network's pipelines as a substitute for electricity. I think there is no good argument for that in terms of the economics.[126]

Other organisations suggested the role of alternative renewable sources in substituting gas. Clean Energy Council supported electrifying residential and business energy needs, but believed that renewable hydrogen and biomethane should be used to address otherwise hard-to-abate energy needs:

> In the long term, the CEC recognises that a transition to 100 per cent renewable gas for residential and business purposes would not be an efficient option for natural gas replacement. We expect that electrification will present the most efficient and cost-effective energy outcome for residential and business customers, and that renewable hydrogen and biomethane will be most productively focused on addressing hard-to-abate energy needs such as high temperature process heat such as shipping, aviation and steel production (as well as heavy transport).[127]

ClimateWorks acknowledged the importance of electrifying industrial processes, but thought that other options such as renewable hydrogen are still required for part of fossil fuel use in industry:

> Electrify heat in industrial processes and switch remaining fossil fuel use in industry to zero emissions options like renewable hydrogen. This can largely be achieved through the establishment of Renewable Energy Industrial Precincts where renewable hydrogen can be produced and used, and businesses can access cheap, reliable renewable electricity. [128]

Infrastructure Victoria currently has taken a cautious approach to the alternatives. It suggested that all three possibilities for gas substitution need considering:

> Several futures are possible. One is electrification, another is replacing natural gas with green hydrogen produced from renewable electricity, or replacing with biomethane. This may or may not use existing gas networks. Assuming a definitive future now for Victoria's gas networks, and immediately locking in a transition pathway, may pre-empt a better future decision.[129]

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126 Professor Bruce Mountain, Director, Victoria Energy Policy Institute, public hearing, Melbourne, 17 March 2022, *Transcript of evidence*, p. 32.

127 Clean Energy Council, *Submission 80*, p. 11.

128 Climateworks Australia, *Submission 43*, p. 8.

129 Infrastructure Victoria, *Submission 44*, p. 14.

It advised that to limit future costs, 'prudent actions can be taken now to maximise Victoria's opportunities to reach net zero emissions and reduce the size of the risks from a large potentially stranded asset.'[130]

It also identified questions arising from substituting gas with hydrogen, including the need for zero-emissions electricity, the cost and the compatibility with existing gas pipelines:

> The challenges are a few things—firstly, the sourcing of that electricity, the zero-emissions electricity, which you need to generate the hydrogen, and in some instances the sourcing of the water that you need to generate it too. Secondly, there is an economic question about the cost of getting hydrogen down so it is competitive with other energy sources, particularly competitive with just zero-emissions electricity when we are thinking at the longer term. So they are a couple of considerations. The other matter that a lot of industry players think about, as have we, is the compatibility of existing gas pipelines to be used to transport hydrogen. Studies so far have shown that it is pretty viable for up to a 10 per cent blend of hydrogen with natural gas to be used in existing pipelines. Beyond that there are challenges in terms of the technical capacity of existing pipelines. So if they cannot take the hydrogen, we are looking at a considerable cost to replace them, and again we are weighing up, 'Well, is it better to use hydrogen or is it better to actually invest in zero-emissions electricity and still get to net zero?'.[131]

It also pointed to the challenge created by the need to change end users' appliances to fit hydrogen use:

> The last component in terms of the challenge is the end user, right? So in a household sense you would need to change over your appliances or in an industrial sense—some appliance changes as well—to use hydrogen. So there are clearly some challenges involved. Those are not insurmountable challenges, and the prize at stake for zero-emissions hydrogen is really considerable. So it is something that we think is worth investing in and planning for as one of the options that gets us to net zero. Over the next decade or so that is where we will probably know whether that is going to pay off or whether we need to take another path.[132]

Regarding biogas, Infrastructure Victoria said the challenges would be 'the cost of doing that and whether that is competitive with other energy alternatives, and also whether you can get enough raw material to create a sustainable supply'.[133]

The Government has indicated it will adopt a combination of these technologies. It told the Committee that:

> There are many ways to reduce emissions from natural gas use. These include improving energy efficiency of buildings, appliances and equipment, reducing fugitive emissions

130 Ibid.

131 Dr Jonathan Spear, Chief Executive Officer, Infrastructure Victoria, public hearing, Melbourne, 16 March 2022, *Transcript of evidence*, p. 4.

132 Ibid.

133 Ibid., p. 6.

> that arise from gas production and transportation, switching from gas to renewable electricity sources, and adopting renewable gases such as hydrogen and biogas. Further, a 'no regrets' approach to decarbonising gas will likely involve a combination of these technologies and will be influenced by consumer choices, technology costs and advancements in lower emission technologies.[134]

The Committee considers that electrification is the most viable alternative to gas. The Committee also recognises the important role of renewable hydrogen and biogas, especially for their potential to address hard-to-abate gas use in industrial processes and transport.

Measures to accelerate the transition

Stakeholders to this Inquiry made a number of suggestions regarding the transition from gas.

The City of Melbourne encouraged the Victorian Government 'to consider a moratorium on new exploration', saying that 'Continued exploration and extraction of fossil fuels is inconsistent with Victoria's net zero goals.'[135] It also argued that putting such a moratorium will create policy certainty on gas substitution and thus, speed the transition:

> Clear market signals and policy settings are needed to support businesses and investors to transition to a low carbon economy. Investment in new renewable energy is being driven by the commitments of the Victorian government, however without a clear commitment to transition the economy away from natural gas, the level of investment needed to meet the increased energy demand may be inadequate.
>
> Policy certainty on gas will bolster investor certainty and speed the transition to a fully renewable energy system, avoiding the risk of stranded gas assets. Explicit policy directions from the Victorian government would assist businesses and investors to manage climate-related financial risks and meet their obligations to their stakeholders.[136]

It also noted that ending gas exploration is in line with the International Energy Agency's roadmap for the global energy sector:

> It is further noted that the International Energy Agency's roadmap for the global energy sector to reach net zero warns against new fossil fuel projects, stating that beyond 2021 there should be no new fossil fuel development and no new gas fields approved. To this end, continued exploration and extraction of new gas is inconsistent with achieving the goals in the Paris agreement and with Victoria's net zero goals.[137]

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134 Department of Environment, Land, Water and Planning, *Submission 88*, p. 11.

135 City of Melbourne, *Submission 18*, p. 6.

136 Ibid.

137 Ibid.

Moreland City Council shared this view by emphasising the importance of ruling out new fossil fuel developments. It suggested that this can be done by extending 'the ban on unconventional onshore gas development to a complete ban of onshore and offshore gas.'[138] Dr Leanne Morrison and Carol Bond from RMIT echoed this by suggesting a staged phase-out of fossil fuel, including coal and gas, by 2030, which would 'begin with a moratorium on any new coal mines or fossil fuel exploration licenses in Victoria.'[139]

Yarra Climate Action Now expressed to the Committee its disappointment at the recent recommencement of methane gas exploration in Bass Strait, arguing that no more new natural gas fields should be opened.[140]

6.2.3 Substituting gas in Victorian households

Given the available alternatives, residential gas use will be easier to phase out than in other sectors. This section discusses the importance of substituting gas in households, the impact and challenges of this task and possible measures to accelerate it.

The importance of substituting gas in Victorian households

Residential use accounts for the majority of emissions from natural gas in Victoria. According to the Victorian Government's *Gas Substitution Roadmap*, 66% of Victorian households use gas for water heating and 64% use gas for space heating.[141] In its submission, Renew Australia compared three novel scenarios (7-Star basic all-electric, 7-Star efficient dual fuel with solar, 7-Star efficient all-electric with solar) with the baseline scenario (6-Star basic dual fuel) to illustrate the significant reduction in carbon emissions when switching households from gas to electricity. It is shown in Figure 6.6 below.

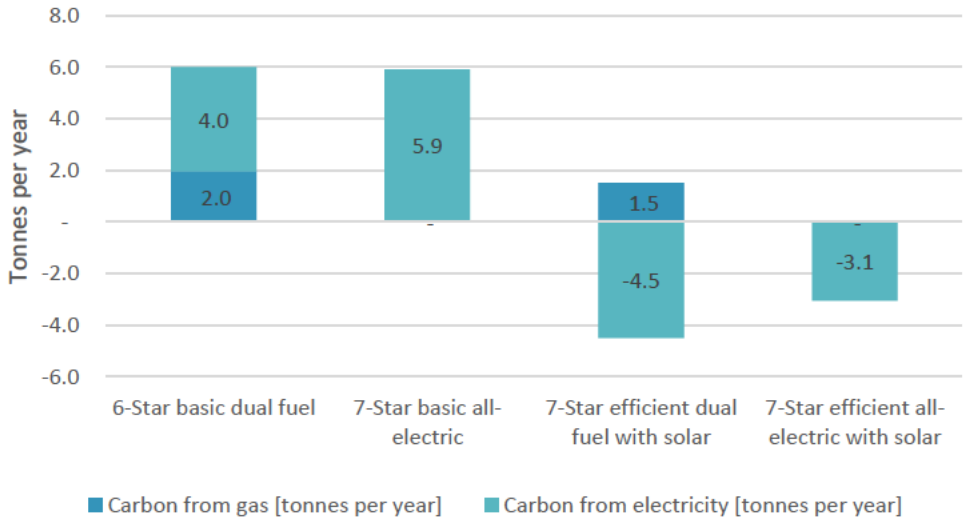
138 Moreland City Council, *Submission 57*, p. 5.

139 Dr Leanne Morrison and Carol Bond, *Submission 68*, p. 3.

140 Yarra Climate Action Now, *Submission 33*, p. 1.

141 Engage Victoria, *Help Build Victoria's Gas Substitution Roadmap*, Consultation paper, Victorian Government, Melbourne, 2021.

Figure 6.6 Renew Australia's modelling on household greenhouse gas emissions



Source: Renew Australia, *Submission 51*, p. 7.

The opportunity to reduce emissions from switching Victorian households from gas was raised by Powerledger in its submission to this Inquiry. Citing Dr Griffith, Josh Elision and the Australia Institute, the submission stated:

> moving away from gas to a fully electric system for new homes and potential incentives to retrofit older homes would accelerate Victoria's reduction of greenhouse gas emissions.[142]

In addition to emissions reduction, stakeholders told the Committee of other benefits when moving households away from gas. Beyond Zero Emissions and Environment Victoria highlighted the advantages of cost savings and avoiding gas shortfalls, among others:

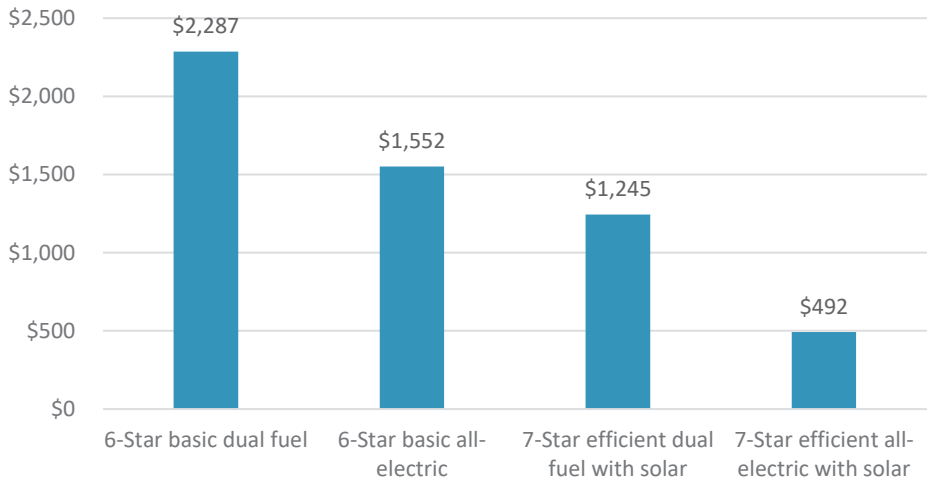
> Along with saving households money, this would significantly reduce peak winter gas demand, avoiding any looming gas shortfalls and removing the need for destructive new gas supply projects.[143]

The chance to save living costs was affirmed by Renew Australia's modelling, which illustrated how a household can save money by moving to electricity, as shown in Figure 6.7.

142 Powerledger, *Submission 65*, p. 5.

143 Beyond Zero Emissions and Environment Victoria, *Submission 84*, pp. 11–12 (with sources).

Figure 6.7 Renew Australia's modelling on households' annual energy bill in Melbourne



Source: Renew Australia, *Submission 51*, p. 4.

Moving away from gas in households has the added advantage of reducing gas-associated adverse health effects. Doctors for the Environment pointed out that 'the use of gas inside the home is associated with adverse health effects which are often ignored.'[144]

FINDING 17: Switching Victorian households from gas will contribute significantly to lowering carbon emissions, save household costs and help to avoid the health risk associated with gas.

The broad impact of residential gas substitution in Victoria

Infrastructure Victoria suggested to the Committee that the impact of transitioning from gas is broad and intense, given Victoria's strong reliance on gas:

> This has implications for the extensive 33,000 kilometres of natural gas network infrastructure. Victoria is the only state where most natural gas demand is from residential and small commercial customers, who mainly use it for heating. Over 80% of Victorian households are connected to the gas network.[145]

Given the current situation, Infrastructure Victoria stated that Victoria still requires natural gas in the short to medium term, but emphasised action should be taken as soon as possible to facilitate a better transition:

> Natural gas will still need to be supplied in the short to medium term, but work needs to begin now on better understanding transition pathways for natural gas and the implications for gas networks and the electricity system.[146]

144 Doctors for the Environment Australia, *Submission 30*, p. 7.

145 Infrastructure Victoria, *Submission 44*, p. 14 (with sources).

146 Ibid.

The Housing Industry Association has expressed some concerns over the transition. It suggested in its submission that the transition will attract costs and alternatives remain uncertain and thus, argued that gas should not be totally decommissioned:

> changes like fully decommissioning gas will impact consumer choice and could impose additional cost on homeowners. Any shift to electricity from gas supply will likely set peak demand in the summer season (transitioning from gas in winter), largely due to space heating and there has to be significant queries on supply networks without gas to meet this demand.[147]

The Housing Industry Association also stated that 'Network availability is not guaranteed using renewable energy alone' and that 'A combination of energy sources is currently and will in future be required to meeting consumer energy demand in Victoria.'[148]

Victorian Trades Hall Council emphasised the impact that the transition can have on the workforce and households and proposed guiding principles to mitigate such impact. In relation to workforce transition, the Victorian Trades Hall Council asked that there should be:

- No forced redundancies;
- No involuntary unemployment among affected workers; and
- Retraining for all who want it.[149]

Also, in relation to households use, it proposed:

- Reduction in energy costs for consumers; and
- Improvement in thermal comfort and energy efficiency for households.[150]

Moyne Shire Council were more concerned about local manufacturers' reliance on gas and the relatively new household gas network in the area. They believed that the phase-out of gas should be gradual:

> some of Moyne's largest employers rely heavily on gas for manufacturing. Additionally, household use of gas in Port Fairy is relatively new with reticulated gas provided in 2006. Withdrawal of gas infrastructure needs to be gradual and negative impacts mitigated. The Roadmap did not provide Council with confidence that there were adequate linkages between strategies to transition to renewable energy.[151]

147 Housing Industry Association, *Submission 26*, p. 3.

148 Ibid., p. 1.

149 Victorian Trades Hall Council, *Submission 81*, p. 8.

150 Ibid.

151 Moyne Shire Council, *Submission 61*, p. 5.

The barriers and measures to support Victorians in the transition from gas

Stakeholders raised with the Committee key barriers to this transition, including costs and the public's insufficient understanding of the transition. They also suggested measures to overcome these barriers.

Citipower, Powercor and United Energy raised the issue about costs and complexity arising from getting rid of gas in current Victorian houses:

> The impact of the transition from gas to electric appliances will predominantly be seen in residential areas and this will create the need to build new assets to ensure customers continue to receive a reliable supply of electricity. New urban development space limitations for additional electricity assets and a drive by local planning bodies to underground electricity assets may significantly increase cost and complexity.[152]

The APPEA also warned about the costs to overhaul the infrastructure when electrifying Victorian households, and that many low-income families might not be able to access that.[153] Renew Australia also expressed their concern that low income and vulnerable Victorians may be left behind if the transition has high upfront retrofitting costs:

> In the long term, residents stand to benefit from retrofits to replace gas with all-electric heating, cooling, cooking, and hot water. However, the upfront costs of retrofits mean that many Victorians are unable to access these benefits and long-term savings. Perversely, households on lower incomes are less likely to be able to meet upfront costs and are locked into higher bills on an ongoing basis due to poor thermal efficiency, inefficient appliances, and the duplicate connection fees incurred by dual fuel homes.[154]

It then suggested that the Government introduce retrofit programs to address the upfront costs of fuel switching for low income and vulnerable Victorians.[155]

Brotherhood of St Laurence also pointed out the need to support low-income homeowners to electrify and improve energy efficiency:

> Low-income homeowners face greater barriers to electrifying their homes. These include barriers common to many households, such as a lack of trusted advice or trusted service providers, the hassle factor of switching appliances from gas to electricity, the cost2, and the perceived risks (justified or unjustified). In addition to these common barriers, many low-income households also face greater financial constraints, especially those facing multiple forms of disadvantage.[156]

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152 Citipower, Powercor and United Energy, *Submission 54*, p. 7.

153 Andrew McConville, *Transcript of evidence*, p. 25.

154 Renew Australia, *Submission 51*, p. 10.

155 Ibid.

156 Brotherhood of St Laurence, *Submission 82*, p. 2.

It also suggested the following key groups would require greater support:

- households who cannot meet the co-contribution required, who should be provided with fully funded retrofits
- people with high needs, for example chronic health conditions that necessitate sustained use of heating or cooling (for example neurological and other conditions eligible for the medical cooling concession).[157]

Lighter Footprints identified a number of programs that could support households in the transition, including:

> The $335m VEU program will assist 250,000 low income households to move to efficient reverse cycle air conditioners. One in ten Victorian children have asthma, around 128,000. A $250,000 program offering $1,500 rebates to facilitate moving away from gas cooking could shift the majority of these families away from significant levels of indoor pollutants, particularly if coupled with low interest loans for the remainder of the upfront costs, as well providing a welcome trade jobs boost. On the prevention end, a further $150m could provide $1000 rebates to shift over 100,000 lower income households away from gas cooking, reducing health impacts and health system, economic and burden of disease costs.[158]

Stakeholders suggested that current subsidies are not enough to address the prohibitive costs. The Animal Justice Party argued that some people will need further assistance:

> The costs for individuals in changing large-scale appliances such as heaters and water heaters could be prohibitive, particularly for lower socioeconomic populations. This may be despite government subsidies and the long-term savings attributable to newer, more energy-efficient appliances. The costs of changeover must also be assessed.[159]

Most of the suggestions addressing this issue involved expanding current support programs and focused on low income and other disadvantaged households. Moreland City Council said support mechanisms needed to:

> Utilise the findings and success of programs such as the Victorian Energy Smart, Healthy Homes and Energy Savvy Programs, and support the expansion of well-designed programs to provide financial and energy advice services for low income and households at risk of energy stress. [160]

Brotherhood of St Laurence commended the Victorian Government's Home Heating and Cooling Upgrade Program as 'a very good initial step' and suggested that 'Future programs will need to build on these successes.' They also said that 'the Victorian Government commit to a larger-scale program commensurate with the size of the problem.'[161]

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157 Ibid., p. 3.

158 Lighter Footprints, *Submission 76*, p. 15.

159 Animal Justice Party, *Submission 87*, p. 21.

160 Moreland City Council, *Submission 57*, p. 4.

161 Brotherhood of St Laurence, *Submission 82*, p. 3.

Australian Parents for Climate Action proposed that the Government develop and promote 'innovative financing options such as Environmental Upgrade Agreements to help avoid the upfront bill shock and optimising greenhouse credit and rebating schemes to favour electric appliances over gas.'[162]

Environment Victoria also said that current subsidy programs need expanding to accelerate the transition:

> Various studies have shown that it is actually much cheaper for households to use electricity to heat their homes, and so what we should be doing is increasing existing government programs that support households to switch from gas to efficient electrical appliances. There are already some really good programs, like the program to replace 250 000 heaters with efficient electric heaters, but those could be scaled up massively. We should be aiming to cut gas sector emissions in half by 2030 at the very least and doing that through switching households from gas to electricity.[163]

FINDING 18: To move away from gas, households will incur considerable retrofitting costs which are prohibitive to low-income households and other disadvantaged groups.

RECOMMENDATION 23: Programs that the Victorian Government has developed to support the move away from gas should be enhanced to ensure that disadvantaged groups who may suffer from financial impediments are not excluded.

Beside the upfront costs issue, the Committee was told there is a lack of public understanding about the benefits of moving away from gas. Renew Australia pointed out this problem in its submission:

> While growing, there is still limited community understanding of the financial, health and environmental benefits of shifting to all-electric homes. Furthermore, many people buying or renting a home are unable to access information about the home's energy efficiency.[164]

Mr Alan Pears AM from RMIT also told the Committee about the preferences for gas appliances in Victorian homes:

> gas consumers have been conditioned by decades of cheap gas and comparisons of environmental impacts of gas relative to brown coal. Most do not realise the risks we face if we continue to rely on gas.[165]

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162 Australian Parents for Climate Action, *Submission 42*, p. 6.

163 Greg Foyster, Acting Campaigns Manager, Environment Victoria, public hearing, Melbourne 17 March 2022, *Transcript of evidence*, p. 13.

164 Renew Australia, *Submission 51*, p. 11.

165 Alan Pears AM, *Submission 35*, p. 3.

Furthermore, Sustainable Agriculture and Communities Alliance said that there is still a lack of commitment on the part of home builders to the transition. In its submission it said:

> Some young people in Warrnambool have met with refusal from builders who wish to continue to build houses that are energy guzzlers. The problem to overcome here is that builders need to be educated on the advantages of electric over gas for both health and the environment, as well as the hip pocket.[166]

To solve the problem, stakeholders emphasised the role of education. Peter Moraitis said that 'There is an urgent need to widely disseminate why the switch away from gas is necessary and how this can be done'.[167] He added that: 'The Victorian Government will have a key role in building community knowledge and engagement on these changes.'[168] He also said that the Government, through Sustainable Victoria, already has relevant programs, but this needs to be elevated:

> Sustainability Victoria's programs are a step in the right direction in mobilising businesses and communities to adopt renewable based practices and reduce reliance on gas. However, these efforts need to be massively expanded to engage many more groups and this task needs to be, and can be carried, by many more government funded public institutions than merely one department within government. Attention should be given to mobilising the full resources of the state government to develop a whole of government approach to this educational and activation strategy.[169]

With regard to information dissemination and public education, Renew Australia emphasised that consumers must have access to independent, accurate, clear and evidence-based information and this should be a part of a gas substitution plan:

> As part of a gas substitution plan for the residential sector, Victoria should ensure clear, evidence-based consumer information is available on energy choices. Victoria should furthermore continue to roll out the Residential Energy Efficiency Scorecard and work with other state, territory and Commonwealth governments to develop a nationally consistent scheme for the mandatory disclosure of home energy ratings.
>
> Clear consumer information is needed about the benefits and costs of different fuels. Private advertising for gas appliances typically presents gas as a cheaper fuel than alternatives, however we are concerned that inappropriate comparisons are used in this advertising that lead to misleading conclusions. Independent and accurate information should be provided to Victorian consumers.[170]

166 Sustainable Agriculture and Communities Alliance, *Submission 73*, p. 3.

167 Peter Moraitis, *Submission 58*, p. 1.

168 Ibid.

169 Ibid.

170 Renew Australia, *Submission 51*, p. 11.

Moreland City Council suggested that education and training on the transition from gas should target all relevant stakeholders:

> Provide education training for builders, architects, building designers and other building professionals, who provide advice to consumers. This initiative should specifically include training for plumbers and electricians in the installation of technologies such as heat pumps, draught proofing and insulation to reduce gas demand and improve thermal comfort.[171]

Another stakeholder suggested ways in which public education on the transition from gas can be conducted, including conversations and pamphlets:

> In my view, there needs to be an education/information campaign regarding the alternatives to gas and how this fits in with Australia's efforts to reduce emissions. [172]
>
> This may include:
>
> - Conversations with new home builders to get them on board with only offering non-gas appliances in new homes;
> - Pamphlets which explain the benefits of non-gas appliances such as heat pumps, induction cooktops which are available at builders display homes and even appliance retailers; [173]

Australian Parents for Climate Action believed that to support householders in the process of phasing out gas, education must be provided in tandem with timely consultation. As householders, they realised a problem that 'a large majority of appliances are bought in a hurry when the old one breaks' and at that time, it would be difficult to replace gas as this involves some complex process. Thus, in addition to educating households on the benefits of electrification, they proposed that the Government provide 'a service to help householders what they need to do to get ready for electrification before their appliance breaks' and provide 'Education and other encouragement for retailers and installers of gas appliances to help building owners switch go electric alternatives.' These actions would help avoid it being 'more complex and expensive both for the installer and for the householder.'[174]

Stakeholders also made suggestions on improving energy efficiency in buildings among the measures to move households away from gas. This measure will be discussed further in Section 6.4 of this Chapter.

The Committee understands that substituting residential gas usage in Victoria is a large-scale transformation that will affect most Victorians and will require uniform actions of different stakeholders such as householders, retailers and installers. The understanding, support and readiness of all these stakeholders is essential to this

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171 Moreland City Council, *Submission 57*, p. 4.

172 Neil Andrews, *Submission 45*, p. 14.

173 Ibid., p. 15.

174 Australian Parents for Climate Action, *Submission 42*, p. 6.

process. Local governments can also play an important role in facilitating their communities to transition from gas.

RECOMMENDATION 24: That the Victorian Government establish a community education campaign about the benefits of gas substitution and to inform householders, retailers and installers of the steps necessary to get them ready for the transition to renewable energy.

RECOMMENDATION 25: That the Victorian Government, in cooperation with local government authorities, make available information and consultation services to facilitate residents' access to information who want to transition away from gas.

Avoiding new gas connections

It was the view of a number of submitters that there should be no gas connections in new residential buildings to avoid locking them into gas. This would reduce future retrofitting costs. One submission said:

> Houses that are built today which are fitted out with gas heating, hot water systems and cooktops will be reliant on gas for many years to come. I have a six-year-old house with all of those things. And while I see the need to electrify everything I can, it will be a while before those items kark it. So I am hooked on gas for some time into the future. And, given the rate of new home building in Victoria, there will be many households just like mine.[175]

Renew Australia also suggested that continuing new gas connection will make new homes incur retrofitting costs in the future:

> Retrofitting homes to remove established gas connections will come at a cost to governments and households. While this cost is unavoidable for existing homes with a current gas connection, a moratorium on new connections avoids adding to the problem.[176]

Brotherhood of St Laurence highlighted how continuing to connect new homes to gas is counterproductive:

> Consideration should be given to ceasing new residential gas connections. Expanding the gas network now is counterproductive and will impose costs on both households and government now and in future.[177]

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175 Neil Andrews, *Submission 45*, p. 14.

176 Renew Australia, *Submission 51*, p. 8.

177 Brotherhood of St Laurence, *Submission 82*, p. 3.

A number of stakeholders, including local city councils such as Moreland Council and Melbourne City,[178] emphasised the necessity to avoid locking new developments into gas. Northern Alliance for Greenhouse Action said in its submission:

> Ensure new buildings and urban renewal precincts are not locked into natural gas infrastructure and support communities to prepare for the transition away from natural gas. These requirements should instead require zero emissions infrastructure and for new developments to achieve 100% renewables.[179]

Local government authorities are also taking action to accelerate the transition from gas in their areas. The City of Melbourne said it had introduced a planning scheme amendment that encourages new buildings in the council area to be carbon neutral and discourages gas connections:

> The City of Melbourne is supporting our community to make the transition towards a clean energy future. Council's draft Planning Scheme Amendment C376[iii] establishes environmentally sustainable design requirements to ensure that buildings are planned and designed to facilitate carbon neutral or carbon positive outcomes across construction and operational stages. The amendment will discourage development that incorporates infrastructure which is not aligned with a zero emissions future. This includes a recommendation that developments should not incorporate connections to gas services or other non-renewable energy.[180]

Stakeholders highlighted the role of regulation in addressing the issue. Moreland City Council proposed to integrate the requirement of gas switching into the Victorian Planning Framework. It asked the Victorian Government to ensure that fuel switching and gas-free development requirements and standards are adopted within the revised environmentally sustainable design (ESD) of the Victorian Government's Planning Framework (Action 80 of Plan Melbourne 2050).[181]

Beyond Zero Emissions and Environment Victoria suggested the Government set the target that almost all new buildings switch to electricity by 2023, by either requiring or incentivising the transition:

> A plan to require new buildings to be all-electric, or at least strongly incentivise it, should be developed to ensure that virtually all, if not all, new buildings in Victoria are fully powered by electricity by 2023.[182]

Renew Australia expressed the view that some existing rules and regulations are outdated and are slowing down the gas transition. Specifically, Clause 56.09–2 of the Victoria Planning Provisions requires: 'where available' residential developments must be connected to 'the satisfaction of the relevant gas supply agency'. In addition, Schedule 2, Clause 11 (4) of Victorian Plumbing Regulations also says that if a gas

178 Moreland City Council, *Submission 57*, p. 5; City of Melbourne, *Submission 18*, p. 5.

179 Northern Alliance for Greenhouse Action, *Submission 55*, p. 3.

180 City of Melbourne, *Submission 18*, p. 2.

181 Moreland City Council, *Submission 57*, p. 4.

182 Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 11.

supply is available for connection in a new building, new solar hot water heaters must be boosted by gas. Heat pump water heaters are only allowed to be installed if they are not connected to the main electric supply. Renew Australia emphasised that 'These regulations should be changed as a matter of urgency'.[183]

This proposal was supported by local city councils.[184] The City of Melbourne suggested that:

> Planning, building and plumbing regulations should remove mandatory requirements to connect to gas infrastructure so that new developments can achieve zero carbon … These requirements should instead require zero emissions infrastructure and for new developments to achieve 100% renewables. In the context of all electric and zero carbon buildings, regulations should support the use of alternative approaches to meeting grid connection requirements, such as on site or community scale storage rather than traditional network augmentation.[185]

The Committee notes that in the US, cities such as Berkeley, California, San Jose, Mountain View, Santa Rosa, Brookline, Massachusetts and Brisbane have banned gas in new buildings while many others have passed laws to strongly encourage all-electric construction.[186]

FINDING 19: Current planning, building and plumbing regulations that mandate connection of new buildings to gas infrastructure conflict with the need to transition away from gas.

RECOMMENDATION 26: That the Victorian Government consider reviewing and removing the regulations that mandate connection of new buildings to gas infrastructure and consider enacting a moratorium on new residential gas connections. In doing so, consideration should be given to ensuring no disruption to energy supply and that the impact on workers affected by the transition is minimised by ensuring just transitions for workers are factored into any anticipated downturn in gas connections.

6.2.4 Substituting gas in rental homes and businesses

With respect to rental homes, Australian Parents for Climate Change noted that the Victorian Government has minimum standards for rental properties. They asked that 'these be strengthened and include phasing out gas appliances.' They also suggested the Government provide 'Obligations for landlords to electrify, insulate, provide

183 Renew Australia, *Submission 51*, p. 9.

184 City of Melbourne, *Submission 18*, p. 5; Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 11; Yarra Climate Action Now, *Submission 33*, p. 1.

185 City of Melbourne, *Submission 18*, p. 5.

186 Irina Ivanova, *Cities are banning natural gas in new homes, citing climate change*, 2019, <https://www.cbsnews.com/news/cities-are-banning-natural-gas-in-new-homes-because-of-climate-change> accessed 11 February 2022.

suitable power for EV charging (if on site parking is provided), etc.'[187] Brotherhood of St Laurence raised the 'split-incentive problem' of rented homes (which happens as renters pay energy bills while landlords pay for upgrade costs) and suggested a solution:

> A possible first step would be to foreshadow the switch away from gas for rented properties, with, for example, a date for switching to efficient electric heating. There would need to be sufficient notice for an orderly transition. The Victorian Government could then develop further standards and dates to replace other gas appliances (such as hot water systems and cookers) in keeping with its Gas Substitution Roadmap.[188]

For commercial use of gas, Lighter Footprints suggested that the Government create a framework that ceases gas connection in new businesses while providing incentives to fully electrify existing ones.[189] They also suggested educating trades and trade associations about the transition.[190]

RECOMMENDATION 27: That the Victorian Government design an education program on gas substitution specific to tenancy landlords and businesses to enhance their understanding of the benefits of the substitution, the alternatives and the support available to them.

RECOMMENDATION 28: That the Victorian Government consider updating the minimum standards for rental properties to keep it in line with Victoria's Gas Substitution Roadmap and provide incentives to businesses to encourage them to switch away from gas.

6.2.5 Gas substitution in industrial processes

The Committee received many submissions which addressed the issue of phasing out gas in industry. Beyond Zero Emissions and Environment Victoria told the Committee that:

> Electrifying industry offers additional potential to reduce emissions through electrification. According to recent analysis from consulting firm McKinsey, almost 50% of energy consumed by industry could be already electrified. As a reference, according to Beyond Zero Emissions' Electrifying Industry report, Australia could reduce our greenhouse gas emissions by up to 8% by electrifying industry's heat uses.[191]

Aurecon, on the other hand, suggested hydrogen and biogas as potential substitutes for gas in industrial use. According to Aurecon, hydrogen and biogas present an

187 Australian Parents for Climate Action, *Submission 42*, p. 6.

188 Brotherhood of St Laurence, *Submission 82*, p. 3.

189 Lighter Footprints, *Submission 76*, p. 13.

190 Ibid.

191 Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 12 (with sources).

alternative to electrification, especially in hard-to-abate sectors. At the moment, as the technologies are still immature, it is advisable to start with a small blend, then expand as the technologies get more advanced.[192]

In a public hearing, Andrew McConville, the Chief Executive Officer of the Australian Petroleum Production and Exploration Association (APPEA), said however, that it would be costly and complicated undertaking to electrify industrial processes that use gas:

> in some industrial processes it is the case at the moment that it is not as simple an exercise as simply taking gas out and putting electricity in, because a lot of the actual physical infrastructure is built around the use of gas, not the use of electricity. I know it is not the case in Victoria, but, for example, if we look at the electrification of LNG plants on Curtis Island in Queensland, there is a suggestion there that they could be electrified. It is actually quite a complex re-engineering process—an enormous cost involved to replace gas-fired generation in those plants to electricity … That is not to say it cannot happen in the longer term, but it is not as simple as just turning one off and turning the other on.[193]

At the same hearing, Mr Ashley Wells, Director of Government Relations at APPEA told the Committee that the heat created by gas cannot easily substituted by electricity:

> the heat that is generated through natural gas… cannot easily be replicated through electricity, and that materially matters when it comes to glassmaking, aluminium production and so on. So at the heavy end of the industrial spectrum, for want of a better expression, there is no readily available substitute for natural gas at this point at the cost point that we are talking about here as well.[194]

Stakeholders also noted that natural gas provides not only energy but also a chemical feedstock for industrial processes. For this reason, Lighter Footprints thought that cautious measures should be taken to substitute gas in industry, and that natural gas will still be needed until 2030–2035. It suggested to:

- Conduct a detailed study of the economics of creating renewables hydrogen/ammonia or synthetic hydrocarbons precincts for industrial feedstocks.
- Look at 'reserving' some natural gas for industries that require *gas as a chemical feedstock*. 'Reserves' policy in place until 2030 to 2035.[195]

Despite this, Lighter Footprints still believed the Government should provide incentives for industry to transition away from natural gas to electricity where possible.[196]

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192 Aurecon, *Submission 79*, pp. 12–13.

193 Andrew McConville, *Transcript of evidence*, pp. 25–26.

194 Ashley Wells, Director of Government Relations, Australian Petroleum Production and Exploration Association, public hearing, Melbourne 16 March 2022, *Transcript of evidence*, p. 26.

195 Lighter Footprints, *Submission 76*, p. 14.

196 Ibid.

Banyule Clean Energy Group supported Government actions to date in replacing gas in industrial processes:

- The government has already begun to explore many of these solutions that could be influenced by funding through the Victorian Energy Upgrades program (VEU). For example, the high energy efficiency and modular nature of industrial heat pumps, combined with the dynamic nature of the food and beverages sector in Victoria is a particularly attractive opportunity for VEU to focus on, at least in the first instance.
- It is pleasing to hear that the VEU is now consulting on the implementation of discounts for commercial and industrial heat pump water heating.[197]

The Committee recognises that transitioning from gas in industrial processes is challenging. However, it considers that substituting gas in industrial processes to lower carbon emissions in Victoria is possible, pending further development in technologies relating to alternatives such as electricity, renewable hydrogen, and biogas.

6.2.6 Gas substitution in government buildings

A number of stakeholders noted that the public sector needs to play a part in moving away from gas. A submitter said that:

> Victoria owns or leases a lot of public buildings... Many government buildings would have gas heating, gas hot water and gas cooking appliances. These eventually need to be replaced by electrical appliances and a replacement schedule, with appropriate funding, needs to be developed and actioned as soon as possible.[198]

The need to transition from gas is also seen in social housing and locally managed buildings. Beyond Zero Emissions and Environment Victoria recommended that all social housing go electric:

> The Victorian government should commit to building all-electric social housing, as it will yield the greatest benefits for residents, the energy system and for the development of the industry.[199]

In its submission, Renew Australia identified risks for social housing in the gas substitution plan if left to the market:

> If residential gas substitution is left to market mechanisms based on the individual choices of households, public and community housing tenants risk being excluded from the transition. Like renters in the private market, social housing residents are in practice dependent on decisions of a landlord to spend money upfront on energy efficiency upgrades or the replacement of fixed appliances. Public housing tenants in some locations pay no gas connection fee and have constrained energy choices.[200]

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197 Banyule Clean Energy Group, *Submission 64*, p. 17 (with sources).

198 Neil Andrews, *Submission 45*, p. 15.

199 Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 11.

200 Renew Australia, *Submission 51*, p. 11.

They suggested a statewide strategy for gas substitution in social housing. The strategy would include retrofitting for existing buildings and an all-electric requirement for new buildings:

> A statewide strategy must be developed for the substitution of gas in Victoria's social housing. This strategy should include energy efficiency retrofits, replacement of gas appliances with efficient, all-electric appliances, and access to renewable energy through measures such as community renewables, storage and PPEs. Newly constructed social housing should be all-electric, which will benefit residents while also using government procurement processes to build industry capacity.[201]

At the local government level, Moreland City Council pointed out that local councils manage a number of sites which have high gas consumption, such as aquatic centres. It suggested that the Government provide funding to local councils to remove gas from these sites.[202]

Stakeholders also mentioned what the Government is doing to remove gas from its buildings. A submission to the Inquiry commended The *Greener Government Buildings Program* as a step in the right direction in terms of limiting future emissions but asked it to go further:

> However, the Program would need to go much further than what is described in *Victoria's Climate Change Strategy*.[203]

Most of the measures to substitute gas in government buildings sit within a broader plan of improving the energy efficiency in those buildings.

6.3 Solving leakage in energy transmission

The Committee heard that waste in transmission is significant and reducing this waste would reduce emissions. In the gas sector, Infrastructure Victoria told the Committee that fugitive emissions[204] from leaks or venting of gas in exploration, processing, storage, transmissions and distribution accounts for 14% of the emissions from natural gas, which on its own accounted for 17% of Victoria's total emissions.[205]

Notably, losses from gas transmission in Victoria are currently the most severe in Australia. As seen in Figure 6.8 below, in 2021 the gas losses in Victoria was 6.6 PJ, accounting for about 3.2% of total consumption while that ratio for Australia was just 0.7%. It suggests that taking action with respect to this issue can help reduce a significant amount of carbon emissions.

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201 Ibid.

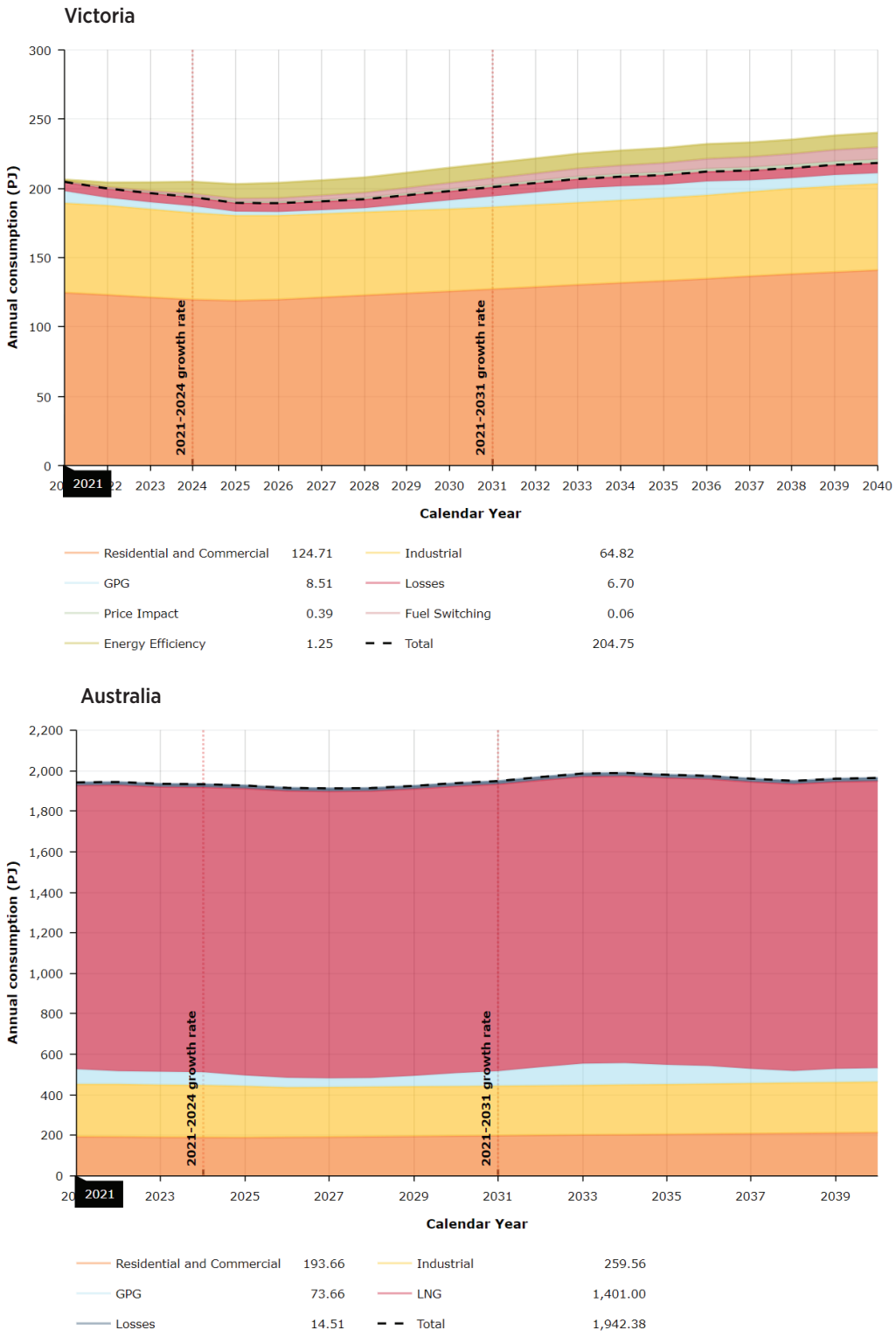
202 Moreland City Council, *Submission 57*, p. 4.

203 Neil Andrews, *Submission 45*, p. 15 (with sources).

204 Fugitive emissions mean losses, leaks and other releases of gases such as methane or carbon dioxide into the atmosphere that are associated with the production, transport and development of natural gas, oil and coal. See Infrastructure Victoria, *Submission 44, Attachment 2*, p. 10.

205 Ibid., p. 12.

Figure 6.8 Victoria's gas consumption in 2021 vs. Australia's gas consumption



Source: AEMO, National Electricity and Gas Forecasting, <http://forecasting.aemo.com.au/Gas/AnnualConsumption/Total> accessed 27 November 2021.

In its submission, Aurecon discussed the opportunity to reduce emissions from natural gas by reducing fugitive emissions:

> Another way to reduce emissions from today's natural gas use is reducing fugitive emissions that arise from gas production and transportation. The way forward is to undertake better measurement of fugitive emissions. With better information from more accurate measurement, the state can more accurately calculate fugitive emissions and therefore better measure the impact and devise solutions.[206]

Waste in the electricity sector also presents a big problem. Alan Pears from RMIT told the Committee that:

> The electricity industry itself is Victoria's largest electricity consumer, mainly due to distribution losses in wasteful wire networks. Losses from Single Wire Earth Return power lines are very significant, especially at times of high loads. Many of these power lines provide unreliable services and are vulnerable to extreme weather events.[207]

Improving energy efficiency is seen as an important measure for Victoria to successfully transition to renewables and thus, the issue of waste from energy transmission needs to be addressed. Reducing such waste not only reduces the carbon emissions that go directly into the environment but also reduces the demand for energy and so reduces the pressure on the grid.

FINDING 20: Victoria currently loses a considerable amount of gas and electricity across the transmission network. This needs to be addressed to avoid any unnecessary greenhouse gas emissions and reduce the pressure on energy production.

6.4 Improving energy efficiency in buildings

As discussed in Chapter 3, reducing energy demand is one of the key pillars in moving to 100% renewable energy and reducing carbon emissions. Energy efficient buildings are an important part of this energy demand reduction strategy. This Section will look at the opportunities to reduce emissions by improving energy efficiency in buildings.

6.4.1 How improving energy efficiency contributes to carbon emissions reduction in Victoria

The Committee was told that the opportunity to reduce carbon emissions from Victoria's buildings is substantial because energy consumption in buildings accounts for around one-third of Victoria's total greenhouse gas emissions and the energy efficiency

206 Aurecon, *Submission 79*, pp. 12–13.

207 Alan Pears AM, *Submission 35*, p. 3.

in Victoria's existing building stock is poor. This was highlighted by Infrastructure Victoria:

> Energy use in buildings accounts for around one-third of Victoria's total greenhouse gas emissions, with heating and cooling making up over 40% of home energy costs. The existing building stock in Victoria, particularly residential housing, generally has poor energy efficiency. Sustainability Victoria studies found the average House Energy Rating constructed prior to 2005 (when higher minimum energy efficiency standards were introduced) was only 1.8 stars, while in the commercial sector the National Australian Built Environment Rating System Energy Star rating was 3.13 for offices, 3.26 for retail and 3.6 for accommodation.[208]

Infrastructure Victoria identified other benefits from improving energy efficiency in buildings:

> In addition to reducing greenhouse gas emissions, improving energy efficiency of buildings can lower energy bills, improve health and comfort, improve the reliability of the energy system, increase home values, provide local employment and save money on energy infrastructure.[209]

Other stakeholders raised the issue of energy efficiency in buildings. The Banyule Clean Energy Group urged action on enhancing heating performance, pointing out the benefits such as health and wellbeing, cost savings and more resilient dwellings:

> there should be a push towards improving the thermal performance of the new and existing dwelling. This would help to reduce heating requirements which is a significant consumer of gas in the housing sector. The benefits would not only be a reduction in energy consumption but improved health and wellbeing for occupants, reduced energy costs and a more resilient dwelling which would be better able to accommodate changing climatic conditions.[210]

Victorian Trades Hall Council also acknowledged the potential of emissions reduction in buildings:

> substantial decarbonisation opportunities exist in relation to buildings, including committing to 100% low carbon materials in government buildings and infrastructure by 2030 and the electrification of households.[211]

Moreland City Council asserted that investing in energy efficiency in existing buildings is a 'no regrets' measure as it 'reduces demand for heating, reduces bills and improves comfort.'[212] These benefits were echoed by Renew Australia:

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208 Infrastructure Victoria, *Submission 44*, p. 8 (with sources).

209 Ibid.

210 Banyule Clean Energy Group, *Submission 64*, pp. 14–15.

211 Victorian Trades Hall Council, *Submission 81*, p. 8.

212 Moreland City Council, *Submission 57*, p. 4.

By reducing the amount of energy needed to heat and cool homes, potential pressure on the electricity grid is reduced while residents enjoy better health, comfort and lower energy bills.[213]

FINDING 21: Energy consumption in buildings in Victoria accounts for a considerable part of the state's greenhouse gas emissions, partly because of the poor energy performance of its building stock. It is therefore important to improve energy efficiency in buildings to lower Victoria's carbon emissions.

6.4.2 Measures to improve energy efficiency in Victorian buildings

The Committee recognises that the Victorian Government has adopted measures to improve energy efficiency in buildings. In particular, the Government has been running the following programs:

- the Net Zero Carbon Homes pilot program to develop sustainably designed residential homes in Victoria[214]
- the 7 Star Home program (built on the above pilot program) with a view to accelerating the transition to 7-star homes. This is ahead of the likely change of the current 6-star requirement under the National Construction Code.[215]

The Government has subsidised householders to improve home energy efficiency through:

- Solar Home Program to support households to install rooftop Solar PV[216]
- Victoria Energy Upgrade Program to support households to switch to LED light[217]
- offering low-income households with rebates to upgrade gas, electric and wood heaters.[218]

The Government's adoption of Minimum Energy Standards for rental properties was also commended by Australian Parents for Climate Action.[219]

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213 Renew Australia, *Submission 51*, pp. 9–10.

214 Sustainability Victoria, *Zero Net Carbon Homes*, 2022, <https://www.sustainability.vic.gov.au/energy-efficiency-and-reducing-emissions/in-a-business/by-sector/zero-net-carbon-homes> accessed 22 February 2022.

215 Sustainability Victoria, *7 Star Homes Program*, 2022, <https://www.sustainability.vic.gov.au/energy-efficiency-and-reducing-emissions/building-or-renovating/7-star-homes-program> accessed 22 February 2022.

216 Solar Victoria, *Welcome to the Solar Homes Program*, <https://www.solar.vic.gov.au> accessed 21 December 2021.

217 Department of Environment, Land, Water and Planning, *Save Energy and Money: Lighting*, 2022, <https://www.victorianenergysaver.vic.gov.au/save-energy-and-money/victorian-energy-upgrades/save-with-these-energy-efficient-products/lighting> accessed 22 February 2022.

218 Home Heating and Cooling Upgrades, *Home Heating and Cooling Upgrades*, <https://www.heatingupgrades.vic.gov.au> accessed 22 February 2022.

219 Australian Parents for Climate Action, *Submission 42*, p. 3.

Beyond Zero Emissions and Environment Victoria believed that Victorian Government's actions have put Victoria ahead of other states:

> Victoria is ahead of other states since it has already taken a broad approach to improving household and commercial energy efficiency through the Victorian Energy Upgrades program. The program's new targets through to 2025 are a welcome start, as is the revision of emissions factors that will mean the VEU will no longer incentivise gas appliances.[220]

However, other stakeholders to this Inquiry believed that the Government could do more. The suggested expansion of current programs involves:

- upgrading energy efficiency standards for new buildings
- improving energy efficiency in existing buildings
- improving energy efficiency in rental homes
- improving energy efficiency in government buildings.

Upgrading energy efficiency standards for new buildings

To improve energy efficiency in new buildings, one of the key measures that stakeholders highlighted is to upgrade the energy efficiency standards. Moreland City Council referred to the Nationwide House Energy Rating Scheme (NatHERS) and suggested that the Environmentally Sustainable Design (ESD) with a minimum energy performance of 7-star standard of NatTHERS be introduced into the State Planning Policy Framework:

> Introduce a robust ESD Policy for developments into the State Planning Policy Framework, including a minimum energy performance standard of at least 7-star NATHERS equivalent for new dwellings.[221]

Infrastructure Victoria not only supported the requirement of 7-star rating for new homes, but also wanted it to be increased after 2022.[222] It also proposed other measures to ensure energy efficiency standards be followed, including mandating a home energy rating disclosure scheme and strengthening minimum energy efficiency standards for rented homes.[223]

Renew Australia outlined the potential effect of upgrading to 7-star rating:

> Consideration is currently being given to increasing the minimum NatHERS energy efficiency rating of new homes from 6 to 7 Stars. In Melbourne, this improvement in standards would result in a 27% decrease in the amount of energy required to heat and cool new homes. Meanwhile, 7 star rated homes require 78% less energy to heat and cool than a typical 2-star rated older home in Melbourne. This reduction in energy

220 Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 12.

221 Moreland City Council, *Submission 57*, p. 3.

222 Infrastructure Victoria, *Submission 44*, p. 8.

223 Ibid.

> requirements through better thermal efficiency has an important effect of minimising the additional pressure on the electricity grid caused by the electrification of appliances and changed peak consumption patterns associated with distributed energy resources, and should be undertaken alongside gas substitution.[224]

It advocated for higher energy star rating:

> Victoria should support and implement increases in the energy efficiency standards of new homes under the National Construction Code 2022, while continuing to work towards further stringency increases in future NCC iterations in line with the Trajectory for Low Energy Buildings.[225]

The Committee notes that not all stakeholders support increasing the energy efficiency rating of buildings. The Housing Industry Association said that the current standard is already high and efforts to enhance energy efficiency should focus on existing buildings:

> HIA continues to advocate strongly that far greater gains can be had by tackling energy efficiency upgrades for existing housing stock, through programs such as put forward in the Victorian Energy Upgrades program, rather than seeking to further increase standards for new residential building than are already highly efficient 6-star standard homes.[226]

The Association's views were cognisant of housing affordability and supply:

> The residential building industry acknowledges the need to build environmentally responsible housing to the extent that it does not negatively impact on housing affordability and housing supply.[227]

However, Infrastructure Victoria said that delaying action would risk locking new buildings with long-lasting poor energy performance:

> The energy efficiency of homes and buildings can lock in future energy demand, as they are long-lasting and can be difficult to change. More than half of Australia's 2050 building stock will be constructed during the next 30 years, at prevailing energy efficiency standards. The rest may need retrofitting to help prevent escalating energy costs and demand. Improving the energy efficiency of Victorian homes and workplaces reduces the energy needed to heat and cool them.[228]

Further, it pointed out that the upgrade to 7-star rating system is underway at the national level:

> New national residential building standards, including minimum energy efficiency standards are due for adoption in 2022. Victoria is working actively with other

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224 Renew Australia, *Submission 51*, pp. 9–10.

225 Ibid.

226 Housing Industry Association, *Submission 26*, pp. 2–3.

227 Ibid., p. 2.

228 Infrastructure Victoria, *Submission 44*, p. 8.

jurisdictions, with options being considered for this standard informed by the *Trajectory for Low Energy Buildings* agreed by the former COAG Energy Council in 2019, including:

- raising the minimum requirement for thermal performance of new homes to the equivalent of 7 stars achieve a level of thermal comfort equivalent to 7 stars; and
- introducing a new 'whole-of-house' approach to manage energy used for heating and cooling, hot water systems, lighting and pumps for pools and spas, which could involve on-site renewable energy.[229]

Banyule Clean Energy Group supported Infrastructure Victoria's position and advocated for more rigorous standard of energy performance in buildings:

> With the NCC being updated every three years, it would not be a big step for Victoria to start advocating for a minimum 8 star 'whole of house' minimum requirement in 2025.
>
> In the meantime, the Government should introduce incentives for 'all-electric' or 'no-gas' developments within ESD policy, such as rate rebates for 8-star energy efficient new buildings or retrofits.[230]

The Committee supports the early adoption of an energy star rating higher than the current 6-star standard, as this reflects the trend toward energy efficiency and will assist in avoiding retrofitting costs in the future.

FINDING 22: Ensuring Victoria's new buildings are up to date with high energy efficiency requirements is necessary to avoid poor energy performance in the future. Upgrading the current energy star rating of new buildings is a measure to achieve this. This also prepares the Victorian building industry for the new requirements under the National Construction Code, which is in the process of being updated.

RECOMMENDATION 29: That the Victorian Government update the State Planning Policy Framework to integrate the 7-star standard of the Nationwide House Energy Rating Scheme into its requirement for Environmentally Sustainable Design of new buildings.

RECOMMENDATION 30: That, if the Victorian Government integrates the 7-star standard of the Nationwide House Energy Rating, it should have incentives to encourage developers to apply the higher energy efficiency standard.

A number of stakeholders emphasised the importance of design in improving the energy performance of buildings. Banyule Clean Energy Group said that 'Environmentally Sustainable Design (ESD) guidelines can help improve design and performance outcomes.'[231] The Sustainable Agriculture and Communities Alliance

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229 Banyule Clean Energy Group, *Submission 64*, p. 16 (with sources).

230 Ibid., p. 17.

231 Ibid., pp. 14–15.

also said 'Legislation on both ergonomic design and prohibitions against new gas appliances for new homes would help those wishing to purchase energy saving homes.'[232] A stakeholder mentioned the colour of house roofs as a small but effective step to improve energy efficiency in buildings:

> It has been reported that the NSW government will move to ban dark roofs as part of its push to deliver more sustainable housing and reach its target of net zero emissions by 2050 (Davies and Visiontay 2021). Research by the University of NSW found a light-coloured roof could reduce temperatures inside the home by up to 10 degrees during a heatwave.
>
> This simple move could reduce electricity demand and emissions associated with summer cooling, and should be considered in Victoria.[233]

Under the current Nationwide House Energy Rating Scheme (NatHERS), buildings are rated based on the energy efficiency of their design. Factors being considered include the roof, walls, floor, windows, the orientation and the type of glazing.[234] These design-related criteria need to be upgraded with the upgrading of the current NatHERS to improve energy performance in buildings.

Regarding support, the Housing Industry Association referred to the government funded subsidies for existing houses to put in solar panels or energy efficient lighting. They argued that these subsidies should also be applied to new buildings to encourage builders to install energy efficient items and solar panels:

> There are a number of Federal and State Government rebate schemes focused on energy conservation, being solar hot water, photovoltaic systems (PV) and some recent ones for installation of battery storage systems.
>
> There are also a number of current state rebate schemes focused primarily on water conservation and replacement of high energy using appliances and things like televisions, lighting and fridges.
>
> HIA would like to see these rebates being provided for new construction as this would provide an incentive for the building industry to promote the installation of renewable energy sources.[235]

The Committee considers that new buildings developed by the housing industry contribute significantly to Victoria's housing stock and improving their energy efficiency is essential.

RECOMMENDATION 31: That the Victorian Government consider appropriate incentives to encourage home builders to adopt best energy efficiency practices and introduce necessary measures to ensure that the impact of incentives flows on to home buyers.

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232 Sustainable Agriculture and Communities Alliance, *Submission 73*, p. 3.

233 Neil Andrews, *Submission 45*, p. 19.

234 Victorian Building Authority, *Energy efficiency requirements*, 2022, <https://www.vba.vic.gov.au/consumers/home-renovation-essentials/energy-efficient-requirements> accessed 4 April 2022.

235 Housing Industry Association, *Submission 26*, p. 2.

Improving energy efficiency in existing buildings

The Committee heard several suggestions to improve energy efficiency in existing buildings, including auditing their energy performance, providing support for retrofitting and an education campaign on the importance of energy efficiency improvement.

Ms Leonard made the case for a state-wide audit on the basis that it would inform the state of the required action to pursue efficiency in existing buildings:

> A statewide audit of buildings – residential, commercial and publicly owned – will identify where the best gains can be made and allow the government to map a pathway to the highest standard of thermal and appliance efficiency in industrial, commercial, residential and public applications.[236]

For existing buildings, the Committee also heard that they should be retrofitted with energy efficiency measures. The Community and Public Sector Union's (CPSU) submission mentioned the Intergovernmental Panel on Climate Change's finding on how retrofitting helps existing buildings lower carbon emissions:

> The Intergovernmental Panel on Climate Change has found that retrofitting existing stock and replacing energy-using equipment would realise the largest portion of carbon savings by 2030–36.[237]

Banyule Clean Energy Group told the Committee that 'These retrofit opportunities include improving insulation and sealing up cracks and gaps around houses.' [238]

Stakeholders are aware that the efficiency rates of Victorian buildings vary and some buildings get as low as the 2 star-rated level. Beyond Zero Emissions and Environment Victoria suggested that insulating and weatherproofing would improve these buildings:

> Another easy and affordable action is to insulate and weatherproof 1.5 million 2-star rated homes in five years. Victorian homes are cold, unsealed and costly to heat, but this can be easily fixed. We recommend a comfortable homes program to rapidly improve the thermal performance of Victorian homes. Comfortable homes, better health, lower bills, and lower demand for gas and electricity.[239]

Stakeholders also believed that to incentivise energy efficiency upgrades in existing homes, the Government needs to extend its current program and provide further support. Yarra Climate Action Now called for support which covers broader items and with a focus on people and areas of lower socio-economic status:

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236 Freja Leonard, *Submission 75*, p. 4.

237 Community and Public Sector Union (CPSU), Victorian Branch, *Submission 59*, p. 17.

238 Banyule Clean Energy Group, *Submission 64*, pp. 14–15.

239 Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 12.

> Broader support for efficient, electric homes: information and subsidies for insulation, weather proofing and double glazing, and to replace gas with efficient electric appliances - with a focus on people and areas of lower socio-economic status.[240]

Friends of the Earth suggested expanding the Solar Homes program to every home in the state, with policies bolstered so that it can reach 'low-income housing and rental properties.'[241] It also recommended that the Government 'Consider subsidy schemes for low cost, high benefit repairs/upgrades to existing homes such as draft-proofing'.[242] Similarly, Australian Parents for Climate Change recommended that 'The Victorian Government provides financial support to households to purchase energy efficient appliances and features for the home (e.g. energy-efficient light bulbs, insulation for houses).[243] While Freja Leonard, a submitter, called for subsidies and zero interest loan programs, which are to be customised to fit the needs of different actors:

> This, coupled with a program to assist efficiency upgrades to under-resourced small businesses and households through subsidies or zero interest loans alongside incentives for larger corporate interests will ensure that we know how much energy we need to supply the state.[244]

Beyond Zero Emissions and Environment Victoria welcomed the Victorian Energy Upgrades program, but suggested that to maximise its effectiveness it should become compulsory for large energy consumers:

> to be maximally effective, the program should become compulsory for the largest consumers of energy, much like the Environment and Resource Efficiency Plans Program that was administered by the EPA until its early sunsetting in 2013. A key element was mandatory implementation of efficiency measures that have a payback period of three years or less. An interim review of the program found that many facilities would not have implemented any efficiency measures were it not for the assistance of the EPA through the program.[245]

The Committee considers there are a number of options to upgrade the energy performance in existing buildings, including insulation, weather proofing, double glazing, and draught proofing. In the Committee's view, the Government can support Victorians to access these options by providing guidance and subsidies to low-income households. The Committee acknowledges that the Victorian Government has a number of programs in place to incentivise the upgrade of energy efficiency in buildings in Victoria. Their expansion to cover more upgrading activities, with a strong focus on low-income households will significantly raise the energy efficiency of existing buildings in Victoria.

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240 Yarra Climate Action Now, *Submission 33*, p. 1.

241 Friends of the Earth, *Submission 85*, p. 6.

242 Animal Justice Party, *Submission 87*, p. 22 (with sources).

243 School Strike for Climate, *Submission 67*, p. 4.

244 Freja Leonard, *Submission 75*, p. 4.

245 Beyond Zero Emissions and Environment Victoria, *Submission 84*, p. 12.

In addition to providing financial support, stakeholders also emphasised the role of education in getting Victorians to understand the importance of improving energy efficiency in their homes, how to do it and what support is available to them. School Strike for Climate said that 'Education of consumers and businesses is critical so that they know they can access cheaper, cleaner energy, but also so that they can reduce their own consumption.'[246] So besides financial support, it recommended 'The Victorian Government provides information and education to households and businesses on how to reduce consumption of energy.'[247]

RECOMMENDATION 32: That the Victorian Government consider expanding current home energy efficiency-related programs (Solar Homes, Victoria Energy Upgrades) to cover energy efficiency improvement practices such as insulating, weather proofing, double glazing and replacing gas with efficient, electric appliances, and focusing on low-income households.

Improving energy efficiency in rental homes

Rental homes accommodated 28.7% of Victorian households (according to the 2016 Census), so enhancing energy efficiency in this sector is essential. Renew Australia pointed out the key driver of poor energy performance in rental homes:

> Rental homes are, on average, less energy efficient than owner-occupied homes. A significant driver of poor rental energy performance is the 'split incentive' problem, in which energy bills are paid by renters while energy efficiency upgrades are paid for by landlords. In practice, many landlords do not choose to pay the upfront costs of energy efficiency upgrades, the replacement of fixed appliances or the installation of solar.[248]

To avoid the problem of 'split incentive' with rental homes, Renew Australia suggested that:

> Specific strategies are required to ensure that renters are not left behind in the energy system transition. These include the continued strengthening of minimum rental standards to include energy measures such as insulation, efficient hot water, and increased efficiency levels of heat pump heating and cooling; these regulations should ensure that the replacement of fixed appliances is consistent with the goal of residential gas substitution. Further measures including rebates for efficient appliances and solar should be maintained and extended.[249]

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246 School Strike for Climate, *Submission 67*, p. 3.

247 Ibid., p. 4.

248 Renew Australia, *Submission 51*, p. 10.

249 Ibid., p. 11.

Improving energy efficiency in government buildings

Government buildings account for a large portion of building stock in Victoria. In its submission, the CPSU suggested that the Government should retrofit their buildings with energy efficiency measures:

> the Government has a responsibility to ensure they use as little energy as possible. Reducing energy used in Government owned buildings is critical to reach net zero emissions by 2050. The Government should ensure all Government owned and leased buildings are audited and retrofitted for maximum energy efficiency. Where Government agencies rent their premise or the premises are public-private partnerships, an agreement to audit and retrofit the building must be established with the owner. Finally, where the Government is proposing to commission new buildings, tender documents must factor a net zero emissions commitment into the build price and must include the requirement for a 6-star energy efficiency rating[250]

Infrastructure Victoria also pointed out that current energy performance in government buildings is inefficient and raising their energy efficiency is important for Victoria to lower its carbon emissions:

> The Victorian Government owns or leases many buildings. Past programs and targets have produced limited results in reducing energy use. Victorian Government buildings used the same amount of energy in 2019–20 as 10 years earlier.[251]
>
> ...
>
> Energy efficiency upgrades and renewable energy at the National Gallery of Victoria, regional health services, primary and secondary schools, and public transport facilities is creating $1.7 million of savings annually on energy bills and abating 9,805 tonnes of greenhouse gas emissions. By taking action, the Victorian Government can demonstrate leadership for the commercial sector, while also providing visibility of benefits to the many people who use or visit government buildings.[252]

Infrastructure Victoria did recognise the Government's efforts to upgrade the energy efficiency in its buildings:

> The Victorian Government has committed to achieving a minimum 5-star energy efficiency rating from 2021 and a 6-star rating from 2025 for new government buildings. It is also continuing the Greener Government Buildings program, which had a 2020 target to reduce government office emissions by 30% below 2015 levels.[253]

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250 Community and Public Sector Union (CPSU), *Submission 59*, p. 17.

251 Infrastructure Victoria, *Submission 44*, p. 10.

252 Ibid., p. 10 (with sources).

253 Ibid.

The Committee acknowledges that the Government is working to improve the energy efficiency in its buildings. Notably, the Government has introduced the Greener Government Buildings program in Victoria's *Climate Change Strategy*, which states that:

> From 2021, all new Victorian Government buildings will have embedded environmentally sustainable design with a minimum 5-Star energy performance rating to apply to new office buildings and tenancy fit-outs. This will be increased to 6-Star – the highest rating for office buildings, in 2025. Government leases will also preference higher rated buildings and those with Green Lease Schedules.[254]

In Victoria's *Climate Change Strategy*, the Government also committed to invest $60 million in the Greener Government Buildings program, adding to the $280 million invested since 2009.[255]

Infrastructure Victoria suggested the Victorian Government continue its energy efficiency upgrades in its buildings to create savings and reduce emissions:

> The Victorian Government should continue to generate energy efficiency savings in its existing buildings through energy efficiency upgrades. This would reduce emissions and building running costs, improve climate resilience of public buildings, and avoid extra energy infrastructure investment.[256]

FINDING 23: Improving the energy performance of government buildings is important to show the Government can lead the way in energy efficiency. The Victorian Government is working actively on this through the Greener Government Buildings program.

6.5 Reducing carbon emissions from the agriculture sector

DELWP said that the agriculture sector has the fourth largest share of total emissions in Victoria with 17%. Of this proportion, 70% of the emissions are methane from livestock. The remaining are from fertiliser use and manure management. According to DELWP, the sector can embrace low-emissions technology and management practices that reduce methane emissions.[257]

The Young Animal Justice Party (YAJP) told the Committee how it believes animal agriculture industry increases greenhouse gas emissions:

> Australia has witnessed the devastating consequences of the animal agriculture industry for decades. The industry contributes more than 13% of greenhouse gas emissions each year, which is often a hidden, underreported reality. Approximately half of the

254 Department of Environment, Land, Water and Planning, *Victoria's Climate Change Strategy,* May 2021, p. 22.

255 Ibid.

256 Infrastructure Victoria, *Submission 44*, p. 10 (with sources).

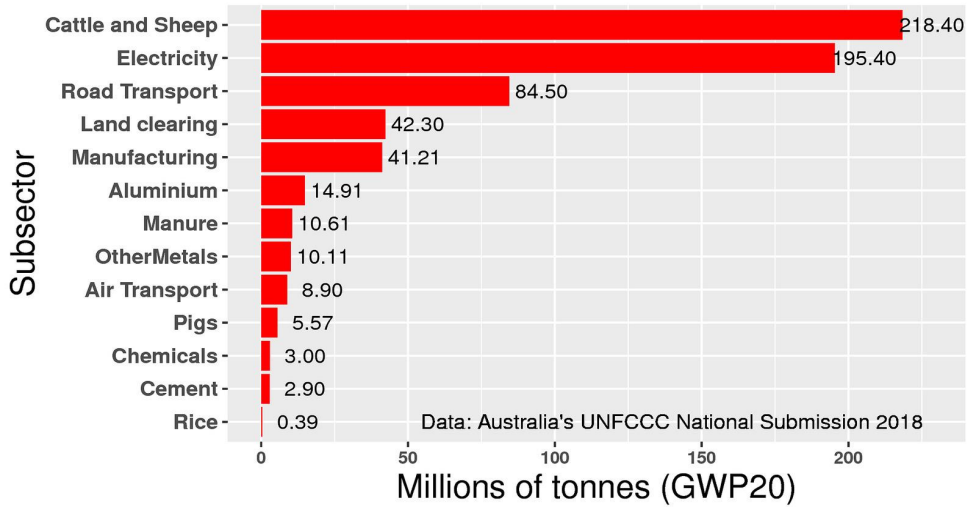
257 Department of Environment, Land, Water and Planning, *Cutting Victoria's emissions 2021–2025: Agriculture sector emissions reduction pledge*, May 2021, p. 2.

agricultural sector's emissions is methane from cows and other "livestock", due to the fermentation of plant matter in their stomachs. Other forms of agriculture emissions also include fertiliser and animal waste.

Another source of agriculture emissions is through land clearing. Pastures and grazing land require thousands of acres to be dedicated to animals killed for meat and dairy consumption, contributing to high emissions. Because of this, Australia is routinely identified as a global hotspot for land clearing at rates never seen in several countries around the world. Land clearing in Australia for agricultural purposes has caused 115 million tonnes of greenhouse gases to be released into the atmosphere per year, in comparison to fossil fuels' 400 million tonnes per year.[258]

In the long term, the Animal Justice Party estimated that sheep and cattle will be responsible for more warming over the next 20 years than all fossil-fuelled power stations, as shown in Figure 6.9.

Figure 6.9 The relative climate impact of major sectors over the next 20 years in Australia



Source: The Animal Justice Party, *Submission 87*, p. 20.

To reduce emissions in the agriculture sector, YAJP proposed to 'Reduce land clearing for animal agriculture-related business, instead promoting biodiversity, rebuilding of forestry, vegetation and other land restoration practises.' [259] It also asked to 'Educate all relevant stakeholders to adopt a plant-based diet and include information regarding the impact of animal agriculture on emissions and the environment.'[260] The Animal Justice Party echoed this in suggesting changes to dietary regimes:

Historically, much of Victoria was cleared for grazing and cropping. Shifting to plant-based diets can allow large areas of forest to regrow. This is doubly valuable. First there is a reduction in methane that could help Australia match or exceed the

258 Young Animal Justice Party, *Submission 77*, p. 25 (with sources).

259 Young Animal Justice Party, *Submission 77*, p. 27.

260 Ibid.

30 percent methane reduction embodied in the EU and US initiated Global Methane Pledge. Second, the consequent forest regrowth would help roll back 200 years of biodiversity losses in addition to sequestering carbon.[261]

ClimateWorks also suggested opportunities to reduce emissions in agriculture, including:

- Sustainable agriculture practices
- Precision agriculture
- Supporting novel alternative protein production and consumption
- Supporting research, development and deployment of anti-methane solutions such as vaccines and algae feeds. [262]

The Committee notes that the Australian agricultural sector has made significant commitments to reduce carbon emissions, for example, the Australian red meat and livestock industry has set the ambitious target to be Carbon Neutral by 2030 (CN30).[263]

FINDING 24: The Committee acknowledges that the Victorian Government is aware of the opportunity to reduce emissions in the agricultural sector. In addition, the Victorian Government has invested in livestock feed that inhibits methane emissions. It has also committed to support farmers with information to help them understand the emissions profile of their operation and technology and practices to reduce emissions on-farm.

6.6 Introducing renewable energy in areas other than electricity generation

Transitioning electricity generation to renewable energy, coupled with electrifying sectors such as transport, household cooking and heating is currently the key strategy in abating greenhouse gas emissions. However, in addition to that, there are areas which present themselves as hard-to-abate carbon emissions such as heavy industry, aviation, shipping, and long-haul transport. Introducing renewable energy in these areas provides opportunities to further reduce carbon emissions in Victoria. This Section discusses this potential by looking at the prospect that hydrogen, biogas and geothermal can bring when being introduced into these areas.

6.6.1 Hydrogen and biogas as an alternative to liquid fuels

Infrastructure Victoria confirmed the potential of hydrogen and biogas, saying that 'the capacity to use hydrogen either as a replacement for some of the energy demand

261 Animal Justice Party, *Submission 87*, p. 19 (with sources).

262 Climateworks Australia, *Submission 43*, p. 9.

263 Meat and Livestock Australia, *Carbon Neutral 2030: CN30 overview*, 2021, <https://www.mla.com.au/research-and-development/Environment-sustainability/carbon-neutral-2030-rd/cn30> accessed 10 May 2021.

for natural gas or in vehicles as well, particularly heavier vehicles, is quite promising'[264], and that 'Biogas is methane, so it is chemically like natural gas, and that means that it has the advantage of being compatible with existing pipelines that we use for natural gas and appliances and so forth. So that has got some promise.' [265]

Hydrogen and biogas are mostly suggested for industrial processes and transport. Aurecon saw hydrogen and biogas as a viable replacement for gas in industry. It said that 'Developments in clean hydrogen and biogas represent an alternative to electrification, particularly for hard-to-abate sectors such as heavy industry.'[266] It pointed out the prospect of scaling up hydrogen projects in Victoria:

> Victoria's distribution networks consume more gas than any other Australian network and provide a unique opportunity for hydrogen projects to scale-up as technology and processes mature. Smaller blends, such as 10 per cent hydrogen, by volume, present less of a technical challenge and provide a starting point for larger-scale blending or dedicated hydrogen precincts as have been trialled in other parts of the world.[267]

It believed that biogas can contribute similarly, but on a smaller scale:

> Contributions from biogas can also substitute a portion of existing gas consumption although the large volumes of gas required suggest that hydrogen and electrification need to be considered in parallel.[268]

Aurecon also told the Committee that hydrogen and biogas represents opportunities for collaboration and requirements for coordination, which include:

- across sectors such as energy, water, waste.
- across energy user groups such as residential, commercial, industrial and transport.
- across segments of the energy value chain such as upstream / production, transformation and transportation infrastructure, and downstream energy users.[269]

The Australian Energy Council told the Committee that some industrial processes require highly intensive heat sources. In these cases, hydrogen is more suitable than electricity as a replacement for gas:

> we see the role of heat pump type technology as being extremely useful for carbon reduction in terms of low-intensity heat sources. So whenever you have got a temperature requirement below about 60 degrees, heat pump is all over gas I am afraid at the moment. But the sorts of uses that you are referring to relate to the production of steam, which does require temperatures in excess of 100 degrees. Whilst electricity can do that, at this moment it is not economic to do it. We see that as being more or

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264 Dr Jonathan Spear, *Transcript of evidence*, p. 4.

265 Ibid., p. 6.

266 Aurecon, *Submission 79*, p. 12.

267 Ibid.

268 Ibid., p. 13.

269 Ibid.

> less a post-2035 type of journey, and it could well be that that is going to be the place in future for a renewable hydrogen to participate.[270]

To pursue the target of lower carbon emissions, Ms Leonard told the Committee that hydrogen used for reducing emissions purpose 'must be fossil free.'[271] This is in line with Infrastructure Victoria's classification of hydrogen, brown, blue and green. Of these, only green hydrogen is renewable.[272] Ms Leonard also believed that hydrogen should not be deployed widely, proposing that the use of hydrogen be 'reserved for only those industries where there is no other reliable alternative energy source.'[273]

Lighter Footprints similarly refuted the role of brown and blue hydrogen in emission reduction schemes:

> We believe that investment in brown hydrogen (from fossil fuels) and grey or blue hydrogen (fossil fuels with carbon capture storage) is a retro-grade step. Brown hydrogen is emissions intensive. Grey and blue hydrogen is economically more expensive to build and operate than green hydrogen. Price Waterhouse (PwC as above) forecast that green hydrogen will be cheaper than both brown and grey hydrogen by 2030 and, given the headwinds of some explicit or implicit 'carbon price' and the ability to manufacture green hydrogen close to the end user industry without the need for gas network costs, institutional investors will cease financing brown and grey hydrogen capex projects 3 to 5 years before 2030. [274]

Aurecon agreed on the role of green hydrogen and biogas in replacing gas. However, it pointed out that at present, the possibility of commercialising green hydrogen and biogas still faces barriers 'due to their immaturity and smaller scale, relative to the incumbent fossil fuel supply chain.' [275] In addition, there are number of challenges when replacing gas in industry with hydrogen and biogas, which Aurecon identified as technical, commercial, and regulatory:

- Technical challenges – network engineering (calorific density, injection / blending configuration); materials compatibility such as steel embrittlement; appliance engineering (ensuring residential, commercial and industrial appliances are configured to receive smaller blends or eventually switched out for higher blends or pure hydrogen).
- Commercial challenges – competitiveness against large-scale, incumbent fuel sources, and minimising impacts to the cost of energy.
- Regulatory challenges – development of standards and specifications to ensure safety and reliability.[276]

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270 Ben Skinner, General Manager Policy and Research, Australian Energy Council, public hearing, Melbourne, 16 March 2022, *Transcript of evidence*, p. 16.

271 Freja Leonard, *Submission 75*, p. 5.

272 See Chapter 2 on the definition of hydrogen.

273 Freja Leonard, *Submission 75*, p. 5.

274 Lighter Footprints, *Submission 76*, p. 12 (with sources).

275 Aurecon, *Submission 79*, p. 13.

276 Ibid., p. 12.

Therefore, in order to replace industrial gas use with green hydrogen and biogas, Aurecon said that it is necessary to conduct a complete investigation 'to assess whether this is the optimum decarbonisation pathway and to understand how key challenges can be resolved'.[277]

With respect to commercialising hydrogen and biogas, Aurecon highlighted the role of the Government:

> The Victorian government can play a role to support renewable gas projects while the technology develops from pilot to semi-commercial phases, and then hopefully to market competitiveness.[278]

It also identified what the Government can do to facilitate the deployment of hydrogen and biogas:

> Fostering an emerging energy source creates a need for centralised leadership and planning to bring a variety of stakeholders together and create integrated supply chains (particularly to avoid 'chicken and egg' standoffs when prospective stakeholders are interdependent). Mechanisms that favour low carbon energy could include further subsidies, targets and grants which help to provide investment signals for clean hydrogen and biogas proponents.[279]

6.6.2 Geothermal for heating

Geothermal sources have been detected in Victoria. One of the noticeable sources is in the Latrobe Valley, where natural hot water of 65°C is found at 650 m depth, which is relatively shallow compared to natural aquifers around the world.[280] This source of geothermal, if being used for energy-dependent purposes such as heating, will be another alternative to fossil fuel combustion, thus contributing to emission reduction. Latrobe City Council presented this opportunity in its submission:

> Victoria's heavy reliance on natural gas for heat also presents a huge challenge for the state to meet its legislated greenhouse gas emission reduction targets of 28–33% by 2025, 45–50% by 2030, and net zero emissions by 2050. Producing geothermal energy from hot aquifers can help on both fronts, by avoiding greenhouse gas emissions and by reemploying skilled workers into new industries.[281]

The Committee considers that there is opportunity for Victoria to use geothermal as another renewable source for heating. This opportunity should be further investigated to provide another zero emissions option for heating to contribute to the carbon emissions reduction targets.

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277 Ibid.

278 Ibid., p. 13.

279 Ibid.

280 Latrobe City Council, *Submission 14*, p. 5.

281 Ibid., p. 6.

6.7 Carbon Capture and Storage

Carbon Capture and Storage (CCS) has been promoted as an important solution in lowering carbon emissions, as it helps capture and store carbon emissions without contributing to global warming.

The Victorian Government defines CCS as follows:

> CCS is a suite of technologies that capture and permanently store large quantities of CO2 from a range of sources and industries, preventing the CO2 from contributing to global warming. It involves three major steps: capturing CO2 at the source, compressing it for transport and then storing it deep into a geological formation where it will stay permanently.[282]

Some stakeholders discussed CCS as a way of lowering carbon emissions. The Australian Energy Council believed carbon sequestration is important to pursue zero carbon electric sector:

> a more sensible goal is a net zero emissions power sector, which will include some fossil-fuel as a back-up supply to renewables, whose emissions can be readily offset with carbon sequestration.[283]

Daryl Scherger, a submitter, proposed to use carbon sequestration to offset residual carbon emissions so that the agriculture sector is not compromised:

> The majority of residual CO2 emissions for the state would then be from agricultural. If farmers are forced to reduce emissions it would place additional pressure on the industry when it will be struggling to feed Victoria's population in the face of a hotter and dryer climate.[284]

Mr Scherger also mentioned the role of Victorian forest as another mechanism of carbon sequestration:

> The suggested alternative is to use active (multiple use) management of the state's forests to maximize carbon sequestration and produce long life timber products (housing materials and furniture). Active management of Victoria's forests will be needed anyway to maintain forest health in the face of reduced rainfall and more frequent severe bushfires. Incorporating low impact timber harvesting in the management of all the state's native forests would offset the cost of active management and maximize carbon sequestration.[285]

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282 Georgina Jerums, *The Victorian Connection: Carbon Capture explained*, 2022, <https://connection.vic.gov.au/carbon-capture-explainer> accessed 31 March 2022.

283 Australian Energy Council, *Submission 63*, p. 6.

284 Daryl Scherger, *Submission 69*, p. 6.

285 Ibid.

APPEA believed that CCS is a solution to maintain the use of natural gas:

> Carbon capture and storage is probably one of the most positive options available for large-scale decarbonisation of gas use, whether it be in gas-fired power generation or the use of gas in industrial processes.[286]

APPEA said that CCS is not new and has been rolling out in Australia:

> I think it is very important to understand that carbon capture and storage is not a new technology or technique. It has been done in Australia for more than 40 years. It has been done around the world for more than 60 years. There are currently about 110 carbon capture and storage programs operating or in construction around the world, which will account for about 135 million tonnes of carbon captured every year. Here in Australia we do have the world's largest carbon capture program in Western Australia at Gorgon. Santos, another APPEA member, has just announced a commitment to build the world's largest carbon capture facility in the Cooper Basin. So, yes, it is. It is really a question of geology, actually; it is not technology. It is finding the basins that are geographically proximate, if you like, in order to secure the carbon. The actual science behind it, the process of carbon capture, is very, very straightforward, and it will provide probably the single greatest decarbonisation pathway for natural gas use as we go forward.[287]

According to APPEA, this technology not only helps capture the fugitive emission from gas use, but is also a good source of hydrogen. It said that 'the most economic pathway to hydrogen at the moment would be hydrogen from natural gas using carbon capture and storage.'[288] It flagged the prospect that:

> Australia will have a significant opportunity to be a major hydrogen producer, and the most economic and efficient means of producing hydrogen at least for the foreseeable future will be hydrogen from natural gas.[289]

Support for CCS was not universal, however. Lighter Footprints told the Committee:

> With respect to CCS (carbon capture storage), we note it is possible but very expensive. For example the capital costs are more than double, and the operational costs are almost double for CCS gas or coal plants. CSIRO's GenCost Final Report 2020–2 (Graham, P et. al., 2021) compares CCS very un-favourably with firmed renewables in the stationary energy sector. CCS is not practical for gas emissions capture in households.[290]

Lighter Footprints asserted that the costs make this solution impractical:

> We note that KPMG have modelled carbon capture storage (CCS) costs as +50% additional capex for grey hydrogen versus brown hydrogen and opex costs are 15 to 20% higher for grey hydrogen versus brown hydrogen.[291]

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286 Andrew McConville, *Transcript of evidence*, p. 26.

287 Ibid.

288 Ibid., p. 29.

289 Ibid.

290 Lighter Footprints, *Submission 76*, p. 11 (with sources).

291 Ibid., p. 12.

On Carbon Capture and Storage, the Victorian Government regarded it as having great potential to help reduce emissions. DELWP said in its submission that:

> The government has also made significant investments into Carbon Capture and Storage (CCS) that can support emissions reduction action across multiple sectors and is a critical enabler for decarbonising industry and for new industries such as clean hydrogen and fertiliser production. CCS also creates the potential for negative emissions through Direct Air Capture and biomass.

The Government is rolling out CarbonNet project to deploy this technology in Victoria:

> The Victorian Government's CarbonNet project is establishing a commercial-scale carbon capture and storage (CCS) network hub in Gippsland, using world class offshore storage sites in Bass Strait. CarbonNet provides an opportunity to support the development of a hydrogen supply chain, secure jobs, create new employment, boost skills and attract investment in new industries, while strengthening Victoria's energy security and climate change leadership. The Victorian Government will continue to advance the CarbonNet project towards a Final Investment Decision by end of 2024.[292]

Adopted by the Legislative Council Environment and Planning Committee
Parliament of Victoria, East Melbourne
9 May 2022

292 Department of Environment, Land, Water and Planning, *Submission 88*, pp. 9–10 (with sources).

Appendix A
About the Inquiry

A.1 Submissions

1	Ian Campbell
2	Energy and Grid Alliance
3	Tom de Graaff
4	Heidi Johnson
5	Brendan Toohey
6	Fiona Maskell
7	Australian Conservation Foundation (ACF)
8	Paul Lewis
9	Hamish Cumming
10	Andrew Macmeikan
11	Viva-Lyn Lenehan
12	Philip Quinn
13	Gerald Conroy
14	Latrobe City Council
15	Andrew Blakers
16	Joy Howley
17	Maree Avery
18	City of Melbourne
19	Erin Sear
20	Ben Schembri
21	Geoffrey Fenn
22	Ian Russell
23	Jocelyn Gray
24	Philippa Harrison
25	Jacques Miller
26	Housing Industry Association
27	Bronwyn Spark
28	Bart Wissink
29	Meredith Kefford
30	Doctors for the Environment
31	Benjamin Cronshaw
32	Yarra Climate Action Now
33	Clare Morrissey
34	Janet Chimonyo
35	Alan Pears AM
36	Nooramunga Coastal Communities
37	Flow Power
38	Sally Clarke
39	Graeme James
40	Daisy Norfolk
41	Tesla Energy
42	Australian Parents for Climate Action
43	ClimateWorks Australia
44	Infrastructure Victoria
45	Name Withheld
46	Margaret Phillips
47	Tesla Owners Club of Australia
48	Rosemary Lyne
49	Victorian Farmers Federation
50	Coalition for Community Energy
51	Renew Australia
52	Snowy Hydro
53	Jim Crosthwaite
54	City Power, Powercor and United Energy
55	Northern Alliance for Greenhouse Action
56	Australian Conservation Foundation Community Geelong
57	Moreland City Council
58	Peter Moraitis
59	Community and Public Sector Union (CPSU) Victoria

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60	Marinus Link, TasNetworks
61	Moyne Shire Council
62	Hydro Tasmania
63	Australian Energy Council
64	Banyule Clean Energy Group
65	Powerledger
66	Liron Lightwood
67	School Strike for Climate
68	RMIT Business & Human Rights Centre
69	Daryl Scherger
70	Transurban
71	RE-Alliance
72	Australian Energy Market Operator
73	Sustainable Agriculture & Communities Alliance
74	ANU 100% Renewables Group
75	Freja Leonard
76	Lighter Footprints
77	Young Animal Justice Party
78	Jill Kaufman
79	Aurecon
80	Clean Energy Council
81	Victorian Trades Hall Council
82	Brotherhood of St Laurence
83	Voices of the Valley
84	Environment Victoria and Beyond Zero Emissions
85	Friends of the Earth
86	Star of the South
87	Animal Justice Party
88	Department of Environment, Land, Water and Planning
89	Rachel Mason
90	Hugh Venables

A.2 Public hearings

Wednesday 16 March 2022

via videoconference

Name	Title	Organisation
Jonathan Spear	Chief Executive Officer	Infrastructure Victoria
Lorraine Conway	Senior Adviser	Infrastructure Victoria
Ben Skinner	General Manager, Policy and Research	Australian Energy Council
Peter Brook	Wholesale Policy Manager	Australian Energy Council
Andrew McConville	Chief Executive Officer	Australian Petroleum Production and Exploration Association
Ashley Wells	Director Government Relations	Australian Petroleum Production and Exploration Association
Kane Thornton	Chief Executive Officer	Clean Energy Council
Arron Wood	Industry Development Manager	Clean Energy Council

Thursday 17 March 2022

via videoconference

Name	Title	Organisation
Professor Andrew Blakers		Institute for Climate, Energy & Disaster Solutions Australian National University
Dr Saul Griffith		Rewiring Australia
Dr Dylan McConnell	Research Fellow, University of Melbourne	Energy Transition Hub
Dr Kelvin Say	Research Fellow, University of Melbourne	Energy Transition Hub
Greg Foyster	Acting Campaigns Manager	Environment Victoria
Paul Beaton	Senior Energy Policy Analyst	Environment Victoria
Erin Coldham	Chief Development Officer	Star of the South
Professor Bruce Mountain	Director	Victoria Energy Policy Centre
Tony Goodfellow	Victoria/Tasmania Coordinator	RE-Alliance

Extracts of proceedings

Dr Ratnam moved, that the words 'natural gas' be replaced by the words 'fossil gas' throughout the report.

The Committee Divided.

The question was put.

Ayes	Noes
Dr Ratnam	Ms Terpstra
Mr Hayes	Mr Melhem
Mr Meddick	Ms Watt
	Ms Bath
	Dr Bach

The question was negatived.

Ms Bath moved, that at line 371 the following words be inserted:

The Victorian Parliament's Economy and Infrastructure Committee – Inquiry into the Closure of Hazelwood and Yallourn Power Stations, heard evidence that a closure date by 2032 is unlikely.

The closure window announced for Loy Yang A is 2040–2045.

> I think 2032, in my opinion, is too soon to have that orderly transition. They will become jeopardised, the three key areas, as we decarbonise: affordability, sustainability and the most important, security of supply.
>
> Mr Steve Rieniets, Group General Manager, Operations, AGL Loy Yang.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 448 the words ‘carbon free’ be removed.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 448 the words ‘its energy future.’ is deleted and replaced by the words ‘Both the Victorian and Commonwealth Government have set an agenda to establish regulatory structures and investment pathways needed to build a secure energy future’.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that that after line 461 the following words be inserted:

Two key assets that Victoria requires:

- ‘low cost electricity’, a critical success factor for domestic manufacturing and,
- Installed manufacturing for renewable energy components such as solar and wind generation.

Victoria is largely reliant on imported components.

Currently, only 11% of the clean energy supply chain is manufactured in Australia.

Table 2: Employment in manufacturing, construction and operation of renewable energy[1]

Energy source	Manufacturing Overseas (Job-Year/MW)	Manufacturing Australia (Job-Year/MW)	Construction (Job-Year/MW)	Operation & Maintenance (Job-Year/MW)	Manufacturing in Australia (%)
Wind	1.3	0.4	2.8	0.2	24%
Utility Solar	4.3	0.1	2.3	0.1	2%
Rooftop PV Solar	4.2	0.2	5.8	0.2	5%
Utility batteries	6.3	0.3	4.7	1.2	5%
Distributed batteries	6.3	0.3	5.6	0.3	5%
Hydro	2.8	0.7	7.4	0.1	20%
Pumped Hydro	2.8	0.7	11.1	0.2	20%
Mean					**11%**

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 468 the following words be inserted:

3.1.1 A snapshot of global energy prices

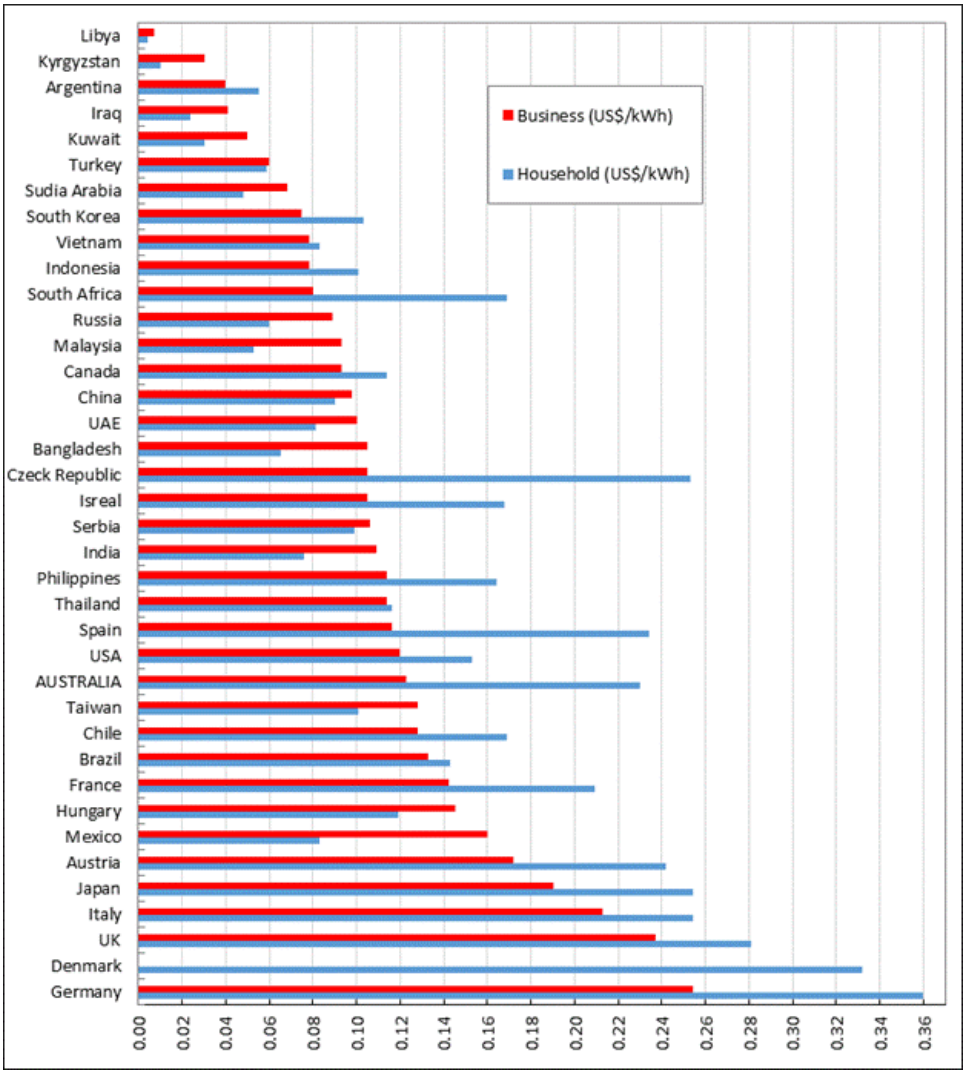
Australia ranks in the highest third in terms of business and household energy prices.

Australia's path to renewables is challenged by high costs of components for renewables due to high electricity and manufacturing costs and lack of domestic manufacturing capability.

Boosting domestic manufacturing to complement the natural advantages of sunlight and wind can only be achieved if input costs such as electricity are reduced.

1 Clean Energy Council (2021). Submission No 80 to LC EPC Enquiry into Renewable Energy in Victoria. Dec 2021.

Figure 1: Business and household electricity prices in US$ per kilowatt hour in June 2021[2]



The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

2 GlobalPetrolPrices.com

Ms Bath moved, that after line 520 the following words be inserted:

Commonwealth policy, initiatives and programs.

There has been and continues to be significant action at the Commonwealth Government level.

The Australian Governments whole-of-economy Long-Term Emissions Reduction Plan (the Plan[3]) sets out how Australia will achieve net zero emissions by 2050 based on five key principles:

- **Technology not taxes** – no new costs for households or businesses.
- **Expand choices, not mandates** – expand consumer choice.
- **Drive down the cost of a range of new energy technologies** – bringing a portfolio of technologies.
- **Keep energy prices down with affordable and reliable power** – consolidate our advantage in affordable and reliable energy, protect competitiveness of our industries and the jobs they support.
- **Be accountable for progress** – set ambitious yet achievable whole-of-economy goals, then beat them, consistent with our approach to our Kyoto-era and Paris Agreement targets.

Modelling suggests the Plan will create more than 100,000 new jobs, including critical minerals, clean hydrogen, renewable energy, green steel and alumina, many in Australia's regions. Australia's export-oriented sectors are projected to grow significantly in aggregate, with the value of Australian exports to more than tripling between 2020 and 2050.

Australia reduced its emissions by 20% between 2005 and 2020. The technologies prioritised through Australia's Technology Investment Roadmap are to deliver another 40% reduction (approximately half the emissions reductions needed to achieve net zero emissions by 2050).

The technologies are:

- Clean hydrogen
- Ultra low-cost solar
- Energy storage for firming
- Low emissions steel
- Low emissions aluminium

3 Australian Government (2021). Australia's long term emissions reduction plan - A whole-of-economy Plan to achieve net zero emissions by 2050.

- Carbon capture and storage
- Soil carbon.

Another 15% is expected to be delivered by global technology trends, a further 10% (to 20%) by international and domestic offsets and the remaining 15% by further technology breakthroughs.[4]

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at lines 524 to 527 the words 'However, the Committee heard that because of reluctance on the part of the Commonwealth Government to coordinate the transition to renewable energy at a national level, State Governments including Victoria are choosing to act alone' be removed.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

4 https://www.industry.gov.au/data-and-publications/australias-long-term-emissions-reduction-plan

Ms Bath moved, that at line 628 to 631 the words 'In this light, the Committee believes the Victorian Government's actions to progress the transition to renewable energy without national coordination from the Commonwealth Government are prudent' be removed.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 632 to 635 the words 'The Committee commends the Victorian Government's emission reduction targets and renewable energy targets. They provide certainty for participants in Victoria's energy system about the Victorian Government's intention to encourage the transition to renewable energy. This certainty reduces financial risk and encourages investment' are deleted and replaced by the words 'The Committee recognises the Victorian Government's emission reduction targets and renewable energy targets provide a mechanism to encourage participants in Victoria's energy market to transition to renewable energy'.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at lines 636 to 639 the words 'The Victorian Government's emission reduction targets and renewable energy targets provide certainty to the market about Victoria's intention to transition to renewable energy. This assists participants in Victoria's energy system to invest in renewable energy generators.' are deleted and replaced by the words 'The Victorian Government's emission reduction targets and renewable energy targets signal to the market about Victoria's intention to transition to renewable energy and this assists participants in Victoria's energy system to invest in renewable energy generators'.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 911 to 915 the words 'However, the Committee supports the Victorian Government's renewable energy targets and measures such as renewable energy auctions to help the state reach its targets. Relying on other states to provide generation capacity or waiting for a nationally coordinated approach may compromise Victoria's ability to meet its renewable energy and emissions reduction targets' be removed.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Dr Ratnam moved, that a new recommendation be inserted at line 915 in the following terms:

Victoria should increase the Victorian Renewable Energy target above the current 50% target to drive further investment in the roll out of new renewable energy

The Committee Divided.

The question was put.

Ayes	Noes
Dr Ratnam	Ms Terpstra
Mr Hayes	Mr Melhem
	Ms Watt
	Ms Bath
	Dr Bach
	Mr Meddick

The question was negatived.

Ms Bath moved, that after line 1018 the following words be inserted:

Noting the costs theorised by Dr McConnell, it is important for the committee to understand how many Giga Watts of effective capacity the $10 billion to $18 billion will deliver.

By comparison, the 53 MW 'notional capacity' solar plant at Broken Hill was built at a capital cost of $167 million including a $65 million government subsidy.

It has only 5–6 MW of available power given inefficiencies. The capital cost of say 264 similar sized solar plants to replace Yallourn's 1,450 MW could be about $43 billion.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 1024, after the words 'The demand for' the word 'electrical' be inserted.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
Mr Hayes	Ms Watt
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 1025 the following words be inserted:

To meet Victoria's energy needs from renewables by 2050 a rigorous strategy, based on considerable feasibility and financial analysis of options must be developed and shared with the community.

The governance requires analysis of the ecological sustainability of options on a 'cradle to grave' basis to avoid a potential health and environmental events similar to that created by asbestos type residues and instil confidence in the community for renewables.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 1025 the following words be inserted:

Coal fired power stations closing two to three times faster than anticipated may have unforeseen consequences if the transition to renewables proceeds before local adequate manufacturing is in place, before appropriate mechanisms for recycling of components are in place and before new transmission infrastructure are in place.

Currently Solar and Wind generation rely heavily on imported components, and there is a need to develop a local manufacturing base as renewables expand.

There is also a risk of discarded components inappropriately going to landfill, until dedicated recycling is in place.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Dr Ratnam
Dr Bach	Mr Hayes
Ms Terpstra	
Mr Melhem	
Ms Watt	
Mr Meddick	

The question was agreed.

Dr Ratnam moved, that a new recommendation be inserted at line 1029 in the following terms:

That the Victorian Renewable Energy Target should be increased to facilitate a faster transition of our electricity system to renewable energy.

The Committee Divided.

The question was put.

Ayes	Noes
Dr Ratnam	Ms Terpstra
Mr Hayes	Mr Melhem
	Ms Watt
	Ms Bath
	Dr Bach
	Mr Meddick

The question was negatived.

Ms Bath moved, that after line 1140 the following words be inserted:

To facilitate the regulation and oversite of new offshore wind technologies, the Commonwealth Government has implemented the Offshore Electricity Infrastructure Act 2021 which will come into effect by June 2022.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 1141 the following words be inserted:

Victorian and Commonwealth

The Committee supports the efforts of the Victorian and Commonwealth Governments to establish Australia's first offshore wind facility and grow the sector. The large generation capacity that can potentially be provided by offshore wind will be important to meet Victoria's energy needs into the future.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Dr Ratnam moved, that at line 1185 the following words be inserted:

However it is important to note that current hydrogen production projects use brown coal as their source material.

The Committee Divided.

The question was put.

Ayes	Noes
Dr Ratnam	Ms Terpstra
Mr Hayes	Mr Melhem
Mr Meddick	Ms Watt
	Ms Bath
	Dr Bach

The question was negatived.

Ms Bath moved, that at line 1216 the following words be inserted:

'and Commonwealth', so the text reads 'The Committee notes the work of the Victorian and Commonwealth Governments in supporting the…'.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Dr Ratnam moved, that a new finding be inserted at line 1221 in the following terms:

Victoria is currently piloting the Hydrogen Energy Supply Chain project using brown coal.

The Committee Divided.

The question was put.

Ayes	Noes
Dr Ratnam	Ms Terpstra
Mr Hayes	Mr Melhem
Mr Meddick	Ms Watt
	Ms Bath
	Dr Bach

The question was negatived.

Dr Ratnam moved, that a new recommendation be inserted at line 1221 in the following terms:

That the Victorian Government abandons any plans to create hydrogen using coal given the catastrophic climate impacts that it will result in.

The Committee Divided.

The question was put.

Ayes	Noes
Dr Ratnam	Ms Terpstra
Mr Hayes	Mr Melhem
Mr Meddick	Ms Watt
	Ms Bath
	Dr Bach

The question was negatived.

Mr Hayes moved, that at line 1222 the following words be inserted:

However, in the Committee's view, this project should only be supported in the short term as it is transitional and is not strictly a Renewable Energy project. In addition, the long-term effectiveness of Carbon Capture and Storage is yet to be proven and should not be relied upon to manage the emissions created by the production of the hydrogen. Further, the Committee considers that the transitioning of the workforce to other industries will still be achievable.

The Committee Divided.

The question was put.

Ayes	Noes
Dr Ratnam	Ms Terpstra
Mr Hayes	Mr Melhem
Mr Meddick	Ms Watt
	Ms Bath
	Dr Bach

The question was negatived.

Ms Bath moved, that at line 1377 the following words be inserted:

'private or', so that the paragraph reads: That the Victorian Government consider the introduction of a Community Energy Target that includes subsidies for the growth of localised private or community energy projects.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that after line 1634 the following words be inserted:

To date battery storage technology is not without its risks.

A 300 MW Tesla lithium battery near Geelong caught fire in July 2021. The fire broke out during testing of a Tesla megapack at the Victorian Big Battery site. A 13-tonne lithium battery was engulfed in flames, which then spread to an adjacent battery bank.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that after line 1698 the following words be inserted:

The committee recognises that as well as the total amount of electricity required, the transmission lines and fast charging capacity must be built at existing filling stations to encourage electric vehicle (EV) uptake.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that after line 1763 the following words be inserted:

Professor Blakers' testimony implies a bright future for deep storage by pumped hydro and while the Committee is highly supportive of the technology further comparison of the operating cost-effectiveness and socioeconomic and environmental impacts of battery storage compared to pumped hydro is warranted.

Pumped hydro may have the potential for greater local content and lower social, economic and environmental risks than imported batteries.

Imported batteries using lithium, cobalt and other rare minerals mined in countries with poor environmental and human rights records may not meet the same triple bottom line standards without domestic manufacturing and dedicated facilities to recycle the spent batteries.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that a new recommendation be inserted after line 1769 in the following terms:

That the Victorian Government

a. undertakes an analysis of the operating cost-effectiveness and socioeconomic and environmental impacts of battery storage compared to pumped hydro and

b. support new investment in deep storage by pumped hydro.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 2369 the word 'believes' is deleted and replaced by the word 'considers'.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
Mr Hayes	Ms Watt
Mr Meddick	Dr Ratnam

There being an equality of votes, the Chair gave her casting vote to the Noes.

The question was negatived.

Ms Bath moved, that after line 2564 the following words be inserted:

The Latrobe City Council highlights the regions assets and missed opportunities ahead of job losses.

Latrobe City has significant energy production and distribution industries and infrastructure, including an electricity grid with connections to Tasmania, South Australia and New South Wales. These assets provide Latrobe City with significant opportunities to attract alternative and new energy technology investments, leveraging not only existing infrastructure but the extensive skill base and engineering capabilities of this region.

This places Latrobe City at an advantage as an ideal location to generate and transmit large-scale renewable energy, supported by its abundant natural resources. Governments at all levels can capitalise on existing transmission infrastructure by working with local communities on the siting of suitable renewable energy projects in Latrobe City subject to appropriate siting and social licence.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that after line 2594 the following words be inserted:

CFMMEU Victorian District Secretary Mr Geoff Dyke elaborated on the scheme to the same Committee.

The other thing was the worker transition scheme that we trialled for Hazelwood. That was partially successful. We got 90 young employee's jobs at the newer power stations and retired 90 workers. Our data suggests that we could have transferred up to 200 workers, or over 200 workers, and the scheme promised to transfer 150.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 2642 the word 'high' is deleted and replaced by the word 'moderate'.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that after line 2648 the following words be inserted:

The Committee notes current State Budget 2022–2023 provides $7.5 million for the next financial year in funding to the LVA.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

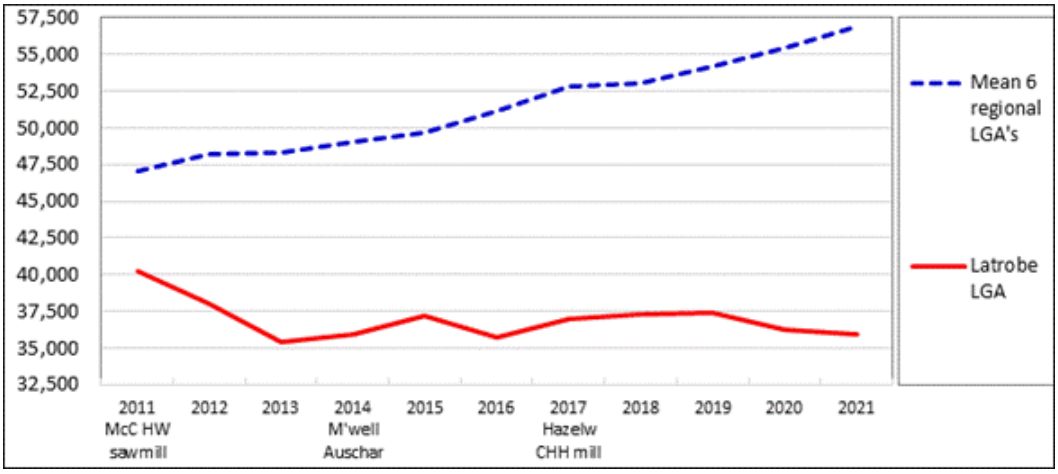
The question was negatived.

Ms Bath further moved, that after line 2648 the following words be inserted:

A core performance indicator for the LVA was to grow jobs in the region, however small labour market figures cast a different scenario. Latrobe City local government area (LVA) has lost over 5,000 jobs over the last decade compared to average jobs growth of almost 10,000 for six other regional LGA's.

The $266 million of funding was virtually all invested in 'one-off' job creation in construction phase only (liveability projects) and scheme administration costs. There was limited investment in projects that would support on-going employment beyond 'construction phase' such as in increasing manufacturing or local health services.

Figure 2: Latrobe LGA labour force compared to six regional LGA's (No)[5]



Note: Six regional LGA's – Ballarat, Bendigo, Geelong, Mildura, Shepparton and Wodonga

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that a line 2724 the following words be inserted:

Opportunities to enhance energy from waste projects should be encouraged.

The Maryvale Energy from Waste (EfW) project has received a $48.2 million grant through the Australian Government's Modern Manufacturing Initiative (MMI).

The Maryvale EfW project is aligned with the principles of the circular economy and will bring state-of-the-art alternative energy technology to Gippsland. It will offer local and metropolitan councils and commercial customers a competitive waste management solution that will divert waste from landfill, reduce emissions and deliver a range of social benefits.

5 Aust Government (2022). Labour Market Portal 17/3/22. Annual data are means of four quarters (except for 2021 which is mean of three quarters)

The Maryvale EfW project is aligned with the principles of the circular economy and will bring state-of-the-art alternative energy technology to Gippsland. It will offer local and metropolitan councils and commercial customers a competitive waste management solution that will divert waste from landfill, reduce emissions and deliver a range of social benefits

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath further moved, that the recommendation be inserted at line 2724 be omitted.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Dr Ratnam moved, that at line 2728 the recommendation be amended to read:

That the Victorian Government continue to build on the lessons learnt from the closure of Hazelwood and apply them to in the lead up to the closure of Yallourn and later Loy Yang A by developing a transition plan and provide funding to develop it and deliver over next 15 years. This includes the need for a strong Worker Transition Service. Work should be undertaken to identify the supply chain companies that service Yallourn ahead of time to help them to be ready to transition when it closes in 2028.

The Committee Divided.

The question was put.

Ayes	Noes
Dr Ratnam	Ms Terpstra
Mr Hayes	Mr Melhem
Mr Meddick	Ms Watt
	Ms Bath
	Dr Bach

The question was negatived.

Dr Ratnam further moved, that a new recommendation be inserted at line 2728 in the following terms:

That the Victorian Government provide long term funding and certainty for the Latrobe Valley Authority.

The Committee Divided.

The question was put.

Ayes	Noes
Dr Ratnam	Ms Terpstra
Mr Hayes	Mr Melhem
Mr Meddick	Ms Watt
	Ms Bath
	Dr Bach

The question was negatived.

Ms Bath moved, that at line 2870 the following words be inserted: 'universities, TAFE and other training providers'.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
Mr Hayes	Ms Watt
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 2870 the word 'forced' is deleted and replaced by the word 'unfair'.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 3125 the following words be inserted into the finding after the words 'renewable energy':

has the long-term potential to create a good source of employment, but to date generates limited employment because of the lack of domestic local manufacture of components most of which are currently imported.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Mr Hayes
	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that the following words be inserted with a new finding:

The Committee notes that renewable energy technologies are not 'health risk free' as for example the mining and manufacturing to produce solar equipment and its maintenance results in significant atmospheric emissions and environmental challenges associated with disposal and recycling of components.

Worldwide, turbine blades contain 249,365 tonnes of epoxy resin containing highly toxic bisphenol A and there will be 43 million tonnes of toxic blades to be disposed of in future years.[6]

Processing the rare earth minerals mined at Bayan Obo in China has left a huge toxic radioactive waste pile. Rare earth neodymium-samarium magnets are used in the turbines.

Finding XX:

There are socioeconomic, environmental, health and geopolitical risks and benefits associated with all forms of energy – fossil fuels and renewables.

6 https://epoxy-europe.eu/wp-content/uploads/2015/07/epoxy_erc_bpa_whitepapers_wind-energy-2.pdf

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

Ms Bath further moved, that a new recommendation be inserted at line 3211 in the following terms:

The Victorian Government conducts a 'cradle to grave' analysis of all forms of energy against socioeconomic, environmental, health and geopolitical risks.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

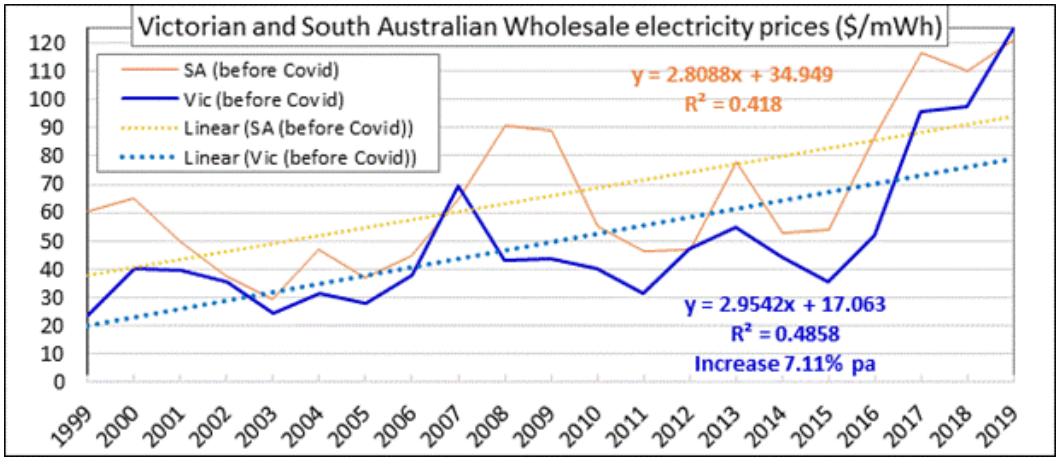
The question was negatived.

Ms Bath moved, that after line 3317 the following words be inserted:

The costs of solar systems and wind farms and battery storage have declined in real terms as they incorporate new emerging technology and become more efficient.

During the transition from coal fired power to renewables in Victoria and South Australia market electricity prices have increased.

Figure 3: Victoria electricity prices in US$ per mega Watt hour[7]



The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

Ms Bath moved, that the recommendation at line 3318 be omitted.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

7 Australian Energy Regulator.

Ms Bath moved, that after line 3632 the following words be inserted:

Other community groups raise similar concerns. Strzelecki Community Alliance (SCA) is an incorporated Entity of over 1000 community members who live or hold property in the Yinnar, Boolarra, Hernes Oak area of Central Gippsland.

Strzelecki Community Alliance opposes a proposed 33 wind turbine Delburn development, citing several concerns, including, concerns of inability to adequately mitigate bushfires on forested land situated on Hancock Victoria Plantation.

The Planning Panel Report – CFA submission

The CFA submitted the planning permit conditions proposed by FRC such as access tracks are only likely to be effective on Fire Danger Rating days of Low to Moderate and High. It said the Project is likely to be impacted at some stage by uncontrollable landscape bushfires; fires that cannot be managed by site-based mitigation or of broader emergency management. It said 'damage and destruction of assets by bushfire is likely if the proposal proceeds'.

Noting that the Minister for Planning has provided approval for the development, the SCA community requests further investigation.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

Mr Meddick moved, that a new recommendation be inserted at line 3662 in the following terms:

That the Victorian Government consider funding further research to determine the best approach for ensuring wind farm developments don't adversely impact native species, particularly Brolgas (*Grus rubicunda*).

The Committee Divided.

The question was put.

Ayes	Noes
Mr Meddick	Ms Bath
Dr Ratnam	Dr Bach
Mr Hayes	
Ms Terpstra	
Mr Melhem	
Ms Watt	

The question was agreed.

Ms Bath moved, that a new recommendation be inserted at line 3663 in the following terms:

Community concerns in relation to wind farm technologies must be adequately addressed by government prior to any new land-based developments.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Mr Melhem
	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

Ms Bath moved, that after line 3889 the following words be inserted:

The safe recycling of components of wind turbine blades is a challenge to be solved, noting that worldwide, in turbine blades there are 249,365 tonnes of epoxy resin containing highly toxic bisphenol A and there will be 43 million tonnes of toxic blades to be disposed of in future years

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

Ms Bath moved, that the finding at line 3898 be amended to read:

The Victorian Government needs to ensure recycling schemes to accommodate recycling of renewable energy waste are in place and address guidelines for toxins in the epoxy resins of wind turbine blades. Facilities need to be developed and/or modified so that waste that cannot be recycled can be dealt with in an environmentally sensitive way at the end of a product lifecycle. Manufacturers of renewable energy materials must also take responsibility for disposal options of their products.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 4107 the words 'That the Government continue the zero emissions vehicle subsidy program until ZEV prices reach purchase price parity with internal combustion engine vehicles, along with measures to stimulate ZEV second-hand market to improve the accessibility to ZEVs.' is deleted and replaced by the words 'That the Victorian Government continue to support the transition to Zero Emissions Vehicles.'

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

Dr Ratnam moved, that a new recommendation be inserted at line 4116 in the following terms:

That the Victorian Government remove the electric vehicle road user charge until it reaches its electric vehicle uptake goals so as not to add a further barrier to electric vehicle usage in Victoria.

The Committee Divided.

The question was put.

Ayes	Noes
Dr Ratnam	Ms Terpstra
Ms Bath	Mr Melhem
Mr Hayes	Ms Watt
Dr Bach	Mr Meddick

There being an equality of votes, the Chair gave her casting vote to the Noes.

The question was negatived.

Dr Ratnam moved, that the recommendation at line 4156 be amended to read:

That the Victorian Government Victoria should set its own ambitious vehicle emissions standards similar to that introduced in NSW.

The Committee Divided.

The question was put.

Ayes	Noes
Dr Ratnam	Ms Terpstra
Mr Hayes	Mr Melhem
Ms Bath	Ms Watt
Dr Bach	
Mr Meddick	

The question was agreed.

Ms Bath moved, that the recommendation at line 4171 be omitted.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

Mr Hayes moved, that a new recommendation be inserted at line 4228 in the following terms:

That the road user charge should be removed and replaced by user pays system, such as a road congestion charge.

The Committee Divided.

The question was put.

Ayes	Noes
Mr Hayes	Ms Terpstra
Dr Ratnam	Mr Melhem
	Ms Watt
	Mr Meddick
	Ms Bath
	Dr Bach

The question was negatived.

Mr Meddick moved, that at the end of recommendation 18 at line 4356 the following words be inserted:

with an emphasis on a regional area rollout.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Terpstra	Ms Bath
Mr Melhem	Dr Bach
Ms Watt	
Dr Ratnam	
Mr Hayes	
Mr Meddick	

The question was agreed.

Ms Bath moved, that at line 4477 the following words be inserted at the end of the current paragraph:

For those travelling long distance, infrastructure priorities of the Victorian Government must also include upgrades to roads with a view to improving safety and fuel efficiency.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

Ms Bath moved, that at line 4565, the quantity of gas be inserted.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

Ms Bath moved, that the finding at line 4806 be omitted.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

Ms Bath moved, that a new recommendation be inserted at line 4932 in the following terms:

Any programs that the Victorian Government develops to support the move away from gas must not disadvantage lower socioeconomic groups who may suffer from financial impediments.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
Mr Hayes	Dr Ratnam
	Mr Meddick

The question was negatived.

Ms Bath moved, that the recommendation at line 5100 be omitted.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

Dr Ratnam moved, that the recommendation at line 5100 be amended to read:

That the Victorian Government remove the regulations that mandate connection of new buildings to gas infrastructure and consider enacting a moratorium on new residential gas connections. In doing so, consideration should be given to ensuring no disruption to energy supply and that the impact on workers affected by the transition is minimised by ensuring just transitions for workers are factored in to any anticipated downturn in gas connections.

The Committee Divided.

The question was put.

Ayes	Noes
Dr Ratnam	Ms Terpstra
Mr Meddick	Mr Melhem
	Ms Watt
	Ms Bath
	Dr Bach
	Mr Hayes

The question was negatived.

Dr Ratnam moved, that the recommendation at line 5459 be amended to read:

That the Government require via planning and building regulations that house builders to adopt best energy efficiency practices and introduce necessary measures to ensure that the impact of incentives flows on to home buyers.

The Committee Divided.

The question was put.

Ayes	Noes
Dr Ratnam	Ms Terpstra
Mr Hayes	Mr Melhem
	Ms Watt
	Ms Bath
	Dr Bach
	Mr Meddick

The question was negatived.

Ms Bath moved, that the recommendation at line 5459 be omitted.

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
	Dr Ratnam
	Mr Hayes
	Mr Meddick

The question was negatived.

Ms Bath moved, that after line 5654 the following words be inserted:

The Committee notes that the Australian agricultural sector has made significant commitments to reduce carbon emissions, for example, the Australian red meat and livestock industry has set the ambitious target to be Carbon Neutral by 2030 (CN30)[8].

The Committee Divided.

The question was put.

Ayes	Noes
Ms Bath	Ms Terpstra
Dr Bach	Ms Watt
Mr Hayes	Mr Meddick
Dr Ratnam	

The question was agreed.

8 https://www.mla.com.au/research-and-development/Environment-sustainability/carbon-neutral-2030-rd/cn30/

Minority reports

VICTORIAN PARLIAMENTARY INQUIRY INTO RENEWABLE ENERGY IN VICTORIA

BY ENVIRONMENT AND PLANNING COMMITTEE

THE LIBERALS AND NATIONALS MINORITY REPORT

Cover: Veja Mate Offshore Windfarm and Tasmanian Hydro Scheme dam

Prepared by The Nationals and Liberals

19 May 2022

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Summary

The Liberals and Nationals members support a responsible transition to renewable energy.

A transition to renewable energy is necessary to reduce atmospheric emissions and climate change. However, a transition to renewable energy is not without socioeconomic and environmental risks.

Despite substantial Victorian and Commonwealth government subsidies for renewable energy, wholesale and retail electricity prices have increased in real terms (7 per cent pa). There are many potential renewable energy options which the Committee Report has not fully explored.

The Committee Report focusses heavily on solar and wind renewable technologies and battery storage all of which may have significant environmental, social, and economic challenges when subjected to a 'cradle-to-grave' analysis of carbon emissions, recyclability, and safe handling of toxic materials.

Other forms of renewable energy such as hydro-electricity, clean hydrogen, wave energy and biofuels were largely overlooked in the Committee Report. The potential of pumped hydro and opportunities for energy from waste in localised circular systems were not rigorously investigated. The Committee Report failed to investigate emission reduction from improved energy efficiencies in industrial and household settings and increasing carbon sequestration via biologic and geologic pathways. The Liberal and Nationals members consider these renewable technologies to have the potential for greater local content for example in the Latrobe Valley and warrant closer examination.

The closure of Hazelwood Power Station resulted in substantial job losses in the Latrobe Valley. Over the last decade the Latrobe local government area (LGA) has lost over 5,000 jobs while six comparable regional LGAs each have gained about 10,000 jobs over the same period (see page 7 and 8). The Andrews Government assistance of $266 million channelled through the Latrobe Valley Authority (LVA) focused largely on liveability projects with one-off jobs in construction, rather than ongoing employment through strengthening innovation in technology and manufacturing, including local manufacture of components for renewables.

Closing coal fired power stations before sufficient transmission infrastructure to link renewable energy projects, adequate local component manufacturing and appropriate recycling facilities are established, has risks.

An opportunity exists to assist local manufacturers to make components for renewable energy and replace imports. Currently only 11 per cent of components for renewable energy are manufactured in Australia (e.g. solar panels, wind turbines).

The Liberals and Nationals members support the development of local 'cradle-to-grave' management and recycling of renewable energy components to ensure no adverse environmental impacts from the transition to renewable energy.

Victoria needs dedicated recycling for discarded solar panels. Victoria also needs to find an alternative to the resin used in wind turbine blades which contain a toxin (bisphenol A) such that the blades cannot be dumped into landfill, nor recycled, nor pulverised and secured within the concrete foundations of wind farms. Alternatives to current battery storage technology should be encouraged, given the energy intensity in mining the lithium, cobalt, nickel and other rare earths elements and manufacturing the components.

The Liberals and the Nationals support the following recommendations in the Committee Report[1]: 1, 2*, 3, 4, 5, 6, 7, 10, 11, 12, 14, 15, 16, 19*, 20*, 21, 22, 24, 25, 26, 27, 28, 29

The Liberals and the Nationals oppose the following recommendations in the Committee Report[1]: 8, 9*, 13*, 17, 18, 23

[1] * Attempted amendment.

The Committee Report recommends a cut-off date for sales of new internal combustion engine vehicles. The Liberals and Nationals members consider that as new technology becomes available ie. electric vehicles (EVs), consumers will change their purchasing patterns without a government mandate.

It is necessary to ensure that in transitioning to powering transport with renewables that those having to travel long distances are not disadvantaged in that transition.

The Committee Report recommends the Victorian Government build separated cycle paths and that active transport opportunities form part of any new infrastructure projects. The Liberals and Nationals members moved an amendment to include infrastructure priorities to improve safety and fuel efficiency and increase road maintenance for regional and rural Victorians travelling long distances. It is disappointing but unsurprising that a Labor/Greens dominated Committee opposed this amendment.

The Committee Report recommends recycling schemes to accommodate recycling of renewable energy waste. The Liberals and Nationals members sought the inclusion of a recommendation calling on government support the development and/or modification of facilities to ensure unrecyclable waste be dealt with in an environmentally sensitive way at the end of a product lifecycle.

The Liberals and Nationals members are disappointed that the Labor/Greens MPs ignored an amendment to prioritise Federation University as the university of choice for skills and training in the Latrobe Valley.

The Committee Report states that gas usage for cooking, heating and industrial processes constitutes a '*sizeable source of carbon emissions in Victoria*' but fails to quantify the emissions from domestic and industrial usage. Gas has a role to play in meeting peak demand in the transition to renewable energy. The Liberals and Nationals members are concerned that Committee Report Findings and Recommendations in relation to gas are inconsistent with the potential use of Green Hydrogen in the future.

The Liberals and Nationals members make the following Minority Report Recommendations:

Minority Report Recommendation 1: That the Victorian Government conducts a 'cradle-to-grave' analysis of all forms of renewable energy.

Minority Report Recommendation 2: That the Victorian Government adequately addresses community concerns in relation to wind farm technologies prior to any new land-based developments being approved.

Minority Report Recommendation 3: That the Victorian Government introduce bonds (similar to retiring coal fired power station bonds) for large-scale solar energy facilities to ensure sufficient funds are available for site rehabilitation.

Minority Report Recommendation 4: That the Victorian Government undertakes an analysis of the operating cost-effectiveness and socioeconomic and environmental impacts of battery storage compared to pumped hydro.

Melina Bath

Melina Bath MP
Member for Eastern Victoria Region

Matthew Bach MP
Member for Eastern Metropolitan Region

1. Introduction

1.1 Terms of Reference

On 4 March 2020, the Legislative Council agreed to the following motion:

> That this House requires the Environment and Planning Committee to inquire into, consider and report, by July 2021, on —
>
> a) measures to enable Victoria to transition its energy supply to 100 per cent renewable energy;
>
> b) jobs and economic benefits and implications of Victoria transitioning to 100 per cent renewable energy;
>
> c) investment, both public and private, required to achieve 100 per cent renewable energy generation in Victoria, including investment in grid infrastructure and energy storage;
>
> d) further opportunities for Victoria to reduce emissions, including through finding alternatives to industrial and household gas consumption;
>
> e) government investment or action that would be needed to support workers in impacted industries to facilitate a just transition and ensure workers and communities are not left behind as Victoria transitions to 100 per cent renewable energy;
>
> f) the economic risks of not urgently reducing emissions by transitioning to 100 per cent renewable energy; and
>
> g) any other related matters.

The Liberals and Nationals members contend that the Terms of Reference were deficient in several respects such that the Committee Report doesn't explore all the alternatives for renewable energy

- **Of particular concern is the lack of 'cradle-to-grave' analysis of all modes of energy production and energy storage.**
- **The Terms of Reference ignore the important role sequestration of CO_2 emissions can play in minimising the emissions impact of some forms of energy production.**
- **Disappointingly Labor, Greens and 'Labor Like' MPs of the Committee obstructed the inclusion of Commonwealth Government policies and legislation in the Committee Report.**

Minority Report Recommendation 1: That the Victorian Government conducts a 'cradle-to-grave' analysis of all forms of renewable energy.

As a result of Committee workload, the Inquiry into Renewable Energy did not commence until the latter part of 2021, delaying the tabling until May 2022.

1.2 Submissions and Public Hearings

The Committee commenced the Inquiry by writing to several stakeholders in October 2021. At the same time, the Committee advertised a call for submissions in The Age newspaper and on the Parliament's Facebook page and on its other social media. When submissions closed, the Committee had received 90 submissions from a range of individuals and organisations.

The Committee only held two days of public hearings on 16 and 17 March, 2022. At these hearings, the Committee heard from a limited number of organisations and individuals with expertise in renewable energy. A full list of witnesses is provided in Appendix Two, and the transcripts of evidence can be found at https://www.parliament.vic.gov.au/epc-lc/article/4462

1.3 Scope of the inquiry

The Liberals and Nationals members consider the limited scope of the Inquiry led to it focussing predominating on wind and solar energy. The Committee Report missed the opportunity to support 'cradle-to-grave' analysis of all forms of renewable energy and energy storage.

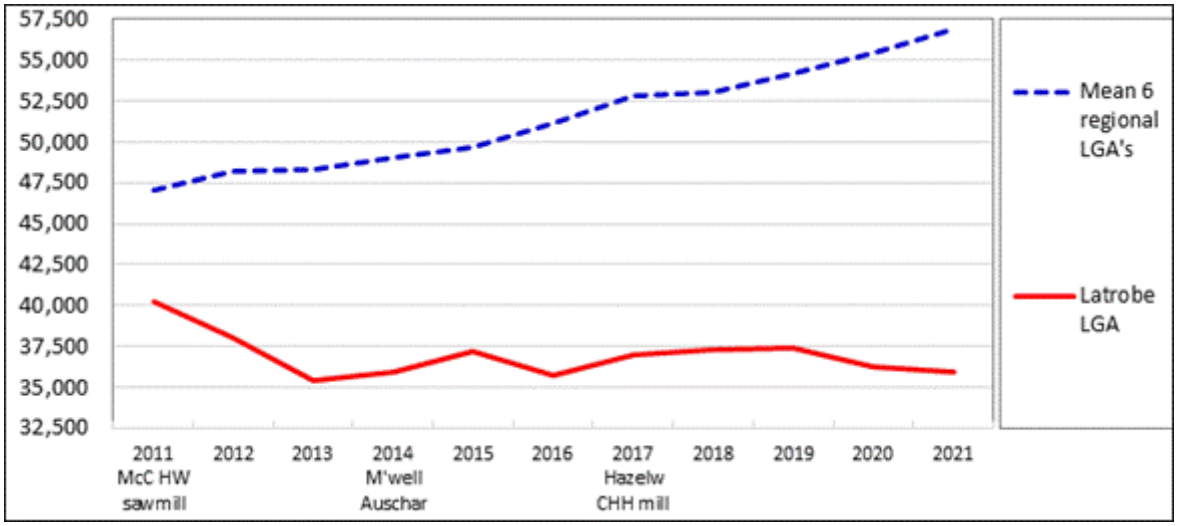
The Liberals and Nationals members value policies based on rigorous analysis of all forms of energy to ensure that government policy, regulation and assistance reduces Victoria's ecological footprint.

2. Closure of Latrobe Valley Power Stations

2.1 Impact of the closure of power stations and coal mines on Latrobe Valley jobs

Closure of McCormack Morwell hardwood sawmill (McC sawmill) in 2011, Morwell Power and Briquette including Morwell Mine (M'well) in 2014, Auschar Morwell (Auschar) in 2014, Hazelwood Power and Mine (Hazelw) in 2017 and Carter Holt Harvey softwood sawmill (CHH) in 2017, likely caused the loss of about 10,000 job opportunities in the region (direct employment + production induced + consumption induced)[2]. Over the last decade the Latrobe LGA labour force has declined by 5,250 jobs while on average each of the other six LGAs have gained 9,900 jobs each (**Figure *1***).

Figure 1: Latrobe LGA labour force compared to six regional LGA's (No) [3]



The decrease in the size of the labour force for Latrobe LGA coupled with an increase in unemployment, is in stark contrast with the six other regional LGAs. This suggests the Andrews Government's transition plan and Latrobe Valley Authority (LVA) assistance program has not generated significant ongoing employment.

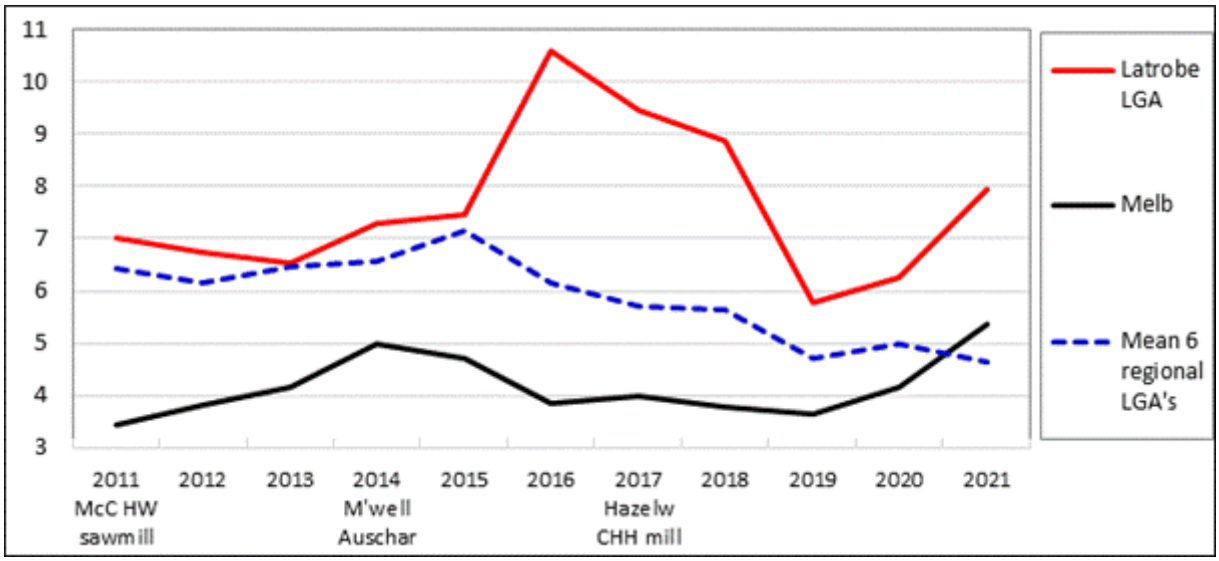
[2] J N Cameron (2021). Submission No 58 to LC EIC Inquiry into the Closure of the Hazelwood and Yallourn Power Stations. 16/12/21.

[3] Aust Government (2022). Labour Market Portal 17/3/22. Annual data are means of four quarters (except for 2021 which is mean of three quarters). Six regional LGA's are Ballarat, Bendigo, Geelong, Mildura, Shepparton and Wodonga.

2.2 Impact of power station and coal mine closure on unemployment in the Latrobe Valley

Over recent years the unemployment rate in Latrobe LGA has been almost twice that of six similar regional LGA's – Ballarat, Bendigo, Geelong, Mildura, Shepparton and Wodonga, and over the entire decade Latrobe unemployment has been almost twice that of Melbourne in percentage terms (%). Latrobe LGA unemployment was 7.8 per cent at December 2021 and approximately the fifth highest of 80 Victorian LGAs. The transitional arrangements failed to generate ongoing jobs and the current employment/unemployment outcome is detrimental to prosperity and contrary to a submission[4] using earlier employment data.

Figure 2: Latrobe LGA unemployment rate compared to 6 regional LGA's and Melbourne (%) [3]



2.3 Latrobe Valley Authority

A core performance indicator for the LVA was to grow jobs in the region, however small area labour market figures cast a different scenario. Latrobe LGA has lost about 5,000 jobs over the last decade compared to average jobs growth of almost 10,000 each for six other regional LGAs.

The majority of the $266 million funding was invested in 'one-off' job creation in construction phase only for liveability projects and the Authority's operational and administration costs. There was limited investment in projects that would establish new industries, expand existing industries or support on-going employment beyond 'construction phase' such as in increasing manufacturing or local health services.

The LVA has continued operating without program funding from the State Government since 1 July 2021.

During PAEC in December 2020 the former Minister for Regional Development, Hon Jaclyn Symes confirmed program funding for the Latrobe Valley Authority would expire at the end of June 2021.

> ***MINISTER SYMES:*** *Currently the LVA's budget is secured for two years in this year's budget. So for LVA it is two years' staffing—programs are for one year.*
>
> ***MINISTER SYMES:*** *In relation to the specific breakdown of funding referred to in your question, $13.8 million is allocated to staff to June 2020, $13.1 million to program delivery funds to June 2021*[5]*.*

The LVA staff funding has been extended for a further 12 months at a cost of $7.5 million as Minister for Regional Development confirmed in April 2022.

"I've asked the Director of the Latrobe Valley Authority to prepare a transition plan for the community. The LVA will be funded for another year"[6]*.*

[4] Wiseman, J et al (2021). Submission No 17 Attachment 3 to LC EIC Inquiry into the Closure of the Hazelwood and Yallourn Power Stations.
[5] Friday, 18 December 2020 Public Accounts and Estimates Committee Page 3.
[6] Minister for Regional development, Maryanne Thomas WIN Gippsland 20 Apr 2022.

Any referral to the worker transition scheme as having a 'high' success rate by the Committee Report ignores significant evidence. CFMMEU Victorian District Secretary Mr Geoff Dyke proved to be an insightful witness to the Economy and Infrastructure Committee Inquiry into the Closure of Hazelwood and Yallourn Power Stations[7].

> *The other thing was the worker transition scheme that we trialled for Hazelwood. That was partially successful. We got 90 young employee's jobs at the newer power stations and retired 90 workers. Our data suggests that we could have transferred up to 200 workers, or over 200 workers, and the scheme promised to transfer 150*[8].

Based on the LVA's goal for the $20 million Worker Transfer Scheme it only achieved 60 per cent of its key performance target[9].

Unfortunately, the lessons have not been learnt if the failures of the LVA and the ongoing job losses in the Latrobe LGA are considered a success. It is certainly not a success for those workers and their families who have not been able to transition to local ongoing employment. The ***Committee Report Recommendation 8*** needs to be substantially strengthened with the following addition:

- This funding should be invested in projects that deliver sustainable on-going jobs beyond the construction phase.
- Potential examples include renewable energy projects, pumped hydro projects, hydrogen from lignin, Energy from Waste projects such as Opal's Maryvale Mill (supported by a Commonwealth Government), further value-added manufacturing of Gippsland agricultural and forest products.

2.4 Future closure of Yallourn and Loy Yang power stations and coal mines

The Victorian Parliament's Economy and Infrastructure Committee - *Inquiry into the Closure of Hazelwood and Yallourn Power Stations*, heard evidence that a predicted exit date for coal fired power generation in Victoria by 2032 is unlikely and bringing forward a closure date for Loy Yang A of 2040-2045 would be challenging.

> *"I think 2032, is too soon to have that orderly transition. They will become jeopardised, the three key areas, as we decarbonise: affordability, sustainability and the most important, security of supply"*[10]
>
> Mr Steve Rieniets, Group General Manager, Operations, AGL Loy Yang.

2.5 Replacing Yallourn and Loy Yang Power Stations with renewables involves a huge investment

The Committee report cited transcript excerpts of Dr Dylan McConnell a Research Fellow at the Energy Transition Hub, University of Melbourne.

> *I guess, just drawing out some interesting findings in the context of this inquiry from that, what that means in terms of investment is there are some pretty big numbers. There (sic), just looking at wind, solar and storage, we are talking about investment in the state of Victoria in the vicinity of $10 billion out to 2030 or, in that sort of expanded scenario where we decarbonise faster, close to $18 billion. I should say this is investment only in wind, solar and storage, including rooftop PV*[11].

It is important to explain to Victorians how many gigawatts of 'effective capacity' will be delivered from the theorised $10 to $18 billion cost of investment required to transition to renewable energy.

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[7] Mr Geoff Dyke, Economy and Infrastructure Committee Inquiry into the Closure of Hazelwood and Yallourn Power Stations, Victorian District Secretary, CFMMEU

[8] Mr Geoff Dyke, Victorian District Secretary, CFMMEU 24th November 2021

[9] https://lva.vic.gov.au/news/community-report-released-today/12770-DJPR-RRV-LVA-community-report_v7a-web-ready2.pdf

[10] *Inquiry into the Closure of Hazelwood and Yallourn Power Stations* Transcript: 3 March 2022 Steve Rieniets, Group General Manager, Operations, AGL Loy Yang-

[11] Dr Dylan McConnell, Research Fellow, Energy Transition Hub, University of Melbourne, transcript of evidence, 17 March, p.14.

This was not addressed in the Committee Report. The example below suggests that $10 to $18 billion investment is insufficient.

The 53 MW 'notional rated capacity' solar plant at Broken Hill was built at a capital cost of $167 million including a $65 million government subsidy.

It has only 5 to 6 MW of available power given inefficiencies. The capital cost of for example, 264 similar sized solar plants to replace Yallourn's 1,450 MW could approximately $43 billion[12]. Dr Dylan McConnell appears to have grossly understated the investment in renewables required to replace Latrobe Valley's coal fired electricity generation.

2.6 Transitioning to renewables based optimising local content, recycling & transmission

Closing coal fired power stations two to three times faster than anticipated may have unforeseen consequences if the transition to renewables proceeds before sufficient transmission infrastructure and local adequate manufacturing are in place and before appropriate mechanisms for recycling of components are established.

Currently Solar and Wind generation rely heavily on imported components, and there is a need to develop a local manufacturing base as renewables expand. There is also a risk of discarded components inappropriately going to landfill, until dedicated recycling is in place.

Australia's path to renewables is challenged by the high costs of components for renewables due to high electricity and manufacturing costs and lack of domestic manufacturing capability.

Australia is largely reliant on imported components for renewable energy. Currently, only 11 per cent of the renewable energy supply chain is manufactured in Australia (***Table 1***).

Table 1: Employment in manufacturing, construction and operation of renewable energy[13]

Energy source	Manufacturing Overseas (Job-Year/MW)	Manufacturing Australia (Job-Year/MW)	Construction (Job-Year/MW)	Operation & Maintenance (Job-Year/MW)	Manufacturing in Australia (%)
Wind	1.3	0.4	2.8	0.2	24%
Utility Solar	4.3	0.1	2.3	0.1	2%
Rooftop PV Solar	4.2	0.2	5.8	0.2	5%
Utility batteries	6.3	0.3	4.7	1.2	5%
Distributed batteries	6.3	0.3	5.6	0.3	5%
Hydro	2.8	0.7	7.4	0.1	20%
Pumped Hydro	2.8	0.7	11.1	0.2	20%
Mean					**11%**

[12] Cameron, J N (2022). LC EIC Inquiry into the Closure of the Hazelwood and Yallourn Power Stations Submission 58 - Attachment 2
[13] Clean Energy Council (2021). Submission No 80 to LC EPC Enquiry into Renewable Energy in Victoria. Dec 2021.

2.7 Latrobe Valley infrastructure and opportunities missed by the Andrews Government's Renewables Directions Paper

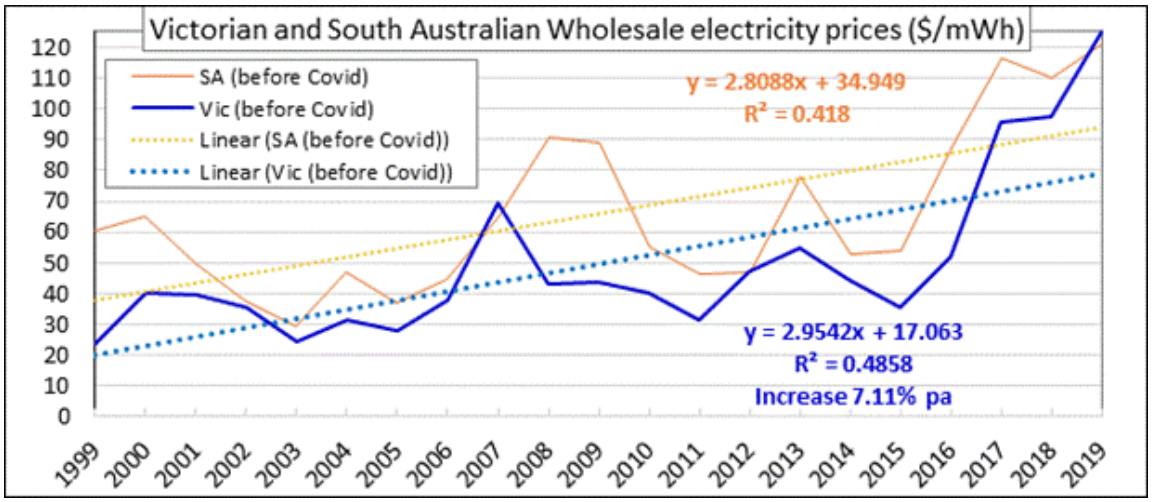
Latrobe City Council made the following points in its submission[14]:

> *Latrobe Valley has significant energy production and distribution industries and infrastructure, including an electricity grid with connections to Tasmania, South Australia and New South Wales. These assets provide Latrobe LGA with significant opportunities to attract alternative and new energy technology investments, leveraging the existing infrastructure, extensive skill base and engineering capabilities of the region.*
>
> *This places Latrobe LGA at an advantage as an ideal location to generate and transmit large-scale renewable energy, supported by its abundant natural resources.*
>
> *Governments at all levels can capitalise on existing transmission infrastructure by working with local communities on the siting of suitable renewable energy projects in Latrobe LGA subject to appropriate siting and social licence.*
>
> *Despite this significant existing and proven infrastructure, The State Government's recent Renewable Energy Zone's Directions paper identifies only one project for Gippsland, which connects projects further west of the Latrobe LGA into the existing infrastructure network. This project is identified as part of the Stage 2 projects.*
>
> *Therefore, the Directions Paper indicates a failure to capitalise on the existing grid network of the Latrobe Valley and the skilled workforce that currently exists here? It also failed to encourage suitable renewable projects and battery storage projects in the Latrobe City municipality and we question is enough being done to inform, consult and involve the community so that social licence is achieved. This is a missed opportunity!*

3. Victorian Energy Prices

During the transition from coal fired power to renewables in Victoria and South Australia market electricity prices have increased. Victorian wholesale electricity prices have increased by 7.1 per cent pa compound over the last 20 years exacerbated by the closure of the Hazelwood Power Station in 2017 (**Figure *3***). High retail prices for electricity are causing cost of living pressures for Victorians. High electricity prices have also contributed to a decline in Australian manufacturing.

Figure 3: Victorian electricity prices in US$ per mega Watt hour[15]

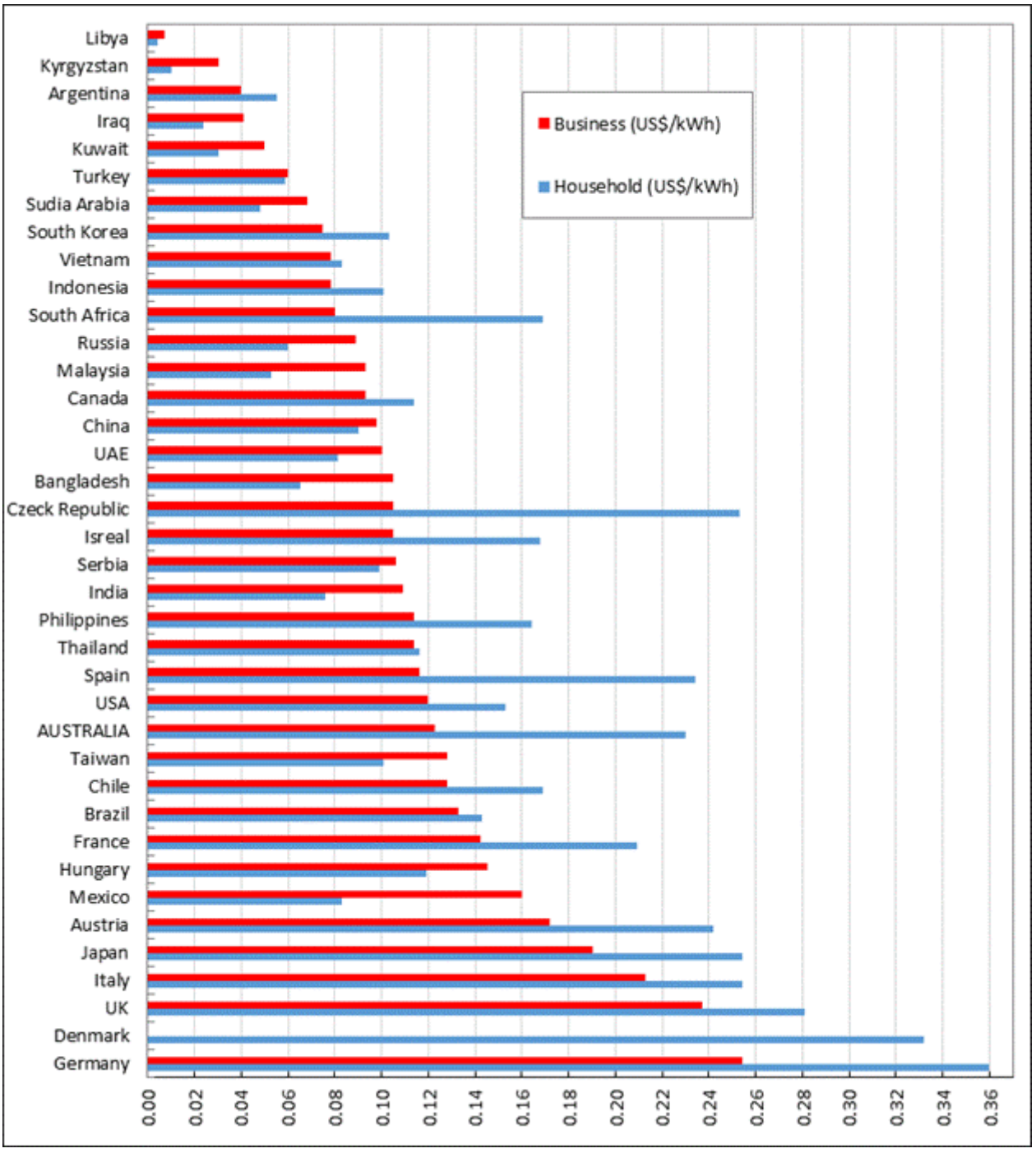


[14] Latrobe City (2021) EPC Inquiry into Renewable Energy Latrobe City Council, Submission 14.
[15] Australian Energy Regulator.

4. Australian and Global energy prices

Australian electricity prices to business are in the third quartile of international electricity costs, making it extremely difficult for Australian businesses to compete on international markets and compete domestically against imports, particularly those made in Asia with the aid of cheap coal and gas fired power (**Figure *4***). Germany has outsourced a large percentage its manufacturing to Eastern European countries because of high power costs (Following Russia's invasion of Ukraine, German and most European power costs will get considerably more expensive).

Figure 4: Business and household electricity prices in US$ per kilowatt hour in June 2021[16]



[16] GlobalPetrolPrices.com

5. Commonwealth Government Initiatives

The Committee Report fails to acknowledge the significant action taken by the Commonwealth Government.

There has been and continues to be significant action and investment at the Commonwealth Government level.

5.1 Commonwealth Long Term Emissions Reduction Plan

The Australian Governments whole-of-economy Long-Term Emissions Reduction Plan[17] (the Plan) sets out how Australia will achieve net zero emissions by 2050 based on five key principles:

- **Technology not taxes** – no new costs for households or businesses.
- **Expand choices, not mandates** – expand consumer choice.
- **Drive down the cost of a range of new energy technologies** – bringing a portfolio of technologies.
- **Keep energy prices down with affordable and reliable power** – consolidate our advantage in affordable and reliable energy, protect competitiveness of our industries and the jobs they support.
- **Be accountable for progress** – set ambitious yet achievable whole-of-economy goals, then beat them, consistent with our approach to our Kyoto-era and Paris Agreement targets.

Modelling suggests the Plan will create more than 100,000 new jobs, including critical minerals, clean hydrogen, renewable energy, green steel and alumina, many in Australia's regions. Australia's export-oriented sectors are projected to grow significantly in aggregate, with the value of Australian exports to more than tripling between 2020 and 2050.

Australia reduced its emissions by 20 per cent between 2005 and 2020. The technologies prioritised through Australia's Technology Investment Roadmap are to deliver another 40 per cent reduction (approximately half the emissions reductions needed to achieve net zero emissions by 2050). The technologies are:

- Clean hydrogen
- Ultra low-cost solar
- Energy storage for firming
- Low emissions steel
- Low emissions aluminium
- Carbon capture and storage
- Soil carbon

Another 15 per cent is expected to be delivered by global technology trends, a further 10 per cent (to 20 per cent) by international and domestic offsets and the remaining 15per cent by further technology breakthroughs.

5.2 Commonwealth Regulation and Legislation

Commonwealth legislation and regulation underpins the Commonwealth Long-Term Emissions Reduction Plan and it is administered through the Clean Energy Council.

The Clean Energy Regulator is the independent body responsible for administering legislation that will reduce carbon emissions and increase the use of clean energy.

The Clean Energy Regulator was established on 2 April 2012 as an independent statutory authority under the Clean Energy Regulator Act 2011 and operates as part of the Department of Industry, Science, Energy and Resources portfolio[18].

The role of the Clean Energy Regulator is determined by climate change law.

[17] Australian Government (2021). Australia's long term emissions reduction plan - A whole-of-economy Plan to achieve net zero emissions by 2050.
[18] http://www.cleanenergyregulator.gov.au/About/About-the-Clean-Energy-Regulator

Renewable Energy Target legislation

- Renewable Energy (Electricity) Act 2000
- Renewable Energy (Electricity) Amendment Act 2015
- Renewable Energy (Electricity) (Large-scale Generation Shortfall Charge) Act 2000
- Renewable Energy (Electricity) (Small-scale Technology Shortfall Charge) Act 2010
- Renewable Energy (Electricity) Regulations 2001
- Renewable Energy (Method for Solar Water Heaters) Determination 2016
- Renewable Energy (Electricity) Amendment (Transitional Provision) Regulations 2010
- Renewable Energy (Electricity) Amendment (Transitional Provisions) Regulations 2009
- Renewable Energy (Electricity) Amendment (Solar Zones and Other Measures) Regulations 2014

Emissions Reduction Fund legislation

- Carbon Credits (Carbon Farming Initiative) Act 2011
- Carbon Credits (Carbon Farming Initiative) Regulations 2011
- Carbon Credits (Carbon Farming Initiative) Rule 2015
- Carbon Credits (Carbon Farming Initiative) Amendment Regulation 2013 (No. 1)
- Carbon Credits (Carbon Farming Initiative) Amendment Rule 2019 (No. 1)

National Greenhouse and Energy Reporting Scheme legislation

- *National Greenhouse and Energy Reporting Act 2007*
- National Greenhouse and Energy Reporting Regulations 2008
- National Greenhouse and Energy Reporting (Measurement) Determination 2008
- National Greenhouse and Energy Reporting (Audit) Determination 2009
- National Greenhouse and Energy Reporting (Auditor Registration) Instrument 2019
- National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015

Australian National Registry of Emissions Units (ANREU) legislation

- *Australian National Registry of Emissions Units Act 2011*
- Australian National Registry of Emissions Units Regulations 2011

6. Renewable energy options

Renewable energy is energy that has been derived from earth's natural resources that are not finite or exhaustible, such as wind and sunlight. Renewable energy is an alternative to the traditional energy that relies on fossil fuels, and it is considered to be less harmful to the environment. However, as indicated in our Minority Report, 'cradle-to-grave' analysis suggests that is not necessarily the case in every instance.

6.1 Wind powered electricity

Land based wind turbines

Local community groups have raised significant concerns with land-based windfarms. Strzelecki Community Alliance (SCA) is an incorporated Entity of over 1000 community members who live or hold property in the Yinnar, Boolarra, Hernes Oak, Mirboo North area of Gippsland. SCA opposes a proposed 33 wind turbine Delburn development, citing several valid concerns, including, concerns of an inability to adequately mitigate bushfire risk on Hancock Victoria Plantation land situated underneath the wind turbines.

A submission to the Delburn Wind Farm Planning Report highlights a significant bush fire risk.

> *The CFA submitted the planning permit conditions proposed by FRC such as access tracks are only likely to be effective on Fire Danger Rating days of Low to Moderate and High. It said the Project is likely to be impacted at some stage by uncontrollable landscape bushfires; fires that cannot be managed by site-based mitigation or of broader emergency management. It said "damage and destruction of assets by bushfire is likely if the proposal proceeds"[19].*

Another submission to the same inquiry by bushfire scientist, David Packham OAM, indicated that there is a significant risk of the wind turbines being the source of ignition for bushfires, citing examples of turbines catching fire.

The Minister for Planning has provided approval for the development and the Strzelecki Community Alliance has requested a halt to proceedings.

Minority Report Recommendation 2: That the Victorian Government adequately addresses community concerns in relation to wind farm technologies prior to any new land-based developments being approved.

Offshore Windfarms - Star of the South

Offshore wind farms are becoming increasingly common overseas with projects established in Europe, the United Kingdom and China. Despite having significant and persistent winds along our ample coastline, the take up of the technology in Australia has been relatively slow.

The Liberals and Nationals members are supportive of offshore wind farms, including the development of Australia's first offshore wind project - the Star of the South project, which is being developed off South Gippsland's coastline.

It has the potential to power nearly 20 per cent of Victoria's electricity needs while creating thousands of jobs and long-term investment in the Gippsland region. The project is currently in the environmental assessment phase and aims to start construction in the middle of the decade, generating full power by 2030 (subject to financial investment decision)[20].

To facilitate the regulation and oversite of new offshore wind technologies, the Commonwealth Government has implemented the Offshore Electricity Infrastructure Act 2021 which will come into effect by June 2022[21].

[19] https://www.planning.vic.gov.au/__data/assets/pdf_file/0030/564852/Delburn-Wind-Farm-Panel-Report-.pdf page 117.
[20] Star of the South Inquiry into the Closure of hazelwood and Yallourn Power Station, Submission 49, 2021
[21] Offshore Electricity Infrastructure Act 2021, Commonwealth Parliament.

6.2 Solar Energy

The Liberals and Nationals members support sustainable transition to solar energy in concert with end-of-life recycling of solar panels.

Minority Report Recommendation 3: That the Victorian Government introduce bonds (similar to retiring coal fired power station bonds) for large-scale solar energy facilities to ensure sufficient funds are available for site rehabilitation.

6.3 Battery Storage

Battery manufacturing has a significant environmental (including emissions) footprint, due to extraction of lithium, cobalt, nickel and other minerals for the batteries. Victoria needs to develop domestic manufacturing capabilities and dedicated facilities to recycle spent batteries, in appropriate locations away from human settlement.

Battery storage technology is not without other risks. A 300 MW Tesla lithium battery near Geelong caught fire in July 2021. The fire broke out during testing of a Tesla megapack at the Victorian Big Battery site. A 13-tonne lithium battery was engulfed in flames, which then spread to an adjacent battery bank[22].

6.4 Electric Cars

The Liberals and Nationals members support and endorse an orderly uptake of electric vehicles.

The Committee Report recommends a cut-off date for sales of new internal combustion engine vehicles. The Liberals and Nationals members consider that as new technology becomes available ie. electric vehicles (EVs) consumers will change their purchasing patterns without a government mandate.

It is necessary to ensure that in transitioning to powering transport with renewables that those having to travel long distances are not disadvantaged by that transition.

7. Renewable Energy options that warrant greater consideration

The Liberals and Nationals members support appraisal of other renewable energy options.

7.1 Hydro Electricity

Hydroelectric power is versatile and can be generated using both large scale projects, like the Snowy River Scheme, and small-scale projects like underwater turbines and dams on small rivers and streams. Production of Hydroelectric power does not generate atmospheric emissions, however, construction of the dams and equipment and their maintenance results in some atmospheric emissions and some environmental challenges.

7.2 Potential for Pumped Hydro Electricity Storage

There is a need for greater Victorian Government support for new investment in deep storage by pumped hydro given the limited operational performance of battery storage (shallow storage) and potential adverse socioeconomic and environmental risks associated with battery storage.

In his testimony to the Inquiry, Australian National University, Professor Blakers paints a sufficiently bright future for deep storage by pumped hydro. What is lacking in the Committee Report is further interest in interrogating indicative analysis of the financial feasibility of some of the potential options. A detailed comparison of the operating cost-effectiveness and socioeconomic and environmental risks and benefits of pumped hydro vs battery storage is required. The Victorian Government appears to be supporting storage using imported batteries, without a dedicated facility to recycle the spent large-scale batteries.

[22] https://www.abc.net.au/news/2021-09-28/fire-at-tesla-giant-battery-project-near-geelong-investigation/100496688

Pumped hydro has the potential for greater local content and lower environmental risks than batteries.

Victoria has excellent natural resources for pumped hydro including two pairs of existing reservoirs and 4000 other good sites. Modelling by Hydro Tasmania showed delivering 750MW of firming power was 15 to 35 per cent cheaper than other options available. This indicates the need for greater Victorian Government support for new investment in deep storage by pumped hydro, given poorer operational performance (shallow storage) and adverse socioeconomic and environmental risks associated with battery storage.

Minority Report Recommendation 4: That the Victorian Government undertakes an analysis of the operating cost-effectiveness and socioeconomic and environmental impacts of battery storage compared to pumped hydro.

7.3 Energy from Waste (EfW)

The 2019 Environment and Planning Inquiry Report into Recycling and Waste Management recommended:

"That the Victorian Government implement energy from waste technologies in Victoria, in conjunction with a future circular economy policy, as an alternative to landfill for residual waste.[23]*"*

The Liberals and Nationals have committed to a policy to end household waste going to landfill by 2035 in Victoria[24].

The Maryvale EfW project is aligned with the principles of the circular economy and will bring state-of-the-art alternative energy technology to Gippsland. It will offer local and metropolitan councils and commercial customers a competitive waste management solution that will divert waste from landfill, reduce emissions and deliver a range of social benefits[25].

The Commonwealth Government in April 2022 provided $48.2 million in the form of a grant to assist an Opal Australian Paper consortium to build an $500 million EfW plant at its Maryvale Mill.

Energy from Waste will become increasingly important with Opal's Maryvale Mill offering one project. Other projects including work by a group of South Eastern Metropolitan councils also align with these objectives in offering viable projects.

7.4 Hydrogen

Hydrogen is classified as 'Blue' or 'Green' hydrogen with the terminology related to the energy source used:

- **Blue hydrogen** – refers to Hydrogen produced via fossil fuels, with the use of carbon capture and storage technology.
- **Green hydrogen** – refers to Hydrogen produced from electricity derived from renewable sources like wind and solar via the process of electrolysis.

The Committee Report is not particularly supportive of hydrogen energy despite the availability of significant suitable lignite raw material resource, complimentary infrastructure and nearby sites for carbon capture and storage.

Hydrogen occurs naturally in compound form with other elements in liquids, gases, or solids. Hydrogen combined with oxygen is water. Hydrogen combined with carbon forms different hydrocarbons found in natural gas, coal, and petroleum. When hydrogen is separated, it can be used for both fuel and electricity. Hydrogen can be used as a clean burning fuel, which leads to less pollution and a cleaner environment. It can also be used for fuel cells which are similar to batteries and can be used for powering an electric motor. The energy used to produce the hydrogen involves atmospheric emissions. Scope exists in Gippsland to limit the emissions of blue hydrogen through carbon capture and storage and bio sequestration.

[23] Environment and Planning Inquiry into Recycling and Waste Management, Recommendation 37, 2019, p 183
[24] https://vic.nationals.org.au/media-releases/war-on-waste-liberal-nationals-commit-to-zero-waste-to-landfill-by-2035/
[25] https://opalanz.com/app/uploads/2022/04/Maryvale-Energy-from-Waste-project-recipient-of-MMI-48.2M-grant.pdf

Australian Carbon Innovation (ACI) is an independent, not-for-profit company with the mission to develop technologies and people to broaden the use of lignite sustainably. ACI is confident of a bright future for Victorian lignite even in the context of net zero greenhouse gas (GHG) emissions. There are potential technologies that produce little or no CO_2 while adding value to lignite. Where upgraded products do have a CO_2 footprint, Victoria has nearby enough geological CO_2 storage capacity to last for hundreds of years. The key is to convert the 33 billion tonnes of recoverable lignite representing 6 billion tonnes of low-cost clean carbon into high value products. It is a unique local resource not exposed to global commodity trading. Value adding must be done locally as it is not economic to ship the raw product. This means that high value, skilled, highly paid, interesting, hi-tech jobs in the region and state[26].

The Hydrogen Energy Supply Chain Project (HESC) has received financial support from the Commonwealth and Victorian Government, each contributing $50 million to the $500 million project.

A world-first demonstration of an international hydrogen energy supply chain was completed earlier this year.

HESC operations in the Latrobe Valley, is an important beginning for Australia's hydrogen industry. The HESC project produced hydrogen using coal from Victoria's Latrobe Valley, with the liquefied hydrogen exported to Kobe in Japan.

> *This world-leading project is an important step in developing Australia's hydrogen industry, which is estimated could generate more than 8,000 jobs, many in regional Australia, and over $11 billion a year in GDP by 2050.*
>
> *The HESC operations are part of a significant joint collaboration between industry and the Australian, Victorian and Japanese governments[27].*

The Liberals and Nationals members acknowledge the potential to integrate hydrogen fuel and energy sourced initially from blue hydrogen production transitioning to green hydrogen as it becomes available.

Other consortia presented their vision for a green hydrogen economy in a submission to the Economy and Infrastructure Committee Closure of Hazelwood and Yallourn Power Station Inquiry.

Gippsland Circular Economy Precinct (GCEP) Pty. Ltd., a collaboration between Gippsland businesses Marathon Electrical, Ferguson Civil, Solis RE and Nexsys Industries Consulting, has been established to drive and lead the development of the green hydrogen economy in Gippsland.

GCEP and our consortium partners are driving and facilitating industry investment in jobs and manufacturing capability in renewable energy. Green hydrogen and technology will lead to decarbonisation and emission reductions[28].

7.5 Wave Energy

Wave energy is renewable and abundant and also more predictable and consistent than solar and wind energy yet has been largely ignored in the Committee Report and has received little government support. Most populated cities tend to be near oceans and harbors, making it easier to harness this energy for the local population. Production of wave energy does not generate atmospheric emissions; however, construction and maintenance of the equipment results in some emissions and environmental challenges. Large machinery needs to be built nearby to help capture this form of energy, which can cause some mostly temporary disruptions to the ocean floor and the sea life that habitats it. Rough weather produces lower energy output when compared to normal waves without stormy weather.

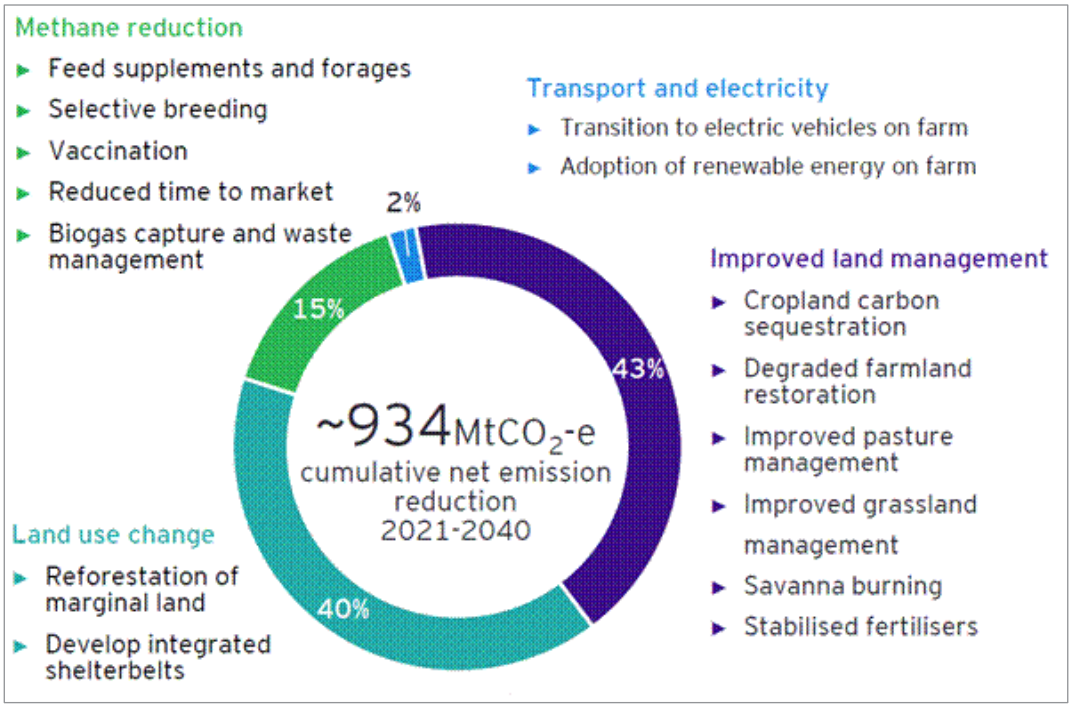
[26] Australian Carbon Innovations ACI (2021). Submission No 17 Attachment 1 to LC EIC Inquiry into the Closure of the Hazelwood and Yallourn Power Stations.
[27] https://www.minister.industry.gov.au/ministers/pitt/media-releases/australias-hydrogen-industry-celebrates-production-milestone
[28] Gippsland Circular Economy Precinct, Economy and Infrastructure Committee CHYPS Inquiry, Submission 44.

8. Reduced emissions through agricultural and industrial efficiencies

The Committee Report overlooked the considerable progress made through improving efficiency of energy use aided by Commonwealth Government assistance.

The Liberals and Nationals members acknowledge the Australian agricultural sector has made significant commitments to reduce carbon emissions, for example, the Australian red meat and livestock industry has set the ambitious target to be Carbon Neutral by 2030 (CN30)[29].

Figure 5: Farmers for Climate Action - Emissions Reductions[30]



Australian farmers are significantly reducing CO_2 emissions through the introduction of new technologies and land use practises aided by producer levies and Commonwealth Government assistance that is substantially cheaper than government subsidies for renewable energy. As science evolves, our agriculture sector will play a key role in progressing to net zero as we learn and adapt to store carbon on our primary producer's soil.

Emissions reductions through agricultural and industrial efficiencies will be important in assisting to achieve Victoria's announced objective of 50% emission reductions by 2030.

9. Conclusion

The Victorian Liberals and Nationals members are committed to the attainment of net zero emissions by 2050, which is why this Minority Report has been submitted to help guide this achievement.

[29] https://www.mla.com.au/research-and-development/Environment-sustainability/carbon-neutral-2030-rd/cn30/
[30] Farmers for Climate Action Report, 13 September 2021 Ernst & Young Australia.

Minority report - Dr Samantha Ratnam MLC

Introduction

The Legislative Council's planning and environment committee was asked to investigate how Victoria can transition to a state powered by 100% renewable energy as quickly as possible. The scope of this inquiry also covered the employment opportunities from this transition and actions the Victorian Government should be taking to ensure a transition that is fair for current fossil fuel workers and their communities.

This inquiry comes at a time when climate change-driven extreme weather events are playing out across Australia with catastrophic flooding in Queensland and New South Wales. These events come just two years after the catastrophic climate change-fuelled fires of the 2019-20 Black Summer. It has never been more important for our Parliaments and elected representatives to take all possible action to address climate change.

I would like to thank all the members of the public and organisations who made submissions, and also those that presented to the committee. The collation of current and Victoria-specific energy analysis is invaluable. As always, I would also like to thank the excellent committee staff for their tireless work.

While I largely support the majority report from this inquiry, I have prepared this brief minority report to:

1. Highlight evidence heard during the inquiry that Victorian can and must go further and faster in it's transition to renewable energy and that it is indeed possible and desirable (in fact, essential) for Victoria to reach 100% renewable energy within 10 years.
2. Elevate the importance of long term transition planning and funding for fossil fuel workers and their communities
3. Emphasise the need for Victoria to take stronger action to reduce emissions from the transport sector
4. Debunk evidence provided by fossil fuel lobbyists during the inquiry related to carbon capture and storage.

1. Accelerating Victoria's energy transition

Chapter 3 of the majority report covers measures to transition to 100% renewable energy. The inquiry heard extensive evidence that while Victoria is taking important steps to reduce greenhouse gas emissions fromthe energy sector, our state can and should be going further and faster with this transition. For example:

Greg Foyster, Acting Campaigns Manager from Environment Victoria noted that on current forecasts the Victorian Government is already on track to meet its 50% target sooner than 2030, and argues it should revise the target to be more ambitious:

“The Victorian government still has a renewable energy target of 50 per cent by 2030, and by our calculations and forecasts from the Australian Energy Market Operator we are well on track to overachieve that. So one of our recommendations is to significantly increase that target to close to 100 per cent by 2030.”

To address this evidence, I moved for the addition of the following recommendation.

Additional recommendation 1: Victoria should increase the Victorian Renewable Energy target above the current 50% towards a 100% by 2030 target to drive further investment in the roll out of new renewable energy.

2. Supporting long term transition planning for fossil fuel workers and their communities

Burning coal and gas is the biggest cause of climate change and it is therefore urgent for Victoria to cease using these fossil fuels for energy. However, it is important for Governments to play a leadership role in planning for this transition so that coal and gas workers and their communities are not left to bear the brunt of unplanned economic transition.

While the majority report acknowledges this to some degree, the associated recommendation is relatively narrow, focusing on a Worker Transition Service and the impacts on the supply chain for the Yallourn mine and power station. In reality, the Latrobe Valley community is calling for a much more holistic plan for their community. The Victorian Labor Government has licenced the Loy Yang power station to operate until 2048, yet energy analysts, including AMEO have estimated that all of Victoria’s coal power stations are likely to close by 2032.

To ensure that workers and their communities are not left in the lurchI make the following additional recommendation:

Additional recommendation 2: The Victorian Government undertake an urgent holistic plan for coal and gas transition in Victoria, including providing long term funding to the Latrobe Valley Authority over the next 15-20 years to oversee the planning of coal closure and the development of alternative industries for the region and to ensure that existing workers and communities are supported through the transition away from coal and gas.

3. Stronger action to reduce transport emissions

Chapter 6 of the majority report looks into further opportunities to reduce emissions in Victoria. One of the key areas it identifies is transport. In 2019, transport accounted for 25% of Victoria’s emissions, making it the second-largest source (after energy), and the fastest growing source of emissions.The majority report makes a range of recommendations to support electric vehicle uptake including continued subsidies. I support these recommendations and was also pleased to successfully move a recommendation that Victoria adopt vehicle emissions standards to stop our state becoming a dumping ground for polluting cars and to protect health and the climate.

However, while the committee heard evidence that Victoria's introduction of a state-based electric vehicle charge is a backward climate policy step for Victoria, this is not reflected in the report findings. To address this, I've made the following finding and recommendation:

Additional finding 1: Victoria's introduction of a new charge that only applies to electric vehicles is acting as a barrier to electric vehicle uptake, and Victoria is the only state to have introduced such a charge at this time.

Additional recommendation 3: That the Victorian Government remove the electric vehicle road user charge until it reaches its electric vehicle uptake goals so as not to add a further barrier to electric vehicle usage in Victoria.

4. More fossil fuels are not part of the solution

Fossil fuel lobby groups provided evidence to the committee via both submissions and as witnesses. These lobbyists have a clear vested interest in continuing the life of fossil fuels, despite the impact that burning coal and gas is having on the climate.

The committee heard evidence from fossil fuel witnesses who pushed the idea that "carbon capture and storage" is a way to lessen the climate impacts of burning fossil fuels by 'storing' these emissions underground, or under the ocean. Yet in reality, carbon capture and storage is a fig leaf that hides the fossil fuel industries' continued and knowing destruction of our climate.

The first carbon capture and storage (CCS) project started in 1972. Despite this almost 50-year history, there are only 19 operating carbon capture and storage projects around the world. Over half of the currently operating projects are used to extract more fossil fuels, creating more climate pollution. The process is called 'enhanced oil recovery', where captured CO2 is pumped into oilfields to essentially push out more oil.

No operating carbon capture and storage project comes even close to capturing all of the carbon pollution they create. For example, the Gorgan carbon capture and storage project in WA will capture only 3.3 per cent of the emissions generated from extracting, refining, transporting and burning the gas from the field.

For over 50 years governments around the world have been paying trillions in subsidies to coal, oil and gas to develop a technology that would allow them to keep profiting from fossil fuels. Yet unlike the technologies of renewable energy and storage, CCS has failed to materialise.

The evidence presented elsewhere in the majority report shows that we have the technology and capacity to replace all fossil fuel use and there is no place for continuing their life under using carbon capture and storage as a justification.

Given the failure of CCS it's deeply concerning that Victoria is spending public funding on a carbon capture and storage project called CarbonNet.

It is also concerning that the Victorian Labor Government has provided $50 million in public funding for a project to create hydrogen from brown coal. While hydrogen made from genuinely renewable sources of energy will play a role in Victoria's energy transition, making hydrogen by burning coal will actually increase Victoria's emissions.

In the face of increasing climate change, it is unacceptable that the Victorian Labor Government is spending taxpayer dollars on new fossil fuel projects and I have therefore added the additional recommendation:

Additional recommendation 4: The Victorian government should immediately remove funding and other support for the CarbonNet and Brown Coal to Hydrogen project.

Conclusion

Climate change is here already, and is affecting Victoria and our residents in devastating ways, from fires to floods, extreme storm events to coastal erosion, and heat waves taking people's lives. Victoria must be as ambitious as possible in the climate action we take over the coming years. In fact, we must meet what the science says is necessary. This means it is vital for this and the next Victorian Government to stop all new fossil fuel production, to urgently transition our current coal and gas to renewable sources, and to eliminate emissions from other sectors, especially transport. The report from the inquiry provides a wealth of insights and evidence about how Victoria can achieve these changes, and reach 100% renewable energy in the next 10 years, as well as reduce our emissions significantly from other sources, and the benefits that will flow to our state in doing so. Anything less than this will be condemning our current citizens, and future generations, to a life of uncertainty and climate collapse. Victoria can, and must, go much further, and the evidence provided to this inquiry shows that we have the technology, resources and expertise to do so, all we need now is the political will. I look forward to the Government's response to the recommendations in this report.