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Animal Justice Party

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The Animal Justice Party 2021

Images
Front cover: Batteries aren't renewable, they are fuelled by mining. Top image: Graphite miner in China (Source: Jixi, Heilongjiang, China. 4th July, 2017. A worker covered in graphite dust at a warehouse where graphite is processed. Credit: Dave Tacon/ZUMA Wire/ZUMAPRESS.com/Alamy Live News), Bottom image: Children mining cobalt in the Democratic Republic of the Congo (Source: Gwenn Dubourthoumieu / AFP | Children at work in a mine in Kamatanda, in the Katanga region of DR Congo, on July 9, 2010)
This Page: Mount Ash Forest, Kinglake, Dr Nadine Richings © 2020

The Animal Justice Party acknowledges the First Nations peoples as the custodians of the land on which we live and work.

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About the Animal Justice Party

The Animal Justice Party (the AJP) is a political party established in 2009 to secure the interests of animals and nature through Australia's democratic institutions of government. Our vision is a planet on which animals and nature have the right to live and thrive free from negative human interference and a human society which functions with kindness and compassion within its ecological limits as a responsible member of the Earth community. The AJP seeks to foster respect, kindness, and compassion towards all species particularly in the way governments design and deliver initiatives, and the manner in which these initiatives function.

In New South Wales the AJP has two elected representatives in the Legislative Council of NSW, Mark Pearson MLC and Emma Hurst MLC. In Victoria, the AJP has an elected representative in the Legislative Council, Andy Meddick MLC, and two councillors in Local Government, Councillors Julie Sloan and Charlie Vincent.

This submission was prepared by the Victorian Submissions Working Group within the AJP. The working group makes this submission on behalf of the AJP with the approval and the endorsement of the Board of Directors.

Submission

The AJP is concerned about the reliance on fossil fuel energy sources in Australia. These have been scientifically proven to contribute to climate change. While the AJP recognises that humans rely on energy in their daily lives, we seek a solution that is not only sustainable, but also considers the lives of other animals. Energy production is a major source of greenhouse gases. This submission responds to the Terms of Reference of the Inquiry into Renewable Energy in Victoria:

Inquiry into Renewable Energy in Victoria Terms of Reference

(a) measures to enable Victoria to transition its energy supply to 100 percent renewable energy;
(b) jobs and economic benefits and implications of Victoria transitioning to 100 percent renewable energy;
(c) investment, both public and private, required to achieve 100 percent 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;

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(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 percent renewable energy;
(f) the economic risks of not urgently reducing emissions by transitioning to 100 percent renewable energy; and
(g) any other related matters[1]

This submission is guided by our mission and vision and underpinned by our policies. The AJP has policies developed in accordance with our core values: kindness, equality, rationality and non-violence. Our policies cover animal, environment and human issues[2]. Our policies on climate change[3], energy[4], environment[5], land clearing[6], natural gas[7], wildlife and sustainability[8], and waste[9] are particularly relevant to this consultation.

The AJP submission is structured following the terms of reference posed by the consultation; 67 recommendations are provided throughout our submission.

Thank you for the opportunity to contribute to this consultation.

Introduction

The *United Nations Intergovernmental Panel on Climate Change (IPCC)* released the sixth assessment report on 9 August 2021[10]. Every region on the planet is affected by anthropogenic-climate change, and extreme droughts, floods, wildfires, heatwaves and storms are all set to increase in frequency and severity if global heating continues. If drastic and immediate action is taken we may prevent a global temperature rise above 1.5°C. Even in the best-case scenarios, some of the changes are irreversible for millennia, including rises in sea levels.

The World Alliance of Scientists published their 2021 review of the planet's health based on vital signs on 28 Jul 2021[11] - it has worsened since their first report in Jan 2020[12], in which they posed a six-point plan for climate action. Given the extent of damage and expected ongoing climate

[1] https://www.parliament.vic.gov.au/epc-lc/article/4460
[2] Animal Justice Party *Policies* https://animaljusticeparty.org/policies/
[3] Animal Justice Party *Climate Change Policy* https://animaljusticeparty.org/wp-content/uploads/2018/06/climate-changeA4.pdf
[4] Animal Justice Party *Energy Policy* https://animaljusticeparty.org/wp-content/uploads/2019/04/ENERGY-NAT-Basic.pdf
[5] Animal Justice Party *Environment Policy* https://animaljusticeparty.org/policieslist/environment/environment/
[6] Animal Justice Party *Land Clearing Policy* https://animaljusticeparty.org/wp-content/uploads/2017/11/land-clearingA4.pdf
[7] Animal Justice Party *Natural Gas Policy* https://animaljusticeparty.org/policieslist/environment/natural-gas/
[8] Animal Justice Party *Wildlife & Sustainability Policy* https://animaljusticeparty.org/policieslist/environment/wildlife-and-sustainability/
[9] Animal Justice Party *Waste Policy* https://animaljusticeparty.org/wp-content/uploads/2020/05/Animal-Justice-Party-Waste-Information-Sheet-May-2020.pdf
[10] IPCC (2021) Sixth Assessment Report - AR6 Climate Change 2021: The Physical Science Basis. ttps://www.ipcc.ch/report/ar6/wg1/
[11] Ripple WJ, *et al.* (2021) World Scientists' Warning of a Climate Emergency 2021, *BioScience*, 2021;,biab079, https://doi.org/10.1093/biosci/biab079
[12] Ripple WJ, et al. (2020) World Scientists' Warning of a Climate Emergency, *BioScience*, 70(1): 8-12, https://doi.org/10.1093/biosci/biz088

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damage, we cannot act too extremely, or too urgently; nothing will be an over-reaction. We must act with urgency and extreme responses to have any impact on the extent of climate damage.

Alarmingly, Australia has the highest per capita emissions in the Organisation for Economic Co-operation and Development (OECD), with 25 tonnes of greenhouse gases being emitted per person every year. Australia committed to reducing emissions by five percent from 2000 levels by 2020, in line with The Paris Agreement (2015). Electrical energy generates a disproportionate amount of greenhouse gases, but all fossil fuels have to be eliminated.

While Australia's overall electricity emissions are trending down[13], the trend is slow. If Victoria's progress is continued, in particular as it has over the last decade, it will take until well after 2050 to remove coal; as the following graph (Figure 1) shows. Keep in mind that the renewable roll out to date hasn't had to deal with any of the hard problems that will be faced as the percentage of renewables gets higher. The reason the Australian Energy Market Operator (AEMO) is doing so many studies on renewable integration is that there are so many unknowns. What's been done to date is the easy bit.

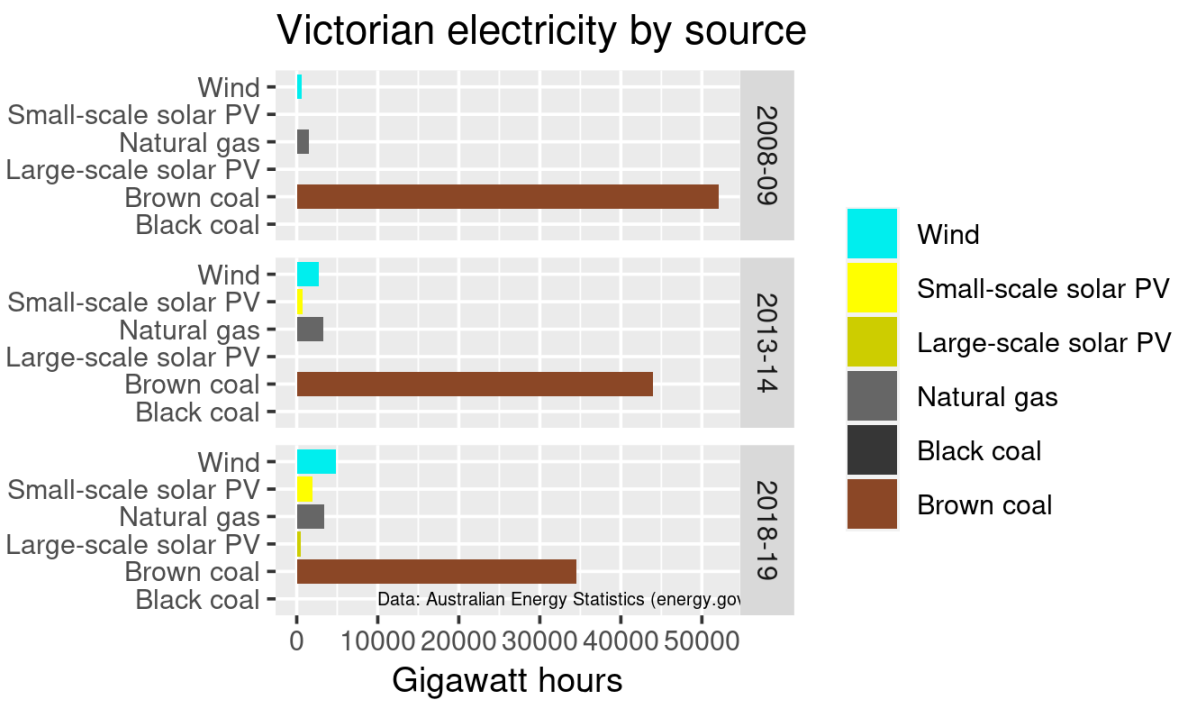

Figure 1. Victorian Electricity by source - comparison at five year intervals (*Source: AJP graph using data from energy.go.au)*

While "clean energy" and "renewables" are often put forward as solutions, these terms are somewhat misleading, as all energy-harvesting technologies generate pollutants during their life-cycles. Renewables such as wind and solar, for example, require considerable materials to be

[13] https://www.industry.gov.au/data-and-publications/national-greenhouse-gas-inventory-quarterly-update-march-2021

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mined[14]. The mining requirements of renewables increases still further if mining for battery components or other storage technologies is included.

Understanding the full consequences of energy production systems is necessary for meeting demand while also safeguarding the ecological systems on which we depend.[15] Significant losses of global biodiversity and ecosystem services are already occurring as a direct result of increasing climate change. We need systems which simultaneously minimise impacts on animals at a species and individual level, while reducing greenhouse gas emissions rapidly.[16]

G) Any other related matters.

The AJP wishes to respond to item G) first because we need to explain the reasoning behind our approach, for example a government might call for submissions on using a drug to treat Covid-19, and the best response may be to tell that government that the call is too narrowly defined in omitting to mention the possibility of a vaccine. So it is with this inquiry. It makes assumptions that we believe are unsupported by available evidence.

The AJP begins by considering "energy storage", mentioned in C) below. The roll-out of home batteries is assumed by many to be an inevitable part of any renewable energy system; as is the use of "big" batteries like that installed in South Australia in 2016 in response to its state-wide blackout earlier that year. "Big" batteries are currently under construction in Victoria. So while item C) talks generically about "energy storage", the AJP will assume that batteries will be one major component of any such storage. It is understood that just one Pumped Hydro scheme is planned for Victoria, and that is truly tiny at just 30/180 MW/MWh.

A battery is a piece of technology which stores electricity. It is made from mined and processed materials which in theory may be recycled, but which currently are not. Some of the elements in current batteries, such as nickel and manganese are hazardous to health. Manganese is explosive, nickel is a carcinogen. The organic solvents used as electrolytes are highly flammable. The risks, difficulties and costs of recycling batteries at scale are substantial and largely unsolved.

The requirement for batteries in an electricity system cuts to the heart of the difficulty of defining a "renewable" energy system. Batteries are not renewable energy systems, so is a system which needs them really renewable?

Sunshine is renewable in the sense that harvesting its energy doesn't change the sun's output, but that isn't true of wind. Harvesting wind energy does have an ecological impact; whether it is significant will depend on the circumstances.

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[14] https://academic.oup.com/bioscience/article/65/3/290/236920
[15] https://academic.oup.com/bioscience/article/65/3/290/236920
[16] Animal Justice Party *Energy Policy* https://animaljusticeparty.org/wp-content/uploads/2019/04/ENERGY-NAT-Basic.pdf

In both cases, while the source of the energy might arguably be called renewable, the resources required are like any other. The materials required to build wind farms and solar panels need to be mined and processed at a massive scale using methods which are typically dirty, dangerous and destructive to wildlife habitat. The land required for wind and solar farms is massively changed by their construction.

Hydroelectricity can be either run-of-the-river, and reasonably called renewable, or made by flooding valleys, which is equally reasonably, not renewable.

In every case, the term "renewable" should not be taken to imply anything positive about the methods of production of the technologies involved. Some two thirds of the world's cobalt – a major component in electric vehicle batteries – comes from the Democratic Republic of the Congo, where a 2016 report by Amnesty International found 40,000 children working in cobalt mines. China now dominates the production of polysilicon, where a 2021 report finds them using Uyghur workers to crush the mined quartz under coercive labour conditions. These industries are hiding dirty secrets.

The unbridled enthusiasm for the term "renewable" in this enquiry speaks to either ignorance or a serious lack of social conscience on the part of the Victorian Parliament. This enquiry should be about "clean" energy, meaning zero greenhouse gas emissions, or as close as possible. It should be about minimising the total ecological and social damage of the energy supply chain. The Victorian Parliament seems unaware that we are beset by two global crises; climate and biodiversity; the terms of the inquiry seem to indicate a lack of awareness about the second.

Some numbers may serve to illustrate the problems. 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. Consequently both the World Bank and the International Energy Agency have recently done studies on the mineral requirements for a global renewable energy rollout. These studies are part of the reason that big mining companies are increasingly enthusiastic about renewables; particularly the copper industry.

Both wind and solar generation typically suffer by being available not just at the wrong time, but in the wrong place. Globally, this problem is being attacked with yet more mined and processed materials; to massively ramp up transmission capabilities, both HVDC and HVAC connections (high voltage DC and AC links).

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The North Sea Link between Norway and the UK has recently been completed. Technical details aren't available, but a recent Economist article[17] put the weight of such cables at about 150kg/metre; implying that the link could be some 108,000 tonnes of a complex web of copper and aluminium. The cable pictured at left (Figure 2) is a small example of this kind of cable.

Figure 2. Example of resource-dense cable used to convey electricity long distances. (*Source: https://twitter.com/pickover/status/1255286408970997760*)

The North Sea Link is just one of a vast network being built to shift electricity around to compensate for fundamental weaknesses in wind and solar technologies. A 2014 European study estimated that the European transmission system would have to be expanded by a factor of 6 to 11 in a 100 percent renewable system. Here's a picture (Figure 3) from a recent review.[18]

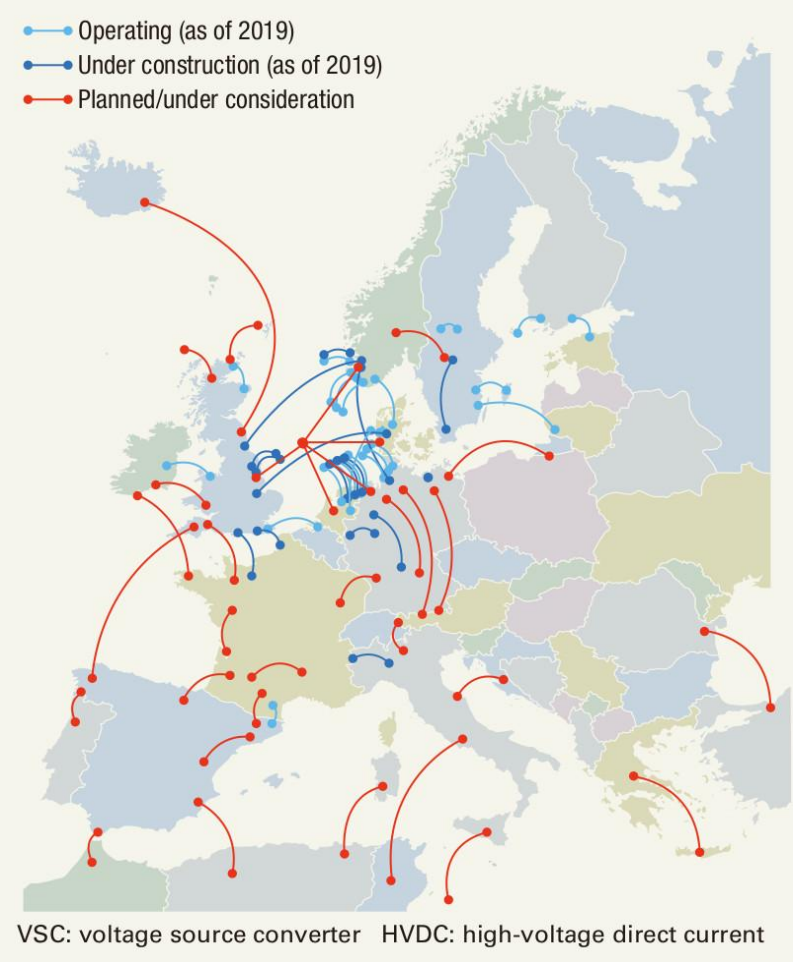

Figure 3. Construction of VSC and HVDC in Europe.
(*Source: https://www.hitachi.com/rev/archive/2020/r2020_04/pdf/gir.pdf)*

[17] https://www.economist.com/business/2021/10/11/the-booming-business-of-knitting-together-the-worlds-electricity-grids
[18] https://www.hitachi.com/rev/archive/2020/r2020_04/pdf/gir.pdf

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Closer to home, the Australian Energy Market Operator, in May 2020, floated a moratorium on further PV in South Australia without a third large ($2 billion) electricity interconnector to firm up the SA grid. It's worth quoting from their advice:[19]

> *"If EnergyConnect [a new big transmission connection between SA and NSW] does not proceed, extensive further measures (beyond those outlined in this report) will be required to address identified system security risks. Potential further measures could include commissioning significant utility-scale storage to provide FFR, retrofit of a large number of distributed PV systems to improve disturbance ride-through capabilities, resistor banks for managing excess distributed generation, and possibly a moratorium on new distributed PV connections."*[20]

Clearly, AEMO is making it clear that even though South Australia has plenty of gas backup, and, as we keep being reminded, one of the largest batteries in the world, it's desperately in need of more backup in the form of reliable, rather than just cheap, electricity.

In addition to mining and habitat loss, there is also significant risk to birds and bats from wind farms. The tips of wind turbine rotors may seem to be moving slowly, but are actually moving at speeds quite deadly to flying animals. A 3.6MW land-based turbine[21] has a rotor tip speed of between 100 and 300 kph. No bird or bat can survive an impact from blades moving at this speed.

Given this data, the AJP would like to raise a few points:

a) Growth rates globally of both wind and solar are in decline. The graph below (Figure 4) was generated by an AJP author using BP Statistical Review of World Energy 2021[22], and shows that while solar growth rates (CAGR) are still very high, they are dropping fast.

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19 https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/SA_Advisory/2020/Minimum-Operational-Demand-Thresholds-in-South-Australia-Review

20 https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/SA_Advisory/2020/Minimum-Operational-Demand-Thresholds-in-South-Australia-Review

21 https://en.wind-turbine-models.com/turbines/58-ge-general-electric-ge-3.6s

22 https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html

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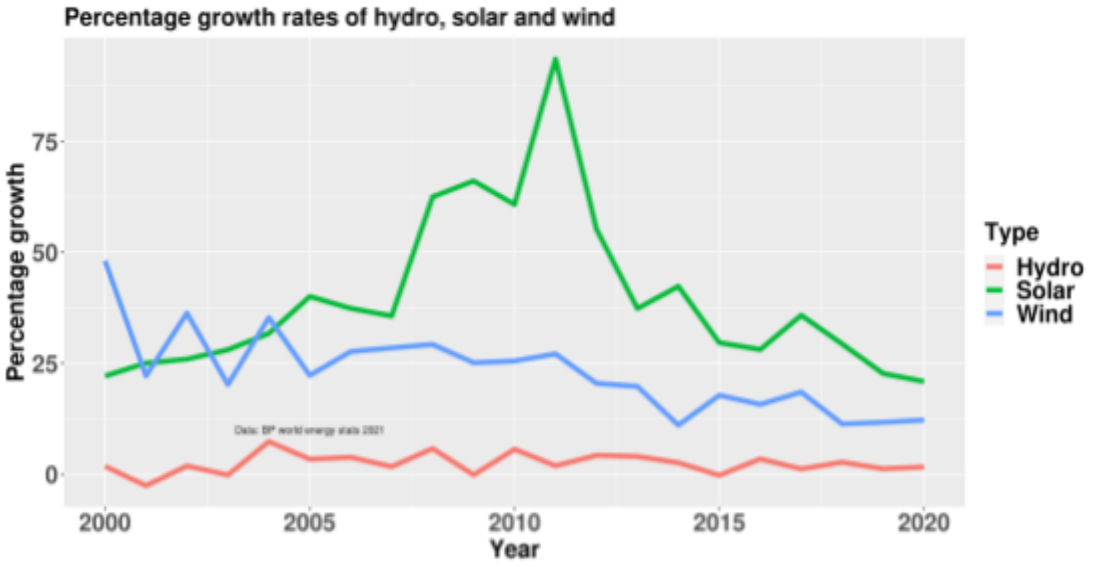

Figure 4. Growth Rate comparison between different sources of energy (*Source: Graph prepared by AJP from the 2021 BP Statistical Review of World Energy.*)

It seems likely that material bottlenecks are at least part of the reason for dropping growth rates. Put simply, the world is having trouble opening up enough mines to supply an increasing requirement for key materials. These difficulties have been foreseen and discussed in reports by the International Energy Agency[23], the World Bank[24]; both of whom have recently published reports into critical minerals required for any renewable electricity transition. The United Nations Environment Program warned of these problems as far back as 2011[25].

b) A 100 percent renewable energy grid of any significant size has never been created. Simple models[26] suggest that it is possible, but more detailed work[27] suggests that the simple models are too simple; using more detailed data shows that even assuming "perfect transmission", systems that can supply over 90 percent of energy will have hundreds of hours of shortfalls; even with 12 hours of storage. And once you get close to real world conditions, the simple models simply fail.[28]

c) Virtually all of the wind and solar plants installed to date will have failed before 2050 and need to be rebuilt. Most of the wind and solar installed during the next decade will have failed before 2050. Solar systems typically come with inverters having just a 10 year warranty and even shorter warranties on the "BOS" (balance of system).

d) The rate of building renewables has globally been extraordinarily slow. The chart below (Figure 5) was generated by an AJP author using BP Statistical Review of World Energy

[23] https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary
[24] https://www.worldbank.org/en/topic/extractiveindustries/brief/climate-smart-mining-minerals-for-climate-action
[25] https://wedocs.unep.org/bitstream/handle/20.500.11822/8824/GreenEconomyVulnerabletoRareEarthMineralsShortages.pdf
[26] https://www.sciencedirect.com/science/article/pii/S2542435117300120
[27] https://www.nature.com/articles/s41467-021-26355-z.pdf
[28] https://www.sciencedirect.com/science/article/pii/S2542435118300485

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2021[29], and shows countries and technologies ranked by rollout speed as measured by megawatt-hours per person added over a 10-year period. A full description follows.

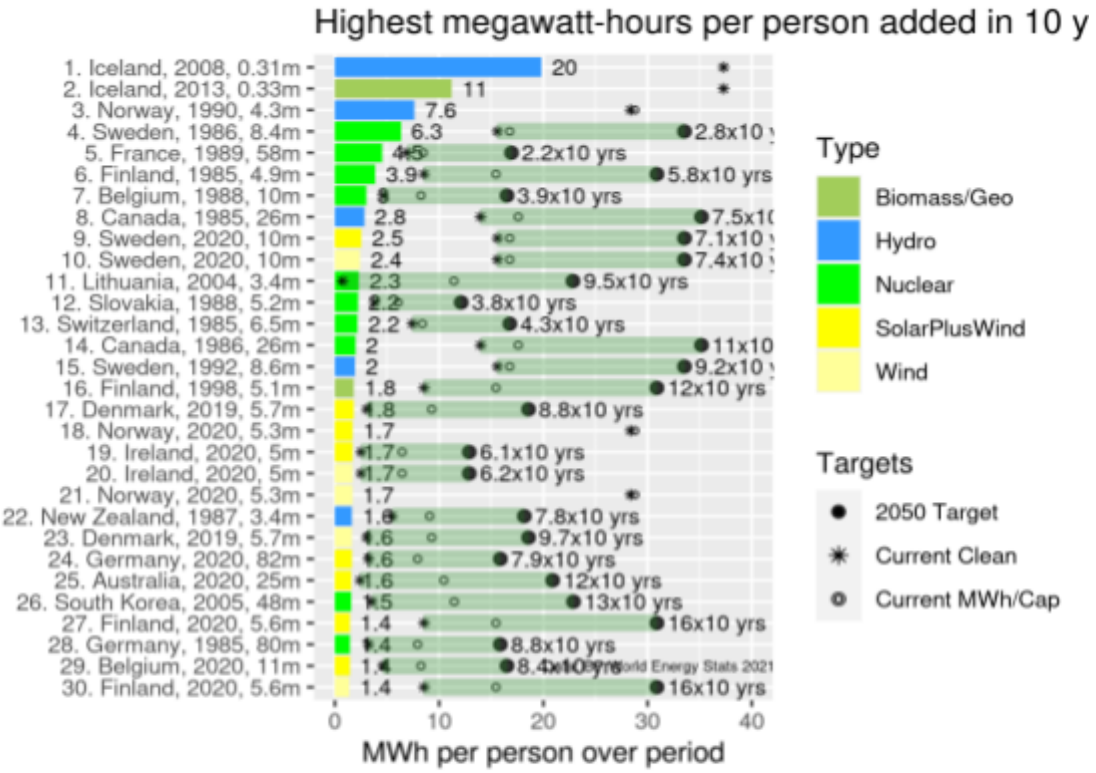

Figure 5. Ranking of countries and technologies by rollout speed (Source: Data collated by AJP from the 2021 BP Statistical Review of World Energy)

The ranking process ignored coal and gas construction. If coal and gas had been included there would have been only two renewable rollouts in the chart; Sweden at #9 above and Denmark at #23 above. In both cases, it is primarily wind power that is responsible for the rollout speed. The situation with hydro in Norway and Iceland is a special case only possible because of the geography of those countries. Otherwise, the top spots are filled by nuclear rollouts; Sweden, France, Finland and Belgium.

Focus on Sweden at #9 and #10. Between 2010 and 2020 Sweden added 2.5 megawatt-hours per person of wind and solar, with 2.4 megawatt-hours being wind. To get from their current level of clean energy (shown by the asterisk) to the 2050 IEA target (shown by the black dot) they will need 7.1 decades at their maximum rollout speed to date (that decade to 2020). Germany at #24 will require 7.9 decades and Australia at #25 will require 12 decades. Sweden can hit its 2050 IEA target in 28 years with nuclear, but not with wind+solar. The green shaded bars show the length or time each country will need to hit the International Energy Agency Net Zero targets by 2050. It should be noted that there is a considerable disparity between the amount of per capita electricity in various countries. Nor did the IEA specify the targets on a per

[29] https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html

country basis; we have simply scaled up the 2.6 increase in global electrical energy in the IEA scenario.

Clearly, there has to be a massive increase in rollout speed; but solar and wind growth rates are falling, not rising. Alternatively, countries will have to have much smaller targets than those suggested by the International Energy Agency.

The superior speed of thermal energy plant (hydro, nuclear, gas or coal) expansion is probably a result of simplicity. There is no grid redesign to worry about, no transmission infrastructure expansion and no reliability and stability issues; thermal energy plants don't require smart grids or storage. Thermal energy plants are characterised by large spinning lumps of metal (turbines and generators) which deliver stability automatically. The past 20 years has seen a raft of technology inventions aimed at simulating this stability (called "inertia" and "system strength") without those large spinning lumps of metal. This has included batteries and what is termed "synthetic inertia". It is fair to say that these developments are still a work in progress. The plans for 100 percent renewables with heavy wind and solar penetration are built on technology that has never been demonstrated at scale.

In contrast to thermal electricity plants, as wind and solar expand, they create a raft of new and complex problems to solve. These technologies are dependent not just on new technology but the rapid expansion of new mines and the use of materials that have the potential to create both manufacturing bottlenecks as well as ecological damage.

The rollout of renewable energy is therefore not straightforward, as there are a multitude of options, which all have varying environmental, ecological, financial and social costs, making it difficult to determine which direction we should support and where to concentrate our resources. We need to conduct an independent comparative study of the different available methods of producing renewable and clean energy and ensure that all factors are taken into account, not just expected energy output and monetary costs, but the intangible costs also as discussed previously. We cannot ignore the impact on biodiversity from killing birds and bats with wind turbines, the impact on landfill from producing poorly recyclable volumes of batteries with a finite lifespan and the ethical costs of supporting mining in areas with questionable attention paid to human rights, when we weigh up the 'costs' and benefits of different methods of supplying our state's energy requirements. What is not in doubt, is that Victoria (and Australia) must move away from our current reliance on fossil fuels.

Recommendations:

1. Create an independent body to oversee and guide the transition to net zero emissions goals, to minimise disruptions caused by changes in government and corresponding agendas and vested interests.

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2. Conduct a comprehensive, independent, comparative study of the different available methods of producing renewable and clean energy and use this to guide future decision-making.
3. Consider the environmental impact of all proposed changes on wildlife and wildlife habitat.
4. Do not rely on a technology that does not exist; it is highly risky. Despite decades of well-funded effort, grid-scale batteries are too expensive to use for anything except frequency control.
5. Phase out all natural gas use and export, except where all emissions can be sequestered.

A) Measures to enable Victoria to transition its energy supply to 100 percent renewable energy

Please see the comments relating to item C) below.

Recommendations:

6. Determine the criteria to be used for comparison of different sources of energy. Ensure these criteria consider all areas impacted, such as the direct and indirect environmental cost, financial costs, workforce implications and carbon footprint. Modelling must also be conducted to assess the impact of future energy requirements.
7. Create a comparative study between emerging and renewable energy sources and gas/electrification. Do not expand natural gas use, whether from coal seam or other sources.[30]
8. Do not invest in existing gas infrastructure upgrades or developments.
9. Implement a carbon tax on fossil fuels.[31]
10. Prohibit any fossil fuel expansion.[32]
11. Immediately cease subsidies of non-clean energy.
12. Include the impact on animals and the environment, and human and planetary health, in the selection criteria for all clean energy sources.[33]
13. Eliminate vested interests in decision-making.
14. Prioritise long-term solutions which will help us meet our climate emissions target.

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[30] Animal Justice Party *Natural Gas Policy* https://animaljusticeparty.org/policieslist/environment/natural-gas/
[31] https://theconversation.com/politics-aside-a-simple-carbon-tax-makes-more-sense-than-a-convoluted-emissions-trading-scheme-45433
[32] https://animaljusticeparty.org/policieslist/environment/climate-change/
[33] https://animaljusticeparty.org/policieslist/environment/energy/

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15. Evaluate the environmental impact of each source of alternative energy, in both the short and long-term.
16. Evaluate alternative forms of energy to consider the environmental implications of different geographical locations. For example, offshore wind farms must be evaluated separately to land-based wind farms.
17. Implement a carbon tax on both the coal and animal agriculture industries.[34]
18. Direct carbon taxes into clean energy solutions, sustainable, plant-based food agriculture systems and education.[35]
19. Rapidly transform to a carbon-free energy infrastructure.[36]
20. Protect existing forests and marine habitats from further destruction.[37]
21. Invest in the development of new, clean, animal-friendly energy technologies.[38]

B) Jobs and economic benefits and implications of Victoria transitioning to 100 percent renewable energy

Noting previous comments on the reality of 'transitioning to 100 percent renewable energy', the AJP will approach this question from the perspective of job and economic benefits of exploring innovations in future energy production technologies and embracing and expanding clean energy solutions.

Education

Australia's education system does not address climate science in a cohesive and meaningful manner.[39] Climate change science must be delivered to children and young people in an evidence-based, effective, age-appropriate manner across diverse disciplines. Children and young people should have opportunities to engage with nature, have practical experiences and directly observe life and its many interactions; for example school-community gardens.[40]

When preparing varied government responses, we urge policy makers to recognise that young people will frequently be at the forefront of emerging new technologies in the fields of climate change science, climate action, species conservation, and planetary and human health. Therefore, educators must be supported to develop appropriate, evidence-based curricula and learning modes to respond to advances in these disciplines.

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[34] https://animaljusticeparty.org/policieslist/environment/climate-change/
[35] https://animaljusticeparty.org/policieslist/environment/climate-change/
[36] https://animaljusticeparty.org/policieslist/environment/climate-change/
[37] https://animaljusticeparty.org/policieslist/environment/climate-change/
[38] https://animaljusticeparty.org/policieslist/environment/energy/
[39] Whitehouse H & Larri LJ (2019) Ever wondered what our curriculum teaches kids about climate change? The answer is 'not much'. The Conversation. 19 Sep 2019. https://theconversation.com/ever-wondered-what-our-curriculum-teaches-kids-about-climate-change-the-answer-is-not-much-123272
[40] Harvey B, et al. (2020) School-community gardens plant the seeds of change to address global warming. The Conversation. 13 May 2020. https://theconversation.com/school-community-gardens-plant-the-seeds-of-change-to-address-global-warming-134776

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Considering that every year, education services are delivered to one-third of Victorians[41] via our education sector, (which encompasses early childhood through to adult education and training), there is a large proportion of our state's population who are engaged with our education system at any one time. When the family members of these students are added to these numbers, it results in a significant proportion of the community coming into contact with, or impacted by, our education services on a regular basis.

This creates a unique opportunity for our education and training sector to lead the way, from increasing awareness and knowledge about the importance of lifestyle changes to providing a roadmap to demonstrate how to adopt these changes. Discussions around climate change impacts and mitigation strategies such as considering where and how we source our energy, need to become commonplace within the community.

It is impossible to adequately discuss Victoria's move towards clean sources of energy without considering the bigger picture of WHY we urgently need to move away from fossil fuels and WHAT are the current challenges facing our community and environment? Education must be supported more broadly in the community. Local Government areas, NGOs and community groups should be funded to develop and deliver evidence-based information on the three crises – biodiversity emergency, climate emergency and emerging diseases.

This leads to a very broad scope of possibilities for job prospects in the future as changes will be required across many fields and existing roles may evolve and expand in different directions. There are significant implications for training and education as existing courses may need to be expanded to include new skills, there will also need to be courses developed for new roles and 'bridging' courses to allow existing workers to upskill and expand their scope of practice. These education implications must extend into the secondary school sphere as course prerequisites may require knowledge in certain subjects and also there must be information available about future job prospects for school leavers and those making decisions about their future career paths.

Jobs

A simple example is an electrician: courses currently may be fairly similar across various educational establishments. In the future however, a trained electrician may need to choose whether they will specialise in houses that rely on solar power, they may become specialised in batteries as these become more commonplace, or they may remain working in the general electrics field, similar to the concept of a GP/specialists in the medical field. These specialised electrical fields will require additional study and 'hands on' experience beyond the current

41 https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.vic-engage.files/4016/2578/9268/Education_and_Training_Climate_Change_Adaptation_Action_Plan_2022-2026_for_consultation.pdf

training modules. These career possibilities must also be incorporated into TAFE and VCAL programs, they will require training for careers counselling staff to understand the different directions a student may follow, and they will require realistic information to be provided on the likely job prospects in these fields. Additionally, existing electricians may require upskilling. With a wide age range and therefore educational background, this will also require a way to assess current knowledge levels, transferable skills and how to efficiently address the gaps that new technologies in energy production create. The economic implications of significant changes and upgrades to secondary and tertiary school curricula must be considered.

A more complex example is that exploring clean energy sources requires the knowledge and expertise to compare the costs, risks and benefits of different methods of energy production. It is not sufficient to merely compare energy output per hour of a solar panel versus a wind turbine. This simplistic view is outdated and useless. We need people who can accurately evaluate the impact of an off-shore wind farm, taking into account the toll on the environment, wildlife, people, the climate and biodiversity from mining for materials, transporting materials, disrupting the sea bed, ongoing noise and movement pollution affecting the feeding and breeding habits of marine animals, bird strike killing birds and bats and affecting flight paths and migration patterns. This must then be evaluated against similar data for a solar panel: the 'cost' of mining for materials, transporting of materials, the size of land that must be cleared for sufficient solar panels to create the desired quantity of electricity, the materials required for cables to transport electricity, the impact on wildlife from digging up land or sea beds to bury cables, the lifecycle of the panels and the ability to recycle materials, the materials required to hold the weight of large panels and their ability to be reused and recycled, the issue of disposing of materials that cannot be recycled, the impact of heavy metals potentially leaching into soil from landfill. The list continues, and this is only one example of many.

This move towards alternative forms of energy will require environmental scientists, geologists, engineers, mining engineers, veterinarians, wildlife experts, marine biologists, water engineers, and many more disciplines which either may not yet exist or which may be a hybrid of some of these fields of expertise. These career paths may again require changes to existing courses of study, plus opportunities to upskill existing workers and expand the field for others.

The economic benefits long-term will hopefully be positive as there will be new jobs created by the requirement to explore renewable and clean energy production in Victoria, however in the short-term there will be an economic cost as schools, universities and other education providers scramble to update courses in line with future evolving careers.

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Regardless of technology choices, a clean energy infrastructure has to be manufactured; not simply designed or envisaged. It will be built by engineers and tradies not web designers and marketers or lawyers. Currently Australia's productive capacity in the energy tech sector is close to zero. Victoria doesn't make wind farms, lithium-ion batteries, or nuclear plants and there are very few solar PV panel makers left. Our industrial base rests on imports of core capital equipment paid for by commodity exports to which other countries add value. Many of our exports are emissions intensive with a limited future; including coal, cattle, sheep, meat and gas. We have just one pilot battery factory[42] under development. If we are to reduce our emissions intensive industries we need to be training our work force and investing in manufacturing capacity so that we can export not just the materials used to make energy infrastructure, but the products themselves.

Recommendations:

22. Ensure that all students have a good understanding of environmental science, including climate science, biodiversity and environmental science[43].
23. Communicate effectively. Ensure regular communication with students and parents regarding proposed climate change adaptation strategies, and that there are sufficient opportunities for feedback and engagement throughout this process.
24. Ensure age-appropriate comprehension of climate change is built into the curriculum at all levels and across all subjects.
25. Include sustainable living practices within the curricula at all ages.
26. Investigate potential new roles and career paths that will develop as a result of climate change adaptation strategies or new and emerging technologies, such as renewable energies.
27. Develop criteria for identifying new career pathways in a timely manner, and prioritise their inclusion into curricula to ensure our future workforce has opportunities to leave school skilled in these areas. Create opportunities where adult workers have easily accessible opportunities to upskill.
28. Identify key skills that will be useful in adapting to climate change impacts, and ensure these are incorporated into the curriculum across all subjects, as many of them may be transferable skills.
29. Work with tertiary education providers to develop curricula which address expanded or emerging career paths.
30. Work with tertiary education providers to develop curricula which upskills or expands the skills of workers established in a field of expertise.

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42 https://www.pv-magazine.com/2021/07/23/australias-first-lithium-ion-battery-manufacturing-facility-attracts-additional-funding/

43 http://animaljusticeparty.org/policieslist/humans/education/

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31. Work with tertiary education providers to establish criteria to easily and accurately assess current skills, recognise prior on-the-job learning , and how to incorporate these into newer technologies.
32. Develop plans to ensure that remote students will not be disadvantaged by limited access to places of learning during times of climate change-induced crisis such as bushfire or flood, or lack of communications access to online learning.

C) Investment, both public and private, required to achieve 100 percent renewable energy generation in Victoria, including investment in grid infrastructure and energy storage

As explained above. Renewable energy shouldn't be thought of as an end in itself. The end is to reduce climate forcing[44], preferably with as few environmentally adverse impacts as possible.

If we can generate clean electricity without a total grid redesign and rebuild and without much, or any, energy storage and without requiring considerable habitat loss, then why wouldn't we?

Requiring thousands of kilometres of HVAC/DC interconnectors is a sign that renewables don't just produce energy at the wrong time, but in the wrong place. The chief beneficiary may well be the copper industry. Storage can be useful in any grid, but it makes much more sense to store heat than to store electricity, storing electricity is expensive and requires a considerable amount of toxic mined and processed materials.

The AEMO Renewable Integration Study[45] described in some detail the various ways in which renewable integration is degrading the stability in our current grid and also the capacity to plan and manage change. Section 2.3.4 describes how simulating a single fault scenario has changed from a computationally simple task to one requiring 3-5 hours of computing time because inverter connections require non-linear electromagnetic transient modelling. The study as a whole illustrates a disconnect between the gung-ho confidence of renewable advocates and the engineers responsible for implementing political decisions. If building 100 percent renewable systems was easy, it would have been done. But it hasn't happened. At small-scale, renewable integration is easy, but at large-scale it is clearly becoming a tail wagging the dog.

The AEMO RIS is ominously subtitled "Stage 1".

Recent months have seen Europe and many other parts of the world suffering from serious energy shortages. Wind and solar haven't rescued them; on the contrary, lower than usual output from North Sea wind farms[46] have exacerbated the problems. German wind output in September was also down.[47] South America has needed more gas because drought has reduced

[44] http://ossfoundation.us/projects/environment/global-warming/radiative-climate-forcing
[45] https://aemo.com.au/en/energy-systems/major-publications/renewable-integration-study-ris
[46]https://www.economist.com/graphic-detail/2021/09/20/what-is-behind-rocketing-natural-gas-prices
[47] https://www.economist.com/the-economist-explains/2021/09/15/why-has-the-price-of-electricity-in-europe-reached-record-highs

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hydro output.[48] China has needed more gas because of both hydro shortages[49] due to drought in key areas (with floods elsewhere!) and coal supply problems due to tighter environmental regulations. In short, weather dependent energy isn't quite like having a large supply of fuel to get you through a shortage (regardless of the fuel). Even if batteries could remedy this; the recycling and waste problems would be considerable. Keep in mind that 8 of the 10 biggest PV panel makers in the World are Chinese[50] and the polysilicon at the base of global PV supply chains is made in China using coal fired electric arc furnaces.[51] So coal shortages in China could cause a substantial bottleneck in global PV growth.

As a result of these ongoing global energy shortfalls, key countries have changed course and are exploring their renewable energy options more comprehensively, Australia must do the same.

Recommendations:

33. Explore the use of non fossil fuel energy sources. Considering that wind and solar technologies have very short lifespans, virtually nothing installed in the past 20 years will still be running in 2050, nor will much of what is done in the next 10 years. Prioritise investigation of how to maintain our energy supply stably and affordably.

D) Further opportunities for Victoria to reduce emissions, including through finding alternatives to industrial and household gas consumption

Reducing Emissions: Dietary considerations

Victoria can go further than just reducing emissions. 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 30 percent methane reduction embodied in the EU and US initiated Global Methane Pledge[52]. Second, the consequent forest regrowth would help roll back 200 years of biodiversity losses in addition to sequestering carbon. The Chinese Government is planning on halving meat consumption in China[53]. Will Australia be left behind … again?

[48] https://www.powerengineeringint.com/world-regions/latin-america/severe-drought-strains-south-americas-power-sector/
[49] https://www.economist.com/finance-and-economics/china-seeks-to-extend-its-clout-in-commodity-markets/21806324
[50] https://www.forbes.com/sites/kenrapoza/2021/03/14/how-chinas-solar-industry-is-set-up-to-be-the-new-green-opec/?sh=37d4dc121446
[51] https://www.shu.ac.uk/helena-kennedy-centre-international-justice/research-and-projects/all-projects/in-broad-daylight
[52] https://www.unep.org/news-and-stories/story/new-global-methane-pledge-aims-tackle-climate-change
[53] https://www.euromeatnews.com/Article-Chinas-government-plans-to-halve-meat-consumption/4025

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Our energy sources are placed into context in Figure 6 generated by an AJP member from Australia's UNFCCC submission data:

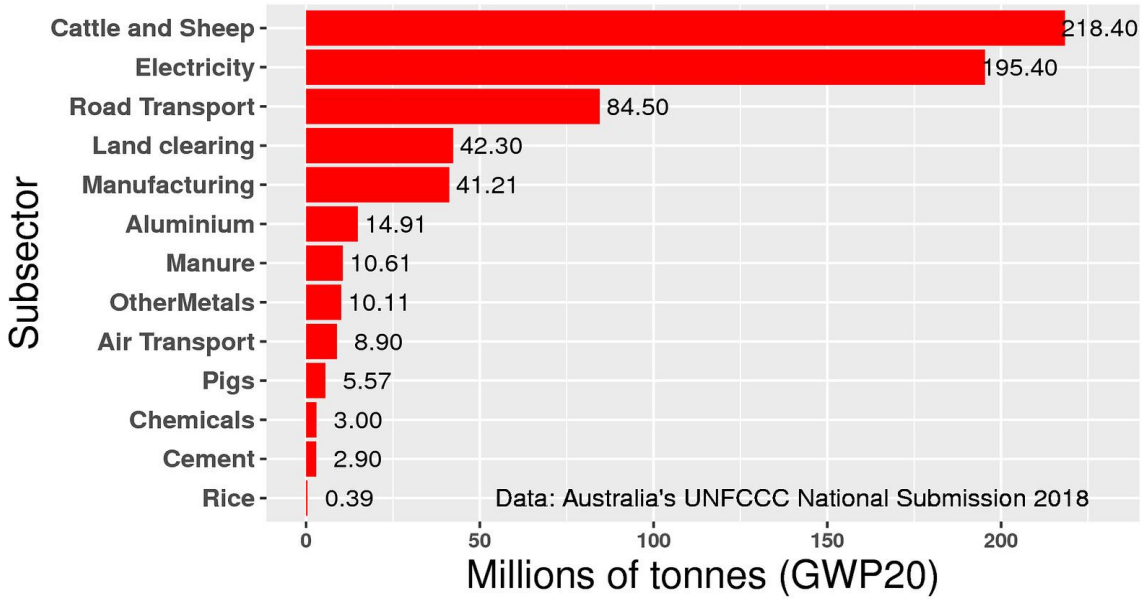

Figure 6 - The relative climate impact of major sectors over the next 20 years in Australia.

The standard conversion factor, used in our greenhouse gas inventory, to convert tonnes of methane into tonnes of carbon dioxide equivalent isn't relevant given the urgency of the need to reduce greenhouse emissions. That standard factor (GWP100) is based on a comparison over 100 years, which is doubly irrelevant because methane is largely eliminated (by conversion to carbon dioxide) from the atmosphere in just 12 years.

The above graph, Figure 6, in contrast, uses GWP20, which is based on a 20-year comparison of impacts. Hence, it is closer to physical reality and the urgency of the climate crisis.

> **The graph shows clearly that sheep and cattle will be responsible for more warming over the next 20 years than all our fossil-fuelled power stations.**

While we understand that this inquiry is primarily into energy, it is bizarre that there isn't a similar inquiry focused on animal agriculture's greenhouse impacts.

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Recommendations:

34. Set plant-based dietary targets based on the scientific evidence relating to methane.
35. Sign up to the Global Methane Pledge by reducing methane emissions by 30 percent by 2030. This should encompass both animal agriculture in addition to fugitive emissions from fossil fuel production.

Reducing Emissions: Household Considerations

The changes in how we source and use energy will impact every Victorian in some way, either through their household use, work, or the products they purchase.

Currently, 66 percent of Victorian households use gas for water heating and 64 percent use gas for space heating.[54] If there is to be a significant push towards electrification, requiring the replacement of these appliances, there needs to be careful consideration of the costs involved. 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.

The potential approaches towards creating a zero emissions society has broader implications than just replacing gas with another source of energy. Each of the potential alternatives has its own attendant risks, benefits and costs, and these will differ across the state based on ecological and geographical considerations, urban planning, and community needs. For example, evaluating the most appropriate energy structure in a small rural community with an abundance of agricultural waste available for biogas and existing stable infrastructure, will show vastly different results to a study conducted in a densely populated industrial area of the city.

Enormous changes will be required within households and large and small-scale commercial enterprises to significantly reduce or eliminate our usage and reliance on gas as an energy source. Time will be needed to evaluate and consider the future alternatives, so there will be an ongoing need for gas supply in the short-term, and this supply needs to be stable and reliable. However, any significant investment in this supply would be imprudent, as it will only waste resources that could be better directed towards cleaner sources of future energy supply.

[54] Victorian Government (2021) Help Build Victoria's Gas Substitution Roadmap: Consultation Paper. https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.vic-engage.files/1716/2544/4975/Victorias_Gas_Substitution_Roadmap_Consultation_Paper.pdf

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A careful balance is required between not allowing our existing gas energy structure to fall into disrepair or to cause significant negative impacts on households and businesses, and ensuring a secure supply framework in the short-to-medium-term.

The use of more sustainable gaseous fuels has some advantages over converting to other energy sources, primarily, the ability to potentially continue to use existing infrastructure, therefore minimising costs for building and development[55]. However, this is a simplistic view to take. Whilst this is true for biomethane, which will not require new pipes for transport to end users, we will still need to build biomethane plants to convert biogas to biomethane.[55] This attracts an initial cost and varying ongoing costs dependent on the proximity of sources of organic material for biogas to the biomethane plant.[55] Alternatively, biogas can be used alone, however, it contains a mixture of other gases such as carbon dioxide, which are inappropriate for large-scale distribution using our current infrastructure and can only be used in specific areas that can accommodate this.

Hydrogen as an alternative gaseous fuel has multiple considerations.[55] Hydrogen on the scale required can be sourced via two methods: renewably through splitting water, and non-renewably from fossil fuels. Neither method is without issues, as both the volume of water required and the use of fossil fuels to produce hydrogen must be considered. Additionally, the percentage composition of each gas will affect the suitability of our infrastructure; 10 percent hydrogen mixed with natural gas can be used safely, whilst a higher proportion of hydrogen may cause damage to pipes made of certain materials. A complete conversion of natural gas to hydrogen will require changes to pipes, some appliances, and gas meters, all of which comes at a cost - both financially and environmentally.

To accurately evaluate the suitability of each of these replacement options, a thorough cost-benefit study must be conducted.

Recommendations:

36. Explore clean energy options and emerging technologies for clean energy and the cost-effectiveness of incorporating into new housing.
37. Investigate the costs associated with various methods of increasing energy efficiency in homes. Compare the costs with expected levels of consumer acceptance and uptake when considering subsidies, long-term no interest loans, and incentive schemes.
38. Consider subsidy schemes for low cost, high benefit repairs/upgrades to existing homes such as draft-proofing.
39. Do not expand natural gas use, whether from coal seam or other sources[56].

[55] Victorian Government (2021) Help Build Victoria's Gas Substitution Roadmap: Consultation Paper. https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.vic-engage.files/1716/2544/4975/Victorias_Gas_Substitution_Roadmap_Consultation_Paper.pdf
[56] Animal Justice Party Natural Gas Policy https://animaljusticeparty.org/policieslist/environment/natural-gas/

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40. Do not invest in existing gas infrastructure upgrades or developments.
41. Monitor and repair existing infrastructure to minimise future disruptions and to identify any issues early.
42. Investigate the impacts of COVID-19 on gas use. Request independent modelling to demonstrate various scenarios and impacts on commercial use, in particular over coming years.
43. Evaluate the efficiency of alternative appliances against existing natural gas appliances. For example: if water heaters that run on hydrogen gas take longer to heat up, overall energy use may be compromised and consumer costs may increase.
44. Investigate both the short and long-term costs and benefits of natural gas, biogas, biomethane from biogas, 'green' hydrogen and non-renewable hydrogen.
45. Evaluate the changes in price expected at different levels of uptake, through independant modelling, for each alternative gas source over the next 30 years as we move towards our 2050 emissions goals.
46. Evaluate the environmental impact of digging up and replacing existing pipe infrastructure for different gaseous fuels. Consider the impacts of replacing existing pipe on wildlife and wildlife habitat.
47. Evaluate the risks to nearby communities from building biomethane processing plants and replacing pipe infrastructure in case of gas misadventure or accident.

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 percent renewable energy

As discussed in section 'B', the transition towards renewable energy creates new roles, hybridises some existing roles and also expands or alters jobs in a number of existing fields. This requires education and training programs to address all of these possibilities.

One of the challenges will be that training must become available in a timely manner across a number of institutions, and must be delivered flexibly to allow existing workers in impacted industries the ability to gain new skills, whilst continuing to work in their current roles. However, simply delivering training is not enough. Workers will need to understand the expected impact of workforce changes, both economically and in terms of tasks and expected job satisfaction, in order to make informed changes before making any major career path changes. Government must ensure that this information is easily accessible, in a range of formats; ideally an independent advisory service would be available to discuss options and answer questions over the upcoming transition period.

Advice and support will be required for those who may wish to transition to other industries. This may appeal particularly to those who have worked in the same field for a long time and may prefer to move to a role with transferable skills, rather than devote their time to expanding their role and learning new skills.

Changes will also need to be incorporated into apprenticeship schemes and teachers may also require additional training as with rapid expansion, the demand for new and additional training may outstrip the number of people currently qualified to provide it.

Financial support will also be necessary, as workers may not have expected or planned for these changes, and current funding subsidy schemes may not adequately cover the training they require. The alternative to not ensuring a smooth transition for workers may be that people leave their current industries, which will result in a skills shortage, as many existing skills will be transferable to new industries, as well as a worker shortage which will be exacerbated by a 'gap' in new workers until training is completed. Consideration must also be given to a subsidy for tools or equipment that may be specific to newer industries related to renewable energy.

An example is the increase in uptake of electric cars, which will play an important role in reducing our future fossil fuel usage and therefore reduce the emission of greenhouse gases. The future mechanic who works on an electric car, powered by a battery rather than petrol, is closer to an electrical engineer than the current mechanic who is familiar with the inner setup and workings of many makes and models of cars. Transitioning to working with electric vehicles is not simply a matter of doing a few modules or units and gaining a new certificate, it's essentially a new trade.

The batteries in electric vehicles are in the vicinity of 800v of electricity, compared to a current 12v car battery; failure to correctly handle this could result in death, rather than merely a shock.[57] Other engine differences result in a change in how services are done; electric vehicles require less work to be conducted per service (*e.g.*, no oil change or spark plugs) resulting in a lower income stream from the 'bread and butter' services that would normally comprise the daily business of a mechanic.

Porsche anticipates a future 'tiered' model of mechanics, with greater numbers of workers skilled at simpler maintenance tasks and a select group specialised in 'level 3' skills, who will be trained to open and repair modules within the batteries.[58] This will potentially necessitate significant investment in training and equipment which may be cost-prohibitive for smaller businesses or require them to complete simpler tasks and engage the assistance of others for the more complicated tasks. This creates logistical issues for many 'traditional' mechanics who may operate as sole traders, or act as a disincentive for consumers to service their vehicles at these businesses who may no longer be able to meet all their needs. Government support will be required to ensure these businesses are not simply 'left behind' to eventually close their doors,

[57] https://www.economist.com/science-and-technology/servicing-and-repairing-electric-cars-requires-new-skills/21805752
[58] https://mail.google.com/mail/u/0/#inbox/FMfcgzGllCdVqwRCWjxwHzDmnsrksrQZ

but that there are supported pathways to allow these workers to transition their businesses viably.

Whilst this example highlights only one area of change within the energy sector, it demonstrates that transitioning workers as part of a move towards clean energy will not be straightforward. Government support will be required across a complex range of areas: skills education for new workers, upskilling for existing workers, support for educators, tailored business support for all size businesses and across all sectors, future modelling to assist with decision making, and financial support to assist with transitioning. Failure to provide adequate support from the start will result in delays in uptake, a loss of worker and consumer confidence, and increased reluctance for workers to embrace and/or adopt change.

Community adoption of these new, clean(er) technologies also requires government investment and support. Currently, there are approximately 3,000 charging stations across Australia[59]. This impacts the distances people can travel and over what time periods, as they must plan for a 'station to station' approach to travel, rather than being assured of the ability to charge at each waypoint or destination. This may have implications for tourism, as people may bypass smaller towns and aim for larger towns where access to charging stations is perceived as more likely.

Incorporating charging stations into shared living spaces such as apartments also raises questions of how users pay, and how the installation of this infrastructure is funded, particularly in older buildings with multiple owners. Not insurmountable issues, but all requiring consideration, planning, potential government funding or interventional support - and this is only a discussion of **some** of the potential considerations for promoting community acceptance of **one** (of many) of our clean energy innovations.

Recommendations:

48. Create new courses to upskill workers in soon-to-be-redundant fields such as gasfitting and some maintenance industries immediately. Courses offering a broad overview of skills required for working with a wide variety of new energy sources will allow workers to evaluate which areas interest them and assist with forward planning.
49. Upskill interested workers to begin early, as early takers can offer on-the-job training and support to other workers.
50. Supports workers who wish to transition to alternative roles and industries.
51. Develop training across a number of institutes and offer a range of modes to create a simple, easily accessible process for learning.
52. Integrate training in emerging energies into existing course material as soon as possible, to ensure that new graduates or apprentices are completing their study with appropriate training rather than requiring additional study in the near future.

[59] https://www.smh.com.au/money/saving/evs-are-a-must-but-they-raise-as-many-questions-as-answers-20211123-p59bew.html

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53. Explore barriers to study and/or transitioning to new roles within the energy sector and develop potential solutions. Identify transferable and universal skills to facilitate transition to new roles
54. Conduct modelling to assess predicted uptake of various renewable and clean energy initiatives. Use this to guide where resources are best allocated for education and training.
55. Evaluate the numbers of workers required to implement each possible alternative energy source, to facilitate comparison and planning.
56. Create a study to prioritise which fields will need the greatest amount of support to assist with resource allocation.
57. Investigate financial support options, including subsidised study options, grants for infrastructure changes and subsidies for practical training.
58. Study the impacts on and challenges faced by local communities during the transition to clean energy. Use this to guide future resource allocation,

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F) The economic risks of not urgently reducing emissions by transitioning to 100 percent renewable energy

The impacts of failing to adopt a strategy of urgently reducing our emissions can be discussed in terms of both direct and indirect economic implications.

"The global shift towards decarbonisation and adoption of net zero targets will have effects on both the domestic economies of those adopting these targets, and of their trading partners."[60]

In simplest terms, the direct economic risk is that Victoria (and Australia) will be left behind in trade negotiations with countries who have committed to more stringent emissions targets than us. Commodity exports such as coal, minerals and metals comprise a significant portion of our economy, and 85 percent of the dollar value of our exports is comprised of items which have a high emissions 'cost'.[61]

> **Embarrassingly, Australia ranked lowest of 193 UN member countries in the *2021 Sustainable Development Report*.**

This impacts our global reputation with trade partner countries.[62] Whilst difficult to quantify this impact without significant economic modelling, it is reasonable to assume that the disparity in emissions targets and mitigation strategies may impact the future desirability of Victorian/Australian goods, which may have significant impacts on jobs, industry growth and stability, and overall economic stability.

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[60] https://www.ey.com/en_au/economics/how-important-is-cop26-for-australia-economy
[61] https://www.ey.com/en_au/economics/how-important-is-cop26-for-australia-economy
[62] https://www.wwf.org.au/news/blogs/cop26-we-need-to-talk-about-australia-s-climate-change-issues

The indirect impacts of failure to urgently transition towards net-zero emissions and embrace clean energy are arguably as important economically, if not more so, as they are further-reaching and more pervasive.

We are rapidly changing the climate. It is not only getting warmer but less predictable. This is nothing short of a global emergency requiring immediate and substantial action across all sectors of society. We must act before we cross "tipping points" that will make further climate deterioration unstoppable and irreversible. Even when we stop emitting greenhouse gases, warming will continue for some decades[63]. The Australian Government is fully aware of the disastrous impacts of climate change across Australia.[64] Some 85 percent of our population living along the coast will be impacted by rising seas, storm surges, flooding, heatwaves, and damage to public infrastructure. More residences will be threatened by larger and more frequent bushfires, causing loss of homes and lives. Our ability to respond to these disasters will be jeopardised, as "the changing frequency, magnitude and distribution of extreme weather may result in natural disasters occurring in new areas and where emergency management experience is limited. Natural disasters could increasingly occur in close succession, limiting the time available for a community to recover between events."[65]

Our agricultural yields will be diminished by natural disasters and sustained drought conditions, putting our food security at risk. Water will become more scarce and freshwater aquifers will become contaminated by seawater. These issues will create social and political problems for future governments as our population struggles to adapt to an unforgiving and unpredictable climate.

Entire ecosystems are already suffering from extreme climatic events. A world that becomes 2-4 degrees warmer will kill billions of individual animals with many species going extinct[66] . Research suggests that half of all threatened species in Australia are especially vulnerable to climate change. The negative impacts will be on a scale comparable to habitat loss.[67] Shrinking habitat area also increases vulnerability to climate change, exacerbating the problem further. As local conditions change, animals will need to relocate to more suitable habitats, or perish.

Grazing and associated land clearing is a major cause of climate change. So, in addition to phasing out fossil fuels, we will also have to phase out sheep and cattle farming. This is essential not only to reduce methane emissions, but also to allow reforestation.

The AJP believes humans can thrive while simultaneously reducing our adverse impacts on the natural environment, particularly wildlife. The human activity which has the most adverse

[63] https://www.science.org/doi/10.1126/science.1103934
[64] https://www.industry.gov.au/policies-and-initiatives/australias-climate-change-strategies
[65] https://www.industry.gov.au/policies-and-initiatives/australias-climate-change-strategies
[66] https://www.ipcc.ch/sr15/chapter/chapter-3/
[67] Pimm SL. Biodiversity: Climate change or habitat loss—which will kill more species? Curr Biol. 2008; 18: 117–119

impacts on the most animals is food production. Changing the way we eat can dramatically reduce our impact on animals. The AJP advocacy for a plant-based diet is therefore a key plank in our environment policy. No organisation or government can have an effective environment policy without food policy and security being central.

Therefore the economic impact of 'standing back' and allowing our climate disaster to worsen will have impacts on food security and water security, which will have serious potential economic implications for long-term affordability. Additionally, the impacts on housing will have economic impacts, from the cost of heating and cooling due to climate change-induced weather extremes, to the costs of maintaining the stability of dwellings in coastal areas and the costs of safeguards required in bushfire prone areas also impacted by climate change-induced environmental effects. Healthcare costs may be impacted through the emergence of new and evolving diseases caused by land clearing, biodiversity loss and the increasing proximity of wildlife, intensively farmed animals, and humans. Consider the current economic costs of COVID-19; many health experts believe that COVID-19 originated in bats. The manner in which we interact with both wild and domestic animals has profound implications for public health.

We ignore the implications of failure to act on reducing emissions as a matter of utmost urgency, at our peril. AJP strongly advocates for Victoria to commit to exploring ALL possible methods of reducing emissions and mitigating the environmental, social and economic impacts of climate change.

Recommendations:

59. Study the economic 'cost' of a range of climate change-induced impacts such as emerging diseases, biodiversity loss, coastal inundation.
60. Study the effects of animal agriculture on a sustainable future for Victoria.
61. Discuss water-saving initiatives, investigate how to support future water security.
62. Introduce habitat protection as a fundamental and consistent planning principle in all regions and sectors.
63. Stop approvals for any new industrialised factory farming of animals in Victoria and employ biodiversity-sensitive farming methods.
64. Stop the expansion of existing factory farms.
65. Phase out cattle feedlots, battery cages for chickens, broiler farms and sow stalls, where the crowded conditions suffered by these animals can easily transmit disease.
66. Increase modelling to examine the potential future impacts of climate change on emerging diseases and allow for early planning of responses.
67. Ban wet markets, including slaughterhouses, altogether. Wet markets are implicated in zoonotic disease emergence and may be a potential cause of the COVID-19 pandemic.[68]

[68] https://www.worldanimalprotection.org.au/news/WHO-must-urge-governments-ban-wildlife-markets?gclid=CjwKCAjw3riIBhAwEiwAzD3TiQUOpIBB1mlKKYcvkN41IMaTZ_Y05kCDBfZBlnHtJQ9sulOUyJWePRoC0mwQAvD_BwE

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Conclusion

It is clear that new fossil fuel projects should be prohibited. Such projects are typically designed to run for decades and, as such, are incompatible with behaving ethically towards future generations. It is equally clear that renewables can be built during the next decade without risking a zero emission target by 2050. But it is less clear that renewable technologies are optimal from a biodiversity or social justice viewpoint; given the extensive mining required and the seemingly inevitable exploitation involved in mineral supply chains. It is not clear that many of the minerals required will be produced ethically.

Unlike other political parties, AJP knows that it does not have all the answers to what is a tough problem. The first step is to look realistically at all aspects of the problem and ignore the ideological advocacy that claims that the problem is simple and that it is only bloody-mindedness holding us back. Rushing off in a 100 percent wind+solar+battery direction without thinking about the very real problems, is a recipe for failure. Even more important than acting quickly, is acting in a way that will not lead us further down the destructive, fossil fuel, dead end path that we have been following for many years.

There are a multitude of factors that need to be considered when evaluating all possible options for how Victoria will source and use energy in the future. Plans for reaching net zero emissions targets must contain the flexibility to adapt to change in the future, as new information is discovered, as well as provide the structure for how these adaptations will be implemented.

We hope that the issue of how Victoria will reach net zero emissions by 2050 will be approached by taking a broad view, not merely focusing on short-term solutions, stop-gaps, and interim targets that are meaningless in the bigger picture. We must create a state that has reduced its energy consumption, utilises clean energy solutions, and prioritises care and respect for the environment during decision-making processes.

All decision-making must also be informed by comprehensive, independent, scientific and mathematical analysis. Energy solutions must be viable on the scale needed to provide for the population size of Victoria and not only in a laboratory or small-scale scenario. This should not preclude investment in innovation and emerging technologies, in fact, these must be encouraged, and plans must be flexible enough to allow for change and their adoption.