Submission No 164

SUSTAINABILITY OF ENERGY SUPPLY AND RESOURCES IN NSW

Organisation: Climate Rescue of Wagga Inc

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Submission to the NSW Inquiry *Sustainability of energy supply and resources in NSW*

We thank the committee for the opportunity to make a submission on these important topics

Climate Rescue of Wagga (CROW) is an incorporated community group that has been established for 12 years. It consists of people interested in sensible, science and technology-based actions to mitigate and adapt to the effects of climate change. Members help one another to keep abreast of developments in technology, science, programs and policies related to renewable energy. We have worked with the local council and other organisations to encourage community projects promoting energy efficiency and renewable energy, and have made submissions to relevant national consultations.

Our submission is made in the context of several recent major reports.

In its 2018 report, *Global Warming of 1.5*^{0} (Summary for Policy Makers), the Intergovernmental Panel on Climate Change (IPCC) compares the predicted consequences of global warming reaching 1.5^{0} or 2.0^{0}C[1]. While the lower temperature would lead to severe consequences, the report states that the upper temperature would result in higher temperature extremes, longer and more widespread droughts, more intense storms, greater species extinction and greater damage to water and land ecosystems.

In addition, 'Climate-related risks to health, livelihoods, food security, water supply, human security, and economic growth are projected to increase with global warming of 1.5°C and increase further with 2°C'[2].

The CSIRO report, *Australia's National Outlook, 2019*[3] (ANO2019) confirms these changes and details how they will affect Australia. With particular reference to rural areas, it states:

> *Making matters worse, the legacy of intensive agriculture on a fragile environment continues to be felt in Australia's soils. Although farmers have made important advances in land management, acidification is at worrying levels in many lighter soils, soil carbon levels remain historically low and the risk of erosion increases with an increasing frequency of droughts and lower groundcover. These processes threaten productivity and reduce crop choice.* [4]

ANO2019 compares two scenarios:

> *Outlook Vision, which represents what could be possible if Australia can achieve its full potential, and Slow Decline, in which Australia fails to adequately address the challenges identified, leading to poorer outcomes in multiple dimensions.*[5]

[1] https://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf p7-11
[2] Ibid p11
[3] ANO2_MainReport_WEB_190614%20(1).pdf
[4] Ibid p.11
[5] Ibid p.3

The consequences of these two approaches are significant and spelt out in Chapter 3 of the report. Minimising the damage of inaction will require strong actions, otherwise 'Australia risks falling into a Slow Decline, with relatively poor economic, social and environmental outcomes' [6]. These 'strong actions' are spelt out in Chapter 4 of the report and relate to shifts in our approach to industry, urban communities, energy, land and culture – all issues directly relevant to the Terms of Reference of this Inquiry.

The Australian Energy Market Operator (AEMO) Integrated System Plan 2018 (ISP2018)[7] deals with technical and engineering issues facing power generation and distribution in eastern Australia. In general terms, it emphasises[8]:

- transition to Distributed Energy Resources (DER) as existing thermal generators reach the end of their technical life
- adoption of a 'portfolio' approach including domestic PV, solar and wind farms, batteries, stored hydro, demand management and other strategies – all of which will result in significant savings
- continued development of resilient transmission to handle the requirements of DERs
- establishment of Renewable Energy Zones
- development and strengthening of inter- and intra-regional networks to provide low cost energy to rural areas.

It is also important to consider the future prospects of coal in NSW. While this is a contentious issue, there is increasing evidence that the future of mining and export of coal is facing uncertainty from the international shift towards renewable generation of energy.

For instance, a recent report from the Institute for Energy Economics and Financial Analysis (IEEFA)[9] points out that Japan has approved a goal of moving to fossil free energy by 2050. Australia's coal exports to Japan peaked in 2015. Even new coal plants under construction will be cancelled out by retirements over the next five years, and closures will increase from the early 2030s.

The report says that the

> *idea that Asian coal-plant operators will switch to more expensive, higher energy Australian coal to reduce carbon emissions into the future is a myth. With renewable energy increasingly cheaper than coal-fired power, nations seeking to reduce carbon emissions will simply switch to renewables in the long term. In the shorter term, cost will be the key factor driving decisions over the energy content of coal to be imported which will favour cheaper, lower energy coal from Indonesia.*[10]

[6] Ibid p.15
[7] https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2018/Integrated-System-Plan-2018_final.pdf
[8] Ibid p.5-7
[9] http://ieefa.org/wp-content/uploads/2019/07/Japan_Coal_July-2019.pdf
[10] Ibid p.1

The issues outlined in these reports are an essential context to the inquiry and are fundamental to all of the Terms of Reference (TOR). Before we address each TOR, we wish to emphasise several important points:

- Zero emissions by 2050 is required by developed nations to limit temperature rise to close to 1.5 degrees, see for instance Climate Institute[11]. NSW's target of net zero emissions by 2050 is commendable and consistent with the requirements of the Paris Agreement.
- While many of the changes in energy production and distribution will be induced by economic and technical forces, the government must do whatever it can to ensure that there is a smooth and just transition over the next few decades.
- This transition applies to jobs and employment, requiring responses in retraining and provision of employment opportunities in regional areas affected by both negative and positive aspects of the change.
- The farming community will also require support as they confront both the consequences of a changing climate and changes in agricultural systems and technology.
- Rural communities will also be affected by change. In many ways the distributed nature of renewable energy production will provide benefits, but full advantage can also be taken of locally produced, cheaper power in rural businesses.

We believe that **one of the most important steps** in achieving a sustainable energy supply is **forming a detailed plan that includes the setting of ambitious interim targets** that will lead to the achievement of NSW's goal of net zero emissions by 2050[12].

Below we address each of the Terms of Reference, with particular attention to TOR 2 'Emerging trends in energy supply and exports, including investment and other financial arrangements'.

Term of Reference 1

The capacity and economic opportunities of renewable energy

The *2019 Clean Energy Council Report*[13] shows record renewable electricity generation installations in 2018 and a pipeline of projects likely to break records again in 2019. The report warns, however, that the momentum may be lost as a primary driver – the Renewable Energy Target – is met. The report states that maintaining the momentum of renewable generation installations may depend on state policies, targets and incentives.

[11] http://climateinstitute.org.au/verve/_resources/TCI_Submission_Climate_Change_Policy_Review_FINAL_090517.pdf

[12] https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Climate-change/achieving-net-zero-emissions-by-2050-fact-sheet-160604.pdf

[13] https://assets.cleanenergycouncil.org.au/documents/resources/reports/clean-energy-australia/clean-energy-australia-report-2019.pdf

Beginning with *Beyond Zero Energy's Stationary Energy Plan in 2010*[14], there have been several well researched approaches to achieving 100% renewable electricity generation in Australia. The *AEMO Integrated System Plan* and the CSIRO's *ANO 2019 Report*, referred to above, are based on the assumption that this can be achieved by 2050.

In their 2019 paper, *The feasibility of 100% renewable electricity systems: A response to critics*[15], Diesendorff and Elliston of UNSW refute the myths claiming that this is not possible. Importantly they say that '(t)he principal barriers to 100% renewable electricity are neither technological nor economic, but instead are primarily political, institutional and cultural'.

Leading economist and climate change policy expert, Professor Ross Garnaut, said in April 2019 that Australia could be powered 100 percent by 'intermittent' renewables by the early 2030s, and have a grid that is reliable, secure and cheaper than it is now[16]. As the NSW Energy Minister Matt Kean has stated, 'the most economic form of reliable generation is firmed renewables and that is driving the biggest change in our electricity system's history'[17].

The capacity of renewable generation to supply cheaper energy is evidenced in the renewable energy Power Purchase Agreements (PPAs) being signed by universities, government departments and corporations. Signing up to a PPA will secure low-cost power for organisations for up to 25 years. With prices as low as 50% of market rates and other benefits, PPAs are a smart investment that will result in huge savings in the long run[18]. These advantages can be supplemented by emerging schemes that allow businesses to interact directly with the energy market and purchase power at lower spot prices[19].

While the concept of 'base load' power is increasingly seen as a distraction in these developments, dispatchable energy is now seen as compensating for the intermittency of solar and wind generation. In this connection the NSW Government's commitment to pumped hydro schemes (including *Snowy 2.0*) and battery storage is commendable. The ability of battery storage to provide high speed grid services and lower costs has been well established by the operation of the Hornsdale battery in South Australia[20].

In NSW, in 2018, investment in renewables reached $4.7 billion dollars, installing 3800 megawatts of generation and creating 2320 jobs. Across Australia $24.5 billion was invested and 13,200 jobs were created[21]. It is important to note that a lot of this investment and most of the jobs directly benefited rural and regional communities. In addition, siting

[14] https://bze.org.au/research/renewable-energy-plan/
[15] https://www.sciencedirect.com/science/article/pii/S1364032118303897
[16] https://reneweconomy.com.au/australia-can-be-powered-100-by-renewables-by-early-2030s-says-garnaut-16846/
[17] Stated at the August 2019 meeting of the NSW Coalition for Conservation https://www.smartenergy.org.au/news/nsw-coalition-conservation
[18] https://www.environment.nsw.gov.au/resources/government/160416PPA%20explainer.pdf
[19] For example see https://flowpower.com.au/
[20] For example see https://www.afr.com/companies/energy/south-australias-big-battery-slashes-40m-from-grid-control-costs-in-first-year-20181205-h18ql1
[21] https://www.cleanenergycouncil.org.au/resources/resources-hub/clean-energy-australia-report

agreements provided many farming enterprises with a secure extra source of income. In addition, Queensland and Victoria, with their state renewable targets, had more investment and more jobs created.

Prices for renewable energy are already below wholesale electricity prices and will continue to fall. Hence the Government can prudently set very ambitious targets for renewable generation as a percentage of all electricity generation. Tristam Edis of Green Energy Markets states that zero emissions for NSW by 2050 implies a 2030 electricity target of at least 46% renewables, which he says is readily achievable given the rate of commitments to construction of renewable generation over the last three years[22].

Various studies have shown that renewables, in combination with energy storage, have the capacity to provide for 100% of electricity supply in a secure, reliable and more affordable system. ANO 2019 forecasts that, with good management

> *Australian energy productivity and low-emission technologies (will) offer affordable, reliable energy and create new opportunities and sources of comparative advantage. Renewables (including biofuels) (would) account for 25–37% of total primary energy use, including almost 100% of electricity generation.*[23]

The NSW Government should maintain the momentum of decarbonisation of the electricity system, continue improving the speed of provision of ancillary services, avoid pollution and create jobs aligned with a zero emission future. To do this the Government should set the interim targets for 2025, 2030 and 2040 to meet its 2050 zero emission goal. These interim targets should designate (and put in place mechanisms to require) ambitious renewable energy targets by 2025 and 2030. Given the advanced state of solar and wind generation technology and its continuing cost reductions, and the availability of economic storage options with their even more dramatic cost reductions, the decarbonisation of the electricity sector is very feasible economically and hence an important early focus on the path to zero emissions.

We encourage NSW to orient itself to and support the AEMO scenario for achieving the 1.5 degree limit of the Paris Agreement, to be in AEMO's upcoming (2019) Integrated System Plan. The 1.5 degree scenario is most congruent with our NSW 2050 zero emission goal.

Term of Reference 2
Emerging trends in energy supply and exports, including investment and other financial arrangements.

We respond to this Term of Reference under the headings:

[22] https://www.smh.com.au/politics/federal/nsw-set-to-fall-short-of-climate-targets-but-victoria-on-track-20190701-p5230a.html
[23] ANO 2019 Section 4.3

- Grid changes
- Marginal Loss Factors
- Energy storage
- Demand management
- Electric vehicles
- Energy efficiency
- Grassroots action
- Financing
- Prepare for early closure of coal generators

Grid changes

A very important emerging trend in energy supply involves the changes necessary to the transmission and distribution networks of the electricity grid to manage and encourage increasing levels of renewable energy generation, as its capacity and affordability are recognised.

As recognised in the *NSW Transmission Infrastructure Strategy,* there is a need to strengthen the grid, provide new links and provide the transmission for renewable Energy Zones, 'areas with high energy potential where planned transmission infrastructure upgrades are able to connect multiple projects at lower cost'[24]. The congestion on the grid is described in the strategy, which states that in late 2018 over $27 billion worth of renewable generation projects were proposed for NSW but only 1 in 20 of the projects would be able to connect to the grid.

We applaud the work of the *Transmission Infrastructure Strategy* and its moves to accelerate the regulatory approval process. We believe that this work should continue to build on the planning of the AEMO through COAG. In relation to this, the AEMO says in its 2018 report (our emphasis):

> *While actual investment in generation and storage projects will be driven by market incentives and technology costs at the time,* ***the transmission grid to support this requires planned, regulated investment.*** *The strategic design and selection of a transmission route is critical. Cost savings are available if interconnectors pass through identified REZs and alleviate the need for intra-regional network extensions to remote locations.*[25]

Even though the siting and design of the transmission grid requires engineering and technical expertise, it is also important that the NSW Government incorporate opportunities for the development of regional manufacturing, agricultural and services industries into the design by ensuring quality connections and minimum pricing for these enterprises. The NSW Government should not rely on the market to provide new grid

[24] NSW Transmission Infrastructure Strategy, p. 10 https://energy.nsw.gov.au/media/1431/download

[25] ISP 2018 p.10 https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2018/Integrated-System-Plan-2018_final.pdf

infrastructure; this is particularly the case with the urgently needed transmission infrastructure for the new renewable Energy Zones.

Marginal Loss Factors

The changing measure of how much a renewable generator is paid because of the congestion of the grid has been a problem for developers. The Marginal Loss Factor (MLF), determined by AEMO for each area, is the basis on which generators are paid for each unit of electricity, and reflects the losses in the transmission of the electricity before it reaches the consumer[26]. The factor is multiplied by the generation to indicate the amount of payment.

Thin or weak lines often exist where there are particularly good renewable resources. As more renewable generators have connected to an area of the grid without a strong transmission network, the increased 'traffic' on the line reduces the loss factor for all generators in the area (that is, the losses in transmission increase). The newly determined MLFs for 2019-2020 have meant significant drops in revenue for a number of generators throughout the National Electricity Market (NEM), including some in NSW. For example, a generator near Coleambally had a reduction of MLF 13%, one near Griffith a reduction of nearly 15% and two generators near Broken Hill experienced decreases of around 20%. These reductions of MLF would be expected to be reflected in similar reductions to income.

The Government needs to create systems that increase certainty of income for generators and minimise the losses in energy and income due to the inadequate capacity of the transmission lines. There are a number of potential solutions to the MLF issue, for example:

- strengthened grid (particularly to designated renewable Energy Zones[27])
- guaranteed MLF for a number of years
- battery storage
- treating generators differently depending on which arranged connection first

NSW needs to consult with stakeholders and facilitate equitable solutions to this issue as it threatens the viability, and hence the bankability, of projects. Finance providers for renewables need more certainty about a project's long term profitability.

Energy storage

Energy storage can provide supply at peak times, can address voltage problems and frequency disturbances and can balance variability in generation. Storage can be in different forms; at this time in Australia it primarily takes the form of pumped hydro and batteries.

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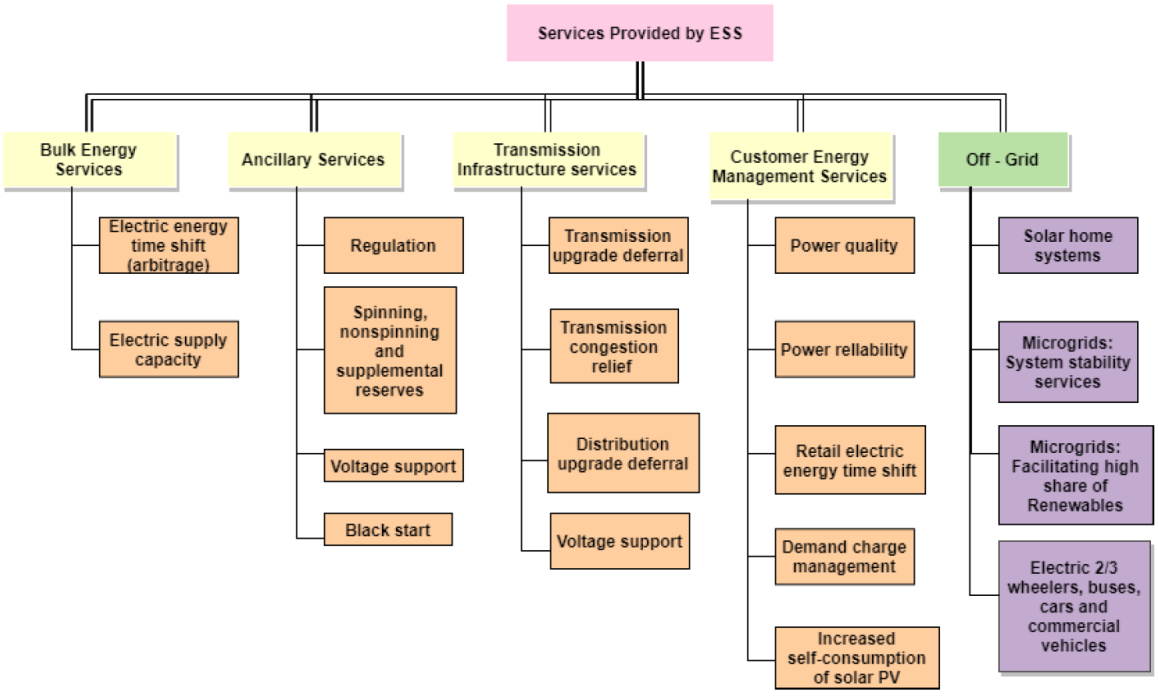
[26] AEMO 2019 Jun, Marginal Loss Factors for the 2019-2020 Financial Year - https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Loss_Factors_and_Regional_Boundaries/2019/Marginal-Loss-Factors-for-the-2019-20-Financial-year.pdf

[27] As described in the NSW submission to the AEMO Integrated System Plan https://energy.nsw.gov.au/sites/default/files/2018-10/NSW-Government-Submission-on-Integrated-System-Plan.pdf
and (with slight changes) in the NSW Transmission Infrastructure Strategy https://energy.nsw.gov.au/media/1431/download

There is also a promising possibility of using renewable power to produce hydrogen (hence 'green hydrogen') as a form of storage.

The importance of balancing variable renewable energy generation has been highlighted recently, as wind farms have been reported as switching off during some low (or negative) price events[28]. This is likely to occur more often when more of the pipeline of committed and proposed wind and solar farms are generating. With adequate energy storage we can avoid wasting renewable generation and support investment in further renewable generation.

The different 'value streams' provided by energy storage systems (ESS) are represented in the diagram below (Nadeem, Hussain, Tiwari, Member, Goswami & Ustun 2019, p. 2)[29]. Unfortunately, the deployment of energy storage and remuneration for these value streams (signifying many benefits to the network) are problematic due to current regulatory and market structures.



Energy storage can also be part of an alternative more reliable and much cheaper (microgrid) electricity system for rural or remote communities where long electricity supply lines have to be maintained or upgraded for relatively few people[30].

[28] https://reneweconomy.com.au/electricity-prices-across-the-grid-fall-to-zero-as-renewables-reach-44-share-77635/

[29] https://ieeexplore.ieee.org/document/8580457

[30] https://reneweconomy.com.au/networks-push-to-take-regional-consumers-communities-off-grid-27204/ https://onestepoffthegrid.com.au/the-40-australian-towns-that-could-and-should-quit-the-grid/ https://reneweconomy.com.au/w-a-to-fund-solar-farms-in-six-remote-indigenous-communities-66975/

NSW needs to gain experience with the use of utility scale batteries. With experience of grid storage, designers and operators of the grid may come to understand new possibilities about how the grid (and market) can be designed around renewables and storage. As stated in the document *Opportunities for Utility Scale Battery Storage in NSW*[31] (p. 8),

> *A pilot undertaken at scale in NSW would provide knowledge sharing and lessons learnt, in a similar manner to the utility scale battery storage projects instigated and funded by the SA, QLD, and VIC State Governments and the Australian Renewable Energy Agency.*

As the report on storage from ACOLA (2017, p. 3)[32] points out, security of the electrical power system can be threatened when 'big disturbances in interconnected electricity grids [cause] a cascading failure that results in a major power disruption.' The Hornsdale Reserve, Australia's first large utility battery (the 'Tesla Battery'), averted just such cascading effects and avoided load shedding in South Australia on 25 Aug 2018 when a lightning strike on the NSW-QLD interconnector caused a disturbance that led to load shedding in NSW of 724MW, and of 280MW in Vic. It appears that the speed of the response by the battery meant that grid frequency was balanced without load shedding.[33] This speed has led to the recognition that regulation and the market structure need to be changed to provide payment for such speed and its value to the grid.

In addition, the Hornsdale Reserve battery saved South Australian state consumers $40 million in charges for Frequency Control Ancillary Services (FCAS) in its first year[34]. This is testimony to the value of utility scale storage that NSW needs to explore.

Utility level batteries (as well as pumped hydro) can avoid peaking plants.[35] In California recently, large scale batteries have been chosen over gas plants to provide peaking power, including one case where distributed solar and batteries are being installed on low income housing as a replacement for fossil fuel peaker plants.[36]

We encourage the NSW Government to recognise that the falling costs of batteries (80% drop from 2010 to 2018 and further 50% forecast within 10 years[37]) may make **firmed** renewables decidedly cheaper than fossil fuel generation in a few years where they may not be cheaper currently. So, the option for a new peaking gas generator may appear cheaper

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[31] https://energystoragealliance.com.au/site/wp-content/uploads/2018/06/AESA-AECOM_Report_June-2018.pdf

[32] https://acola.org.au/wp/wp-content/uploads/ENRG-final.pdf

[33] https://arena.gov.au/assets/2019/02/hornsdale-power-reserve.pdf

[34] As noted here https://www.afr.com/companies/energy/south-australias-big-battery-slashes-40m-from-grid-control-costs-in-first-year-20181205-h18ql1

[35] Refer to California experience - https://cleantechnica.com/2019/02/07/battery-energy-storage-competitive-substitute-for-gas-peakers/
See also the low prices for solar and storage https://reneweconomy.com.au/coal-and-gas-on-notice-as-us-big-solar-and-battery-deal-stuns-market-60011/

[36] https://www.energy-storage.news/news/sunrun-solar-and-battery-systems-to-hasten-the-demise-of-oakland-power-plan

[37] https://www.climatecouncil.org.au/uploads/d4a4f17c09c83d03f13234051e3e77d8.pdf and http://econews.com.au/61825/as-battery-costs-halve-energy-storage-investments-to-boom/

currently, but firmed renewables (firmed with both grid scale and distributed storage) may be available less expensively within a few years, long before the half-way point of the fossil generator's normal lifespan, and perhaps before it is even operational.

In 2016, there were 6,750 household batteries installed[38]. This trebled to nearly 21,000 in 2017[39] and the Clean Energy Council (CEC) anticipates that the total number of households with batteries in Australia will reach 70,000 in 2019[40]. These distributed batteries provide a number of the benefits to the grid shown in the diagram above even though their operation is normally optimised to yield returns for the owner.

The grid benefits of distributed storage are much stronger when the batteries are linked and coordinated so that they respond in concert to grid needs, e.g. by discharging at periods of extreme peak demand; that is, when they operate as a Virtual Power Plant (VPP). Households or other battery owners are paid for participating in a VPP. In an announcement of a VPP trial earlier this year, AEMO emphasised the importance of being able to integrate the generation of Distributed Energy Resources (DER) (such as rooftop solar systems and residential or business batteries), which may become the highest capacity generation technology in the NEM by 2040[41].

With the NSW Empowering Homes program, the Market Sounding Paper notes that the government is considering encouraging participants to commit also to participating in a VPP. We recommend that the government strongly consider limiting participation in the Empowering Homes program to residents who are willing to participate in VPP programs so that the maximum grid and community benefit is gained from the concessional program, while providing good returns and conditions for participants. The structure of, and experience with, other VPPs (in South Australia and Victoria & by AGL and by AEMO) may inform the design of NSW VPPs. Also, (for at least a substantial percentage of the loans) we suggest giving preference for participants in targeted areas where the grid benefits of the installations will be greatest.

VPPs may help manage local problems of high voltage and so enable more rooftop solar to be installed (or more solar generation to be exported from existing rooftop systems) in an area.

NSW could discuss with partners in the Empowering Homes (or other NSW VPP program) the possibility of offering upfront incentives, in a discounted price for the battery system, for participation in the VPP (as Tesla has recently done as part of the South Australian trial[42]).

[38] https://www.climatecouncil.org.au/uploads/d4a4f17c09c83d03f13234051e3e77d8.pdf
[39] https://reneweconomy.com.au/solar-battery-installs-reach-33000-2018-economics-improve-89443/
[40] https://assets.cleanenergycouncil.org.au/documents/resources/reports/clean-energy-australia/clean-energy-australia-report-2019.pdf
[41] https://energylive.aemo.com.au/News/Funding-for-AEMO-VPP-demonstrations
[42] https://onestepoffthegrid.com.au/tesla-slashes-price-of-powerwall-2-battery-price-by-2000-for-vpp-customers/

We encourage the NSW Government to orient VPP (and other) programs to benefit socially disadvantaged households where practicable, following the lead of South Australia[43].

Energy storage is an area that is likely to see a number of different technologies develop, and in which some technologies promise breakthroughs. This makes for research opportunities and also opportunities to develop products and services that will grow as the world economy transitions to low emissions. Establishing and developing NSW research expertise can help NSW businesses and professionals secure a place in that low emission economy.

The report 'The role of Energy Storage in Australia's Future Supply Mix' by the Australian Council of Learned Academies lists a number of NSW universities as organisations involved in energy storage[44]: UTS, UNSW, Uni Wollongong (including through its partnership in The Australian Centre of Excellence for Electromaterials Science) and Uni Sydney (including through the Future Grid Research Program). The potential benefit for energy storage research is suggested by the Future Battery Industries Cooperative Research Centre's (FBICRC) claim that it will deliver 'an estimated $2.5 billion benefit to the Australian economy over the next 15 years'[45]. We encourage NSW to foster its energy storage research centres and networks.

NSW could partner in case studies to explore possibilities of flow batteries, particularly of their use in stationary applications. The characteristics of flow batteries (heavy, unlimited cycles and so long life, able to be completely discharged, easily scaled as the energy stored can be increased simply with larger tanks of electrolyte) make them particularly suitable for some applications.

The production of green hydrogen shows much potential to store and even export renewable generation[46]. Renewably powered electrolysis can make use of surplus renewable generation to produce hydrogen, which can then be stored to power fuel cells when demand is high. Green hydrogen could be produced (and stored) at key points in the network to power fuel cells on site when needed.

We ask the NSW Government to pursue the development of capability to renewably produce, store, use and export hydrogen. One use for hydrogen that promotes a low emission economy is through replacing the role of gas in, for example, industrial processes and space heating. The CSIRO ANO 2019 shows (referencing an ARENA report) that **the export of renewably produced hydrogen could mean billions of dollars in exports and national economic contribution. This could complement, and may be dwarfed by, the increased NSW export of embodied energy in the form of manufactured or value-added**

[43] https://premier.sa.gov.au/news/virtual-power-plant-is-powering-forward
[44] pp. 111-113 https://acola.org.au/wp/wp-content/uploads/ENRG-final.pdf
[45] http://fbicrc.org.au/
[46] *Hydrogen for Australia's future* https://www.chiefscientist.gov.au/wp-content/uploads/HydrogenCOAGWhitePaper_WEB.pdf

goods based on the competitive advantage in energy costs that the transition to a renewably based energy system should provide Australia.

We recommend that NSW set ambitious energy storage targets. These can include targets for:

- utility battery storage
- green hydrogen and fuel cells as a storage/generation option
- distributed storage in general, and
- large scale VPP programs in particular.

The targets can be formed around the AEMO ISP anticipation (and aligned state planning) of what constitutes the optimal configuration of different technologies in the transition to zero emissions.

Energy storage based on these state targets will enable more rooftop storage capacity to be installed (and more generation exported). It can assist with the congestion of the grid and the loss factors (MLF) affecting so many renewable generation sites. It will enable further large scale renewable installations and lessen the chance of curtailment of existing generators. One cost effective mechanism for realising the storage targets is reverse auctions, as shown recently by the ACT Government[47].

In addition to the prospect of the export of renewable generation through hydrogen, we encourage the NSW Government to recognise the renewable energy generation that can be exported in the 'embodied energy' in other products that NSW exports (if produced using renewable energy).

We encourage the NSW Government to instigate cases studies with utility scale battery storage and work to remove the regulatory barriers and lack of market payments that have hampered its deployment. A 2017 CEC document identified thirteen energy market reforms to accelerate the commercial deployment of energy storage throughout Australia[48]. While some of these may now be dated, we encourage the NSW Government to pursue those reforms listed that are still needed.

NSW should not rely too much on the mega-storage projects like Snowy II and Battery of the Nation, given the time before these (and necessary transmission augmentations) will be completed, the risks of relying too much on distant storage, and the faster services that batteries can provide.

While we celebrate the compiled information, the programs and the initiative shown in the 2018 Pumped Hydro Roadmap[49], we ask the NSW Government to more aggressively pursue pumped hydro storage, with less reliance on the market to supply it.

[47] https://reneweconomy.com.au/eight-energy-companies-win-act-battery-storage-auction-40680/
[48] https://assets.cleanenergycouncil.org.au/documents/resources/reports/unlocking-energy-storage-in-australia.pdf
[49] https://energy.nsw.gov.au/media/1546/download

Demand Management

Demand Management uses programs that reward customers for reducing their electricity use for one to a few hours during peak periods, such as heatwaves or blackouts. It can produce massive savings compared to building generation and transmission equipment that will only be used for very short times in a year.

In 2017, the AEMO and ARENA instituted a three year trial of demand management in South Australia and Victoria[50]. The trial involves several retailers, large businesses and homeowners who participate on a voluntary basis. The NSW Government is to be commended for adding $7.2million to the $35.7million total cost of the trial.

Demand Management is a simple approach to cost saving in this area. It would seem to be appropriate for participation by larger regional firms and residents. We strongly recommend that, once the results of the trial are assessed, the NSW Government implements this program on a wider scale.

Electric vehicles

The emergence of electric vehicles (EVs) brings a 'sector coupling' of the transport and electricity sectors[51]. That is, the likely dramatic growth in the percentage of EVs has significant implications, such as greatly increased electricity demand, for energy supply and for energy and resource markets. The transition to EVs will reduce the negative effects of exhaust (and noise) on health. It will progress the environmental sustainability of our energy supply and the NSW goal of zero emissions by 2050.

Programs can be put in place to incentivise and enable EV charging in ways that complement the variability in grid supply and demand. In fact, in planning by the United Kingdom to realise zero carbon by 2050, an important aspect is the balancing of the grid that can be achieved by EVs supplying electricity to the grid at key times (known as Vehicle to Grid or V2G)[52].

The CSIRO ANO[53] and a Clean Energy Finance Corporation (CEFC) study[54] forecast the upfront cost of EVs to be as cheap as, or cheaper than, internal combustion vehicles by 2025. As the cost of 'fuelling' and maintaining an electric vehicle is so much less than with internal combustion vehicles, the total cost of ownership (TCO) will be substantially less for EVs than for petrol or diesel vehicles. This means decreased costs for NSW residents.

One economic consequence of the uptake of EVs could be a lower reliance on petrol imports, with less money going to foreign oil producers/merchants and more money reinvested in Australia. EV uptake would promote Australia and NSW as energy producers.

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[50] https://www.aemo.com.au/Media-Centre/AEMO-and-ARENA-demand-response-trial-to-provide-200MW-of-emergency-reserves-for-extreme-peaks

[51] p. 10 of the September 2019 Energy Security Board issues paper "Post 2025 Market Design" http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/EC%20-%20Post%202025%20Market%20Design%20Issues%20Paper%20-%2020190902_0.pdf

[52] http://fes.nationalgrid.com/media/1409/fes-2019.pdf

[53] ANO2_MainReport_WEB_190614%20(1).pdf

[54] https://www.cefc.com.au/media/401920/australian-ev-market-study-full-report-jun2018.pdf

EVs with fuel cells (FCEVs) can be powered by hydrogen instead of charging from the electricity grid. Hydrogen is particularly attractive for long distance transport. We encourage NSW to develop a trial hydrogen refuelling network (using renewably produced hydrogen) for long distance transport, in conjunction with a case study of a commercial operator with a set long distance route. Trials could also be conducted by the government with FCEVs in its fleet.

The 2019 *NSW Electric and Hybrid Vehicle Plan*[55] can be commended for its thoughtful initiatives on different aspects of the electric car revolution. Below are responses to the plan in light of the need to promote the uptake and integration of EVs as part of the sustainability of our energy supply:

- The plan commits to pilot only a few electric buses when the economic benefits of electric buses are well established, as the report itself acknowledges
    - *Sydney Airport reports that the electric buses' lower fuel and maintenance costs meant that operating the buses has been a good business decision as well as an environmental benefit* (p. 29), and
    - *Although electric buses have a higher purchase price than standard diesel buses (around $240,000 more), they are already competitive on total operating costs, with the price offset by significant operational savings generated over their service lifetime* (p. 30)

  We recommend pressing on with much larger trials of fully electric buses in NSW, and planning a steep increase in the use of electric buses within a year of the beginning of the trial.

- The NSW plan's target of 10% of NSW fleet vehicles being electric or hybrid by 2020-2021 is good to see, but:
    - more emphasis needs to be given to fully electric rather than hybrid vehicles, e.g. 10% fully electric fleet by 2021
    - ambitiously increasing targets for percentages of fully electric vehicles need to be identified for subsequent years (as ClimateWorks points out in the 2019 report *Electric Vehicle Ready Local Government Fleets*[56], EVs in a number of categories already have a similar or lower total cost of ownership)
    - ClimateWorks also points out that EVs in fleets educate staff and normalise EV ownership, as well as supply the second-hand market.

[55] https://future.transport.nsw.gov.au/sites/default/files/media/documents/2019/Future%20Transport%20NSW%20Electric%20%26%20Hybrid%20vehicle%20plan.pdf

[56] https://www.climateworks.com.au/sites/default/files/documents/publications/ev_ready_local_government_fleets_report.pdf

    - We encourage the NSW government also to use vehicles in its fleet for V2G trials, as V2G may be very valuable to the grid and may provide income for EV owners that accelerates the uptake of EVs
- The *NSW Electric and Hybrid Vehicle Plan* could also identify, through consultation with the EV industry and associations, targets and incentives for the uptake of electric vehicles by consumers.
- The *NSW Electric and Hybrid Vehicle Plan* (p. 44) refers to the CEFC's projections of the future customer uptake of electric vehicles, including a projection that the year in which all new cars will be electric will be fourteen years earlier if incentives are provided, yet the plan does not commit to a number of the important incentives that the CEFC's document (electric vehicle market study)[57] identifies.
- With much more ambitious targets and with incentives described in a number of reports and shown in other nation's initiatives[58], the health and amenity benefits detailed in the plan can be accelerated. As the UNSW Climate Change Research Centre pointed out in a submission[59] to the Senate Inquiry on Electric Vehicles[60], 'The OECD estimated that the economic cost of pollution from Australian motor vehicles was about $5.8 billion in 2010, up from $2.9 billion just five years earlier'.

EV associations, leading national and state governments, and other organisations have published material about incentives to promote and service the uptake of EVs. We recommend that staff of the state government assess incentives from these documents (including ClimateWorks *The Path Forward for Electric Vehicles in Australia*[61] and, as mentioned, the *CEFC EV Market Study*[62] and the *New Zealand Electric Vehicles Programme*[63]) to form a suite of effective NSW incentives. These incentives might include:

- cash subsidies based on the health benefits that EVs provide, particularly in cities
- reductions in registration costs
- free charging at some public fast chargers (until EVs reach a designated percentage of the NSW public/private fleet)

We recommend that the state government develop a whole ecosystem of planning, incentives, education, and other initiatives to bring about this change to a more sustainable transport energy supply. This includes building codes and requirements that prepare for upcoming electric-charging needs which will accompany the projected rapid growth of EVs

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[57] Snapshot https://www.cefc.com.au/media/401922/cefc-snapshot-electric-vehicles-jun2018.pdf
Full report https://www.cefc.com.au/media/401920/australian-ev-market-study-full-report-jun2018.pdf
[58] E.g. https://www.transport.govt.nz/multi-modal/climatechange/electric-vehicles/
[59] https://www.aph.gov.au/DocumentStore.ashx?id=a6fd580d-f625-4adc-a439-982848b97cf5&subId=658630
[60] https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Electric_Vehicles/ElectricVehicles
[61] https://www.climateworksaustralia.org/sites/default/files/documents/publications/the_path_forward_for_electric_vehicles_in_australia_-_submission_to_the_federal_government_vehicle_emissions_discussion_paper_0.pdf
[62] https://www.cefc.com.au/media/401920/australian-ev-market-study-full-report-jun2018.pdf
[63] https://www.transport.govt.nz/multi-modal/climatechange/electric-vehicles/

in the near future. For example, the UK is considering a requirement for charging points to be installed on all new homes and offices[64].

We also recommend that the state government further increase initiatives to develop fast charging and other public charging infrastructure.

The rapid transition to fully electric vehicles, using domestically and renewably generated energy, is very much in our state's interest. If NSW provides the energy for its transport through state-generated renewable energy, it is arguably bringing a new industry worth billions of dollars to the state. The rapid transition to fully electric vehicles could be described as the opening of a multi-billion dollar market (previously supplied by foreign produced oil) for NSW resources – i.e. for energy produced in our state. It gives an opportunity to 'buy Australian' with our transport energy.

Therefore, incentives for electric vehicles are actually an investment in the development of a multi-billion dollar new NSW energy industry or energy market. They not only speed very important health and climate benefits, they promote economic opportunities for the state as a whole and hasten a reduction in transport costs for consumers.

Energy efficiency

Increases in the efficiency of the design of homes and commercial buildings, and the equipment and appliances within them, reduce energy use, save consumers money, reduce peak demand and save emissions while the power sector decarbonises. The Australia Institute notes that energy efficiency, through reduction in peak demand, also lowers electricity costs for all consumers[65]. Australian state governments and the national government have developed energy efficiency plans and strategies, but the CSIRO ANO report[66] states that, to achieve a future of increasing prosperity, the rate of adoption of energy efficiency needs to be increased. It refers to a CSIRO *Low Emissions Technology Roadmap*[67] for technologies and business models to increase adoption.

We call on the NSW government to develop programs that take greater advantage of the opportunities for cost effective energy efficiency, including in standards for buildings. Such programs will also include raising minimum appliance efficiency standards. Doing so will actually benefit consumers who purchase an appliance, as the savings in energy use will usually more than pay for the difference in upfront purchase price.

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[64] https://www.techspot.com/news/75410-uk-require-all-new-homes-have-electric-vehicle.html

[65] The Australia Institute submission to the Climate Change Authority's 'Review on power system security, electricity prices and emission reductions' http://www.climatechangeauthority.gov.au/sites/prod.climatechangeauthority.gov.au/files/files/2017%20Elec%20Review/Submissions/P390%20Submission%20to%20CCA%20AEMC%20special%20review%20security%20price%20emissions%20FINAL.pdf

[66] Op cit.

[67] Campey T, Bruce S, Yankos T, Hayward J, Graham P, Reedman L, Deverell J (2017) Low emissions technology roadmap: Technical report. CSIRO

Given the trend to electrification of industrial processes associated with the move to zero emissions[68], the NSW government should consider, with its energy efficiency programs, ceasing support for fuel switching to gas or new gas appliances (unless the gas is renewably sourced), particularly if the lifetime of the equipment is over 10 years.

ACOSS[69] explains the particular importance that energy efficiency programs can have for people on low incomes and identifies barriers to access energy efficiency that need to be addressed by related programs. We encourage the NSW government to incorporate the knowledge of the ACOSS (and similar publications) in their energy efficiency programs.

Grassroots

Achieving a sustainable energy supply will require work on multiple levels, including that of grassroot community action. We call on the NSW government to facilitate local communities that are seeking to take responsibility to assist in the reduction of their community emissions and promote renewable energy generation. In particular, help local government to work with communities on emission reduction. This includes providing or facilitating the provision of emission profiles for the Local Government Area. Promote ways that councils can learn from each other's initiatives, perhaps through existing Local Government Association conferences. Develop effective programs that each council can take up and adapt to their local communities.

Financing

We encourage the NSW government to facilitate green bonds (and green banks). Investors recognising the risks of climate change, both on a private financial level and on a wider community level, are looking for investment opportunities that avoid the risks of fossil fuels and instead fund alternatives. The NSW government could also work with superannuation boards to facilitate the flow of capital to sustainable energy supply and market solutions.

Similarly, the state government can explore ways of facilitating further renewable Power Purchase Agreements (PPAs) for corporations and PPAs for smaller enterprises. This may be in part through the use of state buying power to combine with and support corporate PPAs. As stated earlier, corporate PPAs for renewable generation are taking advantage of the lower prices that renewable generation offers.

Prepare for early closure of coal generators

A report for AEMO has found a number of plausible scenarios in which coal generators would likely bring forward their scheduled closure dates[70]. For example, as the cost of firmed renewables drops below that needed by coal plants to make a profit, the plant owners may seek to close them in advance of their previously expected lifetimes.

One factor in the economics of coal generation is the large expense of maintaining these mostly old plants. This is especially true given the problems with the reliability of coal

[68] https://bze.org.au/wp-content/uploads/electrifying-industry-bze-report-2018.pdf
[69] Energy efficiency and people on low incomes
https://www.acoss.org.au/images/uploads/ACOSS_ENERGY_EFFICIENCY_PAPER_FINAL.pdf
[70] https://www.energycouncil.com.au/analysis/new-report-grapples-with-the-economics-of-coal-closures/

generators[71]. In its analysis of the load shedding in Victoria last summer (24-25 January 2019), AEMO describes the large-scale outage of coal generation, peaking on 25 January when 'Four of the 10 normally available coal generating units in VIC were either offline or operating at reduced capacity' resulting in a reduction of 1.6GW of power[72].

Fossil fuel failure rates increase in high temperatures (as with the heatwave in Victoria mentioned above) and so coal generators are increasingly at risk with climate change.

Without adequate preparation, early coal plant closures may lead to reduced reliability of electricity supply and higher prices, which are damaging to businesses and to household finances.

We ask the NSW government to pursue strategies that will prepare us for early closure of coal plants. These strategies will include:

- assuring the installation and connection of adequate renewable generation – including large scale generation as well as residential, commercial and industrial (rooftop or other) generation
- extending and upgrading the grid to capitalise on Distributed Energy Sources, the generation potential of renewable Energy Zones, and interconnection with other states
- assuring the building of adequate utility scale energy storage
- developing Demand Management programs on a scale of at least hundreds of MW
- promoting small and large-scale Virtual Power Plants (VPPs)

Term of Reference 3

The status of and forecasts for energy and resource markets

This term of reference is addressed in a number of points both above and below.

Term of Reference 4

Effects on regional communities, water security, the environment and public health

A number of the points made in relation to the inquiry's other terms of reference also apply here. Two points that we would like to emphasise or add in relation to this TOR are below.

In transport, a benefit of renewable energy in the form of electric vehicles is a lessening of the multi-billion dollar effect of health issues caused by transport pollution. The OECD estimates that from 2005 to 2010 the annual health cost of pollution in Australia rose over 50% to $5.8 billion dollars[73]. There have been recent estimates that each electric vehicle has

[71] Meltdown 2018: Breakdowns at gas and coal plants over 2018 https://www.tai.org.au/sites/default/files/P652%20Gas%20Coal%20Watch%202018%20%5BWEB%5D_0.pdf

[72] pp. 19-20, https://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2019/Load-Shedding-in-VIC-on-24-and-25-January-2019.pdf

[73] http://www.oecd.org/env/the-cost-of-air-pollution-9789264210448-en.htm

a health benefit of over $2,000. The Senate report on EVs stated that 'widespread use of EVs in the Australian transportation fleet would deliver significant economic, environmental and health benefits to Australian consumers and society.' (p. xv)[74]. We recommend that the NSW Government promote an accelerated adoption of EVs in its fleet and by the public so that we may reap these health and other benefits.

The effects of sea-level rise were highlighted in a recent Sydney Morning Herald article reporting that a development was having to locate 170 metres from the coastline to allow for erosion with sea-level rise over the next 100 years[75]. NSW also needs planning processes to minimise the likelihood of new buildings or infrastructure being constructed in areas that will likely be eroded or inundated because of sea-level rise (in conjunction with high tide and/or storm surge).

Given maps of likely sea-level rise, what areas in NSW are likely to have to be abandoned due to rising seas? How will these homeowners (and business people) be treated? How will they be transitioned (preferably in advance of the inundation)? It is better that we think these things through now rather than wait for an emergency. NSW should plan ahead for areas that will be inundated or effected by sea-level rise.

Term of Reference 5

Opportunities to support sustainable economic development in regional and other communities likely to be affected by changing energy and resource markets, including the role of government policies

Environmental Upgrade Agreements[76] (EUAs, also known as Business Upgrade Finance) involve a process (legislated by the state government[77]) by which loans for energy efficiency improvements, or solar installations, on businesses or strata residences are attached to the land by Council, and the repayments collected by Council with the rates. Because of the increased security this provides for lenders, the interest rates on loans can be lower and the period of the loans can be longer. The repayments are then very likely to be less than the savings on the energy costs. In effect, the upgrade or solar installation pays for itself and then provides free energy for the life of the equipment. Thus, Environmental Upgrade Agreements assist in developing the financial viability of our local businesses and communities.

The EUA process includes a mechanism by which tenants can be charged for improvements on their facility.

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[74] https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Electric_Vehicles/ElectricVehicles/Report

[75] https://www.smh.com.au/national/developers-forced-to-plan-for-new-coastal-suburb-shorelines-170-metres-inland-20190813-p52gko.html

[76] See https://www.environment.nsw.gov.au/business/upgrade-agreements.htm and/or https://www.cherryenergysolutions.com.au/incentives/environmental-upgrade-agreements/

[77] https://www.legislation.nsw.gov.au/#/view/act/2010/110/sch1

We call on the NSW Government to:

- create more support for EUAs and to encourage councils to opt in
- facilitate linkages between potential hosts and lenders
- provide processes that assure that the costs imposed on tenants to support environmental upgrades are less than the savings gained by the tenants (that is, develop safeguards to assure that tenants are better off).

The NSW Climate Change Fund (or other state government fund) could provide low interest or no interest loans to households to install solar on their premises, where the business case for the installations is sound (e.g. the roof is without significant shading, and there is enough daytime electricity consumption). This could be organised as a **circular fund**, that is, after the initial outlay by the government to establish the program, repayments from loans can provide capital for further loans. Given the generally very good economic returns on rooftop solar installations, and energy efficiency improvements, payback periods are often as low as 5 years with the savings from the installation funding the repayments, as found by the non-profit CORENA (Citizens Own Renewable Energy Network Australia) through its experience of loaning over $400,000[78] at no interest for solar (and energy efficiency upgrades) to non-profits[79].

CORENA has developed a plan for low interest loans by Councils[80] that could inform a state program (or the state could provide a pool of funding for such Council programs).

We ask the NSW Government to develop programs for overcoming the split incentive with rental properties. Landlords may wish to install solar or improve energy efficiency on a dwelling, but the benefits mostly accrue to the tenant and so there is insufficient economic return on the investment. Tenants may wish to use solar power (or make an energy efficiency upgrade) but either do not have the permission of the landlord to make the change, or risk not getting their investment paid back before they leave the property.

The government could, for example, facilitate agreements between the tenant and landlord, through which the tenant will pay monthly for benefits gained by a landlord-funded upgrade or solar installation (but with a system to assure that the payments are less than the savings). Transparent and accessible monitoring of the use of solar generation by the tenant could be a foundation for such schemes, as it could give confidence to the tenant that the arrangement is equitable. Solar management systems that could provide this data are commercially available.

The NSW Government should incentivise and/or facilitate more rooftop solar (in conjunction with smart inverters, energy storage etc. to assure optimal functioning of the grid). This may be done through setting an ambitious state renewable energy target for 2025 and/or 2030. The mechanisms of these targets - e.g. through requiring retailers to source that percentage of energy they supply through renewable sources – can incentivise distributed rooftop solar as well as utility scale renewable installations.

[78] https://corenafund.org.au/
[79] https://corenafund.org.au/quick-win-projects/
[80] https://corenafund.org.au/clever-climate-economics-for-local-councils/

Increases in renewable generation and utility scale storage translate into jobs for the regions. As a Clean Energy Council document states[81], 'The successful projects [in the Victorian reverse auctions to meet the state renewable energy target] are expected to generate $1.1 billion of new investment and 900 new jobs (including 270 apprenticeships).' As the size of the NSW market is larger than Victoria, the same percentage target for renewables would generate a larger number of jobs and larger investment in NSW.

Ambitious NSW renewable energy targets will also lead to more windfarms, which can provide a diversified, reliable and drought-proof income for farmers.

While these developments are generally positive, the state needs to give greater consideration to the social license[82] of solar generation and its value balanced against loss of amenity, or other negatives, for a community. The renewable revolution is bringing a large number of proposals for multi-megawatt solar installations in the rural landscape. Local councils, with approval authority on projects below a certain threshold size, seek to balance the advantages in terms of environmental benefits and jobs or economic opportunities for their community with the effects on (and objections about) amenity. Some open areas around a rural town might be regarded as suitable, whereas others, because of (for example) the value residents place on the landscape or because of the greater population density, might not.

Overriding a local council's judgement of the merits versus the negative effects of a solar installation on the basis of a project's 'state significance' does not seem reasonable given the many alternative locations where renewable generation projects have been proposed. If there are current or soon to be available alternatives in locations that are more degraded, more drought affected or with fewer objections, the issue of amenity should be given more weight in decisions.

An acceleration of the infrastructure that will open renewable Energy Zones, will assist in multi-megawatt installations being located where it is in the best interest of the whole community, rather than being imposed where other values outweigh the benefit of the installation.

The government should also require an annual contribution to the local community (in addition to any other fees and contributions normally paid by a development) by commercial solar farms (as in Europe and with wind farms in Australia[83]). Otherwise, after the construction phase, outside of a very small number of ongoing jobs, the installation would not seem a member of the community or aligned to its well-being. We would like these installations to 'give back' to the community.

[81] p. 1, https://assets.cleanenergycouncil.org.au/documents/resources/reports/nsw-election-recommendations.pdf
[82] https://publications.csiro.au/rpr/download?pid=csiro:EP117743&dsid=DS3
[83] See for example, the community fund of the cooperatively owned Hepburn Wind Farm https://www.hepburnwind.com.au/community/

We need to provide greater security for investors, so that they know the climate risks associated with their investments. Investors need to know that assets developed by companies they invest in will be in accord with strong climate action, and not become stranded, for example by ramping of government policies, and emerging technologies and trends that address the need for decarbonisation. Investors also need to know that public infrastructure on which the economy depends will not be lost due to climate change effects. Strong policies and action by the state government toward zero emissions, and to assure the resilience of state infrastructure to climate change effects, can lead to increased investor confidence (as investors would be more confident that the issues are in the open and being addressed). We also call on the NSW Government to support movements for companies to effectively report on their climate risks.

Cheaper energy through both behind-the-meter and grid supplied renewables means **increased industrial competitiveness**. There is an opportunity for increases in jobs in manufacturing or other businesses based on this competitive advantage arising from Australia's exceptional renewable resources.

Local projects and distributed generation can keep money local. Rooftop solar in particular tends to keep funds local, rather than those funds going out of the community to, in many cases, foreign owned entities. This local infusion of funds of course tends to promote the local economy.

A NSW plan for each sector to achieve zero emissions[84] will guide and speed the transition and its associated economic benefits for rural and other communities.

Term of Reference 6

Any other related matters

We encourage the NSW government to negotiate and facilitate – take responsibility for – progress within COAG to move standards, policies, regulations etc. forward. Also, if insufficient meetings of COAG are organised, we call on the NSW government to capitalise on other ways of cooperating with the other states for a successful, fair, secure and reliable energy transformation.

While the submissions to this current inquiry discuss the sustainability of energy supply, the National Electricity Objective itself[85] makes no reference to sustainability, except perhaps through its use of the phrase 'long-term interests of consumers of electricity'. We recommend that steps be taken to ensure that sustainability, in particular the avoidance of greenhouse emissions, be incorporated in the National Electricity Objective. Given that nearly all of the states/territories have committed to zero emissions, such a change seems appropriate. A change of a few words (one deleted, three added) as below could align the

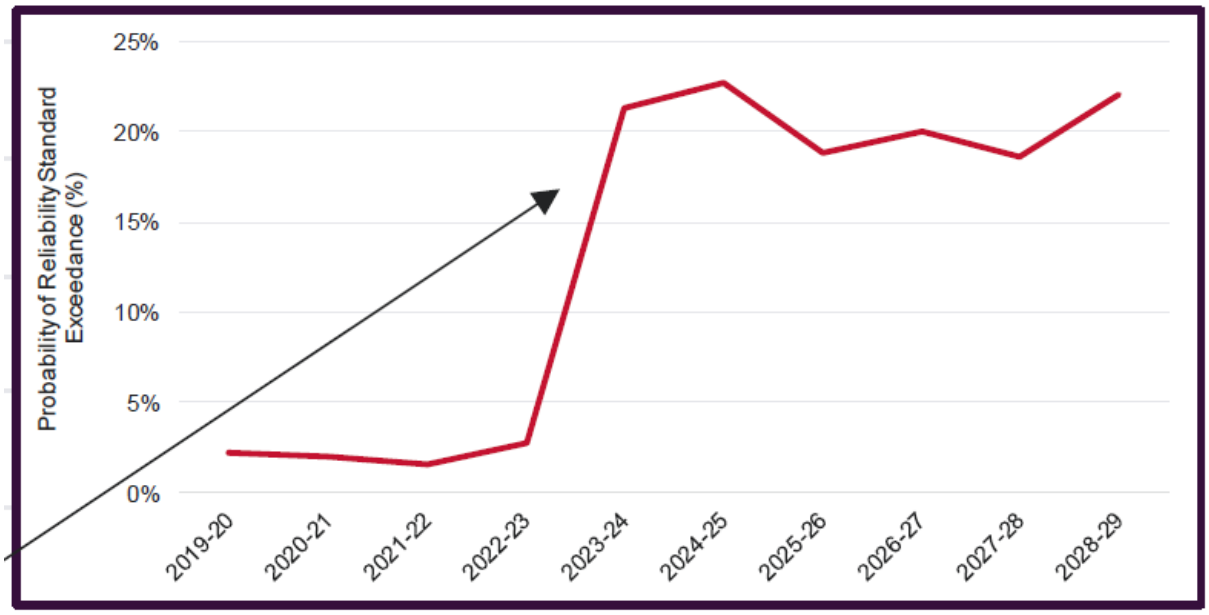
[84] "define detailed sectoral strategies to meet the target [of zero emissions by 2050]", p. 2 http://climateinstitute.org.au/verve/_resources/TCI_Submission_Climate_Change_Policy_Review_FINAL_090517.pdf

[85] https://www.aemc.gov.au/regulation/regulation

National Electricity Objective to the very important commitments and objectives of the states in accord with the Paris Agreement:

> *to promote efficient investment in, ~~and~~ efficient operation and use of, **and minimal emissions** from electricity services for the long term interests of consumers of electricity with respect to:*
>
> - *price, quality, safety and reliability and security of supply of electricity*
> - *the reliability, safety and security of the national electricity system.*

The Energy Security Board, in its September 2019 issues paper reviewing the electricity market, questions whether the market provides sufficient incentives to investors for investment in new electricity generation[86]. This may be a problem for NSW, especially as AEMO shows the probability of the reliability standard being exceeded in NSW increasing dramatically in a few years[87], as shown in the diagram for NSW below.



We encourage the NSW government to use reverse auctions[88] and contracts for difference to overcome the risks facing investors with connections to the grid, new requirements, MLFs, the loss of the RET as a driver, and other factors. We need to have substantial additional supply brought in before coal generators close, but until they do wholesale prices may be too low to incentivise investment. It is in the interest of NSW consumers that the state government bridge the gap and incentivise investment through reverse auctions and contracts for difference so that the new generation is in operation when a coal generator

[86] http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/EC%20-%20Post%202025%20Market%20Design%20Issues%20Paper%20-%2020190902_0.pdf

[87] p. 14, https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/NEM_ESOO/2019/2019-Electricity-Statement-of-Opportunities.pdf

[88] Reverse auctions are briefly explained in this 2018 CEC document https://assets.cleanenergycouncil.org.au/documents/resources/reports/nsw-election-recommendations.pdf

closes. After a closure, electricity prices are then likely to rise (more moderately) and provide sufficient return to the new generation, minimising the cost to the state.

We also call on the NSW government to build a strong emission reduction trajectory and adaptation framework into the planning and decision-making of different departments of the government. This will involve a detailed plan on how to achieve zero emissions by 2050, with detailed sub-plans for individual sectors that are reviewed regularly to assure that they are progressing at an adequate pace.

Nuclear power

An option for energy supply that has re-entered public discussion recently is nuclear generation. While its emission-free nature and dispatchability are advantageous, the high cost and poor ramp rate of nuclear generation are not a good complement to sustainable energy supply for NSW in the future.

In a 2018 analysis for AEMO, GHD considered the costs of nuclear and other electricity generation types[89]. It found that the capital cost for new wind generation is 'less than' $2,000/kW, while that for nuclear generation is approximately $16,000/kW. It also found that the combined lead and construction time for nuclear is 15 years, while that for wind is just over 3 years. Even considering the longer design life for nuclear (60 years) than wind (25 years), the capital cost of nuclear (per year of design life) is over 3 times as high as that of wind (without including any discount rate). The capital costs of solar PV are similarly much lower than nuclear[90].

This is corroborated in the 2018 Lazard *Levelized Cost of Energy Analysis*[91], which shows that **the levelized cost of wind or utility solar** (that is the cost per kWh or MWh over the life of the project) **to be in the order of 1/3 the levelized cost of nuclear**. This does not consider the costs of decommissioning or the federal loans guarantees that would likely be required with a nuclear installation.

The much shorter lead and construction times of solar and wind are much more suited to our NSW situation in which coal closures are scheduled before a nuclear plant could be operational, especially considering that (as described elsewhere in this submission) circumstances may well result in coal plants being closed before their current scheduled closure.

AEMO[92] indicates that, with the increase of variable renewable power, which is desirable because of cost, flexible energy sources will be needed to complement the future grid. Nuclear energy is not a flexible source of generation.

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[89] https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/Inputs-Assumptions-Methodologies/2019/9110715-REP-A-Cost-and-Technical-Parameter-Review---Rev-4-Final.pdf

[90] the cost given by GHD for utility scale, single-axis tracking, solar pv is $1574/kW, with a combined development and construction time of approximately 3 years.

[91] https://www.lazard.com/media/450784/lazards-levelized-cost-of-energy-version-120-vfinal.pdf

[92] https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2018/Integrated-System-Plan-2018_final.pdf

Given nuclear generation's high costs and the extended period before it could be operational, and given the availability of more flexible alternatives for dispatchable power, we recommend that NSW pursue less expensive, renewable energy sources for a secure, reliable, affordable and sustainable power supply. Nuclear power is too expensive, too inflexible and would not be ready in time for our needs.

Information and recommendations of relevance to this inquiry

There are many recent reports, consultations and submissions to those consultations that can also guide this current inquiry, such as that for the NSW Climate Change Fund draft strategic plan[93] (2016). Many of the submissions to that likely raise points that are applicable to the terms of reference to this inquiry. For example, the December 2016 submission (to the *NSW Climate Change Fund Draft Strategic Plan*) by the UNSW Centre for Energy and Environmental Markets (CEEM) advised on empowering local communities to adopt renewable energy, and to make NSW a centre for advanced energy innovation, among other things[94].

We recommend that the NSW government consider the information and options in documents from relevant organisations, including:

- Beyond Zero Emissions (such as its *Electrifying Industry* plan[95], and its *Renewable Energy Superpower*[96] report)
- Climate Change Authority (such as its 2019 *Industry Action on Climate Change Mitigation and Low-Emissions Technologies* [97])
- Australian Council of Learned Academies (such as its 2017 *The Role of Energy Storage in Australia's Future Energy Supply Mix*[98])
- Climate Institute (such as its *2017* submission[99] to the federal government's *Review of Climate Change Policies*)
- Climate Council (such as its 2019 *Ageing and Unprepared: Energy in NSW*[100])
- ClimateWorks (such as its 2016 *The Path Forward for Electric Vehicles in Australia*[101])
- Electric Vehicle Council (such as its August 2019 report *State of Electric Vehicles*[102])

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[93] https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Climate-change/draft-climate-change-fund-strategic-plan-160438.pdf

[94] http://ceem.unsw.edu.au/sites/default/files/documents/NSW%20CCF%20draft%20strategic%20plan%20-%20Submission%20CEEM%20UNSW.pdf

[95] https://bze.org.au/research/manufacturing-industrial-processes/electrifying-industry/

[96] https://bze.org.au/research/renewable-energy-superpower/

[97] http://climatechangeauthority.gov.au/sites/prod.climatechangeauthority.gov.au/files/Industry%20paper.pdf

[98] https://acola.org.au/wp/wp-content/uploads/ENRG-final.pdf

[99] http://climateinstitute.org.au/verve/_resources/TCI_Submission_Climate_Change_Policy_Review_FINAL_090517.pdf

[100] https://www.climatecouncil.org.au/wp-content/uploads/2019/02/climate-council-nsw-report-2019.pdf

[101] https://www.climateworksaustralia.org/sites/default/files/documents/publications/the_path_forward_for_electric_vehicles_in_australia_-_submission_to_the_federal_government_vehicle_emissions_discussion_paper_0.pdf

[102] https://electricvehiclecouncil.com.au/wp-content/uploads/2019/09/State-of-EVs-in-Australia-2019.pdf

- Clean Energy Council (such as its annual *Clean Energy Australia Report*[103])
- UTS Institute for Sustainable Futures (such as its 2019 *The Business Case for Behind-the-Meter Inverter Control for Regulating Voltage*[104])
- The 2019 report of the Senate Select Committee on Electric Vehicles[105]

The recommendations of the Clean Energy Council for NSW[106] before the recent state election were well reasoned and we ask that the NSW government pay close attention to these.

We also ask the NSW Government to consider any analyses or reports from the NSW Climate Change Council advising the government on reaching its zero emission goal. The *Sydney Morning Herald* reported that the NSW Climate Change Council contributed to policy proposals to decarbonise the state's economy that were provided to the government[107]. We recommend that the Committee access this important resource for this current inquiry.

We thank you again for the opportunity to comment on the Sustainability of energy supply and resources in NSW.

[103] https://assets.cleanenergycouncil.org.au/documents/resources/reports/clean-energy-australia/clean-energy-australia-report-2019.pdf
[104] https://www.uts.edu.au/sites/default/files/2019-03/uts-isf-business-case-april-2019%5B3%5D_0.pdf
[105] https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Electric_Vehicles/ElectricVehicles/Report
[106] https://assets.cleanenergycouncil.org.au/documents/resources/reports/nsw-election-recommendations.pdf
[107] https://www.smh.com.au/environment/climate-change/government-climate-plan-stalled-after-berejiklian-took-over-documents-show-20190314-p5145l.html