Electrical Trades Union of Australia

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SUBMISSION

Parliament of Australia
Standing Committee on the Environment and Energy

Inquiry into modernising Australia's electricity grid

April 2017

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Contents

1. **Executive Summary**
2. **Recommendations**
3. **System Security and Reliability**

3.1 South Australia Incident 8 February 2017

3.2 National Transmission Development Plan

3.3 Variable Renewable Energy Integration

3.4 Physical Resilience of Energy Grids

3.5 Microgrids

4. **Energy Storage**

4.1 Energy Storage Jobs

5. **Just Transition**
6. **Pricing**
7. **National Electricity Objective**

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1. Executive Summary

The Electrical Trades Union (ETU) is the Electrical, Energy and Services Division of the Communications, Electrical, Electronic, Energy, Information, Postal, Plumbing and Allied Services Union of Australia (CEPU). The ETU represents approximately 65,000 workers electrical and electronics workers around the country and the CEPU as a whole represents approximately 100,000 workers nationally, making us one of the largest trade unions in Australia.

We welcome the opportunity to submit to the Standing Committee on the Environment (the Committee) in relation to its current Inquiry into modernising Australia's electricity grid.

Our energy industry is in a period of deep crisis. The government has presided over the creation of a policy vacuum that has led to high prices for consumers, a collapse of investor confidence, job losses though unplanned and unsupported generator closures, fuel shortages, blackouts, higher relative emissions and a total erosion of public confidence in the National Electricity Market.

All the while, the inevitable change that is driven by technological advances has marched forward through significant developments in renewables, storage, networks and metering.

There is no doubt that Australian electricity markets are entering a period of evolution from the traditional status quo of centralised electricity supply and how transmission and distribution networks are being utilised. This change is being driven by a confluence of factors that include new and developing technologies and increasing customer control over how, when and how much consumers use electricity – all within the context of ever increasing power prices and a need to act on curbing carbon emissions.

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Unfortunately, the Government through its inaction and prevarication, has left the nation flat footed in responding to the rapidly changing challenges and opportunities in the energy sector.

As the power sector is the single largest source of carbon pollution, its decarbonisation is central to meeting Australia's emission reduction goals. Electricity remains the greatest single sectoral source of emissions in Australia. The electricity sector accounts for approximately one third of national emissions.[1][2] Australia's electricity supply is among the most emissions-intensive in the developed world, as illustrated by the fact our electricity sector has exceeded China's electricity emissions over the period 2007 -2013.[3]

While this is alarming in many respects and highlights the need for urgent action, it also means that the electricity sector offers the greatest opportunity to make serious progress in emissions reductions though effective structural design, operation and policies that will drive the ongoing take up of new low emissions technologies and open up the economic and employment opportunities that a change to lower emissions in the energy sector will bring. With the proper policies and incentives in place, the electricity sector can easily be the single largest source of domestic emissions reductions and the workers and communities that currently rely on the fossil fuels can benefit.

Fundamental to this will be a move towards low emission energy generation and distribution – this will mean more renewables and speedy adoption and expansion of energy storage technologies.

[1] Treasury, Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (2013), Climate Change Mitigation Scenarios, modelling report provided to the Climate Change Authority in support of its Caps and Targets Review, Canberra.
[2] Climate Change Authority 2016.
[3] International Energy Agency (IEA) (2013), Redrawing the Energy-Climate Map—World Energy Outlook Special Report, Paris.

A very recently published study from the Australian National University[4] concluded that a 100 percent renewable energy generation and network was achievable, secure and affordable. The report concluded that a zero-emissions grid would was possible with mainly wind and solar photovoltaic (PV) generation when used in conjunction with pumped hydro storage at a cost of approximately AU$75/MWh, which is cheaper than coal and gas-fuelled power, thus eliminating any need for coal and gas-fired power.

Recently the Government has attempted to spruik the merits of High Efficiency Low Emissions (HELE) coal generation, otherwise known as clean coal, as a way of decarbonising the energy generation sector without the need for further adoption of renewables. This has been proven to be bad policy on both metrics of cost and emissions outcomes.

The Clean Energy Finance Corporation recently assessed an proposal for a new $1.2bn 900MW coal-fired power station with carbon capture and storage technology. The CEFC subsequently advised a parliamentary inquiry that the CEFC had concluded the project was not “financeable” without the government agreeing to indemnify the project against the future risk of a carbon price being introduced and against the cost of delays in the project prompted by likely community protest action.[5]

In 2017 wind and solar projects that will go to construction this year add up to more than $5.6 billion of investment, almost 3150 direct jobs and more than 2500 MW of new power capacity. Underpinned by the RET, by 2030 there will be about $50

[4] A Blakers, B Lu, M Stocks. ‘100% Renewable Energy in Australia’, Australian National University, February 2017.
[5] https://www.theguardian.com/australia-news/2017/feb/27/cefc-approached-about-coal-fired-power-station-but-says-plant-not-financeable

billion for new renewable energy generation, large and small, since the policy was first introduced in 2001.[6]

Energy storage technologies are a game changer for the Australian energy market, offering the prospects of greatly increased flexibility, reliability and efficiency in the delivery of power to consumers. Energy storage will complement the accelerated deployment of renewable energy in its various forms. As storage technology evolves and costs decline, the potential for storage technology in Australia almost limitless if it is properly supported by Government. Electricity storage also has an important role in enhancing resilience as it can help to balance supply and demand thereby improving grid resilience by removing some of the challenges related to managing intermittency and reducing the requirement for backup generation and use of the network so it’s no surprise to see that The Clean Energy Finance Corporation (CEFC) and Australian Renewable Energy Agency (ARENA) have welcomed the opportunity to finally work together to accelerate the development of flexible capacity and large-scale storage projects that enable certainty of energy supply and smooth integration of renewable energy sources.

What is abundantly clear is that the NEM in its current form is not fit for purpose in its current. It doesn’t work for the majority of participants, for governments, for workers, for the environment and definitely not for consumers.

Australia’s energy networks need to modernise quickly. We need to quickly move to build significant storage capacity at both a household and industrial scale, and we need to reign in consumer prices that have risen dramatically, particularly with privatised networks, since the corporatisation of the energy sector and the establishment of the NEM.

[6] ‘Renewables will win the race for energy investment dollars’, Australian Financial Review, 17.2.17.

That's why the work that the Committee is currently undertaking will be of critical importance to finding the best pathway forward for the energy industry. In order to assist, we make the following recommendations.

2. Recommendations

1. That current NEM laws, regulations and wholesale market rules are not fit for purpose and should be abolished and replaced with a regime that places security and affordability ahead of commercial interest. Regulations for networks in particular, need to be replaced entirely and replaced with a regime that better reflects a balance of consumer price outcomes and efficient operations for a natural monopoly asset.

2. Urgent work be undertaken to formulate a plan to re-nationalise all electricity distribution and transmission grids in order to provide security, affordability and sustainability for the future.

3. That a national Emissions Trading or Intensity Scheme be implemented as a matter of urgency in order to reduce energy costs and energy sector emissions while driving economic and employment stimulus through increased certainty for investment.

4. That a national energy storage target be established. The timelines for which with should have regard to national emission reductions targets as part of international responsibilities, domestic renewable energy targets and reliability and security standards in both the National Electricity Market and non-national electricity market networks.

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5. That the current National Energy Objective be abolished and replaced with a mechanism to will promote energy democracy via emission reductions for the sector, affordability, security, safety, reliability, clarity, transparency and public accountability.

6. Given the rapid deployment of new and developing technologies that part of the wider energy sector transformation, any future plan for the energy sector must include plans for detailed skills mapping to ensure an adequate supply of suitably qualified labour.

7. Establishment of an Energy Transition Commission to be charged with the responsibility for ensuring that Australia's transition is managed in a fair and just manner, including where affected workers and communities are supported to find secure and decent jobs in a clean energy economy.

8. NEM regulations be amended to allow sufficient flexibility for adjustments that protect consumers from price impacts where future demand and network investment decisions taken by network businesses are unwarranted.

9. Consideration should be given to examining ways to reduce and streamline the regulatory arrangements between federal and state and territory energy jurisdictions in such a way that it involves industry, community and government stakeholders.

10. Given the staggering growth in the Australian renewable sector new regulatory arrangements under the National Electricity Objective should be

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developed and introduced aimed at supporting renewable energy, workforce development, training and industry standards.

11. Government and industry provide for a significant increase in energy storage research and development aimed at accelerating current storage development and deployment. This must include ensuring that high potential demonstration projects are adequately funded.

3. System Security and Reliability

There is a subtle but important difference between security and reliability in the electricity system - a *secure* power system is one that is able to continue operating within defined technical limits, even in the event of the disconnection of a major power system element such as an interconnector or large generator, while a *reliable* power system is one in which there is sufficient generation and transmission capacity to meet all grid demand.

Put simply, a secure power system is one that is being operated or managed such that all vital technical parameters such as voltage, equipment loading and power system frequency are within design limits and are stable and all persons are safe. A reliable power system is one that has a high likelihood of supplying all consumer needs.

Given current events there is evidence to prove that the current NEM arrangements are failing on both counts.

3.1 South Australia Incident 8 February 2017

On 8 February 2017 in South Australia, the power system was not in a secure operating state for over 30 minutes. AEMO directed interruption of supply to 100 megawatts (MW) of customer load in South Australia and gave clearance to restore that load 27 minutes later. Following this direction, approximately 300 MW was interrupted. At 1803hrs AEMO directed ElectraNet to shed 100MW of load by 1830hrs, it was apparent that there had been a demand reduction of about 300MW and spare capacity was available on generating units in South Australia and on the Heywood interconnector[7].

AEMO stated load shedding became the only option available when it became clear a gas plant at Pelican Point was not available to respond to the surge in demand as local temperatures in SA. it directed load shedding of 100MW to preserve the security of the electricity grid but the local network operator ElectraNet shed three times that amount – 300MW. It has subsequently been reported that the distributor, SA Power Networks, suffered a 'software glitch' that was responsible for the extra 200 MW of load shedding that resulted in an additional 60,000 being affected[8].

There are conflicting statements on the public record around critical issues like the time required to bring Pelican Point's second generation unit online. Some reports state that Engie, which owns the Pelican Point gas generators, advised it needed 6-8 hours to bring the second generator online which exceeded the two hours notice given by AEMO[9].

That contrasts with subsequent statements made in an appearance on 20 February 2017 at the Adelaide public hearing of the parliamentary inquiry that is currently underway into the Resilience of Electricity Networks[10] energy company stated that it was not directed by AEMO quickly enough to be able to have enough time to fire up Pelican Point's second generator. This is despite advice ahead of the known weather

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[7] AEMO, SYSTEM EVENT REPORT SOUTH AUSTRALIA, 8 FEBRUARY 2017. Published 15 February 2017.
[8] https://www.theguardian.com/australia-news/2017/feb/21/software-glitch-to-blame-for-blackout-of-extra-60000-sa-homes-in-heatwave
[9] http://www.afr.com/news/politics/engies-pelican-point-not-operated-second-unit-since-2015-20170213-gucadd
[10] http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Resilience_of_Electricity_Infrastructure_in_a_Warming_World/ElectricityInfrastructure

event to AEMO from Engie that would require an hour to bring Pelican Point's second unit online[11]. Engie also stated Engie Pelican Point ran at a loss three years, culminating in a $17m loss in 2015, before the decision to mothball and remains commercially unviable to operate.

AEMO has conceded that the widespread blackouts could have been prevented by faster action to the second Pelican Point generator online[12]. This calls into question both the current financial incentives for conventional generators and the fundamental operations of the market.

In summary, AEMO's report[13] into the incident has thus far concluded that at the peak:

- The Heywood interconnector was operating at or near its full capacity prior to the event.
- The flow into South Australia on the Murraylink interconnector was restricted by AEMO to 78 MW to manage grid voltage constraints.
- Demand was higher than forecast.
- Wind generation was lower than forecast. From 1600 hrs onwards, actual wind generation declined more rapidly than forecast, as a result of a sharp drop in wind speed between 1600 hrs and 1800 hrs.
- Thermal generation capacity was reduced due to forced outages.
- 165 MW of Pelican Point capacity had been notified as unavailable. The operator advised AEMOof a start-up time which would not have enabled AEMO to meet the system security requirements under the National Electricity Rules.
- Load was only available option for AEMO to restore system security.

[11] http://www.theaustralian.com.au/national-affairs/state-politics/south-australia-power-market-not-broken-senate-inquiry-hears/news-story/388cdf7c1e79dfc1a861531dc8f57844
[12] 'Blackouts put heat on grid manager AEMO', Media Article, The Australian, 16.2.17.
[13] AEMO, System Event Report South Australia 8 February 2017.

- AEMO directed load shedding of 100 MW, and gave clearance to restore that load 27 minutes later. Actual load shedding by the local network operator was approximately 300 MW.

Under the National Electricity Rules, AEMO can direct a generator to run if satisfied that the direction is necessary to maintain or re-establish a secure power system or reliability of supply. The rules effectively require AEMO to be satisfied of two fundamental elements before issuing a direction:

- Direction is necessary to achieve the required security or reliability outcome. In other words, the market will not resolve the situation unless AEMO intervenes in this way.
- Any directed action will actually achieve the required outcome, either by itself or in conjunction with other measures, in the required timeframe.

AEMO uses forecasts of available generation capacity and demand to calculate the reserve available in the power system. If there is insufficient reserve to maintain a secure and reliable power system, AEMO will take operational action to restore it. AEMO notifies the market of lack of reserve conditions: LOR 1, LOR 2, and LOR 3. If reserves are at LOR 2 or LOR 3 levels, AEMO can intervene in the market to maintain power system security.[14]

It is our view that AEMO is loathe to suspend the operation of the wholesale trading market to such an extent, that by the time a Direction is necessary to achieve the required security or reliability outcome, it will fall foul of the requirement that the Direction will actually achieve the required outcome. It is what happened in South Australia and several prior instances. The current rules place the commerciality of the wholesale generation market far about that of security of supply to consumers, so much so that the emergency security of supply arrangements themselves provide

[14] Ibid.

an endless loop of failure with no real consequence for market operators or participants, but with severe real consequences for consumers who suffer avoidable blackouts.

Following the South Australian incidents the same extreme heat weather tested the NSW system. While NSW did not have to resort to load shedding, the market hardly can claim any credit through excellence of operation.

More than 2000MW of thermal generation failed during NSW's demand peak and Australia's largest smelter was required to curtail its production for more than three hours and energy Queensland produced generation was transmitted to NSW in order to avoid blackouts across the state. confirmed plant outages on the afternoon of February 10 at AGL's Liddell power station (1000MW), Snowy Hydro's Colongra (724MW) and Energy Australia's Tallawarra gas plants (440MW) contributed to the shortfall of power reserves during the heatwave[15].

3.2 National Transmission Development Plan

As part of its normal forward planning and also in relation to system reliability and security issues, AEMO recently released a National Transmission Development Plan which examined transmission development under three scenarios:

- The Neutral scenario, considered the most likely estimate for demand growth.
- The Low Grid Demand scenario, which considers a different, credible path to test how the low boundary for demand (falling 32% in 20 years) could impact transmission development.
- The 45% Emissions Reduction scenario, which considers an accelerated emissions reduction trajectory towards 2030, based on the Neutral level of demand.

[15] http://www.afr.com/news/politics/gas-and-coal-failures-were-behind-nsws-power-scare-aemo-20170221-guiesi

The plan was developed based on strategic 'high level' modelling as opposed to detailed data and recommended:

- A new interconnector linking South Australia with either New South Wales or Victoria from 2021.
- Augmenting existing interconnection linking New South Wales with both Queensland and Victoria in the mid to late 2020s.
- A second Bass Strait interconnector from 2025.

It concluded that transmission development will be required over the next 20 years to connect up to 22 GW of new large-scale wind and solar generation and integrate this intermittent generation while maintaining a reliable and secure power system.

Estimates for the cost of the recommended transmission infrastructure range from $3 billion to $5 billion or above, and the report itself acknowledges that the benefits are only marginally greater than the costs.

In our view, while the plan has some merit, much greater detailed work needs to be undertaken before any serious decisions about future transmission infrastructure can be made. Aside from being a high level desktop review, the AEMO report did not assess how energy storage and micro grids might affect the transmission sector, nor the costing associated with any alternatives. Essentially, we regard the report as a roadmap on the 'business as usual' pathway for the current centralised system. It lacks the dynamic scope that is demanded by the reality of the energy transformation that is already underway.

3.3 Variable Renewable Energy Integration

An urgent priority for climate policy in electricity is how to ensure energy security in a market increasingly dominated by intermittent renewable generators.

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Overseas, it has been demonstrated for over a decade that wind generation can provide stable, secure FCAS service. In Canada, Quebec and Ontario have required wind farms to provide FCAS for more than a decade, and this is now being adopted in European grids. In Quebec, which has more than 3,000MW of wind generation, more than two-thirds of its wind capacity can now provide what is known as “synthetic inertia”, which can respond to voltage changes of the type that helped bring down the South Australian grid last September. Planning for a trial for wind power to provide 48 hours of FCAS service is currently underway in South Australia. The trial will be conducted at the newly commissioned 100MW Hornsdale 2 wind farm and will involve AEMO[16]. The intention is to show that wind farms can provide what is known as FCAS – frequency control and ancillary services – a critical component in ensuring grid stability in the face of unexpected voltage swings and other faults.

Funding has recently been approved for a $300 million 109MW Hornsdle 3 proposal that is underpinned by a 20 year power purchase agreement with the ACT at $73 per mWh. The project proponent now has 455MW of wind and solar and is aiming for 1000MW by 2020[17].

The Interim Report acknowledges that technical challenges of renewable generation intermittency is being met overseas, and canvasses several technical solutions to increase grid security and reliability[18]:

- Synchronous condensers: spinning synchronous motors whose shafts are not connected to a mechanical load. They consume very little real energy (machine losses), and in addition to providing inertia, they can generate or absorb reactive power to help to stabilise the system voltage and supply fault

[16] http://reneweconomy.com.au/australian-wind-farms-to-compete-with-gas-to-provide-grid-stability-62697/
[17] http://www.afr.com/news/wind-costs-fall-as-french-renewable-group-neoen-seals-300m-hornsdale-stage-3-20170301-gunv7z
[18] Interim Report, p27.

current contributions to the network. They can be purchased as new, or reconfigured from decommissioned synchronous generators.

- Synthetic inertia: new controllers are available that will transiently convert the non-synchronous mechanical inertia of a wind turbine into 'synthetic inertia'. These are compulsory, for example, for all new wind turbines installed in Québec, Canada.
- Power conversion systems: These allow the stored energy in large batteries to be used for a variety of power system tasks including the synthesis of inertia, reactive power control and system restart. Battery connected power conversion facilities are currently being installed in England and Wales.
- Fast interruption of loads to correct demand and supply imbalances.

We concur with the Interim Report position that solutions could be implemented through a mix of market mechanisms and regulatory requirements and that further analysis is needed to identify optimal solutions and implementation frameworks. We stress that the analysis must not be conducted on a usual economic cost-benefit basis but must include employment, community and emissions related outcomes.

We note that the AEMC and AEMO are working together to address the challenges for maintaining power system security in the NEM associated with the shift from synchronous generation to non-synchronous and intermittent generation, along with the related technical, regulatory and market framework challenges that arise.

3.4 Physical Resilience of Energy Grids

Anthropogenic emissions of greenhouse gases are causing various forms of climate change including higher national and global temperatures, warmer oceans, increased sea levels, and more extreme weather events. The increased incidence of severe weather represents one of the most significant threats posed by climate change.

The economic threat posed by the impacts of natural disasters to the Australian economy is staggering. More than a fifth of Australia's economic output is at high or extreme risk of disruption from cyclones, while more than a quarter of national gross domestic output is located in areas with high to extreme risk of flooding. Analysis undertaken by SGS Economics & Planning found that 11 per cent, or $175 billion of national GDP, is located in areas subject to bushfire[19].

Natural disasters and other large scale events that impact on electricity networks affect not only the electrical infrastructure in communities, but also many other infrastructure sectors, which are all interdependent with the electrical system (e.g., communications, financial, and health care) and often span several states and/or regions.

Grid resilience is increasingly important as climate change increases the frequency and intensity of severe weather. Greenhouse gas emissions are elevating air and water temperatures around the world. Scientific research predicts more severe hurricanes, winter storms, heat waves, floods and other extreme weather events being among the changes in climate induced by anthropogenic emissions of greenhouse gasses. Severe weather is the leading cause of power outages in Australia. Power outages close schools, shut down businesses and impede emergency services, costing the economy billions of dollars and disrupting the lives of tens of thousands of Australians.

Electricity grid component age and maintenance of the grid’s components has contributed to an increased incidence of weather-related power outages. For example, older transmission lines dissipate more energy than new ones, constraining supply during periods of high energy demand and grid deterioration increases the system’s vulnerability to severe weather given that the majority of the grid exists above ground. Grid resilience, a core requirement for climate adaptation,

[19] ‘Billions of GDP dollars at risk from natural disasters’, Australian Financial Review, 8 Nov 2016.

includes ensuring stability and general readiness through appropriate staffing levels, pole maintenance, vegetation management, use of mobile transformers and substations, and inspection frequency. Grid resilience strategies require a partnership across all levels of government and the private sector to promote a regional and cross-jurisdictional approach.

Placing power lines underground eliminates susceptibility to wind damage, lightning, and vegetation contact. However, underground power lines present significant challenges, including additional repair time and much higher installation and repair costs. Burying overhead wires costs between $500,000 and $2 million per kilometre, plus expenses for coolants and pumping stations. Perhaps the most important issue for coastal regions is that underground wires are more vulnerable to damage from storm surge flooding than overhead wires.

Additional transmission lines increase power flow capacity and provide greater control over energy flows. This can increase system flexibility by providing greater ability to bypass damaged lines and reduce the risk of cascading failures. Power electronic-based controllers can provide the flexibility and speed in controlling the flow of power over transmission and distribution lines.

Energy storage can help level network loads and improve system stability. Electricity storage devices can reduce the amount of generating capacity required to supply customers at times of peak load periods. Another application of energy storage is the ability to balance microgrids to achieve a good match between generation and load. Storage devices can provide frequency regulation to maintain the balance between the network's load and power generated.

3.5 Microgrids

Microgrids are a key component to improved grid resilience whilst increasing renewable energy deployment. A key feature of a microgrid is its ability during a utility grid disturbance to separate and isolate itself from the utility seamlessly with little or no disruption to the loads within the microgrid. Then, when the utility grid returns to normal, the microgrid automatically resynchronises and reconnects itself to the grid in an equally seamless fashion. Technologies include advanced communication and controls, building controls, and distributed generation, including combined heat and power which demonstrated its potential in the US by keeping on light and heat at several institutions following Superstorm Sandy. Because Microgrids can be used as backup power sources or to help manage peak load reductions they are ideal when matched with renewables to help enhance grid resilience to extreme weather events such as the South Australian storm, cyclones and bushfires.

4. Energy Storage

The impact of cost-effective energy storage on networks and the broader power industry will be transformative. Energy storage technologies are continuing to develop at a fast rate and become increasingly commercially viable for both consumers and business alongside ever increasing demand for clean and low emission electricity as part of efforts to de-carbonise the energy sector.

Energy storage, both at a household and industrial scale offers significant opportunity to integrate intermittent generation sources in ways that will improve network resilience and security of supply.

Energy storage technologies are a game changer for the Australian energy market, offering the prospects of greatly increased flexibility, reliability and efficiency in the delivery of power to consumers. Energy storage will complement the accelerated deployment of renewable energy in its various forms. As storage technology evolves and costs decline, the potential for storage technology in Australia almost limitless if it is properly supported by Government. In the residential market, solar systems with batteries are particularly attractive in markets with the high retail prices and all of Australia's residential power markets fall into that category. In time, every solar system installed will have storage, which will act as a backup generator for the home.

Electricity storage also has an important role in enhancing resilience as it can help to balance supply and demand thereby improving grid resilience by removing some of the challenges related to managing intermittency and reducing the requirement for backup generation and use of the network.

Global leaders in energy storage, such as Germany and the US, have already taken active steps to support energy storage technologies and deployment through policy and regulatory reform driven primarily by the aim of integrating increasing amounts of intermittent renewable energy, like wind and solar, that are required to meet renewable energy targets.

The Australian energy market has much in common with both the US and Germany, such as regions of high concentrations of intermittent renewable energy (wind in Texas and Solar, wind and Geothermal in California) and high penetration rates of residential solar PV (Germany). This is an excellent opportunity for Australia observe, develop and apply learnings from leading energy storage jurisdictions that shape future policy directions and guide Australia along the path to a sustainable energy future.

One of the keys challenges in Australia is integrating increasing amounts of wind energy into the grid, particularly in South Australia, which currently has 1.5 GW or approximately 40% installed wind capacity, and is forecasted to grow to 4.4 GW by 2024[20].

In order to achieve renewable energy targets, California 50% by 2030 and Germany 80% by 2050, both have taken a holistic approach to supporting energy storage by implementing a comprehensive range of policies and regulations that places an onus on utilities to facilitate the deployment of energy storage systems whilst providing residences and small businesses with financial incentives.

Energy storage will be the key enabler in integrating up to 100% renewable energy into the grid. This is largely because of the versatility of energy storage in that it can provide a wide range of services including demand matching and peak reduction, network congestion relief and infrastructure deferral, rapid frequency and voltage response and seasonal storage[21].

Globally storage has grown almost 300% between 2014 and 2016. This trend is expected to continue with the International Renewable Energy Agency predicting an installed capacity of 14 GW in 2030 compared to the current capacity in 2016 of just over 1 GW[22].

Australia has the potential to be one of the largest markets for battery storage due to the high cost of electricity, the large number of households with solar panels and Australia's excellent solar resources. Half of all households in Australia are predicted to adopt solar systems with battery storage with the residential storage market alone potentially growing to $24 billion over the next 10 years[23].

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[20] Moore, J and Shabani, B. 'A Critical Study of Stationary Energy Storage Policies in Australia in an International Context' School of Engineering, RMIT, 24 August 2016.
[21] Ibid.
[22] Battery Storage for Renewables: Market Status and Technology Outlook; International Renewable Energy Agency (IRENA): Abu Dhabi, UAE, 2015.
[23] Climate Council, 'Powerful Potential: Battery Storage for Renewable Energy and Electric Cars', Australia, 2016.

Whilst many countries have supported energy storage through demonstration projects, few – including Australia - have implemented the policy and regulatory changes required to facilitate market growth and development. The leading countries have each customised their investment to meet the needs of their own unique energy market which has resulted in different levels of support (low, medium and high) across the energy market.

The Bloomberg New Energy Finance Global Energy Storage Forecast 2016-24 predicts that between 45GW and 81GWh of energy storage could be installed by 2024, representing an investment of USD$44bn[24]. Australia is currently poorly positioned to attract its share of this investment due to the significant uncertainty around renewable energy policy in Australia, particularly at the federal level, which has prevented the large scale renewable energy market from operating efficiently.

This uncertainty has also had an impact on energy storage in Australia with the country considered a minor market player with only 14 MW of battery storage and no large scale hydrogen storage and Bloomberg New Energy Finance forecasts reveal slow growth with an estimated energy storage capacity of only 104 MW by 2020.

<u>Australian energy storage capacity in MW</u>

[24] https://www.bloomberg.com/company/new-energy-outlook/

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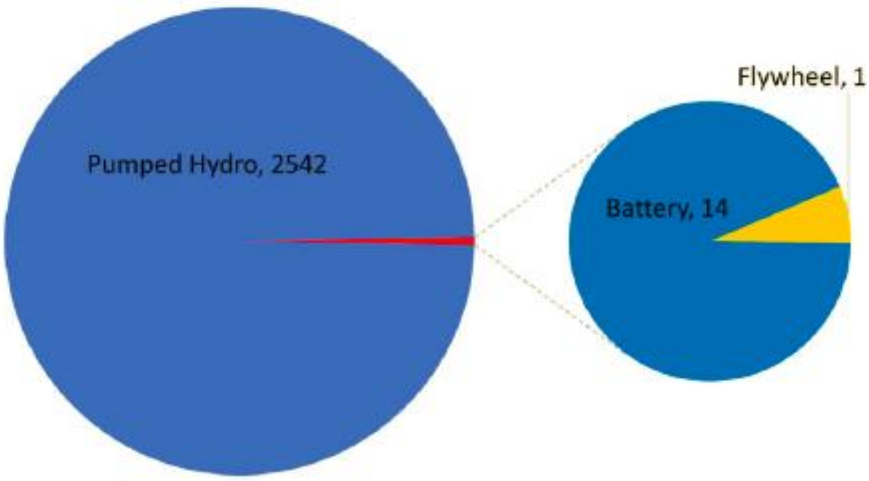

(Source: Bloomberg New Energy Finance)

At present, the key mechanism supporting energy storage in Australia is the Australian Renewable Energy Agency (ARENA) via its AUD $2.5 billion investment fund. ARENA has identified that energy storage can play a crucial role in helping to achieve the objectives of all three investment themes and to date has invested approximately AUD $83M in battery storage projects[25]. The majority of this funding is in commercial and utility battery storage which comprises several projects involving the integration of storage with solar PV for off grid applications such as islands and mine sites. Australia has a large off-grid sector consuming over 7% of the total electricity demand and in these remote areas the cost of gas and diesel for electricity generation is very high. As a result, the business case for energy storage is strong and therefore it is one of ARENA's investment focus areas.

<u>ARENA battery storage funding</u>

[25] https://arena.gov.au/projects/energy-storage/

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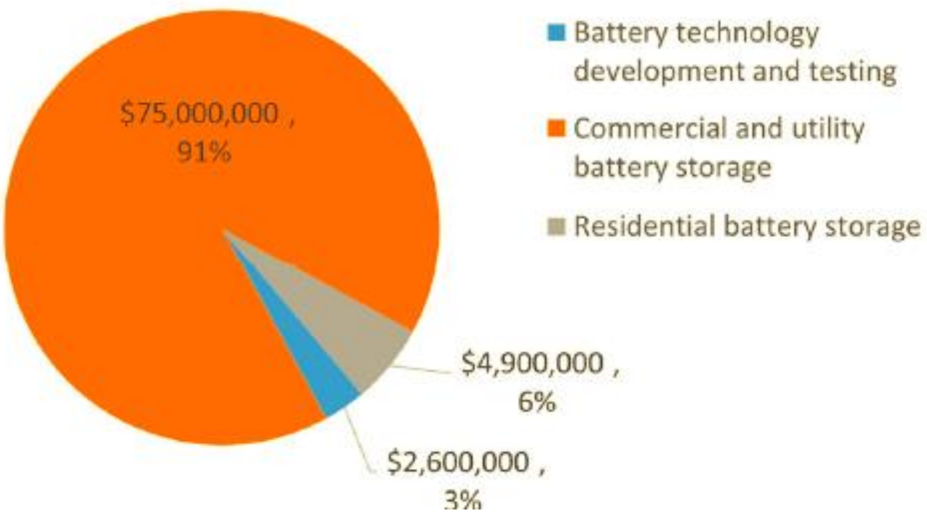

(Source ARENA)

The other key supporting mechanism energy storage in Australia is the Clean Energy Finance Corporation (CEFC) which to date has made two significant investments in battery storage. $15 million part funding towards the largest integrated off-grid solar and battery storage facility in Australia consisting of 10.6 MW of solar PV and 6 MW/1.8 MWh of battery storage at the DeGrussa copper mine in Western Australia and $100 million for Origin Energy to expand its solar and battery storage Power Purchase Agreements for commercial and residential customers[26].

It is clear that Australia can do more from a policy and regulation perspective to support energy storage technologies and arguably renewable energy in general. Whilst ARENA has identified energy storage as being crucial to increasing renewable energy penetration and has provided grants for a number of demonstration projects, there is little else occurring at a Federal Government level. The most active area of investment at present is in the off-grid market with a number of battery storage projects in various stages of development on islands, remote communities and mine sites.

[26] http://www.cleanenergyfinancecorp.com.au/case-studies.aspx

We are hopeful that this is about to change with the recent announcements that the CEFC and ARENA will work together to accelerate the development of flexible capacity and large-scale storage projects as part of a focus on encouraging the development of flexible capacity and large-scale storage projects in Australia as it transitions to low emissions technologies. ARENA will call for Expressions of Interest for demonstration projects under its Advancing Renewables Program (ARP). It is expected that ARENA would allocate at least $20 million to the successful projects. Eligible projects are those which provide flexible capacity to the system such as battery storage, pumped hydro, concentrated solar thermal, biomass and demand management technology.[27]

Realising the full potential of energy storage requires strategic planning by the government and industry actors. Future policy, regulatory and market reform to support the uptake of energy storage should focus on the following objectives:

- Engaging with stakeholders and raising awareness about best practice implementation, and engagement in policy and regulatory issues;
- Ensuring proactive analysis and monitoring of the growth of the storage sector;
- Establishment of appropriate technical and skills standards to ensure integrity of the storage sector;
- Ensuring an appropriately skilled and qualified (fully licenced) workforce to manufacture, install and maintain energy storage infrastructure and assets; and
- Ensure effective regulation and policies to incentivise and support the uptake and implementation of storage technology.

[27] https://arena.gov.au/media/arena-and-cefc-support-solutions-for-certainty-of-energy-supply-including-flexible-capacity-and-large-scale-energy-storage/

Focusing on these key objectives will ensure that the sector develops and sustainably on a foundation of high standards that will protect the integrity of the sector and build demand and confidence at all levels across the energy sector.

To ensure the effective uptake of energy storage government and industry must remove the barriers to deployment to ensure a level the playing field for storage.

Many of the technical barriers that face energy storage, particularly battery systems, relate to grid interface issues. Complex rules, lack of ability to respond to technological change and a lack of transparency stifle innovation and create challenges for battery storage and other forms of distributed generation. A number of simple measures would assist storage technologies such as resource mapping for bulk storage technology, funding for assessment of supply chain opportunities and skills gap analysis for particular technologies[28].

Support for uptake of electric vehicles would also have a major impact on the residential and commercial market for storage through the creation of a secondary market for used batteries. Work is needed to consider these issues, as policy changes could happen quickly and without much warning as state and federal government look for ways to stimulate employment.

4.1 Energy Storage Jobs

Energy storage will have a significant economic impact not only via stimulated investment but through its potential to create tens of thousands of new, high-quality jobs.

[28] Clean Energy Council, 'Australia energy storage roadmap', Melbourne, 2015.

In the United States, it is clear that energy storage policies and incentives can drive spur job creation. A paper by the US Solar Foundation estimated the jobs created in residential installations, with 8,305 linked to storage and 16,609 storage-induced PV jobs by 2021[29]. In 2010 the US Energy Storage Association commissioned a report on the benefits associated with energy storage legislation that were before Congress at the time. That assessment concluded that up to 114,000 jobs could be created by 2020[30]. The storage incentives contained in the legislation that were assessed as part of the analysis included a 20 percent energy investment credit for grid-connected energy storage and a 30 percent energy investment credit for onsite energy storage through 2020. The jobs projections contained in the report were very conservative in that they were only the number of direct jobs created and did include jobs that would be created in the supply chain.

Incentivising and accelerating the adoption of energy storage technologies will create jobs and will move us closer to 'smart' electricity grids of the future, including full integration of renewable energy, better reliability, and more demand response and emissions control capabilities.

In our view the development and incorporation of energy storage technologies into the energy market will be critical to reducing emissions by driving increased deployment of renewable technologies and increasing network and supply reliability for consumers and network businesses in the future.

We recommend that strong policy frameworks that encourage the rapid deployment of commercially viable energy storage technologies form a critical part of future plan for the Australian energy sector.

[29] https://cleantechnica.com/2016/07/15/27000-new-jobs-2021-due-solar-energy-storage-paper/
[30] http://blogs.dnvgl.com/energy/potential-for-114000-energy-storage-related-jobs-created-in-us-by-2020

5. Just Transition

An essential element to in mapping out a viable plan for the future of the energy sector is ensuring that there is a just transition plan for affected workers and vulnerable communities as the inevitable structural adjustment associated with a move to lower emissions takes place.

Transitioning an industry is a massive economic and social disruption and is something that has been done poorly to date in Australia. History shows that workers and communities often bear the brunt of such transitions suffering hardship, unemployment and generations of economic and social depression.

Australia is currently facing one such transition in the coal-fired electricity sector. If Australia manages the transition well, the nation could have a structured and equitable approach that could apply to any industry undergoing similar change in the future.

To date in Australia in the energy sector impacts on the workforce and ensuring a just transition in the move away from fossil fuel generation has barely been mentioned in government and regulatory reports, yet with the closure of Port Augusta power state in South Australia and the imminent closure of Hazelwood in Victoria's Latrobe Valley, we see the usual reactive scramble from governments to decisions from the private commercial sector.

We often wait until a company, or an entire sector, goes under before offering training or financial assistance to redundant workers.

The sudden closure of Alinta's operations in Port Augusta illustrates the inadequacy of an unplanned transition away from coal-fired power. People in areas with high unemployment, including regional towns with coal-fired power plants such as Victoria's La Trobe Valley, have been neglected by multiple governments and companies over many decades.

It doesn't have to be this way, and it should be this way.

International experience, such as with the mining and energy sector in Germany, shows that a transition can be done equitably, can achieve positive outcomes for workers, save communities and forge new industrial growth and prosperity.

We strongly recommend that transitional arrangements for the workforce and affected communities form part of the Panel's deliberations. The key principles underpinning a Just Transition include:

- equitable sharing of responsibilities and fair distribution of the costs across the sector;
- institutionalised formal consultations with relevant stakeholders including trade unions, employers and communities, at national, regional and sectoral levels;
- the promotion of clean job opportunities and the greening of existing jobs and industries through public and private investment in low carbon development strategies and technologies in all nations and the appropriate educational qualifications that enhance working peoples' capacity;
- formal education, training, retraining, and life-long learning for working people, their families, and their communities;
- organised economic and employment diversification policies within sectors and communities at risk;
- social protection measures (active labour market policies, access to health services, social insurances, among others); and
- respect for, and protection, of human and labour rights.

A successful just transition plan needs to be predicated on the premise that workers in fossil-fuel industries have a "right to know" how the transition to a more sustainable energy mix will be managed. The "right to know" includes an entitlement to information on future prospects for existing workers in fossil industries "who will need to have their entitlements (eg superannuation etc) secured if they are older workers or to have upskilling or redeployment opportunities if they are younger workers.

Renewable energy and energy efficiency are more labour intensive than fossil fuels and should therefore create more jobs, provided there is the right policy framework and support. If the policy settings are right, the faster the transition to clean energy, the greater the jobs increase. But clean energy creates different types of jobs to those that are supported by fossil fuels. The construction and manufacturing sectors could see the biggest gains, whilst fossil fuel utilities and mining sectors would see the largest job losses. We caveat this by saying that employment projections of this kind are inherently uncertain due to the mix of technological, market and economic uncertainty involved.

We have identified several key elements of a framework that will need to be implemented to ensure the energy sector transition away from coal fired generation occurs in a fair and just way. They are:

- A transition plan – ensuring that Australia’s transition is managed in a fair and just manner, where affected workers and communities are supported to find secure and decent jobs in a clean energy economy;
- The Establishment of a Just Transition Commission;
- Detailed skills and employment mapping for the future of the energy market;
- A jobs plan – focusing on creating new jobs in a clean energy economy;
- Targeted labour market initiatives for affected workers;
- Realising the full potential of renewable and low emissions related employment opportunities;
- Establishing a Australian renewable manufacturing sector; and
- An energy plan – setting out a sustainable future energy mix that ensures affordable and secure supply of electricity.

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We believe that the Australian Government has an important and crucial role to play in supporting the creation of employment opportunities and encouraging the take up of new opportunities in the energy sector by creating a stable energy and climate policy platform that supports investment and creates new decent and secure jobs.

Regardless of views on whether or not Australia's fleet of coal-fired power stations will or should be shut down over the next 5 years, 15 years, or 30 years, one thing is clear: the foundations of a post-coal future must be put in place today if affected workers and communities are to thrive through the transition and it is a critical part of any future plan for the national electricity sector.

6. Pricing

Over recent years we have seen electricity prices increase by large, unsustainable amounts to the point where it has become the most significant cost of living expenses for private consumers, and one of the largest ongoing expenses for businesses. It is no surprise that recent polling[31] has revealed that 44 percent of respondents thought that rising energy prices were the top issue that governments should address.

The hyper-inflation of electricity prices has sparked significant regulatory and policy reform as regulators and governments have reacted to soaring costs. Given that the National Electricity Market and the energy sector are one of the most heavily regulated industries in the country, it is hard not to arrive at the conclusions that the market design and regulation has failed to deliver the consumer outcomes on affordability that the NEO demands.

[31] https://www.theguardian.com/australia-news/2017/feb/28/more-voters-see-malcolm-turnbull-as-out-of-touch-and-arrogant-essential-poll-shows

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There has been a swath of reports over the last 5-7 years that have examined the issue of rising electricity costs, what the drivers are and what can, or should, be done to arrest their continued increase. The costs associated with each section of the electricity price stack - generation, transmission, distribution, retail and government incentive polices have all been blamed to varying degrees (some certainly more than others) of being the main driver of increasing costs, and in a collective sense they all do bear some portion of responsibility.

The AEMC's 2016 Retail Competition Review broke down the retail energy price stack thusly:

- 30-40% - Network costs, comprised of transmission and distribution costs
- 40-50% - Competitive market costs, comprised of wholesale costs and the retail cost component.
- 5-15% - Environmental and other policy costs.

The report shows that residential electricity prices are expected to rise over the next two years to 2018/19 and contends that will be driven by increases in wholesale costs due to the retirement of some thermal generation capacity and increased environmental policy costs. We contend that the report does not represent an accurate or reliable guide future prices. This is partly because it does not take into account the increased supply, mainly renewable generation, capacity that will be coming on to the market, nor does it include the at least $3 billion dollars of generation and transmission infrastructure it is proposing in its National Transmission and Distribution Plan.[32] While these reasons are compelling enough, the report itself contains several serious disclaimers. Namely, that the report does not provide, and should not be regarded as providing, forecasts of future prices,

[32] http://www.abc.net.au/news/2016-12-12/what-is-the-aemo-and-what-is-it-proposing/8113466

including those which are set by jurisdictional regulators or government and that the price trends identified in the report are not a forecast of actual prices.

While each individual element of the price stack should rightly be closely examined in any thorough attempt to address price increase, the one thing they all have in common is the NEM framework.

In our view, one of the biggest contributors to high electricity prices has been the ineffective regulatory environment within the NEM that has resulted in network businesses being able to consistently achieve profits that are far in excess of those allowed for in AER determinations, generators to seemingly game the wholesale market and retailers (many of them vertically integrated with generation) pass through spiralling marketing and administration costs.

Linked to is the role that forecast modelling by agencies such as the AER, AEMO and AEMC play in decisions of network businesses, generators and new entrants.

The current oversupply of electricity, along with perceived over investment in networks can be linked back to demand projections from NEM governance bodies that were wildly inaccurate. Coupled with a regulatory environment that did not allow for appropriate adjustments, it has contributed significantly to the price outcome problems that are currently besetting energy regulators and governments.

While it is not possible to accurately predict the future, important data such as demand projections should not totally inaccurate, and in instances where it is, market rules should be sufficiently designed to allow for corrections and pricing protections for consumers. There needs to be sufficient flexibility in the regulatory process to allow adjustments that protect consumers from having to foot the bill of bad investment decisions via bloated AER determinations investment decisions based on critically erroneous data.

Much has been made of network costs as the main culprit of steep increases to residential electricity prices. In particular, the term 'gold plated' networks was coined in reference to publicly owned transmission and distribution network businesses that (allegedly) overinvested in network capital expenditure in comparison to private networks. This led to a barrage of calls from various industry sectors that those remaining public electricity networks, such as those in Queensland and New South Wales, to be privatised.

We do not agree that privatisation of the energy sector is the best way forward, not least of which is because privatisation does not lead to lower retail energy prices. In fact, the energy sector policies that delivered hyper-inflation of consumer electricity prices were largely a result of national competition based reforms that trumpeted privatisation. Advocates for privatisation of government owned energy infrastructure on the basis that it will driving increased market competition that will eventually be of benefit to consumers. Continuing to pursue this failed and outdated ideology is not warranted. Evidence drawn from other jurisdictions clearly shows that privatisation leads to high electricity prices as private companies profit gouge and maximise returns to shareholders.

In a theoretically ideal competitive market, prices perform at several distinct functions. Prices provide a signal to consumers about the social cost of the product they are consuming. Consumers will buy the product if, and only if, its value to them exceeds the price, which represents the value of the resources used to produce it.

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Conversely, prices provide a signal to producers about the value of their product. Firms will produce more (or less) if the price is greater (or less) than their cost of additional production.

In addition, prices provide a signal to firms on whether to invest in additional production capacity. If prices are high, and expected to remain so for some time, the industry will attract new investment. If prices are low, there will be no new investment and existing capacity will be scrapped or allowed to run down.

Finally, competitive prices ensure that, in the long run, businesses earn the market rate of return on the capital they have invested, no more and no less.

The NEM attempts to reproduce all of these outcomes but fails. There are several critical problems.

First, there are problems in relation to network infrastructure. The physical network is a natural monopoly, which means the market is best served by a single set of poles and wires.

Of course, in the absence of regulation, such a natural monopoly could potentially will charge prices that are too high. Consumers will get less than they should at a higher price, profits will be excessive and investment will be distorted.

These problems can be reduced, though not eliminated completely, by comprehensive price regulation. But when privatised firms are regulated in this way, their primary incentive can be to ‘game’ the system to secure higher returns. This often entails delaying investment (a pattern seen with Telstra on broadband).

Electricity networks are highly capital-intensive. As a result, the cost of electricity is predominantly determined by the capital value of the network and the rate of return earned by its owners. In the NEM era, public electricity enterprises funded their investment by issuing bonds, normally at a small premium to the government bond rate. In some cases, governments guaranteed these bonds. However, the primary reason for the low rate of return demanded by investors is that, under normal conditions, the risk of these investments is very low.

The risk associated with the regulated monopoly components of the industry, transmission and distribution, remained low. The standard method of regulation involved fixing allowable revenue based on an estimate of the efficient costs of operation.

The dominant component of efficient costs was the need for a return to capital.

Regulators such as the AER are required to set a rate of return derived from methodologies based on the private sector. This involves setting a 'Weighted Average Cost of Capital' (WACC), which was substantially higher than the true cost of capital for private firms, let alone the government bond rate that had previously formed the basis of electricity pricing. The result of the requirement for excessive rates of return is that distributors have had a strong incentive to 'game' the system.

This is a two-step process. First, distributors make arguments that the required level of capital investment, to which the rate of return is applicable, is very high. Then, to the extent possible within a given regulatory period, they under-invest and claim to have made gains in efficiency. The success of this process can be seen from the fact that the market value of distribution assets is substantially greater than the value given by regulators.

Since 2013, twelve of the AER's twenty decisions on electricity network revenue and gas access arrangements have been subject to applications by network businesses for review by the Tribunal seeking a $7 billion cumulative revenue increase over five years.

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This obviously represents a huge potential additional cost to consumers. It also means increased uncertainty for consumers, businesses, employees and regulators alike as reviews typically can take over two years.

The fact that 60 percent of AER determinations have been taken to review since 2013 can be indicative of a number of factors, such as:

- That the AER determinations are not being made correctly;
- That there are gaps in the regulatory framework;
- That the LMR framework inherently encourages litigation;
- That the 2013 LMR Review outcomes have been ineffective; and
- That the network businesses are well resourced enough to seek a merits review as part of business as usual.

It likely that a confluence of these factors, rather than any single one, is the basis for the high percentage of determinations that are taken to review and some of this will be evident from Tribunal determinations.

We note the work that is currently underway under the auspices of the COAG energy council to review the current Limited Merits Review regime. While it is undeniable that the review process is vitally important and should be maintained, we believe the LMR review is addressing the symptom rather than the root cause.

We only need to look at the recent experience with the most recent New South Wales distribution AER determinations.

The initial AER determinations unsustainably slashed the money spent on maintaining, repairing and operating the network which simply leads to inadequate infrastructure that may spark bushfires, fail in periods of extreme weather, or result in a growing number of blackouts and service disruptions. Thousands of proposed job cuts were pursued by Essential Energy, Ausgrid and Endeavour Energy based on the flawed

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AER determinations. The appeal process afforded by the LMR was critical to providing a mechanism that saved jobs and reliability and safety standards.

The Australian Competition Tribunal ruled in February 2016 there were flaws in the modelling and assumptions used to set NSW power prices required the process to be conducted again, directing that a better balance be struck between affordability, reliability and safety. As the union which represent the workers that maintain and operate the state's electricity network, we feel the decision vindicated our argument that massive cuts imposed by the AER determinations were wrong and would negatively impact on service delivery and network reliability.

Overall, this amounts to more evidence that the current NEM regulatory arrangements are not fit for purpose and should be abolished in favour of a new regime that is better suited to deliver outcomes for industry participants, consumers and the planet alike.

7. National Electricity Objective

Australia's energy policy objectives focus on promoting the long-term interests of consumers with respect to the price, quality, reliability and security of electricity services. These objectives are encompassed in the National Electricity Objective (NEO). The NEO is set out in section 7 of the National Electricity Law:

"The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:

(a) price, quality, safety, reliability and security of supply of electricity;

and

(b) the reliability, safety and security of the national electricity system."

The NEO is currently structured to encourage energy market development in a way that supports the

- efficient allocation of electricity services to consumers that value them the most, typically through price signals that reflect underlying costs;
- provision of, and investment in, electricity services at lowest possible cost through employing the least-cost combination of inputs; and
- ability of the market to readily adapt to changing supply and demand conditions, and the preferences of consumers.

We believe that in any objective assessment of consumer outcomes there are serious doubts as to whether the NEO is being met, particularly with respect to price and reliability.

Away from the political debate which technologies or policies may be responsible, in part of whole, for why both retail and wholesale power prices are high and blackouts are occurring there is the undeniable fact that the staggering growth in the Australian renewable sector continues unabated at both residential and commercial levels. We recommend that the NEO should be updated and rewritten to reflect the new reality of both current technological deployment as well as the need to prioritise price and reliability outcomes over market rules that are designed to deliver outcomes through competition policy.

A new NEO should be more prescriptive and aimed at promoting energy democracy via emission reductions for the sector, affordability, security, safety, reliability, clarity, transparency and public accountability.

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Appendix A – Terms of Reference

The House of Representatives Standing Committee on the Environment and Energy will inquire into and report on the adequacy of the current electricity transmission and distribution networks to support Australia's future needs, giving particular consideration to:

1. the means by which a modern electricity transmission and distribution network can be expected to ensure a secure and sustainable supply of electricity at the lowest possible cost;

2. the current technological, economic, community and regulatory impediments and opportunities to achieving a modern electricity transmission and distribution network across all of Australia, and how these might be addressed and explored; and

3. international experiences and examples of electricity grid modernisation in comparable jurisdictions.

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