Australian Government
Department of the Environment and Energy

COVER SHEET FOR SUBMISSIONS

Independent Review into the Future Security of the National Electricity Market

Overview

Please include this cover sheet with your submission on the Preliminary Report of the Independent Review into the Future Security of the National Electricity Market.

Background

The Preliminary Report outlines the Panel's observations about the current state of the NEM and offers questions on the major issues the Panel has identified. The questions are designed to elicit suggestions or answers that may help form the Panel's final recommendations.

The Preliminary Report serves as an issues paper for broad public consultation. As such, the questions and views will be subject to further consideration and discussion, in anticipation of the final blueprint being produced in 2017.

Stakeholders are encouraged to keep their submissions as succinct as possible, and include a one-page executive summary.

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Submission Instructions

The submission period will be open until close of business on Tuesday **21 February 2017**.

All submissions should be emailed to the NEM Security Review at the mailbox: NEMSecurityReview@environment.gov.au

3 March 2017

Via Email: NEMSecurityReview@environment.gov.au

To whom it may concern,

RE: Independent Review into the Future Security of the National Electricity Market

Thank you for this opportunity to make a submission to the Independent Review into the Future Security of the National Electricity Market.

Please note that this submission is complementary to Total Environment Centre et al, Group submission to Independent Review into the Future Security of the National Electricity Market in relation to the National Electricity Objective, 23 February 2017.

Key points

- Any reform of the National Electricity Market (NEM) must be integrated with a stable, credible and bipartisan climate change policy that is consistent with Australia's international commitments. To this end this review must inform the broader review of climate change policy. Failing to do so will compromise investor confidence and continue to put energy affordability and security at risk.
- ACF recommends that NEM reform and grid design be framed by the long-term goal, and government commitment established through ratification of the Paris Agreement, of achieving net zero emissions well before 2050. This is a goal which experts including the Climate Change Authority have shown is necessary if Australia is to meet its Paris commitments.
- To this end we recommend the adoption of a target to ensure that the electricity sector achieves net zero greenhouse emissions by 2035, so that the entire energy sector (e.g., transport, industrial processes, etc.) can be decarbonised through increased electrification well before 2050. The target should be bipartisan and supported by stable policy and market design. Doing so will:
    - Provide the policy stability required to generate investor confidence.
    - Allow investors and governments to make an informed decision about technologies that are not consistent with that long-term goal, such as natural gas and ultra-supercritical coal power stations.
    - This in turn would prevent a lock-in of technologies that are inconsistent with our international commitments and encourage investment in

renewable energy and complementary storage technologies that can provide the clean energy we need as well as flexible, dispatchable supply that resolves intermittency issues.

- The National Electricity Objective (NEO) also needs to be amended with a third element to represent the carbon emissions reduction element of the energy affordability, reliability and greenhouse pollution reduction trilemma we face.
- New coal fired technology has no place in Australia's energy future as it jeopardises energy affordability, will not lower emissions sufficiently and will not help provide system stability due to its inflexibility/incompatibility with renewables.
- Similarly, carbon capture and storage cannot be part of a feasible carbon reduction strategy due to the substantial upwards impact it would have on levelised cost of electricity (LCOE), making the associated generators substantially more expensive than renewables.
- Over three-quarters of Australia's fossil fuel generators are passed their original design life but there is no plan, policy or orderly process in place to manage their exit. This is creating uncertainty and adding significantly to the social, environmental and economic costs of transition. In particular, a national plan for the orderly retirement of coal-fired generators that provides for just transitions for workers and communities is urgently needed.
- Though gas currently is playing a short-term role, it is not a longer term solution to decarbonisation, affordability or energy security. Reliance on gas as a baseload fuel is incompatible with achieving net zero emissions. Any investment in new gas facilities are at high risk of becoming stranded assets.
- It is already commercially feasible for pumped hydro to play the role of peaking gas generators at a lower Levelised Cost of Capacity (LCOC) than gas generators, due to its flexibility allowing it to fulfil a greater variety of roles on the NEM.
- Solar thermal has recently become cost competitive with peaking gas technology and has several advantages over OCGT namely lower emissions; ability to operate as baseload and; adding new generation capacity to drive down wholesale prices (unlike batteries).
- A grid entirely based on renewable technology can feasibly supply affordable and reliable energy and is the only credible option capable of resolving all three elements of the energy trilemma. Other countries have shown that this move is achievable and technically feasible. Multiple documents exist highlighting paths to 100% renewable energy generation.
- There are multiple options that exist which can improve grid stability in the short-term:
    - Improved forecasting informing AEMO's management of demand and supply.
    - Broad rollout of updated fault ride through settings on wind generators, which would have helped prevent the 2016 South Australian blackout and likely prevented it altogether.
    - A full review of best practice in other countries to find solutions like adjustments to fault ride-through settings which, as noted in your

preliminary document, have been known and implemented in Europe for over a decade.

- Curtailing renewable energy generation while security issues are addressed would be an error as it would:
    - Reduce supply volume and competition, driving up prices.
    - Exacerbate supply shortage issues like those seen recently in South Australia, and increase vulnerability to the sudden non-availability of fossil-fuel sources as happened in that event.
    - Undermine investor confidence further, stunting the construction of new generation, thereby increasing prices in the long term.
    - Reinforce the erroneous narratives around renewables being intrinsically a threat to security, eroding public support for a critical future industry.
    - Reduce grid diversity, thereby further jeopardising security. There are numerous examples of how renewables increase grid security and can be more secure than fossil-fuels sources if managed well.
    - Compromise Australia's ability to meet even its short-term carbon reduction targets, with emissions already set to be increased over 2005 levels by 2030.
- ACF recommends that a greater national commitment be made to energy productivity and demand management to help manage peak energy demand and the overall transition to clean energy. Energy efficiency must also play a role in assisting low income households manage the cost of transition. This should include a target to double Australia's energy productivity by 2030. To support this flexible tariffs and smart meters should be introduced to more accurately reflect fluctuations in price, thereby encouraging consumers to self-manage demand and adopt efficiency measures. The behavioural component, demand management, is critical and one that can most easily be managed through appropriate signals and market design.
- Reform and modernise the NEM. The current market and its rules were composed over a decade ago with input from engineers familiar with the technologies and grid structure being implemented at the time. The whole system is now outdated and in need of overhaul so that it is fit for purpose for a future powered by renewable energy and complementary technologies. This will require input not only from market operators but also from engineers familiar with the current and emergent technologies.
- Reform of the NEM should be part of a national clean energy transition plan including a phased closure plan for Australia's dirty coal-burning power stations; support for workers and communities to be a part of the clean energy future; a 100 per cent clean renewable energy target, strategy and policy pathway; and a national energy efficiency strategy.

3.1 What role should the electricity sector play in meeting Australia's greenhouse gas reduction targets?

The role of the electricity sector in greenhouse gas reduction targets is crucial, a fact recognised by the Climate Change Authority when it notes that it is "both the largest source of emissions and a significant source of emissions reduction opportunities"[1]. It also potentially plays a crucial role in supporting emissions reduction strategies in other sectors, such as transport, which are likely to be highly dependent of electricity driven technologies to reduce emissions. Therefore, reducing the electricity generation sector's emissions is an essential element of any credible carbon reduction policy.

The same CCA report recommends the introduction of emissions intensity reduction scheme to reduce the emissions of the sector to net zero "well before 2050", a target which is necessary in order meet Australia's international commitments and the global target of zero net global emissions by the second half of the century[2].

It is the opinion of ACF that any decisions relating to structure and design of the NEM must be framed by the longer-term goal of achieving net zero emissions in the electricity sector to enable net zero emissions from the entire energy sector well before 2050. Australia has made commitments internationally to pursue a 1.5 degree limit on global warming and to be part of a process to ratchet up Australia's 2030 pollution reduction target through 5 yearly reviews. Policy decisions and market design must be informed by that commitment and ultimately the need to achieve zero emissions in the energy sector. Similarly, the national electricity objective (NEO) needs to be revised to reflect the third strand of the energy trilemma, reducing carbon emissions. Failing to do so will continue to create a bias towards pricing and security rather than a balanced approach.

Modelling by the Institute of Sustainable Futures (ISF) at UTS has concluded that net zero emissions by 2035 is an achievable, appropriate and necessary target for the electricity sector. Furthermore, we note that this is achievable without jeopardising energy security or substantially increasing energy prices.

Modelling by the Institute of Sustainable Futures has also verified that a transition to 100 per cent renewable energy within one generation is technically feasible and economically responsible.[3] Similarly the AEMO itself has confirmed that the National Electricity Market can operate with 100 per cent renewable energy while meeting the current National Electricity Market reliability requirement.[4] In other words, 100 per cent renewable energy can meet the energy needs of the NEM 99.998 per cent of the time.

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[1] Climate Change Authority, Towards a Climate Policy Toolkit: Special Review on Australia's Goals and Policies, August 2016, p.7

[2] Climate Change Authority, Towards a Climate Policy Toolkit: Special Review on Australia's Goals and Policies, August 2016, p.21

[3] The Climate Institute, A Switch in Time: Enabling the electricity sector's transition to net zero emissions, April 2016

[4] Australian Energy Market Operation 2013, 100 per cent Renewable Study: Modelling Outcomes, July 2013

There are several publications indicating the feasibility of transitioning to 100% renewable energy (and roadmaps to do so) that we would like to draw your attention to:

- Energy Networks Australia and CSIRO's Electricity Network Transformation Roadmap contains a comprehensive roadmap to 100% renewable energy by 2050
- GetUp And Solar Citizens' Homegrown Power Plan.
- Beyond Zero Emissions and Melbourne Energy Institute's Zero Carbon Australia Stationary Energy Plan.

These publications along with the anecdotal experience of countries aiming for high levels of renewable energy suggest that a zero-emissions generation sector, providing affordable and reliable energy, is technically feasible as the costs of renewable energy and storage technology continues to fall, though it is not necessarily easy and the need for specific policy interventions and market design is clear. The main barriers have been and are likely to be political rather than technical or financial.

In summary, we recommend the adoption of a target for Australia's electricity sector to achieve zero net greenhouse emissions by 2035 and for the NEO to be amended to include a clear decarbonisation objective that supports a transition to renewable energy and more flexible, dispatchable clean energy sources.

3.2 What is the role for natural gas in reducing greenhouse gas emissions in the electricity sector?

Gas is currently playing a short-term role in smoothing over intermittency of renewable energy supply. However, the role of gas must be framed by the need to achieve zero emissions by 2040-2050. Without this goal as a frame there is a danger that gas will receive a disproportionate level of investment, potentially leading to a "lock-in" which would a) cause Australia to fall short of its commitments and; b) reduce investment in storage technologies which have the potential to be cheaper than gas in the long-run, while being consistent with Australia's international commitments. Given that the design life of many plants would be 25 years or more, new gas facilities would end up as stranded assets.

Furthermore, it is difficult to see how the extensive use of peaking or baseload gas is consistent with the goal of providing universal access given the documented impact on electricity prices in South Australia[5], though some sources were quick to blame renewables. This theory is supported by the recent price spikes in Queensland (where renewable energy only constitutes 4.4% of the supply) on 13th January of this year. Prices in Queensland climbed as high as $13,800 a MWh[6], far higher than the spikes of $9,000 a MWh seen in South Australia in July 2016. This spike was most likely to have been caused by peaking gas[7]. Though it has been suggested that gas prices may be lowered by increasing supply, it is

[5] The Conversation, South Australia's electricity price woes are more due to gas than wind, July 2016
[6] AER, Wholesale electricity price spikes during Queensland summer triggers regulator report, January 2017
[7] ReNew Economy, Jumping Electricity Prices - It's a gas, gas, gas, January 2017

likely this would still represent an increased expense relative to renewables with storage in the long-term. There is also good cause to doubt whether increased gas supply will substantially affect the price of gas given the current LNG export market, and the connection of Australia's gas prices to the world oil price.

There is research that pumped hydro is already a financially feasible alternative to peaking gas, able to meet peaking demand on the NEM while fulfilling a broader role. ACF would like to refer you to the article by Dylan McConnell of the Melbourne Energy Institute, relating to peer-reviewed academic research on this matter[8].

Similarly, though solar thermal is often considered too expensive, recent research indicates large declines in the LCOE relative to gas. As of December 2016, Lazard's LCOE analysis shows that the unsubsidised LCOE of solar thermal with storage is as low as $119-182/MW(USD). This is compared to peaking gas which has a global LCOE of $165-217/MW (USD).[9] This is confirmed by a report by the Melbourne Energy Institute which, using higher cost assumption data than that used by Lazard, shows that the Levelised Cost of Capacity (LCOC) of solar thermal can be competitive with OCGT in Australia.[10] In addition to being as cheap as if not cheaper than OCGT, it has several advantages over gas and even batteries:

- Solar Reserve's Crescent dunes CSP is proven to be able to operate as a 'baseload' plant at Crescent Dunes in Nevada as it operated as such for three months, even though it is more frequently used for peaking supply.[11] Solar Reserve has proposed a 110 MW solar thermal plant in Port Augusta, as the potential first of six in Australia.
- CSP adds significant new generation to the grid (unlike batteries), making it competitive with gas generators at high and low prices, suppressing wholesale prices.
- Unlike batteries and pumped hydro, it does not require an initial investment of energy from the grid (which is likely to have come from fossil fuel sources given the current mix). This means it is more effective at reducing emissions.
- In terms of storage, solar thermal is cheaper than existing utility scale battery technology.[12]
- CSP provides synchronous generation and black start capability and so has the potential to make a considerable contribution to grid security.

In terms of location the research currently undertaken by ANU and ARENA should produce critical data for potential pumped hydro sites to support demand around the NEM.[13] In

[8] The Conversation, Storage can replace gas in our electricity networks and boost renewables, October 2015
[9] Lazard, Lazard's Levelised Cost of Electricity Analysis: Version 10.0, December 2016
[10] Melbourne Energy Institute, Winds of change An analysis of recent changes in the South Australian electricity market, August 2016, p.40
[11] ReNew Economy, SolarReserve aims to build 6 solar tower power plants in South Australia, September 2016
[12] Melbourne Energy Institute, Winds of change An analysis of recent changes in the South Australian electricity market, August 2016, p.40
[13] ARENA, Old dog, new tricks: the oldest form of clean energy could be key to increasing

terms of solar thermal there are an extensive number of proposals around Australia. BZE's comprehensive plan also has the details of 12 key sites that were identified as being able to supply a large share of Australia's energy needs as well as sufficient storage to ensure consistency of supply.[14]

In summary ACF believes that the role of gas in reducing emissions is limited by the fact that it is inconsistent with long-term pollution reduction and short-term affordability goals. The focus instead should be on storage including pumped hydro and solar thermal, which are already competitive with OCGT peaking gas supply, while offering several significant advantages in terms of affordability and security.

3.3 What are the barriers to investment in the electricity sector?

Currently the key barrier to investment in the electricity sector is uncertainty created through policy instability and years of toxic debate in relation to energy. Numerous commentators and analysts have noted and tracked the severe impacts that divisive debate around the RET has had on renewable energy investment in Australia[15][16][17]. This is while the government has publicly supported fossil-fuel generation sources such as ultra-supercritical (aka "clean") coal, which many analysts have described as "uninvestable" due to their capital costs, emission levels and 30 to 40-year design life that is intrinsically incompatible with Australia's international climate commitments[18].

Lack of a clear consistent bipartisan climate policy is a major barrier to investment in the electricity sector and one that needs to be addressed urgently to mitigate against eroded energy security, inflating prices and insufficient carbon mitigation. Stable, credible, predictable policy informed by a long-term target would have the opposite effect.

3.4 What are the key elements of an emissions reduction policy to support investor confidence and a transition to a low emissions system?

Certainty is required and this can be achieved through a range of different policy options, but they must be stable, predictable and credible. As noted, a long-term emission reduction target is crucial if investors are going to be able to make informed decisions confidently. A 2030 target is useful as an interim target, but insufficient as it only provides certainty for 15 years when investment decisions relate to technology that span two decades at the very least.

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renewables in our national grid, November 2016

[14] BZE, Zero Carbon Australia Stationary Energy Plan, June 2010, p.46

[15] Sydney Morning Herald, Confidence in renewable energy sector 'evaporated' after Abbott cut: Bloomberg, January 2016

[16] Ernst & Young, Renewable Energy Country Attractiveness Index, May 2016, p.17

[17] Clean Energy Council, Clean Energy Australia Report 2014, 2015, p.15

[18] Sydney Morning Herald, 'Clean coal' would push up power bills more than wind, solar or gas: analysts, February 2017

A clear, stable and predictable policy pathway to 100 per cent renewable energy (i.e., achieving net zero emissions in the electricity generation sector) will create a favourable environment for those technologies we know will support such a target.

The following policies would help ensure that Australia is able to harvest the opportunities from clean energy.

Commit to an expanded and flexible RET of 100% out to 2035

An expanded RET would continue to play an important role supporting a suite of technologies, by providing a long-term goal that signals to investors the pathway of renewable energy growth.

Introduce national renewable energy capacity auctions within the expanded RET

To ensure there is a secure mix of different technologies to meet Australia's energy needs, additional measures may be needed to complement the least cost approach of the RET. Auctions can be used to support the build of specific technologies in specific geographies to ensure the integrity of the grid.

Maintain and strengthen ARENA and the CEFC

ARENA and the CEFC have played an essential role in facilitating the development and commercialisation of renewable energy projects in Australia.

The CEFC mandate could be expanded to be more innovative and support a range of other projects like community renewables, roll out of electric vehicle (EV) infrastructure and other technologies.

Kickstart community power

Resource community efforts to build clean renewable energy in towns and suburbs across Australia. While community power projects would be eligible for RECs, upfront capital costs are usually the biggest barrier. Government could help drive the growth in community renewables by establishing a community project registry, provide free project advice, information about finance options including CEFC support, green bonds or government provided tax incentives.

Household and business uptake

According to the Electricity Supply Association of Australia, Australia has the highest rate of household solar panel installation in the world, with over 15 per cent of Australian homes having solar on their roofs. Yet the space for growth in this market and in the SME market remains significant, delivering households and businesses savings and job growth opportunities in towns and suburbs across the country.

- Set a target for the number of solar PV rooftops to drive greater investment certainty

- Continue the Small Scale RET Scheme (SRES)
- Install solar PV on all new and existing public housing stock

Build up Batteries

- Establish a mechanism to reward distributed generators (households and businesses) for the full value of distributed electricity exported to the grid. This would include smart integration of distributed generation, storage and centralised generation as well as smart network connected appliances and electric vehicles19.
- Ensure the development of minimum standards for new battery storage technologies.
- Introduce standards to require new government buildings to include minimum requirements for battery storage capacity.
- Support consumer awareness campaigns which guide consumers on the available technologies, appropriate installation and ongoing operation of battery systems.[20]

Exit of coal-generators

Multiple policy options exist for government to drive successful, planned and well-managed retirement of coal-fired generators. These include;

a) **A market mechanism for regulated closure** of highly emissions intensive power stations, such as that proposed by Jotzo and Mazouz (2015)[21].
b) **Introduction of an emissions intensity standard** for power stations that tightens over time, ensuring the dirtiest coal-burning power stations are closed first.
c) **Introduction of an aged-based regulation** that tightens over time and ensures the oldest (and therefore largely least-efficient) power stations are closed first.
d) Other similar proposals or combinations of the above.

Policy proposals including the Jotzo and Mazouz (2015)[1] model are important 'first mover' options insofar as they will likely perform best in incentivising the shutting down of the initial one or two generators. However, supporting regulation will be needed to facilitate the closure of the many other coal-fired generators. Regulatory measures could include tightening emissions standards or mandated closure ages. Working in tandem, these policy instruments can ensure the most competitive bidding process in the initial offer to shut-down, while also signalling to other operators who stay in the market that they will eventually be phased-out over a certain time period. Such policy proposals could also be used to raise funds for worker and community transition plans.

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[19] Clean Energy Council, 2016. *Accelerating the uptake of Battery Storage.* https://www.cleanenergycouncil.org.au/news/2016/March/battery-storage-blueprint-accelerating-uptake.html

[20] Ibid.

[21] Jotzo, F and Mazouz, S. Nov 2015. *Brown coal exit: a market mechanism for regulated closure of highly emissions intensive power stations,* available here and at https://ccep.crawford.anu.edu.au/sites/default/files/publication/ccep_crawford_anu_edu_au/2015-11/ccep1510_0.pdf.

ACF recommends development of a plan for the phased closure of Australia's dirty power stations, which includes an initial target for retirement by 2020[22], and full retirement of all other coal-burning power stations before 2035.

Again, a key issue is policy certainty and predictability. As noted above the policy instability created by the partisanship continues to erode investor confidence. One of the few themes consistently identified in submissions to the Queensland Renewable Energy Expert Panel (regardless of whether submitters were supportive or sceptical of renewable energy) was the need for policy stability[23]. The frustration over policy instability has recently culminated in a coalition of industry and business groups, environmental organisations and unions to call for a stable bipartisan energy policy, identifying its absence a threat to reliable energy supply.[24] ACF is part of this coalition, which has been able to find important common ground on a range of climate policy principles including the need for credible, durable policy.

3.5 What is the role for low emissions coal technologies, such as ultra-supercritical combustion?

USC

Ultra-supercritical coal has no credible place in the future energy market as it comprehensively fails to address any of the three strands of the energy trilemma identified. It provides neither affordability or reliability while being insufficient to meet carbon reduction objectives. The following analysis and commentary in relation to this technology clearly substantiates these points:

Emissions reduction:

- "Clean" coal power stations still emit 60% (at best) of the carbon of a regular coal-fired generator. That equates to 700 grams of CO_2 per kWh[25], more even than gas at 400 grams and far more than the 15 grams OECD countries need to reach if we are to avoid exceeding 2 degrees of warming.[26]
- Tristan Edis, director of Green Energy Markets, produces analysis that shows that the figure of 700 grams/kWh is higher than the projected baseline emissions intensity of the electricity sector in 2022. Given the timeframe for financing and building an

[22] ACF have calculated that government should adopt a target to retire a further 4000MW of coal generation by 2020. In 2014, the Australian Energy Market Operator (AEMO) identified 9,000MWs of oversupply in the energy market. Approximately 4,000–5,000MW of capacity has already closed, committed to close or mothballed. This 4,000MW closure target would see the remainder of this oversupply closed by 2020.

[23] Articulous Communications, Report on Public Engagement Phase 1: Renewable Energy Study Expert Panel, August 2016, p.22

[24] ABC, Industry, environment, community groups demand bipartisan energy policy, February 2017

[25] The Guardian, Australia's coal power plan twice as costly as renewables route, report finds, Jan 2017

[26] IEA, Re-powering Markets, 2016, p.11

ultra-supercritical generator, by the time they come online they are likely to increase emissions intensity.[27]

- Research by the University of Queensland indicates that coal-fired generators currently make up 29% of Australia's current emissions. Replacing the entire coal fleet with ultra-supercritical or advanced ultra-supercritical (which won't be for years as it needs to be tested and trialled) is impractical as it:
    - Would only reduce the emissions of coal-fired generation by 16 per cent and 25 per cent respectively, equivalent to 5.5% to 7.7% of total emissions.[28]
    - Makes it inevitable that the stations would have to close before the end of their 40-60 year lifespan, if Australia were to meet international commitments.[29]

Affordability:

One 1,000 MW station costs 900 million euros in China, a price which will be much higher in Australia where new builds are much more expensive.[3031]

- A report published by CSIRO and other leading energy agencies estimates that plants using this technology would cost $3100 a kW to build meaning that a plant of a 1000 MW would cost as much as $3.1 billion.[32]
- Akihiko Kazuno who is the head of global strategic planning for Mitsubishi Hitachi Power Systems, a company which builds ultra-supercritical power stations, has said that the costs outlined by CSIRO are probably under-estimated. He puts the figure at closer to $4.6 billion for a 1000 MW and confirms that the carbon reduction is marginal, still producing 700-750 Kg/MWh.[33]
- Research by Dylan McConnell of the Melbourne Energy Institute indicates that it would cost up to $62 billion to build enough ultra-supercritical coal plants to achieve the 27% reduction in carbon emissions in the electricity sector cited by Senator Matt Canavan. This is twice as much as it would cost to build enough wind and solar to achieve the same reduction (costed at $24-34 billion).[34]
- When fuel cost is factored in the cost of energy from the most efficient current coal plants would be from $134-$203 MWh over the course of its lifetime according to research by Bloomberg[35], much higher than wind ($61-118) or solar ($78-140) and

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[27] The Guardian, Government 'clean coal' push would be likely to make Australia's emissions worse, February 2017
[28] The Conversation, Is 'clean coal' power the answer to Australia's emissions targets?, Jan 2017
[29] ReNew Economy, New coal plants wouldn't be clean, and would cost taxpayers billions, February 2017
[30] Power-Technology.com, Yuhuan 1,000MW Ultra-Supercritical Pressure Boilers, China
[31] Energy Source and Distribution, Power costs will keep hurting business: Ai Group, October 2016
[32] CO2CRC, Australian Power Generation technology report, November 2015, p.120
[33] Australian Financial Review, 'Clean coal': billions of dollars and lots of carbon, February 2017
[34] The Guardian, Australia's coal power plan twice as costly as renewables route, report finds, Jan 2017
[35] Sydney Morning Herald, 'Clean coal' would push up power bills more than wind, solar or gas: analysts, February 2017

approximately double the current wholesale price of electricity[36]. The cost of new build coal could fall to $94, but only if fully subsidised by taxpayers or if government offered guarantees to investors against future carbon policies. To do so would cost approximately $27-45 billion over 30 years for a power station the size of Hazelwood, a cost that would inevitably be incurred as emission targets increase.[37]

- By the time these plants would be built, the cost of renewables is likely to be very much cheaper by comparison in Australia. Projections see wind and solar falling to prices as low as $50 per MWh by 2025.[38]

Security

- The Queensland Renewable Energy Expert Panel recognised that coal power struggles to compete with renewable energy on the market. Renewable energy consistently erodes market-share by putting downwards pressure on wholesale prices. Simultaneously coal is ill-positioned to take advantage of troughs in the supply of renewable energy as it takes too long to fire up and it is relatively expensive to do so. This indicates that coal is fundamentally unable to co-exist with a high level of renewable energy generation[39].
- This conclusion is supported by Tennant Reed of the Australian Industry Group, who points out that the market is likely to be increasingly hostile to such inflexible forms of generation. If these new power plants are forced to operate below capacity, then their LCOE will only climb making them even less competitive on the market.[40]

<u>CCS</u>

Though CCS does produce much more significant reductions in carbon emissions than ultra-supercritical there are several reasons to be sceptical of its potential role.

Firstly, as the CO2CRC and CSIRO point out, CCS technology is "not very mature" currently.[41] Globally there are only three large-scale CCS plants in operation globally, none of which are viable commercially.[42] Given this fact it is hardly surprising that Australia has, according to Prime Minister Turnbull, "*invested $590 million since 2009 in clean-coal technology research and demonstration, and yet we do not have one modern High Efficiency Low Emissions (HELE), coal-fired power station, let alone one with CCS (carbon capture and storage)*".[43] Given the

[36] ABC, Electricity prices could double with new coal-fired stations, energy experts say, February 2017
[37] Sydney Morning Herald, 'Clean coal' would push up power bills more than wind, solar or gas: analysts, February 2017
[38] ReNew Economy, New coal plants wouldn't be clean, and would cost taxpayers billions, February 2017
[39] Queensland Renewable Energy Expert Panel, Issues Paper, May 2016
[40] The Guardian, No, new coal is not feasible: on price, reliability or emissions, January 2017
[41] CO2CRC, Australian Power Generation Technology Report, November 2015, p.IV
[42] Australian Financial Review, 'Clean coal' not profitable enough costly for CEFC mandate, February 2017
[43] Sydney Morning Herald, Coal could get clean-energy subsidy under new Turnbull focus, February 2017

relatively low amount of CCS installed globally this is hardly surprising.

The immaturity of CCS technology relative to mature renewable technology like wind and solar makes it a risky and unnecessary investment, especially when suggested to prolong the life of coal or fossil fuel generation. CCS technology has a severe impact on the levelised cost of electricity (nearly doubling the LCOE of coal and increasing that of gas by 50%, even by 2030)[44]. A 1000 MW ultra-supercritical plant with using the technology is anticipated to cost as much as $7-8.5 billion, while retrofitting a black coal plant with CCS is anticipated to cost as much as $5 billion.[45] The risk is that such high costs will jeopardise universal access through prohibitive energy prices. Meanwhile wind and solar are relatively much cheaper and set to become even more so over the next 15 years. As such CCS is unlikely to be able to satisfy the need to provide affordable electricity.

It is also unlikely to resolve security issues as it does little to resolve the fact that coal struggles to compete on an increasingly renewable market and does not increase the flexibility of coal-fired generation, which is a critical issue.

Finally, though the carbon emissions reductions are impressive relative to ultra-supercritical, they are still much higher than renewables. As a result they are incompatible with any attempt to achieve net zero emissions.

In summary, there is no role for USC with CCS as both fail to address any of the elements of the trilemma sufficiently. They are inconsistent with zero emissions, expensive and ill-suited to resolving the intermittency of renewables.

4.1 What immediate actions could be taken to reduce the emerging risks around grid security and reliability with respect to frequency control, reduced system strength, or distributed energy resources?

Improved meteorological forecasting, or response to the forecasting already available, will be critical. Anticipating supply is essential for managing any potential intermittency and mitigating against both price spikes and blackouts.

As acknowledged in the AEMO preliminary report into the South Australian blackout, inappropriate fault ride-through settings on the wind generators were a key factor in the drop in demand an issue that has been known and resolved elsewhere in the last 10 years. The AEMO has recently confirmed that these settings have been adjusted and would have been sufficient to prevent the state-wide blackout.[46] A key recommendation is to ensure that these settings are rolled out to wind farms across Australia.

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[44] CO2CRC, Australian Power Generation Technology Report, November 2015, p.V

[45] Australian Financial Review, 'Clean coal' not profitable enough costly for CEFC mandate, February 2017

[46] ReNew Economy, AEMO says wind farm changes mean SA blackout won't be repeated, February 2017

A second is to ensure that best practices from other countries are implemented, especially when they relate to relatively simple solutions such as settings adjustments which can be implemented at low cost. Worryingly the AEMO alluded to the settings as having been opaque to them historically and related to software downloaded by the manufacturers.[47] Transparency and active management of these settings by the AEMO must be another recommendation. The automatic download of software influencing the management of critical infrastructure without the oversight of a government body represents a risk to national security, not just grid security.

4.2 Should the level of variable renewable electricity generation be curtailed in each region until new measures to ensure grid security are implemented?

Curtailing the level of renewable energy available in each region would be an ill-advised and retrograde step that would indubitably jeopardise energy security for several reasons:

- Removing a significant level of capacity from the NEM is likely to cause price spikes because of reduced competition.
- Furthermore removing supply is likely to exacerbate problems with supply shortages such as those seen across Australia in the recent heatwave, which lead to another partial blackout in South Australia.[48] This increases the grid's vulnerability to the unanticipated withdrawal of supply or unavailability of generators.
- Curtailing the use of renewables is likely to decrease investor confidence yet further. Stunting investment in renewables will drive prices up in the long-term by reducing competition on the NEM.
- Such an action reinforces the incorrect view that renewable energy generation is intrinsically a threat to grid security. As highlighted by the relative grid security of countries mentioned in the appendix to your draft report (e.g. Denmark), this is fundamentally not true. Your report notes that any grid security associated with the introduction of renewables can be managed using the best practice and lessons learned by countries that have managed to traverse these issues successfully. Using this approach is more likely to deliver grid security.
- Curtailing the use of renewables will also curtail the diversity of generation sources which is likely to compromise rather than reinforce the security of the grid. ACF would draw your attention to the example of Texas. There a high level of wind penetration was critical to keeping the lights on and supplying neighbouring states with energy during the polar vortex of 2014.[49]
- Importantly, curtailing renewable energy generation will drive up Australia's carbon emissions. This is problematic as emissions must be reduced rapidly due to climate change and Australia's international commitments. Currently they are increasing

[47] ReNew Economy, AEMO says wind farm changes mean SA blackout won't be repeated, February 2017

[48] ABC, SA heatwave forces blackouts to cope with electricity demand, angering Government, February 2016

[49] American Wind Energy Association, Wind energy saves consumers money during the polar vortex, January 2015

rather than reducing.[50] Analysis by Reputex suggests that Australia's current policy trajectory is already set to see an increase on 2005 carbon emissions by 2030, rather than the reduction of 26-28% committed to at Paris. [51]

Curtailing renewable energy would jeopardise our carbon mitigation targets, push up energy prices while doing little to contribute to grid security. Indeed, it may jeopardise it. It would be addressing symptoms rather than treating the underlying disease of inflexible policy and market design in the face of inevitable change.

6.2 What are the alternatives to building network infrastructure to service peak demand?

The International Energy Agency (IEA) has identified energy efficiency as a critical "fuel" in the transition to a low-carbon economy. Its analysis has shown that over one-third of emissions reductions needed to reach climate goals by 2040 must come from energy efficiency policies.[52]

The Energy Efficiency Council has found that "improving energy efficiency by just one per cent a year will grow Australia's economy by $26 billion by 2030. Further, the global market for smart energy products and services is worth more than $470 billion per annum and growing. If Australia captured just one per cent of the global market it would deliver $4.7 billion in income every year and create thousands of jobs."[53] The Australian Alliance for Energy Productivity (A2EP) – an independent, not-for-profit coalition of business, government and environmental leaders promoting energy efficiency, energy productivity and decentralised energy – is currently developing an energy productivity roadmap to achieve a doubling of Australia's energy productivity. They have determined that a commitment to doubling energy productivity would lead to investment of $100 billion over 15 years, a 2.8 per cent increase in real GDP, a $30 billion reduction in energy spend in 2030, and a 25 per cent reduction in greenhouse gas emissions.[54] As such there is a strong economic case for exploring demand management and energy efficiency options in this review. Such options are likely to enhance grid security too. The recent issues during the heatwave across Australia could have mitigated the need for any load-shedding by encouraging consumers to manage their own demands on the system.

To take advantage of the opportunities and security energy efficiency and productivity afford, the NEM must be restructure in a way that rewards the more efficient use of energy. A critical first step would be to adopt an ambitious target relating to efficiency. We would suggest a target to double Australia's energy productivity by 2030 and develop an energy

[50] Department of Environment and Energy, Quarterly Update of Australia's National Greenhouse Gas Inventory: June 2016, p.3
[51] Reputex, Framing Australia's 2030 Energy and Climate Policy Mix, September 2016, p.4
[52] International Energy Agency, Energy efficiency gains ground despite lower energy prices, October 2016
[53] Energy Efficiency Council, Australian Energy Efficiency Policy Handbook, July 2016
[54] Australian Alliance for Energy Productivity at http://www.a2se.org.au/

efficiency roadmap to achieve this goal.

Setting such an objective will again help frame market design. The current tariff pricing structure is inadequate and does not reward efficiency and productivity behaviours. There was a push to this end in the 1990s with efficiency and demand management being explored as a key pathway explored by the National Grid Management Council (NGMC) producing *Demand Management Opportunities in the Competitive Electricity Market*, aka "the yellow report".[55] The recommendations of that report never came to fruition due to the rapid move to privatisation in many states, a move which made the reduction and management of demand less appealing than building new generation capacity to service ever-growing demand .[56]

However now there is the opportunity to remedy this by reforming electricity tariffs to reflect the true costs of providing electricity and generate appropriate signals for business and household use of electricity. As outlined in the Leadership Forum on Energy Transition's plan, doing so will give "people and businesses incentives to adopt clean and smart technologies, while ensuring the transition is as smooth as possible, especially for vulnerable people.".[57] A focus only on technical solutions will miss the crucial behavioural solutions to the energy trilemma this review is looking to resolve.

7.1 Is there a need for greater whole-of-system advice and planning in Australia's energy markets?

The current design of the NEM is ill-equipped to facilitate the deployment or integration of new technologies such as large-scale or distributed renewables, or to support energy efficiency. The current operation of the NEM is also acting as a barrier to the adoption of modern, clean technology sources. The legislated objectives of the NEM require review and reform to properly facilitate the energy transition needed in Australia.

This NEM review should align current rules, regulations, laws, institutions (AEMO, AEMC, COAG Energy Council) and market structures with a new set of objectives around a clean energy transformation. Issues related to market design such as demand management incentives, storage, role of networks in the transition to a clean energy system, grid access guarantees, local energy trading as well as low-income friendly tariffs and pricing need to be addressed.

A second recommendation relates to the expertise deployed in system advice and planning. The original NEM design was constructed with input from engineers with a specific

[55] National Grid Management Council (NGMC) 1994, "Demand Management Opportunities in the Competitive Electricity Market: Discussion Paper", Canberra: National Grid Management Council
[56] Chandrashekeran, S. 2016, "Multidimensionality and the multilevel perspective: Territory, scale, andnetworks in a failed demand-side energy transition in Australia", Environment and Planning A, 0(0), pp.1-21
[57] Leadership Forum on Energy Transition, Our energy future: A plan to transition Australia to clean energy, November 2016, p.18

knowledge of the technologies available at the time. This engineering knowledge is again needed to help modernise the system and allow the integration of technologies in a way that maintains reliability and affordability of supply.

Furthermore, the system should be able to incorporate future technological developments. To this end it should be open to a regular process of review and able to accommodate changes when needed.

National Clean Energy Transition Plan

It is essential that climate and energy planning and policy are truly integrated and supported by a strong national clean energy transition plan.

Therefore, our final recommendation is that any reform of the NEM must be part of a comprehensive national plan to transition the energy sector to clean renewable energy including a plan for the phased closure of Australia's dirty coal-burning power stations; a plan that ensures just transitions for impacted workers and communities; a 100 per cent renewable energy target, strategy and policy pathway that ensures complementary technologies such as storage technologies and smart energy management technologies enter the system alongside renewable energy and demand management solutions; and a national energy efficiency strategy.