28 April 2017

AUSTRALIAN CONSERVATION FOUNDATION

ACF Submission: Inquiry into modernising Australia's electricity grid

The Australian Conservation Foundation (ACF) welcomes the opportunity to submit to the Standing Committee on the Environment and Energy's Inquiry into modernising Australia's electricity grid.

Key recommendations:

- Truly integrate climate change and energy planning and policy to support modernisation of the electricity grid.
- Transitioning to 100% renewable energy must be set as the goal driving grid modernisation.
- Develop a national clean energy transition plan and establish a single body charged with managing the overall transition to ensure that it is well-planned, nationally coordinated, rapid, equitable and efficient.
- Ensure the transition, including grid modernisation is supported by National Electricity Market reform.
- Increase the speed of regulatory decision-making to effect change.
- Establish policy mechanisms to incentivise renewable (variable/dispatchable) energy solutions and increase access to markets and the grid.
- Ensure energy storage and physical grid infrastructure reviews are conducted urgently to inform a national clean energy transition plan.
- Increase access for decentralised, renewable (variable/dispatchable) energy solutions to markets and the grid and ensure that decentralised energy solutions are considered on a level playing field with poles and wires in network pricing and planning processes.
- Pursue much greater energy efficiency as a key alternative to building network infrastructure to service peak demand.
- Plan for substantial transformation of existing networks including: to allow bi-directional flow of energy; establish efficient electricity-demand and grid management mechanisms aimed at reducing peak loads, improving grid flexibility, responsiveness and security of supply; improve interconnection; introduce technologies and procedures to ensure proper grid operation stability and control; and introduce energy storage capacity to store electricity from renewable sources when power supply exceeds demand. [1]

[1] IRENA, Renewable Energy Integration in Power Grids, Technology Brief, April 2015 available here: http://www.irena.org/DocumentDownloads/Publications/IRENA-ETSAP_Tech_Brief_Power_Grid_Integration_2015.pdf

Background

To meet current and future greenhouse pollution targets under the Paris Agreement, the electricity sector will be critical for achieving large-scale emissions reductions to 2030, and beyond, as Australia transitions to net-zero emissions. This must occur well before mid-century to meet Australia's Paris commitment to "holding the increase in the global average temperature to well below 2 degrees C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 degrees C."

The transformation from centralised coal and gas to a diversified, more decentralised, clean energy system is inevitable, necessary and has already started, but it is not happening quickly enough to meet our climate change commitments. Further, it is lacking an overall national plan and effective, durable policy to enable the transition to be equitable, well-managed, predictable and coordinated so as to be as smooth and efficient as possible while also reducing impacts on workers and vulnerable households. Finally, the changes that are occurring are not being rolled out through a fit for purpose national electricity market or a modern grid that is capable of handling the shift to flexible, decentralised renewable energy sources. This inquiry is a welcome opportunity to clearly identify the future needs of Australia's electricity grid, to identify a pathway to modernise the grid so it can meet these needs and to integrate this thinking into developing a national clean energy transformation plan with appropriate policy and reforms. As such, the conclusions of this inquiry should inform the Finkel Energy Security Review, the Government's Climate Policy Review and National Electricity Market (NEM) reviews being undertaken by AEMO and AEMC.

Climate and energy planning and policy must be truly integrated

Integration of climate and energy policy and planning is critically important to inform the way the NEM and Australia's physical transmission and distribution infrastructure are reformed to enable a smooth, efficient, and predictable energy transition that maximises all three elements of Australia's energy trilemma: energy security and reliability, affordability and greenhouse pollution reduction.

Australia's energy sector is reaching a crisis point due to national climate and energy policy paralysis that has resulted from a long-running, divisive political debate. The resulting policy uncertainty is holding up modernisation of our electricity system, including necessary updates to the way Australia's electricity is transmitted and distributed. It is also stalling needed investment in the electricity sector.

Grid modernisation is critical to Australia's energy transition and must be fully connected to Australia's long-term greenhouse pollution reduction commitments. This means planning for a grid that operates effectively and efficiently as part of a system based on 100% renewable energy, which will be needed to achieve our zero pollution commitment.

The transition to renewable energy is unstoppable

While this inquiry is not focused on energy generation, the changing nature of our electricity generation is relevant to the needs of our current and future grid. Equally important is recognition that addressing climate change and meeting Australia's commitments under the Paris Agreement will require a transition to net zero greenhouse pollution well before mid-century and that requires a transition to 100% renewable electricity before 2035 to enable other energy-dependent sectors such as transport and industrial processes to transition through electrification and fuel switching well before 2050.

A transition has already begun, but lacks a national clean energy transition plan, or roadmap, to manage the overall transformation including the growth of renewable energy and complementary technologies, the managed retirement of coal-fired generators, modernisation of the physical grid, and reform of the NEM.

The Clean Energy Council (CEC) recently noted that Australia is adding more solar power every year than the combined capacity of South Australia's recently closed Northern and Playford coal-fired power stations. CEC also noted that the wind and solar projects that will go to construction this year add up to more than $5.6 billion of investment in more than 2500 MW of new power capacity. Renewable energy currently represents the biggest program of works since the end of the Snowy hydro scheme more than 50 years ago.[2] With the Renewable Energy Target Scheme coming to an end in 2020, policies are needed to maintain this growth, and to work alongside plans to modernise the grid.

Further, our fossil fuel generation is dirty and getting old. Three-quarters of Australia's fossil fuel generators are passed their design life and in need of replacement. Closures of coal generators are already happening including 10 closures since 2012 with the latest being Hazelwood. That means investment in new energy supply will need to occur as a result of these closures, as well as to address our greenhouse pollution. Renewable energy is well-placed as the investment of choice both because it is clean and because it is now cheaper than fossil fuels.

Recently released analysis by Bloomberg New Energy Finance compares costs for new supply, which is relevant to the question of replacing generators that are closing with new sources of supply, and hence has implications for modernising the grid. It showed new wind and solar are already much cheaper than any form of new coal. In fact, solar costs are now so low that large, industrial scale solar plants are providing cheaper power than new fossil fuel or nuclear power.

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[2] Clean Energy Council, Coal hard facts missing in latest energy brawl, 7 March, 2017, available here: https://www.cleanenergycouncil.org.au/news/2017/March/clean-coal-kane-thornton-afr-facts-missing.html

RepuTex has also released analysis with similar findings showing renewable energy technologies constitute the cheapest form of investment in new energy in Australia, with wind and solar cheaper than new fossil fuel generation sources such as gas and coal.

Particularly notable is further RepuTex analysis of the 'full cost' of various power supplies on a like for like basis by calculating the levelised cost of firm power (LCOFP). This takes into account the cost of supplying flexible, instantaneous power across all technologies. For renewable energy this means the cost was adjusted to include storage and provide the requirements of firm power.[3]

RepuTex concluded that new renewables with energy storage are now competitive with new gas in providing flexible generation services. This is because of recent declines in capital costs of both wind and solar, coupled with rises in electricity and gas prices, is resulting in a rebalancing of the least-cost technologies.

At the household level, increasing electricity prices and concerns about energy insecurity are driving more households to invest in solar PV and battery storage. As of April 2017, there were over 1.66 million PV installations in Australia, with a combined capacity of over 5.92 gigawatts[4]. With so many households already powered by solar PV and uptake increasing, the importance of distributed energy to grid modernisation cannot be overlooked. As solar PV uptake soars in Australia, batteries are also on the rise. The number of storage units across Australia is projected to be greater than 21,000 in 2017, up from 6750 in 2016.[5]

A future powered by 100% renewable energy must be the goal driving modernisation of the electricity grid

The electricity grid is an extremely expensive network. Modernising the grid is therefore not a task that should be done with short-term goals in mind. It should be modernised based on a long-term vision—at least a vision that takes Australia to 100% renewable energy well before mid-century.

CSIRO and Energy Networks Australia published an *Electricity Network Transformation Roadmap* in December 2016, which predicts that:

> *Wind and solar will provide nearly all generation by 2050, with a significant amount – between one-third and one-half – coming from the nation's rooftops. Battery storage in homes and*

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[3] RepuTex, A cost curve for abatement & energy storage in the Australian power sector, 8 March 2017, available here: **http://www.reputex.com/research-insights/a-cost-curve-for-emissions-reductions-energy-storage-in-the-australian-power-sector/**

[4] Australian PV Institute, http://pv-map.apvi.org.au/analyses

[5] Australian Solar Council, Solar Uptake Soars, available here: https://www.solar.org.au/industry-news/solar-uptake-soars/

business, and located on the grid, or at renewable energy installations, will balance the output and provide most network stability services.

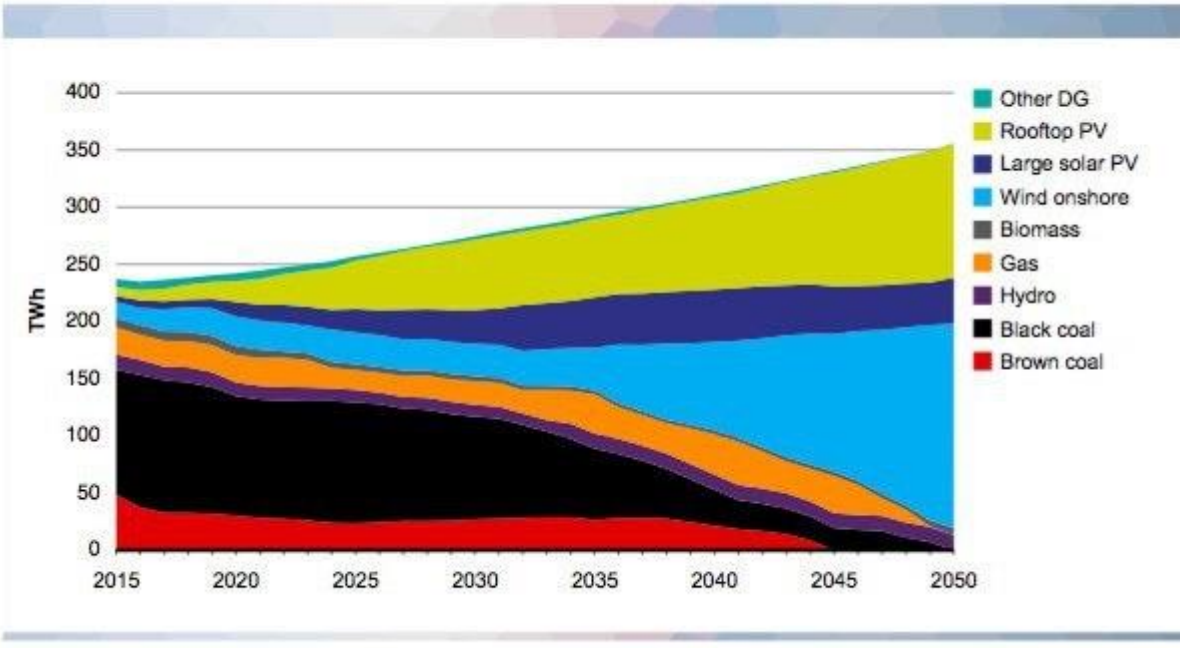
On top of this, this scenario will save $100 billion in upfront capital costs over business as usual, and also deliver significant bill savings – of $400 or more a year for "active homes", those with solar and storage and smart controls, and more than $600 for "passive homes", those with no interest or no possibility to pursue such technologies.

By 2050, more than 10 million customers will own distributed resources like solar, storage, home energy management systems and electric vehicles, which they can use to sell grid support services worth $2.5 billion per year.

Rooftop solar PV will grow six-fold within a decade, and 16-fold by 2050, which is the equivalent of 80GW. Up to half of all electricity generation will be sourced "locally", mostly on rooftops. Battery storage uptake will be significant, accounting for nearly 100GWh at the local level alone.

The CSIRO/ENA projected energy mix to 2050 is below.

Figure ii: Plausible projection of Australia's changing energy mix to 2050



This battery storage will play an important role in balancing the grid and providing the network services needed, along with centralised storage, which could be from batteries, pumped hydro, solar thermal, or other source.

Grid modernisation should not be about short-term adjustments or slightly altering business as usual, it must be about enabling a full energy transformation.

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.

To enable an efficient transformation of Australia's existing networks to support transition to a clean, modern system, Australia needs a national energy transition plan and a single body charged with managing the overall transition to ensure a well-planned, coordinated, rapid and efficient transition. This should be a new independent statutory authority charged with managing and navigating the energy transition.

In addition, the transition needs to be supported by NEM reform, appropriate policy incentives, review and upgrade of energy storage and physical grid infrastructure, and greater access for decentralised energy solutions. These are discussed below.

National Electricity Market Reform

Australia's NEM needs objectives that can drive the clean energy transition through the day-to-day actions of all organisations and individuals involved in electricity delivery in Australia, from the Federal government and the COAG Energy Council down to the smallest solar provider and everyone in between - regulators, rule makers, market operators, retailers, network companies, commercial and household solar producers/consumers, and so on.

The commitment of the COAG Energy Council to better align climate and energy policy is not possible without a change to the National Electricity Objective (NEO). Currently, the Australian Energy Market Commission (AEMC), the Australian Energy Regulator (AER) and AEMO cannot consider the environmental implications of critical decisions such as rule changes and network pricing determinations. This must change as a matter of urgency and the best way to do this is through changing the NEO.

Governments in places leading the energy transition globally, such as New York, the UK, Denmark and Germany, have aligned their energy market objectives with their climate and social justice objectives and targets.

Increase the speed of regulatory decision-making to effect change

Modernising requires the ability to enact change, and right now the process of making change in the NEM is blocked by the NEM's own governance framework.

AEMO's submission to the Finkel review makes this case by stating the following:

> *…the NEM governance framework has a hierarchy of regulatory levels including legislation, Rules, Reliability Panel, industry procedures and operational systems. Some changes can take well over 6 months for each of a number of layers to serially make assessments. Once decisions are made, upwards of a year might then be required to implement changes, and transition periods are also required in some cases. Changes can therefore take many years from proposal to delivery.*

The current arrangement is therefore not sufficiently responsive or forward-looking to meet the needs of the paradigm shifts the NEM and its participants need to embrace.

AEMO suggests that changes are required to the regulatory regime so that upper layers, including the Rules, are used to define roles and policy principles with broad expression rather than detailed definition. Detailed adaptation of processes or settings within that broad policy space could then be managed and driven at a single regulatory level by agencies such as AEMO and the AER, through a continuous, transparent, well-defined industry mechanism.

Furthermore, policy and Rules settings should more clearly assign forward-looking risk assessment and management roles to agencies such as AEMO and NSPs with a view to identifying emerging technical issues early enough for them to be addressed proactively rather than reactively. It is often argued that there is nothing in the Rules to stop agencies from taking on these roles autonomously, however the work requries allocation of expert resources, funding and often also access to information from other businesses, and then only to promote change rather than effect it. Therefore, in practice, unless there is a clear obligation assigned to an appropriate body on a continuous basis, there is no certainty that forward risk assessments can be progressed with the necessary focus.

Policy mechanisms to incentivise renewable (variable/dispatchable) energy solutions and increase access to markets and the grid

A combination of market and policy mechanisms is likely to be required as we shift away from a baseload/peakload energy system (coal and gas) to a variable/dispatchable energy system (e.g., wind, solar, batteries, solar thermal, electric vehicles (EVs)). In particular, attention should be paid to:

- Policy mechanisms needed to incentivise dispatchable energy solutions to enter the market. For example, reverse auctions targeting dispatchable energy.
- Changes to wholesale market price setting, to reduce price gaming. For example, switching from a 30-minute determination of the spot price to 5-minute determination.
- Assessing options to strengthen and increase the interconnection of the NEM (see below).

Energy storage and physical grid infrastructure reviews

As a priority the COAG Energy Council should commission thorough reviews of both energy storage opportunities and our current national electricity grid physical infrastructure.

Storage solutions such as pumped hydro, batteries, and concentrated solar thermal provide flexibility and dispatchability to complement renewables such as wind and solar. A national energy storage plan that examines available technologies, considers geographic opportunities and constraints, and delivers optimal storage mapping, would

provide the technical basis to inform decision making and the roll-out of storage technologies to complement renewable energy generation.

Similarly, the physical NEM infrastructure including interconnectors and transmissions lines will need to be updated. The details of this should be determined by a technical review of the grid that includes an urgent assessment of critical bottlenecks and optimal placement of new or expanded interconnectors.

Assess options to increase interconnection

The Clean Energy Finance Corporation recently commissioned a review of transmission upgrades particularly focused on interconnectors, which assessed various emissions and demand scenarios and their impact on the need for additional interconnection.

The report by Jacobs finds that in all studies it examined, a doubling of the energy import/export capacity from Tasmania (i.e., a second Bass Strait interconnector) is required by 2025, and the benefits of this would include:

- allowing additional renewable energy resources to be developed
- lowering the market price for power and reduce price volatility
- increasing competition
- improving energy supply security and reliability.[6]

The study also finds that a second interconnector would be beneficial to Victoria as they increase renewables and potentially see further coal closures.

The report findings are summarised as follows:

> *In a world where greenhouse gas emissions are required to be reduced and the electricity sector is being transformed so that the existing coal fleet is being retired within 15 years, interconnect upgrades appear to be part of the least cost solution for replacement of the coal fleet with low emission plant.*[7]

In addition, the South Australian government has instigated a study into a new interconnecter between SA and NSW.

[6] Jacobs, Benefits of Transmission Upgrades in a Transforming Electricity Sector, 21 November 2016, available here: http://www.cleanenergyfinancecorp.com.au/media/222968/benefits-of-transmission-upgrades-in-a-transforming-electricity-sector.pdf

[7] Jacobs, Benefits of Transmission Upgrades in a Transforming Electricity Sector, 21 November 2016, available here: http://www.cleanenergyfinancecorp.com.au/media/222968/benefits-of-transmission-upgrades-in-a-transforming-electricity-sector.pdf

As such, further consideration of additional interconnection should be part of a technical review of the physical grid infrastructure with the results integrated into a national clean energy transition plan.

Increase access for decentralised, renewable (variable/dispatchable) energy solutions to markets and the grid

Currently, decentralised variable/dispatchable energy solutions also have difficulty accessing energy and ancillary markets and are not utilised to deliver grid services.

Reforms are needed to ensure that decentralised energy solutions are considered on a level playing field with poles and wires in network pricing and planning processes. Consideration should also be given to opening up grid services to greater competition.

In addition, reforms are needed to ensure that small generators and demand aggregators not only have better access to the energy market, but are better recognised for the important role they play in the energy mix.

Consideration should be given to:

- Establishing grid connection processes that embrace technical capabilities to realise the potential of renewable energy and storage.
- Establishing fair, reasonable and independently approved commercial terms for connection.
- Ensuring that customers who elect to install non-exporting renewable energy and energy storage systems are not treated any differently to customers who make adjustments to their equipment, given they have no additional impact on the grid.
- Developing a grid connection opportunities mapping tool that maps location-specific hosting capability of the grid, reducing the burden on generator proponents and networks.

Pursue much greater energy efficiency as a key alternative 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.[8]

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

[8] International Energy Agency, Energy efficiency gains ground despite lower energy prices, October 2016

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."[9]

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.[10] 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 energy productivity afford, the NEM must be restructured 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. Australia can and should pursue a doubling of energy productivity by 2030 and develop an energy efficiency roadmap as well as a national energy efficiency scheme 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".[11] 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 .[12]

As outlined in the Leadership Forum on Energy Transition's plan, reforming electricity tariffs to reflect the true costs of providing electricity and generate appropriate signals for business and household use of electricity 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.".[13] A focus on technical solutions is important but should be coupled with crucial behavioural solutions.

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[9] Energy Efficiency Council, Australian Energy Efficiency Policy Handbook, July 2016

[10] Australian Alliance for Energy Productivity at http://www.a2se.org.au/

[11] National Grid Management Council (NGMC) 1994, "Demand Management Opportunities in the Competitive Electricity Market: Discussion Paper", Canberra: National Grid Management Council

[12] 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

[13] Leadership Forum on Energy Transition, Our energy future: A plan to transition Australia to clean energy, November 2016, p.18

Current 'Power of Choice' reforms that are intended to promote efficient use of energy networks and empower customers to make efficient energy decisions including through metering, network pricing and embedded generation are positive steps in this regard. The AER is working to implement these reforms, initially in cost-reflective network pricing.[14]

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.

Technological

The CSIRO and Energy Networks Australia (ENA) in their Electricity Network Transformation Roadmap predict that 2017-2017 will see a step change in adoption of new technologies, including distributed energy resources such as rooftop solar, energy storage and electric vehicles (EVs).[15]

CSIRO and ENA maintain that the transmission network plays a critical role by allowing a diverse and dispersed resources mix to provide highly reliable energy balance for a wide range of operating conditions, and maintaining power system security with much lower levels of system inertia.

It should be noted that their roadmap calls for a detailed power system security analysis for a system with low levels of native inertia, noting that there are a range of technical solutions to achieve inertia and frequency such as use of synchronous condensers, large-scale batteries, flywheel technology and emulated inertial responses from wind farms. They maintain that detailed specification for the transmission system including the connected equipment and controls to achieve security under a net zero future is needed.[16] Further, they note that the distribution system is a potential source of new ancillary services. These are important considerations for this review.

The International Renewable Energy Agency (IRENA) makes the case that for any country transitioning to a system powered by high levels of renewable energy a re-thinking of the design, operation and planning of future power systems from a technical and economic point of view is required. IRENA states that there are several technological options that can help to integrate variable renewable energy (VRE) into the power system grid: system-friendly VREs, flexible generation, grid extension, smart grid technologies, and storage technologies. They also maintain that "new advances in wind and solar PV technologies allow them to be used over a wider range of conditions and provide ancillary services like

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[14] Australian Energy Regulator, State of the Energy Market 2015, Available here: https://www.aer.gov.au/system/files/State%20of%20the%20energy%20market%202015%20%28A4%20format%29%20%E2%80%93%20last%20updated%204%20February%202016.pdf

[15] CSIRO, Energy Networks Australia, *Electricity Network Transformation Roadmap: Key Concepts Report*, December 2016.

[16] CSIRO, Energy Networks Australia, *Electricity Network Transformation Roadmap: Key Concepts Report*, December 2016.

frequency and voltage control.[17] The following excerpt outlines key considerations, which are also relevant to Australia's energy transition.

IRENA: Renewables Integration into Power Grids

The integration of a significant share of variable renewables into power grids requires a substantial transformation of the existing networks in order to:

- *allow for a bi-directional flow of energy; that is top-down (from generators to users) and bottom-up (with end-users contributing the electricity supply) aimed at ensuring grid stability when installing distributed generation;*
- *establish an efficient electricity-demand and grid management mechanisms aimed at reducing peak loads, improving grid flexibility, responsiveness and security of supply in order to deal with increased systemic variability;*
- *improve the interconnection of grids at the regional, national and international level, aimed at increasing grid balancing capabilities, reliability and stability;*
- *introduce technologies and procedures to ensure proper grid operation stability and control (e.g. frequency, voltage, power balance) in the presence of a significant share of variable renewables; and*
- *introduce energy storage capacity to store electricity from variable renewable sources when power supply exceeds demand and aimed at increasing system flexibility and security of supply.* [18]

Economic issues

The cost of not keeping pace with evolving demands is high. The power blackout in South Australia due to a massive storm was assessed at $367 million. It's likely that global warming will fuel more extreme weather that will have futher costs when transmission infrastructure fails. Futher, outdated transmission and distribution networks will add delay, difficulty, and insecurity to Australia's transition to clean energy.

Importantly, the cost of the network to consumers is very high and despite the high cost, Australians still do not have a resilient future-proofed network. Electricity prices vary from state to state, but in general network charges accounted for 43 per cent of residential electricity prices in FY 2015. Of this, transmission accounted for 7 per cent and distribution charges accounted for 36 per cent.[19] The costs are largely associated with the following:

- The building of new substations, power line towers and wires to cope with growing peak demand.

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[17] IRENA, Renewable Energy Integration in Power Grids, Technology Brief, April 2015 available here: http://www.irena.org/DocumentDownloads/Publications/IRENA-ETSAP_Tech_Brief_Power_Grid_Integration_2015.pdf

[18] IRENA, Renewable Energy Integration in Power Grids, Technology Brief, April 2015 available here: http://www.irena.org/DocumentDownloads/Publications/IRENA-ETSAP_Tech_Brief_Power_Grid_Integration_2015.pdf

[19] Dr Alan Finkel AO, Independent Review into the Future Security of the National Electricity Market, Preliminary Report, December 2016, pg 43.

- Fixing faults and damaged power lines to ensure there will be no unnecessary outages.
- The maintenance of poles and wires, related infrastructure such as substations, and the electricity meters located at every house and business across the country. [20]

The majority of these costs are passed onto energy retailers, who then pass them onto consumers through their electricity bills.

Expenditure on network services has been substantial yet it has not provided Australia with a modern, secure and reliable grid. Any future expenditure needs to be supporting a modern grid that delivers more clean, localised energy not locking in expensive assets built for a different era.

A model that would help achieve this is outlined in the Homegrown Power Plan, and entails creating an 'ebay of local energy' where network companies take the role of local energy system platform operators. This would shift the business model of network companies from delivering electricity to consumers by building and maintaining more poles and wires to facilitating local energy trading.[21]

Consumer issues

Australia's energy system is not only failing on climate change, it is failing consumers with rising energy prices that are particularly hurting vulnerable households and people who are disadvantaged.

According to ACOSS, "from 2007-2016 low income earners endured electricity price increases of a whopping 65% in real terms, which translates to a spend of up to five times more of disposable income on energy costs than high income earners." It is therefore essential that vulnerable and low income households be protected from unfair price rises as Australia transitions to a clean energy grid, and effort be place on developing policy that specifically ensures an inclusive and equitable transition.

Failure of competition is one reason for energy price rises and needs to be further scrutinised. The federal government recently announced an Australian Competition and Consumer Commission investigation into retail electricity pricing. This is useful for uncovering some of the key issues driving retail price increases but more work is needed to uncover, explain and address rising electricity prices, including network costs.

One thing is clear, and that is that renewable energy has been unfairly blamed for recent electricity price rises and price spikes. The ACF commissioned a report by the Melbourne Energy Institute to determine the drivers of price spikes in South Australia, and the very clear conclusions were that renewable energy was not to blame, rather some of the key issues behind price spikes included heavy reliance on expensive gas, a small number of generators which has resulted in limited competition and significant market power, and failure of the National Electricity Market. That report is available through the following link:

[20] https://www.originenergy.com.au/blog/lifestyle/understanding-the-ins-and-outs-of-your-electricity-bill.html

[21] GetUp! and Solar Citizens, Homegrown Power Plan, page 52.

https://d3n8a8pro7vhmx.cloudfront.net/auscon/pages/1246/attachments/original/1470896648/SA_PRICES_FINAL.pdf?1470896648

In addition, the COAG Energy Council's review of the Limited Merits Review regime should help to inform decisions about network revenue determinations and their review by the Australian Competition Tribunal. It is important that this regime ensures protection for consumers against unnecessary price rises.

According to the Australian Energy Council, climate policy uncertainty is also one of the key drivers of rising electricity prices. AEC has found that this uncertainty is currently adding 4-6c/kWh to wholesale costs, equivalent to a $50 tonne carbon price. Yet, we are not gaining the benefits that a carbon price would bring to Australia by efficiently helping to decarbonize and clean up our economy to address global warming and protect our health, which is dependent upon the health of our air, water and land.

International experiences and examples of electricity grid modernisation in comparable jurisdictions.

New York State, USA

The New York Power Authority (NYPA), as part of "Reforming the Energy Vision, launched a Strategic Vision Plan, 2014-2019, with a key component of Infrastructure Modernisation.

The plan included making New York's Generation and Transmission Assets more flexible, reliable, and responsive. According to NYPA, this was part of an effort to create an electricity system that expands New York's energy mix and provides customers with significantly greater access to safe, clean and affordable service.

NYPA also embarked on a ten-year, Smart Generation & Transmission (G&T) initiative that includes: infrastructure upgrades, cutting-edge hardware, software technologies and practices to support the state's Strategic Vision.

Newer technologies, such as advanced transmission monitoring systems, grid-scale energy storage and microgrids were included, with the plan that as these newer technologies transform the electrical grid landscape, faster acquisition and processing of real-time data would be used to ensure the grid's reliability.

Audrey Zibelman, new chief executive of AEMO, was previously head of New York's Public Service Commission, charged with implementing that state's ambitious 'Reforming the Energy Vision' program, and its target of 50 per cent renewable energy by 2030. She will be well-placed to bring insights from that leading initiative into Australia's thinking. In a recent interview she stated:

"The objective is how we use these technologies better… If we compensate people who invest in batteries or distributed generation on their side of the meter, and we really create a two-way system, then we create a more productive system, meaning you don't have to invest in generation that you are only going to use a few hours a year, because you can use the load itself as a balancing resource."

Texas, USA

Despite being a state known for its fossil fuel developments, Texas is moving to a clean energy future. Some of the factors that have enabled this transition include:

- The competitive market structure within the Electric Reliability Council of Texas (ERCOT), which manages the grid for about 90 percent of the state.
- The construction of a massive transmission line highway, known as the Competitive Renewable Energy Zone (CREZ), built to carry West Texas wind to cities throughout the state.

The points below captured from Nick Miller, US power-systems engineer who was in Australia as a consultant to AEMO, about lessons integrating renewables in Texas are instructive and bring to light useful lessons for Australia.

Extract from '*7 bright ideas on renewable energy*'

> ***The important things for running a power system with lots of wind or solar power are: No.1, flexibility; No. 2, flexibility; and No. 3, flexibility***
> *The fact that there's uncertainty of demand (higher demand from consumers at different times of day) and uncertainty of supply (somewhat unpredictable variations in when the wind blows and when the sun shines) means that everything else in the power system needs to be more agile. The term we use in the industry is flexibility.*
>
> *Another piece of the puzzle is flexibility of institutions, politics, business.*
>
> ***Australia is an energy country, just like Texas is an energy "country"***
> *Texas has one of the largest electrical systems in the US and it runs its grid accordingly. It is about the size of Australia, in terms of people and power. Texas has 15,000 megawatts (MW) of wind generation. And it regularly gets to operating conditions of 50% of instantaneous renewable penetration. That is, one out of two watts, at a time of day, are coming from wind. Texas does it reliably and they've kept the rates down.*
>
> *Australia, like Texas, is an energy country. You've got great wind, you've got great solar, you've got a whole bunch of different fossil fuels. So has Texas. Texas looked at wind power and said, "Oh! This is energy; we do energy. Let's do wind…" Texas has the best wind forecast. They've invested in their operations. They've invested in the transmission. They've changed the rules. They're constantly adjusting the market rules to the reality that the system doesn't look the way it always did.*
>
> ***People don't like to live where it's super windy***
> *In places where you have a great wind resource, you generally don't have good transmission infrastructure or easy access to the grid. Texas recognised that and they sought a whole bunch of public comment and did a whole bunch of slicing and dicing of the figures and said, "OK, here are some areas where there's great wind resource and we've done enough homework to believe that those areas will be developed."*
>
> *They went ahead and found public money, and did all the pain of routing and permitting,*

and built transmission lines into these wind-rich areas. A field of dreams. Then the wind plants came along and subscribed to those lines. They covered the risk that the ratepayers had paid forward. They're fully subscribed. It was wildly successful. That's one of the ways Texas got to 15 gigawatts of renewable generation.

You have to ask the tough, "Where's the beef?" questions
In crude vernacular, Texas runs its grid really tightly, and they demand, without exception, a high level of performance, including from all the wind plants.

For example, the Electrical Reliability Council of Texas (ERCOT) has put in place a retroactive requirement on all wind plants to add the capability to provide primary frequency response. That means the ability to change their output locally, autonomously, in response to a deviation in system frequency. That's not standard practice, but ERCOT said: We need this. There are going to be operating conditions when we need that capability from the wind plants. We're putting it in place. Some of the market participants were not necessarily pleased with the changes initially. In the end, though, it's a relatively small cost, and it's worked really well[22].

Conclusion

In summary, grid modernisation is critical but it cannot be separated from Australia's necessary clean energy transition that must focus on achieving 100 pre cent renewable energy as soon as possible. Australia's current grid is not up to the task, but it certainly can get there as part of a national coordinated clean energy transition plan that is integrated with effective, durable climate change policy and sets grid modernisation on a path to support a clean energy future.

The Australian Conservation Foundation strives to advance lasting solutions to Australia's environmental problems and to create a sustainable future and better quality of life.

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[22] Natalie Filatoff, ***7 bright ideas on renewable energy,*** *Posted on December 16, 2016.*