Resilience rule change request

Briefing note — 3 November 2020

> The Inquiry notes the broader question: is it worth investing in these ways [of improving the resilience of the electricity network for bush fire prone areas], and charging consumers commensurately, to a level that can withstand low-likelihood but high-consequence events? The trade off between these costs and benefits is best addressed in a collaborative manner between the utilities sector and government in order to come to agreement about the level of investment that best reflects the value placed on protection versus consumer cost.[1]
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> Centralised infrastructure, including power systems, can be disrupted during disasters, leaving communities in greater danger. Decentralised systems including microgrids based on solar and batteries can help ensure that communities have a secure and reliable source of power.[2]

Early in 2021 TEC and partners intend to submit a new rule change request to the AEMC. The objective of the rule change will be to increase the resilience of the energy system by incentivising distribution networks to invest in assets and services which increase resilience to the benefit of consumers. This will involve requiring networks to consider the long-term impacts of more frequent and intense severe weather events in their five yearly revenue proposals, and to plan accordingly. [3]

Background

The electricity system is amongst the critical infrastructure affected by severe weather events. Heatwaves, severe storms and bushfires in particular are responsible for blackouts, damage to electricity infrastructure and related loss of life and economic losses. This was graphically illustrated by the 2019-2020 bushfire crisis in south eastern Australia:

> We heard that during the 2019-2020 bushfire season, more than 280,000 customers from various energy providers experienced a bushfire-related power outage at some point. These outages were largely attributed to fire damaging more than 10,000 power poles and thousands of kilometres of powerlines, including those located underground.[4]
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> The Inquiry heard that fires burned across more than 45% of Endeavour Energy's network supply area, and bush fires interrupted electricity supply to 54,000 of its customers between December and January, with 20,000 people left without power at the fire's peak over the New Year period, mainly on the South Coast. In the worst-affected areas, some customers were without power for up to 10 days. Essential Energy reported that over 104,000 of its customers were affected (including 4,700 life support customers) and over 3,200 power poles and 4,500 cross arm poles were damaged or destroyed.[5]

In the absence of national and international commitments to limit global heating to no more than 1.5° in line with the Paris climate agreement, these impacts are likely to accelerate. This was evident in the globally unparalleled scale and ferocity of the bushfire crisis. In a study undertaken for this process, after briefly reviewing the relevant literature CutlerMerz concluded that "It is therefore considered plausible, assuming there is currently around 4% probability of a bushfire occurring in any given year in bushfire prone areas, that this could more than double in the medium term future…"[6]

While this rule change request focuses on accelerating climate change impacts, other potential risks to resilience include cyberattacks and "black swan" events like the coronavirus that appear to come out of nowhere and potentially wreak havoc on business as usual.

Intuitively, the most resilient energy system is one which balances the exposure of assets to threats in the supply chain between where energy is generated and where it is consumed with access to backup supply or redundancy. And appropriate analogy might be the desire of many families to grow their own food during the coronavirus pandemic, partly because, especially in the early stages, there were supply chain issues.

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[1] *Final Report of the NSW Bushfire Inquiry*, July 2020, 201. Nevertheless, this rule change request will argue that investing in resilience is cheaper than maintaining the status quo.

[2] Climate Council researcher, Simon Bradshaw, quoted by *pv magazine Australia:* https://www.pv-magazine-australia.com/2020/11/04/climate-council-says-bushfire-royal-commission-findings-put-solarstorage-front-and-centre/

[3] This rule change request focuses on climate change impacts, but other risks to resilience such as cyber attacks could also be targeted.

[4] *Royal Commission into National Natural Disaster Arrangements Report*, 28 October 2020, 229.

[5] *Final Report of the NSW Bushfire Inquiry*, July 2020, 327.

[6] [6] CutlerMerz for ENA/ARENA, *Opportunities for SAPS to enhance network resilience*, October 2020 (CM1), 15.

Unfortunately, no analysis has been done in Australia of the optimum balance between centralised and decentralised opportunities for increasing energy system resilience. In the absence of such analysis, we regard it as reasonable to surmise that investment in bulk scale resilience should be balanced by investment in DER for the same purpose. At present that is this is not the case. Even where DER are investigated for their resilience potential, the focus has been largely on the need to maintain power to telecommunications facilities in the event of bushfires and other severe weather events. This is important, but it is far from the only potential resilience role for DER. In general terms, others include:

- Less vulnerability to supply chain interruptions.
- Higher reliability in fringe of grid locations.
- Lower total (lifetime capital plus operating) cost.
- Lower electricity generation carbon emissions.[7]
- Improved opportunities for energy equity through local energy sharing.

It therefore makes sense that the increased utilisation of distributed energy resources (DER) and other distribution level assets and activities (eg undergrounding and de-energising power lines) can potentially increase the overall resilience of the energy system.

AEMO (which typically underestimates the pace of the energy transition) projects that DER could provide up to 22% of total underlying annual NEM energy consumption by 2040,[8] potentially saving consumers at least $4 billion (High DER scenario) and up to $41 billion (Step Change scenario).[9] This contribution could take the form of increased investment in SAPS, microgrids, islandable PV and battery systems, community batteries, EVs with V2G capability, small consumer demand response and the undergrounding of more suburban lines as alternatives to rebuilding poles, wires and substations like for like after major damaging outages.

However, there is no positive requirement under the existing framework for NSPs to make these kinds of investments for resilience purposes.

In fact, there are regulatory *dis*incentives to investing in resilience (eg, with the CESS and EBSS rewarding networks for underspending on capex and opex, respectively).

Scope

This rule change request focuses on the role of distribution networks (DNSPs) in increasing system resilience.

As CutlerMerz observes below,[10] at the distribution network level there are several regulatory dimensions of resilience, relating to arrangements before, during and after severe weather events. This rule change request relates only to the first of these – i.e., investment planning as part of the five yearly revenue determination process. This focus was chosen to address possibly the most significant structural issue networks face in addressing climate risk, and the urgent need for reform in view of the last bushfire season and then five year revenue determination cycle. The AEMC is, of course, welcome to broaden the scope of the process by making a more all encompassing "more preferable rule".

Naturally, resilience pertains to the entire electricity chain. Beyond the distribution system, resilience was a focus of the AEMC's review of the "black system" event in South Australia in September 2016.[11] Unfortunately, the final report highlighted an alleged myriad problems for system security caused by rooftop solar and other distributed energy resources, while noting only one benefit : DER can assist system security by being turned off (ie, tripped).[12]

On the other hand, also in 2019 the AEMC noted in its Grid of the future report that:

> Importantly, the change in energy storage – from rotating parts in large, centrally dispatched generators to distributed batteries may provide opportunities to improve resilience and reliability. Smaller and smaller

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[7] Compared with the current NEM average of about 0.8kgCO2-e/MWh when local generation is from renewable energy sources.

[8] AEMO, 2020 Integrated System Plan, 41.

[9] ibid, 38, table 4.

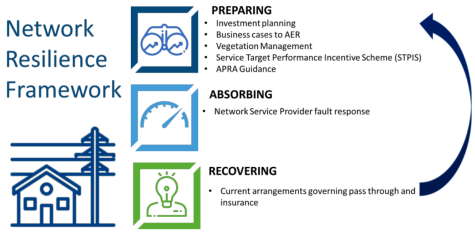
[10] CutlerMerz for ENA/ARENA, *Opportunities for SAPS to enhance network resilience*, October 2020 (CM1), 25.

[11] AEMC, Mechanisms to enhance resilience in the power system - Review of the South Australian black system event, Final report, 12 December 2019.

[12] https://reneweconomy.com.au/energy-rule-maker-rues-reality-rejects-real-reform-in-s-a-blackout-response-16659/

segments of networks may become capable of forming grids and standing on their own, either permanently or for a period of time while the network is reconfigured and repairs are made.

As the majority of supply interruptions are due to distribution network faults… lower level nesting also has the potential to significantly improve reliability in future if it can allow time for switching and repair on the primary distribution (generally 11kV or 22kV) network.



This rule change request is intended to give DER its due in increasing overall system resilience – potentially at lower cost than bulk supply interventions.

Focus of bushfire inquiries on nexus between electricity supply and telecommunications.

Compliance with the NEO

This proposal is expected to lead to more efficient investment in DER (SAPS and microgrids) and non-DER assets (eg undergrounding) vis-a-vis both replacing assets like for like after severe weather events, and increasing system resilience by hardening transmission level assets. It would therefore be consistent with the NEO — the long-term interest of consumers — because it would place download pressure on network revenue requirements and tariffs while increasing system security.

Details

The rule change request could include the following elements:

1. A definition of resilience (distinguishing it from reliability).[13]
2. An explanation of the relevance of resilience to the NEO.
3. **Changes to chapter 6 of the NER related to forecast capex and opex to require DNSPs to "maintain the reliability, security *and resilience* of the distribution system through the supply of standard control services" (6.5.7(a)(3)(iv)).**
4. Changes to the AER's VCR framework to recognise the costs of long duration but localised outages, potentially including social costs based on recent Australian data.
5. Changes to the STPIS Beta 2.5 methodology to reflect the increasing number and severity of major event days (MEDs).
6. (possibly) Recognition of resilience as a distribution service, thereby potentially creating a market for resilience services.
7. A requirement for the AER to create a resilience guideline including:
   - A risk assessment framework.[14]
   - The considerations that a DNSP is able to consider in determining whether to transition existing customers to a SAPS to include improved resilience.
   - Consideration of the impact of a resilience requirement on other incentives (e.g. the CESS and EBSS).
   - Consideration of any impacts on jurisdictional reliability standards.

Examples

1. *SAPS:* A distribution network estimates that it would be revenue negative or neutral over a planning horizon of 10 to 20 years to put end of line customers in an area with high bushfire risk onto individual

[13] We are likely to use the following definition, which is derived from the work of the Bushfire and Natural Hazards CRC: "the capacity of communities to prepare for, absorb and recover from natural hazard events and to learn, adapt and transform in ways that enhance these capacities in the face of future events."

[14] We expect that this will be forthcoming in early 2021 from the CSIRO/BOM/AEMO electricity sector climate information (ESCI) project. This will include probabilistic treatment of individual severe weather events, and potentially an alternative approach for compound severe weather events.

SAPS and remove the last several kilometres of poles and wires. However, by applying the risk assessment framework it estimates that (because the bushfire risk is likely to double) it would now be revenue positive over the same timespan to take this action, and therefore does so. This results in total capex and opex savings and higher reliability over the planning horizon.

2. *Microgrids:* While the business case for temporarily islanding or permanently disconnecting remote towns is currently likely to be generally negative, in view of increasing climate risks there may be "some locations with certain combinations of relative remoteness, small populations, existing unreliable power supply and feeders nearing the end of their useful asset life that would justify investing in [microgrids] from an economic perspective."[15]
3. *PV/battery rebates:* Applying the risk assessment framework to an urban area with extensive vegetation, a distribution network calculates that it would be cheaper to offer rebates for customer-owned islandable PV/battery systems than to increase its vegetation management opex to maintain the current level of reliability.
4. *EV/V2G rebates:* Applying the risk assessment framework to a rural town with an increasing bushfire, cyclone or flood risk, a distribution network calculates that it would be cheaper to offer rebates for customer-owned EVs with the vehicle to grid (V2G) capability with guaranteed access than to invest directly in SAPS to maintain the reliability of a selected number of emergency or high-priority facilities during long duration outages.

Related work

Total Environment Centre and Renew, *Best case scenario: Local energy and climate change resilience*, Discussion paper, September 2019.

Final Report of the NSW Bushfire Inquiry, July 2020.[16]

CutlerMerz for ENA/ARENA, *Opportunities for SAPS to enhance network resilience*, October 2020 (CM1).[17]

CutlerMerz for TEC, *NEM resilience cost-benefit analysis*, December 2020 (forthcoming) (CM2).

Explainer: resilience and reliability

While there are other definitions of resilience — some narrow and engineering-focused,[18] others broad and more subjective[19] — we use the definition derived from the work of the Bushfire and Natural Hazards CRC: "The capacity of communities to prepare for, absorb and recover from natural hazard events and to learn, adapt and transform in ways that enhance these capacities in the face of future events."

Reliability has a more narrow meaning. It is defined in the national electricity rules (NER) as "The probability of a system, device, plant or equipment performing its function adequately for the period of time intended, under the operating conditions encountered."

Broadly speaking, reliability can be considered as one measure of resilience. But in Australia at least, electricity system reliability as currently conceived is too narrow to encompass resilience, particularly because it excludes would have to definitely be called high impact low probability (HILP) events, but which we prefer to call high impact increasing probability (HIIP) events. In other words, reliability measures typical outages, rather than extreme ones, which are becoming more prevalent under the accelerating influence of climate change.

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[15] CM1, vii.

[16] Especially 4.4.5.5.2 Improving the resilience of the electricity network for bush fire prone areas, which notes the relevance to resilience of vegetation management, underground power lines, SAPS and fire resistant power poles.

[17] This study modelled four theoretical case studies to assess the business case for offgrid or stand-alone power systems (SAPS) and microgrids to replace poles and wires connections to isolated towns and properties which might be affected by bushfires. The results depend on multiple assumptions and vary according to the sensitivities tested for. But in short, it found that:

- It already makes financial sense to move some individual properties, particularly where existing lines traverse heavily forested areas, onto SAPS, but the business case improves markedly when the potential for more frequent bushfires is factored in.
- While standalone or islandable microgrids do not currently pay for themselves, due primarily to the high capital costs, they are likely to do so as bushfires become more frequent.

[18] eg CIGRE: "Power system resilience is the ability to limit the extent, severity, and duration of system degradation following an extreme event."

[19] eg UN: "The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and function."

The two main metrics used to define reliability in the NEM are the number and duration of outages per year. The AER sets out the values of customer reliability (VCR) in $/kWh it has derived for unplanned electricity outages of up to 12 hours in duration (i.e. standard outages) for the National Electricity Market (NEM) and the Northern Territory (NT). These values "are an important input in identifying efficient levels of network expenditure and in determining the NEM reliability standard and market settings."[20]

Two obvious limitations of this framework for reliability are that it excludes long and wide area outages. The AER set out to remedy this problem by attempting to create metric for widespread and long duration outages (WALDOs), but the process was ultimately unsuccessful. Even if it had been successful, it would have excluded long duration attitudes over relatively small areas, which is often the case in bushfires and other severe weather events.

Complementary reforms

The AEMC's recent SAPS review should result in legislative and rule amendments to implement a new regulatory framework for SAPS provided by electricity distributors in the NEM. Essentially, These new regulatory arrangements would allow distributors to shift fringe of grid customers onto SAPS where it would be economically efficient to do so. However, network businesses are concerned by the complexity of some of the proposals, particularly the requirement to maintain retail contestability in a context where this is clearly a theoretical construct.

[20] AER, Values of Customer Reliability – Final Decision, November 2019, 3.