

Saving mega bucks with negawatts

A fast way to secure Australia's electricity supply before next summer

Why the Finkel Review's recommendation to open markets to aggregated demand response is an important aspect of the report, but has gone almost unnoticed. It has the potential to rapidly improve Australia's energy security.

Discussion paper

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July 2017

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Summary

Australian governments are proposing to fund and build billions of dollars' worth of new electricity generation capacity as the solution to our energy security crisis. Regardless of whether investments like Snowy 2.0 or ideas for 'clean' coal power stations go ahead, these supply-side solutions will require many years to build and will have no impact on security of supply next summer (2017-18).

Luckily, there are demand-side solutions that use energy more wisely, which could potentially secure hundreds of MW of supply headroom this year.

Aggregated demand response is used in other markets around the world to stabilise the grid in response to changing demand. It uses cloud-software to switch off or reduce demand from many consumer devices, or 'loads', at once, acting like a 'virtual power plant'. Unlike expensive and time-consuming generation projects, it merely upgrades existing infrastructure owned by consumers. Controllers are installed on load devices to turn them on or off and can even integrate them into the grid's energy dispatch system. This means it can be implemented cheaply and quickly.

Aggregated demand response has the added benefit of introducing competition into the market. It reduces peak demand on the grid, lowering the wholesale price of electricity, which means lower energy bills for consumers. It can also introduce competition into frequency control markets, which again lowers bill for consumers, including industry users. It protects local distribution networks from stressful peaks in demand and negates the need for expensive 'gold plating', again lowering costs across the market.

The National Energy Market's rule making agency, the Australian Energy Market Commission has been considering rule changes to allow aggregated demand response to participate directly in the wholesale market, for some years.

If governments wish to drive a proven, low-cost, rapid solution to improve Australia's electricity system, they simply need to open the market to energy efficiency measures including aggregated demand response.

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Introduction

Audrey Zibelman, CEO of the Australian Energy Market Operator (AEMO), has insisted that the lights will not go out again¹ as they did in South Australia on 28 September 2016. Importantly, AEMO's reassurance is based partly on the expectation that consumers will help deliver grid security, through demand response.²

In May 2017, the Australian Renewable Energy Agency (ARENA) and AEMO announced a joint initiative to use demand response to moderate extreme peaks in demand and cope with grid emergencies.³ The pilot program will run for three years and seeks to provide 160MW of capacity, for a cost of \$37 million (\$22.5 million from ARENA and \$7.5 million from the NSW Government for projects in that state).

This program is very timely, as AEMO's system security health-check for the National Electricity Market, published in June 2017, predicted that if rainfall is low, there could potentially be an energy shortfall ('USE' or 'unserved energy') this spring and summer in South Australia, Victoria and New South Wales.⁴

A REOCCURRENCE OF THE SAME CONDITIONS IN SUMMER 2017–18 WOULD BE LIKELY TO RESULT IN SIMILAR LEVELS OF USE IN SOUTH AUSTRALIA AND NEW SOUTH WALES, AND SOME USE IN VICTORIA, IN THE ABSENCE OF ADDITIONAL INITIATIVES. – AUSTRALIAN ENERGY MARKET OPERATOR⁵

If rapid reforms are made this year, it is possible that aggregated demand response could be ready to provide increased security to the National Electricity Market (NEM) by next summer. Aggregated demand response works by using cloud software to coordinate many consumer loads into a 'virtual power plant'. This plant can respond to an emergency by time-shifting or avoiding consumption from some consumers,

¹ Audrey Zibelman, "There Is No Energy Crisis and the Lights Won't Go out This Summer," *Australian Financial Review*, June 25, 2017, <http://www.afr.com/opinion/columnists/opinion-there-is-no-energy-crisis-and-the-lights-wont-go-out-this-summer-20170625-gwy0h1>.

² AEMO, "Energy Supply Outlook" (Melbourne: Australian Energy Market Operator, June 2017), p.18.

³ ARENA, "Demand Response Competitive Round Funding Announcement" (Canberra: Australian Renewable Energy Agency, June 2017), https://arena.gov.au/assets/2017/06/20170607_DemandResponse-FundingAnnouncement_PUBLIC.pdf.

⁴ AEMO, "Energy Supply Outlook" (Melbourne: Australian Energy Market Operator, June 2017), p.27.

⁵ Ibid, p.17.

providing the grid not with megawatts of generation but ‘negawatts’ of conservation⁶ i.e. megawatts saved.

The Independent Review into the Future Security of the National Electricity Market (‘Finkel Review’) agreed with AEMO that aggregated demand response is a critical resource for energy security and to moderate price pressures. The Finkel Review’s *Blueprint for the Future* Final Report (9 June 2017) made two recommendations for demand response.

Firstly, that there should be a ‘Strategic Reserve’ (Recommendation 3.4) of reliability demand response, supported through market mechanisms. Secondly, there should be ‘economic’ demand response (see Table 1, page 14 below for definitions of reliability demand response and economic demand response):

“THE COAG ENERGY COUNCIL SHOULD DIRECT THE AUSTRALIAN ENERGY MARKET COMMISSION TO UNDERTAKE A REVIEW TO RECOMMEND A MECHANISM THAT FACILITATES DEMAND RESPONSE IN THE WHOLESALE ENERGY MARKET.” – FINKEL REVIEW, FINAL REPORT, RECOMMENDATION 6.7

Demand response is poised for significant growth globally. Forecasts indicate that by 2025 it could be worth USD 36 billion⁷, growing from 39 GW in 2016 to 144 GW in 2025.⁸ The International Energy Agency benchmark is that demand response can mitigate about 15% of peak demand.⁹

As the Finkel Review pointed out, Australia is falling behind global trends in the adoption of demand response.

“THERE ARE CURRENTLY LOW LEVELS OF DEMAND RESPONSE IN THE NEM. A 2016 SURVEY FOR THE AEMC SUGGESTED THERE IS ONLY AROUND 235 MW OF DEMAND RESPONSE UNDER CONTRACT TO RETAILERS, MOSTLY INVOLVING EXPOSURE TO THE WHOLESALE MARKET SPOT PRICE.” – FINKEL REVIEW, FINAL REPORT¹⁰

⁶ “Negawatt Hour,” *The Economist*, March 1, 2014, <http://www.economist.com/news/business/21597922-energy-conservation-business-booming-negawatt-hour>. Accessed 30 June 2017.

⁷ “Demand Response Management System Market Worth \$35.9 Billion By 2025: Grand View Research, Inc.,” *PRNewsWire*, April 24, 2017, <http://www.prnewswire.com/news-releases/demand-response-management-system-market-worth-359-billion-by-2025-grand-view-research-inc-620212823.html>.

⁸ “Market Data: Demand Response,” *Navigant Research*, accessed June 23, 2017, <https://www.navigantresearch.com/research/market-data-demand-response>.

⁹ “Re-Powering Markets: Market Design and Regulation during the Transition to Low-Carbon Power Systems” (Paris: International Energy Agency), accessed March 5, 2017, p.155.

¹⁰ Alan Finkel et al., “Independent Review into the Future Security of the National Electricity Market: Blueprint for the Future” (Department of the Environment and Energy, June 2017), p.152.

Australia's energy sector is relatively inefficient. The Federal government has a modest objective to increase energy productivity by 40% by 2030¹¹. The advantage of this failing is that it means there are a lot of efficiency gains available at very low cost and which will likely displace significant fossil fuel generation.

As the Climate Change Authority has stated, energy efficiency generally 'offers significant emissions reduction potential at low cost or net savings.'¹² As Alan Pears has argued for many years, negawatts are a vast energy resource waiting to be developed.¹³ This paper explores how aggregated demand response can release hundreds of these negawatts of capacity, in a matter of months, to reduce price peaks and increase security.

For example, EnerNOC, which is a world leader in this sector, claims it can deliver 100 MW to South Australia by 1 December 2017, by harnessing the untapped potential of existing infrastructure in that state.¹⁴ One of the reasons that aggregated demand response is so economically efficient is that it is delivered by a wide variety of already existing assets. This does not just mean a few large, industrial smelters, but many thousands or even tens of thousands of devices, from commercial coolers, pumps and factories to farm equipment and even small residential devices such as air conditioners.

Traditionally, rising demand has been met by building an increase in generation. But the security challenge of guaranteeing reliable supply during period of peak demand or grid emergencies can be solved faster and at a lower cost by clever management of demand.

In some cases, the individual devices, such as reverse cycle air conditioner / heater systems already have control circuitry allowing aggregated control. In other cases, a relatively low-cost control device can be fitted, which integrates them into the cloud software system.

¹¹ Commonwealth of Australia, "National Energy Productivity Plan 2015–2030" (Canberra, A.C.T: Council of Australian Governments Energy Council, December 2015), http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/National%20Energy%20Productivity%20Plan%20release%20version%20FINAL_0.pdf.

¹² Commonwealth of Australia (Climate Change Authority), "Climate Change Authority Special Review Report Three" (Climate Change Authority, August 2016), p.12.

¹³ Alan Pears, "Submission to NEM Security Review," January 30, 2017, <http://www.environment.gov.au/submissions/nem-review/pears.pdf>, p.7.

¹⁴ Giles Parkinson, "South Australia Should Dump Diesel Plan and Think Smarter," *RenewEconomy*, accessed March 31, 2017, <http://reneweconomy.com.au/south-australia-dump-diesel-plan-think-smarter-83644/>.

The great boon for consumers is that they will be rewarded financially for allowing their home systems to be used to provide security and keep wholesale prices low. Aggregated demand response is a sensible and attractive policy that deserves cross-partisan support.

Context

FEDERAL AND SOUTH AUSTRALIAN PLANS

In March 2017, both the federal and the South Australian governments announced new energy plans, based around increasing supply by funding the construction of new generators.

The Prime Minister has proposed a measure to improve energy security through a multi-billion-dollar upgrade to the Snowy Mountains Hydro-Electric Scheme.¹⁵ This upgrade would increase the existing 4GW generation capacity by 50% and build a pumped hydro storage system. This would pump water uphill when electricity is plentiful and cheap and let it run downhill and power a turbine, when electricity is scarce and expensive.

South Australia's plan is a more complex mix of regulatory and policy measures, centred around a new gas-fired power station that will be built and run by the state.¹⁶ The South Australian plan is expected to deliver 200 MW of generation by summer, by temporarily installing in diesel generators, but the gas-fired plant itself will take some years to be built.

REGULATORY REFORM STALLED

Over the past few years it has become clear that technology and consumers are revolutionising energy around the world. Australia's regulatory system has not kept up and it is a major cause of rising prices and instability in the National Electricity Market.

Consider for example the fact that Australia is a world leader in rooftop solar. There are now more than 1,645,464 solar PV systems on Australian homes, with a generation capacity of 5,498 MWp.¹⁷ It is reasonable to expect the National Electricity Market would integrate this vast, free generation resource into the system, to provide for increased energy security; it hasn't.

¹⁵ Malcolm Turnbull, "Securing Australia's Energy Future with Snowy Mountains 2.0," *Prime Minister of Australia*, March 16, 2017, <https://www.pm.gov.au/media/2017-03-16/securing-australias-energy-future-snowy-mountains-20>.

¹⁶ Government of South Australia, "Our Energy Plan" (Government of South Australia, March 2017).

¹⁷ "Postcode Data for Small-Scale Installations," accessed March 22, 2017, <http://www.cleanenergyregulator.gov.au/RET/Forms-and-resources/Postcode-data-for-small-scale-installations>.

A crucial rule reform the regulatory process needs to deliver is the Five Minute Settlement Rule. This would allow energy to be bought, sold and dispatched in five minute intervals.

This reform would improve competition in the wholesale energy market, decrease 'gaming' by incumbent generators and improve efficient use of both generation resources and demand-side resources, through systems such as aggregated demand response.¹⁸

As the Australian Energy Council, which represents the incumbent generators, concedes, 'The effect of reducing the settlement period from 30 minutes to 5 minutes will be to change the economic sustainability of some generators'.¹⁹ This of course, is the whole point – to replace inefficient generation with efficient generation. And the side effect of increasing competition to fossil fuels will be to lower emissions.

FINKEL REVIEW

Following the South Australian blackout in September 2016 the federal Environment and Energy Minister, Josh Frydenberg, convened an extraordinary meeting of the Council of Australian Governments Energy Council on 7 October 2016. This meeting commissioned an independent review of the National Electricity Market by the Chief Scientist, Dr Alan Finkel. The Finkel Review handed down its national blueprint for reforms to maintain security and reliability on 9 June 2017.

Debate about the Finkel Review has largely focused on the highly politicised emissions reduction policy, the Clean Energy Target. Given that the Federal Government has an only modest emissions reduction goal of 26-28% on 2005 levels by 2030,²⁰ it is important to consider the overall system reforms proposed by the Review. When considered in their entirety, the recommendations of the Finkel Review are substantially in favour of aggregated demand response and related clean energy technologies.

The Final Report stated, 'Making better use of demand response in the NEM represents a low cost and as yet under-developed opportunity to maintain

¹⁸ Roderick Campbell, "Submission to AEMC 5 Min Settlement Rule" (The Australia Institute, June 24, 2016), p.1.

¹⁹ Kieran Donoghue, "Five Minute Settlement (ERC0201)" (Australian Energy Council, June 16, 2016), p.2.

²⁰ "Australia's 2030 Climate Change Target," *Department of the Environment and Energy*, 2015, <http://www.environment.gov.au/climate-change/publications/factsheet-australias-2030-climate-change-target>.

reliability.’²¹ The Finkel Review also acknowledged that this approach will be faster and cheaper than the business-as-usual proposals from South Australia and the Federal Government, to build a gas peaking plant and upgrade Snowy Mountains Hydro, respectively.

“USING DEMAND RESPONSE TO INCENTIVISE CONSUMERS TO REDUCE THEIR DEMAND AT PEAK TIMES IS OFTEN CHEAPER, AND FASTER TO IMPLEMENT, THAN BUILDING NEW GENERATION AND NETWORKS TO MEET THE PEAK.” – FINKEL REVIEW, FINAL REPORT²²

The Finkel Review was optimistic about the inevitable transition from synchronous, baseload coal generation to non-synchronous, variable, renewables. As the *Preliminary Report* stated, ‘The transition presents challenges but also opportunities.’²³

The Finkel Review made clear that aggregated demand response and related models are ready. It explained that third party agents or aggregators can ‘form virtual power plants’.²⁴ The *Preliminary Report* cited the lead taken in the US, where the Federal Energy Regulatory Commission has proposed changes to the rules in order to:

“...REQUIRE MARKET OPERATORS TO REVISE THEIR ELECTRICITY TARIFFS IN ORDER TO BETTER ACCOMMODATE THE PARTICIPATION OF BATTERY STORAGE SYSTEMS AND ALLOW DISTRIBUTED ENERGY RESOURCE AGGREGATORS TO PARTICIPATE IN THE MARKET.” – FINKEL REVIEW, PRELIMINARY REPORT²⁵

The *Preliminary Report* framed technologies and reforms in terms of an ‘energy trilemma’. This is the notion that there is a tension and thus a trade-off between three competing objectives: price, security and emissions reduction.

The Australia Institute proposes that while the energy trilemma is a very powerful model to explain the scenario options we face, aggregated demand response is one technological option that can achieve all three electricity objectives at once:

- lower bills for consumers
- increased security and reliability for all users and generators
- less greenhouse gas emissions, for the good of everyone and the planet

²¹ Alan Finkel et al., “Independent Review into the Future Security of the National Electricity Market: Blueprint for the Future” (Department of the Environment and Energy, June 2017), p.101.

²² Ibid. p.146.

²³ “Preliminary Report of the Independent Review into the Future Security of the National Electricity Market” (Commonwealth of Australia, 2016), p.7.

²⁴ Ibid., p.14

²⁵ Ibid, p.15.

It is very desirable for governments to dismantle regulatory protection in the National Electricity Market that thwarts technological progress. If increased competition allows aggregated demand response to be deployed before the next summer, without requiring billions of dollars of government funding, that should be attractive across the political spectrum.

Aggregated demand response

WHAT AGGREGATED DEMAND RESPONSE DOES

At its simplest, aggregated demand response is the management of consumer demand in order to stabilise the balance between supply and demand in the grid. It allows consumers to reduce their demand when there is a relative shortage of supply. This reduces peak demand loads, saving participants on their bill plus delivering them a payment for participating. Large aggregated demand response programs can avoid expensive equipment and transmission investment thus lowering total system costs.

The photograph below (Figure 1) shows an early aggregated demand response device from France. The *Récepteur de télécommande* (or ‘remote control receiver’) was a device deployed by the state-owned energy utility Électricité de France more than fifty years ago. This type was installed in households and turned electric hot water and heating systems off or down.

Figure 1 : A French Récepteur de télécommande



Source: Anthony Kitchener

In return for handing control of heating and hot water over to the utility, French electricity consumers would get rewarded with a lower tariff.

The tariff switching signal was sent down the same wires that carried the power used by the consumer. This ‘ripple control’ system did not require extra poles and wires nor any modern solution like Wi-Fi or 3G telephony. This outdated by elegant engineering solution should encourage regulators in Australia – there is no basis for rejecting aggregated demand response on any argument to do with technological maturity or risk.

France has famously championed nuclear power which, like coal, is a relatively inflexible generation source and in this regard not well suited to the fluctuating demand profile of contemporary advanced economies. So-called ‘baseload’ generators need a relatively consistent demand from consumers.

In order to match demand and supply when supply is inflexible, utilities outside France also offered subsidies to consumers to artificially change their demand profile.

Australia did not deploy the French remote control receiver. We had another engineering and regulatory fix for the inflexibility of baseload. Utilities paid households to soak up excess electricity generated at night and use it for heating hot water. The large “off peak” electric hot water tanks in our homes are *de facto* batteries, storing unwanted coal-fired electricity as heat. (The wholesale price of electricity during the night can even be negative, as a result of the inflexibility of coal-fired power.)

Today’s aggregated demand response is vastly more sophisticated. It fits perfectly with the emerging industry model of millions of decentralised ‘prosumers’ (producer-consumers), such as the 1.6 million Australian homes with solar PV. Australia and the world is at the start of a boom in battery storage.²⁶ If properly managed, it can enable lower prices and improved security, through systems such as aggregated demand response.

Australia needs to use these innovations, not to prop up baseload coal, but to give the system operator Australian Energy Market Operator, the highest level of control over system security and to also maximise efficiency, as we transition to renewable energy.

In order to provide a practical example, this paper draws on two aggregated demand response systems that are ready to be deployed at scale. The vendors claim they can deploy hundreds of MW, in a matter of months, not years.

²⁶ Dan Cass, “Securing Renewables: How Batteries Solve the Problem of Clean Electricity,” (Canberra: The Australia Institute, May 31, 2016).

One system has been developed by an Australian start-up called Greensync and is already being trialed by the Victorian government. The other system is operated by EnerNOC, the largest independent provider of aggregated demand response in the world.

HOW AGGREGATED DEMAND RESPONSE CAN HELP AUSTRALIA

The International Energy Agency recommends that member countries such as Australia use aggregated demand response, to increase security, lower bills and reduce emissions. According to the Agency, 'demand response technologies can bring more security to the system and contribute to solving stress conditions in the transmission and distribution grids, contributing to security of supply.'²⁷

According to the International Energy Agency, demand response reforms are also crucial for climate policy:

“THE PATH TO DECARBONISATION WILL REQUIRE THE DEPLOYMENT OF NEW TECHNOLOGIES SUCH AS DEMAND RESPONSE. THESE TECHNOLOGIES WILL, ON THE ONE HAND, HELP THE SYSTEM TO BE REACTIVE TO THE VARIABILITY OF WIND AND SOLAR POWER, AND THEREFORE SUPPORT THEIR INTEGRATION, AND ON THE OTHER ALSO EMPOWER THE FINAL CONSUMER TO BENEFIT FROM THEIR FLEXIBILITY.” - INTERNATIONAL ENERGY AGENCY²⁸

EnerNOC made a submission to the Finkel Review which details the features and benefits of its technology and aggregated demand response in general. One of the fascinating features of the model is that the aggregator manages risk for its customers and the grid operator. An energy user would be loath to promise they can deliver the energy savings to prevent a grid emergency, because if their equipment failed on the day, they would be blamed and potentially financially liable. An aggregator can procure an excess of customers and use testing to know with a high degree of certainty exactly how much demand response they can promise to supply. They would offer a 'no risk' contract to the consumers.

The aggregator can also reduce risk for the system operator. For example, an aggregator may have 50MW of customers who are extremely likely to be able to deliver and then 50MW who are quite likely. The company could offer a guarantee of

²⁷ “Re-Powering Markets: Market Design and Regulation during the Transition to Low-Carbon Power Systems.”, p.156

²⁸ Ibid, p.172.

40MW of demand response to a reliability market (such as AEMO's Reliability and Emergency Reserve Trader Mechanism).²⁹ The excess capacity (up to 60 MW) could then be sold into the market purely as an economic demand response, competing against expensive peak wholesale electricity prices.

The EnerNOC submission explains how consumers can help lower network demand through changes to their consumption:

- 1 Forgoing the consumption they otherwise had planned – e.g. dimming lights, or turning off water features at a swimming pool
- 2 Delaying consumption – e.g. interrupting production at a factory by bringing forward a maintenance outage, or simply stopping production and catching up by extending a shift at a later date.
- 3 Bringing consumption forward – e.g. pre-cooling a cold store to the bottom end of its acceptable temperature range, so that it can withstand an extended period without cooling.³⁰

It is notable that these are all measures that improve the efficiency of energy use although only the first example reduces net energy used, the second and third examples simply shift when energy is used. In all these cases, they are 'no regrets' in that they do not sacrifice an essential energy service. Like the French *Récepteur de télécommande* and the Australian off-peak hot water systems, these changes would often be invisible to the consumer.

For example, imagine a cold store business that has connected its refrigeration plant to an aggregated demand response system in order to generate additional revenue. The business is already paying for the cooling system through its revenue as a cool store. The aggregator pays for the controller system and software which allows the plant to operate as a demand response facility that can bring forward energy consumption (case 3 above).

In this example, the chops and bananas and other foods need to be at or below 5C in order that all remain safe for human consumption and above 0C in order that none of them are spoiled by freezing. A heatwave is forecast for the next day and the Australian Energy Market Operator predicts that demand will outstrip supply in the hot afternoon when everyone turns on air-conditioning.

²⁹ AEMO, "Reliability and Emergency Reserve Trader (RERT) Request For Expressions Of Interest," *Australian Energy Market Operator*, accessed July 3, 2017, <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Emergency-Management/RERT-panel-expressions-of-interest>.

³⁰ EnerNOC, "EnerNOC Submission - National Electricity Market Review" (EnerNOC, March 1, 2017), p.4.

The aggregated demand response system will then take control of the refrigeration thermostat and takes the cold store down to 0C the night before the heatwave. The fridges can then be turned off for several critical half-hour periods during the hottest part of the day, until the fridge temperature creeps up to 5C, when it turns on again, to safeguard the food.

This reduction in peak daytime demand could coincide with prices being up at the regulated Market Price Cap, which is \$14,000/MWh for 2016-17.³¹ Part of that cost saving is passed on to the owner of the cold store, who is being paid for participating in the virtual power plant. The rest of the saving is kept by the aggregated demand response system operator, to pay for building and operating the virtual plant. When the food is eventually distributed to shops and purchased by consumers, they will never know that their chops and bananas have helped prevent a blackout.

Modern aggregated demand response uses controller circuits that communicate with the cloud-based management system. These are sometimes already installed in consumer equipment by the manufacturers, such as under Australia's Demand Response Enabling Device standard.³² Many air conditioners in Australian homes and business have these circuits built in by the manufacturer and are sitting there, waiting to be used. Devices that do not have this capability can be modified safely with third-party, computerised controllers.

Unlike the French system which sent an analogue signal down the power lines, contemporary aggregated demand response uses cloud software. This has added benefits of collecting vast amounts of valuable data. This can be used by consumers to help increase energy efficiency, by manufacturers to improve reliability of the energy consuming devices and by Australian Energy Market Operator, to better understand demand and thus manage the network securely and efficiently.

The installation of controllers and integration into the aggregated demand response software and Australian Energy Market Operator dispatch system is complex. But it is far less capital intensive and far faster than building billion dollar power stations and upgrading transmission networks.

Aggregated demand response can be thought of as a clever asset recycling maneuver, repurposing existing infrastructure, rather than building new infrastructure. The cold

³¹ AEMC, "AEMC Publishes the Schedule of Reliability Settings for 2016-17," *Australian Energy Market Commission*, February 18, 2016, <http://www.aemc.gov.au/News-Center/What-s-New/Announcements/AEMC-publishes-the-Schedule-of-Reliability-Set-%284%29>.

³² Commonwealth of Australia, "Energy Efficiency and Peak Load Reduction the Work of DCCEE and Equipment Energy Efficiency (E3) Program" (Department of Climate Change and Energy Efficiency, August 2011).

store fridge that is turned up and down is providing an additional service as a virtual power plant, in addition to its original purpose - to keep the bananas and chops cold.

Gas prices in Australia are relatively high and rising. This makes the price of gas fired electricity, such as in the South Australia plan, is both expensive now and uncertain in the future. The cost of turning off loads through aggregated demand response is basically zero. A largely automated cloud based software system responds to Australian Energy Market Operator instructions and the dispatch would be handled in the market just like generation bids are. This means that in addition to having a capital cost advantage over gas peakers, aggregated demand response also wins on short-run marginal cost.

It is important to note that the previous example of aggregated demand response depicted one aspect of the service, the wholesale economic service. Once an aggregated demand response system is in place and tested for safety and reliability, it should be allowed to bid into the energy market for all the diverse and valuable services it can provide, at a price cheaper than the incumbents. EnerNOC proposes four classes of aggregated demand response services (Table 1 below).

Table 1: aggregated demand response services

#	Type of DR	Rationale for employing DR	In the NEM
1	Network DR	DR employed to manage the peak within a geographically distinct transmission or distribution network	Not enough exists; regulatory incentives should be strengthened
2	Reliability DR	DR employed as an emergency lever during supply emergencies, centrally dispatched to avoid involuntary load shedding and rolling blackouts	Does not exist; should be implemented
3	Economic DR	DR employed to avoid buying electricity during times when wholesale spot prices are high	Not enough exists; barriers to participation should be lowered
4	Ancillary Services DR	DR employed to respond very quickly to brief, unexpected imbalances in supply and demand, to return the grid frequency to 50 Hz	Not enough exists; new A/S markets should be created

Source: EnerNOC, “EnerNOC Submission - National Electricity Market Review” (EnerNOC, March 1, 2017), p.4.

AUSTRALIAN INNOVATION

Even before the South Australian blackout, the Victorian government was supporting aggregated demand response. Victoria gave a \$0.5 million grant for a trial by the successful Australian start-up Greensync, on the Mornington Peninsula, with the local distribution network company United Energy.³³ The project will see local commercial and residential consumers encouraged to shift their peak demand and utilise solar PV and battery storage. The cost of these small, distributed energy investments will defer an otherwise necessary investment in expensive capital upgrades to the network, to cope with peak summer demand.

Greensync claims that it is technically feasible for its system to offer 300 MW of virtual power, through aggregated demand response, by next summer.³⁴ Reposit, another Australian startup, is already paying residential customers to use solar and battery systems as a virtual power plant. The company claims that Australian households are signing-up at the rate of about 1 MW a month.

Greensync is also trialling another model with other Australian startups, which challenges the traditional National Electricity Market and points to the vast potential of aggregated demand response. Greensync is working with Reposit and the innovative retailer Mojo Power and two networks, United Energy and ACT's ActewAGL, to run deX, a second energy marketplace adjacent to the National Electricity Market.³⁵ It will provide distributed energy 'producer-consumers' and third parties with a platform to trade and manage energy. The R&D funding for this project is provided by the Australian Renewable Energy Agency.

If residential prosumers with solar PV and batteries were paid the market rates for the power they supply through aggregated demand response, it would be a huge windfall for them. For example, in Melbourne solar homeowners receive about \$0.10/kWh when they export to the grid (the rate is lower elsewhere). When wholesale electricity meets the Market Price Cap, the price of electricity is \$14.00/kWh, a 140-fold increase over the price that retailers pay solar homeowners.

Reposit is already enabling payments to its residential battery customers of \$1/kWh for providing energy back to the grid when security in the local distribution network is

³³ "Greensync Partners with United Energy for Landmark Asset Deferral Project," *Greensync*, August 16, 2016, <http://www.greensync.com.au/greensync-partners-with-united-energy-for-landmark-asset-deferral-project/>.

³⁴ Ben Potter, "Greensync Joins Energy Bidding War," *Australian Financial Review*, March 14, 2017, <http://www.afr.com/news/greensync-joins-energy-bidding-war-20170313-guwz2y>.

³⁵ ARENA, "Decentralised Energy Exchange (DeX)," *Australian Renewable Energy Agency*, accessed March 23, 2017, <https://arena.gov.au/project/decentralised-energy-exchange-dex/>.

at risk.³⁶ The technology can also be financed by electricity distribution companies, for helping to prop up local security and avoiding gold plating of the network.

Aggregated demand response is just one, simple step in moving to a more energy efficient electricity sector. Broader energy efficiency measures have the potential to transform our energy sector and Australia's emissions profile. Dr Alan Pears AM details the whole efficiency issue in his submission to the Finkel Review. As Pears says, 'Energy efficiency is core to energy and energy market policy: it drives the amount, timing and quality of the energy required'.³⁷ Pears points out that many energy efficiency improvements have negative cost, they are profitable for the investor as well as beneficial for the society.

³⁶ Ben Potter, "GreenSync Co-Opts Solar Households to Avert Blackouts," *Australian Financial Review*, February 22, 2017, <http://www.afr.com/news/greensync-coopts-solar-households-to-avert-blackouts-20170220-guh85t>.

³⁷ Pears, "Submission to NEM Security Review."

Conclusion

We agree with the International Energy Agency, which stated that, ‘Looking ahead, demand response technologies have the potential to become a game changer for electricity markets.’³⁸

Aggregated demand response would allow the Australian Energy Market Operator to dispatch energy conservation as a critical resource for grid stability. This is more cost effective and faster than building new generators. If it is allowed to compete for a variety of services – security, peak price curtailment, avoided network investment and frequency control – this will provide the incentive for more to be developed, helping lower prices and increase security.

The Council of Australian Governments has been considering these issues for fifteen years. The 2002 Council of Australian Governments Independent Review of Energy Market Directions (‘Parer Review’) recommended that negawatts should be allowed to compete with megawatts:

THE NEM MECHANISM SHOULD BE AMENDED TO INCLUDE A DEMAND REDUCTION BIDDING OPTION THAT WOULD ENABLE LOAD REDUCTION TO BE BID INTO THE NEM FOR DISPATCH AND PAYMENT IN COMPETITION WITH GENERATION OFFERED INTO THE MARKET TO MEET DEMAND. - PARER REVIEW, 2002³⁹

This was not implemented.

Then in 2012 COAG tried again, with a lengthy ‘Power of Choice’ process, which also stalled before delivering on its potential. Luckily the Finkel Review has recommended a new faith in the emerging capacities of aggregated demand response and related systems. This will hopefully unblock the regulatory and political processes.

The COAG Energy Council has to stop delegating and start governing in the national interest. The Council should push the Australian Energy Market Commission, the Australian Energy Market Operator and Australian Energy Regulator to rapidly implement and properly regulate the opening up of energy markets, including wholesale energy aggregated demand response.

³⁸ “Re-Powering Markets: Market Design and Regulation during the Transition to Low-Carbon Power Systems.”, p.156

³⁹ Council of Australian Governments and Energy Market Review, “Towards a Truly National and Efficient Energy Market” (Canberra: Commonwealth of Australia, 2002), p.54.

Some of these rule changes, such as the Five Minute Settlement Rule, are ready and waiting. Others will require some effort, but it is worth the effort if south eastern Australia are to avoid brownouts or blackouts this summer in South Australia, Victoria and New South Wales, at the lowest cost.

Australia's energy and climate policy has been held hostage by toxic politics for a decade, but there is cause to be optimistic. Changing the rules to enable competition is a zero cost and zero risk proposal, both politically and economically. It simply lets new technology and competition do all the work to help build a more reliable and cheaper electricity market.

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