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discussion paper

# AVOIDING GRIDLOCK: POLICY DIRECTIONS FOR AUSTRALIA'S ELECTRICITY SYSTEM



BY ALEXANDER MARKS

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ACN: 124 425 896

ABN: 82124 425 896

## AUTHOR

### Alexander Marks

Alexander Marks is a recipient of CPD's 2016 Postgraduate Studentship in the Sustainable Economy program. He is a sustainability and international development professional. He has ten years of experience in natural resources governance, including six years on the Australian Government's aid program. Alexander has previously worked in social enterprise in East Africa and as an environmental engineer in Australia. Alexander has a Masters in Science in Environmental Change & Management from the University of Oxford, and a Bachelor of Engineering and Bachelor of Arts from the University of Adelaide. This paper has built off his postgraduate research project with the Sustainable Finance Programme at the University of Oxford's Smith School of Environment and Enterprise. Since completing this paper Alexander has become a policy adviser to the Victorian Greens in the Parliament of Victoria, and joined the Advisory Board of Allume Energy, a solar energy start-up.

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## Glossary of Terms

Behind-the-meter	Services provided behind the meter in a residence or business. For example: switching off air conditioners when the price of electricity is high in order to reduce the electricity bill. Traditionally the domain of the electricity industry ended at the meter; this is changing with innovation in technology and business models.
Depreciated Optimised Replacement Cost (DORC)	An accounting term: the cost of replacing equipment in its entirety with new equipment.
Energy storage	Technologies that allow the storage of electrical charge that can be released on demand. At the household scale it is typically lithium-ion battery technology (similar to what powers mobile phones and laptop computers), although there is a whole host of technologies under development.
National Electricity Market (NEM)	The electricity market and associated grid covering most or all of the states of Queensland, New South Wales, Victoria, Tasmania and South Australia, and the Australian Capital Territory.
Network Service Provider	A business that owns, maintains and operates high voltage transmission powerlines and/or lower voltage distribution grids, and all associated ancillary infrastructure.
Photovoltaic solar panel	Converts sunlight directly into direct current electricity. In residences they are mounted on rooves to maximise exposure to sunlight.
Regulated Asset Base (RAB)	The value of the transmission and/or distribution infrastructure (i.e. the poles and wires and substations) owned by a Network Service Provider. The value of an RAB is one of the inputs that determine the tariffs charged by a Network Service Provider, such that the methodology used to determine an RAB is critical to energy pricing.
Ring-fencing	A regulatory barrier, between the regulated monopoly and deregulated competitive service providers owned by the same entity, to prevent anti-competitive behaviour.

## Executive Summary

Australia's national energy landscape has been transformed since the creation of the National Electricity Market two decades ago. The rapid uptake of renewable technology and leaps forward in energy efficiency and storage have been game changers for generators, distributors, retailers and consumers of electricity. If harnessed effectively, these changes can move us closer to the sustainable energy system we need to power a decarbonised Australian economy in the 21<sup>st</sup> century. But this will only happen if the way we regulate electricity markets keeps pace. This paper argues that an updated approach to regulation of energy distribution networks is especially vital.

Retail prices for electricity have nearly doubled since 2007. This has increased the cost of living, disproportionately impacting poorer households. It has also increased the cost of doing business for companies, harming the competitiveness and productivity of the Australian economy. The greatest source of this increase in prices has been higher network charges for the construction and maintenance of distribution assets - the poles, wires and other 'grid' infrastructure that sit between the large-scale producers of energy (generators) and the companies that connect houses and businesses (retailers).

**If harnessed effectively, these changes can move us closer to the sustainable energy system we need to power a decarbonised Australian economy in the 21<sup>st</sup> century.**

In parallel, the price of photovoltaic solar panels mounted on the roof tops of houses to provide an alternative electricity supply system has decreased rapidly. The total capacity of this form of distributed energy generation soared from a negligible amount in 2009 to over four gigawatts by the end of 2014. This is equivalent to 9 per cent of the capacity of large generators in the National Electricity Market (NEM).

These factors, combined with mandated improvements to the energy efficiency of household appliances, have had major impacts on the energy landscape. The total amount of energy consumed from the grid, despite extensive investment in the grid itself, has declined 7 per cent since its peak in 2008-09. In other words, while the fixed costs of grid services have risen, the total volume of electricity through which the distributors can recoup these costs has fallen significantly. This leads to higher tariffs for each unit of electricity consumed.

This creates a positive feedback loop. As retail prices rise, more households will reduce energy consumption by using rooftop solar, battery storage and other technologies, or defect from the grid altogether. This drives prices yet higher, increasing incentives for yet more households to follow suit. This is known as the 'Death Spiral' phenomenon. As this cycle takes hold, energy distribution assets price themselves out of the energy provision market. These assets become 'stranded' or unable to earn an economic return.

Energy security has recently been the focus of media commentary due to a state-wide blackout in South Australia in September 2016. While much of the focus has been on whether the generation mix of South Australia, with its high wind farm component, is at

all culpable in the blackout, the failure of the privatised network assets to withstand the severe storm has received comparatively little attention. The vulnerability of the network during the September event indicates that despite billions of dollars invested by network owners to expand capacity in order to meet forecasts of rising demand that never eventuated, the system is not resilient to extreme weather events. This incident also necessitates an evaluation of how to best prepare electricity networks for a changing climate. Distributed generation and storage throughout cities and towns may reduce dependence on vulnerable transmission networks linking dense consumption centres to distant large generators.

**This paper argues that a new approach to regulating electricity networks is needed to address problems of energy security and improve outcomes for consumers.** As regulated monopolies, electricity networks have controls placed on what infrastructure they can build to link electricity generators to end users, and how much they can charge for it. But as they stand, these regulatory settings are not just inadequate when it comes to addressing the trends and challenges identified above – they are exacerbating them. The restrictions placed on electricity networks have been too loose. Distribution businesses have maximised infrastructure investment to service low frequency but high demand events, leading to high network capacities that are unused most of the time. These investments underpin burgeoning capital valuations and large guaranteed returns. This has led to the overvaluation of network assets and the ensuing rise in tariffs, undermining the longer-term value of the assets themselves. At the same time, regulated monopoly distribution networks have performed poorly when it comes to offering innovative services and flexibility to consumers, as the costly and flawed roll-out of smart meters in Victoria vividly demonstrates.

Changes to the valuation of distribution assets and measures to ensure meaningful competition and better consumer outcomes in ‘behind the meter’ services should be an urgent policy priority. In the face of major technological and environmental change, the incremental approach to regulatory evolution has left us with a system that is no longer fit for purpose. The desire to preserve stability for established incumbents in the marketplace has resulted in baked-in vulnerabilities that are accentuating current challenges and creating a risk of far greater destabilisation in the longer-term. New technologies, services and commercial realities mean that disruption is inevitable. Policy makers need to ensure that the interests of electricity consumers are prioritised as part of a revitalised and updated regulatory approach. This means creating a robust market of new energy services, rather than protecting the monopoly privileges of large incumbents with immense lobbying power.

The Council of Australian Governments’ Energy Council, which comprises Federal, State and Territory Energy Ministers, has commissioned an Independent Review to develop a national reform blueprint to maintain energy security and reliability in the NEM. This review, which will be led by Dr Alan Finkel AO, Australia’s Chief Scientist, will outline national policy, legislative and rule changes required to maintain the security, reliability

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**Changes to the valuation of distribution assets and measures to ensure meaningful competition and better consumer outcomes in ‘behind the meter’ services should be an urgent policy priority.**

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and affordability of the NEM considering transitions taking place in Australia's energy system.

This paper makes the following recommendations to the COAG Energy Council and the Finkel Review:

- Develop regulations to prevent companies that own electricity networks from engaging in behind-the-meter services and other naturally competitive markets, due to the minimal or negative benefit this will provide to consumers and the high risk of uncompetitive behaviour.
- Through a revamp of the National Electricity Law and the National Electricity Objective, direct networks to a focus on whole-of-system resilience in a future of high penetration of distributed renewables and batteries, and the context of a changing climate and more severe weather patterns. This implies a move away from infrastructure investment dedicated to meeting peak demand events. Increasingly the marginal demand during these low-frequency, high demand events can be cost effectively met by distributed generation and storage.
- Restrict the exclusive hold of networks so it only applies to the parts of the electricity system that are core business – that is, the poles and wires. Other parts of the system should be open to competition. Excision of network exclusivity should be the rule rather than the exception.
- Legislate changes to the valuation and treatment of regulated asset bases to reduce network tariffs to reduce the cost burden of electricity bills on Australian homes and businesses.

## Introduction

Electricity distribution grids in Australia have been long regarded as safe, low-risk investments, with a captured customer base, minimal technological disruption and prohibitive barriers to entry by competitors. The electricity distribution system connects big centralised generators to users through extensive and sometimes inefficient transmission and distribution lines throughout the NEM. It is regulated in a way that allows distributors to make extensive investment in infrastructure, with costs fully recouped and profits guaranteed. This is a stable arrangement for distribution companies and their owners, although it has led to sharply higher prices for customers. The centralised distribution network is well suited to coal-heavy centralised generation rather than renewable, sustainable energy sources that are required to underpin a decarbonisation of the Australian economy.

However, solar energy has been a game-changer. Photovoltaic solar panels, installed on the rooftops of residential housing, provide electricity directly to consumers – skipping the poles and wires of the electricity grid and displacing production by fossil-fuel power plants. They are doing so at rapidly diminishing cost. The prices of panels themselves have plummeted over the past seven years. The price of residential and commercial grade battery storage, once so expensive that batteries were the exclusive domain of extremely remote areas beyond the reach of the grid, is trending towards mass viability.

Other technological changes will allow households to carefully tailor their electricity generation and usage. For instance, the ‘Internet of Things’ - where everyday objects have network connectivity that means they can send and receive data - offers the promise of advanced yet simplified demand management and load shifting of connected domestic appliances, placing control of consumption into the hands of the householder. Similarly, decentralised micro-payments facilitated by innovations in digital currencies may ease trading of energy between households, which could become small producer-consumers. In combination, these changes will fundamentally transform how electricity is generated, stored, used and paid for.

This is a complete reversal of the energy system as we have known it, as shown in Figure 1 overleaf. Australia’s NEM was created from its parts when centralised generation and distribution of electricity was the only option for providing reliable, safe and affordable electricity. Now it is cheaper to produce and consume electricity within a household than to pay the retail rate from the grid. Soon it will be cheaper to store excess electricity produced within a household and use it later than to draw the same amount from the grid. This will all be automated with power management software, with user interfaces through smartphones or tablets. It may be possible for communities to become nearly self-reliant, sharing electricity as required with neighbouring communities.

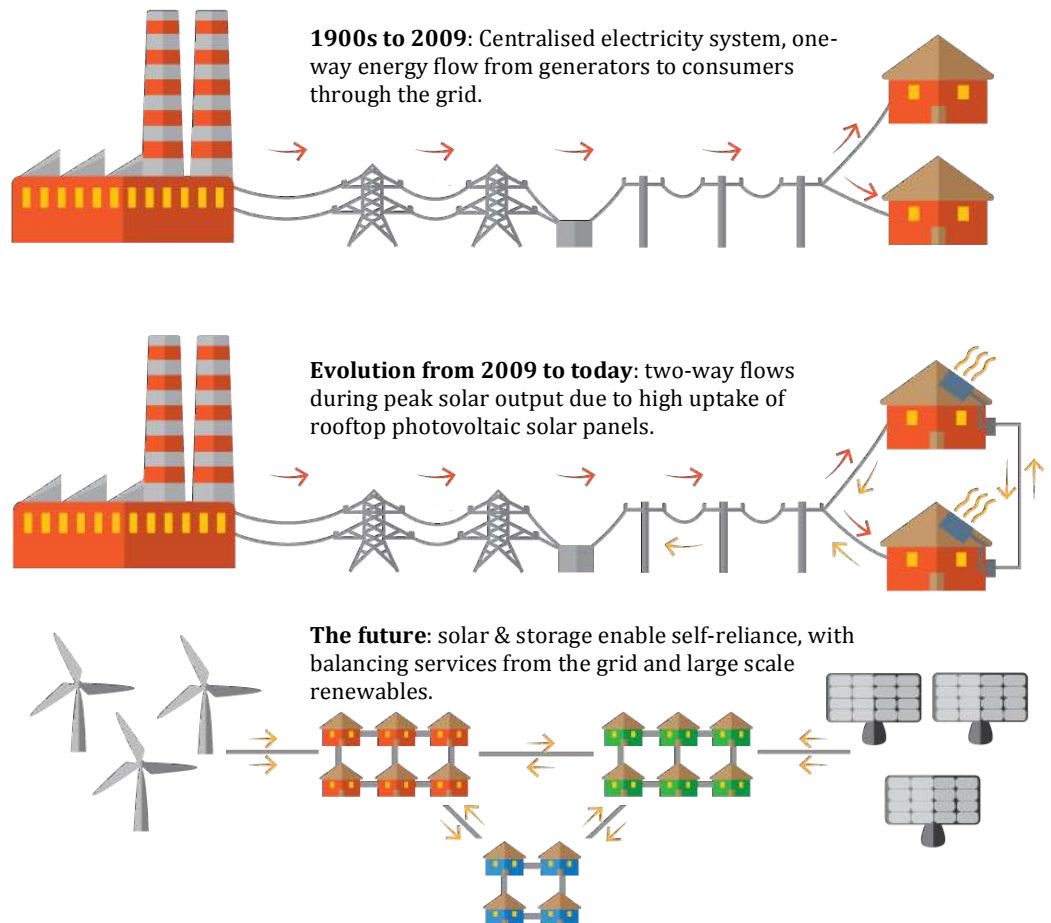
With the right policy settings in place, these changes can deliver a more competitive, efficient and sustainable energy system. The way in which distribution networks are

**In combination, these changes will fundamentally transform how electricity is generated, stored, used and paid for.**

regulated will be key to whether and how this happens – not least because the grid itself will still play a central role in a sustainable energy future, even with these decentralised capacities for generation and storage. There is potential to move toward a more sustainable future that still has large suppliers and consumers connected to a grid, as well as smart aggregated demand and supply from small producer-consumers.

### Figure 1: Evolution of the Australian electricity system

Source: By the author



While technological innovation and price decreases made rooftop solar a possibility for millions of households, the regulatory evolution has been incremental.

Like all technological systems, how it evolves will depend in part on the rules, and the rules are determined by the direction governments and stakeholders set for policy. However, while technological leaps forward have often captured the public imagination, the slow legislative and regulatory evolution in the NEM has received little public attention. While technological innovation and price decreases made rooftop solar a possibility for millions of households, the regulatory evolution has been incremental, with the intention of preserving stability for incumbents, while encroaching disruption continued unabated. Electricity provision is now turning into a highly contested space between distribution companies, generation-retail companies, new energy service providers, public interest advocates and government regulators.

With immense lobbying power, there is a risk that large incumbent players may occupy what should be competitive spaces and block new entrants, to the detriment of market efficiency and customer outcomes. It has happened before, and it could very well happen again, adding to an already complex and challenging environment for policy makers and regulators.

Recent events in South Australia have brought this risk into sharp relief. In July 2016 wholesale electricity prices in South Australia surged to the maximum allowed in the NEM, partly due to a lack of output from that State's windfarms. On 28 September, a state-wide blackout occurred after a major storm cut transmission lines and tripped all the state's grid-scale generators into shutdown mode. These events show the dual challenges of energy policy in a changing climate: the need to ensure energy systems are resilient to more extreme weather scenarios driven by anthropogenic climate change, while adaptive to high levels of integration of grid-scale renewables and distributed renewables necessary to decarbonise the energy system.

After outlining the trends and analysing recent evidence about the adaptability of key players in the industry, this paper suggests high-level policy directions for a more efficient and sustainable energy market centred around the best interests of consumers. This will lead to greater resilience of energy systems with more self-reliance of energy customers and less absolute dependence on the grid.

#### **Outline of this paper**

Chapter 1 of this paper outlines recent trends that are symptomatic of a disruption in the electricity industry. Chapter 2 describes the regulatory and policy underpinnings of Australia's electricity system, and how this has led to challenges facing the sector in the current day. Chapter 3 draws on qualitative research to assess the adaptability of electricity network businesses in an operating context of incursion of rooftop solar and technological innovation. Chapter 4 provides policy prescriptions to optimise outcomes for energy consumers.

## Chapter One: Trends in the Australian Electricity Sector

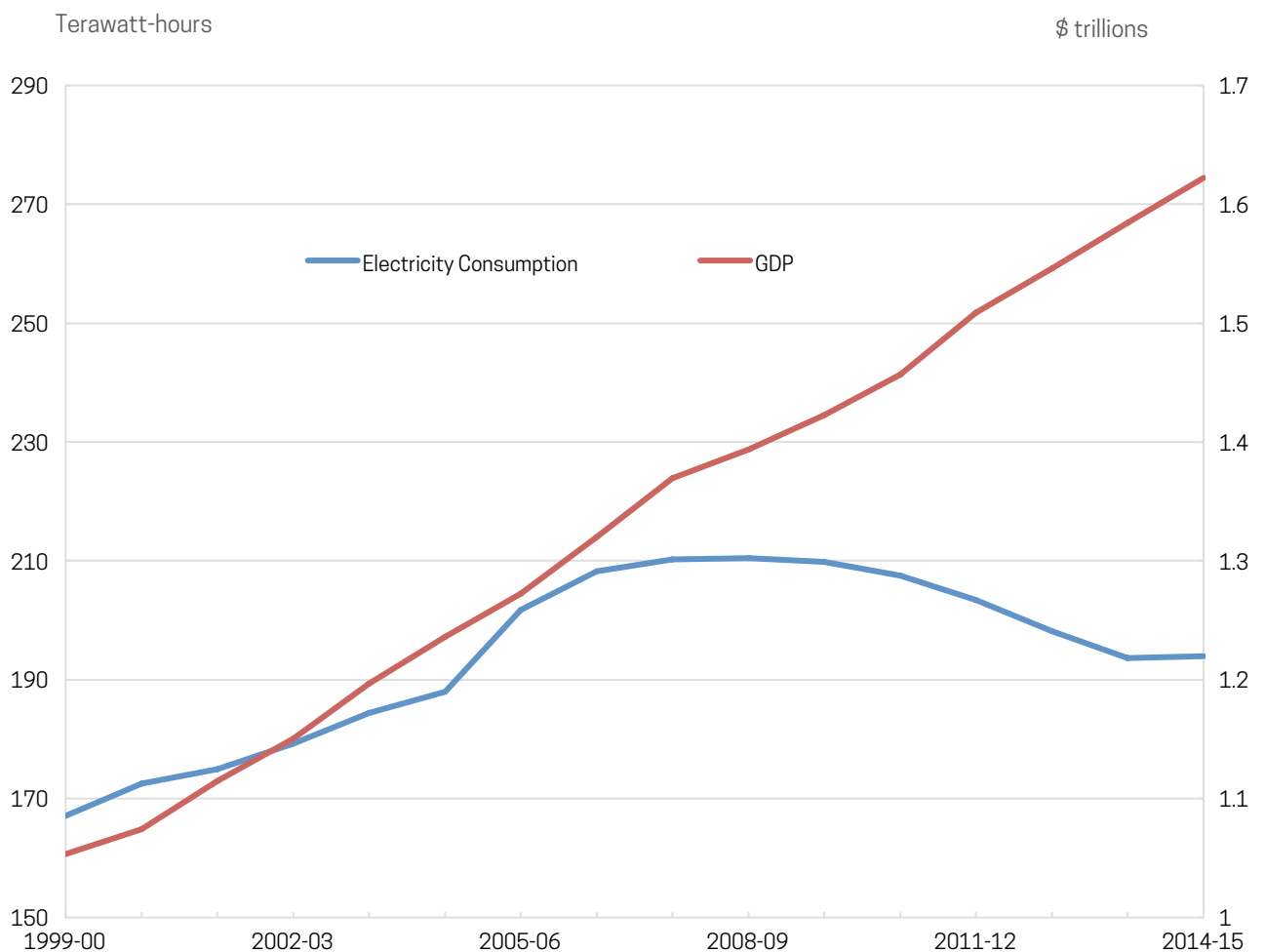
*This chapter discusses the three key trends in the electricity sector: declining electricity consumption, rising retail electricity prices, and declining solar and storage prices. Together, these trends can result in a feedback loop that undermines the value of electricity distribution network assets, with far-reaching consequences for the structure of our energy markets.*

### Declining electricity consumption

Australia is in the middle of its third decade of uninterrupted economic growth. Our economy powered on through the global financial crisis while almost all other OECD countries were mired in recession. But while economic output continued to rise after the GFC, electricity usage did not. Electricity consumed from the grid has decoupled from economic growth. In every year since 2010 the quantity of electricity consumed from the grid each year has been less than the year before (with a plateauing in 2014-15, mainly due to increased demand from liquefied natural gas processing in the state of Queensland).

### Figure 2: Grid electricity consumption and gross domestic product

Source: (AER 2016a; ABS 2016)



The decrease in electricity supplied from the grid in Australia from 2008-09 onwards has been attributed to the following major factors (Saddler 2013; AEMO 2014):

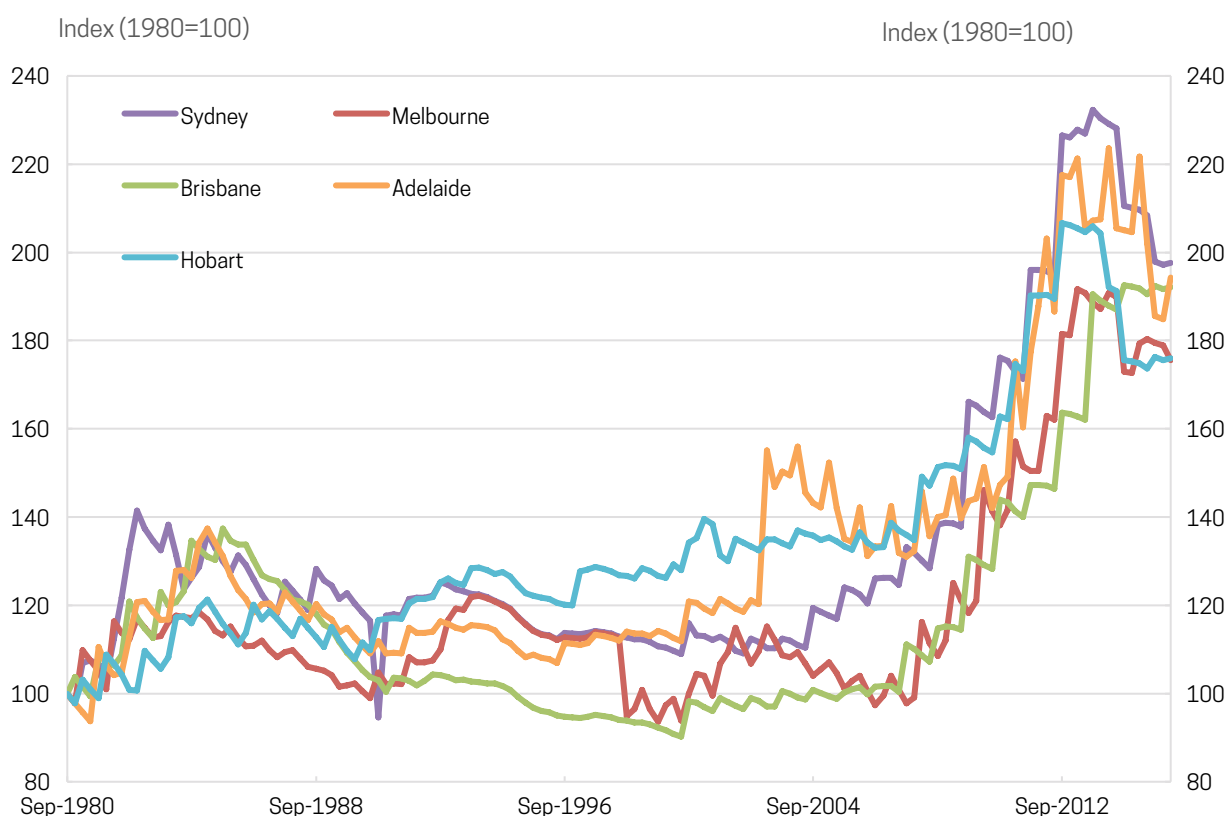
- Energy efficiency programs (37 per cent)
- Industrial closures (10 per cent), and reduced growth in remaining large users, particularly aluminium smelters (14 per cent)
- Consumer response to increased retail prices (14 per cent)
- Rooftop PV (7 per cent), and other forms of distributed generation (5 per cent), and
- “Income effect” due to growth per capita slowing due to adverse global economic conditions (4 per cent), and now deteriorating domestic conditions.

## Rising retail prices

Retail electricity prices across Australia nearly doubled between 2007 and 2013, as shown in Figure 3. The decline in 2014 was due to stricter standards applied by regulators to network distribution costs following the rapid increase in prices.

**Figure 3: Price of electricity in Australian cities, CPI adjusted, 1980-2014**

Source: CME 2015.



By 2014 the largest single component of the typical electricity bill in Australia were the combined network charges for transmission (8 per cent) and distribution (35 per cent). The electricity itself (purchased on the wholesale market or through contracts for supply) comprised 30 per cent of the bill, and retail costs comprised 13 per cent. Other costs, including those imposed by the carbon price (since repealed) and Australia’s Renewable Energy Target came to 14 per cent of the bill.

**Table 1: Electricity bill breakdown by component**

Source: Wood, Carter & Harrison 2014

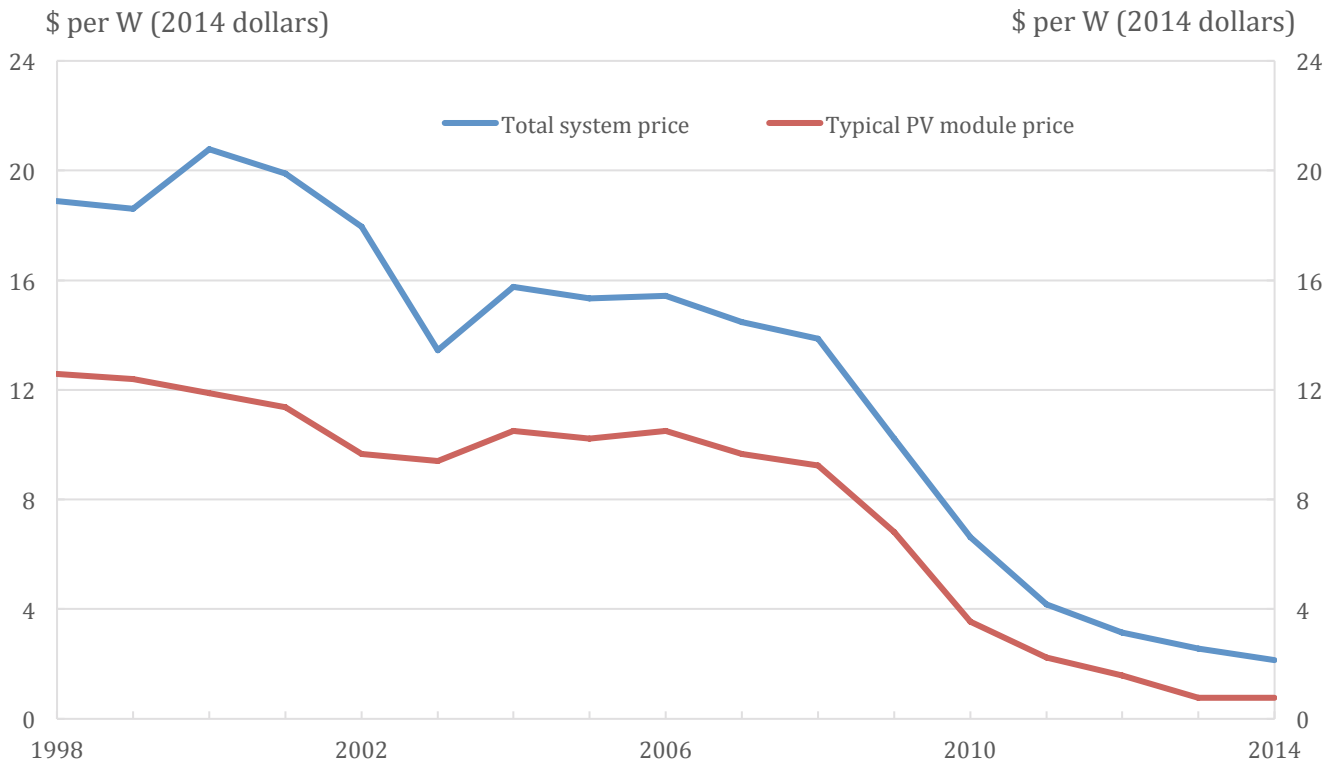
Generation	\$505	30%
Transmission	\$135	8%
Distribution	\$583	35%
Retail	\$208	13%
Other	\$230	14%

**Decreasing solar and storage prices**

Over the same period as the sharp increase in retail electricity prices, the installation price of solar PV dropped dramatically (Figure 4). This has been attributable to three main factors: appreciation of the Australian dollar, sharp reductions in the price of solar panels manufactured in China, and greater competition among system installers (Mountain & Szuster 2014).

**Figure 4: Price of rooftop solar in Australia**

Source: APVI 2015.



Storage assists rooftop solar by allowing excess energy generated during the day to be used when solar generation tails off (i.e. in the late afternoon and evening). Lithium-ion batteries, which are the storage technology of choice for modern electric vehicles, display the greatest potential for household-level distributed storage. Their cost is decreasing with a large ramp-up of global production. There are numerous branded residential storage systems already available in Australia, albeit with price points from \$15,000 to \$20,000.

The total installed volume of distributed storage in Australia remains relatively low. However, this is expected to change very quickly with decreasing price and innovative business models, making it accessible to a large share of the residential and commercial sector. Morgan Stanley predicts there will be one million residential battery storage systems installed by 2020 in a moderate scenario. If realised, this would represent 1 in every 8 households in Australia (Parkinson 2016).

### The 'death spiral'

The combination of increasing retail power prices and decreasing cost of PV and battery storage raises the prospect of further decreases in consumption from the grid. With reduced consumption, the fixed cost of electricity supply per unit of energy delivered increases. This is known as the 'smear'. This raises the retail price of electricity for the customers that remain, driving yet more households to both reduce overall consumption and install distributed generation and storage to supplant consumption from the grid. This again reduces the units over which to smear fixed costs, creating further reductions in consumption, and so on (Sandiford 2014; Caperton & Hernandez 2013; Sonnreich 2014).

This positive feedback loop can lead to financial stranding of network assets. Stranded assets are defined as assets that suffer from unanticipated or premature write-downs, devaluations or conversion to liabilities (Caldecott, Tilbury & Ma 2013). In the Australian scenario, perfectly good poles, wires and substations that were built at great expense lose their value due to markets or technological evolution, and the debt incurred to build them remains. This phenomenon is known as the "death spiral" (Kind 2013).

The death spiral scenario is far from desirable. If electricity assets are stranded, the financial losses involved could send the balance sheets of Network Service Providers (NSPs) deep into the red, driving them towards bankruptcy. It will reduce their capacity to be the backbone of a new energy future. These incumbent NSPs are less likely to be a constructive force if they are laden with stranded assets. Seeking to extend the economic life of generation and network infrastructure, they will apply active pressure on governments to preserve some core areas of the electricity provision as their exclusive domain, reducing customer choice and innovation in the sector.

Furthermore, the energy users that can least afford to determine their own energy futures in a disintegrated grid will be those with the least financial means – the less well-off and the elderly. If forced to remain wholly reliant on the grid, they will be penalised by rising tariffs as more of their fellow citizens reduce consumption or defect. The result will be socially inequitable: those with the least means will be paying more towards the cost of a once-essential infrastructure that was built for all.

Government intervention to stave off the ill effects of a death spiral scenario is inevitable to provide energy security and preserve investor confidence in privatised utilities. If the intervention is early enough to nudge the electricity system to sustainably accommodate technological upheaval, then all stakeholders may benefit.

## Chapter Two: How did the National Electricity Market get to this point?

*This chapter examines the origin, evolution and regulatory underpinnings of Australia's NEM. It then considers the policy interactions between support for solar and energy efficiency and the 'death spiral' dynamic that creates tipping points for mass defection from the electricity grid.*

### Origins of the NEM

The NEM was developed through the 1990s by agreements between the Federal Government and the Governments of Queensland, New South Wales, Victoria, South Australia and the Australian Capital Territory. Tasmania joined on the commissioning of a subsea line across the Bass Strait in 2005. Western Australia and the Northern Territory are not part of the NEM due to remoteness, and have their own self-contained electricity systems.

To create the NEM, the state-owned vertically integrated utilities were disaggregated into different functions of the electricity market. Generation and retail evolved into deregulated competitive markets separated from regulated distribution and transmission. As the electricity market has matured, mergers and acquisitions have occurred in the deregulated markets. This has led to the formation of "gentailers" that operate in both generation and retail markets, three of which - Origin Energy, AGL and EnergyAustralia - dominate wholesale and retail sales in the NEM (Choice 2014).

The NEM has around 200 large generating plants, five transmission networks and 13 major distribution networks that supply electricity to end-use customers. In geographic reach, the NEM is the largest interconnected power system in the world, spanning 4500 kilometres, and one of the least dense. The generation market is hosted by the Australian Energy Market Operator (AEMO), which provides dispatch orders to distribution and transmission businesses.

**Figure 5: The National Electricity Market – extent of transmission network**

Source: AEMO 2016.



## Regulatory framework

The NEM is underpinned by the National Electricity Law, which sets out a National Electricity Objective (Government of South Australia 1996):

*The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for the long-term interests of consumers of electricity with respect to (a) price, quality, safety, reliability and security of supply of electricity; and (b) the reliability, safety and security of the national electricity system.*

As such, the interests of consumers are set as the central objective of Australian energy policy. Omitted from the definition of the interests of consumers, and from the objective or the law more broadly, are environmental concerns such as the reduction of greenhouse gas emissions which cause climate change.

The National Electricity Law also lays the foundation for the regulatory framework governing the valuation of electricity distribution networks by setting out revenue and pricing principles.

## Valuations and pricing of networks

Under this regulatory framework, the bulk of the network's revenues (and therefore the tariffs they can charge) are tied to a guaranteed return on the 'Regulated Asset Base' (RAB) – that is, a valuation of the network assets that distribute electricity. The means by which the RAB and associated allowances are calculated are therefore a key driver of electricity prices and decisions about where and how to invest in grid infrastructure.

From the outset of the NEM, regulators made a determination to value network assets at their 'depreciated optimised replacement cost' (or DORC). Simply put, the DORC at a point in time is the cost of replacing the old network infrastructure in its entirety with new equipment. Under this approach, the new private or public owners of network assets (comprising infrastructure that had been paid for by taxpayers and electricity consumers over decades) were able to set tariffs to service a replacement value as if the original investment infrastructure was worthless and needed to be built wholesale again (Grant 2016). This generous valuation methodology was supplemented with regulatory determinations on revenue allowances that inflated the RABs and their compensated financial maintenance over time.

Grant (2016) divides the history of regulation of revenue allowances into three periods:

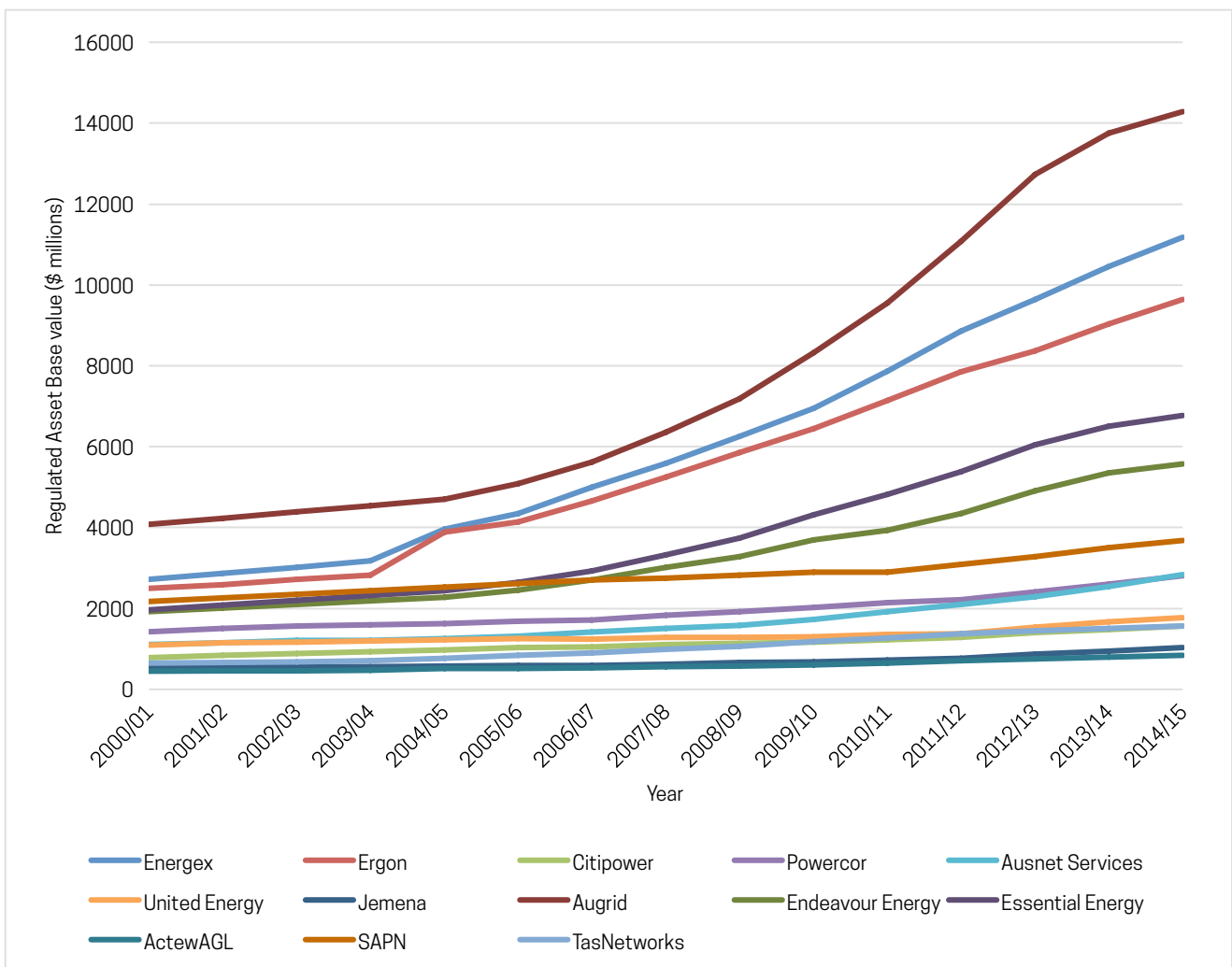
- Pre-2006: The adoption of DORC valuation methodology valued the networks at their cost to replace them in their entirety. To balance this, the regulators had the ability to periodically 'optimise' the ongoing RAB valuations to reflect the minimum value of the assets needed to deliver the required services. This implied excluding the value of excess network capacity from the RAB until such time as it was required.
- 2006-2014: Major changes to the National Electricity Rules further incentivised investment by effectively removing optimisation provisions and ensuring that all future capex would be automatically rolled into the RAB without prudence or efficiency reviews.
- Post-2014: Following pressure from scrutiny by state and federal parliaments and regulatory bodies, the Australian Energy Regulator could conduct reviews of efficiency of networks after the fact in cases where the networks spend above their total capital expenditure allowances.

However, these reviews were subject to contestation by the NSPs in the Australian Competition Tribunal.

The impact of these approaches was to incentivise investment in network assets and capacity that ultimately outstripped demand, but contributed positively to revenue due to the link between RAB valuation and pricing. Figure 6 below highlights the upward trend in the valuation of the RABs of most NSP from 2006.

### Figure 6: Regulated Asset Bases of NSPs in the NEM (\$ millions)

Source: Grant 2016.



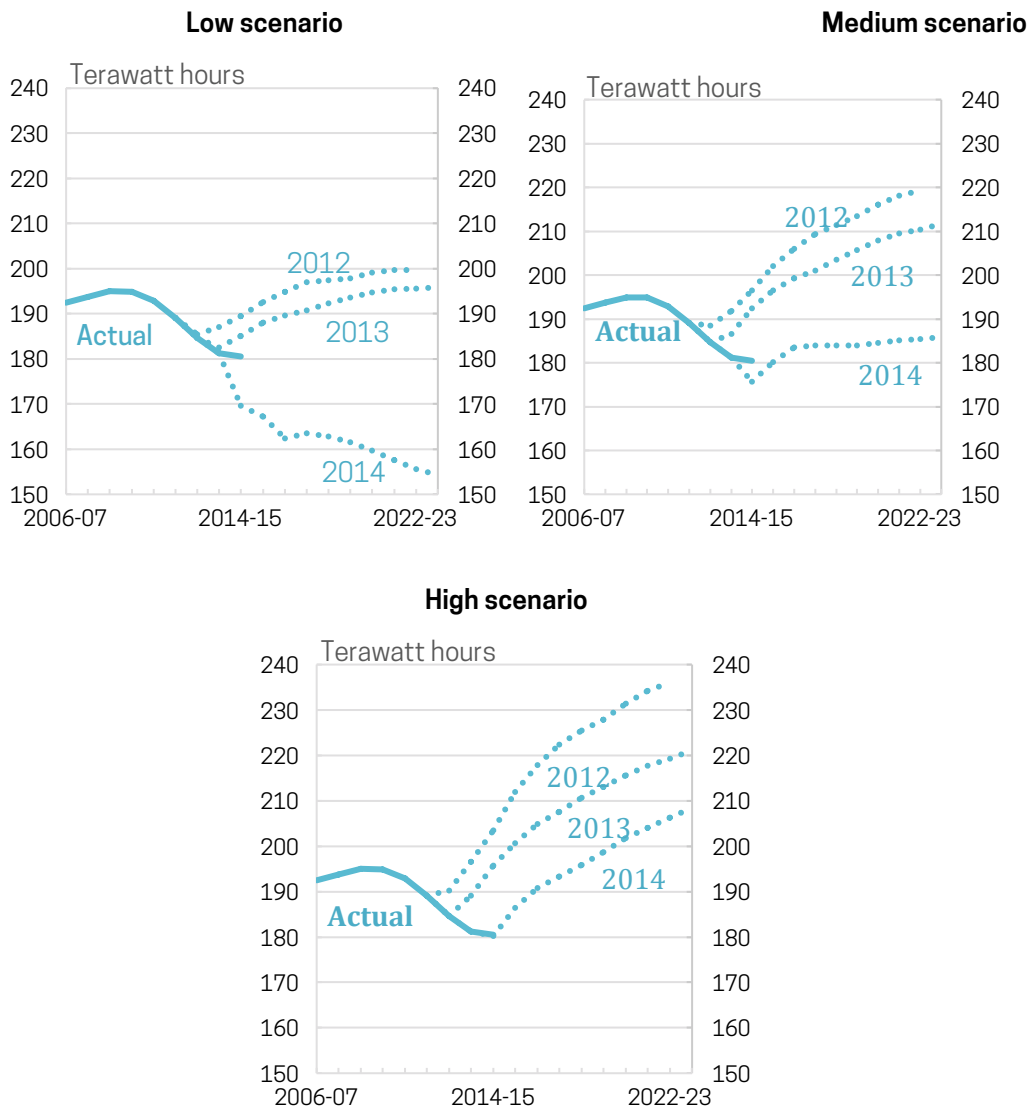
The changes in 2006 came about because NSPs diagnosed a deficit in the capacity of the existing network infrastructure to meet forecast increases in peak demand, in addition to a high maintenance bill due to underinvestment in maintenance over the preceding decade. NSPs lobbied regulators for changes to incentivise investment. The highest peaks in demand typically occur for only a few hours on the hottest summer afternoons, when families switch on air conditioners in addition to other appliances in the house. This high-volume, low-frequency event defined the requirements for the whole grid. Following approval from the Australian Energy Regulator (AER), this led to a significant investment in network infrastructure at a cost of \$86 billion. On some analyses this represents the largest public infrastructure project in the nation's history (Hill 2014a).

To recoup this expansion of the RAB, the AER approved successive increases in the network charges imposed by each NSP. This is what has led to network charges becoming the largest factor in increasing retail prices. Some media reports have claimed that consumption forecasts were deliberately overestimated to maximize the RAB and the regulated return on investment, thereby increasing revenues to state coffers for government-owned NSPs, or to shareholders for private businesses (Hill 2014a, 2014b).

Whatever the driver, the decline in electricity consumption (and peak demand magnitude and frequency) implied the bulk of the investment was ultimately unwarranted, with network assets operating well below capacity. The repeated discrepancy in forecasts by the AEMO to actual consumption are shown in Figure 7. Note that AEMO dispensed with high, medium and low forecasts from 2015, considering the poor performance of these forecasts in preceding years.

**Figure 7: Forecast consumption versus actual consumption in the NEM (low, medium and high scenarios)**

Source: AEMO 2013, 2014, 2015.



## Policy drivers of falling demand

While regulatory decisions were providing incentives for large-scale investment in grid capacity, other policy decisions were supporting changes that contributed to declining demand for electricity from the grid.

Australian households have had access to a range of government-sponsored incentives to install rooftop solar since the year 2000, including Feed-in Tariffs (FiTs), rebates, and emissions abatement credits. This has led to the maturing of the PV installation industry in Australia and the impressive year-on-year increases in installed capacity (Macintosh & Wilkinson 2010). State governments have had a sequence of FiT regimes to further support rooftop solar investment. As FiT programs have expired, the tariffs have dropped from as high as 60 c/kWh to default tariffs of as little as 4 to 6 c/kWh. There is ongoing engagement between solar proponents and state government regulators as to whether the FiT is now too low, and whether it should be increased to reflect the benefits of offsetting consumption from centralised generation, and related network benefits such as reducing the investment needed to augment the electricity grid.

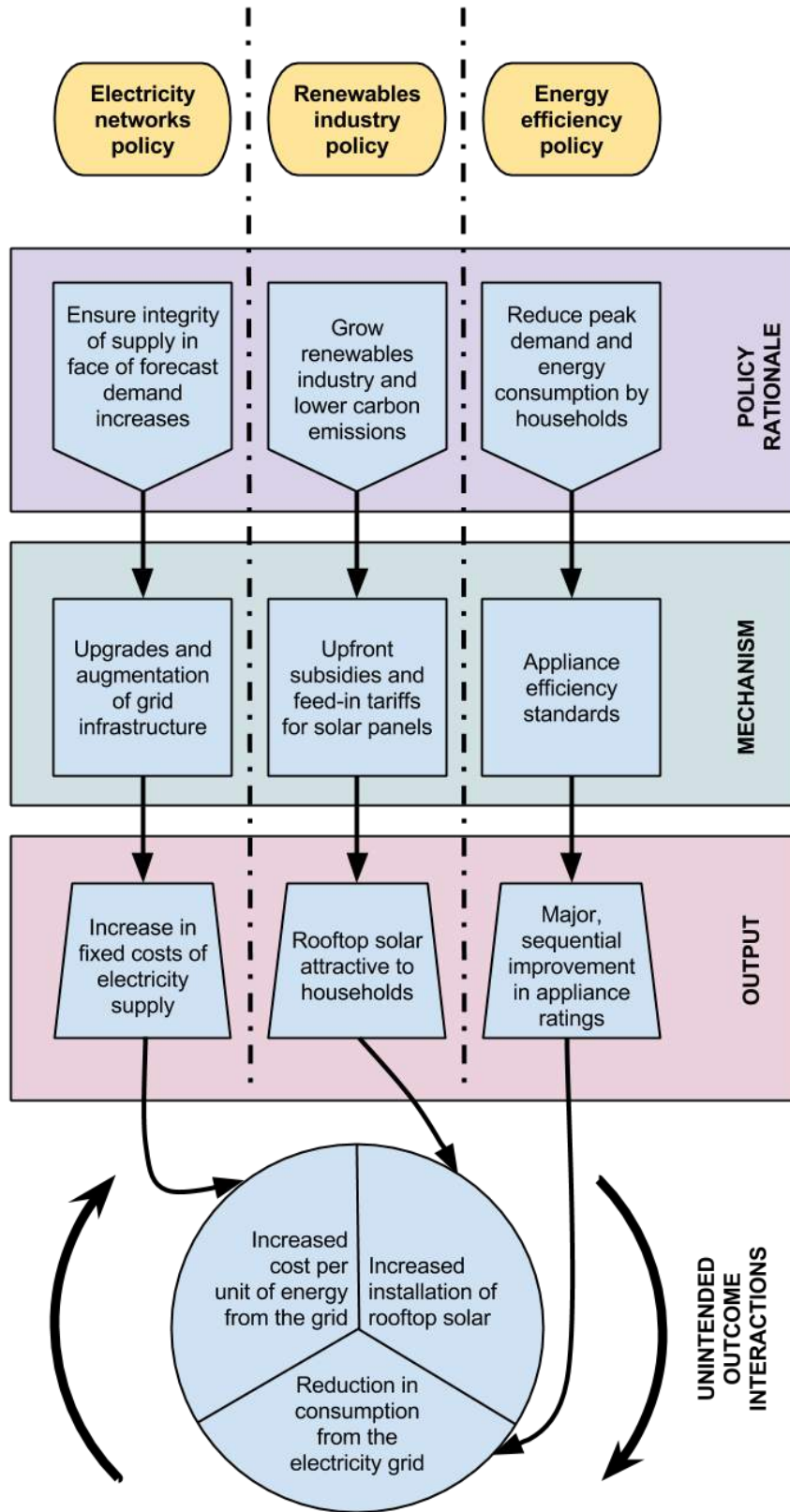
Australia has federal and state policies and laws aimed at **improving the energy efficiency** of household appliances. These include energy rating labelling programs to encourage consumers to select the appliance that uses the least energy while meeting energy service needs. A government-funded review of the program in 2009 estimated that it would reduce electricity consumption per household by up to 28 per cent between 2009 and 2020 as compared to business-as-usual, leading to a reduction in consumption of 22,000 gigawatt-hours per annum (Wilkenfeld 2009). This is equivalent to 12 per cent of forecast demand in 2020 (AEMO 2014). However, a halt to legislating further efficiency improvements based on “reducing red tape” was put in place in 2015, so the impact of energy efficiency may tail off over the current decade (Saddler 2015). Nevertheless, this policy has led to incremental sustained cuts to electricity demand over time, without reducing the amenity of the energy service.

## Policy interactions

These three policies – support for rooftop solar, energy efficiency improvements, and expanded capacity to meet high peak demand – are logical within themselves, yet when implemented in silos have accelerated the positive feedback loop of the death spiral, as shown in Figure 8 overleaf.

**Figure 8: Outcomes of siloed electricity policies in Australia**

Source: Author.



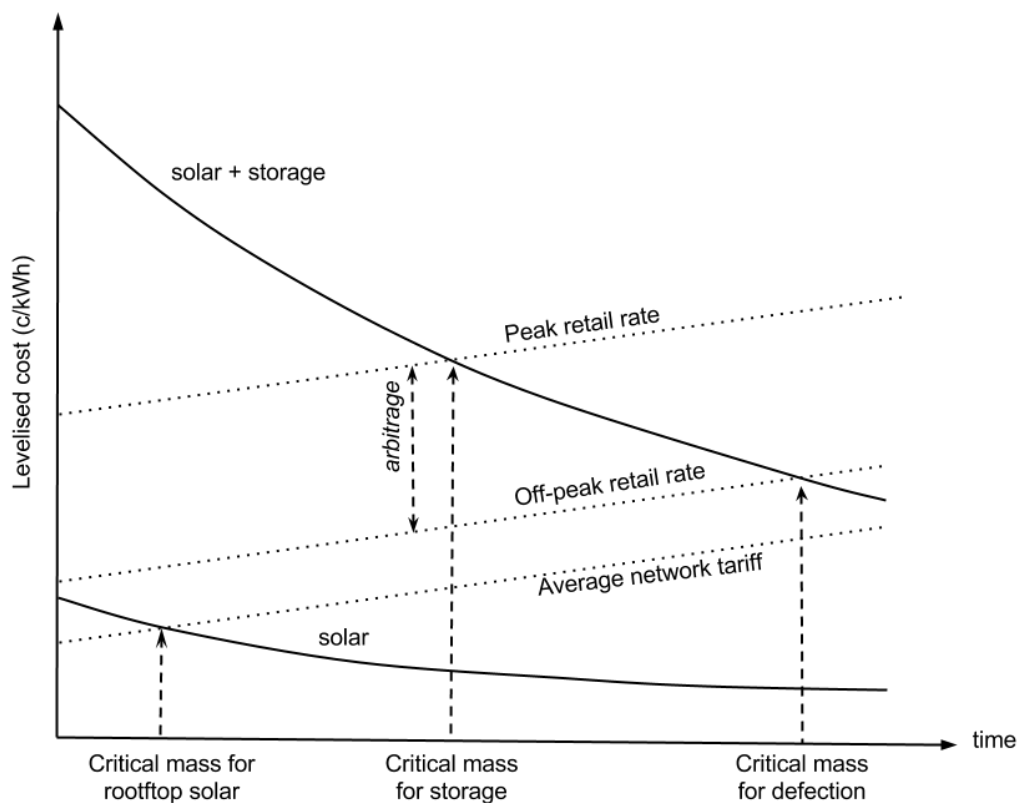
There are some price levels at which solar and storage become economically beneficial to customers, regardless of the availability of incentives, subsidies or other supportive interventions. At these points, there is a critical mass for major shifts in how electricity is generated and how consumers interact (or choose not to interact) with the grid. The points are as follows and shown in Figure 9 below:

- The **critical mass for solar** occurs when the levelised cost of solar<sup>1</sup> equals the network tariff. At this point the electricity retailer will not be able to sustain price competition with PV.
- The **critical mass for storage** occurs when the levelised cost of storage drops to the peak tariff. At this point storage provides an opportunity for arbitrage between the peak and off-peak tariff rates. That is, a household can recharge their electricity storage at the off-peak retail rate, and use that electricity to offset consumption at the peak retail rate.
- The **critical mass for grid defection** occurs when the levelised cost of solar and storage equals the off-peak tariff. At this point electricity generated by the defecting household is cheaper than from the grid at any time of the day.

It is not for this paper to make projections as to when these critical masses will be, or have been, met. However, as rooftop solar has been taken up faster than analysts expected, and the price point of storage is dropping at an unexpected rate, they may be soon.

### Figure 9: Critical mass for solar, storage or grid defection

Source: Author.



<sup>1</sup> The levelised cost is the average cost per unit of energy supplied. For example, the levelised cost of rooftop solar is the cost to purchase, install and maintain a rooftop solar system divided by the total energy output by the system over its lifetime.

## Chapter Three: Adaptability of Network Service Providers

*The ability of the energy system to meet these challenges hinges in large part on the adaptability of NSPs and responsiveness of regulators to a changing competitive environment. This chapter looks at the example of the Victorian energy market and the important case study of the roll-out of smart meters, where failures to fully realise the benefits of new opportunities and technologies have important implications for policy at the national level.*

### Qualitative research of adaptability

How can adaptability of NSPs be determined? The author conducted primary research in 2014 to assess the adaptability of NSPs, using qualitative interviews of key persons at regulators, consulting firms, financial houses and the NSPs themselves (Marks 2014).<sup>2</sup> The research investigated the corporate culture and flexibility of NSPs by examining past scenarios that shed light on how NSPs might respond to a future with high rooftop solar and storage penetration into the networks. It particularly focussed on the use of smart metering technology, modelling of uptake of solar panels, and innovations in tariff structures. The main findings are discussed below.

The research focussed on NSPs in the state of Victoria because:

- Victorian NSPs are fully privatised, so are at the end-point of the privatisation process currently occurring in New South Wales (and previously considered, then dropped, in Queensland)
- Relative to other states, Victorian NSPs have some of the leanest RABs in the NEM, and so could be considered least-worst when it comes to ensuring efficient capital investment, and
- Victorian NSPs have implemented a smart meter rollout since 2008, which has been a test of their ability to deploy, and exploit the functionality of, innovative technology.

The State Electricity Commission of Victoria was vertically disintegrated in accordance with the NEM reforms in the 1990s. The distribution function was separated into five NSPs, which were subsequently privatised. These five NSPs are now Citipower and Powercor (sister networks with the same ownership and management), Jemena, Ausnet Services and United Energy. Ausnet Services also owns and manages the transmission infrastructure in Victoria (VESI 2014). As shown in Figure 10, Citipower is a dense urban network centred around the central business district of Melbourne. Jemena and United Energy cover the suburbs of the greater Melbourne area. Powercor and Ausnet Services cover regional and rural areas in the western and eastern halves of the state respectively.

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<sup>2</sup> Unless otherwise noted, references in this chapter draw from this research.

## Figure 10: Distribution networks in Victoria

Source: DEDJTR 2016.



### Corporate culture

Analysts characterised NSPs as being extremely conservative. This stems from a laudable focus on safety of customers, the public and staff. Layered on top of this is an engineering culture that is focussed on minimising supply disruptions. One analyst noted that at a meeting of heads of practice of a global consultancy firm, the electricity industry was considered “three times slower at adopting technology and reform than any other industry”.

All analysts and renewable energy representatives saw customer service capacity as critical to developing other services that both benefited the customer and created alternative revenue streams. It was noted that early in the deregulation of the Victorian electricity industry, distribution and retail were combined into the same entity, but these “distributor-retailers did not last” and sold off their retail function. This was put down to the engineering mind-set of NSPs not being well attuned to customer service functions. An example of this can be considered in the smart meter rollout in Victoria.

### The smart meter case study

The rollout of smart meters in Victoria is a powerful demonstration of how, under current market structures and regulatory arrangements, the potential for new technologies to improve efficiency of the energy system has only been partially realised in practice.

Metering – the recording of electricity consumption – is a critical function of electricity provision. Until only a decade ago, this function was provided in every home and business by an accumulation meter.

These electro-mechanical meters tick over with each kilowatt-hour consumed. Bills were determined by an NSP employee attending each meter and recording the consumption to date. The difference between the meter readings three months apart determines the consumption during that billing period. It is an antiquated, yet simple and universally trusted means of measuring consumption.

Accumulation meters do not readily provide any information to customers on the rate of consumption, how much electricity is being consumed on a day or other period of interest, or other data that might inform decisions on electricity use. They also don't communicate information to assist network management by the NSPs, such as whether the power has been cut or if there is a power surge.

In the 2000s, digital smart meters with two-way communication between the meter and the grid were seen as a gateway technology to track this data and provide it to all parties (customers, retailers and NSPs).

In 2006, the State Government of Victoria mandated a smart meter rollout to all electricity consumers in the state. The rollout commenced in 2008 and was finalised by 2015. The State Government promoted the following benefits of smart meters to electricity consumers through an education campaign (Government of Victoria 2014):

- Smart meters provide data to enable customers to **make informed choices** about how much energy they use, and facilitate access to real-time information on consumption
- Smart meters **end the dependence on estimated bills and manual meter readings**
- Smart meters **facilitate flexible electricity pricing** through Time-of-Use tariffs, whereby the network tariff for distribution is higher during peak demand periods (afternoons in summer or winter), and
- Smart Meters make it **quicker and easier for customers** to connect or disconnect electricity, switch retailers or commence feeding excess solar power into the grid.

The State Government made a rigid policy determination on smart meters, stipulating that:

- Every electricity customer would get a new smart meter
- Every smart meter would be of the same design with the same functionality
- Smart meters would be installed by the NSPs (not retailers, or the customers themselves, or third parties)
- Electricity customers would pay for the new smart meters through levies on their electricity bills, and
- Even though the customers pay for the smart meters, they would be owned and controlled by the NSPs.

Like other grid infrastructure, the smart meter became part of the RAB. As a result, the price paid by electricity consumers included profit allowance, depreciation and the usual allowances levied by NSPs.

However, NSPs did not stretch beyond the mandatory minimum of providing the usage profile of the previous day to customers. Yesterday's data is of little value in informing today's energy use decisions, because there is no instantaneous feedback on the effectiveness of a change to consumption. Furthermore, there was no innovation facilitated by the meters in the way of automatic

demand management to reduce power bills, for example by turning off air conditioners or refrigeration during peak demand periods or peak price periods.

Interviewees indicated that the main near-term value of smart meters had been captured by the NSPs themselves: they were used for detecting blackouts, informing emergency load shedding, and conducting remote meter reading.

Furthermore, NSPs lacked, and were not developing, the in-house data science capacity to process the many data points produced each day by each meter and draw-out meaningful longer-term analysis that would assist either the individual customer or the infrastructure investment planning needs of the entire grid. Scenarios were described of network engineers and business strategy staff either incapable or refusing to engage with big data analytics and instead preferring legacy assessment techniques for identifying network augmentation needs. Reports also arose of different departments within a NSP using completely different forms of data, such that integration of data sources involved significant transaction costs. In short, the industry has not progressed from technical engineering and construction capabilities into data and information capabilities.

These qualitative findings were validated by an audit conducted by the Victorian Auditor General's Office (VAGO) in 2015. VAGO affirmed that NSPs had captured the benefits of the smart meters for themselves, and customers had seen little in reduced bills as a result. While the savings to NSPs in avoided cost of accumulation meters had exceeded expectations, only 2.5 per cent of the savings that were expected to accrue to customers due to innovative tariffs, products and demand management were realised (Table 2).

**Table 2: Benefits accrued due to the Smart Meter to 2014**

Source: VAGO 2015.

Benefit category	Party to which benefits accrue	Forecast benefit (\$m)	Actual benefit (\$m)	Benefit realised
Avoided cost of accumulation meters	NSPs	579.31	591.99	102.2%
Network operational efficiencies	NSPs and retailers	218.94	107.98	49.3%
Innovative tariffs, products and demand management	Customers	9.19	0.23	2.5%
<b>Total:</b>		<b>807.44</b>	<b>700.20</b>	<b>86.72%</b>

It is worth delving into each of these areas of benefits, and why the expected benefits were or were not realised.

### **Avoided cost of accumulation meters**

VAGO found that the largest single benefit from the smart meter rollout was \$1.4 billion of avoided costs to retailers from 2008 to 2028 for the replacement of accumulation meters. Of this \$1.4 billion, \$592 million had been accrued by the end of 2014. These cost savings do not represent any

additional value generated by the program, as metering was a function provided by the predecessor accumulation meters.

Electricity consumers have paid dearly for this saving to NSPs. Victorian households and small businesses have paid NSPs an average of \$760 for each smart meter. This adds to \$2.24 billion for the whole state by from 2008 to 2014. Furthermore, the smart meter rollout has cost consumers more than maintaining, replacing and manually reading the old accumulation meters would have cost the NSPs (VAGO 2015).

### **Network operational efficiencies**

Network operational efficiencies are those leveraged through the near-real-time data provided by smart meters. This can assist in avoiding or reducing the length of blackouts, or address power surges and power quality issues.

While savings from network operational efficiencies are supposed to be passed on to consumers through lower network tariffs, the VAGO report found that NSPs and retailers “had still not been requested to capture and report key data related to the realisation of a large number of program benefits” (VAGO 2015). Without measurement of the benefits attributable to smart meters, it is impossible to pass these cost savings on to customers. Instead, benefits are accounted for as in-house efficiency gains by NSPs and claimed as legitimate profit.

The benefits accrued to NSPs due to network operational efficiencies are not as large as they could be because NSPs have struggled to conduct remote meter reading. VAGO noted that as of June 2014, 13.5 per cent of installed smart meters were plagued by technical difficulties, and still required a human meter reader to walk around to non-communicating smart meters and take the readings manually (VAGO 2015).

### **Innovative products, tariffs and demand management**

Policy makers expected these developments to assist electricity consumers in reducing their electricity bills while consuming a comparable level of energy service. As shown in Table 2, only a small fraction of the benefits due to new innovative products, new tariff designs and demand management underpinned by smart meters have been realised.

One particular incident is viewed as the cause of this poor level of benefit realisation. When a sufficient number of accumulation meters had been replaced with smart meters, the Victorian Government allowed the introduction of flexible network tariffs. Under this arrangement, the price of distribution could be adjusted to be more reflective of cost. Instead of a flat network tariff for electricity, peak demand periods could have higher network tariffs, and lower demand periods could have lower network tariffs. This would have the effect of subduing demand at the peak periods, thereby deferring or reducing the need for network capacity increases and associated capital expense.

In March 2010, AusNet Services announced, without adequate consultation or consumer education, steep differentials between peak and off-peak network tariffs for all its customers. A network tariff of up to 38.2 c/kWh would be imposed on consumption in peak hours (afternoons), up from the flat-rate tariff of 7.6 c/kWh. Off-peak period network tariffs (overnight, middle of the day) would drop from

that flat rate of 7.6 c/kWh to as low as 2.6 c/kWh. AusNet Services' internal modelling claimed that this would reduce the network tariff impost on electricity bills by over 10 per cent over a full year, but the backlash from the general public was so strong that the State Government imposed a moratorium on flexible network charges (Wood, Carter & Harrison 2014).

This moratorium was in place until 2013, effectively removing the ability to exploit one of the most important benefits of smart meters. Furthermore, this clumsy approach to customer engagement was credited by interviewees in 2014 as halting any consideration of a mandated rollout of smart meters in other states in Australia. It also likely informed the Australian Energy Market Commission's decision in November 2015 to open up metering to third parties as of 1 December 2017, taking it out of the monopoly hold of NSPs (AEMC 2015).

The example of smart meters in Victoria suggests that the lack of adaptability of NSPs could be a serious barrier to the roll-out of new technologies, pricing structures and practices that can improve efficiency and outcomes for consumers across the NEM. To ensure that these opportunities are not squandered, there is an urgent imperative for policymakers to recalibrate the market structures and regulatory settings that are holding back the customer-centric evolution of the energy system.

## Chapter Four: Policy directions for a decentralised energy system

*This paper has described several unintended outcomes from electricity regulation and policies in Australia. Increasing network tariffs and the underutilisation of overpriced infrastructure are very poor outcomes for an essential service such as electricity, particularly if the infrastructure is vulnerable to severe weather events. To prevent further detrimental impact on electricity consumers, this paper recommends that policy makers and regulators consider three areas of major reform in electricity regulation:*

- *Repricing network tariffs to decrease the retail price burden on consumers*
- *Blocking monopoly NSPs from providing services in what are naturally competitive markets, particularly behind-the-meter services, and*
- *Redirect NSPs to focus on whole-of-system survivability during extreme weather events, and away from building a grid to meet 100% of demand during peak demand events.*

### Repricing network tariffs

The NEM is built on a network designed for a centralised energy system. In a decentralised energy future of producer-consumer households and community grids, there will remain a need for grid services, just not as they are currently designed or priced.

The high network tariffs linked to the historic over-build in networks implies they will be in a losing battle with distributed solar and storage for the share of electricity delivered to consumers. One way to improve their competitiveness, and extend the utility of the capital investment, is to reduce the price of network services. This can occur in several ways.

### Voluntary tariff reductions

The networks tariffs approved by the AER are upper limits. An NSP could choose to reduce its network tariffs voluntarily, decoupling network tariffs from the overvalued RAB and overly generous revenue allowance settings. Considering the cost of debt for NSPs on the market is lower than that for which they are recompensed, there exists an excessive profit margin which could be reduced to facilitate a reduction in network tariffs while still servicing the debt.

### Write-downs

There have been several extensive assessments which have called for write-downs on RABs to reduce network tariffs required to service the revenue caps. Grant (2016) assessed the current RAB values to maximum efficient values, and found that across the NEM the current RAB of \$86.3 billion should be revised to \$47.9 billion, a write-down of 45 per cent.

A range of other reports by the Federal Parliament, State Governments, statutory bodies, public interest groups and policy institutes that provide evidence of the need for write-downs. One of these, the Australian Senate's Inquiry into the Performance and Management of Electricity Network Companies, recommended in its final report that "state governments seeking to privatise their electricity network assets examine whether those assets are overvalued and if the regulatory asset base should be written down prior to privatisation" (Senate 2015).

There are several mechanisms that could be used to effect a write-down on an RAB and allow more efficient pricing of network services:

**Voluntary write-downs:** An NSP could choose to apply a write-down on its assets to acknowledge that, with the reductions in electricity consumption, it is unlikely to achieve revenues based on a future of forever-increasing consumption. Since the regulated return underpins the attractiveness of NSPs for investors, a voluntary write-down on the RAB would risk a downgrading of the credit rating of the NSPs which would lead to higher borrowing costs. The scale of the write-down would need to be a function of both the maximum efficient value of the asset base and the risks of a credit rating reduction. These factors would need to be weighed by management. This is a process frequently undertaken by publicly listed companies in competitive fields. There exists no reason why NSPs can not implement such a process.

Government-owned networks, such as in Queensland and in New South Wales (although the latter is in the process of being privatised), could implement a write-down if instructed by their state owners. Considering their debt closely tracks government rates due to being state-owned enterprises, their debt servicing won't be affected by a write-down.

**Involuntary write-downs:** There is no facility for the enforced write-down of RABs in the NEM. This is for two reasons. Firstly, a scenario where write-downs would be required was not conceptualised in the past. The only analogy from previous experience was if a major industrial customer shut down, making a purpose-built transmission line redundant. Yet in practice such dormant capacity had always been picked up by growth in consumption by neighbouring customers.

Second, write-down facilities were not included in the original regulatory design to maximise the attractiveness of Australia's electricity assets (Sylvan et al. 2004; SA 1996). The Energy Networks Association claims that there have been repeated guarantees by government (through speeches and press releases) that there would not be an enforced write-down of the RAB (Crawford 2014).

However, these guarantees have never been written into law. While there is no existing regulatory facility for enforcing write-downs, there is also nothing to prevent governments from imposing new regulations to require NSPs to write-down assets, whether the NSPs are publicly or privately owned.

### **Facilitating sharing of distributed generation**

Instead of applying inflexible tariffs to consumption, regardless of where the electricity is purchased, NSPs could apply lower tariffs for peer-to-peer sharing of solar electricity. The transmission of excess solar electricity between neighbours or households on the same substation area does not use the entire span of the electricity grid, and therefore should be charged a lower tariff. This would be cost reflective and assist in maintaining the relevance of NSPs in a high distributed generation future. Western Australian start-up Power Ledger has already conducted trials using blockchain-based peer-to-peer electricity trading (Vorrath, 2016).

## Maintaining separation of regulated monopolies from new competitive markets

In the original formulation of the NEM, NSPs were considered to have a natural monopoly in the business of transmitting and distributing electricity from the large, centralised generators to the customer. While electricity generation has become more decentralised, the regulatory frameworks around NSPs are a holdover from this mindset.

One of these is the “ring-fencing” guideline. This requires NSPs to separate activities where they are providers of regulated monopoly services from other activities in competitive or non-regulated areas. To use the definition provided by the AER (2016b):

*Ring-fencing refers to the separation within a network service provider of regulated services from contestable business activities or non-regulated services. Regulated services—like traditional monopoly networks regulated by the AER—are separated from those services that are delivered by the competitive market, like energy retailing.*

*Ring-fencing protects the long term interests of consumers by ensuring efficient costs for regulated services provided by networks. It does this by identifying and separating regulated business activities from services available in a competitive market.*

Ring-fencing is necessary to prevent market abuse. If an NSP could participate in deregulated services and competitive markets, it would have an unfair advantage due to owning the wholesale “pipe” through which all supply is provided. However, grid management requires ancillary services to ensure power quality (e.g. prevent power surges, or accommodate reverse flows of electricity from rooftop solar). Ring-fencing was therefore deemed as necessary to allow NSPs to conduct some relatively small electricity generation and storage functions to maintain grid integrity and power quality to prevent power surges, or accommodate non-synchronous energy generation from wind farms. Some NSPs have created competitive service arms, ring-fenced from the main operation, to provide offerings in contested markets. For example, Select Solutions is a wholly-owned subsidiary of AusNet Services, and provides metering and asset management consulting services to essential infrastructure operators across Australia.

Ring-fencing requirements, and the market areas to which they apply, are critical to the future of energy service provision because they determine what business a regulated business can conduct.

This paper has argued that networks have some innate disadvantages: they are conservative, lack capacity for innovation, lack customer relationship management capacity, and have allowed costs to spiral to the point that distributed generation has become competitive. Yet if regulated networks have unhindered access to deregulated competitive markets, they may have some uncompetitive advantages relative to other players. These include:

- Access to customer contact details
- Access to a long series of customer consumption data
- An existing “brand awareness” with customers as a provider of an essential service, because NSPs are responsible for reconnecting power in the event of a fault or disconnection, and

- Deep financial reserves due to their generously-regulated monopoly revenues and large asset bases.

If a NSP were to provide both regulated network services and behind-the-meter competitive services to a customer, there could be cases where they are working towards competing objectives, as summarised in Table 3.

**Table 3: Objectives of regulated networks versus competitive services**

Source: Author.

Function	Objective	
	Regulated network	Competitive service
Consumption from grid	Maximise in order to accrue revenue through network tariffs	Minimise, particularly exposure to high tariff periods, to reduce bills
Blackouts/brownouts	Minimise for all customers	Protect one customer
Power quality stabilisation	Optimise for all customers	Optimise for one customer
Interface between existing NSP-owned smart meter and any products or services behind-the-meter	Ensure compatibility to maximise value capture from NSP-owned meter	Only utilise if it interfaces satisfactorily with other services, otherwise use third party system
Sizing of rooftop solar and storage	Optimise for the network	Optimise for the customer
Peer-to-peer electricity sales facilitated by the grid on a reduced network tariff	Minimise as it cannibalises full tariff consumption from the grid	Use to displace full tariff consumption from the centralised grid

If NSPs are to be allowed to expand their engagement in the provision of competitive services in new energy markets there would need to be a strong ‘Chinese wall’ arrangement to prevent internal exchanges of information and resources that could create conflicts of interest such as those described above. This would increase the regulatory burden, with compliance costs incurred by the regulated monopoly arm of the business falling on electricity consumers through higher network tariffs (as is the case with all other compliance costs).

At the macro level, there is a concern that this nascent market sector of behind-the-meter services could be cornered by NSPs on a lead-loss basis until competition withers, such that NSPs can maintain maximal dependency by electricity consumers on the centralised electricity system. The loss of real competition in services behind the meter would not be beneficial to customers (and not in accordance with the National Electricity Objective).

### The Australian Energy Regulator’s consultations on ring fencing

The AER released its Preliminary Position Paper on Ring-Fencing on 20 April 2016. It proposes ring-fencing obligations for NSPs to neutralise these uncompetitive advantages (AER 2016b). The proposed obligations state that if a NSP owns an entity providing behind-the-meter services, then:

- The competitive service provider must be a separate legal entity
- The competitive service provider's operations must not be at the same physical location as the NSP's facilities
- The NSP and the competitive service provider must not share staff
- The NSP and the competitive service provider must establish and maintain separate accounts that clearly identify the extent and nature of transactions between them
- There must be no cross subsidy between the two entities
- Both must protect information provided by a customer or prospective customer and ensure its use is only for the purpose for which that information was provided
- The NSP must ensure that information provided to a ring-fenced competitive service provider is also available to third parties (such as competing companies) on an equal basis, and
- Ensure information obtained by the DNSP is not disclosed to any party without the informed approval of the customer or prospective customer to whom it pertains.

These are significant and challenging obligations to implement and oversee, as there would be many opportunities for transfer pricing, accidental or purposeful untracked data sharing and movement of staff and institutional knowledge between the two entities. Regulating to prevent market abuse is hard to do, and proving instances of breaches of ring-fencing rules is incredibly challenging.

The window for submissions on the AER's paper closed at the end of May 2016. The dichotomy between the different groups of stakeholders could not be more stark (see Appendix). While there was a broad range of views on the workability of the proposed ring fencing obligations, their positions (as summarised in the Appendix) can be generalised as follows:

- Electricity retailers and consumer advocates want, at a minimum, heavy regulation to ensure NSPs are restricted from engaging in anti-competitive or other behaviour not in the interests of consumers. Some also advocated for structural barriers to prevent NSPs engaging in competitive services at all, and
- NSPs want to be allowed to enter any competitive markets they wish, including behind-the-meter services under simplified ring-fencing arrangements free from onerous regulatory imposts.

These are the opening salvos in a battle for market share in new energy services. The AER released its Final Guideline in November 2016. It tends towards maintenance of the status quo; that is the obligations as stated in the Preliminary Positions Paper.

From the experience of the smart meter rollout in Victoria, it is clear that NSPs are poor at deploying new technology and ensuring that the benefits from the new technology are accrued to electricity customers. If the same experience were to apply to NSP-dominated roll-out of behind-the-meter technologies such as demand management or residential storage, there could be great risks of similar outcomes. For example, a NSP may seek to optimise the economic benefit to itself through increased grid resilience (avoided downtime) or for lucrative plays in wholesale markets, with sub-optimal access to the storage capacity by the customer that lives in the house in which the storage unit lies.

**Example scenario: conflicting objectives**

An example of such a scenario is as follows. A customer chooses to have the NSP install battery storage in the customer's residence. One of the reasons that customer has invested in battery storage is to provide uninterrupted power supply for computers in a home office. The NSP offers the customer an additional revenue stream, governed by an offtake agreement such that the NSP can draw electricity from the battery storage unit to stabilise grid demand in the local neighbourhood.

One a particularly stormy evening the local substation is disabled by a fallen tree, cutting grid electricity to half the neighbourhood. The NSP activates the offtake and draws the battery storage down as quickly as possible. Then the entire grid suddenly flickers off, and the customer has insufficient storage to continue operating facilities in the house. The battery storage unit has been used for the benefit of the NSP above the needs of the customer.

**How well do competitive services function without NSPs?**

There already exists an area in behind-the-meter service provision that has occurred with little to no involvement by NSPs: small-scale rooftop solar installations.

As shown in Figure 4 above, not only has the price of rooftop solar modules dropped since 2008, but the price of installation (the gap between the two lines) has decreased. The highly competitive, highly diverse solar installation industry in Australia has dramatically reduced the cost of installation of solar. This is partly due to improved technology (such as smarter design of the racks on which the panels are held in place), but also due to productivity gains within the installer companies. In simple terms, installers have figured out better ways to recruit customers and install more panels more quickly and more cheaply.

Contrast this with NSPs: as shown on Figure 2 on page 7, the charge an electricity consumer faced to receive 1 kWh of electricity was twice as high in 2014 than in 2007. Much of this increase was due to the dramatic rise in network tariffs. This "negative learning curve" is the opposite to the common experience of products and services getting better and cheaper over time in real terms.

**Recommended direction of ring fencing regulation**

With the example of solar installers, the Australian electricity sector has already shown it can achieve rapid expansion in volumes and leaps in productivity without the involvement of NSPs. Considering the negative learning and poor adaptability of NSPs in the changing context of distributed generation and storage, and the poor track record on smart meters in Victoria, there is a strong case that NSPs be structurally barred from operating competitive arms in new energy services, particularly behind-the-meter services for residential or small business customers.

The recent events in South Australia demonstrate that, despite extensive investment, the infrastructure that underpins the electricity system can be vulnerable. The Bureau of Meteorology has reported that a supercell storm system and seven tornadoes created winds of 260 km/h and were responsible for the physical damage to 22 transmission towers between Adelaide and the state's North (BoM 2016). The review by AEMO of the causes of the state-wide blackout in South Australia in September 2016 is ongoing. Given the importance of ensuring that such dearly priced infrastructure is not susceptible to severe weather events, NSPs might be better advised to refocus attention on core services and system maintenance rather than expanding their focus beyond the meter.

## Conclusions and recommendations

There have been recent calls from large energy users, analysts and consumer advocates for an overhaul of the regulatory framework of the NEM. This attention has mainly focused on the electricity generation market. Yet an overhaul of the NEM must turn its attention to some of the deficiencies and risks in the regulated domains of transmission and distribution. The performance of these parts of the NEM have objectively failed consumers on price over the past decade, and therefore have breached the National Electricity Objective. There area also concerns about the resilience of the grid and its ability to adapt to a future that will involve more frequent severe weather events and a greater emphasis on renewable energy, as demonstrated by recent events in South Australia.

To address these deficiencies, the following high-level changes are recommended to the COAG Energy Council and the Finkel Review:

- Develop regulations to prevent companies that own electricity networks from engaging in behind-the-meter services and other naturally competitive markets, due to the minimal or negative benefit this will provide to consumers and the high risk of uncompetitive behaviour.
- Through a revamp of the National Electricity Law and the National Electricity Objective, direct networks to a focus on whole-of-system resilience in a future of high penetration of distributed renewables and batteries and the context of a changing climate and more severe weather patterns. This implies a move away from infrastructure investment dedicated to meeting peak demand events. Increasingly, the marginal demand during these low-frequency, high demand events can be cost effectively met by distributed generation and storage.
- Restrict the exclusive hold of networks so it only applies to the parts of the electricity system that are core business – that is, the poles and wires. Other parts of the system should be open to competition. Excision of network exclusivity should be the rule rather than the exception.
- Legislate changes to the valuation and treatment of regulated asset bases to reduce network tariffs to reduce the cost burden of electricity bills on Australian homes and businesses.

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## Appendix

This table extracts key perspectives of stakeholders made in submissions to the Australian Energy Regulator's inquiry into ring fencing, May and June 2016, with respect to their impact on consumers.

These submissions can be found on the AER website: <https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/electricity-ring-fencing-guideline-2016/initiation>, accessed 13 June 2016

Type	Name	Would customers be well served by NSPs in behind-the-meter competitive services?	Are more stringent ring fencing regulations required to protect customers using competitive services?
	Ausgrid	Ausgrid considers that views to restrict asset ownership and sharing is inconsistent with the [National Electricity Objective] and undermines other aspects of the regulatory framework. (p. 2)	Ausgrid does not support the underlying premise for the AER's position - specifically we do not agree that robust guidelines must be onerous in order to be effective, nor do we agree that the AER has correctly identified the potential harm that the guideline should be aimed at addressing. (p. 2)
	Ausnet Services	[I]f opportunities developed for a market for contestable distribution services, AusNet Services believes the interests of consumers would be best served by permitting DNSPs to freely compete for those services. (pp. 12-13)	There are adequate measures in place regarding access to connection services up or downstream to ensure an incumbent is not advantaged in such a process. (p. 13)
	Citipower/ Powercor/ SAPN	[D]istributors' participation in unregulated markets will actually increase competition and ultimately deliver benefits to consumers in the form of lower prices and greater choice. This participation will also deliver benefits to regulated consumers by maximising efficient asset utilization. (p. 13)	[T]he AER presumption that networks competing in contestable markets will cause harm is unfounded (p. ii) The AER should use, and not duplicate, the existing regulatory framework that already acts to ensure that distributors' participation in unregulated markets is in the long term interests of consumers. (p. 13) The submission also claims that more stringent ring-fencing regulations are not required because Retailers and other market participants already have a range of competitive advantages over [NSP]s in unregulated markets. (p. 10)
<b>Network Service Providers</b>			
	Jemena	[C]ustomers benefit from innovation initiated by networks [...] The guideline should be developed in a way that does not stifle such innovations, and should recognise that the scale offered by networks can be used to provide customers with real benefits. (pp. 3-4)	The guideline should not create barriers to entry for other 'logical' market players, like NSPs. Imposing a heavy-handed ring-fencing guideline similar to the separation currently proposed in the guideline, becomes disproportionate to the problem being solved and has unintended consequences of removing players that should be in the

Essential Energy	Imposing disincentives on NSPs may mean they do not enter emerging markets, leaving those markets without the benefit of a class of active competitors. Curtailing the participation of a class of entrants where the market structure, major products and competitors are still uncertain increases the risk of regulatory error and may lead to higher market costs, inefficiencies and lower consumer benefit – factors which would not contribute to the National Electricity Objective. (p. 2)	[W]e do not believe that the proposed “all in and then waiver” approach aligns with the stated objective as it is not linked to any evidence or likelihood of market harm, imposes higher costs across the market, particularly on network service providers (NSPs) and therefore, customers, relative to any achieved benefit and presumes that NSP participation in a contestable market will be anti-competitive by default. (p. 1)
		market. (p. 4)

Type	Name	Would customers be well served in competitive markets by NSPs?	Are more stringent ring fencing regulations required to protect customers using competitive services?
AGL		<p>If a regulated monopoly (or affiliate) can operate in a contestable market using regulated funding, with lower financing costs and data gained through its position as a regulated monopoly, then it will have clear advantages over alternative service providers. Other advantages will arise if its association with the network monopoly allows it to realise value not available to competing providers or to benefit from the network's role as gate-keeper of grid connections.</p> <p>This combination of factors has the potential to seriously distort competitive outcomes and ultimately deter entry from alternative providers who simply cannot compete on these terms. This will effectively reserve these new and emerging markets (including the beyond-the-meter market) to the exclusive domain of regulated monopolies which, in the long run, will mean less product and service innovation, and less efficiency and price competition, to the detriment of customers.</p> <p>To mitigate this risk and promote the emergence of a vibrant, competitive energy services market, the revised ring-fencing guidelines must be recrafted to properly account for an evolving energy industry where it is not only generation and retail markets that would be distorted were monopoly network involvement permitted but also a raft of other markets for products and services with an interrelationship with the network, including digital metering and the behind-the-meter market for distributed energy resources (including solar PV, battery storage systems, demand management, load control and home energy management). (p. 3)</p>	<p>The longer it takes to implement and the longer regulated business are allowed to operate outside the scope of the new Ring Fencing Guidelines, the greater competitive advantage these business gain over other market participants of metering and behind the meter energy services. Specifically, network businesses and affiliated energy services businesses will continue to develop customer and commercial insights, and cultivate access to hardware and critical suppliers, leveraging their unique monopoly position as a regulated business. There is a risk that these commercial enterprises develop to such an extent that re-establishing a competitively neutral market environment becomes a very difficult task indeed. (p. 4)</p>
	<b>Retailers</b>		

EnergyAustralia	<p>We see little customer benefit from regulatory frameworks that allow regulated monopolies – who have no direct commercial relationship with customers – to take advantage of their regulated status. Rather, we are confident in the ability of competitive markets to develop technologies that truly reflect customers’ needs (rather than network-specific or locational) and then deliver them at least cost. (p. 1)</p>	<p>While it falls outside the scope of this process, we believe there is a case for revisiting the National Electricity Rules (NER) as a priority to clarify the distinction between network and contestable services and to consider the merits of structural separation and the imposition of cross-ownership restrictions on networks (as the AEMC recommended). (p. 2)</p>
Red/Lumo (owned by Snowy Hydro)	<p>Under the current regulatory framework, Distribution Network Service Providers (DNSPs) have a competitive advantage in supplying contestable services beyond the meter. DNSPs have the ability to:</p> <ul style="list-style-type: none"> <li>• move their shared costs between entities to cross subsidise contestable services;</li> <li>• receive a network support allowance for investments beyond the meter allowing them to cross subsidise contestable services like Distributed Energy Resources (DER); and</li> <li>• recover a financial allowance under the Demand Management Incentive Allowance (DMA) scheme that allows them to develop capabilities for supplying competitive services. (p. 3)</li> </ul>	<p>Red and Lumo Energy strongly support a policy position that excludes DNSPs from supplying contestable services (either directly or through a ring fenced business) from beyond the meter as it has the potential to distort competition in the market for these contestable services. This approach would guarantee that DNSPs were incapable of distorting competition in this emerging market. (pp. 1-2)</p>

Type	Name	Would customers be well served in competitive markets by NSPs?	Are more stringent ring fencing regulations required to protect customers using competitive services?
Customer advocacy organisations	Joint submission by: Total Environment Centre, Ethnic Communities Council of NSW, Consumer Utilities Advocacy Centre, Consumer Action Law Centre, Public Interest Advocacy Centre	<p>All storage and related new services including connections and metering should be contestable. If networks object to this, it is likely because they retain a preference for capex over opex, either for ingrained cultural/historic reasons or because regulatory incentives continue to favour investment in capex over opex. If the latter is correct, the AEMC and AER need urgently to review the effectiveness of capex and opex incentives. This is not a sufficient reason to allow storage services to be regulated (non-contestable).</p> <p>All contestable services should be provided by third parties, not by networks or ring-fenced businesses. This appears to be the simplest way to ensure the maximum competition in new products and services. Where, for instance, a network commissions a grid-side battery from a third party for one purpose – e.g. to manage peak demand or voltage and frequency fluctuations – and that battery has subsidiary value streams such as arbitraging, then the subsidiary value streams could be managed by the same or another third party, with the revenue constituting part of the network's opex contract with that third party. (p. 7)</p>	<p>Our preferred approach is based on the contention that (a) competition is more likely than monopoly control to deliver the best outcomes for consumers, and (b) ring-fencing is likely to be costly, administratively onerous and ultimately ineffective. We therefore advocate for full contestability for battery and other new energy products and services, and prefer structural separation to ring-fencing.</p> <p>However, we recognise that structural separation goes beyond the current AER process, and that the AER is required under the NER to produce a guideline by 1 December 2016. Our overall objective is therefore to ensure that the guideline is as thorough as possible, so that networks do not preference their own ring-fenced businesses rather than third party tendering or structural separation. (p. 10)</p>
	Energy Consumers Australia	<p>Where DNSPs are competing in contestable markets through ring-fenced business units, potential new entrants into the market may not have complete confidence that a ring-fenced business will not access information from the NSP that confers a competitive advantage. This could discourage new entry, damaging competition and service innovation. (pp. 6-7)</p>	<p>[W]e have doubts whether measures short of full structural separation will provide the level playing field that is needed to allow emergence of a vibrant market in new and innovative energy services. (p. 4)</p> <p>ECA has received reports from energy consumers of instances where a proposal to connect a storage or generation project to a distribution network has been rejected by a DNSP only for the proponent to be subsequently contacted by a sister company of the DNSP. (p. 9)</p>