Centre for Energy and Environmental Markets

Submission to the Independent Review into the Future Security of the National Electricity Market

by

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About CEEM

The UNSW Centre for Energy and Environmental Markets (CEEM) undertakes interdisciplinary research in the design, analysis and performance monitoring of energy and environmental markets and their associated policy frameworks. CEEM brings together UNSW researchers from the Australian School of Business, the Faculty of Engineering, the Institute of Environmental Studies, the Faculty of Arts and Social Sciences and the Faculty of Law, working alongside a number of Australian and International partners.

CEEM's research focuses on the challenges and opportunities of clean energy transition within market oriented electricity industries. Key aspects of this transition are the integration of large-scale renewable technologies and distributed energy technologies – generation, storage and 'smart' loads – into the electricity industry. Facilitating this integration requires appropriate spot, ancillary and forward wholesale electricity markets, retail markets, monopoly network regulation and broader energy and climate policies.

CEEM has been undertaking research into these challenges for more than a decade, with a focus on the design of markets and regulatory frameworks within the Australian National Electricity Market, and State and Federal energy and climate policy. More details of this work can be found at the Centre website – www.ceem.unsw.edu.au. We welcome comments, suggestions and corrections on this submission, and all our work in the area. Please contact Associate Professor Iain MacGill, Joint Director of the Centre at i.macgill@unsw.edu.au.

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Executive Summary

CEEM welcomes the opportunity to contribute to the work of the Finkel Review - a review that, unfortunately, reflects the failure of Australian energy and climate policy makers to effectively balance affordability, security and environmental objectives within Australia's National Electricity Market (NEM) over the past two decades. The Preliminary Report does a commendable job in laying out many of the key challenges and opportunities we now face.

Technology is transforming the electricity sector: Undoubtedly true although it is important to not focus primarily on the hardware, but also consider the 'software' knowledge and 'orgware' institutional frameworks that shape technology innovation. Some of the key transformational technologies are distributed options for energy users, requiring new knowledge and institutional capabilities. Judicious development of such capabilities can facilitate deployment of these technologies to maximise societal as well as private outcomes.

Another key governance opportunity to better anticipate technologies change is to broaden the range of stakeholders involved in policy, market and regulatory consultation processes. While incumbents certainly have valuable knowledge, they also have interests, hence their contributions need to be carefully managed. For other stakeholders, there is the usual risk that if you aren't at the table you are probably on the menu. Facilitating greater public availability of relevant industry data can also assist in supporting wider participation – the NEM has high transparency in some areas such as wholesale generation, but far less at the network, retailer and end-user levels. Finally, the greatest opportunities for innovation likely lie in transformational energy efficiency improvements in end-use equipment, an area traditionally neglected by a supply focussed electricity sector.

Consumers are driving change: For an industry supposedly committed to the long-term interests of energy consumers, it seems clear that they should have significant decision making roles. In practice, this is not generally the case. Present retail market arrangements in the NEM are dominated by a small number of incumbents, and they typically offer energy users only limited opportunities for serious engagement. When some 1.5 million households found a meaningful opportunity to engage through residential PV, policy makers and regulators have struggled to reconcile formal market principles of encouraging energy user participation, with the realities of what such participation can do to existing business models, and the social construct with energy users. One outcome has been so-called cost reflective tariff proposals that actually reduce opportunities for end-user participation to save money while contributing to reducing overall system costs.

While there are short-term opportunities to address some of these limitations, in the longer term we need to fundamentally revisit the design of our retail markets so that they actually focus on what consumers want – secure, affordable and environmentally sustainable energy services – rather than what the industry provides – low engagement commodity offerings. This will likely require new energy service oriented market participants, rather than retailers following the present standard business model.

The transition to a low emissions economy is underway: We disagree. If you exclude highly problematic LULUCF emission estimates, Australia's emissions have climbed significantly over the past 25 years except for a brief period over 2012-2014. Furthermore, the current Federal Government emissions target for 2030 is clearly entirely inadequate in terms of delivering the almost complete electricity sector decarbonisation by 2050 that the International Energy Agency and IPCC suggests is required globally to avoid dangerous global warming. While renewables deployment has shown some fitful progress in Australia, lower-emission gas generation is actually falling, as a result of the debacle that has unfolded in the gas markets of Eastern Australia over recent years.

Both renewables and gas markets require urgent policy attention while so-called clean coal is a distraction from the tasks at hand. Finally, while the policy focus tends to be on large-scale electricity industry investors, we need to consider investment barriers for small and medium energy users. They currently face greater uncertainties than large investors in not being able to 'lock in' longer term prices and network tariffs.

Integration of variable renewable generation: The closure of coal-fired plant in the NEM over recent years has been driven by a range of factors other than just growing wind and solar penetrations. Such closures are also a necessary step in reducing NEM emissions. The real challenges would seem to include the short-term 'closure' of some large gas-fired plants in the NEM due to steeply rising gas prices; increasing extreme weather events; a growing proportion of generation coming from distributed resources that aren't appropriately integrated into market processes; market rules around security that haven't yet fully incorporated challenges associated with highly variable and only somewhat predictable non-synchronous generation; and excessive market power in some regions of the NEM.

Short-term actions include providing AEMO with greater discretion in identifying high risk periods, and greater direction powers over participants in order to address them. In the longer term, there are excellent opportunities for variable renewables to contribute to managing frequency control, while bringing distributed resources – generation but also demand response – more formally into market arrangements. At the same time, our dysfunctional gas markets need to be fixed.

Market design to support security and reliability: This is an inappropriate framing of our challenge – market designs to support security and reliability are relatively straightforward but are likely to involve high reserve margins and a focus on conventional plant, working against affordability and environmental objectives.

The Review Report highlights an extremely important and neglected aspect of the NEM's existing FCAS security markets. Investment is inherently forward looking and derivatives based around future wholesale spot prices provide a means to 'lock in' future revenue and hence 'bank' the project. The NEM's FCAS markets do not have any associated derivative markets to similarly secure investments that enhance security. This was not a major problem when wholesale markets inherently delivered sufficient FCAS capability. However, this situation is now changing. And while it appears wind and solar plant can implement useful frequency control capabilities at relatively modest expense, other particularly useful technologies such as battery storage and synchronous condensers require more significant capital investment.

Finally, beyond the question of market design is the question of market structure – the number and nature of market participants. At present all NEM markets – wholesale, FCAS and retail – exhibit high market concentrations with a relatively small number of major players. This need not work against security and reliability, but it can if and when major participants seek to 'engineer' tight supply-demand balance. And while market power does represent a possible risk management approach for supporting investment in the absence of liquid futures (via physical hedges and pricing power), it is a problematic one in terms of innovation and new entry. It also has potentially major affordability implications. Policy makers have largely failed to address this to date, and urgently need to engage.

Prices have risen substantially: True but not the problem – energy prices should be high in a fossil-fuel dominated electricity industry in a dangerously warming world. The problem is that prices are high for the wrong reasons, providing high returns to the wrong parties, and energy users facing these high prices are not being given the support they need to invest in energy efficiency and other demand-side options that can reduce their overall energy costs despite these high prices.

The steep prices rises in East Coast gas reflect an extraordinary failure by policy makers – State and Federal – to carefully manage a resource that has a key role in transitioning the Australian electricity and, more generally, stationary energy sector towards a low carbon future. The outcomes of this failure are now manifesting themselves, including contributing to South Australia's recent electricity supply problems (in key regards more of a gas market problem than a renewables integration problem), and sudden high price rises for industrial users. The answer is not forcing rural communities to accept unwanted coal-seam gas development, certainly without broader efforts. These broader efforts should be domestic reservation or a similar mechanism to reduce exports sufficiently to return supply-demand balance, and addressing market power issues in the gas supply and pipeline sectors.

Other sectors requiring urgent attention are the NEM's retail markets and network tariff arrangements. Our retail markets appear to be providing very high margins to the large gentailers suggesting inadequate competition – competitive markets should see margins competed away. Meanwhile, moves towards more so-called cost reflective tariffs have not put consumers 'in charge' as promised but, instead, may actually be reducing opportunities for energy users to act to reduce their bills. More generally, they may reduce policy efforts to support non-price interventions to assist energy users take action. These are highly undesirable outcomes given the need to establish broad societal consensus on the importance of, and our ability to achieve, low-carbon electricity industry transformation.

Energy market governance is critical: The Finkel Review has an excellent opportunity to address NEM governance challenges beyond previous flawed reviews exploring NEM governance. The key issue is whether current arrangements are 'fit for purpose' in facilitating our transition to a secure, affordable, zero emission electricity industry over less than 35 years. This is clearly not the case, hence the need for a fundamental rethink of present policy, market and regulatory settings. In particular, markets are a 'means' rather than an end in themselves, and while markets can certainly drive major transformation in some circumstances, they typically require careful guidance and a 'firm hand' if they are to provide assured, robust delivery of desired societal outcomes.

Planning has a key role in the NEM, but is currently spread across government, government bodies and private participants with insufficient coherence and comprehensiveness for the task at hand. The White paper process should represent the highest level of planning but has failed over the past decade (reports in 2004, 2012 and 2015) to deliver the longer-term vision and strategy required. The most recent could barely bring itself to mention climate change.

What is needed is at least some measure of bipartisan agreement, and a coherent and comprehensive policy portfolio robust to a wide range of possible future scenarios including a range of political developments. Furthermore, the associated planning process must be continuous to adapt to changing conditions; as the saying goes, 'plans are nothing but planning is everything'. The COAG Energy Council provides a possible alternative to repeated White Paper processes, with the advantage of regular engagement across all State and Territory governments who, after all, have signficant carriage of energy related policy. There are certainly opportunites to improve processes including greater stakeholder engagement and a transition from the preparation of 'static' plans to an ongoing dynamic planning process taking advantage of ICT advances supporting continual knowledge updating.

Such advice and planning requires an evidence base. Energy modelling in Australia is highly problematic at present. Government has little internal capability, and there is high reliance on various specialist energy consultancy firms, running 'black box' proprietary models to deliver selected modelling outcomes; with typically limited transparency on why particular scenarios were investigated while other weren't, using what input data and assumptions, and which analysis and simulation methods. International developments have highlighted the value of transparent, open-source energy modelling platforms to assist informed, transparent investigation and discussion regarding possible energy futures. There is an opportunity here in Australia for governments to support the development and use of such open-source tools, accessible to all stakeholders including universities, industry and government themselves.

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Introduction

CEEM welcomes the opportunity to contribute to the work of the Finkel Review. The Review is certainly timely and, unfortunately, reflects the failure of Australian energy and climate policy makers to effectively balance the energy trilemma of security, affordability and environmental sustainability over the past two decades.

The introduction of the Australian National Electricity Market (NEM) reflected a broader micro-economic restructuring agenda that commenced in the early 1990s, but also evident failings in a number of State government owned, vertically integrated monopoly industries - particularly in terms of generation overinvestment.

Establishing a greater role for competition, however, involves considerable risk. The physical characteristics of AC electricity and technical characteristics of large-scale integrated power systems necessitate high levels of coordination and centralised control to ensure security; and its role in delivering an essential public good means that affordability is seen in terms of equitable and universal access; while its large environmental impacts are externalities, again requiring high levels of coordination.

In consequence, wholesale commercial arrangements in the NEM were made subordinate to security, and while they focussed on prices rather than affordability more generally, retail markets were left under socially directed State jurisdictional arrangements that maintained significant cross-subsidies across consumer sectors. Finally, the initial design criteria for the NEM included the importance of addressing environmental impacts - Australia's short-lived Ecologically Sustainable Development ESD) process ran for a time in parallel with the micro-economic reform agenda while the Kyoto Protocol was negotiated in 1997 when NEM arrangements were still being finalised. However, the chosen market arrangements largely excluded it from industry specific governance, leaving it to be 'managed' by external policy efforts (MacGill and Healy 2013).

The early NEM governance focus on security and electricity prices was aided by a legacy of significant generation overhang in key large States as well as the low costs of fossil fuels – both coal and gas. Although early new coal plant entry was largely driven by State Government owned generators in Queensland, the competitive market did drive considerable gas-peaking plant entry. Affordability was assisted by generally low wholesale prices, while retail markets remained immature and subject to a range of restrictions.

However, the neglect of environmental considerations within NEM arrangements eventually did see the implementation of some externally driven policy measures including several State schemes driving improved efficiency and gas-generation, and, Federally, a relatively modest Renewable Energy Target (RET) and improved energy efficiency programs (MacGill, Outhred et al. 2006).

These saw some additional gas CCGT investment, and, notably new renewables including growing wind generation. The NEM arrangements proved reasonably effective in facilitating these changes, with a wholesale market design that proved reasonably well suited to variable generation, and aided by some proactive and world leading early work on wind integration that arose with early industry development in South Australia (MacGill 2010).

There was only modest generation exit over this period despite the considerable age of much of the coal and gas-fired generation fleet. This period also saw market oriented arrangements introduced for Frequency Control Ancillary Services, and the extension of retail market competition across further States of the NEM, albeit still constrained by simple accumulation metering for most small customers and effectively 'socialised' network tariff arrangements.

The modest environmentally focussed efforts, however, proved clearly inadequate to the scale of the climate change challenge facing Australia and saw, by end 2007, apparent bipartisan agreement on the need for an expanded RET and carbon pricing. Meanwhile, the NEM also saw technical progress and falling costs for a range of distributed energy resources, notably solar photovoltaics, driving growing deployment outside its wholesale market arrangements. Also, the growing role of coal seam gas in Queensland created some expectations of more and cheaper gas supply. Network expenditure grew markedly, in part due to increased mandated reliability standards, but also challenges in terms of getting the regulatory incentives right. Retail prices began to rise markedly. Demand growth slowed and then, remarkably, reversed.

The past five years have seen growing challenges for the NEM. The loss of political bipartisanship on climate policy around both the RET and carbon pricing in 2012 has greatly increased uncertainty and hence risks for market participants. The development of export LNG on the East Coast has exposed the domestic market to some measures of international LNG pricing and revealed the inadequacies of present gas wholesale and transmission so-called market frameworks (Raffan, MacGill et al. 2014). Some of the older and/or higher cost coal-fired generation has departed while demand growth has returned over the past two years, tightening supply-demand balance. A bipartisan, if reduced RET target, State and Territory renewable policy efforts, as well as Federal ARENA and CEFC funding facilitation, has recently seen large scale wind and utility projects return. Meanwhile, over 5GW of PV has been installed, most as small household systems outside the NEM's formal data collection and control arrangements.

All of these changes have highlighted the growing inadequacies of NEM arrangements that keep climate and broader energy policy efforts outside industry specific governance. This includes security considerations which arguably received less attention over recent years as policy makers and the industry took it as a given, and focussed instead on supposed trade-offs between affordability and environmental protection. Recent events have now, of course, returned focus to the importance of security, however, the key is balanced consideration of all three of the trilemmas.

It is therefore unfortunate that the terms of reference for the Finkel Review task it only to seek a blueprint of "*policy, legislative and rule changes required to maintain the security, reliability and affordability of the NEM*" Past experience highlights that ignoring any one of the energy trilemma pillars involves significant risks. Australia's present 2030 target does not reflect the scale and speed of emissions reductions required for Australia to appropriately contribute to an effective global response to climate change. Of key relevance to this Review, variable renewables certainly do pose new operational security challenges that require improved NEM processes. However, the role of near unprecedented extreme weather in recent NEM security events, and the longer term security risks of fossil fuel (and hence carbon) dependence, mean climate change poses significant security risks whether we choose to address mitigation in a meaningful way, or resign ourselves to adaptation to an ever warming world.

In this submission we provide general comments for each section, with further brief commentary on all of the questions raised in the Review's Preliminary Report (from here, termed 'Report'), and more detailed commentary on several questions, with links where appropriate to work of the Centre for Energy and Environmental Markets.

We would, of course, welcome the opportunity to discuss our submission and broader work with the Review.

1 Technology is Transforming the Electricity Sector – Responding to Change

"The energy market is changing. New technologies create opportunities for a more integrated, predictable and responsive system, including to better manage peak congestion and provide reliability at lower cost. There are opportunities for new businesses and service models to meet this need. But if the integration of these technologies is not well managed, they could have a detrimental impact on security." (Preliminary Report p. 15)

The Review provides a valuable discussion on some of the key technologies now driving profound change in the NEM and other electricty industries around the world. It is notable that some of the most important of these are distributed energy resources being deployed by energy users, rather than within the traditional electricity supply chain. The process of technology adoption by energy users is very different from conventional electricity industry experience – economies of mass production rather than scale, a focus on energy services rather than an electricity commodity, and very different investor drivers, knowledge, skills and capabilities. It would be useful to consider an even broader consideration of technology change that includes recent progress with energy efficient end-use equipment from LED lighting to heat-pumps.

In considering future technology change, it can be helpful to consider technology's hardware (equipment), software (know-how) and orgware (institutional and broader) aspects (IIASA, 2017). Technology change often sees new hardware arrive without full knowledge of its potential values and risks, and institutional arrangements that are not well suited to managing these. The likelihood of appropriate technology innovation is improved with a focus on facilitating learning and institutional change, rather than just development of the hardware itself. We must also be mindful that stakeholders will actively attempt to influence (change or maintain) the institutional environment, and the overarching technological paradigm, including perceptions of the future and the legitimacy of technological options.

1.1 How do we anticipate the impacts, influences and limitations of new technologies on system operations, and address these ahead of time?

The challenges of anticipating the implications of new technologies are well noted in the Review. Technological change is inherently uncertain (particularly with regard to large-scale changes), dynamic (responding to changing external and internal drivers over time), systemic (occuring within a broader infrastructure involving technology combinations and the accompanying institutional environment) and evolutionary (a path-dependent process building on previous experience and knowledge, where some innovations emerge as more favourable, and others fail).

Efforts to improve our ability to anticipate the implications of new technology will benefit from a 'becoming modesty' regarding our abilities to do this, and rapid and continuous review processes that look broadly across related technologies and effectively map and record our changing insights over time.

Here, it should be recognised that the process of anticipation can be clouded by interests – key actors in the electricity industry have of course a stake in how these tecnhology futures and implications are seen. Incumbents have highly relevant knowledge, yet also interests, which means that their contributions need to be carefully managed. Because large incumbent stakeholders have significant formal and informal linkages to governance institutions and processes, and will tend to oppose paradigm changes, an immediate opportunity in NEM governance to better anticipate change is to broaden the range of stakeholders involved in consultation processes – for example, input from energy efficiency and ESCO stakeholders as well as greater consumer focussed representation would be of great value.

Another opportunity is facilitating greater public availability of relevant industry data. The NEM has high transparency in some areas – for example, in terms of five minute dispatch and market offers for each major wholesale market participant. However, there is sparse information available at network, retailer and particularly end-user level. Lack of data transparency significantly reduces opportunities for effective competition from new distributed technologies to offer services.

1.2 How can innovation in electricity generation, distribution and consumption improve services and reduce costs?

Our first challenge is to ensure technology innovation does no harm. As currently practiced, not all so-called innovation is socially beneficial – some recent financial 'innovations' are relevant examples. Current commercially oriented energy technology innovation occurs within a framework which does not always ensure security, affordability or environmental objectives are considered. Residential ducted air-conditioning presents a relevant case study – while it undoubtably provides a valuable service to those households who have one, it has increased the peakiness of demand, particularly during extreme events, with consequent adverse impacts on security and hence, through network investment requirements, affordability. Technology innovation doesn't just create unintended 'externalities', it sometimes explicitly exploits them in order to improve the private value of those deploying it. Again, broader stakeholder engagement can assist in identifying potentially adverse impacts of new technologies before widespread deployment.

In terms of socially beneficial innovation, it seems likely that the greatest untapped innovation opportunities at present are in energy end-use equipment. While innovation in this area has been significant over recent years, it is notable that much of this has not been driven by electricity industry value propositions.

As highlighted above, the opportunity and challenge is to get the environment right to shape innovation towards appropriate ends. While targeted support for hardware innovation is relevant, facilitating effective technology 'software' and 'orgware' is likely even more important. For instance, a review of the innovation environment shaped by current retail arrangements to assess end-use innovation opportunities would be worthwhile.

To conclude, the inherent uncertainties of technology innovation suggest that the key task for energy policy makers it to establish robust 'innovation' frameworks that seek to faciliate a potentially wide range of technology solutions, and solution providers, to the industry's challenges. A key role of these frameworks is is to facilitate appropriate risk management, involving both risk reduction but also allocation. It is only appropriate that governments, representing society, underwrite some of the risk associated with socially beneficial innovation. Safe 'sandpits' to permit temporally and locationally constrained experiments, including regulatory trials, can be valuable in supporting this. So can targeted innovation funding support, including capacity building. Certainly, our challenges are too great to leave energy sector innovation to present energy, and associated technology markets.

1.3 What other electricity innovations are you aware of that may impact the market in the future?

As noted in the Review Preliminary Report, it's the 'unknown unknowns' that pose greatest uncertainty. One area that we feel certainly merits greater attention are the opportunities for transformational energy efficiency improvements, and possible energy user defection from the gas supply network as electrical appliances offer ever greater safety, efficiency and cost advantages over gas appliances for services including space and water heating, and cooking.

There are others, no doubt, and a key role for the Review is to seek, and perhaps insist, on a broader range of stakeholder participation than is often the case for electricity industry review and decision making processes.

2 Consumers are Driving Change

"Consumers are helping to drive electricity sector transition by embracing new technologies, choosing ways to better manage their energy costs and help reduce our emissions. The increasingly active role of consumers will be important in supporting the future security and affordability of the power system, but this requires the right prices and incentives. It will be important to address the needs of vulnerable groups." (Preliminary Report p. 18)

Electricity industries play an essential role in societal welfare and progress, and there is a broad societal interest in their success in serving all energy users. Their governance arrangements commonly claim the interests of energy users as their paramount objective – certainly the NEM does – and this would suggest a key decision making role for them, in all their diversity.

However, large interconnected power networks are also highly complex socio-technical systems requiring very high levels of coordination to ensure secure and reliable operation, and have large social, economic and environmental externalities. Balancing individual energy user preferences against these broader, longer-term, shared interests is a key challenge, and the decision making role of energy users has changed markedly over the history of the electricity industry; from highly engaged clients in the industry's early days, to citizens with a right to this essential 'public good', to non-specific consumers within ever larger vertically integrated utilities, to now, in restructured industries, customers. Increasingly, however, emerging distributed energy technologies including photovoltaics, storage and 'smart' loads are offering energy users new industry roles as prosumers rather than just consumers, and utility business partners, or potentially even utility competitors, rather than just customers. The implications are potentially profound, yet highly uncertain and contested (MacGill and Smith 2017).

The NEM is at the leading edge of this transformation globally, and has retail electricity markets in some States that are considered highly competitive by international standards. It alsohas the world's highest residential photovoltaic (PV) system penetration, and has been identified by a number of energy technology providers as a key early market opportunity for distributed energy storage.

These retail market and prosumer developments are certainly related, but not in the way one might assume. By some conventional measures of retail competition – numerous private retailers, high customer transfers (less charitably termed 'churn') and large price spreads between market offers – some of the States in the NEM might be argued to have effective retail competition. By other measures, however, including the NEM's significant retail market concentration, high retailer margins, lack of substantial diversification of offerings, and the major proportion of customer bills going to monopoly (non-competitive) network businesses, effective competition seems less assured. Certainly, it is hard to sell the success of retail competition to small energy users who have seen very high electricity price rises over the past decade.

The evident limitations of retail market restructuring in the NEM has now seen growing policy attention to the importance of more effective energy user engagement in the NEM. This attention is surprisingly belated – efficient markets require effective participation on demand as well as supply side, participation beyond merely paying bills. A range of initiatives have been implemented to improve engagement, largely focused around customer information, education and, particularly, movement towards more 'cost reflective' network tariffs.

Meanwhile, however, a growing number of energy users have found a new and highly effective way to engage in their energy service provision and take greater control of their electricity bills, through residential PV. While there are numerous motivations for households, a desire to save money has certainly been a key driver (CSIRO, 2015) that has increased over time to surpass the environmental motivations of early PV adopters in Australia (Bruce, Watt et al. 2009). Households and businesses have also responded to rising electricity bills with improved energy efficiency.

The response of the key NEM electricity supply stakeholders and governance institutions to the rise of PV prosumers might best be termed mixed. While residential PV can raise some technical challenges for the distribution networks, the key issue has been the adverse financial impacts on their businesses given their primarily volumetric tariff structures. Retailers have also seen reduced sales volumes, although these are matched at least in part by reduced purchases from the wholesale market.

While on one hand, policy makers have welcomed and encouraged this enhanced energy user engagement, as the realities have emerged of what such participation can do to existing business models and the social compact with energy users, compromises of the formal market principles of encouraging energy user participation have emerged. This has been particularly evident with the implementation of purportedly more cost reflective tariffs.

Policy makers argued that tariffs which better reflected the various costs of serving different types of consumers would put customers at the center of future decision making. Instead, many of the tariffs being proposed involve higher fixed charges, specific solar charges, steep declining block flat tariffs, or very broad windows throughout the year for 'peak' charges; the result of which is to limit consumer options to reduce their electricity bills by investing in new distributed energy technologies or changing their behavior.

While PV and volumetric tariffs do create cross-subsidies between houses with and without PV, these woul seem to be dwarfed by present subsidies between households with and without air-conditioning, and urban versus rural households. Tariffs are of course as much social constructs as economic ones, and the social acceptance of some of the proposed tariffs is not settled in Australia. It is also evident that energy users need assistance beyond price signals to respond appropriately to their distributed energy opportunities – something which has received inadequate attention.

A key challenge for the NEM is to better manage the challenges posed by prosumers while facilitating, and maximizing, the societal benefits they can bring, particularly with the growing capabilities and falling costs of PV and energy storage systems. More generally, facilitating greater engagement with energy users will likely be essential in establishing the societal consensus required for the profound and highly disruptive transformation to a cleaner energy future (MacGill and Smith 2017).

2.1 How do we ensure that consumers retain choice and control through the transition?

This question would seem to assume that consumers currently have choice and control. As noted above, their present choices and control are limited, while some changes underway, including so-called cost reflective tariffs, may well reduce their ability to control their network bills through investment and behavioural change.

We need to fundamentally revisit the design of our retail markets so that they actually focus on what consumers want; secure, affordable and environmentally sustainable energy services. This will likely require new energy service oriented market participants, rather than retailers following the present business model.

2.2 How do we best meet the needs of vulnerable and hardship consumers?

This is an important issue – electricity industry tariffs are as much a social construct as an economic one, and universal access is a widely agreed societal goal. Conventional economic theory argues that economically efficient pricing will maximise net societal surplus, and this can be redistributed to vulnerable and hardship consumers via external transfers.

It is is hardly surprising that there is little trust in large sections of society that such redistribution will occur – in some other areas of the economy delivering essential services, redistribution currently appears to be upwards rather than downwards. Restructuring towards more cost reflective tariffs will have to establish far greater levels of trust than currently would seem to exist.

Even with more economically efficient tariffs, the idea that all, or even most, energy consumers are rational, well-informed, decision makers seeking to maximise expected returns is absurd on the face of it. For all but a few energy consumers, electricity is non-core, and their decision-making is best described as satisficing (based on habit, routines and assumptions), rather than optimising (Grubb 2014). While this satisficing behaviour has left a huge untapped scope to improve economic efficiency, consumers will require expert assistance in order to take advantage of opportunities, particularly in terms of their energy service delivery options including distributed energy resources.

This is particularly the case for vulnerable and hardship consumers who will often have little opportunity (eg. renting or public housing) or capability (eg. access to finance). Targetted energy efficiency programs, including education, and wide-ranging public housing upgrades, including investments in efficient building envelopes, appliances and distributed generation and storage, can assist here.

2.3 How do we ensure the needs of large-scale industrial consumers are met?

For large energy intensive users, energy is, or should be, a core interest. Globalised supply chains for energy intensive commodities mean that expensive and/or unreliable power supply will certainly reduce future investment, and may see earlier closure of existing operations. Increasingly, these energy consumers are also concerned with the environmental performance of their electricity supply. A high emissions intensity Australian electricity industry seems likely to become ever less attractive for such investment.

Australia is in the invidious situation of having major industries established around low cost, reliable electricity, now facing higher costs and potentially less reliable electricity service, a service delivered by an electricity sector which also has one of the world's highest emissions intensities.

While many of these industries have excellent opportunities to improve their energy efficiency, this requires investment and that requires some certainty regarding future security, affordability and environmental outcomes.

The alternative approach of extracting 'sweetheart' subsidies from State and Federal Governments is problematic on economic and equity grounds, and not sustainable in the longer term.

2.4 How can price structures be made more equitable when consumers are making different demands on the grid according to their electricity use and their investments behind the meter?

Equity is a complex issue in the electricity sector, and addessing this question requires greater clarity on which 'equity is being considered. Present network tariffs certianly involve cross subsidies across many consumer classes. While there has been particular attention recently by policy makers and industry participants regarding subsidies between households with PV and those without, these subsidies would seem to be far less than those between households with air-conditioning (particularly ducted AC) and those without. Those subsidies in turn, would seem to be far less than the present cross subsidies between urban and rural consumers (MacGill and Bruce 2015).

Targetting particular cross-subsidies while considering others sacrascant is hardly the basis for building broad societal consensus on what will be a very challenging clean energy transition. More cost-reflective tariffs can play a useful role if implemented appropriately but have inherent limitations, not the least of which is widespread consumer distrust and dislike for some proposed changes such as peak demand charges (MacGill and Smith 2017).

Targetted support to assist consumers to undertake socially optimal investment and behavioural changes will also have a key role. Unfortunately, there is a risk that cost reflective tariffs will be seen as an alternative, rather than complement, to such activities.

2.5 How do we ensure data sharing benefits and privacy are appropriately balanced?

It is hardly surprising that those with commercially relevant data are reluctant to share it in most circumstances. Where societal welfare is improved by greater disclosure, it is incumbent on policy and rule makers to require it.

The NEM is, by some measures, a highly transparent electricity market implementation. However, this applies to the large-scale generation sector only. There is only very limited information on retailers by comparison with the five minute dispatch, market offers and revenue information available for generators. This needs to be addressed. The assymetry is stark – retailers are not required to formally participate in market dispatch – for example, by having to bid into the wholesale NEM in a similar manner to generators, and with the associated transparency this would bring.

Greater network data transparency should be a requirement of these economically regulated, monopoly, service providers. Aggregate demand data or suitable de-identification should be sufficient to address privacy concerns.

Finally, consumers should have access to their own data and straightforward opportunities to decide who they want to share it with, under what circumstances.

3 The Transition to a Low Emissions Economy is Underway

> *"The world is acting to reduce greenhouse gas emissions. Australia has a target to reduce emissions by 26 to 28 per cent below 2005 levels by 2030. The electricity sector has an important role to play in achieving Australia's emissions reduction targets. Not only is it Australia's largest source of emissions, but also a large source of opportunity for abatement and innovation. This will require stable and effective emissions reduction policies to support the necessary investment in long-lived generation and network assets while maintaining security and reliability." (Preliminary Report p. 24)*

Firstly, it is very unclear that the transition to a low emissions economy is underway in Australia. By official measures, Australia's total emissions have remained fairly flat over the last 25 years, with emissions in 2014 being about 3 per cent below those in 1990. In reality, emissions have climbed significantly over these 25 years if LULUCF emission estimates are excluded. These land use and land use change and forestry estimates are of course very problematic in terms of emissions measurement, especially where counterfactual baselines are used, and permanence, particularly given weather extremes and other eco-system impacts of a warming world. The key outcome of policy efforts in Australia, to date, therefore has been near complete failure to reduce direct national emissions, except for a brief period over 2012-2014 (Raffan, Bruce et al. 2016).

At present, the Federal Government has a renewable energy target of an expected 23.5% renewable electricity by 2020 (almost certainly falling over the period to 2030) and a 2030 target of 26-28% greenhouse emission reductions from 2005 levels as Australia's contribution towards the Paris Agreement. These ambitions fall way below those of Victoria, Queensland, South Australia, the ACT and NT in terms of renewable targets, and Victoria, South Australia and the ACT in terms of longer term emission reductions (aspirational targets of net zero emissions in 2050) (Mills, Bruce et al. 2016).

It should also be acknowledged that while Australia still has a significant decarbonisation challenge to meet current targets, Australia's Paris targets are currently amongst the weakest from developed countries. Climate Action Tracker's assessment is that (Raffan, Bruce et al. 2016):

> *"We rate Australia's INDC 2030 target to reduce greenhouse gas (GHG) emissions by 26–28% from 2005 levels including land-use, land-use change and forestry (LULUCF) by 2030 as "inadequate." "After accounting for LULUCF, this target is equivalent to a range of around 5% below to 5% above 1990 levels of GHG emissions excluding LULUCF in the year 2030…. All other industrial countries, except Canada and New Zealand, have proposed 2025 or 2030 goals significantly below 1990 levels. The "inadequate" rating indicates that Australia's commitment is not in line with most interpretations of a "fair" approach to reach a 2°C pathway: if most other countries followed the Australian approach, global warming would exceed 3–4°C."*

The current Federal Government targets are clearly entirely inadequate in terms of delivering the almost complete electricity sector decarbonisation by 2050 that the International Energy Agency and IPCC suggests is required globally to avoid dangerous global warming. Queensland is seeking 50% renewable generation by 2030, Victoria 40% by 2025 and South Australia 50% by 2025. The Australian Capital Territory looks set to achieve 100% renewables by 2020 while the Northern Territory has just announced a 50% target for 2030. Despite this, the Federal Government has been highly critical of the various State renewable targets (Mills, Bruce et al. 2016). There may be considerable international pressure for Australia to increase its level of ambition in coming years. While current negotiations have been largely based on the burden of mitigation being undertaken by different countries (relative change) and geo-political realities, there is a strong argument that supports principles based around equal per-capita emissions rights, and the idea of distribution of effort based on historical responsibility.

Looking forward, the most recent IPCC climate science and energy technology assessments suggest that near-complete decarbonisation of the electricity sector is required within the next 35 years to achieve 450ppm CO2e, giving us a reasonable chance of keeping warming below 2 deg.C. Australia has signed on to this objective and as such, all long-lived electricity sector investment needs to be assessed on the basis of whether it contributes towards or against such near complete decarbonisation over that time frame.

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

Most work suggests that the electricity sector has a particularly key role to play given its significant emissions and excellent options for reducing these compared to some other sectors. Given Australia's excellent renewable resources and other low emission options for the NEM, the only target consistent with Australia contributing fairly towards global efforts to restrict warming to less than 2 deg.C is complete decarbonisation by 2050. Given the long-lived nature of electrcity infrastructure assets, this suggests that significant emission reductions are required by 2030. Certainly, relying primarily on LULUCF poses unacceptable risks for achieving longer-term emission reductions in Australia.

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

The challenge of decarbonisation highlights the limited and strictly transitional role that gas can play in Australia's longer-term electricity industry future, unless widespead deployment of gas-fired CCS can be achieved.

Still, this transitional role is critical, and highly problematic at present given the lack of a coherent gas sector strategy and policy framework in Australia at present. In particular, the transition from an East coast gas market supplying only domestically to one which is now dominated by LNG exports has been very poorly managed (Raffan, MacGill et al. 2014).

There are many opportunities to improve efficiency in Australia's gas markets due, in large part, to the limited efforts seen to date. Past efforts have often been thwarted by private ownership of key gas infrastructure and their concerns that more efficient markets may impact on their own future prospects. Such private ownership has, indeed, restricted the ability of governments to restructure the industry as effectively as was achieved in electricity. This has relevance to current Federal and State Government plans to further privatise currently State owned electricity industry infrastructure. It needs to be acknowledged that this may well adversely impact on Government opportunities to undertake future electricity industry reforms. Significant progress in gas markets will require Governments to better manage incumbent pressures to restrict restructuring to changes that benefit, or at least do not greatly adversely impact, existing industry players.

Certainly, the ACCC has noted some of the challenges for effective competition in the market including the fact that less than 20% of transmission networks are now subject to any form of regulation. Questions of supply competition are also evident.

More generally, we need to revisit the wisdom of exposing Australian energy consumers to so-called international LNG pricing. Firstly, such pricing has very low transparency – LNG represents a relatively small proportion of cross-border gas trading, and such trading represents only a small proportion of gas consumption. And the great proportion of LNG is traded via long-term contracts rather than through 'spot' markets. Given the strategic importance of natural gas towards Australia's electricity sector decarbonisation both as a lower emission fossil fuel but particular in terms of renewable energy integration, State and the Federal Governments need to engage far more effectively than they do at present.

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

The focus here needs to be on barriers to appropriate investment, rather than investment generally. Both socially beneficial and harmful investment has been seen in the NEM over recent years, and it is entirely possible for government's to incentivise further harmful investment through inappropriate policy, market and regulatory settings.

For clean energy options, the key cost is that of capital, and that is driven by the cost of finance, and that is driven by investor perceptions of risk. And the key risks at present would seem to be policy and regulatory risk. As such, government has a vital role in managing risk and this will invariably involve taking on some of the social risks associated with clean energy transition. This process requires careful, transparent and well managed decision making. Investors all want certainty, but need to face some of the risks involved. Policy and regulatory certainty should only be provided where there is clear alignment with societal objectives, rather than through government guarantees that move unreasonable risk to energy users and public more generally.

Finally, while the policy focus tends to be on large-scale electricity industry investors, we need to consider investment barriers for small and medium energy users, who face greater uncertainty than large investors in some regards, and yet have an important role to play. In particular, these smaller energy users generally can't lock in longer-term prices via suitable retail contracts while network tariffs are also subject to regular revision. This will be an increasingly important barrier to appropriate demand-side investments, including in distributed energy options.

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

The growing risks of climate change are now nearly globally accepted, and it is well understood by the great majority of investors that the energy sector in Australia will need to undergo dramatic clean energy transformation over the coming decades as part of international efforts to avert dangerous global warming, or else face potential diplomatic and trade penalties as a result of inaction. Investors will draw confidence from a clearly elaborated and credible strategy for achieving societally appropriate carbon pricing and associated policies, in a gradual, supported and stable manner. Clarity around the mechanisms that will be applied is an essential prerequisite for investing in any kind of long-lived capital intensive infrastructure.

The most assured way for our political processes to deliver such certainty in a two-party demoncracy such as Australia, is to have bipartisan support. High levels of consensus can be seen in some political systems regarding clean energy – it generally also has wide public support. Unfortunately, Australia has the dubious honor along with the United States, of currently having one of the most adversarial political contexts for clean energy policy. Greater discipline is required of the political process here.

Even with some level of bipartisan consensus, suggestions for an entirely non-political, technically led governance framework, require careful consideration. Energy transformation will involve risks and costs as well as benefits and is likely to have distributional impacts that need to be managed. These are inherently political considerations and the process cannot succeed and investor confidence cannot be maintained without sufficient societal consensus for progress. Recent political developments including Brexit and the US Presidential election have certainly highlighted the risks of major political consensus without concurrent societal acceptance.

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

Such generation is best termed lower emission rather than low emission given that the only generation technologies with higher emissions than ultra-supercritical plant are less efficient and/or lignite (brown) coal fired power stations.

A number of countries are currently replacing older and less efficient coal-fired plant with super-critical and ultra-supercritical plant, notably China. Given the lower wealth of these countries by comparison with 'rich' countries such as Australia, rapid demand growth and far lower per-capita emissions, it is difficult for wealthier countries to argue against this without making far greater efforts to reduce their own emissions.

The latest climate science and energy modelling (IEA, 2017) emphasises that new coal generation – ultra-supercritical or otherwise – has no longer-term future in a world taking effective action to avoid dangerous global warming, unless fitted with carbon capture and storage.

Australia, as a wealthy country with very high per-capita emissions, should therefore not be investing in new coal fired generation unless it is fitted with CCS that captures the majority of emissions. Discussion of making such plant 'CCS ready' is not sufficient – the proposed CCS may or may not come to pass.

Much recent discussion of 'clean coal' and CCS has focused on abstract construction cost estimates. Such discussions tend to import assumptions and cost data from jurisdictions with no or limited comparability to Australia. For example:

- Emissions sources are hundreds of kilometres from prospective sinks. Little meaningful data on these sinks is available.
- The 2009 National Carbon Taskforce Report called for a $254m, strategically phased, pre-competitive exploration program to validate coarse estimates of potential storage sites. The taskforce was disbanded shortly after this and no Federal actions taken.
- The ZeroGen project began in 2007 as a $4.3bn integrated project financed by Stanwell Power Company, the Australian Coal Association's Low Emission Technology Deployment Fund, Federal and Queensland State government funds. Judgements in the face of insufficient data were necessary to decide on geological storage sites, though the project was ultimately shelved by the Queensland Government after some 12 test wells were drilled at a cost of over $100m (Garnett et al, 2014).
- The Australian Coal Association failed to spend even half the $1bn ACALET fund raised until 2012, after which point the fund was used for pre-election advertising for coal (Long, 2017)
- Overhauling mining tenement holding and allocation with a view to sequestering, rather than extracting CO2, would be a worthy policy for Australia in light of the limitations of Paris agreement commitments (see also Kuch, 2017).

Carbon Capture and Storage has had some success in the United States where there is a buoyant Enhanced Oil Recovery market for CO2 streams. Such market does not exist in Australia, meaning a relatively increased role for government intervention or a carbon price. As summarized in a recent article (Kuch, 2017):

> *Success for CCS is defined by confidence in the availability of large-scale CO2 storage to facilitate "policy and investment decisions being made today, including in relation to the construction of new fossil fuel-based power generation which may require CCS retrofit as emissions requirements are tightened in the future" (IEA, 2016). This link between 'confidence in storage', present investment decisions, and future regulation has eluded demonstration. Political support and public funding to further develop CCS has fallen in response to poor returns from billions of dollars in investments. Over the past 14 years, governments have announced a total of $24bn in funding commitments for carbon capture and storage projects, according to the Bloomberg New Energy Finance research firm. Companies have spent at least $9.5bn since 2005 (Clark, 2015). There are currently 22 large-scale CCS plants operating or under construction, according to the Global CCS Institute (2016), but only three are on power stations. Assuming all 38 Large-Scale currently listed on the Global CCS Institute website (Global CCS Institute, 2017) as identified or under construction were to be completed by 2030, they would sequester approximately 60 million tonnes of CO2 annually – approximately 10% of Australia's national emissions in 2015, or 0.04% of total global coal emissions. Furthermore, just one of 38 proposed integrated CCS power plants has commenced operation: Boundary Dam (Saskatchewan, Canada), with a second plant (Kemper County, Mississippi) overdue to commence at triple its original budgeted cost of $2bn, and a third plant set to*

commence operation in 2018 (Petra Nova) (IEA, 2016). These three large-scale integrated CCS projects have commenced operation in North America where the oil and gas industry has strengthened its grip on energy policy with the development of shale gas resources in recent years.

Integrated CCS projects involve enormously costly construction to build or retrofit power plants and risks in the storage of CO2. Financial support for projects has come from Federal agencies in every major jurisdiction, in addition to revenue from EOR. For example, the state-owned utility SaskPower received C$240 million from the Canadian Federal government for its Boundary Dam project (Leo, 2015). The Boundary Dam project is not a complete retrofit of the 45 year old lignite-fired power station of the same name; rather, 90% of the CO2 emissions were designed to be captured from just one of its five operating units (Leo, 2015). This unit required a C$1.467 billion retrofit to produce approximately 115-120MW of power with the capture plant operating (IEAGHG, 2015). Half of the captured CO2 is emitted to the atmosphere during the processing from plant to its sequestration, with the remainder sold to oil and gas company Cenovus for C$25 per tonne for use in EOR under a contract. Breach of this contract, through a failure in the capture technology, cost SaskPower C$12million in 2014 in penalties alone (Leo, 2015).

Given the absence of market failures or institutional barriers to the deployment of a relatively mature technology in an electricity system designed around similar technology, there is no justification for government support for investment in ultra-supercritical coal generators. Any support for lower-emission electricity generation via the Clean Energy Finance Corporation or government agencies must consider the trajectory required of Australia's electricity system over the life of the assets and the likelihood of stranded assets.

4 Integration of Variable Renewable Electricity

"The closure of coal-fired generators and their replacement with wind and solar PV generators has technical implications for the security and reliability of the power system. This is because wind and solar PV generators lack spinning inertia and the ability to contribute to medium and long-term frequency control, reactive power control, system voltage control, and system restart. Gas-fired generators can help address technical challenges, but there has been a reduction in gas-fired generation capacity. Work is underway on implementing technical and market solutions to increase grid security and reliability." (Preliminary Report p. 33)

Strictly speaking, wind and solar are not replacing coal-fired generators – their departure results from a range of factors including the age of many of these units and growing maintenance costs, as well as changing corporate strategies. However, the challenges of relatively inflexible generators competing with very low operating cost wind and solar generation has certainly added to their challenges.

Also, there has been only very limited retirement of gas and liquid fuel generation. However, we have certainly seen some gas generation – including several of the most efficient and lowest emission generators in the NEM – mothballed, or operated at only partial output. Again, there are a range of factors, but a key one would seem to be much higher gas prices meaning their long-term supply contracts are more valuable when sold to the LNG export facilities, than for generating electricity.

Another factor worth noting is some of the extraordinary extreme weather events seen over the past year, certainly in South Australia. Unfortunately, these events may well be a harbinger of the challenges of a warming world for electricity industry infrastructure.

Finally, there is the question of how the exercise of market power might be exacerbating some of the security challenges being seen in some jurisdictions.

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

There are a range of immediate actions that can be implemented – none necessarily desirable for the longer-term. As already seen, AEMO can be given greater discretion in determining periods of higher security risks, and direction powers for market participants at such times. The interface between the security and commercial market regimes in the NEM is a difficult one for AEMO. Generally, arrangements have been designed to provide market participants with a high level of assurance that interventions will only take place when absolutely necessary, and such interventions will not impact the pricing that would have otherwise eventuated.

The highly variable and somewhat unpredictable nature of wind and solar generation is driving a growing number of periods which don't fall within traditional classifications of credible and non-credible contingencies, but do represent periods of greater risk. Along with what appears to be the exercise of market power by some market participants in ways that threaten market security, there is a good case for AEMO to be given greater powers in this regard.

Tasmania provides an interesting example of high renewables management given its significant wind generation but, particularly, only HVDC connection to the rest of the NEM. This link must effectively be treated as non-synchronous and Tasmania is still successfully managing quite high non-synchronous penetrations. The State is aided by the flexible nature of the hydro generation mix, which does pose some inertia challenges, but has also been deploying a range of techniques to increase inertia, and speed the response to incidents such as the sudden loss of Bass Link. These lessons would seem to have potential wider applicability – for example, in speeding up the response to sudden events such as the loss of the Heywood interconnector.

There are only limited immediate opportunities for improved security outcomes with distributed resources. Better forecasting is a key need. Considerable challeneges exist with regard to private control systems linked to distributed energy resources. Behind the meter control systems have been rolled out in a relatively unregulated manner, but as the penetration of distributed energy resources (DERs) increases, these control systems will potentially be managing significant fractions of the grid's generation capacity. This presents risks of hacking, software malfunction and reliance on the presence of IT infrastructure (which may fail in a power outage). As this technology is still in its infancy, it is difficult to find immediate straightforward solutions to the security risks of distributed resources without creating barriers to innovation and investment, but one option is to establish rules around delegating to aggregators and software providers in emergency situations in a similar way that existing generators can be directed by AEMO.

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

This is relevant to only South Australia at Tasmania at present given existing renweable penetrations, unless the level of variable renewables was set at quite low levels. This approach has certainly been used in other jurisdictions such as Ireland. It does have potentially significant commercial implications for renewable generation, but also market participants with conventional plant. Such an approach would need parallel restrictions to address these potential market power issues. It will also increase renewables spill hence adverse environmental impacts – another consideration in how the limits are set.

The level at which curtailment occurs could be set dynamically, for example permitting AEMO to mange the system more conservatively during extreme weather events. It is not clear exactly what powers AEMO already has in this regard, and it would be useful to document these.

4.3 Is there a need to introduce new planning and technical frameworks to complement current market operations?

Without doubt – the limitations of present planning and technical frameworks are becoming ever more apparent. These frameworks need to include gas, demand response and distributed energy resources in a far more comprehensive and coherent way than at present.

4.3.1 Should all generators be required to provide system security services or should such services continue to be procured separately by the power system operator?

Requiring all generators to provide system security services would be an inefficient approach. It would potentially exclude technologies such as batteries and demand reponse from providing services that require fast reponse, which they are well placed to deliver cheaply, as was evident in the UK's recent reverse auction for fast frequency response.

4.4 What role can new technologies located on consumers' premises have in improving energy security and reliability outcomes?

There are already energy consumer technologies that are improving energy security for delivery of their own energy services including backup generators and UPS. Controlled load hot water and demand response (DR) operated by networks also already plays an important role, with the potential for further and more sophisticated use of DR based on commercial loads, as well as residential loads, including air conditioning. Progress with Battery Storage Systems and PV are further expanding such options. These can also offer security services for the grid at large if appropriate control systems and associated incentives are put in place. It is unfortunate that the AEMC has rejected the implementation of a formal demand response mechanism, as greater demand response capabilities have proven highly valuable in other jurisdictions for improving security of supply.

4.4.1 How can the regulatory framework best enable and incentivise the efficient orchestration of distributed energy resources?

We are not convinced that 'orchestration' is the right term – orchestras are generally highly regimented with very little participant freedom. The most appropriate frameworks will provide coordination rather than control. A mix of both pricing and complementary regulation will be required. Importantly, appropriate investment in distributed resources requires that potential investors be able to manage risk, and this really requires mechanisms for assuring future prices. These are available for large-scale utilities through various derivative market offerings such as power purchase agreements. Equivalent financial mechanisms are not generally available for distributed resources. In some circumstances, governments may need to provide equivalent mechanisms to assist potential investors in managing such risks, such as longer-term network tariff commitments for energy users.

4.5 What other non-market focus areas, such as cybersecurity, are priorities for power system security?

Cybersecurity can be considered as a market focus area given that with the increase in DER penetration, increasing fractions of the NEM's generator pool will be controlled via IP infrastructure. Significant challenges exist in this space. The majority of behind-the-meter applications are based on proprietary control systems and APIs that are designed to lock customers in to proprietary software. This gives technology providers a significant degree of power over the NEM and the security of Australia's power systems more broadly.

The most efficient high-penetration DER scenarios appear to be those in which generation and consumption are closely matched via a 'smart grid' network of sensors and controls. It follows that in such scenarios, grid stability is reliant upon the presence of internet infrastructure.

At the moment, this infrastructure is being rolled out by a range of private firms, with proprietary control systems and potentially insecure backend infrastructure. There are therefore a range of energy security problems that remain unaddressed under the current regulatory frameworks around the integration of DERs with internet-based control technology.

Power outages often result in communications infrastructure outages. There may be challenges inherent in this link, if DERs are unable to be operated in times of electricity crisis.

It appears difficult to regulate the current roll-out of behind-the-meter IP devices without presenting potential barriers to innovation in this space. It seems reasonable however to suggest that regulators should monitor this space for potential inadvertent centralisation of IP infrastructure that may be able to impact the operation of DERs enough to compromise grid security. This may not necessarily be simply the concentration of a retail aggregator's control, but infrastructure up the technology stack as well including DNS servers and API hosts (ie. AWS).

4.6 How could high speed communications and sensor technology be deployed to better detect and mitigate grid problems?

The presence of high-speed communications and sensor technology represent a host of opportunities to impact fast frequency response. Digital response timescales are orders of magnitude faster than single AC wavelengths; we can thus see that fast detection can be paired with fast deployment of frequency response measures if the appropriate infrastructure is deployed. Further, this opens the door to discussions around the increased potential roles for 'synthetic inertia' systems derived from non-traditional electrical infrastructure. Tasmania's management of high non-synchronous generation periods with Basslink operating provides a relevant example in this regard.

4.7 Should the rules for AEMO to elevate a situation from non-credible to credible be revised?

As noted above, there are opportunities to improve both the discretion that AEMO can apply to identifying high risk situations, and the powers that it has to address such risks.

5 Market Design to Support Security and Reliability

"The design of the NEM has significant implications for maintaining security and reliability objectives in the context of the transition taking place in the electricity sector. It is critical that the design of the NEM provides appropriate incentives for efficient investments that achieve secure and reliable electricity supply." (Preliminary Report p. 40)

Undoubtably true but only part of the story – we need market designs that provide appropriate incentives for investments that help us meet our affordability and climate change objectives as well as secure and reliable supply. The task of market design only for achieving secure and reliable supply is in some ways straightforward, but would work against these other objectives by driving excess dispatchable generation and network investment.

Beyond the question of market design is that of market structure – the number and nature of market participants. At present, all NEM markets, wholesale, FCAS and retail exhibit very high market concentrations. This need not work against security and reliability, but it can should major participants seek to 'engineer' tight supply-demand balance. It also has potentially major affordability implications.

5.1 Are the reliability settings in the NEM adequate?

There are two relevant reliability settings here – that of the overall target for unserved energy due to insufficient generation capacity, and those for the reliability of supply for energy users.

In both cases, there is the question of how much consumers are willing to pay for greater reliability. Asking consumers this through Customer Value of Reliability (CVR) processes is problematic, and there are opportunities to better explore this trade off through more sophisticated surveying techniques.

Emerging distributed technologies such as battery storage are giving customers a greater range of options with regard to their desired service reliability. While this does allow those energy users requiring very high reliability to buy it, it is important that the reliability settings within the NEM maintain adequate service reliability for those customers unable or unwilling to invest in such resources.

5.2 Is liquidity in the forward contract market for electricity adequate for the needs of commercial and industrial consumers and, if not, what can be done?

This is an important question. While there is a lot of annecdotal evidence regarding current challenges for such consumers, policy makers really should be collecting detailed data on large consumer experiences in the market, including the types of offerings, costs, time periods and additional flexibity options. There are growing efforts in this regard through surveying by AEMO and others, but more that could be done.

It is certainly notable that large generators and retailers can secure long-term derivatives (OTC if not on ASXEnergy) but typically industrial and commercial customers (other than the largest) can struggle to secure prices over similar time periods. The same goes for network tariffs which are typically only fixed for less than five years. It certainly represents a challenging environment to undertake investment. It is interesting to note that large consumers are showing much greater interest in off-site renewables projects given recent market developments (Mills and Mitchell, 2017).

5.3 Are commercial and industrial users experiencing difficulties in obtaining quotes for supply?

Again, there is considerable annecdotal evidence that this is proving challenging, but we should really be collecting this type of information from market participants through user surveys and, ideally, mandatory disclosure requirements on retailers.

5.4 What impact will an increasing level of renewable generation have on the forward contract market and what new products might be required?

An interesting question. There has been some work on tailored 'shaped' CFD and call derivatives better suited to wind and solar generation than those presently available. We discuss derivative products for FCAS markets below.

5.5 Rule changes are in process to make the bid interval and the settlement interval the same, both equal to 5 minutes. Are there reasons to set them to a longer or shorter duration?

Despite metering challenges, a change to 5 minute settlement seems warranted by the evident efficiency impacts in providing greater assurance of returns for fast start plant, and the potential for negating some evident participant bidding behaviours around the present hybrid 5-30 minute arrangements. Progress in ICT also makes managing the larger data sets increasingly straightforward.

5.6 What additional system security services such as inertia, as is currently being considered by the AEMC, should be procured through a market mechanism?

Markets are a means rather than an end so both regulatory and market oriented approaches should both be considered, seperately and in tandem, as means to deliver additional security services. The tendering processes currently used for NCAS provide one such approach.

If markets are used to procure services, scarcity during relevant time intervals should drive the price, as distinct from broad capacity markets that pay for capabilities regardless of whether they are needed and tend to provide windfall gains. A market where all technologies (including generators that are operating and providing the service) receive the marginal price for the service would achieve this outcome. The challenge will be to ensure that markets are designed carefully to procure what is actually needed (e.g. over what timeframe is would fast frequency response be best procured in order to reduce the need for inertia?).

5.6.1 How can system security services be used as 'bankable' revenue over a sufficient period of time to allow project finance to be forthcoming?

This question highlights a particular challenge in FCAS markets at present. Present prices for FCAS are only relevant to investment to the extent they reflect future prices. Derivatives in the wholesale energy market provide a mechanism to 'lock in' future prices but are, as far as we are aware, not available for FCAS. There are some particular challenges for liquidity given that there are eight markets in each region, each requiring different technology capabilities. It does raise the question of whether FCAS markets are able to deliver investment, or only operational changes for existing resources. If adding FCAS capabilities only represents a modest additional expense then present FCAS arrangements may suffice. Otherwise, investigation of other approaches to securing appropriate investment will be required. This applies of course to potential new security services such as inertia or very fast frequency response.

The other challenge of course is market concentration in FCAS as well as wholesale and retail markets in the NEM. Incumbents who can effectively set the price in these markets can influence potential new entry.

5.6.2 How will generators and retailers mitigate price risk in such a market?

Present risk management strategies seem likely to continue to apply – grow horizontal market share and integrate vertically across supply and demand as much as possible as a physical hedge, and in order to gain some level of control of these prices.

While this may be an appropriate business strategy for incumbents, it can adversely impact on the entry of new technologies and participants. If policy makers want to facilitate innovation, then they will have to address this issue. To date, they have shown reluctance to do so, and have often fared badly in the relevant legal arenas when they have attempted to do so. If this is the case, then there are opportunities to encourage incumbents to deploy new technologies, but this may require providing them guarateed high returns and there will likely be some highly disruptive technologies that they will generally not be willing to implement.

6 Prices Have Risen Substantially

"Australians have experienced rising electricity prices in recent years. Affordability must be an important consideration as the regulatory framework seeks to also meet the objectives of energy security and reduced emissions. Where new measures are proposed to meet security and reliability objectives, it is critical that the potential impact on affordability is minimised and any trade-off between the objectives is transparent and reflects the long term interests of consumers. This will require attention to the costs associated with each element of the NEM: distribution and transmission networks, wholesale electricity generation, and electricity retail." (Preliminary Report p. 46)

Affordability is certainly a key, some would argue the most important, pillar of the trilemma. However, it is important to distinguish it from energy market prices; it is the bill rather than the price that matters to energy consumers. For example, falling residential energy consumption has assisted many households to manage higher per-unit prices in the NEM over recent years. This suggests a greater focus on end-use equipment within the NEM is warranted.

Also, it should be recognised that economic efficiency doesn't necessarily deliver reasonable equity outcomes; it is therefore not enough to look at just the 'economic' efficiency of different cost components in the 'energy service' delivery chain when considering affordability.

It is surprising that the Preliminary Report doesn't include discussion of market concentration and the exercise of market power. NEM retail markets appear problematic in this regard, as shown in Figure 1. While the available data is limited, the four largest retailers appear to have 80% or more market share of small energy users in all States. Furthermore, these retailers all own considerable generation assets and are, therefore, best characterised as gentailers. Questions of market design need to be considered in parallel with those of market structure – the number and nature of market participants. It is particularly challenging to create efficient markets for oligopolistic market structures.

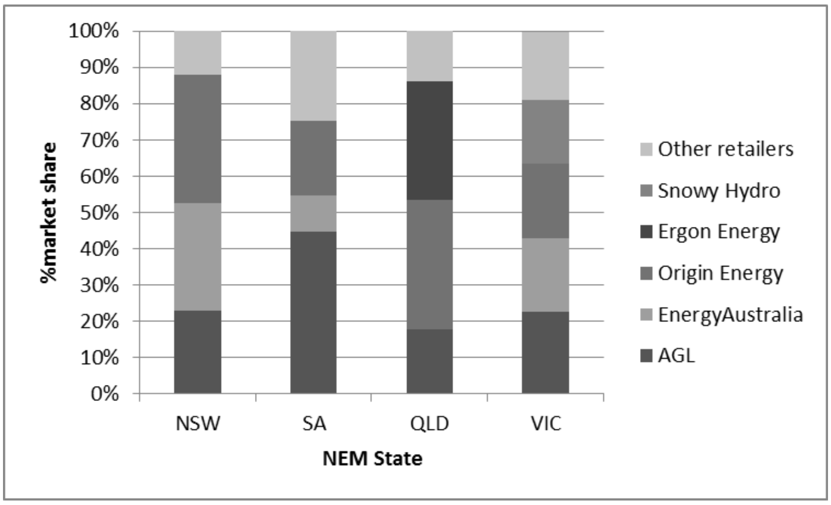

Figure 1. Market share of small customers for the largest three retailers (four retailers for Victoria) in the four largest States in the NEM. Data from www.aer.gov.au for NSW, SA and QLD, and www.esc.vic.gov.au for Victoria (residential customers only).

6.1 What additional mechanisms, if any, could be implemented to improve the supply of natural gas for electricity generation?

This is a vitally important question that largely lies beyond the scope of this submission, but reflects the urgency of addressing the present debacle in Australia's so-called gas market. Indeed, it in not clear that 'market' is an appropriate term for current arrangements which would seem to exhibit some very 'cartel' like characteristics.

Increasing the production of natural gas in Eastern Australia seems an obvious way to improve supply for electricity generation. However, it is as much a pricing issue as it is an availability issue, and there is clear potential for additional gas supply to merely find its way to the LNG export facilities. We need to seriously consider domestic reservation or a similar mechanism such as reclaiming third-party gas currently being exported (Credit Suisse, 2017), given the key role that gas will play in transition of the NEM. In some regards, South Australia is facing more of a gas market challenge than a renewables integration challenge given its dependence on gas-fired generation.

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

Interval metering with smart communications including in-house displays and load control capabilities, smart appliances and battery storage systems facilitate distributed demand response. Demand response aggregators and/or network businesses could bundle such responses to deliver assured demand reduction. The issue is not a lack of alternatives to network build, but the present regulatory arrangements that work against its deployment.

6.3 What are the benefits of cost reflective prices, and could the benefits be achieved by other means?

In the NEM, network costs represent almost half of small consumers's electricity bills. Tariffs charged to small consumers have traditionally had some proportion of fixed and volumetric (consumption) components with often little or no variation across time or often large geographical regions. In part this represented the fairly simple accumulation metering used for small consumers, in part the belief that these consumers would be unwilling or unable to respond to price signals, and in part a widely held consensus on the importance of affordability, even in areas of the network that are particularly expensive to serve.

However, the economic inefficiency of these tariffs have seen recent growing interest by policy makers and regulators in the development of more cost-reflective network tariffs. Such pricing can theoretically ensure that consumers cover the costs they impost on the network, reduce cross-subsidies and incentivise efficient use of network assets, in terms of end-user investment and operation of appliances and distributed energy technologies.

In practice, however, there are many complexities in the implementation of such tariffs. One issue is which costs need to be reflected – past (sunk), present (short-run marginal) or future (long-run marginal costs). Past cost recovery is a key aspect of network business financial sustainability while present costs are key to efficient operation of existing assets. Future costs are key in terms of incentivising efficient investment but are complex and fundamentally problematic to calculate. These costs are also very location-specific and invariably change over time. Increasingly, too, distributed energy resources offer an alternative to traditional network service delivery.

Unfortunately, the tariffs that have been introduced to date under cost-reflective requirements for DNSPs have been shown to have low cost-reflectivity in terms of aligning customer bills with their contribution towards peak network demand, and instead tend to reduce consumers' ability to reduce their bills by applying 'peak demand charges' over a wide window of hours, applied to the consumer's peak, rather than the network peak. Such misalignment has potentially significant adverse impacts on the economic efficiency of such tariffs. In addition, these tariff structures are not necessarily being passed on by retailers, and there remain questions about the willingness and ability of consumers to engage effectively with more complex tariffs. Finally, for equity reasons, the proposed tariffs generally do not reflect the locational costs of providing network services to different locations and large cross subsidies between urban and rural consumers remain in place (Passey and MacGill).

There are means by which some of the benefits of more cost reflective prices can be achieved even in their absence. As just one example, mandatory energy efficiency standards can reduce peak demand and hence network expenditure without 'price' signalling through the costs of running particular household appliances. Peak demand management options are also available, however, these typically require high levels of engagement by network businesses and potentially other market players with energy consumers.

There will be no perfect answers to the question of how we require, incentivise, nudge or shove energy consumers towards more efficient choices. A mix of more cost reflective prices if and as appropriate, and targeted interventions likely holds the greatest chance of success.

6.4 How can we ensure that competitive retail markets are working?

A first step is towards ensuring that NEM retail markets are working is to agree on a set of measures for assessing this. By some of the common retail market indicators used by the AEMC including numerous private retailers, high customer transfers (less charitably churn) and large price spreads between market offers – most of the States in the NEM might be argued to have effective retail competition. By other measures, however, including the NEM's significant retail market concentration, high retailer margins, and the major proportion of customer bills going to monopoly (non-competitive) network businesses, effective competition seems less assured. Certainly, it is hard to sell the success of retail competition to small energy users who have seen very high electricity price rises over the past decade.

Price-cost margins appear key to understanding retail competition; typically low margins suggest effective competition, while high margins reflect some form of market failure as excess profits haven't been competed away by competitors including possible new entrants. Others, however, argue that high margins can reflect significant innovation in new offerings that consumers are happy to pay more for. In theory, of course, those innovations should eventually be competed away as well (MacGill and Smith 2017).

We agree with the AEMC on the challenges of measuring retails margins - regulators have few rights to the internal business data of retail firms. However, more still needs to be done to make such assessments given the importance they have in evaluating competition. There may be value in regulators gaining some further insight into this fundamental question via further oversight or additional modelling techniques. Cross jurisdictional comparisons would also be useful.

Metering is an emerging issue that should also be considered in upcoming competition reviews. The AEMC's recent opening up of competition around metering appears to present a number of opportunities for cost reduction in the metering space. It is however important that regulators ensure that metering contracts do not provide opportunities for retailers to increase customer lock-in. Much of the wording of the recent ruling relates to customer choice around metering and pricing, implying that retailers may offer additional metering services to customers who value such contract features. It should be noted however that metering contracts are typically signed on a multi-year basis and it is unclear whether customers may be faced with longer retail contracts and high switching barriers under such retail arrangements.

Finally, retail market competition, certainly the bills that energy users pay, will be greatly impacted by wholesale market competition. Recent developments in some regions of the NEM in this regard are highly concerning, as discussed further below.

6.4.1 What outcomes of competition should we monitor?

As discussed, a broader suite of measures of competition should be used in the NEM including estimated retailer margins. More broadly again, policy makers and regulators should obtain more detailed data on actual household bills – the measure that energy users likely see as most relevant to whether competition is working or not.

Processes for monitoring the exercise of market power in the wholesale market are also proving problematic, as supply-demand balance tightens and opportunities for the exercise of market power increase. The design of the NEM explicitly permits very high market prices – the risk of these provide incentives for retailers and large customers to sign long-term contracts that underwrite investment in new generation. Without the exercise of market power, these high price events would only occur when supply fails to meet demand. The exercise of market power at times of very tight supply-demand balance can provide this investment signal without load shedding.

However, there are limits to public and market participant acceptance of the exercise of market power, particularly when they also threaten energy security. The AER investigates price movements in the NEM over $5000 and appears to have been uncovering evidence of potential exercises of market power, which may have on several occasions led to system security issues. Yet there appears to be little follow-up on these reports from a market design and enforcement perspective.

The risk, of course, is growing energy user and government outrage that eventually leads to extreme actions. The California energy crisis seventeen years ago provides one example of the damage that can be done from unchecked market power that also threatens energy security. The eventual political response in California essentially saw some of the market arrangements abandoned, and a return to far greater regulation. There are, of course, considerable risks associated with such actions.

7 Energy Market Governance is Critical

> *"Effective energy market governance is essential for managing the transition that is currently underway in Australia's energy market. The Review is considering whether the current institutional architecture can do this and support effective national coordination of energy policy." (Preliminary Report p. 50)*

The Finkel Review's focus on governance is commendable. Clear governance arrangements are fundamental for setting and meeting Australia's energy objectives, as a necessary, if alone insufficient, pre-requisite for effective planning, decision-making, risk and reward allocation, and accountability.

The Finkel Review can draw, of course, upon the final report of the Panel for the Review of Governance Arrangements for Australian Energy Markets, chaired by Michael Vertigan and conducted in 2015. Unfortunately, in our view, the final report represented somewhat of a lost opportunity to investigate these arrangements. In particular, the Vertigan report lacked any formal, transparent and rigorous assessment of how well or poorly governance arrangements have met the National Electricity Objective (NEO) to date, or the stated objectives of the Australian Energy Market Agreement (AEMA) more generally (Raffan and MacGill, 2015).

The Vertigan Panel identified two strong recurring themes in the submissions – an unprecedented pace of change in the energy sector driven by IT and renewable technologies and climate change policy; and a 'strategic policy deficit' which "*.. are most evident at the policy level, but they have also been identified across the market institutions as a whole.*" We agree and therefore were surprised that the Panel's proposed changes to governance arrangements appeared so modest in most regards - it seems unlikely that only modest 'tweaks' are sufficient to effectively address the challenges identified.

Therefore, and while the Panel provided some useful recommendations including the need to improve Energy Council processes and the scope of AEMC activities, key governance assessment and reform tasks remain to be done. The Finkel Review is an excellent opportunity to progress such efforts.

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

Planning has proven a particularly vexed issue for the NEM, and the Australian energy sector more generally. In part it reflects a view that Governments should just get the market settings right, and then leaving planning to private market participants who will take on the rewards yet risks of getting planning right or wrong. Successful electricity governance, however, requires high levels of coordination and coherence across generation, networks and energy-use. There are clear areas requiring some level of centralised planning such as transmission, something only rather belated recognised when AEMO was given a formal transmission planning role. The process they apply through the NTNDP is instructive; AEMO must effectively estimate future private generation investment in order to assess the value of different transmission investment options; options which if developed will then shape the commercial context for said generation investment.

Beyond this 'circular' planning challenge, those investors operate within a broader context that requires confidence in broader policy settings as well as specific governance. For example, the growing risks of climate change are now nearly globally accepted, and it is well understood by the great majority of investors that the energy sector in Australia will need to undergo dramatic clean energy transformation over the coming decades if dangerous global warming is to be averted. Investors draw confidence from a clearly elaborated and credible strategy for achieving such reductions, in a gradual, supported and stable manner. They also need confidence around broader settings including Australia's present fossil fuel export orentation with its consequent impacts on fossil fuel availability and future costs. Such clarity is a key prerequisite for investing in any kind of long-lived capital intensive infrastructure.

7.1.1 If so, what are the most appropriate governance arrangement to support whole-of-system advice and planning?

The highest level of government planning at present is the White Paper process which most recently ran in 2015. Unfortunately these don't have a great track record of predicting key emerging issues, and establishing a clear strategy to address them. The 2004 Energy White Paper, for example, predicted ongoing electricity demand growth, continued but slow take-up of wind and solar that would remain well below use of biomass, and prominent future roles for geothermal energy and carbon geo-sequestration. It made barely any mention of Coal Seam Gas let alone potential East Coast LNG exports. Such discrepancy from current conditions, only a little over a decade later, suggests a need for caution in present predictions of what future energy challenges are in store. It also highlights the need to consult with a broader range of stakeholders than present industry incumbents, and the vital importance of policy robustness against such uncertainties.

Rather than consideration of particular policies in isolation, we require a coherent and comprehensive policy portfolio robust to a wide range of possible future scenarios. Furthermore, the associated planning process must be continuous to adapt to changing conditions. The COAG Energy Council provides an alternative to repeated White Paper processes, with the advantage of regular engagement across all State and Territory governments. There are certainly opportunites to improve processes including greater stakeholder engagement and a transition from the preparation of 'static' plans to an ongoing dynamic planning process taking advantage of ICT advances that support continual knowledge updating.

Such advice and planning requires an evidence base. Energy modelling in Australia is highly problematic at present. Government has little internal capability, and there is high reliance on various specialist energy consultancy firms, running 'black box' proprietary models, with typically very limited transparency on why particular scenarios were investigated, with what input data and assumptions, and which analysis and simulation methods, to deliver selected modelling outcomes.

International developments have highlighted the value of highly transparent, open-source energy modelling platforms to assist informed, transparent investigation and discussion regarding possible energy futures. Some funding bodies now require that funded modelling deliver open source tools and data. There is an opportunity here in Australia for governments to support the development and use of such open-source tools, accessible to all stakeholders including universities, industry and government.

7.1.2 Do the roles of ministers and energy market institutions need further clarification?

Almost certainly yes. The complexity of present arrangements is probably unavoidable, but there are circumstances where accountability is not well aligned with decision making autonomy – apparent State government 'responsibility' for major blackouts is a one recent example here in Australia. Progress here requires a detailed review of how objectives, autonomy and accountability are presently assigned across stakeholders, strengths and weaknesses of these arrangements (in particular, around alignment and risk management) and options for improvement. Key areas for attention certainly include the discretion that AEMO has when seeking to balance security against market concerns. At present, its decision making is highly proscribed.

7.2 What lessons can be drawn from governance and regulation of other markets that would help inform the review?

The unique characteristics of the electricity industry means caution is required when seeking to draw on the experience of other infrastructure and technology markets.

Likely of more value is an assessment of international experience with electricity industry and more broadly energy sector, governance towards low-carbon transition. A number of countries have established highly detailed, inclusive and rigorous processes for mapping such transformation.

7.3 How should the governance of the NEM be structured to ensure transparency, accountability and effective management across the electricity supply chain?

A very significant question and the key task of your Review. And we suggest that the Review actually broaden this question to include not only goverance across the electricity supply chain, but governance all the way through to 'energy service delivery' to energy users.

7.4 Are there sufficient outcome statistics for regulators and policy makers to assess the performance of the system?

Clearly not, as covered elsewhere in our submission, and particularly with respect to the objective of delivery of electricity services serving the long-term interests of energy consumers.

Note also that greater transparency and reporting of such outcome statistics should extend beyond regulators and policy makers to broader stakeholders to permit independent review of regulatory and policy maker assessments of system performance.

7.5 What governance measures are required to support the integration of energy and emissions reduction policies?

While the AEMC has recently considered this question, a broader ranging review is required given that this has been one of the greatest failings of NEM governance to date.

Should the AEMA be amended? We would first ask how seriously is it even being considered? For example, the Vertigan review of governance arrangements issue paper references AEMA 22 times and notes that the Council's ".. *mandate in energy markets is limited to matters defined by the AEMA, which is its key foundation document for energy market matters.*" However, the draft report provides little discussion of AEMA beyond suggesting that ".. *it's general policy stance is towards promoting efficient production, distribution and supply of electricity and gas in the long-term interests of consumers, including by encouraging competition where it is considered feasible"(p.13) and that "The Panel's general conclusion is that the division of functions established by the current governance arrangements remains appropriate for serving the purposes of the Australian Energy Market Agreement (AEMA) and serving the relevant national objectives.*"

It is unclear how such a conclusion be supported without addressing the objectives agreed in AEMA which go well beyond those summarised by the Panel. For example, one of the six agreed objectives is to "*address greenhouse emissions from the energy sector, in light of the concerns about climate change and the need for a stable long-term framework for investment in energy supplies*". The Vertigan Panel noted the importance of climate change as a driver of potentially disruptive change in the industry but places climate change mitigation efforts as one of the policy areas developed outside of the national energy governance arrangements (p.25). To the extent that is correct, such placement of climate change policy outside energy governance arrangements is a design choice, and the evident failure of climate change governance to date suggests that alternative options require consideration.

Another example is the AEMA objective to "*enhance the participation of energy users in the markets including through demand side management and the further introduction of retail competition, to increase the value of energy services to households and businesses*".

The Vertigan Panel's draft report doesn't mention energy services at all, and includes only a few mentions of demand-side participation. Again, this seems contrary to the explicit focus on the long term interests of consumers that is meant to drive governance.

To conclude, progress against all criteria of the AEMA should at least be assessed in a rigorous way, before decisions are made on whether it needs to be amended. A very brief and preliminary commentary on progress against all AEMA objectives is provided below (undertaken for our submission to the Vertigan Review) (Raffan and MacGill 2015).

AEMA objective: "establishment of a framework for further reform to:" (COAG Energy Council 2013)	**CEEM Comments**
i) "strengthen the quality, timeliness and national character of governance of the energy markets, to improve the climate of investment"	There has certainly been a move towards a more national character of governance and significant investment has occurred – but unclear whether it has been the most appropriate investment in generation, and it is unlikely to have been the most appropriate for networks. While national frameworks can reduce the compliance burden of different State arrangements, it also carries the risk of 'lowest common denominator' frameworks. In the past, State Governments have played a valuable role in policy development by exploring different types of approaches and instruments.
ii) "streamline and improve the quality of economic regulation across energy markets to lower the cost and complexity of regulation facing investors, enhance regulatory certainty, and lower barriers to competition;"	By most measures there has been a failure to manage network investment – assessment of this failure needs to get beyond blaming the failure to fully privatise the network businesses and address underlying causes. More generally, regulatory certainty to private investors may merely move inherent risks (e.g. the potential need for large and rapid emission reductions from the electricity sector in the near future) onto the public.
iii) "improve the planning and development of electricity transmission networks, to create a stable framework for efficient investment in new (including distributed) generation and transmission capacity;"	More coherent transmission planning has certainly been assisted by giving AEMO a national transmission planning role. It would be useful to question why it took almost a decade from the start of the NEM for this glaring planning need to be formally recognised. There are of course still concerns of over investment in intraregional networks. It is also surprising that the objective explicitly flags efficient investment in distributed generation without explicitly referring to distribution network investment.
iv) "enhance the participation of energy users in the markets including through demand side management and the further introduction of retail competition, to increase the value of energy services to households and businesses;"	There has been important progress on formal recognition of this including the AEMC 'Power of Choice' review. However, progress to date has been limited. Part of the problem is that the debate is still framed in terms of private consumers undertaking rational behaviour in response to more competitively priced energy commodities. This misses the key need for new players that assist end-users to participate effectively in the retail market, and market arrangements that focus on increasing competition in energy services, which are after all what end-users actually seek, rather than commodity kWh.
v) "further increase the penetration of natural gas, to	This objective is now likely accepted as a mistake given rising cost of gas, and improved electrical equipment alternatives including

lower energy costs and improve energy services, particularly to regional Australia, and reduce greenhouse emissions; and"	reverse cycle heat pumps. It is telling that there are still programs using public money to facilitate gas distribution in regional Australia despite these lower cost alternatives.
vi) "address greenhouse emissions from the energy sector, in light of the concerns about climate change and the need for a stable long-term framework for investment in energy supplies."	Governance of our policy efforts to address greenhouse gas emissions from the energy sector has been highly flawed to date, and requires urgent attention. This is likely the most important task ahead for the energy sector and should therefore play a key role in this review.

7.5.1 Should the NEO be amended?

The Vertigan Governance Review was not particularly helpful on this question, stating that *"Consideration of possible changes in the national energy objectives has been raised by a number of submitters, but is not something that the Panel is inclined to contemplate. That is because the great weight of international thought and experience would speak against such change, and very compelling reasoning and evidence would be needed to overturn that body of work. No such reasoning and evidence have been put before the Panel ."* (p.13). It should be noted, however, that the Panel's Issues Paper did not ask submissions to address the appropriateness, or otherwise, of the NEO.

There is certainly value in revisiting this question. While there were some sound resaons for deciding that the NEO did not include environmental and societal externalities, experience has highlighted that a narrow intepretation of the long-term interests of consumers within AEMC processes, and a disfunctional policy set of external climate and energy policies, has impeded progress.

The AEMC has some attractive governance aspects that have eluded higher level policy making – any interested party can propose rule changes, and there are formal processes for assessing such proposals that include meaningful engagement with submissions, rather than just the cherry picking of 'appropriate' comments from particular submissions as suits the chosen policy.

7.6 How can decision-making be appropriately expedited to keep up with the pace of change?

Our challenge of course is to make good decisions faster, not bad decisions. As seen in electricity industry operation, some inertia can be a useful thing, and this also applies to policy processes where rapid variation can be highly destabilising. Rule makers are natually particularly concerned about the potential for unexpected and unwelcome surprises from rule changes given that the 'rules' are meant to provide as best able universality to participants. As discussed previously, geographically and temporally constrained sandboxes can allow for policy, market and regulatory innovation experimentation while still limiting potentially adverse impacts.

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