03 March 2017

Dr Alan Finkel
C/- NEM Security Review Taskforce
GPO Box 787
Canberra, ACT 2601

By email: NEMSecurityReview@environment.gov.au

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

Dear Dr Finkel

Energy Networks Australia welcomes the opportunity to make a submission to the Independent Review into the Future Security of the National Electricity Market.

Energy Networks Australia is the national industry body representing businesses operating Australia's electricity transmission and distribution and gas distribution networks. Member businesses provide energy to virtually every household and business in Australia.

There is strong consensus among stakeholders that political dispute in the sector has undermined the necessary stable and enduring policy settings required to enable better outcomes for customers. This has been evidenced by:

- poor coordination in carbon and energy policy
- inconsistent State and Federal Government frameworks
- inaction on agreed COAG Energy Council reforms.

In our view, the greatest single risk to an efficient and secure transition is conflicting government policy frameworks in a national market and a lack of regulatory cohesion. Energy Networks Australia therefore regards the Review as a watershed opportunity to reset consensus-based policy and regulation and strengthen our institutional capacity to respond to unprecedented opportunities and threats to customer outcomes.

Our response to the issues and questions raised in the submission focuses on six key themes:

1. The Review Blueprint should strengthen Australia's institutional capacity and build in measures to assure implementation is 'followed through'.
2. Technology neutrality and flexibility, rather than prescription, will deliver the best outcomes for customers.
3. Incentives play an important part in the energy market transformation.
4. There are multiple pathways to deep decarbonisation.
5. Gas has a significant role to play in Australia's electricity system.
6. Transmission interconnection is vital to creating a renewable energy future.

Our response to this Preliminary Report draws largely on the analysis, evidence and expert material that the two-year joint CSIRO and Energy Networks Australia, *Electricity Network Transformation Roadmap* provides. Its analysis found opportunities deliver more choice and control for Australian energy customers, while maintaining system security and meeting international climate change commitments through coordinated, timely action to changes in the energy system.

Realising these opportunities relies on strengthening, rather than undermining, NEM institutions and markets in which investors – whether they are utilities, new innovators or households – can make decisions without unnecessary policy risk.

Should you have any additional queries, please feel free to contact Brendon Crown on (02) 6272 1515 or bcrown@energynetworks.com.au.

Yours sincerely,

John Bradley
Chief Executive Officer

Independent review into the future security of the NEM

Response to Preliminary Report

(March 2017)

Energy Networks Australia

Contents

Energy Networks Australia www.energynetworks.com.au
Unit 4, 110 Giles St, Kingston ACT 2604 **P:** +61 2 6272 1555 **E:** info@energynetworks.com.au
Energy Networks Association T/A Energy Networks Australia
ABN: 75 106 735 406

Overview

Energy Networks Australia welcomes this opportunity to make a submission in response to the Preliminary Report of the Independent Review into the Future Security of the National Electricity Market (Review).

Our Association represents Australia's energy grid supporting all Australian customers with over 900,000 km of electricity transmission and distribution lines and almost 90,000 km of gas distribution mains.

The Review provides a critical opportunity to provide a much-needed blueprint for the future of our electricity system. It correctly recognises that the energy sector is going through the greatest transition since the "war of the currents in 1890" with an urgent need for action to ensure "the energy system we take for granted can continue to adapt to the changes taking place".

The Australian electricity system has experienced historic shifts in the last five years that has seen:

- A decoupling of energy consumption from economic growth.
- The rise of rooftop solar PV penetration to world leading levels.
- The loss of synchronous generation in the weakly connected system of South Australia.
- Significant increases in renewable energy capacity impacting physical and financial markets as well as the operation of incumbent generation.

In addition to market uncertainty, the policy and regulatory environments have become increasingly less predictable in the National Electricity Market (NEM). There is strong consensus among stakeholders that polarised political disputes have undermined stable and enduring policy and threatens outcomes for customers. This has been evidenced in:

- Poorly integrated carbon and energy policy;
- multiple and overlapping policy reviews on similar issues;
- inconsistent State and Federal Government frameworks; and
- inaction or inconsistent implementation of agreed COAG Energy Council reforms.

The Review will benefit from its broad terms of reference, diverse expertise, a consultative evidence-based approach and its responsibility to report to the COAG Energy Council rather than any single jurisdiction. As such, Energy Networks Australia regards the Review as a watershed opportunity to reset consensus-based policy and regulation and strengthen our institutional capacity to respond to unprecedented opportunities and threats to customer outcomes.

Energy Network Transformation Roadmap

As the Panel's Preliminary Report noted, Australian energy networks have partnered with the national science agency, CSIRO in the landmark study, the Electricity Network Transformation Roadmap. The two-year analysis produced a comprehensive transition plan for the electricity grid to *keep the lights on, bills affordable and decarbonise electricity.* This roadmap is to help guide network businesses to an efficient and timely transformation.

The Key Concepts Report for the Electricity Network Transformation Roadmap[1] identified measures, which could see 10 million participants using the grid as a platform for energy exchange, customers saving over $414 per year on average, total savings of $101 billion in system expenditure and zero net emissions for the electricity sector by 2050.

Our response to this Preliminary Report draws largely on the analysis, evidence and expert material the Roadmap provides. Its analysis found that **coordinated, timely action** to changes in the energy system can deliver more choice and control for Australian energy customers, while maintaining system security and meeting international climate change commitments. In fact, CSIRO's analysis confirmed that Australia's electricity sector could exceed its share of current national carbon abatement targets, achieving 40% below 2005 levels by 2030. The analysis also suggested it is possible for the electricity sector to maintain a reliable, stable grid while achieving zero net emissions by 2050, in line with the aspiration of the Conference of the Parties (COP 21 Paris Agreement – December 2015) to the United Nations Framework Convention on Climate Change.

Realising these opportunities relies on strengthening, rather than undermining, NEM institutions and markets in which investors – whether they are utilities, new innovators or households – can make decisions without unnecessary policy risk.

The greatest single risk to an efficient and secure transition is conflicting government policy frameworks in a national market and a lack of regulatory cohesion.

Key themes to our response

Our response to the issues and questions raised in the report focuses on six key themes:

1. ***The Review Blueprint should strengthen Australia's institutional capacity and build in measures to ensure implementation is 'followed through'.***

   A number of related reviews and studies aimed at creating integrated national frameworks and consistency have previously been completed, but not acted upon.

[1] CSIRO and Energy Networks Australia 2016, Electricity Network Transformation Roadmap :Key Concepts Report (Roadmap)

Recognising this, the Panel's comprehensive Review should be expanded into a plan of action, with specified timeframes, actions and accountabilities.

2. *Technology neutrality and flexibility, rather than prescription will deliver better customer outcomes.*

While technology scanning will be important, the Review should seek to avoid identifying a 'silver bullet' or building the Blueprint exclusively on particular technology assumptions. The Blueprint should instead adopt a principle of technology neutrality and seek to establish a mix of market and regulatory frameworks which encourage innovation and competition, and remove barriers to the formation of commercial solutions. Measures supporting research and development, pilots and trials can play an important role in niche areas of technology development. However, the more significant investment risks to an efficient energy transition result from governance issues and poorly coordinated policy and regulatory frameworks. For instance, the Review should avoid a recommendation to mandate direct support for particular generation options or other technologies like storage – instead focussing on the market service or outcome that is required. Similarly, Governments should avoid prescriptive regulation of technology solutions which prevent new technologies like storage realising their full value across the supply chain.

Flexibility is likely to be increasingly valuable to Australia's electricity system – both in the generation and transmission sectors and in distributed energy systems. Market-based approaches and open platforms for the release of information will assist the 'animation' of new markets and maximise value for these sectors while also creating value for a broad range of customers.

Flexibility can be achieved in a number of ways:

- Network service providers should have the flexibility to innovate in this transformation through new technologies and non-network solutions. New technologies for enhancing system stability should be incorporated into transmission early so their practical application can be understood and validated in system stability models.
- Wholesale electricity markets will be more efficient with access to flexible resources, such as aggregated demand response (constrained by market frameworks) and gas fired generation (constrained by government bans on upstream gas development.

3. *Incentives play an important part in the energy market transformation*

The Roadmap suggests a 'co-optimised' energy system could reduce average network costs by 30% below 2016 levels by 2050 and contribute to total system savings of over $100 BN by 2050. However, this is reliant on:

- frameworks where customers or aggregators are given efficient incentives to provide flexible capacity services through Distributed Energy Resources (DER) 'in the right place, at the right time'

- networks effectively providing cost-reflective network tariffs which are important for efficiency and fairness
- regulatory arrangements, which are appropriately flexible to allow network innovation and the development of shared experience.

Analysis by CSIRO suggests that without more urgent attention to current pricing incentives in network tariff arrangements, Australia will not achieve the benefits from integration of network and behind the meter infrastructure. This will increase power system risk and affordability in the future.

4. *There are multiple pathways to deep decarbonisation*

A number of parties including Energy Networks Australia and the Climate Change Authority acknowledge that deep decarbonisation of the electricity system is achievable without compromising security or affordability. However, it will require action in a number of areas including securing stable and enduring outcome-based, technology neutral carbon policy.

CSIRO analysis for the Roadmap concluded a plausible projection for meeting wholesale energy requirements and achieving zero net emissions by 2050 in which there is a primary role for storage in balancing the output of intermittent variable renewable energy (VRE). While battery storage is forecast to provide the dominant new source of energy balancing, a diversity of potential solutions exist which could be employed as alternative options while still achieving zero net emissions, depending on their changing economic potential. For instance, other options identified for energy balancing which may provide such solutions in a low or zero net emissions system include:

- renewables diversity (technological and geographical)
- pumped hydro storage
- power to gas hydrogen storage
- concentrated solar thermal generation or gas-fired generation supported by carbon capture and storage (CCS) technology
- firm (dispatchable) renewable capacity
- demand management.

Furthermore, additional work by Energy Networks Australia is providing a conceptual framework for decarbonising gas used directly by households, businesses and industry.

However, it is neither *possible* nor *necessary* for the Panel or Governments to predict the optimal technology mix which would secure deep decarbonisation between 2030 and 2050. As noted in the Roadmap and this submission, it is important that the technology pathways to deep decarbonisation emerge through competition in outcome-focussed, non-prescriptive market frameworks.

5. *Gas has a significant role to play in Australia's energy system*

While recognising the focus of the Review is on the NEM, Energy Networks Australia encourages the Panel to adopt a holistic approach, which recognises the co-dependent relationship between electricity and gas systems in Australia. Gas contributes significantly to Australia's electricity generation sector. In 2014/15, it provided 18% of total generation. As a flexible generation technology, gas fired power stations can provide a critical balancing service, enabling higher penetration of variable renewable energy. This requires market participants to have sufficient commercial confidence to underwrite plant availability and gas contracting.

Further, gas also plays a recognised role in mitigating electricity peak demand events through the energy consumed directly. Gas is a low emission fuel and it is estimated that the direct use of gas in the home has between a quarter to a sixth of the emissions of the same energy sourced from the electricity grid. On a national basis, gas provides 44% of energy used in households for only 13% of the emissions from those households.

Gas can also positively contribute to the security and supply of electricity and energy more widely. Distributed natural gas is complementary to other energy sources and can assist with the energy trilemma (as outlined on page 10 of the Preliminary report):

- *Reliability:* gas networks are largely underground and as such are very reliable. On average, customers experience only one hour off supply every forty years[2].
- *Security of supply*: diversifying the energy mix is key to energy security.
- *Affordability:* reduced distribution gas prices have been placing downward pressure on residential gas prices[3].

Energy Networks Australia also recommends the Review consider the longer term future of gas and gas infrastructure. There is increasing Australian and international recognition of opportunities to further reduce the relatively low carbon footprint of gas with innovation in, for instance, the use of biomethane and hydrogen applications.

6. *Transmission interconnection is vital to creating a renewable energy future*

An increasing proportion of intermittent generation will be made possible by greater inter-regional transmission capacity. This capacity will allow for better management of intermittent generation profiles using geographic diversity, lower energy prices for consumers, and greater energy security and emissions reduction benefits from better utilisation of renewable energy resources. The transmission network will also increasingly provide ancillary services to stabilise the power

[2] Australian Gas Networks (AGN) Victoria and Albury Final Plan. December 2016.
[3] For example, in South Australia, AGN's distribution tariff fell by 23 % on 1 July 2016.

system.

Such interconnection should be economically efficient with each project assessed on its merits against alternative solutions. However, the cost of these services is typically only a fraction of the overall cost of investment in generation and interconnection is recognised internationally as a key solution to manage the integration of variable renewable energy efficiently and securely.

1. Technology is transforming the electricity sector

Energy Networks Australia agrees with the Panel's preliminary findings regarding the need to urgently adapt to the changing mix of generation and investors in power system infrastructure. It forecasts that individual customers will determine how over $200 billion in system expenditure is spent over the next three decades, with millions of customer owned generators likely to supply 30-50% of Australia's electricity needs[4].

An efficient and timely transformation over the 2017-27 decade requires an integrated set of 'no regrets' actions to:

- enable balanced, long term outcomes for customers
- deliver the maximum value of customer distributed energy resources
- position Australia's networks for resilience in uncertain and divergent futures.

In the short term (1-5 years), Energy Networks Australia suggests this can be achieved by:

- improved customer engagement with more customised services and better consumer protection frameworks
- securing a stable carbon policy, including a trading scheme for generator emissions
- implementing new frameworks and services for achieving system security with diverse generation and energy technologies
- incentivising efficiency and innovation by;
  - implementing fair and efficient demand based network tariffs
  - enabling standalone systems and micro-grids
  - ensuring regulation and competition frameworks are 'fit-for-purpose'.
- developing information tools for a cost effective grid including;
  - open standards
  - extended monitoring of the medium and low voltage networks
  - advanced distribution network planning and analysis of 'hosting capacity' [5]
  - the mapping and locational valuation of Distributed Energy Resources
- retaining a focus on physical and cyber security.

Over the medium term, successful integration is achieved by:

- enhancing system operation at all levels - with transmission networks offering

[4] Roadmap: Executive Summary, page 1
[5] Hosting capacity is a measure of the maximum real export power from distributed generation on a Low Voltage network which can be tolerated without causing voltage or current limits to be exceeded.

additional services to maintain system stability and strength; and distribution networks providing visibility of Distributed Energy Resources and that can be aggregated, enabling frequency control and ancillary services

- orchestrating Distributed Energy Resources as networks pay for grid support services 'in the right place at the right time' as alternatives to traditional network investment
- establishing active distribution system operations and markets for technical stability as well as optimising investment
- undertaking a cost benefit analysis of the introduction of digital market platforms for network optimisation, where it would be economic to use short-term trading markets for optimisation of network support services or distributed energy markets.

1.1 Responding to change

The Preliminary Report highlights that transformation outcomes are fundamentally dependent on decisions and actions undertaken now to integrate new technologies into a network that was built to transport electricity one-way from larger power systems[6].

Without a well-planned approach to navigate this transformation, Australia's energy system will be unable to efficiently and securely integrate the diverse technologies, large scale renewable energy sources and customer owned distributed energy resources. This will potentially result in the costly duplication of energy investments.

Australia is not unique in considering these matters. However, Australia arguably has a less cohesive and planned transition program being led by its diverse Federal and State Governments and national institutions, compared to other key jurisdictions.

- In a report for the United Kingdom Department of Business, Energy and Industrial Strategy, the Carbon Trust and the Imperial College of London examined the need for flexibility in the UK Power System to adapt to different future generation scenarios. The report recognised the "possibility of regret" when making decisions for uncertain futures, with power system investment requiring both long lead times before operational, and even longer lifetimes once installed. It concluded that decisions now to support a more flexible energy system provides option value and avoids the impact of maximum regret scenarios in the future[7]. The report arrived at similar conclusions to the Australian Roadmap about the potential value to customers of integrating flexible resources. It found that

[6] Preliminary Report, p15
[7] Carbon Trust and Imperial College of London: An analysis of electricity system flexibility for Great Britain, November 2016

Combining flexible solutions in a whole system approach could save the UK £17-40bn cumulative to 2050 through building less low carbon generation capacity, reducing peaking plant and fuel spending, and deferring investment in network reinforcement while still meeting carbon targets.8

- **China** illustrates that a failure to anticipate system integration requirements can have significant implications for resource efficiency and utilisation. The Peterson Institute for International Economics (January 2017) noted that installed wind capacity in China is 75 per cent larger than that of the **USA.** However, output from wind energy is 14 per cent less, partly due to the necessary curtailment of wind output and the lack of flexibility in the power system to adapt to intermittence from wind generation[9].
- The **New York** Independent System Operator (NYISO) recently released its Distributed Energy Resources Roadmap. The NYISO Roadmap sets out a sequenced plan to develop the market design, pilot programs, metering policy and granular pricing over 3 to 5 years. This capability will permit Distributed Energy Resources to participate in NYISO's Energy, Ancillary Services, and Capacity markets, distinguishing between dispatchable or non-dispatchable resources. It notes that currently, there are limited options for these technologies to participate in the NYISO's markets and the system changes will allow Distributed Energy Resources to take advantage of real-time scheduling[10]:

  "It is important for the NYISO's real-time systems to access and dispatch these resources in response to price signals reflective of grid conditions and needs. From an operational perspective, the intent of this effort is to minimize out-of-market manual activation of these resources by operators."

  In many ways the characteristics of the NEM are different. As noted above, Australia has a less cohesive and planned transition program compared to other key jurisdictions. This is despite it integrating variable renewable energy at higher rates than anywhere else in the world, in terms of rooftop solar PV at microgeneration scale; and large scale renewables in South Australia. A more systematic, well-planned and cohesive approach is required given Australia is experiencing a more rapid transition.

---

[8] Department of Business, Energy and Industrial Strategy & Ofgem (2016) *A Smart Flexible Energy System: A Call for Evidence*
[9] Peterson Institute for International Economics: Against the Wind: China's struggle to integrate wind energy into its national grid, January 2017
[10] NYISO Distributed Energy Resources Roadmap for New York's Wholesale Energy Markets, January 2017

Consultation Questions

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

In a rapidly changing technology environment:

- key institutions, including distribution networks, transmission networks and the Australian Energy Market Operator (AEMO) need to have the capacity and resources to undertake timely assessments of the changing technology mix over medium term investment planning horizons and long-term analysis
- system monitoring, advanced forecasting and analytical capacities will require rapid development to anticipate and respond to managing system operations impacts over time
- timely action by governments and industry will be needed to reform market frameworks for new services (such as inertia and fast frequency response) and institutional roles (such as active distribution system management).

The Preliminary Report is correct in suggesting that, while the timing and scale is uncertain, the customer-led transition is unlikely to reverse and in fact, is more likely to accelerate over the next decade.

This will have a profound impact on power system design and operation from one based on uni-directional power flows to two-way power flows which fluctuate significantly within relatively short time periods. In turn, this substantially changes the need for power systems to monitor and control flows of energy at all levels of the network.[11] In particular, the operation of the distribution networks will become much more dynamic and unpredictable with the connection of new devices at the lowest voltage levels.[12]

The Roadmap clearly identifies a number of requirements a future grid will need in order to anticipate and address the impacts, influences and limitations of new technologies on system operations ahead of time:

- Greater network visibility.
- Better communications and data exchange than we have today, particularly at the distribution substation and low voltage levels.
- Standardisation of data protocols for this data exchange and signals to and from distributed energy resources.
- Measures to manage cyber security of these systems.
- Distributed control architecture to make decisions and take action at a more localised level where required.[13]

---

[11] Roadmap Chapter 10 Grid Transformation Key Finding 2, p67-68
[12] Roadmap Chapter 10 Grid Transformation Key Driver 3 p65
[13] Roadmap Chapter 10 Grid Transformation Key Finding 5,p 69

In addition, transmission networks will require new tools and models to provide better forecasting to better anticipate where environmental and system constraints may lead to system security issues.[14]

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

Innovation in wholesale markets and transmission networks can ensure continued focus on system security and stability, while also avoiding higher costs of transmission capacity and reduced risks of forced outages. Financial benefits can also accrue through lower risk premiums, or risk mitigation costs and through increased competition.[15] The Roadmap identifies the following innovations in ***wholesale market and transmission*** networks:

- New analytical tools to extend current power system forecasting and planning, combined with new operational techniques and measures for dealing with intermittent generation.[16]
- Technology innovations to support energy balancing including
  - battery storage in a low or zero net emissions system
  - pumped hydro' storage
  - 'Power to Gas' hydrogen storage
  - concentrated solar thermal generation or gas-fired generation supported by carbon capture and storage (CCS) technology
  - firm (dispatchable) renewable capacity and aggregated demand response platforms.
- New market frameworks for:
  - ensuring that forms of inertia that also provide system strength are incentivised
  - balancing and ancillary services, such as Fast Frequency Response services.[17]
- Communication and control functionality for co-ordinating and optimising decisions across the power system as a whole, which includes more effective interfacing between the independent market operator and the distribution network connection points.[18]
- Advanced protection mechanisms to better address distributed energy resources impacts and enhance system operation and security.[19]

It is important that system planners have the capacity to identify not only the disruptive impact of new technology on previous approaches, but efficient solutions

---

[14] Roadmap Chapter 9 Grid Transformation Milestone 4, p50
[15] Roadmap, Chapter 9 Power System Security Benefits, p61
[16] Roadmap, Chapter 9 Power System Security Milestone 1, p59
[17] Roadmap, Chapter 9 Power System Security Milestone 2, p60
[18] Roadmap, Chapter 9 Power System Security Milestone 3, p60
[19] Roadmap, Chapter 9 Power System Security Milestone 5, p60

available from existing and emerging technologies. As one example, very low levels of native inertia will require careful analysis of system stability and security risks during the transition of the generation portfolio. A range of technical solutions exist to achieve inertia and frequency management outcomes, including the use of synchronous condensers, rotational stabilisers, large scale batteries, flywheel technology and emulated inertial responses from, for instance, super-capacitor technologies or wind turbines by using the kinetic energy to support the frequency by interchanging this energy with the grid.

Innovation in distribution networks can allow customers to be better informed, giving them better choices in how they use the networks and supporting additional services not available today. Innovation will allow distributed energy resources to be unlocked and enable new products, services and markets to integrate customer-owned and network power system infrastructure, reducing the need for grid investment and lowering customer bills. In addition to better cost outcomes, innovation should allow for fewer, briefer outages and support power systems which are more resilient to disturbances or physical/cyber attacks.[20]

The Roadmap identifies **innovation for distribution networks** in a number of areas:

- Innovation enabled by customer engagement and customised services; [21]
- Innovation enabled by pricing and incentives to realise the full value of distributed resources, avoid increasing cross subsidies between customers and enabling more technology choices for customers;[22]
- Innovation enabled by regulatory arrangements which remove barriers to service delivery models, microgrids and standalone power systems where they are more cost effective;[23]
- Innovation in distribution system operations to allow streamlined connection and integration of more resources, through development of open standards, communication protocols and interoperability.[24]

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

The Roadmap highlights numerous areas for technological innovation, along with enhanced service delivery models:

- Networks need to enhance and deepen relationships with end customers built on improved data analytics capabilities and a deeper understanding of increasingly diverse customer needs. Expanded information services are likely to enhance interactions with customers. New channels of customer assistance are likely to be required, including advisory and information services with increasing

[20] Roadmap, Chapter 10 Grid Transformation Key Benefits, p73
[21] Refer Roadmap Chapters 1 and 2 milestones for customer oriented networks and customer safety net
[22] Refer Roadmap Chapter 7 Pricing and Incentive Milestones
[23] Refer Roadmap Chapter 8 Regulatory and Policy Frameworks
[24] Refer Roadmap Chapter 10 Grid Transformation Milestones

personalisation.

- Networks will need to develop information services so customers can access more transparent data to enable early adoption and connection of a growing range of products and services. The increasing use of digital channels will also provide a simple and seamless means through which customers can interact with networks and access greater levels of information. This will also underpin improved customer service outcomes, such as response times and outage management.
- Networks will play a key role in the delivery and connection of an expanding range of innovative products and services to customers. New products and services will be needed to reflect changing technologies and opportunities for customer benefits, including network support services for micro-grids, standalone power systems, peer to peer trading and electric vehicles.
- Innovation in the electrification of transport, particularly when combined with other innovations in distribution network design and orchestration can substantially improve capacity utilisation, reducing the overall impact of network costs on customer bills. Electric vehicles deliver a number of co-benefits in terms of lower transport sector greenhouse and noxious gas emissions and assistance with system wide load balancing.[25]

[25] Refer Roadmap Chapter 6 Efficient Capacity Utilisation benefits, p36

2. Consumers are driving change

The 2017-27 decade is likely to see dynamic changes in the way Australians consume, produce and value electricity and related network services. This is largely driven by:

- increasing diversity in the way customers use energy and engage with energy service provision, that are not necessarily well correlated with traditional factors like socio-economic groups or specific business types
- customer interest and willingness to directly invest in their own power system infrastructure to generate, store and control electricity via on site distributed energy resources for cost, independence, reliability, and environmental goals
- new edge-of-grid capabilities, enabling multidirectional flows of power and information, so end users can sell services to networks and other market actors.

2.1 Getting the incentives right

Consultation questions

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

Enabling customer choice and control is central in the balanced scorecard of customer outcomes in the Roadmap.

Analysis for the Roadmap identifies the potential to achieve transformative outcomes in choice and control with the right actions by government and industry. While energy customers are increasingly diverse and their use of the energy system will become even more disparate with changing technologies, the Roadmap identifies the scope of policy and regulatory actions which will enable the choice and control sought by customers, without compromising fairness and equity for less active customers.

For instance, the Roadmap identifies a number of benefits from a transformed energy system:

- Up to 10 million households and small customers will have onsite resources like solar, storage, smart homes and electric vehicles by 2050.
- The grid becomes a platform more like the internet, where customers can trade and share energy or receive offers of innovative services, with the confidence of a secure, affordable and low carbon service.
- Networks could buy grid support from millions of customers with solar, storage, smart homes or in demand response programs, with annual payments worth $1.1 billion within 10 years. (The orchestration of these distributed resources benefits all Australians as up to $16 billion in network infrastructure investment can be avoided by 2050, with network charges 30 per cent lower than today).
- Customers, not utilities, will make more than $200 billion of all energy system investment decisions between now and 2050.

- Over 35 per cent of all electricity will be generated and managed by customers by 2050, through rooftop solar and battery storage, which can then be fed back into the grid.

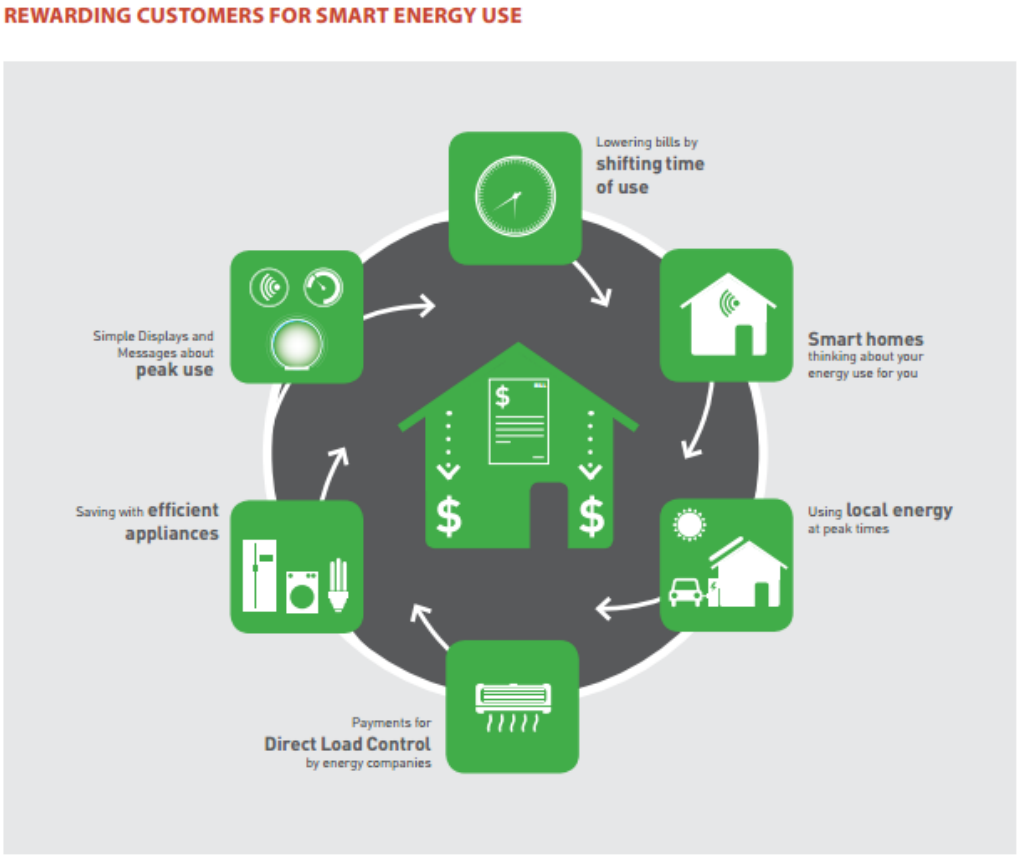
However, Energy Networks Australia recognises the importance of insights from behavioural economics – and that there will be a spectrum of customer participation. Many consumers will avoid complexity, retain a 'default bias' and have strong preferences for decision making at infrequent intervals and automated solutions. These issues are discussed further in the Customer Engagement Handbook developed by Energy Networks Australia and the CSIRO and the Electricity Network Tariff Reform Handbook.

Among the key measures to support customer choice and control include:

- Assisting customers to participate in markets through simplifying information and price comparison;
- Energy management tools that assist consumers to better understand and manage their electricity usage including:
  - Information on how much the size of the customer's bill is caused by various end-uses such as lighting, laundry, and air conditioning, and what actions will have the largest effect on their bill
  - In-home tools such as a "glowing orb" which changes colour to indicate to a household its peak demand consumption
  - More complex, real-time in-home displays would disaggregate the customer's power consumption and explain how much they are paying by the hour.

Customers are often looking for control and choices which allow them better value or lower bills. This is best done through incentives and pricing frameworks which better signal the outcomes of this control and choice. These developments also require:

- appropriate customer protections; and
- support measures and concession frameworks which avoid unfair impacts on vulnerable customers.



Source: Electricity Network Tariff Reform Handbook (May 2016)

As noted above, however, failure to transition to a fairer system of prices and incentives will expose customers to the risk of higher cost outcomes, leading to higher average electricity bills and unfair cross subsidies paid for by some customers.[26]

2.2 Affordability and impacts on vulnerable customers

Price structures can be made more equitable when:

- customers are transitioned to more cost reflective tariff arrangements which:
  - increase incentives/price signals for customers to reduce or substitute grid use at times most likely to reduce future network costs
  - reduce incentives/price signals for customers to reduce or substitute grid use at times unlikely to reduce future network costs
- customers with distributed energy resources are able to receive incentives for providing network support services at the time and location needed to improve the system's efficiency for everyone

[26] Roadmap Chapter 3 Customer Oriented Networks Benefits, p18

- there is flexibility for new and differentiated services to be offered to customers – including transmission networks potentially introducing differentiated pricing in a more dynamic environment, to better incentivise connections in areas with underutilised network capacity.

However, the Roadmap is quite clear that the current policy settings will not achieve equitable outcomes without timely action by government and industry. To deliver affordability, customers need to transition earlier to cost reflective tariffs, with appropriate support measures and safeguards, such as the option to move back to legacy tariff arrangements if they choose. This in turn requires positive action to increase the penetration of digital (smart) meters, and removal of barriers so that customers can be transitioned to cost reflective tariffs by 2020.

Consultation questions

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

Given Australia's energy markets are experiencing significant changes in technology, customer preference and new information and services, it is important to review the effectiveness of the support provided to vulnerable customers - those that are at risk of experiencing financial stress due to a moderate increase in their energy bills.

Energy Networks Australia recently commissioned independent analysis by HoustonKemp, *Supporting Vulnerable Energy Customers*, which has identified potential options for government support and energy industry action.[27] Six key areas of opportunity were identified:

1. Harmonising the value of government assistance across jurisdictions.
2. Effective targeting of government assistance based on need.
3. Maintaining the relative value of energy concessions over time.
4. Providing assistance to finance household or community investments in technology or energy efficiency improvements.
5. Transitioning vulnerable customers to more cost reflective electricity network pricing, including the option of 'social tariffs'.
6. Improving customers' access to information and decision tools.

Vulnerable and hardship customers require effective customer safety net arrangements which are resilient to changing energy technologies and choices by other customers. This can be met through:

- concession schemes which support those who need it most;
- robust customer protection frameworks; and

[27] http://www.energynetworks.com.au/sites/default/files/ena_information_paper_-_supporting_vulnerable_energy_customers_may_2015.pdf

» clear rules for market entry and participation[28].

The introduction of cost-reflective electricity prices will need to be carefully managed to manage impacts for vulnerable customers. In 2014, the AEMC estimated that 70-80% of all customers will have lower network charges as a result of cost-reflective network pricing, over the medium term[29].

There is evidence that cost reflective pricing reforms are often beneficial to vulnerable customer cohorts which may be paying more than their share under existing tariff structures. For instance, a significant study identifying impacts of cost reflective tariffs on vulnerable customers was undertaken by AGL utilising its Victorian residential customer smart meter data combined with demographic data to identify the impact of demand based tariffs on Hardship and Concession and Pensioner Households[18]. The study concluded that vulnerable customers are in fact more likely than other customers to benefit from cost reflective pricing once demand response is accounted for.

Detailed analysis is required of customer segments during the reform process, as noted in Energy Networks Australia's Electricity Network Tariff Reform Handbook

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

Analysis for the Roadmap evaluated the potential for price structures to impact on not only average customer bill outcomes but also the equity of shared cost outcomes between customers on the network. Customers have increasingly diverse load profiles, depending on their use of air-conditioning, energy efficiency, solar panels and other technology.

Despite these varying uses of the network, most Australian residential (and small business) network tariffs rely on volumetric charges (cents per kilowatt hour) which do not vary by time. Historically, the relative homogeneous energy use in the residential sector meant that weak pricing signals had little impact on customer outcomes. Over time however, with the introduction of new technologies, network cost recovery through a flat, anytime volume rate provided no signals for the use of energy at times that contributed to future energy costs. At the same time, the flat anytime volume signal resulted in customers installing solar PV or using less energy to reduce their bills. Because there was no corresponding decrease in network costs from lower consumption, the inefficiency in the price signal resulted in network costs being recovered by other customers - and in future years through higher prices.

The lack of reflectivity between the pricing structures in "legacy" network tariffs – passed through to the customer by the retailer - to drivers of network cost, results in:

---

[28] Roadmap Chapter 4 Customer Safety Net, key findings 1 and 2. See also Power Transformed, Consumer Action Law Centre, July 2016
[29] AEMC: New rules for cost-reflective distribution network prices, News Release November 2014

- unfair cross-subsidies between customers today
- continuing inefficient signals which encourage customers to bypass or avoid energy use for large parts of the day – with no ability for the network service provider to correspondingly reduce network costs
- a failure to provide any signal the costs of increased network investment which would be required in the future.

Recent analysis by NERA Economic Consulting (NERA) for the AEMC identified significant cross-subsidies between customers under current network tariffs[30]. The analysis confirmed customers that contribute most to peak demand, by using a higher proportion of their consumption at peak times, pay the same unit electricity price as other customers. This means that they are subsidised by customers whose use of the network is relatively more constant across peak and off-peak times. NERA used case studies to estimate the cross-subsidy to customers with air conditioners, and customers with solar PV. NERA found that:

- for customers with a large air-conditioner, the cost of their network service exceeded the amount paid in network charges by these customers by $683 per year
- for customers with north-facing solar PV, the reduction in network charges due to lower levels of consumption supplied by the network exceeded the reduction in network costs by $117 per year
- for customers with west-facing solar PV, the reduction in network charges exceeded the reduction in network costs by $29 per year.

In modelling for the Roadmap, CSIRO selected from its customer profiles, sample customer profiles representing four household groups. Energeia modelled the outcomes of the same sample customer assuming **a Base Case (no tariff reform)** and **a Preferred Scenario (Effective Tariff Reform)**. Energeia assessed both **active customers** seeking distributed energy resources, including solar and batteries to reduce energy bills and **passive customers** who did not, or could not, seek to invest in distributed energy resources. The outcomes for the four sample customer types are outlined below:

[30] NERA, Economic Concepts for Pricing Electricity Network Services, A Report for the Australian Energy Market Commission, 21 July 2014

Figure 4: Outcomes for different customer types

	Base Case			Preferred Scenario		
	Active $	Passive $	The Gap $	Active $	Passive $	The Gap $
Working Couple	1,387	1,900	513	1,303	1,552	248
Medium Family	1,584	2,761	1,177	1,577	2,119	542
Large Family	2,722	4,339	1,617	2,655	3,206	552
Single, Retired	1,059	1,792	733	1,076	1,445	370

Source: Electricity Network Transformation Roadmap: Key Concepts Report (Dec 2016)

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

Data sharing and privacy obligations must be actively managed in future energy systems. For instance, energy networks may be both users of, and contributors to, a storage register, recognising that information is currently collected through connection agreements and in accordance with the requirements of privacy law. It would be important that information collected in the register is treated appropriately with respect to customer's privacy. It may be necessary to develop and apply appropriate protections to maintain the confidentiality of certain information.

It is important for COAG to consider whether the NER connections framework will be used to enable the registration of distributed energy generation for new connections and connection alteration once contestable metering commences. If network service providers collect data and provide this information to an AEMO centralised database, then the NER rights of access and confidentiality and privacy of data would apply. This has the additional benefits of improving the accuracy and availability of information, allowing AEMO to improve its electricity distribution planning capacity.

It is also possible that the data collected in the register could be valuable (from a broader commercial or business development perspective) to parties other than the electricity network companies. Clearly therefore, apart from privacy rules being established and complied with, clear agreement between parties exchanging confidential or personal information must be reached in regard to:

- who can access the register
- what level of information will be available
- how the information can be used

- how the information will be kept secure and protected;
- how the information will be managed on an ongoing basis

3. The transition to a low emissions economy is underway

3.1 The role of the electricity sector in meeting our emissions reductions targets

Consultation questions

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

Australia has committed to a 26 to 28% abatement target over 2005 levels by 2030. The agreement reached in Paris in December 2015 consists of two broad international targets; firstly, to reach peak emissions as soon as possible, and secondly, to reach carbon neutrality in the second half of this century. Australia is currently on track to reach its 2020 emissions target but will require additional or strengthened policy settings to reach the 2030 target and/or become carbon neutral in the second half of the century.

The modelling in the Roadmap shows that Australia can meet its 2030 abatement target. Three options to reach the 26 to 28% target were considered:

- Business as usual – where the suite of current government policies continues and major policy settings (i.e. reduction of absolute baselines) are adjusted to reach specific abatement targets.
- Technology neutral – where the current suite of policies is adjusted to become technology neutral and elements of a baseline and credit scheme are introduced.
- Carbon price mechanism – where all policies are removed and replaced by a carbon price on all emissions.

The modelling indicates that the 2030 emissions reduction target can be met through any of the options modelled. The modelling also shows that the electricity sector does more than its share with its reductions being reduced by 36% over the 2005 baseline levels. The main difference between options is in the cost to achieve the abatement.

Australia's electricity sector is positioned to support further carbon abatement targets beyond 2030 and, with appropriate action, achieve net zero carbon emissions by 2050. The Roadmap analysis provides a plausible projection of generation sources to meet wholesale energy requirements and zero net emissions by 2050. However, this modelling is not intended to be an optimised analysis of comparative technical solutions to achieve a wholesale portfolio scenario, and ultimately each NEM region will need to consider all of the possible combinations of solutions. While battery storage is forecast to provide the dominant new source of energy balancing, a range of diverse solutions could be employed as complimentary measures while still

achieving zero net emissions, depending on changing economic potential.[31]

Figure 4: Historical and projected quantity of electricity sector abatement by location on the network (*Roadmap* Scenario)

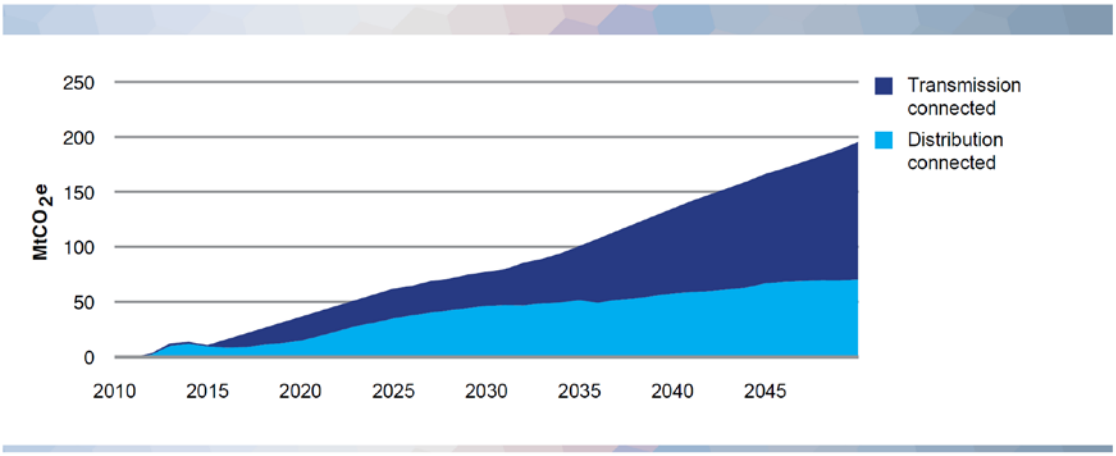
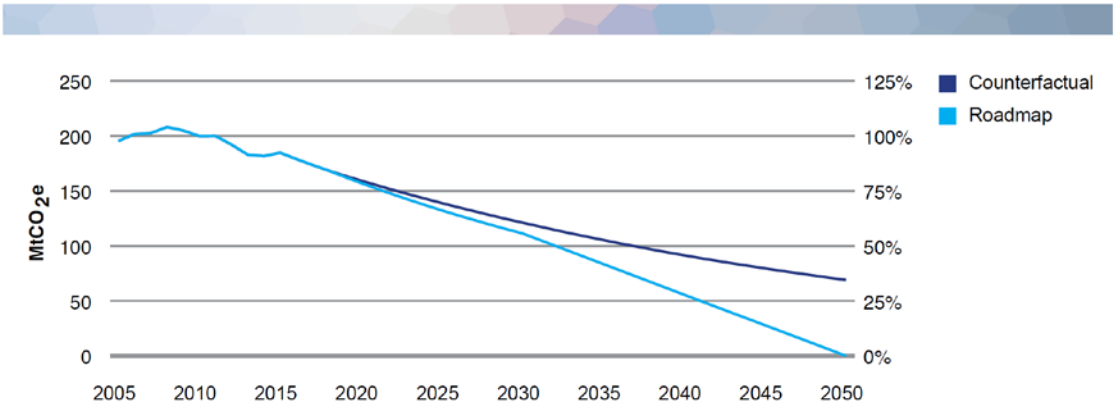


Figure 5: Assumed greenhouse gas pathways under *the Roadmap* and counterfactual scenarios (Left axis: emissions, right axis: percent abatement relative to 2005 emissions)



Source: Electricity Network Transformation Roadmap: Key Concepts Report (Dec 2016)

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

Gas contributes significantly to Australia's electricity generation sector. In 2014/15, gas provided 18% of total generation. Gas is a low emission fuel with significant capacity to support Australia achieve its carbon abatement targets.

It is estimated that the direct use of gas in the home has between (a quarter to a sixth of the emissions of the same energy sourced from the electricity grid)[32]. On a national

[31] Energy Networks Association (2016) *Electricity Network Transformation Roadmap: Key Concepts Report,* p.10
[32] Energy Networks Association (2015), *Australia's Bright Gas Future – competitive, clean and reliable*, accessed from: www.energynetworks.com.au

basis, mains supplied gas provided 44% of energy used in households, but represented only 13% of the emissions from those households. Forty nine per cent of households are connected to mains gas with a further 20 % connected via bottled gas. Overall, more than two-thirds of Australian households are connected to gas. Member businesses of Energy Networks Australia are investing in future technologies for decarbonising gaseous fuels used by residential, commercial and industrial customers. For example:

- **Energy Networks Australia - Gas R&D Fund** - The Energy Networks Australia Gas Committee members contribute to this fund. One of the projects supported by this fund aims to identify the commercial, technical and regulatory issues for ***injecting hydrogen into networks*** at levels of up to 15%. The scheduled completion date for this project is June 2017.
- **Australian Gas Networks (AGN) Hydrogen Project** - AGN has partnered with AquaHydrex, a business that has developed an advanced electrolysis technique for producing ***hydrogen from water***. The concept is based on the use of surplus electricity from renewables (i.e. wind and solar) to produce hydrogen for injection into natural gas networks. AGN currently purchases natural gas to offset system losses, and the displacement of all of this gas with hydrogen would be the ultimate goal. Funding is currently sought to build a demonstration pilot plant for commissioning in 2018.
- **Jemena trials of new technologies -** Jemena is actively exploring the potential for trialling hydrogen, biogas and other low carbon gas technologies in New South Wales with the objective of driving increased GHG emissions reduction and providing large-scale energy storage services to improve electricity grid stability.
- **ActewAGL Networks Sustainability Projects** - ActewAGL is investigating sustainability projects. One of these projects aims to convert organic waste streams to ***biogas*** in an anaerobic digestor and to inject that the produced gas into the ACT's gas distribution network. A business case for a pilot scheme is being developed. The second project aims to establish a pilot plant for research and development into producing hydrogen from excess renewable energy, linked to one of the ACT's wind farms.

Gas used in efficient new gas-fired power generation has approximately half the emissions of the current electricity grid[33]. Modelling completed by Jacobs[34] indicates the energy mix to achieve the 2030 abatement target will change from being coal dominated to becoming more diverse in 2030, with coal, renewables and gas contributing more equally to the fuel mix.

[33] Department of the Environment (2014), *National Greenhouse Accounts Factors.*
[34] Jacobs (2016), *Australia's climate policy options – modelling of alternate policy scenarios*, report completed for Energy Networks Australia, accessed from www.energynetworks.com.au

3.2 The importance of predictability and policy stability

Energy Networks Australia supports the development of effective national policy initiatives that achieve the effective monitoring and abatement of greenhouse gas emissions to meet Australia's current and future international obligations.

This submission highlights in many areas the need for greater consistency between State and Federal policies related to carbon and energy policy, including a coherent and coordinated technology neutral approach to achieving national carbon abatement objectives. To achieve an efficient transition, climate policy frameworks should ideally be national and focused on outcomes (carbon abatement) rather than inputs (renewable energy generated). This permits Australia's abatement targets to be achieved at least cost and in a technology neutral manner.

Frameworks for abatement should:

- facilitate national abatement outcomes in an economically efficient manner across all relevant sectors of the economy, and
- seek to minimise economic distortions and, in the case of the stationary energy sector, emissions abatement policy must consider, and be appropriately integrated with, energy policy objectives and market frameworks.

Consultation questions

What are the barriers to investment in the electricity sector?

With customers, rather than businesses, likely to be responsible for 25% to 40% of all expenditure on power system infrastructure to 2050, pricing and incentives reform is a critical piece in the energy transformation puzzle. Pricing and incentives reform can transition the sector to a low emissions economy, with improved levels of reliability, and with better optimisation of distributed energy resources and network expenditures. These initiatives can also improve affordability compared to alternative scenarios. The analysis shows that the Roadmap Scenario achieves a real $101 billion reduction in cumulative total expenditure.

The barriers to delivering such outcomes largely relate to a lack of policy and regulatory cohesion in areas of:

- carbon policy
- pricing - including clear and efficient pricing signals for the right investment in the right place at the right time
- consumer protection
- market design
- regulation – including regulatory barriers for networks investing in microgrids and standalone power systems.

The Roadmap analysis also points to the need for grid modernisation and a sequential approach to market design to enable future investment to occur in an efficient

manner. Critical enablers of modernised grid and market design include:

- smart meters
- standards and protocols
- workforce enablers.

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

The Energy Networks Australia publication, *Enabling Australia's Cleaner Energy Transition*[35] outlines seven steps to improved national carbon policy. This was supported by detailed economic analysis completed by Jacobs[36] which examined a variety of policy options to achieve Australia's current abatement target (i.e. emission reductions of 26 to 28% below 2005 levels by 2030) or an extended target of 45%[37]. As noted above, the analysis demonstrated that the current 2030 target could be met in any of the three scenarios, with the main difference being the economic efficiency and outcome for customer bills. Significantly, the technology neutral and carbon price scenarios – which did not have an expanded renewable energy target - saw significant increases in the level of renewable generation based on its economic merit in achieving carbon abatement.

These analyses indicate that the introduction of an additional renewable energy target does not increase the efficiency or effectiveness of the growth in renewables. There is material evidence that a technology specific renewable energy target or regulatory closures would perform more poorly than technology neutral "indirect measures". The Climate Change Authority[38] also found that technology pull mechanisms, such as a renewable energy target and/or contracts for difference are a more costly approach to carbon abatement compared to market mechanisms such as a cap and trade or emissions intensity schemes.

Importantly, the key element is to pursue an enduring, stable and nationally integrated carbon policy framework. Building new energy infrastructure requires a long lead time and requires a long-term position on carbon and energy policy to provide investor confidence.

Energy Networks Australia has proposed "Seven Steps to Smarter Carbon Policy"[39] as shown in the figure below. The underlying step is to: "Pursue an enduring, stable and nationally integrated carbon policy framework." This framework will provide a stable investment environment that secures both carbon abatement objectives and efficient

---

[35] Energy Networks Australia (2016), *Enabling Australia's Cleaner Energy Transition*, available from www.energynetworks.com.au
[36] Jacobs (2016), *Australia's Climate Policy Options – Modelling of Alternate Policy Scenarios*, available from www.energynetworks.com.au
[37] The outcomes of the 45% target scenario are reported, indicating similar results – i.e. lowest residential bill under a technology neutral approach.
[38] Climate Change Authority (2016), *Policy options for Australia's electricity sector – special review research report,* p.10
[39] Energy Networks Australia (2016), *Enabling Australia's cleaner energy system*, August 2016.

investment.

BOX 1: SEVEN STEPS TO SMARTER CARBON POLICY

1. Pursue an enduring, stable and nationally integrated carbon policy framework based on consensus.
2. Introduce a 'Baseline and Credit' Scheme leveraging the current legislative architecture of the Emissions Reduction Fund Safeguard Mechanism.
3. Over time, consider options to increase economic efficiency by moving to a Carbon Price mechanism, with appropriate financial transfers and household support and without risking subsequent policy 'churn'.
4. If governments maintain direct incentive programs, transition Commonwealth and State programs to focus on least cost abatement outcomes, which are scale neutral and technology neutral.
5. Continue to review Australia's abatement targets (in the form of Intended Nationally Determined Contributions or INDCs), within the 5 yearly cycle proposed following the COP21 Agreement in Paris.
6. Incorporate an explicit, independent assessment of national energy market implications when developing jurisdiction initiatives on carbon and renewables policy.
7. Ongoing support for research, development and demonstration on a diverse range of low emission technologies.

Source: Energy Networks Australia (2016), Enabling Australia's cleaner energy system, August 2016.

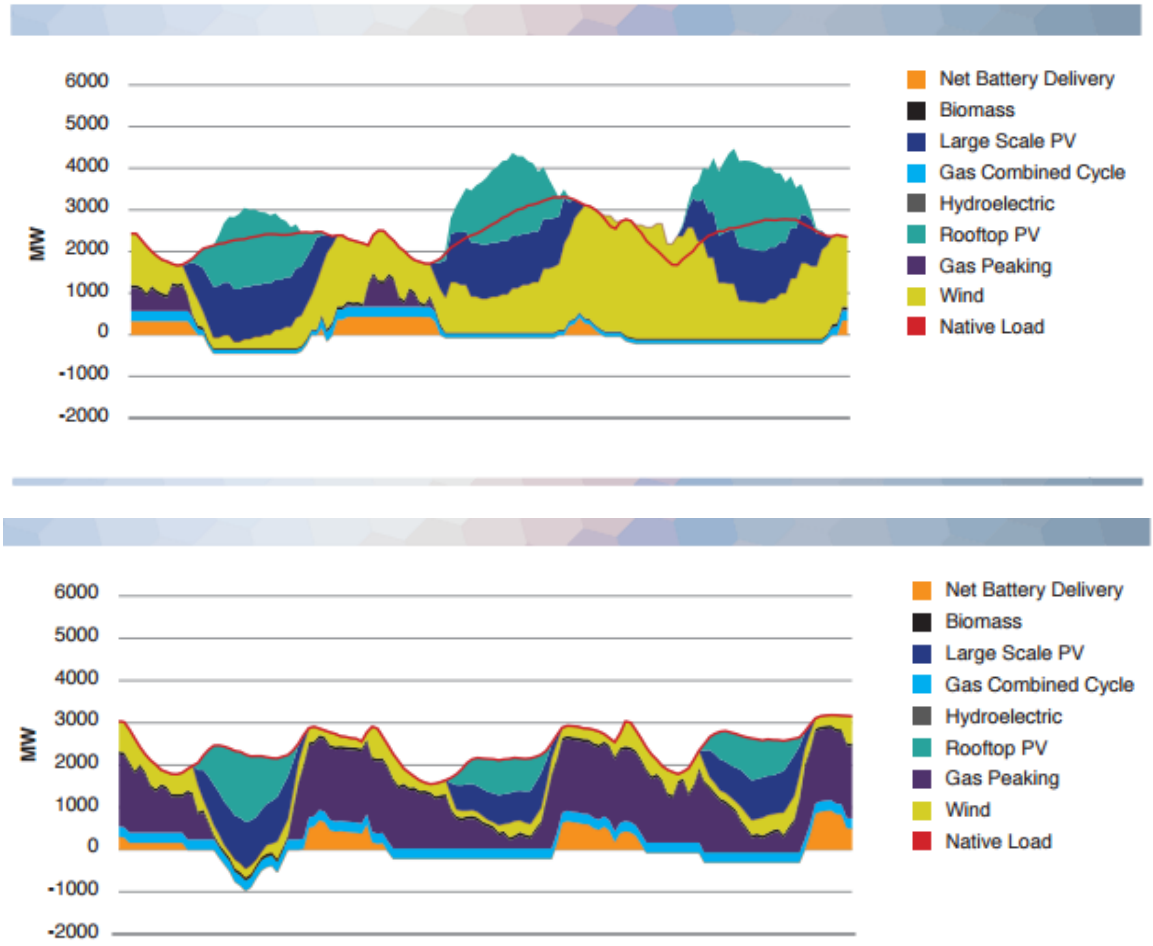
4. Variable renewable electricity generators, such as wind and solar PV, can be effectively integrated into the system

Energy Networks Australia recognises the work currently being undertaken by AEMO and the AEMC focussing on the underlying challenges of power system security. Power system security with a generation mix required to meet a low/zero emissions future requires careful analysis of all aspects of system security during the transition of the generation portfolio.

Analysis for the Roadmap suggests that individual NEM regional balancing is unlikely to rely on one single strategy or solution but will need to rely on a combination of a range of solutions to provide a secure and reliable power system. By way of example, the Roadmap provides projected analysis of the South Australian region in 2036 with 80 per cent renewables and how different energy balancing solutions could work together over a 12 month period.

- In the illustrative, three day window in Summer discussed in the Roadmap, excess energy will be produced in the middle of the day, some of which is transferred to battery storage. Overnight demand is met from battery storage, in combination with some baseload, peaking gas and a small amount of dispatchable biomass. However, on the third day it remained sufficiently windy overnight (green), which allowed for renewable diversity to meet the energy balance on that day without the need for other capacity.
- Winter renewable output in 2036 can be observed as being lower than during summer, and as such the system producing less energy for battery storage during the day. This results in the system needing to utilise gas peaking plant much more during this period. It should be noted that this example could be modified to include other solutions such as the deployment of further demand management options or inter-state interconnectors.

This example demonstrates that individual NEM region balancing is unlikely to rely on one single strategy or solution but will need to consider all possible combinations of solutions to provide a secure and reliable power system.



Source: Electricity Network Transformation Roadmap: Key Concepts Report (Dec 2016)

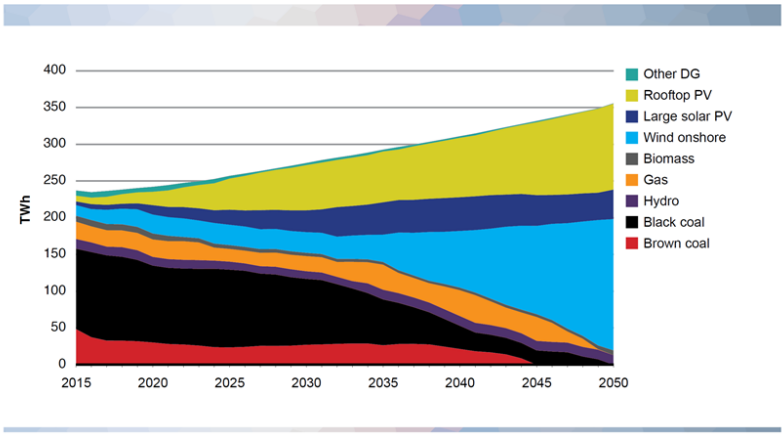
The distribution system is a potential source of new ancillary services to support transmission level system stability. This is outlined in response to other questions below.

4.1 Decline of traditional generation creates technical challenges

As noted above, CSIRO energy system analysis concluded that Australia's electricity sector could exceed its share of current national carbon abatement targets, achieving 40% below 2005 levels by 2030. However, an integrated set of measures will be required including stable enduring carbon policy frameworks and incentives to enable 'orchestration' of millions of distributed energy resources.

Energy system modelling undertaken for the Roadmap identified the generation mix summarised in the Figure below, as a plausible projection of generation sources required to meet wholesale energy requirements and zero net emissions by 2050. The analysis assumes a primary role for storage in balancing the output of intermittent Variable Renewable Energy.

Figure 20: Electricity output by generation type to 2050



Source: Electricity Network Transformation Roadmap: Key Concepts Report (Dec 2016)

The generation modelling is not intended to be an optimised analysis of comparative technical solutions to achieve a wholesale portfolio scenario, and ultimately each NEM region will need to consider a possible combinations of solutions.

Consultation questions

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?

AEMO and network service providers will firstly require increased analytical capacity to prospectively anticipate emerging issues in system stability and loss of system strength in relevant locations. Other than South Australia, there has been limited detailed power system assessment of the implications of increasing levels of non-synchronous generation on system security. The latest AEMO Future Power System Security Program[40] identifies that NEM regions at the ends of the interconnected network are most likely to be impacted by the issues of frequency control and reduced system strength. It is likely some NEM regions will not require immediate action but all regions require that AEMO and TNSPs have the capacity to undertake timely analysis which anticipates potential risks.

Where action ***is*** required, Energy Networks Australia notes the following potential measures:

» **Use of existing TNSP resources.** As recently outlined in Energy Network Australia's submission to the AEMC's System Security Market Frameworks Review's December 2016 Interim Report, a number of Transmission Network Service Providers (TNSPs) currently own and operate assets such as synchronous condensers, which are currently providing both system strength and inertia to the

[40] AEMO: Future Power System Security Program, Progress Report, January 2017

NEM. Market frameworks should encourage the utilisation of existing resources, where it is technically feasible and efficient to do so. Anti-islanding technologies such as Vector Shift, Frequency Forcing or other special protection schemes may also be appropriate in some cases. Any proposed market mechanisms should allow for the continued use of these schemes where efficient; and the development, installation and operation of future schemes where technically feasible and efficient. ElectraNet is currently undertaking a RIT-T evaluating options for improved voltage control in the northern South Australia region resulting from the withdrawal of Northern Power Station. Whilst this RIT-T is being undertaken as a reliability corrective action, there are a number of important wider market benefits that may be generated in addressing the immediate reliability concerns. These market benefits include: improving frequency management; mitigating against reducing fault levels; and reducing constraints on wind farms due to increased voltage limitations in this region.

- **Extended roles for TNSPs:** Given their current responsibilities, TNSPs could reasonably extend current roles to implement fast frequency response, subject to clarity in regulatory frameworks. For instance, Energy Networks Australia notes that modern transmission network infrastructure such as Optical Ground Wire (OPGW) systems provides fast communication capabilities which may support a fast frequency response scheme for the management of change in frequency.
- **Interconnection Assessments:** ElectraNet is currently conducting stakeholder consultation on options to improve system security and lower electricity prices. It is assessing high-voltage interconnection options and non-network alternatives, in accordance with the Regulatory Investment Test for Transmission (RIT-T). The COAG Energy Council recently released a Final Report into its Review of the RIT-T, in February 2017. Broadly, the review found that the RIT-T in its current form remains the appropriate mechanism to ensure that new transmission infrastructure in the NEM is built in the long-term interests of consumers. The review recommended changes to ensure :
  - system security and emission reduction goals are adequately considered
  - low probability but high impact events like the South Australian system black event in September are appropriately taken into account
  - information about transmission networks is more accessible to support more effective engagement by non-network providers.
- **Generation Connection Standards**: TasNetworks has developed region specific requirements for the connection of asynchronous generation. The requirements sit within the current NER framework and describe the minimum technical performance that must be satisfied to achieve connection in Tasmania. For many criteria, the technical performance now required is above the minimum access standard. In effect, TasNetworks has defined the lowest level of performance that it is willing to negotiate. The objective of this approach is to increase the ability of the Tasmanian power system to host future renewable energy projects while managing power system security and reliability.
- **Managing Operational Events:** The potential introduction of the 'protected

event' regime as a proposed new category of non-credible contingency event in terms of reclassification of contingency events appears generally supported by industry stakeholders.

It should also be noted that the switching of aggregated Distributed Energy Resources in the distribution system (e.g. in response to a price signal) may result in a shift in frequency, as the future aggregated capacity may exceed the capacity of a power station and impact on the efficacy of existing under-frequency load-shedding schemes. Market and regulatory frameworks should recognise the potential for high penetration of Distributed Energy Resources, with appropriate measures or incentives to prevent aggregated switching that would adversely affect system security. It is equally likely that technological developments in inverters and smart controls technology can assist in frequency management if appropriate incentives are available.

In addition to these short term actions, Energy Networks Australia suggests that some more medium term objectives should include:

- reviewing the frameworks for protection systems;
- reviewing the extent to which market frameworks continue to efficiently secure capacity and balancing services;
- new frameworks for ancillary services; and
- improved anticipatory constraint forecasting.

4.2 Generator Connections Standards

Consultation questions

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

The takeup of variable renewable electricity has not been incentivised or regulated with any particular consideration of power system security:

- **The Large-Scale Renewable Energy Target (LRET) incentivises development based on resource and market conditions.** Consequently, variable renewable energy in South Australia is over 40% significantly due to wind power generation[41] introduced in response to the LRET. New South Wales has only 700 MW of variable renewable energy. This represents 13% of its total renewable energy capacity of which more than 80% is hydro, a dispatchable source of renewable generation, and developed before the LRET.
- **Individual States propose separate Renewable Energy Targets.** For example, Queensland has a 50% target for 2030 and Victoria is implementing a 20% target

[41] Clean Energy Regulator (2016), *Renewable Energy Target, Administrative report and annual statement 2015.*

by 2020 increasing to 40% by 2025[42].

At its 7 October 2016 meeting, the COAG Energy Council:

- noted the importance of integrating energy and climate policy at the federal level and the Federal Government's commitment to the Paris targets; and
- agreed that AEMO will provide a six-monthly update on the implications for security and reliability of current and proposed investment in the national electricity market. (It was unclear whether this would include state based renewable energy targets).

Energy Networks Australia does not consider it is currently necessary to curtail variable renewable electricity generation (VRE) in any region of the NEM. However, this view is on the basis that:

- Timely, detailed analysis is undertaken to anticipate the implications of increasing levels of forecast variable renewable energy and the loss of synchronous generation (as recommended above);
- Arbitrary State targets to drive in additional VRE in key jurisdictions should not be implemented without assessing potential system stability issues and planning for contingencies; and
- Existing operational responsibilities of AEMO and previous State Government instruments have practically curtailed the level of variable renewable energy in South Australia at times.

Network Service Providers are able, using their system studies and their planning processes, to assist in understanding the potential effect on system security, and possible solutions. A number of TNSPs currently own and operate assets such as synchronous condensers, which are currently providing both system strength and inertia to the NEM. TNSPs are well placed to provide inertia and system strength where it is technically feasible, efficient and economical for them to do so and provided responsibilities are clearly defined. Subject to regulatory requirements, TNSPs may be able to provide some of these solutions and services efficiently, for the benefit of all stakeholders. Once the need for system security services has been established, they can be provided via market mechanisms, including TNSP provision of services or obligations on generators. It is therefore essential that the establishment of market frameworks or obligations for system security be expedited.

As an interim measure Network Service Providers can work with VREs to help them understand what system security services that they would need to provide to ensure system security, and ensure that these services are provided in conjunction with any new connection.

---

[42] Jacobs (2017), *Efficient carbon abatement and technology study for Energy Networks Australia.*

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

It is essential that modelling tools, system studies and their planning processes be developed to assess the impact of VREs on the system under all expected system conditions, prior to approval being given to the connection of any additional source of generation. Network Service Providers can utilise their knowledge and expertise to understand potential system problems and to identify a range of possible solutions. Potential solutions could be realised by placing obligations on the generators, or through other market mechanisms currently being established, such as those being considered by the AEMC in the context of its system security markets review.

Should there be new rules for generator connection and disconnections?

New generator connections could include an obligation on new generators to provide inertia and system strength to the NEM, or enter into an agreement with another provider of the services through market arrangements.

Retirement or disconnection of existing generator assets should be subject to some form of regulation to ensure that adequate notice is provided to ensure that the NEM is able to appropriately respond. It is not only essential that alternative sources of generation are available to replace the retiring generator, but alternative system security services can be made available if a synchronous generator is disconnecting from the NEM. Where retirement of an existing generator requires network augmentation e.g. addition of a synchronous generator, adequate notice will be required to allow this work to be planned, procured, installed and commissioned.

As context, it is noted that ENGIE provided 5 months notice for the closure of the 1,600 MW synchronous Hazelwood Power Station. When the Morwell Power Station closed, one month's formal notice was provided prior to its August 2014 closure. Over the past three years, four large coal fired generators announced closure, including Wallerawang and the Northern Power Station at Port Augusta in South Australia.

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

Energy Networks Australia considers further analysis is required of the advantages and disadvantages of a range of options. It is noted that the AEMC proposed a range of potential mechanisms that could be used for the provision of system security services identified in the AEMC's System Security Market Frameworks Review Interim Report (December 2016), including:

- a minimum technical standard imposed on generators to physically provide the services or enter into an agreement with another provider of the services
- procurement of services via contracts with market participants through a competitive tender process undertaken by AEMO
- the direct provision of services by TNSPs or the procurement of services by TNSPs under a modified Network Support and Control Ancillary Service (NSCAS)

framework

» prices being set for the services on a five-minute basis, similar to the existing energy market dispatch process.

Any approach to the provision of these system security services should however foster innovative and least cost solutions and should not unfairly disadvantage market participants.[43]

4.3 Work underway to integrate new technologies

The Preliminary Report correctly identifies reviews undertaken by both AEMC and AEMO in terms of the impacts of energy transition on power system security. It is recognised that power system security with very low levels of native inertia will require careful analysis of system stability and security risks during the transition of the generation portfolio.

A range of technical solutions exist to achieve inertia and frequency management outcomes, including the use of synchronous condensers, rotational stabilisers, large scale batteries, flywheel technology and emulated inertial responses from, for instance, super-capacitor technologies or wind turbines by using the kinetic energy to support the frequency by interchanging this energy with the grid.

Consultation questions

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

It is widely recognised that Distributed Energy Resources can be harnessed to provide ancillary services including synthetic inertia in the future. Analysis for the Roadmap forecasts that battery storage energy potential could reach 34 GWh by 2027 or over 90 GWh by 2050.

The New York Independent System Operator has recently released a 5-year Roadmap to enable Distributed Energy Resources to participate in the ancillary services market. However, it is recognised this will require close coordination between the Independent System Operator and Distribution System Operators, to provide confidence that the response of aggregated Distributed Energy Resources to wholesale market ancillary service opportunities doesn't present risks to local distribution system reliability.

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

The regulatory framework needs to be more flexible and adaptable to the changing nature of networks and networks services. Recommended changes to regulatory

---

43 Refer to Energy Networks Australia's submission to the AEMC's "System Security Market Framework Review – Interim Report" for further details.

frameworks include:

- ensuring timely transition of customers to more efficient tariffs through changes to tariff assignment policy
- incentivising the penetration of smart meters to allow for timely transition
- allowing for networks to establish pricing, grid modernisation and market platform frameworks which will allow for the development of network optimisation markets to occur
- focusing on incentives for lowest cost procurement of grid services rather than creating regulatory barriers for distributed energy procurement by networks (either directly, through customers or through customer agents).

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

1. Cyber Security

Energy network businesses in Australia recognise the important role cyber security has in ensuring safe, reliable and efficient services to homes and businesses and to enable a rapidly transforming energy system. The four main areas of cyber security relating to energy networks are:

- procurement and operation of grid systems and components
- control systems
- access to, and privacy of, data
- distributed resources.

All businesses are able to utilise Commonwealth Government provided services such as CERT Australia and the Attorney-General's Trusted Information Sharing Network (TISN). Network businesses also have their own internal strategies to actively monitor global developments and deter, detect and respond to threats.

Additional key resources commonly used include[44]:

- Australian Government Department of Defence Intelligence and Security Information Security Manual;
- Australian Signals Directorate (ASD) Top 35 strategies for Mitigating Targeted Cyber Intrusions;
- SANS Institute 20 Critical Controls;
- USA Government National Institute of Standards and Technology (NIST) Cyber Security; and the
- USA Government Department of Energy Cyber security Capability Maturity Model (C2M2).

[44] Further information is available on the Energy Networks Australia website at: http://www.energynetworks.com.au/cyber-security

Physical security of critical infrastructure goes hand in hand with cyber security, as recognised by the Department of Environment and Energy's 'Energy Sector Group' which has a scope covering both security forms.

The interconnected nature of energy networks requires a "defence in depth" approach to both physical and cyber security. Energy Networks Australia submits that effective risk mitigation measures may require a mix of preparation, prevention, response and recovery strategies.

2. Climate Change Resilience

Climate change resilience of critical system infrastructure is also a priority area that needs to be addressed to ensure system security is maintained.

The Australian energy network sector is particularly exposed to climate change impacts including extreme weather events such as storms, heatwaves and bushfires as well as significant changes in the weather.

There is a strong body of scientific evidence which projects that Australia's average temperature will increase, with more hot extremes and fewer cold extremes. The CSIRO notes that climate change is already having scientifically observable effects on extreme events in Australia – notably an increase in fire weather, record-breaking temperatures and heatwaves[45]. It forecasts that extreme rainfall events that lead to flooding are likely to become more intense and the number of tropical cyclones is projected to decrease but with a greater proportion of intense cyclones. In the United States, the US Department of Energy has recognised that the frequency and intensity of storms are increasing, concluding that 7 of the 10 most costly storms in US history occurred between 2004 and 2012.[46]

Given the long life of energy network assets, investment decisions made today must incorporate risk assessments across a whole range of factors including future climate change. The way that energy networks are operated and maintained will also need to be reviewed to maximise their resilience to climate change.

To assist in addressing climate risk, Energy Networks Australia has developed an industry methodology and tools to support members in managing climate risk and resilience across core network business activities and to ensure consistency in factoring climate change risk in future network investment decisions.

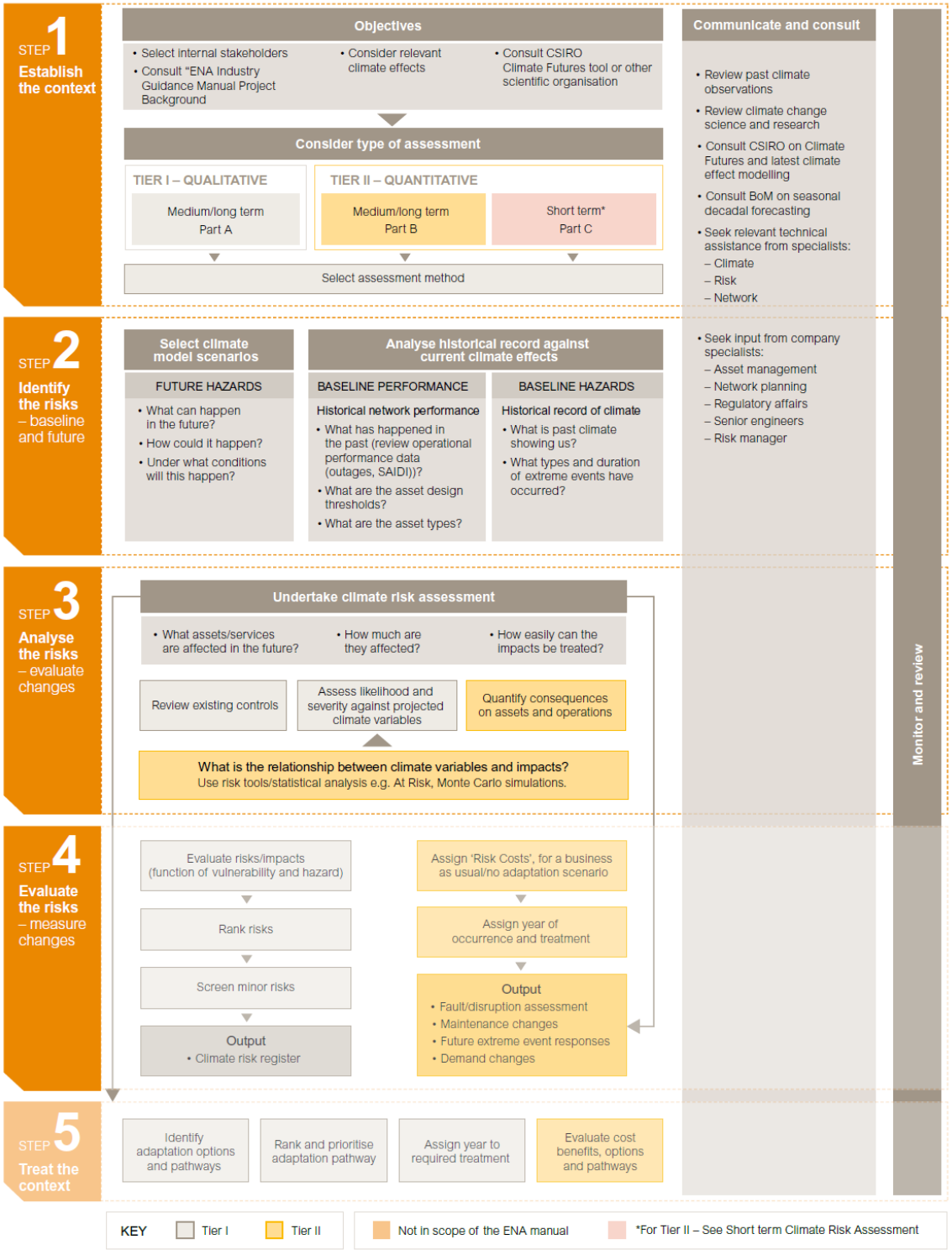
The Energy Networks Australia "*Climate Risk and Resilience Manual*" provides a stepwise risk-based process to identify climate effects, infrastructure and service impacts; metrics or risk measurement; trigger or thresholds for asset sensitivities and responses.

A summary of the Energy Networks Australia climate risk assessment framework is outlined in the diagram below.

---

[45] *Australia's changing climate,* CSIRO, 2016
[46] *Economic benefits of Increasing Electric Grid Resilience to Weather Outages*, Executive Office of the President, August 2013

ENA CLIMATE RISK ASSESSMENT FRAMEWORK



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

High speed communications and related technology will be an important part of the redefined structure and architecture of the electricity system.[47] The diagram below, prepared by the Pacific North West National Laboratory highlights the relationship between an Intelligent Grid's sensors and fast communications, with operational benefits in detecting and responding to grid issues.

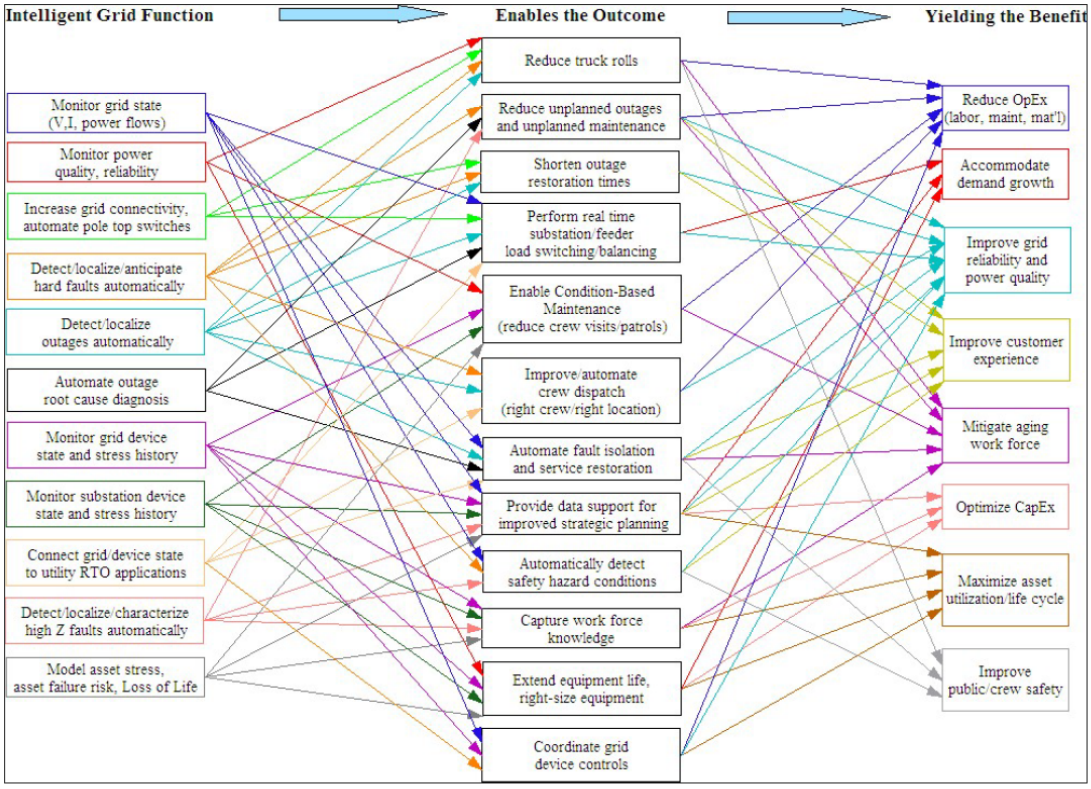


Figure 2.14. Example Three Layer Benefits Analysis Diagram

Source: Pacific North West National Laboratory, Grid Architecture 2

An array of new advanced protection mechanisms will be required for areas of the grid where parameters such as frequency variations and voltage dips are more common. These new advanced protection mechanisms will also require enhanced communications systems so island-enabling technologies can enhance system operation and security.[48] In order to enable the grid of the future to operate efficiently with real time transactions and control, the level of communication and data exchange will be far greater than it is today. Lower voltage distribution networks will require greatest attention given the many connected devices and the need to enable voltage, power flow management and system balancing at a local level.

[47] Roadmap Chapter 10 Grid Transformation Finding 6, p69
[48] Roadmap Chapter 9 Power System Security, Milestone 5, p60

Communications systems are also critical in facilitating new platforms and markets across the sector.

Energy Networks Australia also notes that modern transmission network infrastructure such as Optical Ground Wire (OPGW) systems provide fast communication capabilities which may support a fast frequency response scheme for the management of change in frequency.

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

Recent events have demonstrated that contingencies classified as "non-credible" do occur and can result in significant consequences. Events that are currently considered "non-credible" should be reviewed, and it may be appropriate for the AEMC's Reliability Panel to endorse the outcomes of such a review. AEMO should also re-classify non-credible contingencies as appropriate, during abnormal or emergency conditions.[49]

In this regard, nergy Networks Australia supports the proposal to introduce a 'protected event' regime. A protected event, which is a plausible event which could lead to a major outage or cascading failures, would be managed using a combination of ex-ante measures such as network constraints and fast frequency response (FFR), as well as load shedding.[50] This would allow AEMO to manage the system at all times to limit the consequences of these events.

5. Market design can support security and reliability

Markets can help support additional system security services by:

- providing a framework for assurance of capacity, balancing, inertia, system strength and ancillary services which are important for system security
- lowering risk premiums and avoiding costs of physical capacity or equipment to mitigate these risks which are eventually passed on to customers through lower prices
- where networks are best placed to provide system security services, ensure that the NER provides clarity on the nature of the services to be provided and the mechanism by which the costs surrounding these solutions can be recovered
- ensuring an open platform for the buying and selling of such additional services which eliminates potential for market power under less transparent market mechanisms. Note that where appropriate, networks may also be able to provide

[49] Further information is available in Energy Networks Australia's 14 October 2016 submission in response to the AEMC's System Security Market Frameworks Review Consultation Paper.
[50] Full details are provided in the AEMC's Emergency Frequency Control Schemes - Draft Determination (22 December 2016).

these services through their ring fenced operations.

Our submission has already outlined other options for energy balancing which may provide such solutions in a low or zero net emissions system. They include: renewables diversity (technological and geographical), 'pumped hydro' storage, 'Power to Gas' hydrogen storage, concentrated solar thermal generation or gas-fired generation supported by carbon capture and storage (CCS) technology, firm (dispatchable) renewable capacity and demand management.

It will be necessary for both market and regulatory frameworks to be amended, to facilitate the efficient and optimal provision of these services where required.

TNSPs are well placed and willing to provide inertia and fast frequency response services where it is technically feasible, efficient and economical for them to do so. However, Energy Networks Australia suggests that an overall solution to the management of system frequency and power system security is likely to involve the development of a combination of options and which may not necessarily be limited to those identified by current reviews.

5.1 Security of supply and the value of ancillary services

Consultation questions

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

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

As discussed previously a number of potential mechanisms could be used to provide efficient system security services and any approach to the provision of these system security services should however foster innovative and least cost solutions and should not unfairly disadvantage market participants. Market-based approaches and open platforms for the release of information will assist the 'animation' of new markets and maximise value for these sectors while also creating value for a broad range of customers. However, any market would need to be designed to ensure that there is adequate incentive for the investment necessary to provide these services where required in the network.

As discussed earlier, TNSPs are well placed and willing to provide inertia and fast frequency response services where it is technically feasible, efficient and economical for them to do so. These trends highlight the importance for customers of a more interconnected NEM, with the benefits of transmission investments increasing as the energy transformation accelerates.

6. Prices have risen substantially in the last five years

6.1 Wholesale electricity costs and their growing dependence on gas prices

Consultation questions

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

Gas today is a crucial input to stable and secure provision of electricity. In 2015 it provided 18% of Australia's electricity. Gas engines can be very responsive and are ideally suited to work with the variable nature of renewable generation to ensure a stable and secure supply of electricity.

Rising gas prices is a major concern for Australian industry. Broadening the supply of natural gas for the South Eastern Australia market will put downward pressure on prices. Removing unnecessary regulatory burdens and lifting restrictions on exploration may provide the right set of conditions for industry to explore and develop new gas resources to increase liquidity in the market and place downward pressure on gas prices.

The economic role of gas will remain dependent on its competitive position as a fuel of choice, competing on price, sustainability, security and amenity. While there has been upward pressure on wholesale gas prices due to the internationalisation of Australia's gas market, it is important to recognize the delivered cost to customers reflects other elements of the cost structure.

AEMO[51] has forecast that the retirement of Hazelwood is expected to cause a spike in gas consumption for 2017-19, with this additional demand for gas for power generation expected to stretch available domestic supplies with the greatest challenge occurring between 2018 and 2024. Gas supply may be stretched further if additional gas is required for power generation as per the Jacobs modelling. AEMO has indicated it will provide an update on supply adequacy in its 2017 Gas Statement of Opportunities, expected to be released in early March 2017.

Unnecessary restrictions on gas explorations and development by state governments including Victoria and Northern Territory are placing upward pressure on gas supplies. A national approach to gas exploration and production, based on scientific advice, such as that provided by the Academy of Technological Science and Engineering[52], could provide incentives for industry to recommence exploration activities, placing downward pressure on long-term gas supply and prices.

---

[51] AEMO (2016), *National Gas Forecasting Report,* December 2016
[52] http://www.atse.org.au/atse/content/publications/focus/issue/193-unconventional-gas-is-here.aspx

6.2 Network charges

Consultation question

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

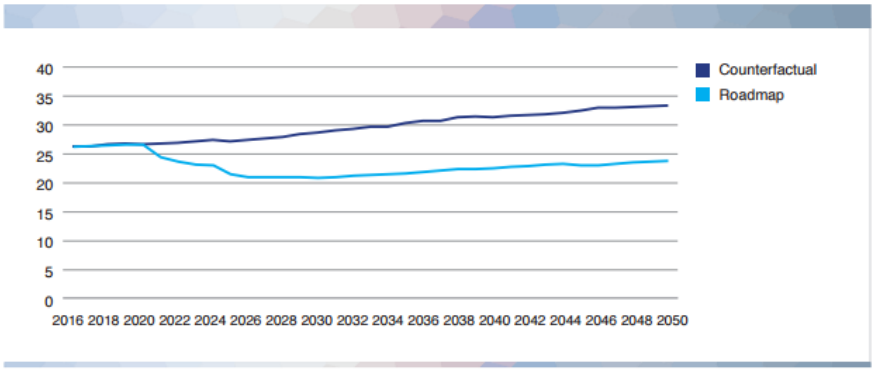
The most likely future source of non-network alternatives to peak demand will be distributed energy resources including:

- non-dispatchable resources like rooftop solar
- dispatchable resources like solar/storage
- demand response platforms
- aggregated smart devices and smart inverters
- vehicle to grid charging from Electric Vehicles.

The Roadmap indicates that such resources are likely to be prevalent in millions of customers' homes and can be incentivised to provide alternatives to traditional network infrastructure. By improving the existing tariff structures, making them more cost reflective, networks can establish an additional layer of direct, targeted incentive signals to integrate new technologies at a locational level.

Incentives to harness the potential grid benefits of DER provides win-win incentives for customers achieve the full value of their investments while lowering peak demand and subsequently network investment. The Roadmap forecasts a $16 billion reduction in network costs to 2050 if network investment is substituted by payments to customers for the use of their distributed energy resources. With the Roadmap measures, around $2.5 billion per annum in payments (or equivalent rebates etc.) to customers could be achieved by 2050 as a more efficient substitution for augmentation and replacement investment[53]

Figure 18: Non-coincident substation peak demand



Source: Electricity Network Transformation Roadmap: Key Concepts Report (Dec 2016)

[53] Roadmap Chapter 7 Pricing and Incentives, Finding 4, p41

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

Our response has already identified that most small customer network tariffs currently provide no reason for consumers to use less electricity during peak times to manage their bills. Instead, network charges are currently structured in a way that rewards customers for using less energy throughout the day, even though it doesn't reduce the underlying costs of providing the network service. This inevitably results in:

- unfair cross-subsidies between customers today
- continuing inefficient signals which encourage customers to bypass or avoid energy use for large parts of the day – with no ability to correspondingly reduce network costs
- a failure to provide any signal of the costs of increased network investment which would be required in the future.

Through the COAG Energy Council, Australian Governments have previously indicated strong support for tariff reform, as reflected in the Communique of December 2014.[54]

> *The Council supports tariff reform as an essential next step in this process as a means of providing better price signals to consumers and notes that new Distribution Network Pricing Arrangements will enable distribution businesses to set prices that reflect the efficient costs of providing network services to each consumer.*

As noted above, efficient energy investment cannot be dictated in the transformed system. Millions of customers - rather than a limited number of utilities - will be responsible for 25-40% of all expenditure on power system infrastructure to 2050. Pricing and incentives reform is critical to achieving an affordable and fair electricity system. By rewarding efficient use of distributed resources, it is possible to achieve a low emissions electricity sector, without compromising reliability and with better optimisation of distributed energy resources and network expenditures.

The Roadmap builds on work undertaken by Energeia and Energy Networks Australia which identifies necessary pricing reform in two waves.

First Wave Tariff Reform ensures universal tariffs are fairer and more efficient by reflecting the key cost driver of additional network services, the capacity required.

Second Wave Incentives allow customers (or their agents) to choose to 'opt in' to rewards for network support in the *right place* at the *right time.* These incentives are location specific and dynamic in time and could include:

- Incentive ***Payments for 'orchestration' of DER*** (eg. battery discharge; smart inverters; load control; HEMs platforms);
- ***Advanced Network Tariffs for Behavioural Response*** (eg. Critical Peak Price; Peak Time Rebates; Nodal Pricing); or

---

[54] COAG Energy Council, Communique, December 2014

» *Transactive Energy* (eg. real time pricing in future in distributed markets).

It is important to note changes to tariff structures are revenue neutral for network businesses in the short term because they operate under revenue cap regulation. In the long-term, less network revenue is actually required. The Roadmap analysis indicates benefits of over $16 billion in avoided costs to customers. Put another way, a failure to achieve First and Second Wave pricing reform will drive up the network investment requirement and result in:

» significant inequitable cost sharing outcomes between customers, and

» unnecessary future investment in both network and distributed energy infrastructure

In its report for CSIRO and Energy Networks Australia, Energeia makes it clear that second wave measures depend on implementing 'First Wave' measures like demand-based tariffs for all customers. Nuanced incentives in specific grid locations at specific times will not be effective if the universal tariffs remain heavily volumetric with increasing cross-subsidies to DER customers. As technology becomes cheaper and smarter over the medium term, arbitrage opportunities from less efficient price signals will dilute any opportunity for networks to offer targeted incentives for the integration of distributed energy resources in the right place and at the right time. As Energeia notes:

> *"…the refinement of First Wave tariffs is critical to realising the full benefits of Second Wave reform … suboptimal First Wave tariffs, without further restructuring will lead to an overinvestment in DER and storage in particular, such that the Second Wave reform will only be effective in optimising the operation of existing DER rather than the optimisation of investment in new DER.*[55]*"*

These reforms to incentives don't need to be complicated for customers. Distributed energy resources will leverage automated platforms, energy management systems and machine learning, so that customers can choose to 'set and forget'. Similarly, customers who prefer simple bills under predictable plans will increasingly be offered retail products where the retailer uses its portfolio of resources to optimise and smooth costs.

6.3 Retail charges

Consultation questions

How can we ensure that competitive retail markets are working?

A greater focus is needed to ensure energy retail markets are working effectively. A number of customer advocates and regulators continue to recognise that segments of

[55] Energeia, Pricing and Incentives Report, October 2016, p73

Australian retail markets are not subject to strong price discipline or competitive pressure.[56]

The Chairman of the Essential Services Commission of Victoria recently observed:

> *"Around us, we see markets with characteristics that force us to question the effective state of competition. Price structures are at odds with what we might expect in a highly competitive market….Retailers have developed contract arrangements that effectively 'hide' their actual prices. Customers have a very low awareness of the market, how they are engaging with it or what it really means for them." (Refer page 33 of the August 2016 paper by Dr Ron Ben-David entitled "Shock Therapy. Reviving retail competition in the energy market").*

A recently released Energy Consumers Australia (December 2016) survey has further indicated that nearly half of all households in NSW and Queensland have never switched supplier (47 per cent and 52 per cent respectively) while even in Victoria, which is regarded as among the most competitive markets globally, 36 per cent of households have never changed their supplier.[57]

The 2013 Productivity Commission Electricity Network Regulatory Frameworks[58] review concluded that a more national hedging market would strengthen retail competition. In particular, the Commission noted that this could enhance retail contestability, as a new entrant retailer could more readily access financial products to manage price and quantity risks, and could use contracts with out of state generators.

Energy networks have a significant role to play in establishing a platform for competition, on a level playing field, by downstream or upstream customers in competitive markets.

What outcomes of competition should we monitor?

Energy Networks Australia recognises the long-standing focus of competition policy in Australia on the ends (customer outcomes) rather than the means (competition) stating:

> *"Competition policy is not about the pursuit of competition for its own sake. Rather, it seeks to facilitate effective competition in the interests of economic efficiency while accommodating situations where competition does not achieve economic efficiency…." (page xvi – National Competition Policy (Hilmer Review 1992-1993)*

In addition, Energy Networks Australia has developed a set of principles to inform and frame its approach to contestability and service classification issues that have been raised by the two rule change proposals from the COAG Energy Council and the

---

[56] St Vincents de Paul Society, The NEM: A hazy retail maze, December 2016
[57] Canberra Times "Open energy markets failing households" 5 February 2017
[58] Productivity Commission Inquiry Report, Volume 2, Electricity Network Regulatory Frameworks, April 2013, p.499.

Australian Energy Council (see below).

Box 1 - Contestability and classification principles

Principle 1 - Primacy of efficient delivery of network services to customers

Customers should pay no more than necessary for the delivery of regulated network services. i.e. monopoly network customers should not be required to pay a 'premium' to support inefficient delivery models to support an goal of facilitating competition.

Principle 2 - Avoid unfair cost shifting between customers of the shared network

Rules that are based on customer choice, but which fail to address unintended impacts of some customer's choices on other customers have the potential to lead to harmful and unfair outcomes.

Principle 3 - Reliance on flexible incentives to drive efficient expenditure solutions

Commercial incentives to drive efficient outcomes will outperform and deliver more flexible outcomes that benefit customers than inflexible, pre-designed regulatory 'fixes' or narrow prohibitions on service inputs.

Principle 4 - Regulatory frameworks need to provide transparency and confidence in investment decisions

Only where networks, customers and third parties can confidently make clear investment proposals and decisions will efficient solutions be chosen, and regulatory risks and investment costs borne by customers be minimised

Principle 5 - Regulatory interventions in network service delivery should be the minimum necessary to address clearly established problems ("the necessity principle")

This principle matches the Hilmer Committee's recommended competition principles for government interventions in infrastructure service markets.

7. Energy market governance is critical

Sound governance is a fundamental building block of a sustainable, predictable energy market framework. It provides the long-term investment signals and confidence necessary to underpin long-term investment decisions by network businesses and individual customer choices. Energy Networks Australia considers the following principle should be adopted when considering possible amendment or strengthening of governance arrangements.

Governance principles

- Markets and prices should be the principal mechanisms through which whole of system outcomes are promoted
- The roles of energy market bodies should be clearly delineated with clear objectives
- Each energy market body should have clear accountability mechanisms to underpin long-term investment confidence, and the maximum incentives to make high quality decisions
- Separation of authority for investment and consumer or regulatory decision-making from accountability for outcomes should be avoided wherever feasible

7.1 Whole of System Perspectives

Coordination and whole of sector perspectives are an important element in energy market governance arrangements. Current energy market arrangements feature a range of mechanisms that seek to recognise whole of sector perspectives. These include regular coordination, defined roles set out in the *Australian Energy Market Agreement*, and reporting to the governing COAG Energy Council.

Energy Networks Australia agrees that the need for whole of system perspectives does not necessarily require determinative conclusions around models based on single or multiple bodies.

Rather, the priority must be to ensure that market design, pricing outcomes, and regulatory approaches allow market participants to make collective and individual choices that deliver the most efficient outcomes across the entire integrated energy system in an accountable way. This needs to include electricity, gas and renewables across generation, transmission and distribution as well as end uses of energy such as electric vehicles, through to direct use of gas in the home.

Clear delivery of wholesale, network and retail market signals through prices across and throughout the energy system is key to this being achieved. The sheer complexity and pace of change across the Australian electricity sector requires constant attention to whole of system impacts. In our view, however, the very pace and complexity of this change means that concepts of a single centralised system coordinating body across market, policy and regulatory functions would be impractical and problematic.

As an example, there remains a critical distinction between the role of energy rule-making, and day to day implementation of network economic regulation functions.

As a general observation, energy market transformation is a process of management of 'bottom up' market developments with uncertain timings and outcomes, rather than being amendable to a process of 'top down' coordination or planning. As a practical example, the diversity of conditions, market developments, emerging demand patterns across Australian States and Territories would make assignment of the overall role to a single body to optimise outcomes across the entire electricity system infeasible.

Consultation questions

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

Some whole of system planning and consultation processes are present within the existing governance structure. This occurs through, for example AEMO's role as the national transmission planner where it is responsible for the long-term strategic outlook. Inter-regional planning activities and collaboration between transmission network businesses, other stakeholders and the Australian Energy Market Operator occurs in reaching 'Statements of Opportunity' for both electricity and gas, and in developing AEMO's National Transmission Network Development Plan.

There may be opportunities to improve whole of system planning, the more pressing requirement is for stable, enduring and nationally integrated carbon and energy policy. Unnecessary policy uncertainty could be addressed in COAG Energy Council processes and policy support functions to increase capacity to follow through on urgent reforms.

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

As recommended by the 2015 review of energy market governance, there is a need for a clear nominated policy body, to be explicitly recognised by energy market governance frameworks in the position as a key strategic advisory body to the COAG Energy Council and for better coordination between these bodies.

Recently, the COAG Energy Council formally commissioned the AEMC to undertake a review of strategic energy market priorities. This development is both welcome and an indication of the need to follow through on a wider range of proposed governance reforms considered by that review.

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

The governance of the NEM at the highest level is based on the constitutional division of State and Federal power. Given this, it is appropriate that joint and coordinated leadership is delivered by an active, regularly convened COAG Energy Council that

has an increased institutional capacity to deliver complex reforms and work programs within reasonable timeframes.

In this regard, Energy Networks Australia urges the rapid consideration and implementation of the full range of recommended reforms from the 2015 independent review of energy market governance.

7.2 COAG Energy Council

In October 2015, the COAG Energy Council received final recommendations of an independent expert panel convened to provide advice on ensuring energy market governance arrangements were flexible and responsive, and that energy market institutions were provided a sound governance framework through which to deliver outcomes for customers.

Despite a formal Energy Council response In January 2016, there has not been rapid progress on implementation of some of the major recommendations of this review, including:

- an expanded secretariat resourcing for management of the Energy Council's work programme
- regular transparency on issues under consideration and updating of stakeholders on the progress of major reform timelines
- introduction of measures to streamline the AEMC rule change and review processes (including one-step reviews, the capacity to terminate changes without strong merit and formal 'gateway' tests to avoid unnecessary resources being dedicated to changes with low priority)
- full management and financial autonomy for the AER, including potential establishment of the regulator as a separate stand-alone body
- review of the AER by a panel of experts.

Regardless of the merits of any single measure, this delay suggests that the existing strategic policy governance and implementation process within the COAG Energy Council itself is not delivering outcomes efficiently and effectively. To address these issues of transparency, Energy Networks Australia recommends immediate implementation of the major governance review outcomes described above, with additional actions outlined below:

- An Annual Report on Energy Reform Progress on delivery against core priorities.
- Increased frequency of Energy Council meetings (at least four per year (excluding ad hoc meetings) and greater transparency surrounding core agenda items.

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

The role of Ministers and energy market institutions have evolved over the past decade. A critical role of Ministers in the current energy market is to collaboratively engage to deliver on the long-term interests of consumers, and the evolution of the

NEM. Individual jurisdictions appear to have been reluctant to adopt nationally consistent approaches despite the national market requirements. Ministers should consider agreed protocols for collectively determining complex energy policy issues in a nationally integrated manner, on advice of a strengthened set of energy institutions.

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

Energy Networks Australia would draw three lessons from the experience of other markets:

- **Set clear and coherent market objectives** - Setting regulators or market institutions a broad set of potentially conflicting objectives does not resolve the conflict (this was, for example, the experience of the UK energy regulator, Ofgem, which was provided with a conflicting set of irreconcilable policy objectives).
- **Reform legacy regulation to avoid creation of regulatory arbitrage** - Faced with disruptive business models and technology changes, there is a need to ensure that particular business models are not inefficiently supported solely by their ability to engage in "regulatory arbitrage". For example, arguably the success of business models of disruptive entrants such as Uber and AirBnB partially reflects a failure of consumer and regulatory frameworks in the traditional service offering to be adaptive to new models of competition enabled by evolving technology.
- **Adaptability** - At the same time, there needs to be flexibility to trial approaches at small scale (i.e. regulatory 'sandbox' approaches) without locking in on a single 'correct' market policy or regulation. This requires flexibility and the capacity/risk tolerance for institutions to cope with "failure" which is legitimate exploration.

7.3 Achieving a national approach

The principal framework through which national cooperation on energy markets has taken place over the past decade has been the *Australian Energy Market Agreement*. To the extent that current market and system security challenges suggest alternative approaches, it will be appropriate to scrutinise the terms and division of, responsibilities in the AEMA.

Many elements of this reflect State and Federal government policy decisions made around 15 years ago on the appropriate scope of energy markets, and overall responsibilities and accountabilities between all levels of government, and different regulatory and market bodies.

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

Current governance measures see energy market institutions, and the Energy Council itself, recognise Australia's international emissions reduction commitments. Rather than a single governance measure, the principle that energy market institutions

recognise these commitments and integrate them into their processes on a 'fit-for-purpose' basis should be adopted. However, such policy development must consider the potential for stakeholders to view this as examples of inappropriate sovereign risk.

Should the AEMA be amended?

Energy Networks Australia supports an open and evidence-based consideration of the performance of the Australian Energy Market Agreement, prior to consideration of any amendments (recognising that it has been amended relatively frequently over the past decade).

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

Broadly, there is a level of information in existence which policy makers and regulators can access. There may be a case for a 'dashboard' of key outcomes that institutions should be required to report to the Energy Council in a collated single report, including:

- state-based policies submitted for cost/national market implications assessment
- total 'policy costs' of Commonwealth/State programs recovered via energy tariffs
- number or percentage of customers on cost-reflective tariffs
- number or percentage of customers with digital metering
- a reliable measure of retail energy market margins
- a measure of 'active' distributed energy resource connected households to passive non-DER households
- average connection time for grid level storage or generation
- a broad set of measures around network asset condition and/or utilisation
- a metric of the extent and impact of generator market power.

7.4 National electricity and gas objectives

Energy Networks Australia considers the national electricity and gas law objectives provide an essentially sound and clear foundation for policy, rule-making and regulatory decision-making under the relevant laws and rules.

As such, they represent a key point of continuity and strength in the regime, while also reflecting the multiple lenses through which consumers' interests can be viewed (e.g. price, quality, and reliability).

Guidance on NEO

The second reading speech of the *National Electricity Law* sets out that the objectives are intended to be primarily interpreted in economic efficiency terms. This is consistent with the recent Independent review of Energy Market Governance and the view that other societal objectives that are the responsibility of parliaments are not implicitly subsidiary, but rather best effected when resources are not wasted in

inefficient uses.

As might be expected in any broad objective, there is not always a shared and uncontested understanding of the precise meaning of the expression 'the long-term interests of consumers'. In part, this is likely unavoidable given the different emphasis placed by stakeholders (including between individual consumers and classes of consumers) on what constitutes the optimum balancing of different aspects of price, quality and reliability.

There may be merit, however, in exploration by the review panel of the COAG Energy Council taking steps to provide a supplementary guideline on the interpretation of the term 'long-term', in particular.

A greater shared understanding of the time horizon this implies, and the impact this time scale has on assessing what are the relevant factors to be considered by decision-makers could assist in promoting a more stable, transparent, and predictable governance, policy and regulatory framework.

This supplementary guidance should address the fact that regulatory and pricing frameworks need to account for the fact that major network infrastructure investments are often long-lived. That is, they will be likely to be required to serve both current and future consumers, just as electricity and gas services that are available and potentially feasible today are underpinned by asset investments made 40-50 years ago. Similarly, policy, rule and regulatory decisions should take appropriate and explicit account of the interests of both current and potential future consumers of electricity and gas services.

Expansion of NEO

Energy Networks Australia does not consider that the inclusion of an environmental or emissions reduction objective to be the critical step in ensuring coherent integration of emissions and energy policy.

It is problematic for regulators and rule makers to be placed into the position of making societal level trade-offs between a multiplicity of economic efficiency, social and environmental policy goals, where they do not have the democratic accountability of governments.

To attempt to do so would lead to likely conflicting goals and objectives, inefficiencies, greater uncertainty and potential unintended consequences. Instead, regulatory, market and rule making bodies should ideally make decisions that adequately take into account broader community level commitments, as expressed in laws and regulations, that outline emissions reduction goals.

As already discussed, this already occurs. For example, AEMO's National Transmission Planning Development Plan which currently takes into account Australia's Paris commitments, and a more extreme potential carbon reduction policy scenario. It is unclear in these circumstances what additionally would be altered to this type of practice by adding another broad objective unlinked to any specific objective standard.

It may be that similar or better outcomes as to those that are sought by proponents of the change can be achieved by alternative means. For example, this could involve requiring the energy market institutions to regularly issue joint guidance on how they interpret the NEO, including the manner in which they would propose to take into account environmental/carbon policy commitments by governments in their decisions.

Should the NEO be amended?

Energy Networks Australia considers other measures, including practical inter-governmental mechanisms and agreements to harmonise and assess the effectiveness of a range of conflicting State and Territory emissions reduction policies will make a more material long-term impact than changes to the NEO.

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

The independent review of energy market governance has set out a number of proposed reforms to the national energy rule-making and review processes undertaken by the Australian Energy Market Commission.

Decision-making at the strategic policy level remains the critical 'constraint' in energy market governance. In this regard several alternative approaches are supported, including:

- more frequent meetings of the Energy Council (minimum four per year)
- greater delegation of policy development and approval tasks to energy market institutions (such as the AEMC, and the COAG Energy Council Secretariat)
- strengthened central resources to the relevant energy market institutions to execute policy development out of session
- strengthened resources within each State and Territory to provide enhanced input into national energy policy making.