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

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Healthy planet, healthy people.

Summary: Human health imperatives in energy policy

Doctors for the Environment Australia (DEA) advocates that the human health imperatives for energy policy are the rapid reduction of greenhouse gas emissions to address climate change which has national and global health impacts, the rapid transition away from coal-fired electricity generation to reduce air pollution with its health costs, and the curtailment of the use of gas-fired power in the transition to renewables. Energy reliability and security, and affordability which are all essential for the cohesion and health of our society can be achieved by the continued inclusion of renewable energy into the market; small- and large-scale wind and solar, supported by smart switching and controlling technologies; and by energy storage facilities such as batteries, pumped hydro and concentrated solar thermal.

Carbon emission reduction

Emission reduction should be the fundamental driver of the energy transformation. Without urgent emission reduction by all Parties to the Paris Agreement, the world is on a course of untenable global warming, threatening the health of humans and the biosphere.

To achieve meaningful emissions reduction and to act as a market incentive to the inclusion of renewables, there must be steady retirement of coal-fired power stations. Coal power is more expensive to the community than renewables because the externalities, the hidden costs to the health budget from pollution, are not taken into account and these costs are recovered through taxes. "Clean coal" is expensive and affords only marginal benefits in emissions reduction while carbon capture and storage is prohibitively expensive.

The involvement of gas-fired power stations in the energy mix is debatable. While gas conveniently provides electricity rapidly, emissions reduction from gas is not as great as commonly claimed because fugitive emissions of methane have high green-house capability. Furthermore, we warn of emerging health harms from unconventional gas and that affordability and availability are threatened by the re-direction of gas to lucrative overseas markets.

Energy reliability and security

Emission reduction from retirement of traditional coal generators and entry into the market of more variable renewable energy can, if not well managed, affect the security and reliability of supply. However, the need for technological reform of the network should not be used as reasons for limiting the influx of renewables for experience overseas demonstrates that grids can operate with a vastly higher proportion of renewables than are currently used in Australia. Blaming the mix of renewables has been inappropriate. The roles of the supervising bodies need strengthening but there is little to gain from centralising control at a federal level.

Affordability

While energy affordability is particularly important for the health of vulnerable sections of the community, it is invalid to claim they will be subjected to soaring energy costs from the increase in renewables. Energy from wind and solar is cheaper than coal when health externalities are considered and is much cheaper than that from gas. Costs will diminish even further with greater market uptake. Coal pre-treatment technologies are not cost-effective. Because of the privatised nature of both wholesale and retail markets there needs to be very strong governance with total accountability and transparency of operations. Whether these requirements can be met in the privatised system is of some concern since profit taking is such a powerful motivating force.

Doctors for the Environment Australia (DEA) welcomes the opportunity to make a submission to the Independent Review into the Future Security of the National Electricity Market.

DEA is a voluntary organisation of doctors and medical students whose aims are to reduce health harms caused by environmental damage, be it of the air, water or land. Because human health is intricately bound with the health of the entire biosphere, we are particularly concerned at the prospect of accelerating damage to our planet caused by green-house gas (GHG) emissions leading to global warming and climate change.

DEA has no connection, implied or otherwise, with any company or business associated with the generation or use of electricity.

DEA is not aligned with any political party but comments freely, positively or negatively as it sees fit, on policy which impacts on health and the environment.

Background to submission

We make our submission on the background of the climate crisis facing the planet that requires GHG to be urgently and severely curtailed.[2] Although this scientific prediction has been known for some years,[3] DEA is of the view that the urgency of the situation is widely unappreciated.

Energy policy is of keen interest to doctors for it encompasses several important health imperatives. The transition to clean energy is a health issue because the use of fossil fuels for electricity generation produces air pollution, leading to many deaths and suffering from heart and lung disease, with huge costs to health services (externalities which are not included in the cost). There is also emerging evidence that conventional gas production has health impacts. In addition, doctors advocate that greenhouse emissions be reduced rapidly, because the health effects of climate change have been recognised as one of the greatest health threats of this century and will progressively affect us all. Affordability is also a health consideration as children, the elderly, the infirm and those of low socio-economic status need continuing access to energy and electrical devices to cope with the increasing number of extreme weather events.

It is against this background and the expectation of climate-related severe damage to human physical, psychological and emotional wellbeing that DEA contributes to this review in the expectation that these medical needs will be considered when finalising the report of Dr Finkel.

Transformation of the Energy Industry

The main driver for transformation of the electrical industry is the need to reduce carbon emissions. In this regard, it is indeed fortunate that there are technologies available which can provide carbon-free power and which are commercially competitive. The cost of wind[4] and solar power is now comparable with coal–fired power on face value, and is much cheaper when the 'external' costs of coal-power are taken into account. These externalities, which are a cost to taxpayers but not the generators, include human health costs from pollution, and the subsidies to industry and mine rehabilitation.[5,6]

Another factor, now entering into calculations of power costs, is the high cost of network or service charges which often constitute about 50% of the consumer's account. Thus, with the combination of a desire to reduce emissions, reduce costs of electricity generation and to avoid network costs, consumers are now changing the traditional electricity market by investing in renewable energy sources and battery storage. Complete separation from the grid, however, could lead to rising network costs for remaining customers. On the other hand, those taking up renewables while remaining on the grid, could use newer technologies to assist grid reliability and security.[7]

Inactivity and insufficient guidance or encouragement from policy-makers to support renewable energy production, has meant that "industrial, commercial and residential consumers are helping to drive the transformation. They are embracing new technologies to better manage their electricity bills and reduce our emissions".[1]

In addressing the energy "trilemma" of:

- network reliability and security
- affordability
- emission reduction

on the evidence of global warming threats to humanity, DEA asserts that reducing emissions is the top priority.

1. Emissions reduction

Carbon emission reduction should have the highest priority. This is a **scientific and health** imperative, not a political or ideological one. Science clearly demonstrates that unless stronger measures are taken by all countries throughout the world to reduce GHG emissions, all life-forms will be adversely impacted by global warming.[8] Although Australia has ratified the Paris Agreement 2015, most analysts believe that our stated commitments are insufficient and do not accord with the "ambitious efforts" required of the Parties.[9,10,11]

There are three main reasons why we should now be making **greater efforts to reduce emissions**.

(a) Australia, with one of the highest emissions per capita in the developed world, is seeing its emissions continuing to increase when we have been aware of the GHG problem for at least twenty years.[12,13]

(b) The world's carbon budget, at the current rate of emissions, will expire in only 12 years, beyond which there will be little likelihood of containing global warming.[14]

(c) Australia is one of 179 countries which each emit less than 2% of the world's total emissions. However, these countries together account for 43% of global emissions so unless all contribute with meaningful reduction measures, global warming will continue unabated.[15]

That the system then needs a number of technologies such as intelligent wind turbine and solar PV controllers, synchronous condensers, and energy storage systems such as batteries should be seen as necessary adjuncts to ensure reliability and security of supply. DEA agrees with the Review that if "the National Electricity Market (NEM) does not currently encourage their adoption", then this failure has to be addressed urgently. As outlined in the Review there is plenty of overseas experience to draw upon. Emission reduction is compatible with network reliability, security and affordability as described below.

Future of coal

In order to achieve adequate carbon emissions reduction, it is essential that coal-fired power stations in Australia be gradually phased out.[16] Coincident with this aim, many power stations will soon reach the end of their life-span, at which time it would be an environmental, health and economic folly to replace them with new coal-fired generators.

To keep within our fair share of the carbon budget, Australia must accept that about 80% of our known coal reserves cannot be mined[17], adding further weight to the argument that we cannot open any new coalmines.

Even the installation of various grades of so-called "clean-coal" technology would afford no favours to future generations which would still have to deal with on-going emissions. The best "clean-coal" technology is only 26% less carbon intensive than untreated black coal (Appendix D) and more expensive than renewables.[18,19]

Carbon-capture and storage is often mentioned in this context but it is prohibitively expensive and is unlikely to ever be practical on any useful scale.[20]

An additional, often overlooked, problem with the continued use of coal is the direct damage to human health due to air pollution, which occurs at every step, from mining to combustion. This is covered below under *"Health costs of coal".*

Future of gas

Gas is often promoted as the fuel of choice in the transition to renewable energy. Certainly, carbon emission intensity is roughly one half that of coal-fired power but this figure does not include the fugitive emissions of gas which occur at every step from drilling to utilisation.[21]

The future of gas in Australia's eastern seaboard is problematic with the advent of the huge LNG industry which has locked into the lucrative higher-priced overseas market. This means that companies are preferentially selling to this market rather than retaining natural gas for local use. Governments have yet to regulate overseas sales which therefore may lead to a shortage of supply, and to rising costs, for many industrial processes as well as electricity generation.

However, the problem should not be resolved by the mining of more gas, either conventional or unconventional (UG). Gas only adds to the burden of carbon emissions for future generations and exacerbates global warming because of the fugitive emission of methane – weight for weight 72 times more green-house intensive than CO_2 over 100 years. Nevertheless, intervention is urgently needed to force the retention of adequate gas supplies in the short term to assist in reducing costs as the domestic energy market transitions away from coal.

Onshore unconventional gas (UG) and health

UG has been touted as the product to fill the gap in gas reserves. However, the mining techniques are fraught with potential health problems for humans and animals.[22] The emerging public human health evidence of harm was presented to the Senate enquiry into "Adequacy of Australia's legislative, regulatory and policy framework for unconventional gas mining".[23]

Following an extensive Inquiry by a Victorian parliamentary committee[24] the Victorian government has rejected outright UG mining in Victoria[25] on the grounds of potential adverse health effects through the contamination

of land and aquifers, and local air pollution, in addition to disruption to livestock and local communities.[26]

Victorian farming communities have overwhelmingly supported this embargo. The mining of UG is particularly prone to fugitive emissions such that the whole process from exploration and mining through to electricity generation is no better for health and GHG emissions than coal-fired power.[27,28,29,30]

Other compelling reasons for more rapid transition to clean renewable energy sources

Vehicular emissions

Reduction of emissions from electricity production by increasing the renewable mix then allows vehicular transport, which contributes to about 17% of Australia's carbon emissions, to gradually transition to electric vehicles, thereby reducing transport emissions overall.

Electrified public transport contributes to emissions when the energy source is fossil-fuel based. In Victoria, there are plans to build a large PV facility which would be connected to the tramways electrification network to assist in emissions reduction.[31]

Higher energy requirements in heat waves

Australia is experiencing unprecedented high temperatures (February 2017) which stimulate use of air-conditioning equipment, creating huge demands on energy supply. These latest heat waves are much more likely to have occurred due to global warming so it makes little sense that we manage these by creating yet more emissions.[32]

2. Energy Reliability and Security

Reliability (the constancy of current frequency and voltage) and security (the maintenance of supply and protection from disruption) are certainly essential but to refer to the total outage in South Australia (SA) as a reason for major concern is invalid.

Black System Event in South Australia

Reference has been made repeatedly in the media to the "black system event" in South Australia on 28th September 2016 which is used as justification for (a) a more coordinated approach between the states and federally and (b) the incorporation of more continuous power generation in the system. While many analysts describe how this can be achieved without new coal- and gas-fired power stations[33,34], others have used the outage to press for reduction in the rate of renewable energy uptake. Therefore, it is important to state that there is little evidence at this stage

that the power outage was due mainly to the high content of renewable energy in the SA market.

It is acknowledged that events commenced when a severe storm including several tornadoes brought down major power lines which created short circuits. At the time 13 windfarms were feeding into the system but because of the configuration of fault ride-through responses, nine windfarms disconnected or cut their output. This led to the Heywood interconnector from Victoria becoming overloaded and disconnecting. Then the two contracted System Restart Ancillary Service Participants failed, after having proven their operational capability earlier in the year.

The important fact regarding the role of the windfarms is that the Australian Energy Market Operator (AEMO) did not know of the fault ride–through settings of the windfarms. They had not been informed and had not sought the information when the windfarms entered the grid[35] even though similar problems had been identified and corrected in Europe over 10 years ago. Since the outage, settings of five of the windfarms in SA have been reconfigured. Thus the total outage was not due to the energy mix but to a constellation and cascade of factors which could have been largely avoided had the AEMO been aware of the specifications of the grid components.

Methods to retain energy reliability and security

Throughout the world, many technologies have been adopted that provide energy **reliability**. These include smart metering, smart switching, and an array of advanced energy management systems. Energy storage in batteries and pumped hydro energy storage (PHES), which could be operated with renewable energy, would also add to reliability, but the uptake of batteries into the grid has been exceedingly slow. There is no reason why these cannot be introduced more rapidly but in an orderly way under the guidance of a market operator. PHES is being used successfully overseas and Australia can learn from that experience.[36]Australia is well-placed to develop this affordable technology.[37]

Likewise, there has been little advance in the up-take of concentrated solar thermal (CST)[38] and concentrator photovoltaics[39] in Australia despite both sides of federal politics publicly declaring they would support CST at Port Augusta.

CST is also able to provide thermal energy storage, offering all the features of steam turbine generators (**reliability**) coupled with the provision of rapid start-up capacity (network **security**). Indeed we recommend that the final report recognises the benefits (including health benefits), viability and increasing cost competitiveness of solar thermal with storage. Once again, Australia can learn from the extensive experience with CST plants overseas over the last decade.[40]

While recognising that energy **security** is vital for our country, there is no evidence that energy security has been jeopardised by the introduction of renewable energy. What concern there is has arisen mainly from several events in South Australia. In these events blame on renewables has been misplaced.

The first event, of partial system failure which occurred in 2015, coincided with repairs to the interconnector with Victoria and a failure of gas-fired generators to come on-line. The second event, the black system failure, has been described above. In the third recent event, there was a combination of misunderstanding between the market operator and the gas-fired power company. There has also been a suggestion that lack of profitability in starting the generators had been a factor.[41] Thus these failures were almost certainly preventable with better management of the systems already in place, and the level of alarm that has been created is unwarranted.

3. Affordability

The third component of the trilemma is the cost of electricity. At present, an average of 1/3 to 1/2 of electricity costs are service or network costs for a grid which has, in some areas, expanded considerably in the last few years. Total power costs are predicted to rise slightly as coal-fired power stations are closed and competition is reduced. However, the cost of power from any new coal-fired station would not compete with that from either wind or solar. Wind power is now cheaper than coal and solar is at parity and is reducing every year.[42]
Electricity costs particularly impact on the health of vulnerable sections of the community, children, the elderly and infirm, and the poor, who are more likely to be living in homes with poor energy efficiency and who cannot afford to operate the appliances to cope with weather extremes.[43]

Two factors are especially relevant to the issue of costs.

1. Health costs of coal

One of the hidden costs ignored when direct comparisons are made between sources of electricity, is the cost of externalities associated with the mining and burning of coal. Taxpayers bear the brunt of the externalities which consist of the many health costs, subsidies to industry, and the costs associated with mine rehabilitation. Every stage in the production of electricity from coal has the potential to threaten health. In particular coal-fired power stations emit a host of potentially toxic chemical substances including particulates, sulphur dioxide, oxides of nitrogen, and mercury - all of which have profound adverse health effects[44,45]. Air pollution from coal contributes to four of the five leading causes of death in

western society: lung cancer, respiratory diseases, stroke and heart disease. Even short exposures to particulate matter (a few hours to weeks) can trigger cardiovascular deaths and illness, while longer-term exposure (over a few years) greatly increases the risk for cardiovascular mortality and reduces life expectancy by several months to a few years.[46]

The air pollution health cost of coal burning in Australia is estimated at $2.6 billion annually[47] and if the cost of GHG damage is included, the true cost of coal-fired electricity would be close to double the nominated cost.[48] On a larger scale, the cost to the world's economies of insufficient action on carbon emissions leading to run-away global warming will be much greater than the cost of action taken now.[49] No country will be immune from the costs of damage repair and adaptation.[50,51]

2. Privatisation of energy market

The increasing addition to the grid of renewable energy together with the complex devices and mechanisms to allow the smooth incorporation of the various sources is providing extreme challenges for the energy market. Part of this challenge is the influence of profitability and how much this enters into decisions of owners of generators to enter the market at any given time.[52]
In such a complex wholesale and retail market where profits are made from the sale of a commodity which should be limited for strong environmental reasons, some have called for a return to public ownership.[53]

The alternative is a complex system of agreements, contracts and special clauses trying to protect both investors (providers) and consumers where the providers will attempt to maximise profits. This fundamental aim of business needs to be recognised when any claim is made about the cost/benefit of any component of the system.[54]

The following are answers to the questions listed at the end of each chapter.

1.1 Anticipation and incorporation of new technologies

Now that variable renewable energy (VRE) has been entering the market for many years, we should be aware of the impacts of these as we proceed. However, the lack of appreciation of the trip mechanisms in wind farms in South Australia illustrates that the AEMO and others in charge of operations need to continually upgrade their knowledge and understanding of the specifications and behaviour of new technologies. Learning from overseas experience would be invaluable.

1.2 Innovation to improve services and reduce costs

Services can be improved with the increasing uptake of battery storage, both small-scale private and large scale. Home battery storage together with smart metering might allow storage from the grid when the price is cheaper, as well as from rooftop PVs. Batteries will certainly add to grid security which, otherwise, will be vulnerable to the demands placed by an increasing likelihood of extreme weather events.[55]

As described above, wind power is now cheaper than coal, and solar is on parity and becoming cheaper. Costs of battery storage are also diminishing with increased market uptake. Use of existing grids and converting them into micro grids reduces the need for investment in new major distributional networks.

The fact that a large proportion of the power bill consists of fixed costs does not give incentives to householders to reduce costs through reduced consumption. Perhaps there needs to be greater scrutiny of the operations of power distributors to rein in these costs.

While the intention of privatisation is to reduce costs and improve service quality through competition, the fixation on profitability means that both aims are often compromised. Therefore, there needs to be greater scrutiny of private operators and more transparency of their operations.

1.3 Other electricity innovations

There are many advances in smart metering and electronic software and hardware to enable a more interactive market for individual customers to take advantage of low prices when available. These opportunities are enhanced when coupled with the capacity to store in home batteries. However, in this type of competitive market, one's gain is another's loss and perhaps the whole idea of a competitive privatised market needs to be reviewed.

2.1 Ensuring consumers retain choice and control

It is vital for customers and investors to have confidence that transition to renewables will proceed at a steady pace and not stall at the whim of political decisions. They can then have confidence that their investment will be of benefit both environmentally and financially. Ensuring choice, though, is difficult because customers do not relish facing a bewildering array of choices. Customers also tend to be suspicious of the attractive claims of smaller retailers. There needs to be strong vetting of such claims and contracts by an energy market authority which could also insist on and underwrite guarantees.

2.2 Meeting the needs of the vulnerable

Perhaps well-advertised and authenticated visits from trained personnel could be arranged if consumers are willing to partake. Personnel could discuss how to get better deals and how to improve power management. There would need to be suitable follow-up to ensure satisfaction.

2.3 Meeting the needs of large-scale industrial consumers

Large-scale industrial consumers need certainty of supply and pricing. Both of these can be enhanced by the advent of renewable energy, an opportunity which has been much neglected. There are thousands of industries throughout Australia where investment in solar panels would be paid for in 5-10 years. Most industry operates in daylight hours so would not require battery storage to save on solar-produced electricity.
The vast acreage of factory roof-tops provides a ready site for solar installation. Industry needs assurance that feed-in tariffs are set at a fair and reasonable level.

2.4 More equitable price structure

Considering the high fixed service-charge, we suggest it would be more equitable to give this a degree of proportionality so that there is some reduction for low energy users. A lower service-charge for small users would encourage consumers with solar and battery to remain connected to the grid, so increasing its stability.
It is still unclear how the Australian Energy Market Commission (AEMC) arrives at the pricing structure for domestic feed-in tariffs. We suggest the pricing structure be reviewed to ensure that decisions are completely impartial and that more consideration is given to domestic investment costs. The fact that the cost of coal-fired power does not include costs of externalities should also be factored in.

2.5 Ensure balance between data sharing benefits and privacy

This question is difficult to answer as computer and internet privacy seems to be vulnerable in multiple ways.

3.1 Role of electricity sector in meeting GHG reduction targets

The electricity sector, being the major single sector contributing to emissions in Australia (~35%) has the key role in enabling Australia to meet its GHG reduction targets. This is even more so since transformation of the industry would enable vehicular transport, another major contributor to emissions (~17%), to switch to low carbon electrification thereby reducing GHG emissions directly.

3.2 Role of natural gas in reducing GHG emissions

Natural gas has an important but short-term role in the transition phase to renewables and storage. Because emissions from the mining, distribution and burning of gas still add considerably to the GHG burden, no new gas-fired power stations should be built. Instead, investment should be directed to carbon-free storage.

3.3 Barriers to investment in electricity sector

The main barrier is the lack of direction provided by policy-makers' ideological objection to renewables and fixation on coal, which has been iterated repeatedly in all media outlets. To fill this void, several states are attempting to provide more certainty by approving large-scale solar and wind-farm projects and by aiming to get more equitable returns for roof-

top solar. However repeated criticism, based on false premises, and the generation of fear over reliability and security, is being used continuously to discourage transition to a low emissions industry. With knowledge going back for two decades of the potential threats to our planet, we should have been well on the way to reducing emissions by now.

3.4 Key elements to support confidence and transition

The key elements are:

- clear and ambitious targets that will help Australia truly meet its national and international obligations. Current targets are considered to be inadequate (see above)
- some form of price on carbon, probably through an emissions trading scheme
- policy commitment to emissions reduction across all sectors of the economy and supported by all government spokespeople. The Paris Agreement 2015 states that governments should "ensure that education, training and public awareness ……are adequately considered in their contribution to capacity building" [56]

3.5 Role for new coal technologies

There is no role for low emission coal technologies for the following reasons:

- while being more efficient and less carbon intensive, emissions are still considerable (at best, there is only ~30% reduction in emissions per unit of electricity)
- the cost of producing this best scenario is prohibitive
- the lead time to availability is too long
- this technology is not suitable for brown coal

4.1 Immediate actions to reduce risks

The electricity market operator, whether it be the AEMO or some other newly formed body, must have the authority to gain all the information relating to technical specifications of the components of the grid when it accepts new entrants. As well as having the authority, the operator must seek the information and, if it does not have the expertise to understand the technicalities, obviously must consult with those with experience elsewhere. There is extensive experience from overseas to draw from. The market operator could also make recommendations on which new switching or control technologies need to be added immediately.

4.2 Should VRE uptake be curtailed until grid security is guaranteed

The measures required to guarantee grid security are not obscure or technically difficult. There is always a specified lead-in time for any new VRE input so the requirements for its incorporation into the grid can be worked out and prepared well beforehand. Because, in Australia, we are

well behind other OECD countries in the uptake of VRE, we must act to make up for lost ground and not provide unnecessary barriers. Overall, grid security is enhanced by having more sources of renewable energy spread over a wider area.

4.3 Should there be new frameworks to complement current operations

Since there have been operational failures related to the grid mix, it stands to reason that the rules relating to current market operations need to be examined closely. The market operator should be totally independent from the ownership of all components of the system, be guided by the governing body's emission reduction targets (these may sometimes be State-determined) and be fully impartial.

4.3.1 Need for new rules

Clearly the current rules are either inadequate or are not always followed so these deficiencies need to be addressed. There should be a detailed assessment of the complex relationships between all the energy market's governing bodies to streamline operations or to change the structure completely.

4.3.2 Need for security services

These requirements need to be bi-directional. It should be incumbent on both parties to both provide and seek information. It is impossible for a market controller to act effectively without full knowledge of the specifications and behaviour of all components.

4.4 Role of consumers' new technologies

New technologies consisting of PVs, battery storage and smart metering in consumers' premises, have the capacity to improve energy security and reliability both for the premises and the grid. Battery storage within premises can modulate energy supply and demand and, of course, can provide security of supply for those premises. Together with smart technologies, batteries should be programmed to sell back to the grid at times of need.

4.4.1 Regulation enabling efficient network

This aspect is probably the most difficult area to control because of the essential desire of all participants to gain financially - those with greater knowledge and investment capability are going to profit most. So how to create a workable framework is a massive challenge and may require complete re-organisation of the supervisory bodies.

4.5 Other requirements for power security

Cybersecurity is always a problem but it would be particularly devastating if means of distribution of power could be accessed by criminal elements. The security would have to match that of internet banking.

4.6 High speed and sensor technology

These are important tools for market operators but it seems that major disruptions to grid function up to the present have been due to poor decision making and the influence of economic factors.

4.7 Rules for AEMO

It is not clear whether the recent failure was related to the rules or the interpretation. Rules may need to be revised and the AEMO may need to be in more frequent contact with the Bureau of Meteorology at times of severe weather threats. It then needs to prepare adequately for adjustment to the energy mix without fear or favour.

5 Questions related to NEM

The technical aspects of this section are outside the purview of DEA so we cannot provide any meaningful answers.

6.1 Measures to improve supply of natural gas

Measures would have to restrict the preference for gas to be sold to the higher priced, overseas markets. However, we have to recognise that it was an environmental folly to develop this market in the first place. The heavy reliance on gas, either here or internationally, is just delaying the transition to zero carbon energy generation and the indications are rapidly accumulating that we are well short of a safe environmental course.

6.2 Alternatives to service peak demand

Alternatives to servicing peak demand are

- home, industrial and large-scale solar
- home battery storage
- large-scale battery storage
- wind farms particularly near the coast where there is often wind at both ends of the day
- increasing capacity of existing hydro schemes
- pumped hydro energy storage (PHES) There is opportunity in Australia for vast development of this resource.
- concentrated solar thermal
- solar thermal and storage

6.3 Cost reflective pricing

Unable to comment

6.4 Competitive retail market

There is some indication that retail markets are not working. A recent survey in Victoria revealed that up to 70% of customers have never been attracted by price offers from other companies. As indicated in this Review, there seems to be little transparency in the retail market and how prices are reached.

6.4.1 Outcomes of competition

Outcomes to be monitored include customer satisfaction, customer complaints, prices, retailer profits, and whether there is any evidence of cartel behaviour by providers.

7.1 Possible greater over-all advice and planning

The problem with greater over-all planning is that political ideology can interfere with the scientific endeavour to have emission reduction as the main driver of energy market reform. Centralised planning can then interfere with more ambitious planning by individual states. Apart from interconnectors between states and the monitoring of flow along these, it is quite feasible for states to be responsible for their own supply. Due to Australia's large size, each state has its own unique geography and resource mix and therefore requires different approaches by the respective governing bodies. However within states, it may be preferable to combine planning and operating bodies to enable a more co-ordinated approach during this time of change.

7.1.2 Role of ministers

The role of ministers is to look dispassionately at governance issues and to determine facts without invoking political rhetoric. Ministers need to work through their various departments and regulating bodies and to comply with the terms of the Australian Energy Market Agreement (AEMA) established through the COAG Energy Council. The AEMA does allow for variations by states because of their specific geographic and market conditions. There does seem to be an excess of governing bodies (the COAG Energy Council, AEMO, AEMC, Australian Energy Regulator (AER)) all having an input into the NEM, which makes it more difficult to instigate orderly and progressive change in the market.

7.2 Lessons from other markets

The Review has compared markets and governance in several countries and states, outlined in Appendix A. Major European countries with VRE penetration much greater than in Australia have operated successfully for years. An example is given of Spain where voltage variation has been resolved by more advanced configuration of the energy system. Australia has been remiss in not learning from these experiences.

7.3 Governance of the NEM

The NEM would appear to be governed by a fairly cumbersome arrangement of multiple bodies all aimed at providing a steady and unchanging mode of electricity production. Now, with the transition to renewables being driven by the community, the NEM is in a state of uncertain flux. Therefore each component of the NEM needs to be quite clear in its goals and needs to transmit these clearly to the community. Of the various bodies, the AEMC needs to iterate its goals based on decisions by state policy-makers and to guide sections of the network in the adoption of the new technologies. In particular, the AEMO should be much more pro-active in seeing that new technologies are incorporated efficiently and

effectively. As suggested elsewhere, perhaps the whole structure needs to be combined into the one organisation to provide more cohesion and better transparency and accountability.

7.4 Performance assessment
Unable to comment

7.5 Governance measures
See 7.2 and 7.3

7.5.1 Should AEMA be amended
As explained above, the Agreement should allow the states a certain degree of autonomy so that they can proceed with plans which suit their particular geographic and resource characteristics. It would be ideal, then, if the AEMC, acting on the Agreement, could guide all state governments on the integration of energy and emissions reduction. In Australia, political decisions are interfering with the adoption of ambitious emissions reduction so that there is a danger that policy, when more centrally controlled, would be influenced by political, and not scientific, considerations.

7.5.2 Should National Electricity Objective (NEO) be amended
While the NEO is admirable in its consideration of consumer welfare and would have been appropriate up to 30 to 40 years ago, it should recognise the increasing problem of carbon emissions created by its industry. The need to reduce carbon emissions substantially must now be included in the objective.

7.6 Decision-making and pace of change
It is probably more expeditious if decisions on network content, balance and control are made at the state level as the states would be more flexible and purposeful in their endeavours to pursue new technologies. The states can then negotiate with one another for inter-connection. Should a central council impose on the states, the likelihood of dissension and obstruction would increase.

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