Submission to the AEMC Frequency Control Frameworks Review draft report

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The Public Interest Advocacy Centre

The Public Interest Advocacy Centre (PIAC) is an independent, non-profit legal centre based in New South Wales. Established in 1982, PIAC tackles systemic issues that have a significant impact upon disadvantaged and marginalised people. We ensure basic rights are enjoyed across the community through litigation, public policy development, communication and training.

Energy and Water Consumers' Advocacy Program

The Energy + Water Consumers' Advocacy Program (EWCAP) represents the interests of low-income and other residential consumers of electricity, gas and water in New South Wales, developing policy and advocating in energy and water markets. PIAC receives policy input to the program from a community-based reference group whose members include:

- Council of Social Service of NSW (NCOSS);
- Combined Pensioners and Superannuants Association of NSW;
- Ethnic Communities Council NSW;
- Salvation Army;
- St Vincent de Paul Society NSW;
- Physical Disability Council NSW;
- Anglicare;
- Good Shepherd Microfinance;
- Financial Rights Legal Centre;
- Affiliated Residential Park Residents Association;
- Tenants Union; and
- Mission Australia.

De-risking the transitions in energy

There are many transitions underway in energy systems in Australia and abroad. Given the great uncertainty that is inherent to long-term forecasts in this environment, PIAC's view is that the long-term interests of consumers in the NEM is best served by managing the risks associated with that uncertainty through adaptable long-term plans rather than relying heavily on narrow forecasts. This entails:

- Envisioning longer term future scenarios and updating the trajectory to these in keeping with the minimum lead times required for changes to be managed;
- Putting weight on the upper and lower bounds and sensitivities of forecasts, and allowing for 'what we don't know we don't know'[1], rather than relying heavily on specific forecasts of demand profiles and generation mix, or being constrained to current knowledge or trends;
- Ensuring that market design and settings caters to any plausible future scenarios with moves toward the right incentives for the future energy system, not minimal changes to the current one; and
- Building adaptability into market settings that can be responsive to changing environments within solid frameworks that provide certainty for investors and other stakeholders over the long term

Example – derisking the transition to capacity pricing

An example of how to put these principles and approaches into practice would be considering how capacity (or flexibility, or dispatchability) is valued and reflected in the design of the market. An energy-only energy market based on the current design (along with some improvements to the current framework[2]), can meet the needs of the consumers in the most efficient way well into the next decade, however by some stage the generation mix is likely to be such that some form of capacity market will be the most efficient way to incentivise investment in flexible or dispatchable supply.

Applying these principles and approaches in the context of the timelines outlined could imply:

- A policy position being adopted at the COAG or COAG Energy Council level that, at least in the absence of a major unforeseen development, some form of capacity market will need to be implemented in the NEM at some stage, such as by 2030. In the absence of a COAG Energy Council shared view, governments and/or the Energy Security Board could formally adopt this position;
- Decisions in the market would then be informed by this policy position, to ensuring that market settings[3] and, importantly for the confidence of the market, long term investment decisions are made with the least possible risk; and

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1 For example: in relation to frequency and inertia control in electronic grids as discussed further herein, it is assumed that developments that have been made in control of smaller 'electronic' energy systems (such as islanded microgrids) will be scaled up to apply to larger interconnected systems, or other developments will occur.

2 Such as: introducing new market participant arrangements to allow direct participation by aggregated demand response and storage providers; refinements to ancillary services; incorporating a strategic reserve that allows AEMO to operate the market within the bounds of what consumers are prepared to pay; and the introduction of 5-minute settlement.

3 Such as market price settings, reliability and security measures and the development of ancillary services.

- The ultimate design of the capacity market itself could then be targeted at new (as distinct from existing) peaking (as distinct from 'baseload') generation, storage and demand response, rather than being a windfall for existing generators or requiring compensation for market changes that they could not have reasonably anticipated.

The mechanical to electronic transition

One transition that is fundamental to managing system frequency, but seldom considered, is that from a mechanical electricity system to an electronic one. This transition is occurring in concert with others – notably those from centralised to decentralised, and dispatchable to variable – with a number of common interrelated drivers, including: the falling cost of power electronics; the falling cost of variable clean energy sources; the uptake of increasingly competitive battery energy storage; the proliferation of inverter-connected small scale and demand-side generation; improved information processing and communications; and changing consumer preferences.

The 'mechanical' system we are moving from is one where electrical energy was provided by centralised clusters of large generation plant, and consumed instantaneously[4]. The generators are 'direct connected' AC machines that have to be electrically synchronised, effectively operated as a single spinning mass – they both provide, and are dependent on, the collective inertia of this mass. The output of these generators is (under normal conditions) limited only by their capacity, but can take hours to days to safely and securely ramp up and down. The mechanical electricity system was the most dependable, efficient, system for supplying our growing energy needs throughout the latter half of the last century.

The 'electronic' system we are moving to involves energy being generated from multiple, dispersed, smaller sources, with some consumed instantaneously and the remainder stored for later consumption. The defining characteristic is that generation and storage plant in this system includes full electronic power conversion, mainly by electronic devices called rectifiers and inverters, so the task of maintaining and synchronising frequency is simpler and not linked to capacity or output. The generators, batteries and power electronics themselves neither provide, nor depend on, material amounts of inertia in the system. The output of generators and batteries, in an electronic system can be ramped up or down in seconds or less, but is limited by the availability of the fuel source, and charge state, respectively. Other types of electronic technology enable the demand side to play an active role in maintaining the supply/demand balance in this system.

In the absence of disruptive innovation that is not foreseen today, and based on current predictions of retirement of generating plant, the mechanical to electronic transition appears likely take place over at least the first half of this century, after which time the last large thermal plants will be closed and a predominantly electronic system[5] will provide our energy needs.

The fundamental differences between the mechanical and electronic grids mean that the nature of this transition, has to be considered in the context of design and operation of our energy systems and markets, including those that apply to system frequency.

4 Some pumped hydro and hot water storage notwithstanding.
5 It is likely that 'mechanical' hydro power will still be part of the energy mix, as well as small thermal plants running on biofuels, however the nature and control of these plants for frequency purposes is more straight forward.

Managing frequency in an all-mechanical or all-electronic system is relatively straight forward. Further, in a predominantly mechanical system, some amount of electronic generation has little or no impact, and the same can be said of a small amount of mechanical generation in a predominantly electronic grid.

Increasing the non-dominant generation type, may requires changes to the system operation in the form of inertia, frequency control and/or other services needing to be procured. In a hybrid system[6], there is a challenge in identifying the most appropriate ways to value and incentivise the services that most efficiently maintain reliability and security, along with who should pay for which services and how trade-offs can be managed. In a system in transition, such as the NEM, this challenge is greater.

Further considerations for this review

In PIAC's view, considering the relationship between: this review; the mechanical to electronic transition; and the long-term interest of consumers, should entail:

- Focusing the desirable attributes of the future generation system over the longer term;
- Stability and strength are both important today, but the way both are commonly viewed is in the context of a mechanical, and centralised, grid, which on one hand provided inertia for 'free', but has generation plant that are dependent on system inertia to maintain security in event of a large generation unit tripping. As this plant is retired, it will be replaced, predominantly, by plant that is less able to provide inertia. In the short term, this exacerbates stability and strength problems, but in the longer term, fully electronic grids will not require as much inertia;
- Choosing measures that are consistent with an efficient transition to the future market arrangements for an 'all electronic' market state. Related investment decisions made in the coming decade[7] should be informed by an understanding of likely future arrangements and the market designs that are anticipated to best support efficient outcomes. Thus, incremental changes to current arrangements made today – where they are adjustments to current frameworks – need to be considered in the context of whether they are consistent with future major redesign;
- Seeking to remove barriers to the most effective forms of supply, for the purposes of managing frequency, in the absence of the direct incentives. This would support consideration of, for example, inverter standards for distributed generation sources;
- Being prepared to change the causer-pays arrangements over time to reflect the changing dynamic. This may entail party's status changing over time with respect to whether they are a causer. A relatively reliable 400MW coal fired power station unit may provide solid frequency and inertia support to the NEM in 2018, and should be remunerated accordingly. In 2038,

[6] That is, with a mix of mechanical and electronic generation.

[7] These investment decisions may include:
- The location and timing of new plant
- Choosing between synchronous and asynchronous generation (different types of wind turbines)
- Choosing between AC and DC transmission (eg, for new interconnectors)
- Choosing inverter control (and generator governor) characteristics that anticipate prospective future changes to ancillary services or constraint (eg for new aggregated solar and battery systems).

however, the same unit may be vulnerable to sudden unplanned outages and be the largest single unit in a region, requiring spinning reserve levels to be higher than if it wasn't operating and imposing material costs on the system to maintain frequency. All of these outcomes should be reflected under causer pays arrangements;

- Considering the materiality of impacts of changes to frequency outcomes over time in terms of consumer outcomes, not just the number of excursions from frequency setpoints. It may be the case that the settings of frequency limits, for example, need to be changed reflect consumer preferences; and
- As a general rule, market based solutions are preferable to standards in the wholesale market. However, there are exceptions to this rule, particularly where there is market concentration in the provision of ancillary, and other, energy services. Consideration should be given to what types of monitoring, enforcement and other interventions are required to identify where market concentration and other matters are resulting in prices above that which is efficient.

Further engagement

PIAC thanks the AEMC for the opportunity to respond to the draft report, and would welcome the opportunity to discuss the issues raised in more depth. Please contact:

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