John Pierce
Chairman
Australian Energy Market Commission
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Dear Mr Pierce

FREQUENCY CONTROL FRAMEWORKS REVIEW – ISSUES PAPER

Origin Energy Limited (Origin) welcomes the opportunity to comment on the AEMC's Frequency Control Frameworks Review. Origin recognises the need for enhanced frequency control in the NEM and that adequate levels of primary frequency control (PFC) is crucial to this. Origin does not support the mandatory provision of PFC, instead a new regulating PFC market should be established that would ensure generators are compensated for the services they provide. This will allow generators to evaluate the trade-offs in providing PFC; and incentivise the ongoing provision of the service at least cost.

The introduction of a fast frequency response mechanism must be co-ordinated with other frequency services, such as primary frequency control and existing FCAS markets, to ensure all services are working towards more stable frequency outcomes.

Origin supports a review into the viability of a standardised minimum connection standard for distributed energy resources (DER) and the continued encouragement of aggregators to easily access DER providers who can supply energy and ancillary services for the NEM.

Primary Frequency Control (PFC)
Preliminary analysis by AEMO and the AEMC suggest that tightening the deadbands and providing PFC services within the Normal Operating Frequency Band will have a positive effect on stabilising frequency oscillations in the NEM. Origin supports this view.

However, Origin does not support the mandatory provision of PFC given that:

- It would require generators to make a trade-off between supplying energy and PFC services resulting in a potential loss of revenue. For example, a CCGT unit would be unable to operate in auxiliary firing mode due to the output fluctuations that would occur when meeting a mandatory PFC obligation. This reduces the available energy that the unit can produce for the NEM by approximately 25%. This represents a considerable amount of MW that could be available to meet peak demand which would be unavailable because of the generators inability to maintain stable output (required for auxiliary firing) due to a mandatory PFC obligation.
- Not all generators are able to provide PFC to the same degree and so the optimal approach is to put in place incentives for generators to provide the amount of PFC that best suits their plant's operation, taking into consideration factors such as wear and tear and maintenance
- It would involve a degree of practical complexity if a re-examination of existing performance standards is required.

The Issues Paper seeks comment on a number of potential market mechanisms that could underpin the operation of PFC. Origin supports a mechanism that:

- Introduces an additional FCAS market known as the 'new primary regulation service' that is based on the existing framework of competitive bids and offers; and
- Does not require mandatory participation, but rather leaves generators able to determine their levels of participation in that market.

Generators must be paid for the services they provide to the NEM and the best way to achieve competitive outcomes is through a market based mechanism. The issues paper details several different ways this can be achieved such as narrowing the deadband, AEMO contracts and a new primary regulation service. Origin believes that allowing a generators droop control to operate within the normal operating frequency band will lead to a co-ordinated and proportional response from units best equipped to respond to frequency changes. The AEMC and its Reliability Panel will still need to determine what the appropriate dead band limit is, notionally set at 0.05Hz within the issues paper.

The establishment of the new primary regulation service should be based on the current FCAS market design where a participant can make bids and offers on volumes across generation units. Under a voluntary and market based scheme participants should be able to decide the amount of services they provide to the market. This benefits the NEM by continuing a familiar and well established process, provides competitive tension by sourcing services from lowest priced providers and allows transparent decision making to take place.

One further consideration, is the minimum droop control value that generators may be required to meet to participate in the new market. Origin prefers a minimum droop control value that allows for a slow, steady and co-ordinated response to frequency changes. A minimum droop control value of between 8-10% would allow units to safely adjust output to counter frequency movements. If a higher value of 4% was required as the minimum value it would increase wear and tear on units as it requires a greater amount of energy to respond to each frequency event.

Table 1 provides an example of the movement required from a generator that responds to a frequency event (0.15Hz) using different droop control values. It has been identified within the issues paper that frequency is both flattening and oscillating with greater regularity and there is potential for multiple frequency excursions to occur. As a result, a droop control value of 4% would cause greater wear and tear on units (across valves and governors) as they rapidly ramp up and down to stabilise frequency.

Table 1: Frequency Event change in MW response

Frequency Event drops to 49.85Hz (0.15Hz)		
Droop Value	**% Change in MW**	**Impact on 700MW generator**
10%	3%	21MW
4%	7.50%	52.5MW

Fast Frequency Response (FFR)

It is important that any introduction of an FFR service is co-ordinated and complementary to both existing frameworks and a potential PFC market. It would be unacceptable to end up in a situation where the introduction of multiple new markets (PFC, FFR) are not co-ordinated and actively work against each other. Origin believes that a co-ordinated frequency response that considers the interaction between all these services will bring about greater market benefits for all NEM participants.

It is Origin's understanding that current FFR systems act in a way that produces a response almost instantaneously (<500ms to reach full value). This can work against a droop control mechanism that provides a proportional response based on system frequency. In other words, when comparing the two responses, FFR will activate all its available resource when it reaches a certain frequency threshold, and it will almost be instantaneous. On the other hand, droop control will provide a proportional response that is based on the frequency at the time of the event and slowly begin ramping the generator to smoothly bring frequency back to 50Hz.

An example of this potential problem is as follows:

1) A contingency event (i.e. loss of a generator) causes the frequency to drop.
2) As the frequency begins to drop and move past the PFC deadband (in the issues paper it is a nominal value of 0.05Hz), generators providing droop control will begin to counter the drop in frequency by providing additional MW through raise services.

3) The droop control response is in proportion to the level of frequency change being caused by the contingency event (i.e. a larger generator will cause a greater frequency change and require a larger droop response from generators). Also, the MW size of the response will be determined by the percentage of droop value a generator is required to use (between 4% to 10%, see Table 1).
4) At a pre-determined frequency threshold, the FFR will provide all its response almost instantaneously.
5) The slower droop control mechanism has already begun its process of adding additional MW to correct the frequency change, however the instantaneous injection of raise services from the FFR reduces the level of response required to return frequency back to 50Hz.
6) A problem arises because the droop control input is slow to react, has already committed the required MW and now has excess raise services that it is committing.
7) The droop control response is now larger than is required to correct frequency and as a result, frequency overshoots to now require lower services.
8) If FFR continues to instantaneously inject MW, this may cause frequency instability and result in localised blackouts, especially in areas of low system strength (i.e. at the end of a long transmission line).

Origin believes that further evaluation needs to be undertaken to understand the interactions and limitations of FFR. A potential way forward may be to limit an FFR service to only operate when a certain threshold of Rate of Change of Frequency (RoCoF) is breached, e.g. 3Hz/second. Another option could be to enforce some type of proportional control and provide a ramp characteristic that is based on its position in the network. These options may work to limit potential unstable frequency responses by ensuring a co-ordinated response between PFC and FFR.

The issues paper also discusses the potential increased value of a faster response, a 0.5sec vs a 2 second response. Origin would prefer a simplified market structure where a 0-2 second response is captured under one FCAS market. There is a risk that the AEMC decides to implement multiple FFR markets which would further complicate the amount of markets that traders monitor, for seemingly little benefit.

Distributed Energy Resources (DER)

In Origin's view the issues paper examines two key areas in relation to DER, namely:

1) What connections framework should apply to DER that will protect system security and reliability; and
2) What are the barriers to entry that restrict the provision of a wider range of services (both energy and ancillary services) being provided to the NEM?

It is Origin's understanding that generally DNSPs use a 'fast tracked' connection standards process for units smaller than 30kVA and a negotiated framework for larger systems. This works to streamline the connections process and apply a standard that is applicable to the conditions within the DNSP network. Applying a large generator connection framework to small scale DER would be costly and time consuming for little benefit.

The AEMC's Distribution Market Model recommended that a nationally consistent DER connection guideline be established to introduce a minimum connection standard across all DNSPs. Origin is supportive of this approach but is cautious that an ENA led process may lead to more beneficial outcomes for DNSPs over the best interests of consumers. This minimum standard could incorporate the current Australian Standard (AS 4777), the relevant NER chapters and local DNSP requirements. If a minimum standard is developed, Origin believes it should apply to new installations only and not to existing systems.

Origin considers that the barriers to entry are primarily due to the infancy of the DER market, especially around aggregators, and the lack of knowledge by owners on the types of services that their systems can offer.

Aggregators will play a key role in bringing both energy and ancillary services to the NEM. The issues paper discusses existing mechanisms such as the Small Generator Aggregator Framework and the

Market Ancillary Services Specification (MASS[1]) that define acceptable standards a DER system must meet in order to provide services to the NEM. Origin believes that both standards provide the appropriate technical guidance for aggregators on the types of compatible systems for the NEM.

Financial incentives play a key role in encouraging aggregators to grow their market share. At present higher wholesale and FCAS prices are providing market signals to providers of these services and this will help to encourage aggregators to sign up additional DER providers, further strengthening competition and growing awareness.

There could be merit in requiring aggregators to assume responsibility for their DER providers. For example, a DER provider would have to meet a certain technical standard in order to qualify for inclusion in the aggregators portfolio. This places the compliance requirement on the aggregator while ensuring a level of system security is met. This would be similar to the way an aggregator is responsible for the 'firmness' of their response when supplying FCAS or energy services to the market. This requirement could see aggregators upgrading older systems if they see value in the trade-off between capital expenditure and future revenues.

As the market continues to grow, new aggregators will arrive and innovation in products and services will take place. We would envision that aggregators will provide a seamless service that pays DER providers appropriate rates for their services based on the best value service at the time, whether that be from local usage, energy, FCAS or SRAS. It would also allow an appropriate return for the aggregator who supplies specialist systems to handle efficient dispatch into the NEM.

Should you have any questions or wish to discuss this information further, please contact James Googan on james.googan@originenergy.com.au or (02) 9503 5061.

Yours sincerely,

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[1] Market Ancillary Services Specification, AEMO, June 2017, p.12