RES Australia Pty Ltd
Suite 4 Level 1, 760 Pacific Highway, Chatswood
Sydney, NSW 2067, Australia
T +61 (0)2 8440 7600 F +61 (0)2 8440 7499
E info-australia@res-ltd.com www.res-australia.com.au

Christiaan Zuur
Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

Our Ref: DV05-000551

13 October 2016

Dear Christiaan,

Re: RES Group Submission to Emergency Under and Over Frequency Control Schemes

RES welcomes the opportunity to provide input into this important work currently being undertaken by the AEMC.

RES Australia is a subsidiary of the wider RES Group with a global presence and experience of over 30 years comprising more than 12GW of renewable energy generation across 4 continents. RES currently has 145 MW of grid scale energy storage projects under contract including 25% of the recent National Grid Enhanced Frequency Response market allocation for 2016. In Australia RES' developed projects exceed 340 MW of wind generation either installed or in construction.

RES is active in developing solutions that enable the transition to a low carbon future and participate in various working groups focussed on the integration of renewable energy relevant to the AEMC's current review including:

- National Grid GC0022 "Frequency Response", Technical Sub Group[i]
- National Grid GC0035/GC0079 "Frequency Changes during Large Disturbances and their effect on the total system"[ii]
- National Grid GC0048 "Workgroup on GB Application of RfG[iii]
- National Grid GC0087 "Requirements for Generators Frequency Provisions[iv]
- National Grid GC0096 "Energy Storage"[v]
- Eirgrid / SONI "DS3 Advisory Council"[vi]
- Wind Europe "Grid Code Task Force"
- AEMC "System Security Market Frameworks Review", Technical Working Group

RES has also recently presented its experience in energy storage technology to various parties to aid in the understanding of the capability of this technology.

RES response to the consultation is broad in nature and presents some observations regarding technology and activities in other markets.

RES' observation is that directly connected induction machines (such as found in some older fixed speed wind turbines connected to the NEM) provide inertia just as well as synchronous machines and will have a reasonably high inertia constant compared to say an OCGT. Reviewing mechanisms such as semi-

scheduled capabilities to enable these technologies to participate in providing inertia may broaden the available pool for inertia related services.

However, inertia should not be considered the only solution available to addressing under or over frequency events. By way of example,

Over frequency events:

- wind power, PV and battery energy storage can all provide much faster response to over frequency events than conventional generators and should be investigated as potential mitigating measures which may improve the effectiveness of an OFGS

Under frequency:

- Wind power can provide fast response to under frequency events even when not curtailed. More information on this can be found with the FFR service proposed in Ireland[vii] and in RES' experience several WTG suppliers claim to deliver this capability;
- Battery energy storage can provide very fast response as discussed recently

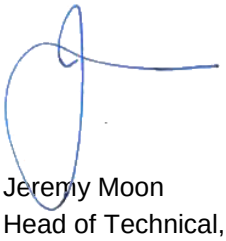
Fast reliable detection of frequency and RoCoF events is necessary to get the best performance from the above non-synchronous fast acting response providers and proper investigation of this will be important.

Until very recently in Ireland and Northern Ireland there was no OFGS scheme in place. Belatedly this risk was identified which is consistent with that outlined in the consultation report i.e. *"Over frequency events could result in uncontrolled generator shedding, potentially resulting in an under frequency event."* In the Irish case, unscheduled trip of the HVDC link to Great Britain while exporting up to 500MW constituted a credible over frequency event and nearly all generators in Ireland have the same over frequency trip setting. The Irish propose to remedy this by setting a wider range of generator over frequency trip settings.

In Great Britain all qualifying generators must operate in "Limited Frequency Sensitive Mode" LFSM, if not already instructed by the System Operator to provide frequency response. This requires generators to reduce output in accordance with a droop curve if the system frequency exceeds 50.4 Hz

RES has taken the opportunity to respond to a sample of the questions posed in the consultation report, with these comments following. RES would welcome the opportunity to discuss further any topics under consideration by the AEMC in its review or more generally should this assist in advancing the AEMC's understanding of technology capability.

Yours sincerely,



Jeremy Moon
Head of Technical, RES Australia
E jeremy.moon@res-group.com
T +61 2 8440 7417

Q1 Materiality of issues impacting management of extreme frequency events

(a) Are the issues identified by the proponent likely to have a material impact on the NEM, over the medium to longer term?

From RES' experience in other markets, we believe that the identified issues are indeed likely to have material impacts.

Q2 Ability of current frameworks to deliver effective emergency frequency control schemes.

(a) Do current frameworks, including currently allocated responsibilities of different parties, allow for the effective consideration of all physical solutions to extreme frequency events?

RES' response is based on the information provided in the consultation report. If the current framework is as described in the consultation report, RES believes the framework is not effective to consider all physical solutions.

Section 5.2.1 only considers load / generation shedding relays as potentially having the capability to manage extreme frequency events. It neglects the potential of fast acting resources such as battery energy storage and PV (and to a slightly slower but still fast extent, wind) to respond in a proportionate dynamic manner to high frequency events as compared with the static (fixed) response of load / generation shedding relays (all or nothing).

Q3 Potential changes to emergency frequency control schemes

(a) Do the current NER frameworks already allow for, actively prevent, or fail to account for, new technologies that could be used to provide more effective emergency frequency control schemes? How would these new technologies work and what kind of solutions can they provide?

RES would encourage the review to ensure the NER allows for new technologies such as

- LFSM,
- graduated generator trip settings,
- intelligent load / generator tripping schemes pre-armed by measurements of generation / demands shedding resource and responding proportionately if practicable to do so (e.g. dynamically identifying resources and the frequency thresholds at which they will be shed
- fast acting frequency response resources (wind, PV, energy storage)

(b) Is there a need for a framework to identify specific non-credible contingencies that AEMO should develop emergency frequency control schemes to address?

AEMO's ability to manage the volume of scenarios within its scope requires filtering of risks. A process of developing a second order grouping of risk events would certainly assist should those events materialise.

The challenge will be managing a broader range of events than what is already considered. RES believes for the security of the network that a broader range of risk events should be considered and perhaps more importantly a review of those risk events that have been considered non-credible.

(c) Could this issue be addressed by AEMO reclassifying certain currently non-credible events as credible, under NER clause 4.2.3A?

As touched on above, recent events indicate that a review of non-credible risk events is warranted. RES notes that some risk events classified as non-credible (such as outage of multiple circuits on single towers) would be classified as credible events in other markets in which we operate.

Q5 Costs to participants

(a) What kinds of costs are likely to be faced by participants if a new framework for emergency frequency control schemes is introduced?

If the participants have to provide elements of the schemes then

- Administrative costs to for set up arrangements and any ongoing procedures
- Capex for equipment installation and commissioning
- Ongoing costs for periodic testing
- Opportunity cost for lost activity for the period that the emergency scheme is triggered

Q6 Managing over frequency events

(a) What should a framework for managing extreme over frequency events look like?

It should look similar to that for under frequency events. The consequences of failure are identical. Some of the resources for responding to a high frequency event may differ but the manner in which they are controlled may be similar.

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[i] http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Modifications/GC0022/

[ii] http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Modifications/GC0035-GC0079/

[iii] http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Modifications/GC0048/

[iv] http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Modifications/GC0087/

[v] http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Modifications/GC0096/

[vi] http://www.eirgridgroup.com/how-the-grid-works/ds3-programme/

[vii] https://www.semcommittee.com/sites/semcommittee.com/files/media-files/SEM-13-060%20DS3%20DS%20System%20ServicesConsulation%20Paper.pdf