ESCRI-SA KNOWLEDGE SHARING REFERENCE GROUP

12 June 2019

ESCRI Learnings

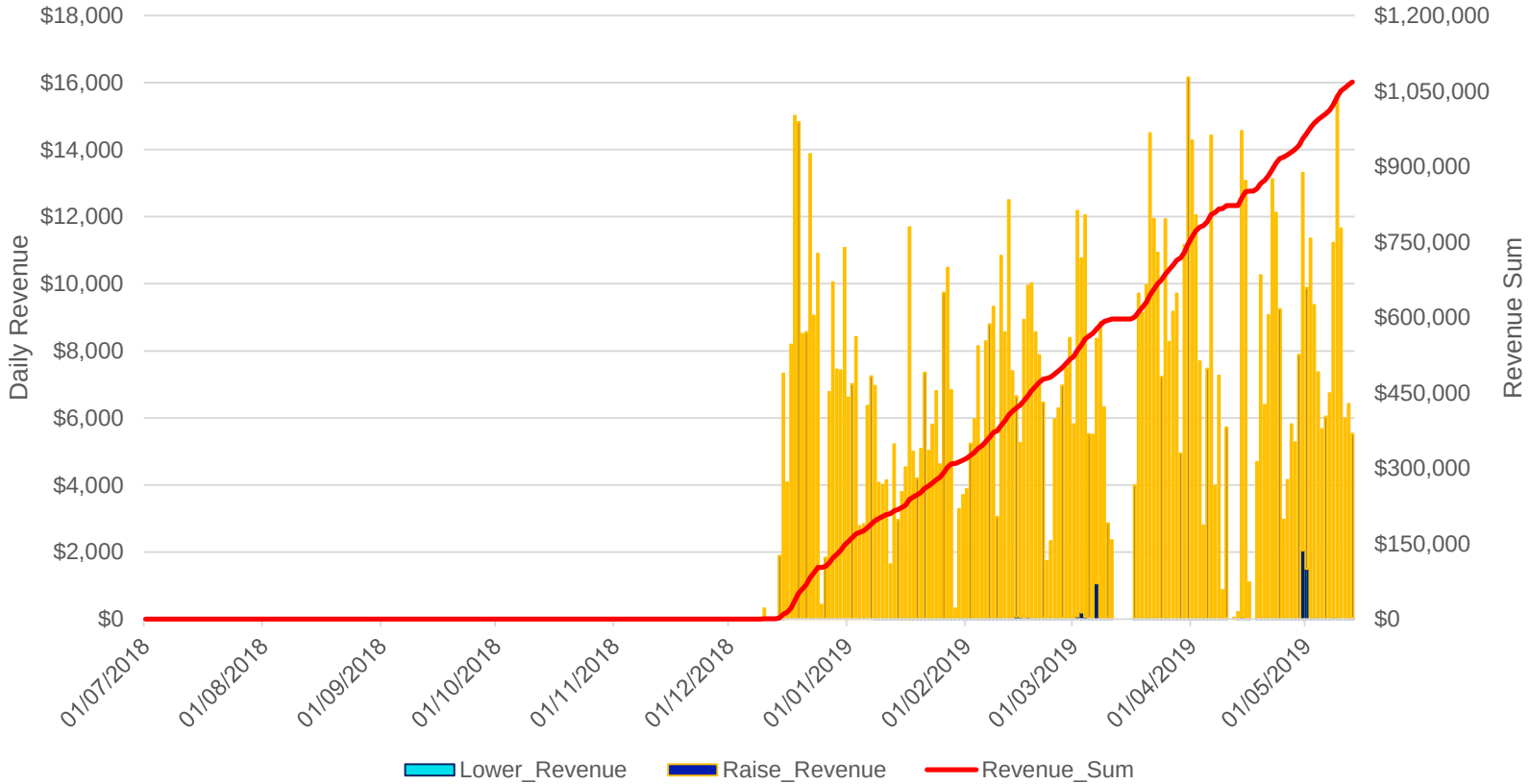
Commercial Performance

1. FCAS REVENUE
2. FCAS RECOVERY
3. DISCHARGE REVENUE
4. CHARGING COST

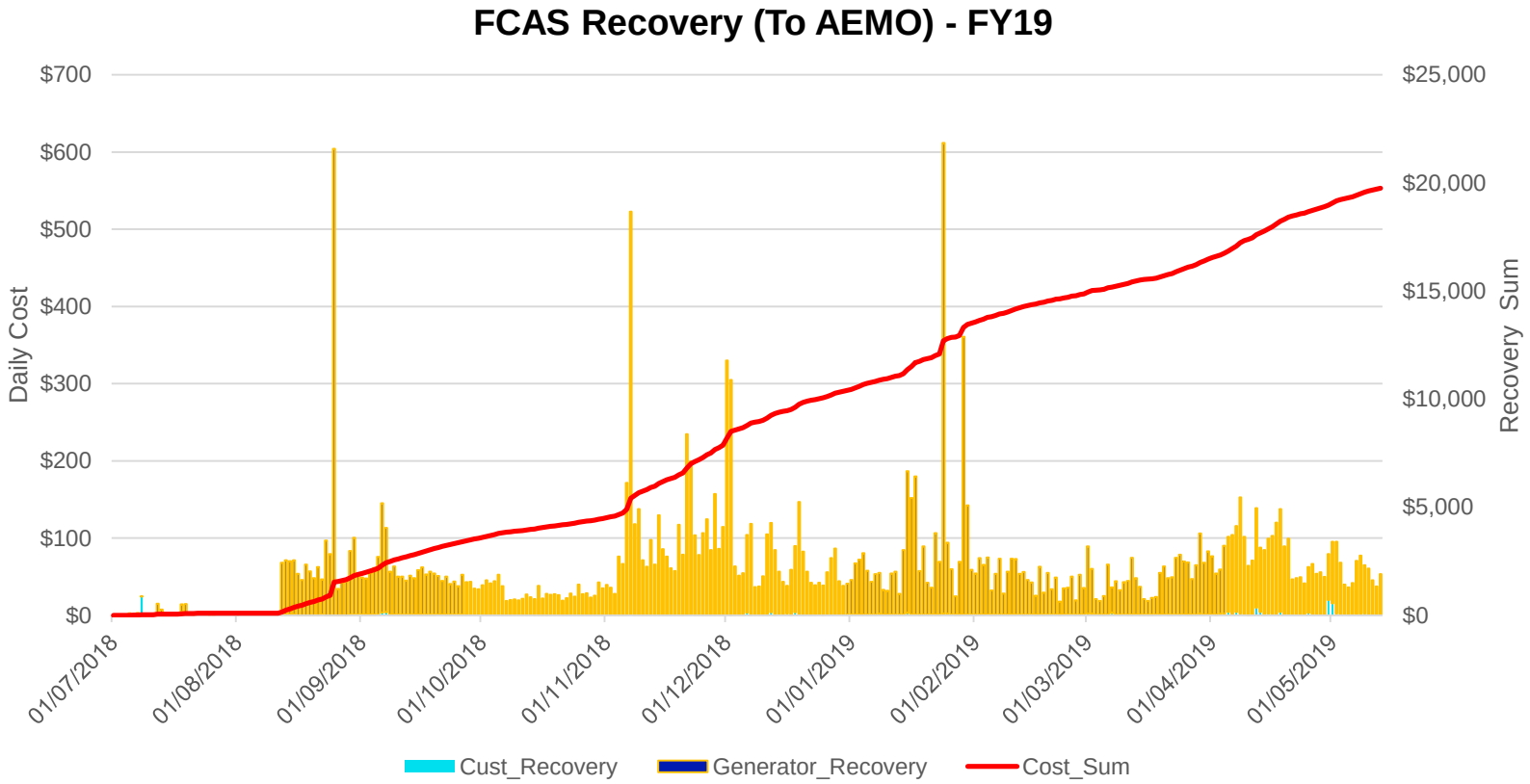
Technical Performance

5. ISLANDING EVENT
6. NET ENERGY CONSUMED and TEMPERATURE DEPENDANCE
7. SYNTHETIC INERTIA
8. ACCEPTANCE of SYNTHETIC INERTIA BENEFIT

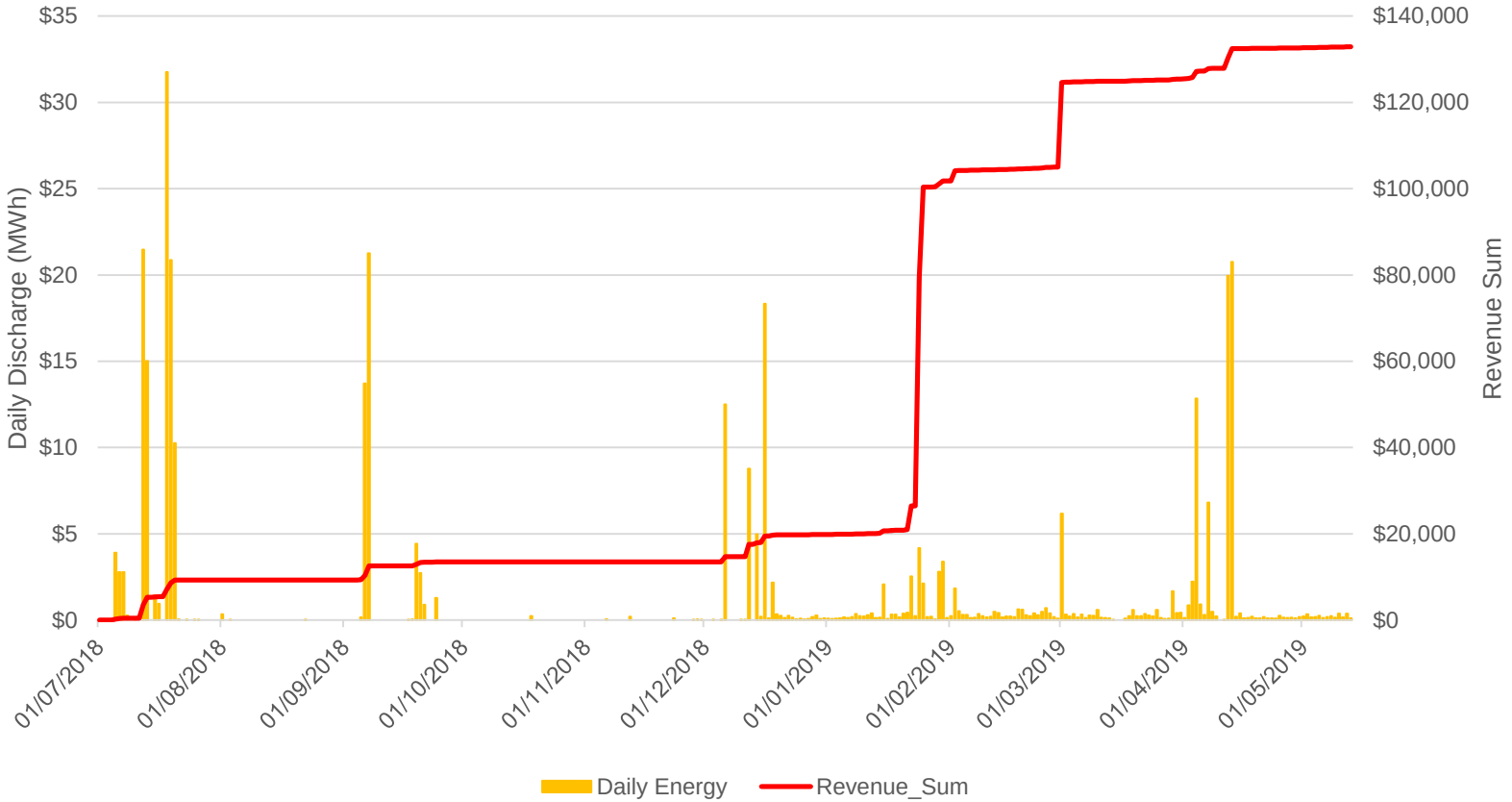
1. FCAS REVENUE



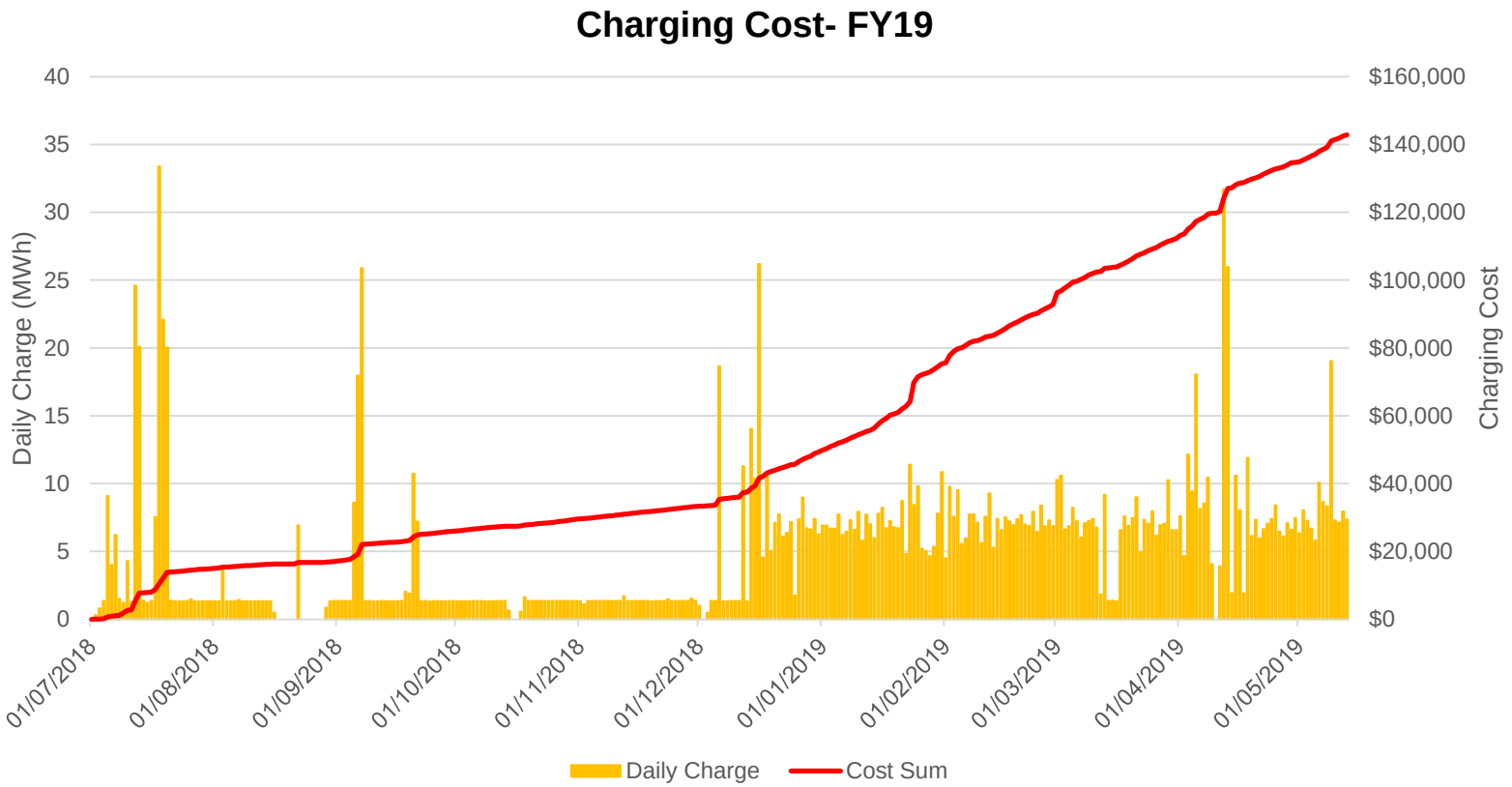
2. FCAS RECOVERY



3. Discharge Revenue (Cap trading)

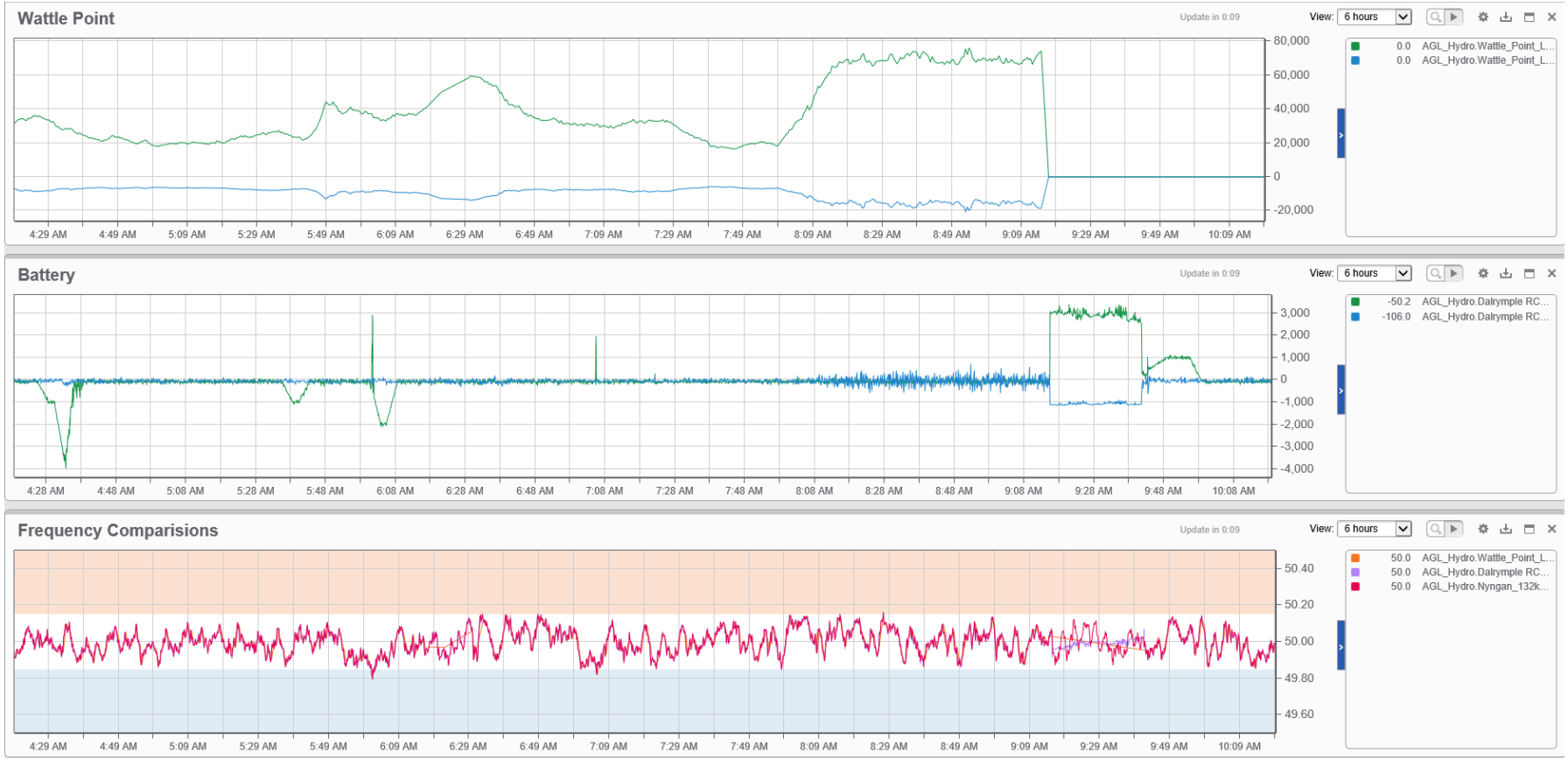


4. Charging Cost



5. UNPLANNED ISLANDING EVENT

Friday 29th March 2019



6.

Net Energy Consumed - (LOSSES)

The Net Energy Consumed by the BESS is higher than expected.

This is largely driven by the standby load and energy for cooling.

Temperature Dependency

The BESS over temperature protection has activated at times of extremely high ambient temperature.

This is being addressed by the installation of additional air-conditioning capacity.

7. Synthetic Inertia

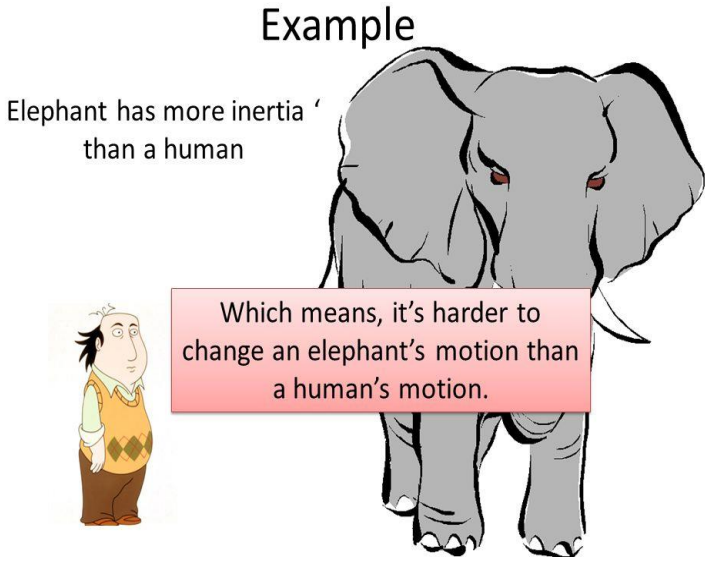
Because synthetic inertia responds to change infrequency it will respond extremely quickly, even if it the output is slightly less accurate for the first cycle or two.

Factory Acceptance tests at ABB works in Darwin have confirmed that the BESS can respond within 30 milliseconds to provide synthetic inertia.

Synthetic Inertia responds as a function of “Rate of Change of Frequency” to slow any frequency change.

Power system inertia is the Kinetic Energy of the steel and copper in the spinning rotors of generators and motors.

The kinetic energy is proportional to the square of the speed of the rotor. When the system frequency drops to 47 Hz, the rotors will have 88.36% of their original energy and have injected11.64% of their kinetic energy back to the grid.



8. Acceptance of Synthetic Inertia and Comparison with Fast Frequency Response

At the maximum expected RoCoF of 3 Hz/second it will take 333 msec for the frequency to drop to 49 Hz, by which time Under-frequency Load Shedding will be activated.

Fast Frequency Response is required by the SA Office of Technical Regulator to respond within 250 msec.

In the 83 msec from 250 msec to 333 msec, a 30 MW battery providing Fast Frequency Response will inject 2.49 MW.seconds back to the grid.

A 30 MW battery calibrated to provide 30 MW at 3 Hz/second will have been injecting 30 MW for at least 303 mseconds after 333 mseconds of a RoCoF of 3 Hz/sec. This will have injected 9.09 MW.seconds back to the grid in this time.

The OTR is yet to accept that synthetic inertia can make a greater contribution to inertia than Fast Frequency Response.