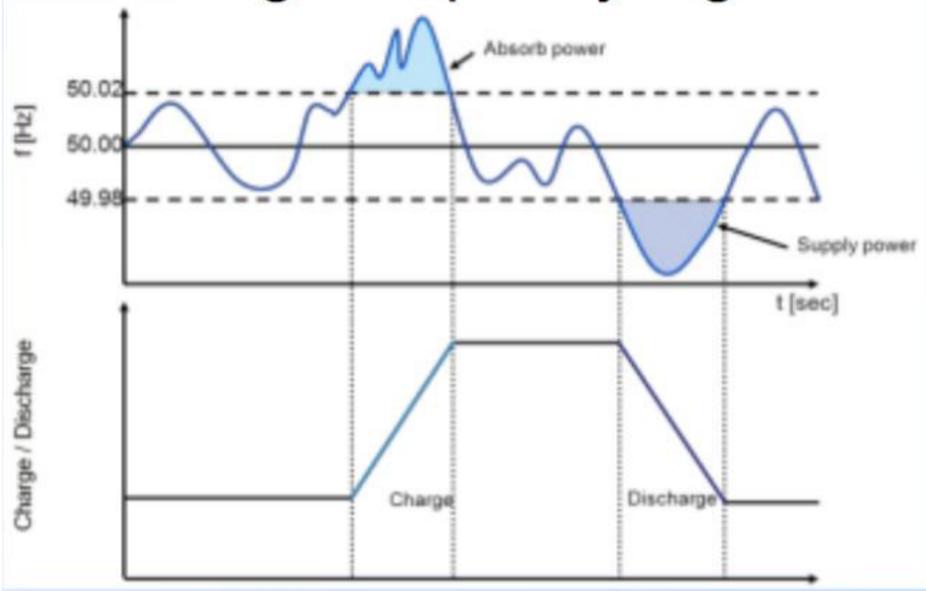


# Enhancing South Australian Grid Security:

Network & market benefits from grid batteries providing fast-acting Frequency Regulation



## Stabilizing: Frequency regulation



Adelaide University Energy Storage Knowledge Bank (AESKB)

25 November 2016

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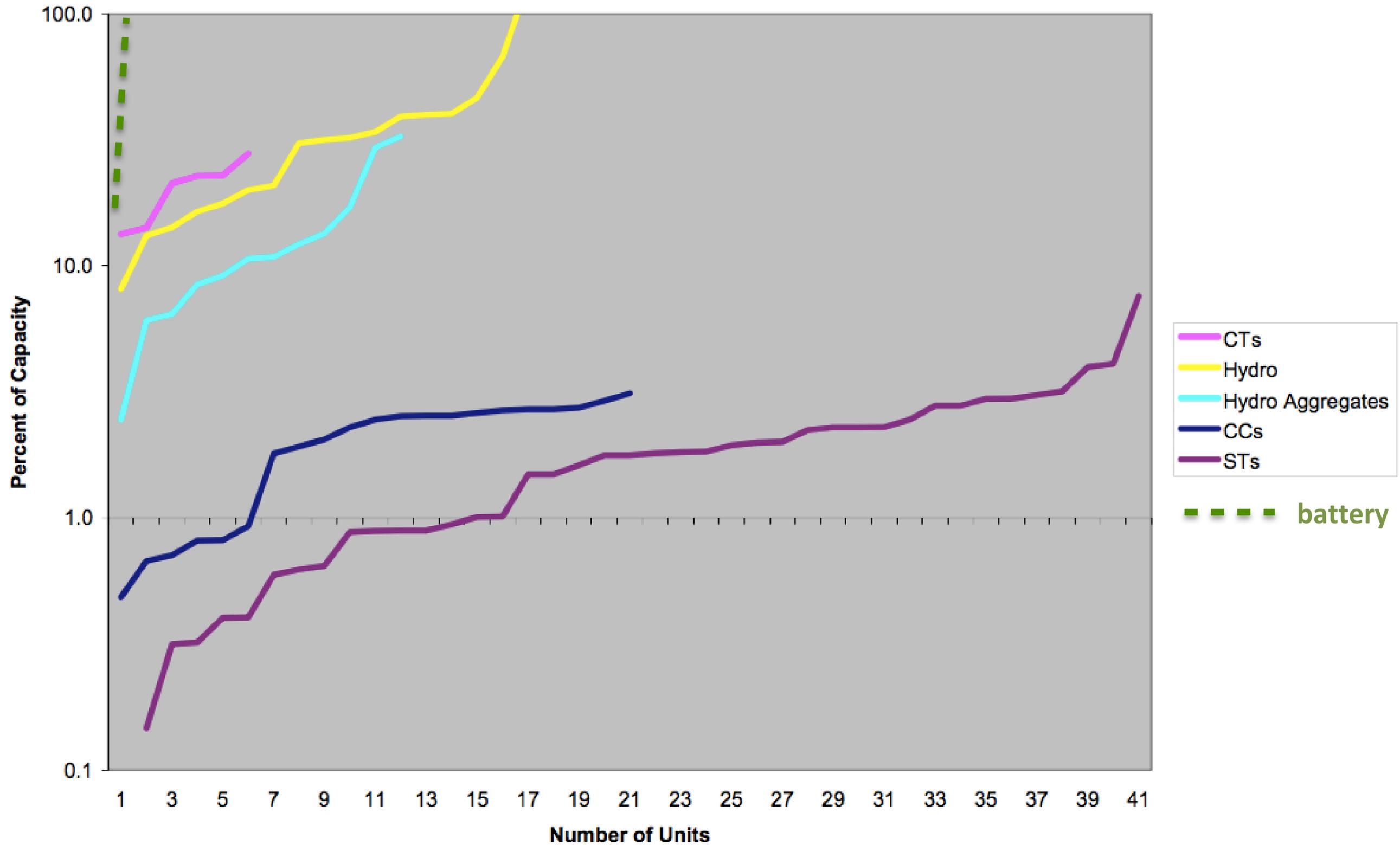
# Agenda

- US policy reform - delivering lower cost grid security from batteries since 2012
- SA crossroads - new inter-Connectors or grid batteries?
- Proposed policy reforms
- Implications for renewable asset owners

# Why is Frequency Regulation important?

- Frequency Regulation lies at the core of grid stability
- An imbalance between generation and demand destabilises the grid frequency
- Frequency Regulation services are provided by thermal generators (coal, gas), hydro generators, and in some overseas countries, by grid batteries.
- Generating technologies vary in their responsiveness to provide Frequency Regulation

# Ramping Capability by Technology (% of capacity per minute)



Source: Assessing the value of regulation resources based on their time response characteristics, Pacific Northwest National Laboratory, June 2008

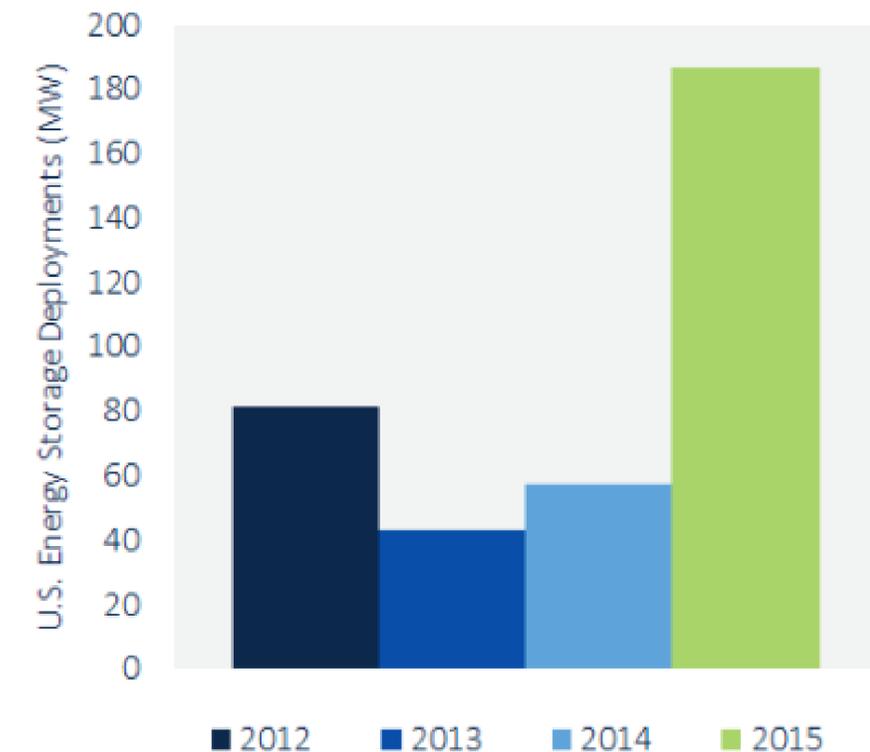
# US Policy Reform: the success story

- Enacted in Oct 2012, FERC 755 provides premium payments for faster, more accurate Frequency Regulation resources (batteries)
- 380 MW of grid batteries deployed (110 MW in PJM)
- Fast ramping resources now make up 38% of PJM regulation procurement (11% in 2012)

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Annual US Energy Storage Deployments (2012-2015)

Front of the Meter



Source: GTM Research/ESA

# PJM results in 2015

*The grid operator procured more expensive premium response from batteries, but procured less total MW of frequency regulation, leading to a significant net saving for grid users.*

## Why?

- Fast response from batteries more accurately meets grid frequency needs
- 1MW of 'top end' is valued at > 1MW of slower response (from thermals)
- PJM reduced the total procurement of frequency regulation from 1.1% to 0.7% of peak load after implementing grid batteries (1)

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(1) A brief history of regulation signals in the PJM

<http://www.pjm.com/~media/committees-groups/committees/oc/20150701-rpi/20150701-item-02-history-of-regulation-d.ashx>

# SA crossroads - new inter-Connectors or grid batteries?



## South Australian Energy Transformation

RIT-T: Project Specification Consultation Report  
7 November 2016



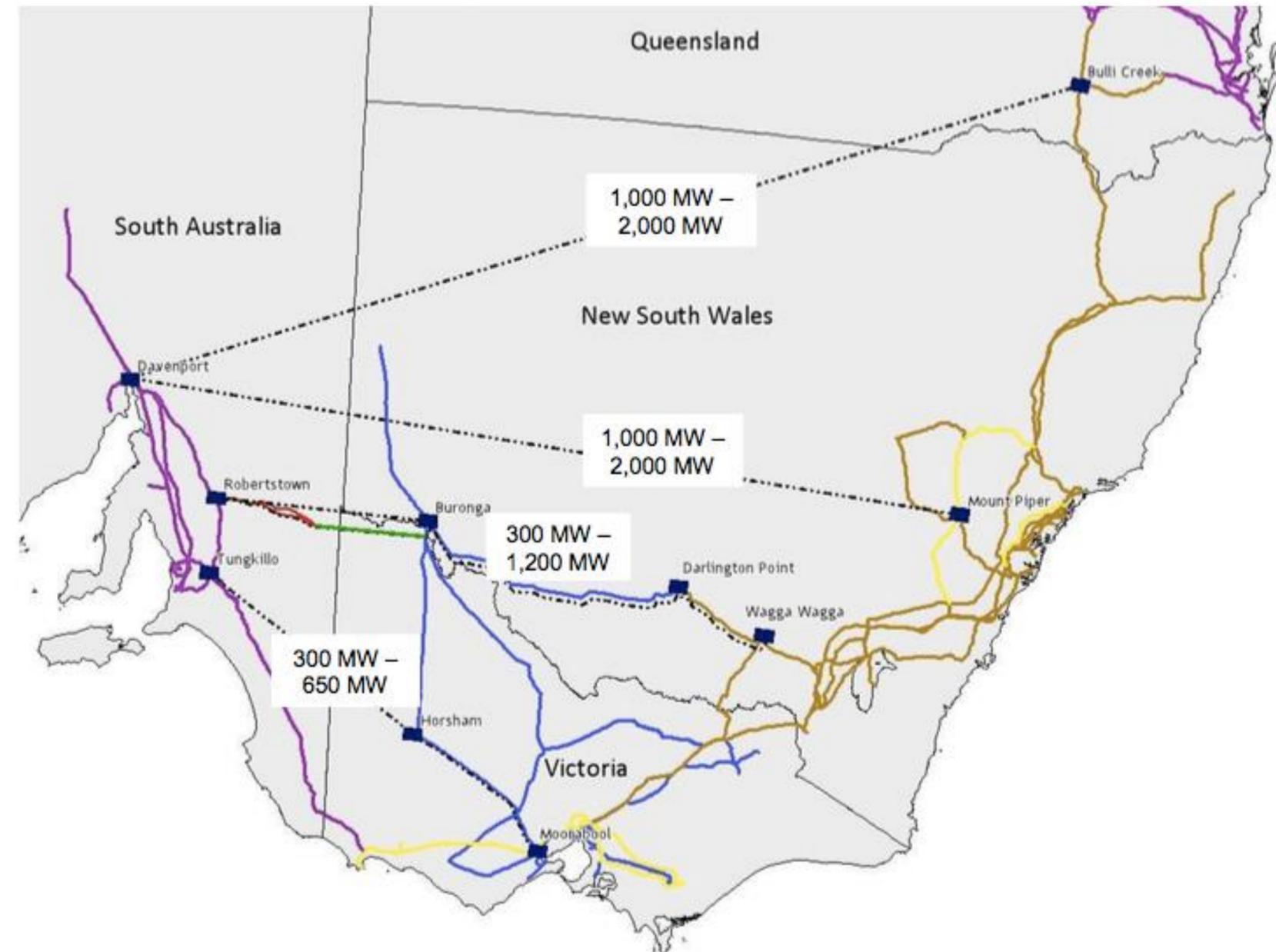
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## SOUTH AUSTRALIAN ENERGY TRANSFORMATION 7 November 2016



Figure 1 Four new interconnector options are proposed to be investigated as part of this RIT-T (line corridors are indicative only)



# The case for a new South Australian inter-connector

The ElectraNet RIT-T posits

- 4 inter-connector credible options (\$0.5bn - \$2.5bn)
- Improved wholesale competition to alleviate high energy prices in SA (\$100/MWh flat swap)
- Improved supply security by insuring against Heywood dependency
- Improved flexibility to export surplus renewable generation

# Grid Batteries as a credible non-network option

The withdrawal of thermal generators has depleted South Australia's local inertia and:

- making the power system more sensitive to frequency fluctuations
- limiting AEMO's ability to acquire FCAS locally to support SA islanded operation

Prima facie, 100MW of grid batteries costing \$100m, a fraction of the cost of ElectraNet's low range option, is sufficient to reinstate inertia, provide local frequency regulation and lessen inter-connector dependence

*But regulatory reform is needed...*

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# Proposed reforms and implications

- Rule change to reward fast-acting Frequency Regulation sources
- Rule change to introduce an Inertia Ancillary Service (1)

*These reforms preference **market action** over **system planning**, and a consequent shift from single actor regulated to multiple actor unregulated investment.*

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(1) ERC0208 Proposed Rule Change: NEM Wide Inertia Ancillary Service, AGL Energy, 24 June 2016

# FCAS market & renewable asset owners

Increased exposure to 'causer pays':

- volatility is increasing - the 4Q15 Heywood inter-connector disruption resulted in \$25m of FCAS costs (market normal \$2.5m p.a.)
- progressive removal of thermal capacity, most recently Hazelwood (1,600 MW), is expected to put upward pressure on FCAS costs

A grid battery can assist an asset owner to manage risk in an uncertain market.

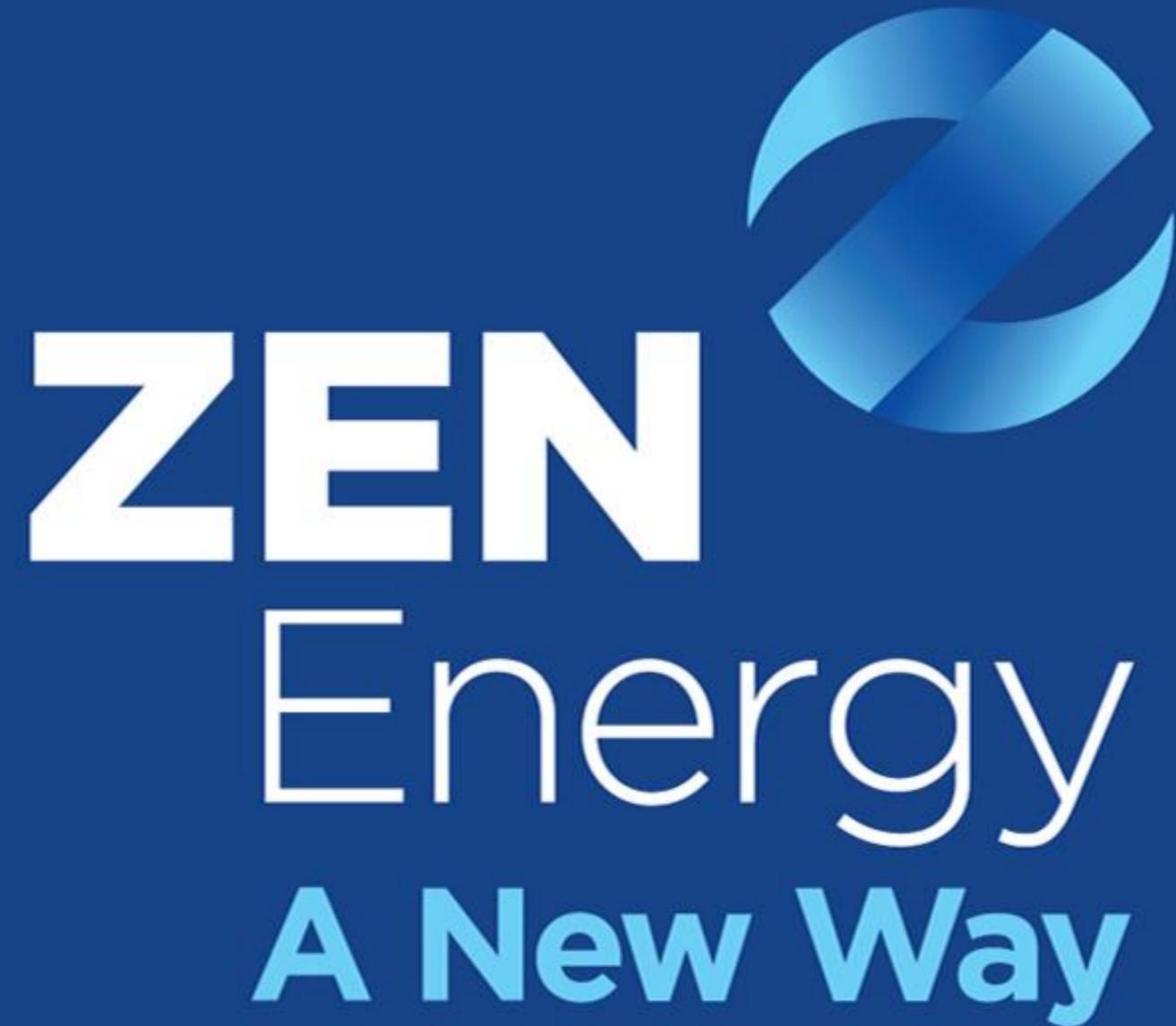
*But the private sector only invests if they can ID a revenue stream...*

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# Conclusions

- In the US, fast-acting grid batteries have lowered the overall procurement cost of Frequency Regulation to the benefit of grid users.
- In the SA inter-connector RIT-T, a grid battery non-network option should be given serious consideration
- Priority reform to introduce a 'FERC 755' style policy to realise the full potential of grid batteries.

Thank you.



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