

Lessons Learned from the UK's Largest Commercial Grid Battery

(Or, where's the elephant?)

Dr Marek Kubik
2nd March 2017



Advancion[®]
Energy Storage



Who am I?



Durham MEng
Reading EngD
Visiting Fellow at Reading
Industrial Supervisor QUB



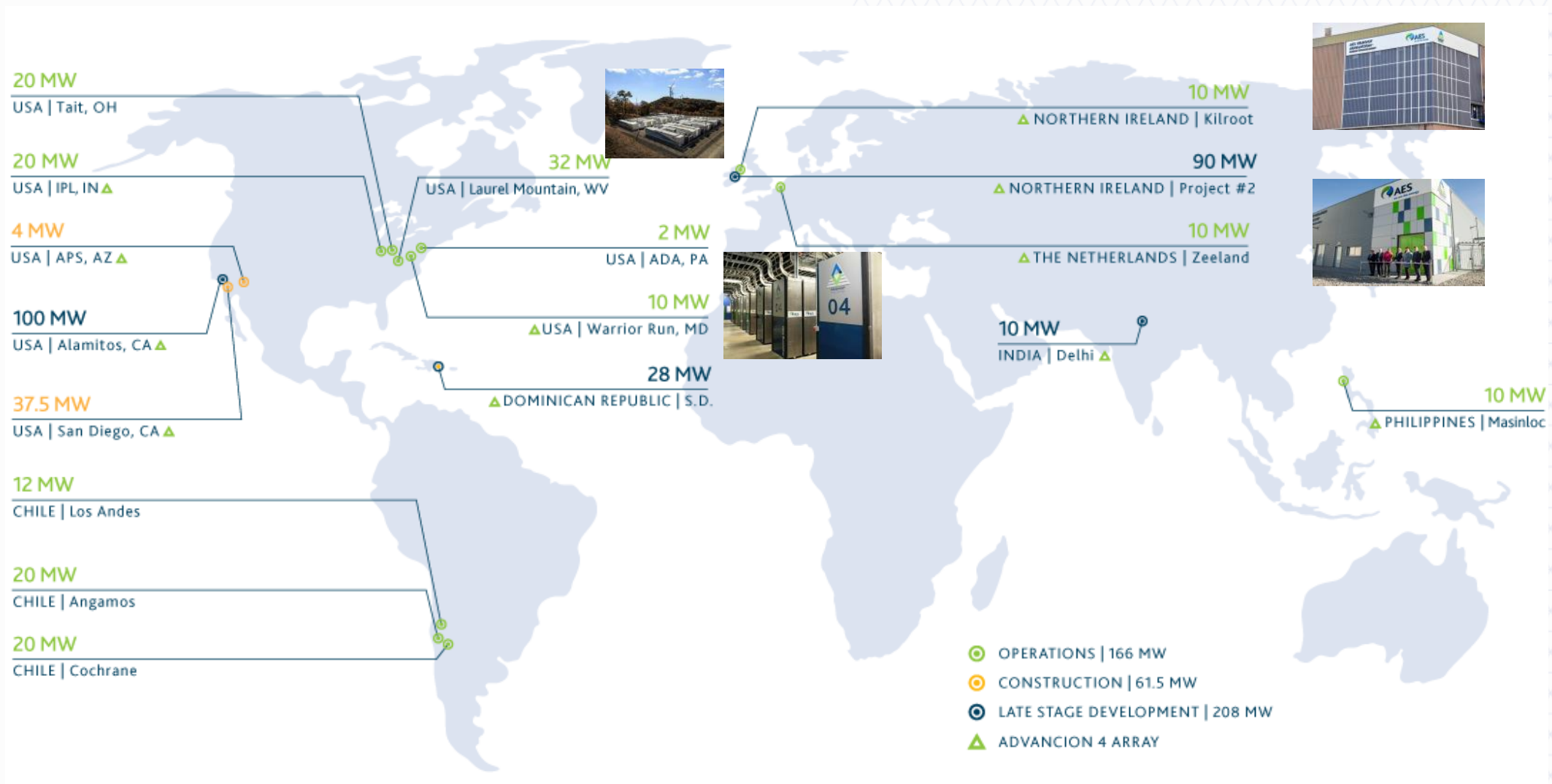
Westminster Experience POST
Northern Ireland APG



Business Strategy Advisor
Commercial Projects Manager
Advancion 3rd Party Sales

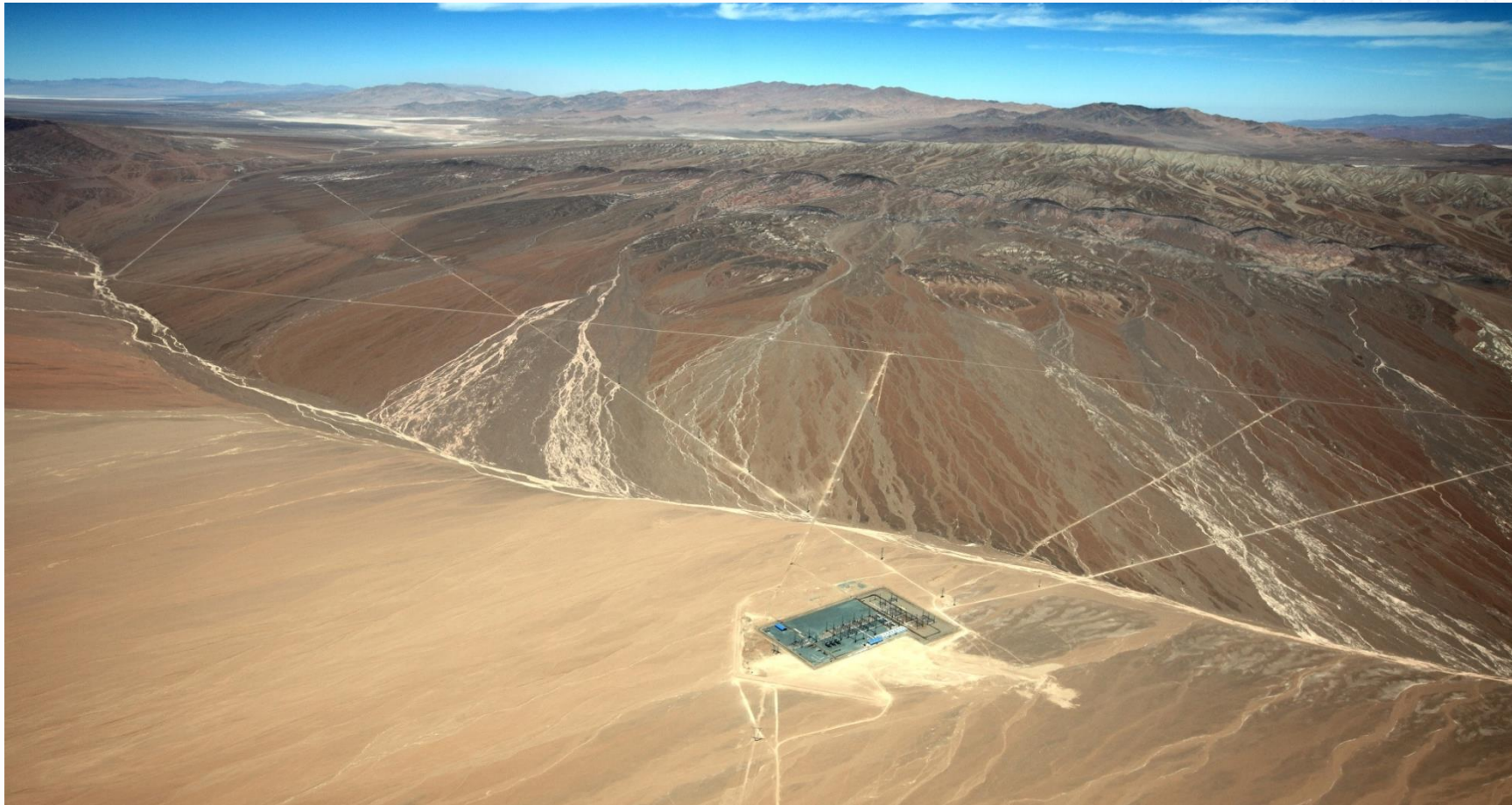


AES: world leader in grid scale energy storage



From the very first commercial grid scale battery storage project...

In the remotest corner of the Atacama desert...



17 Month
Payback



When storage
>\$3000/kW



Complex
requirements
(<5% humidity)

To the largest energy storage project in the world

AES trusted to deliver emergency tender to SDGE for Aliso Canyon gas leak in record time



6 Months



120MWh

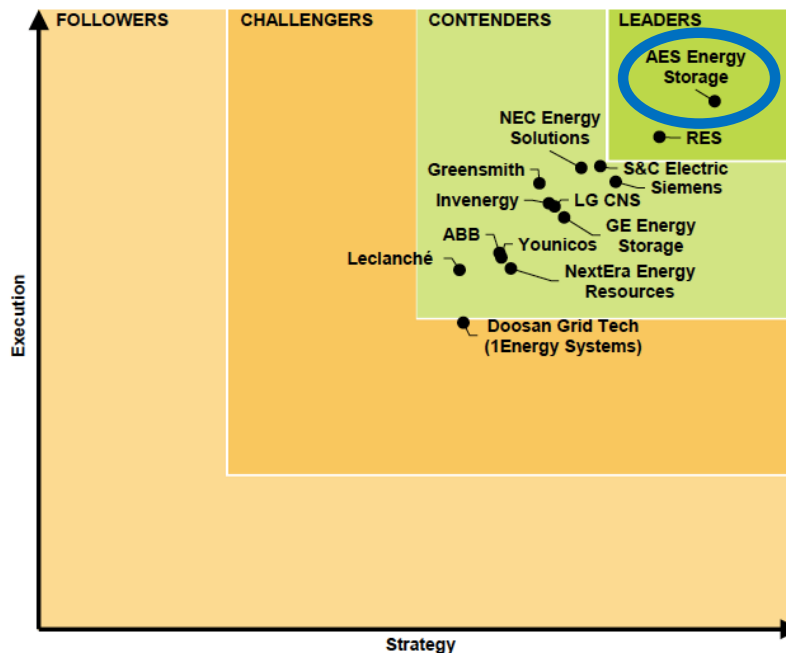


Complex
(Seismic,
Ground
Disturbance)

Advancion[®] is recognized as the leading solution for grid storage



Advancion[®]
Energy Storage



#1 Energy Storage Systems
Integrator – 2015 & 2016



2016
International
Edison Award

Why Ireland?



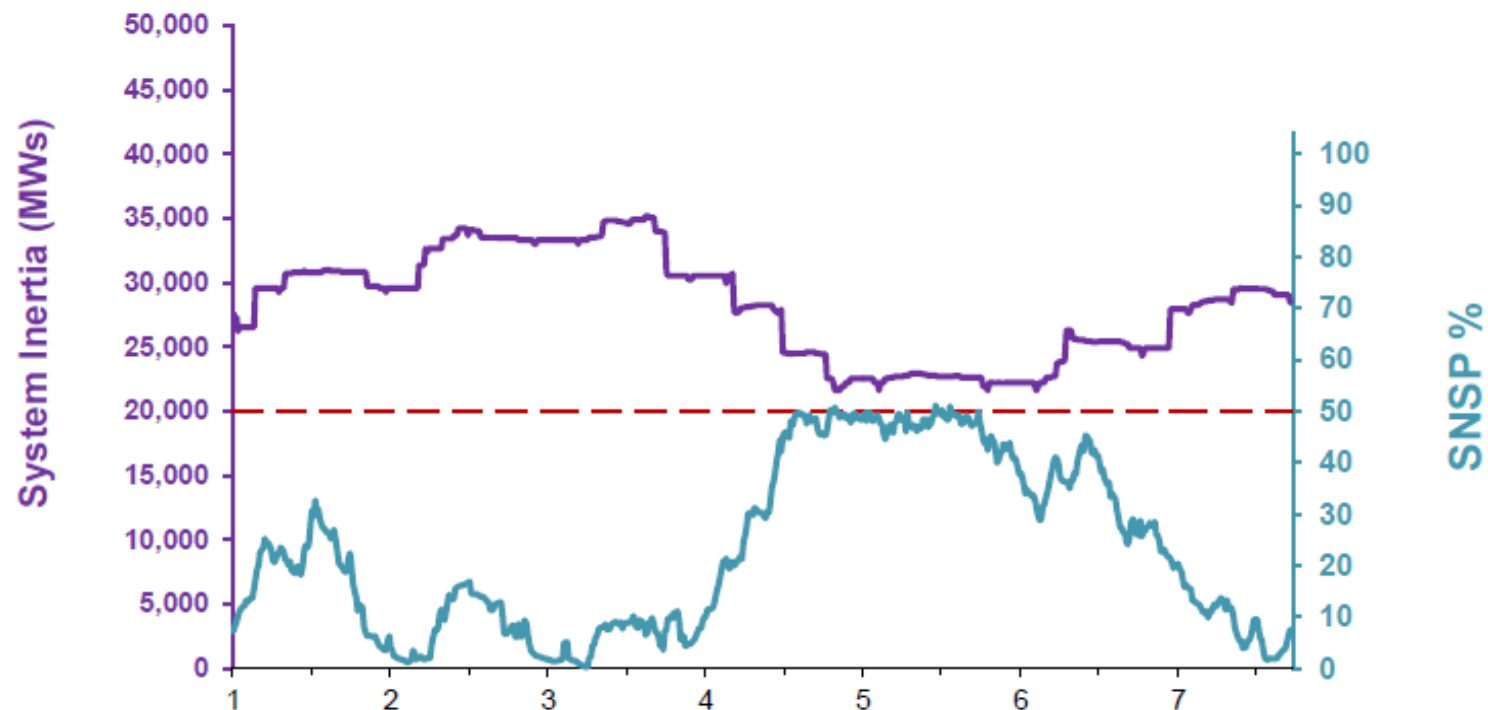
40%



2020



442GWh
curtailed in
2015 (5.1%)



High SNSP = low inertia levels

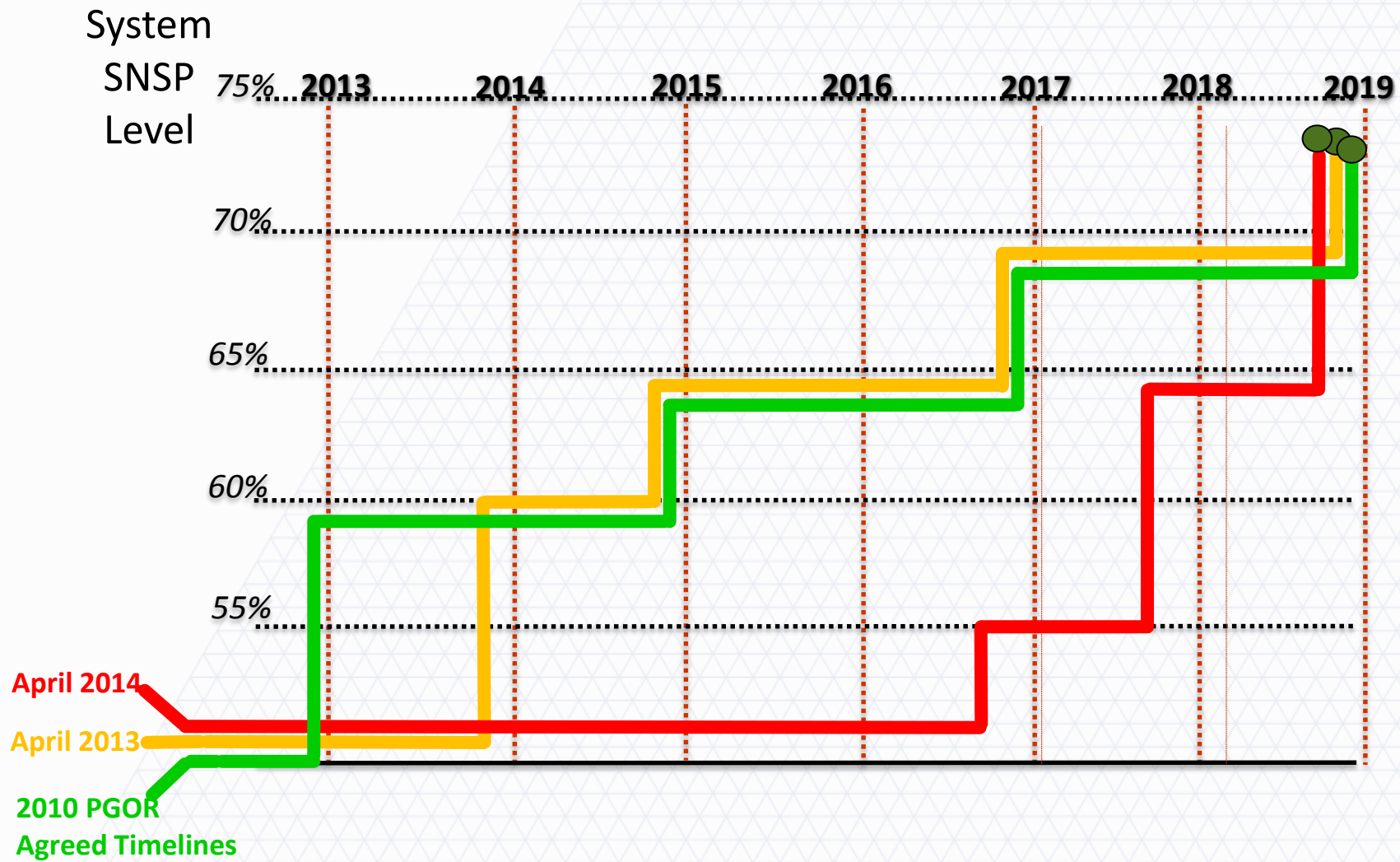
Critical system stability issue - needs increase in flexible system services to maintain system security

Why Ireland?

40%

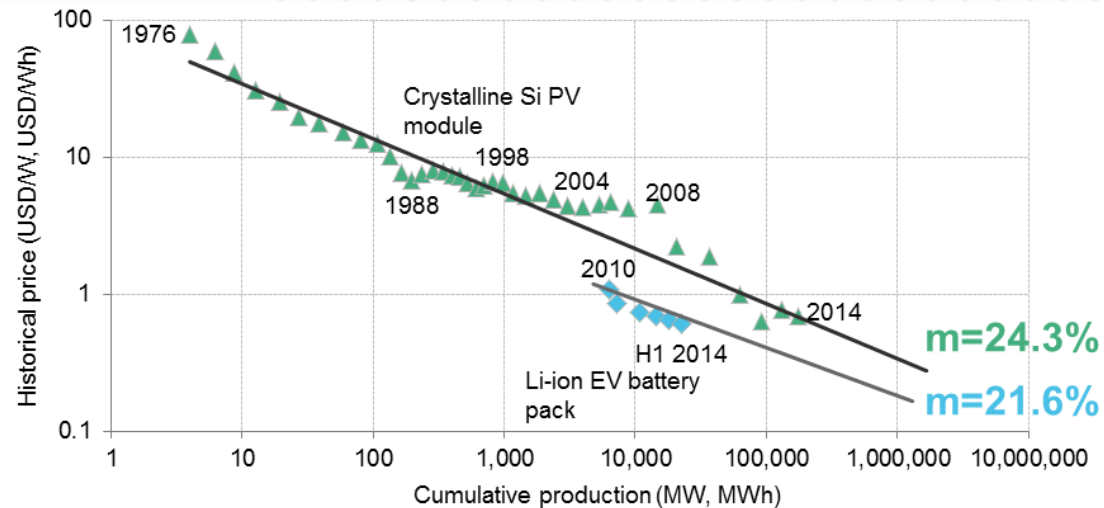
2020

442GWh curtailed in 2015 (5.1%)



Why Batteries?

Flexible, scalable resources that can be deployed virtually anywhere



Note: Prices are in real (2014) USD. Source: Bloomberg New Energy Finance, Maycock, Battery University, MIT

\$/Wh Cost Decline (Bloomberg NEF, 2015)



Fast Response
PJM save \$20/yr



Rapid (37.5MW/4hr in 6 months in Aliso Canyon)



Proven (A decade since 1st grid battery)

Kilroot Advancion Energy Storage Array

Deployed 10MW/30min array in December 2015 in 5.5 months within existing power station



Frequency Regulation Service

Response profile agreed with System Operator for existing Frequency Response payments



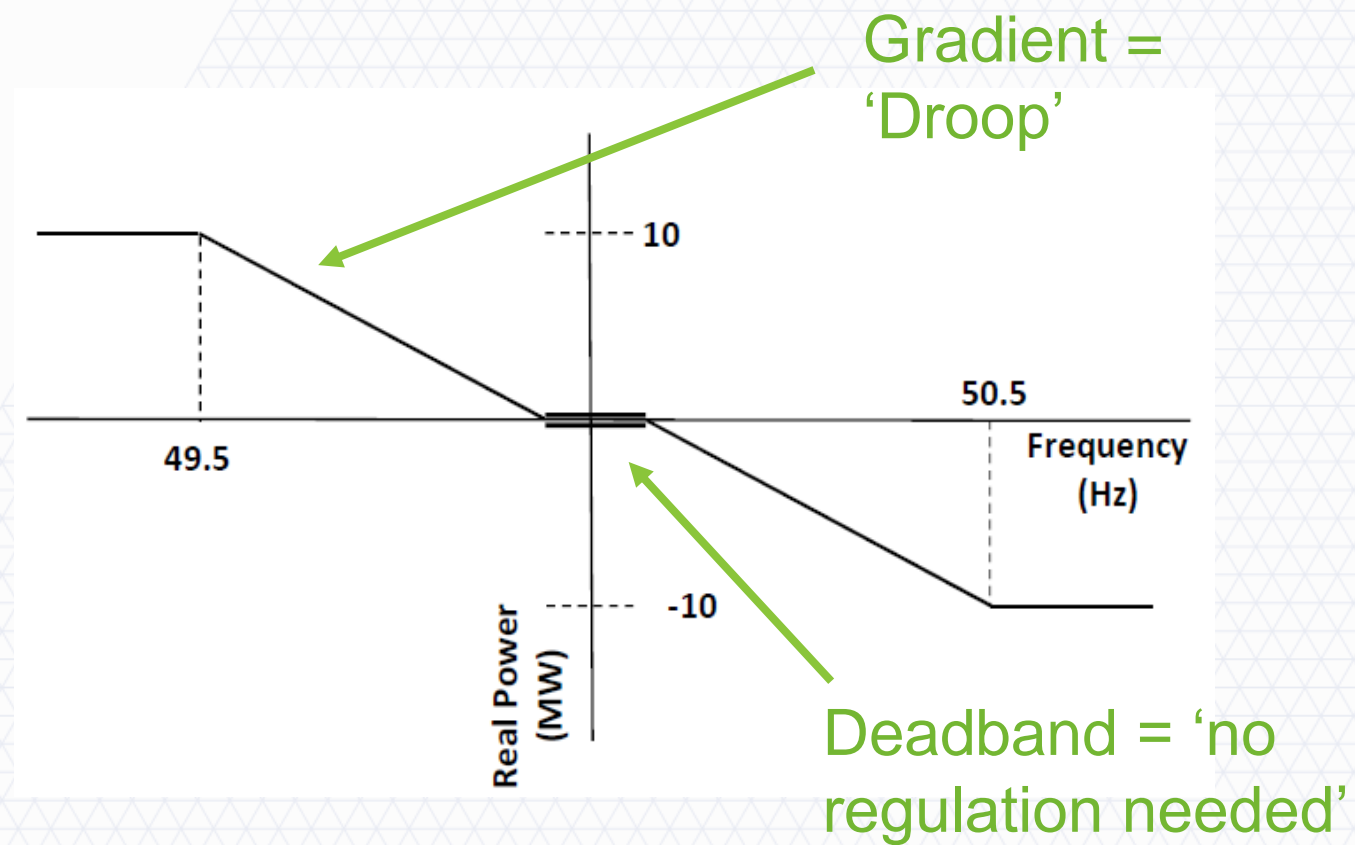
60% faster response than existing Primary Response service



Very high availability (98%+)

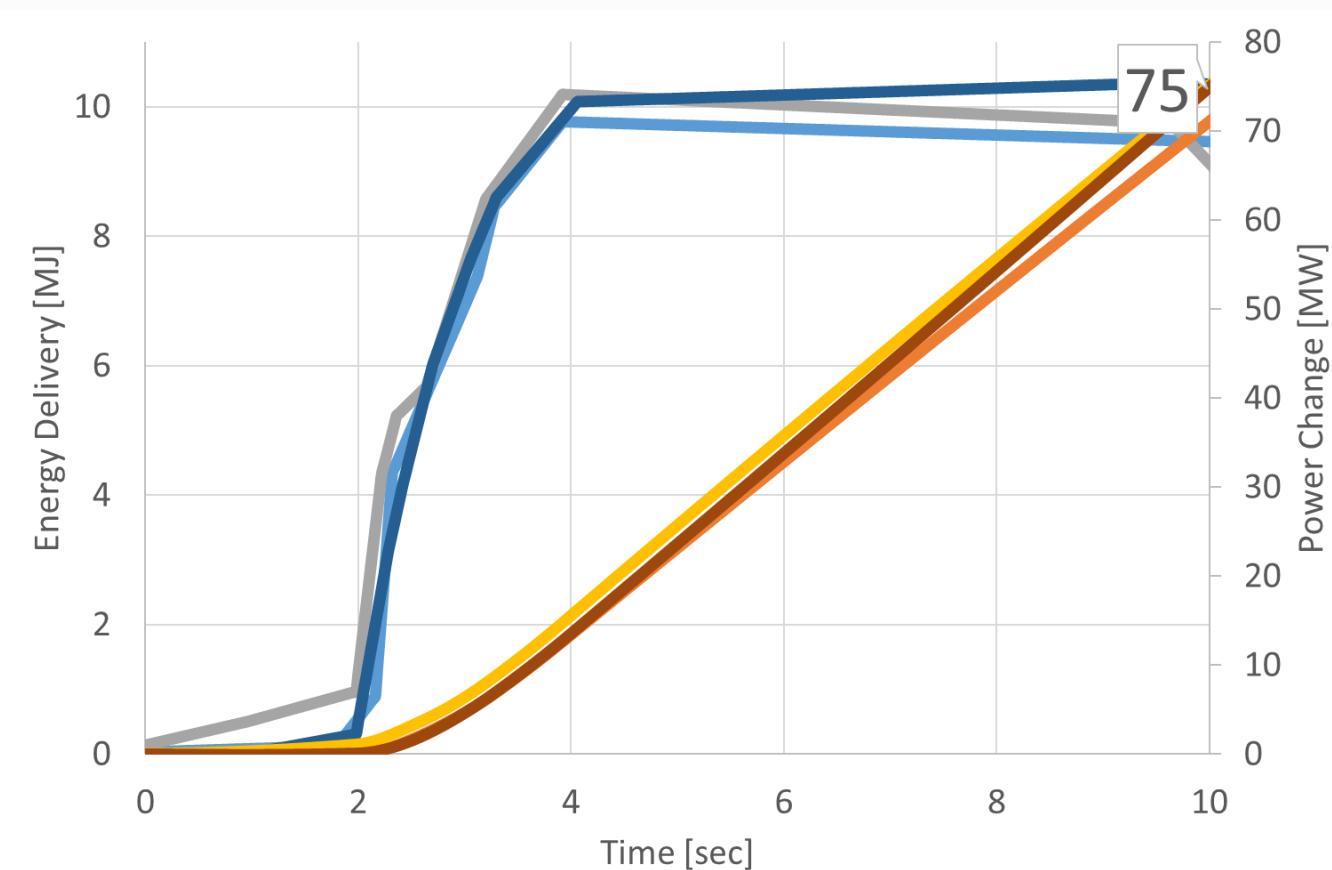


Two postdocs looking at optimisation and system value



Demonstrating FFR

New DS3 System Service: autonomous response to system transients **proven** and **measurable**



← Average response 94% of theoretically perfect profile

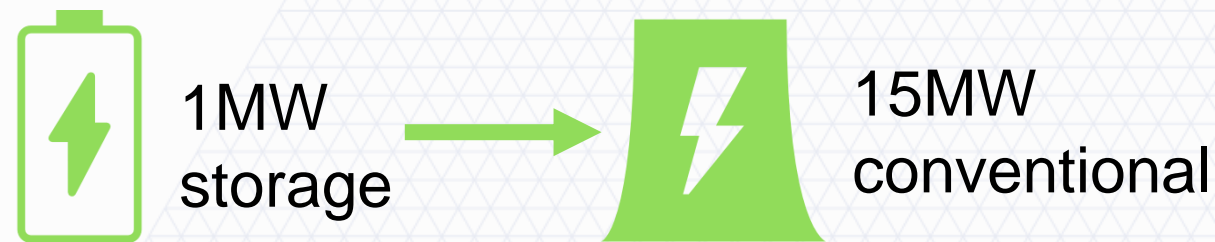


Quarterly Steering Group to feed back results, tune parameters (e.g. deadband 0.05Hz to 0.1Hz for operational reasons)

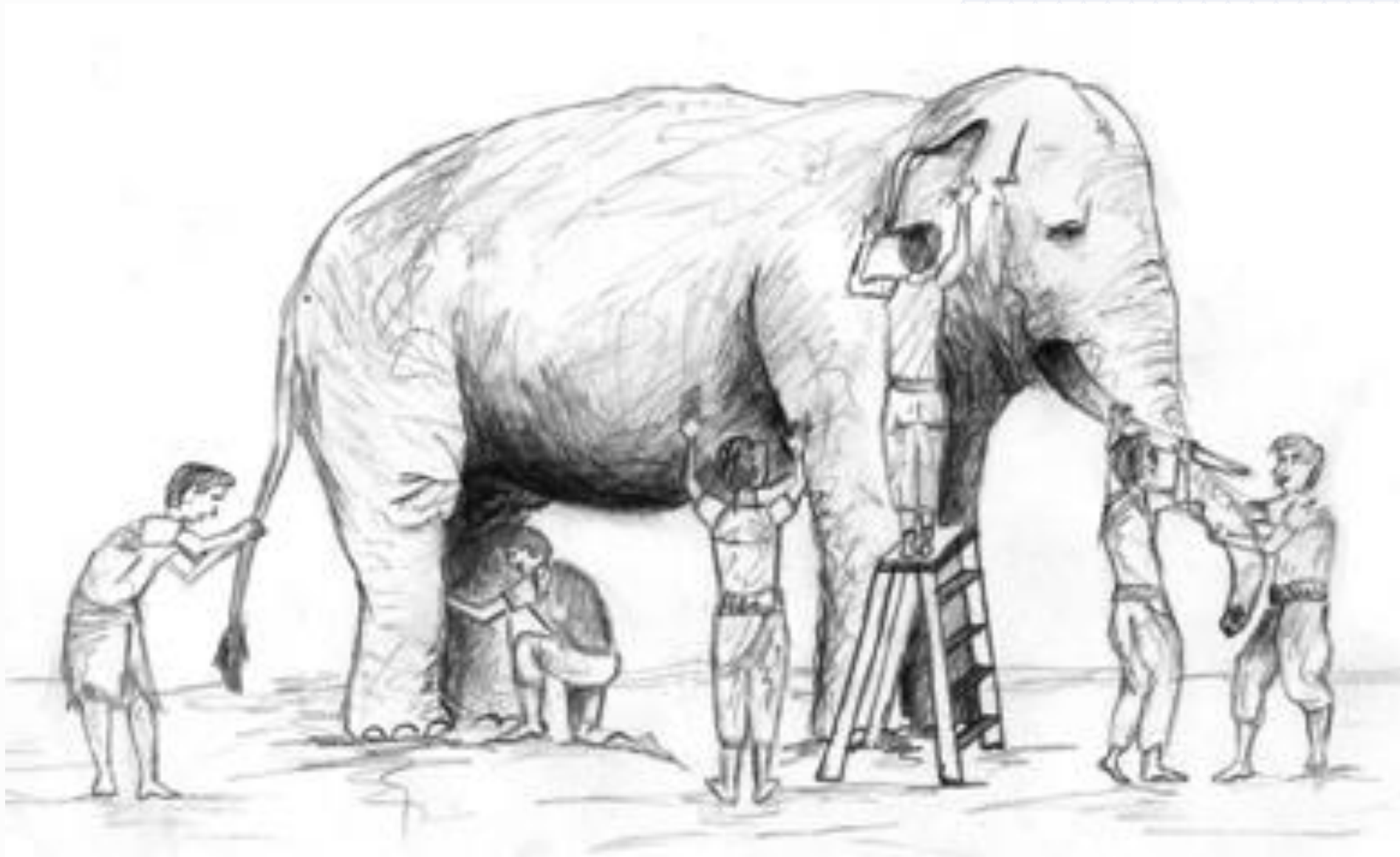
Fast Response: 15 x better than conventional

Because it responds faster and 'cleaner' e.g. without oscillations the value of storage is significant

BESS Specification	Conv. Equivalent (MW)	Nadir (Hz)	BESS Time to Nadir (s)	Conv. Time to Nadir (s)
± 100 MW- 100 mHz db Droop 1%	1,542	49.80	3.53	4.16
± 100 MW- 150 mHz db Droop 1%	1,028	49.78	3.63	4.34
± 100 MW- 100 mHz db Droop 2%	1,028	49.78	3.63	4.34
± 100 MW- 150 mHz db Droop 2%	514	49.76	4.03	4.62



Alikhanzadeh, A., Best, R., Morrow, D., Kubik, M., Brogan, P. Primary Frequency Response from Transmission-Connected Battery Energy Storage System. *IEEE Transactions on Power Delivery*, October 2016 [Under Review]



Finally.... Next Steps

To get in touch visit www.aesenergystorage.com or contact marek.kubik@aes.com



Removing
regulatory barriers



Enduring market
design for flexibility



Kilroot Phase II
(100MW)

