

# GLOBAL ENERGY SOLUTIONS SUMMIT

**March 28 to 29, 2019**

**Embassy of Canada, 501 Pennsylvania Ave NW  
Washington, DC**



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Canada 



**Embassy of Australia**  
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## Welcome & Opening Remarks



**Martin Loken**  
*Minister*  
Embassy of Canada



**Scott Pattison**  
*President & CEO*  
National Governors Association

# Opening Keynote Speaker



**Ethan Zindler**  
*Head of Americas*  
Bloomberg New Energy Finance

## Opening Remarks & Thank You



**Sue Gander**  
*Division Director*  
Environment, Energy &  
Transportation,  
National Governors Association

### Thank You to the Summit Planning Team

NGA

Jessica Rackley  
Abigail Hunter

Embassy of Australia

Sarah Storey  
Anthony Orford  
Meredith Jones

Embassy of Canada

Aaron Annable  
Dan Abele

Embassy of Denmark

Jeppe Helsted  
James Glennie

# Offshore Wind Program: Opening Remarks



**Lone Dencker Wisborg**  
*Ambassador-designate of Denmark to the  
United States of America*  
The Embassy of Denmark



## Transition & Trivia

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## State of the Offshore Wind Market

### MODERATOR



**Amy Harder**  
*Energy Reporter*  
Axios



**Ned Lamont**  
*Governor*  
State of Connecticut



**Morten Bæk**  
*Permanent Secretary*  
Danish Ministry of  
Energy, Utilities and  
Climate



**Alicia Barton**  
*President and CEO*  
NYSERDA



**Thomas Brostrøm**  
*CEO*  
Ørsted US Offshore  
Wind



**Walter Cruickshank**  
*Acting Director*  
Bureau of Ocean  
Energy Management

## Keynote: Advancing Offshore Wind Through Regional Support



**Morten Bæk**  
*Permanent Secretary*  
Danish Ministry of Energy, Utilities and Climate



## Networking Break

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# Opportunities & Next Steps: What Does it Take to Unlock the U.S. Market for Offshore Wind?

**MODERATOR**



**David Livingston**  
*Deputy Director*  
Climate and  
Advanced Energy,  
Atlantic Council



**Sara Bluhm Gibson**  
*Director*  
Office of Clean Energy,  
New Jersey Board of Public  
Utilities



**Tom Kiernan**  
*CEO*  
American Wind Energy  
Association (AWEA)



**Annie Hawkins**  
*President*  
Representative from  
Responsible Offshore  
Development Alliance



**Jason Folsom**  
*US National Sales Director*  
MHI Vestas Offshore Wind



**Rob Gramlich**  
*Founder and  
President*  
Grid Strategies LLC

## Lunch with Keynote on the Future of Offshore Wind



**Joe Balash**

*Assistant Secretary for Lands and Minerals Management*  
U.S. Department of the Interior



## Training Session: Workforce Development for Emerging Energy Technologies

### MODERATOR



**Stephen Pike**  
CEO  
Climate and  
Massachusetts Clean  
Energy Center



**Mary Sotos**  
*Deputy Commissioner for  
Energy*  
Connecticut Department of  
Energy & Environmental  
Protection



**Angela Navarro**  
*Deputy Secretary of  
Commerce and Trade*  
Virginia



**Cory Channon**  
*Assistant Director of  
Construction Sector  
Operations*  
International Brotherhood of  
Boilermakers



## Trivia & Transition

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# Opening Remarks



**Hon. Peter McGauran**  
*Consul-General, Senior Trade and  
Investment Commissioner to Houston, TX  
Australia*

## State of the Energy Storage Market

### MODERATOR



**Max Minzner**  
*Partner*  
Jenner & Block



**Betty Watson**  
*Senior Manager of*  
*Energy Policy*  
Tesla Energy



**John Perry**  
*Coordinator General*  
State of Tasmania



**Sarah Vorpal**  
*Senior Energy Policy*  
*Specialist*  
Washington State  
Department of Commerce




**Ray Hohenstein**  
*Market Applications*  
*Developer*  
Fluence

# Case Study on Energy Storage Project Keynote



**John Zahurancik**  
COO  
Fluence





# Energy Storage: Lessons from Australia; coming to a T&D network near you

John Zahurancik, Chief Operating Officer, Fluence



# Transmission/Trading Enhancement

**AusNet / Energy Australia**

Ballarat, VIC, Australia

30 MW / 30 MWh

## SERVICES

- Local capacity
- Peak/off-peak management
- FCAS/Ancillary Services

## IMPACT

- Competitive selection
- Maximizes transmission
- Strengthens network





# Renewable Integration

## Nexif Energy

Port Augusta, SA, Australia

10 MW / 10 MWh

Under construction adjacent to new wind generation

## SERVICES

- FCAS/Ancillary Services
- Renewable integration
- Peak/off-peak management

## IMPACT

- Grid stability
- Meet regional connection requirements



# FLUENCE

A Siemens and AES Company

## Fluence is the global leader in utility-scale energy storage



**760+**  
TOTAL MW



**70+**  
PROJECTS



**17**  
COUNTRIES



**11+**  
YEARS



**6,000+**  
GW-Hours of Delivered  
Service globally





# Energy storage continues to gain momentum worldwide

Battery-based energy storage assets are serving constrained power systems with fast, flexible power



## CALIFORNIA

TARGET FOR 1,325MW BY 2020

## NEW YORK

TARGET FOR 1,500 MW by 2025

## HAWAII

STORAGE PROCUREMENT

## MEXICO

STORAGE IN MARKET REFORM

## PUERTO RICO

STORAGE FOR RENEWABLES & MICROGRIDS

## DOMINICAN REPUBLIC

STORAGE FOR REQUENCY & RESILIENCY

## CHILE

STORAGE FOR ANCILLARY SERVICES

## BRAZIL

STORAGE FOR REMOTE GRIDS

## UNITED KINGDOM

CAPACITY & GRID SUPPORT

## GERMANY

STORAGE FOR FREQUENCY

## ITALY

ISLAND MICROGRID

## JAPAN

WIND STORAGE, CHANGING MARKET STRUCTURE

## KOREA

200+MW INSTALLED

## PHILIPPINES

STORAGE FOR SYSTEM SECURITY

## INDIA

SOLAR + STORAGE

## AUSTRALIA

SUPPORTING TRANSMISSION STABILITY

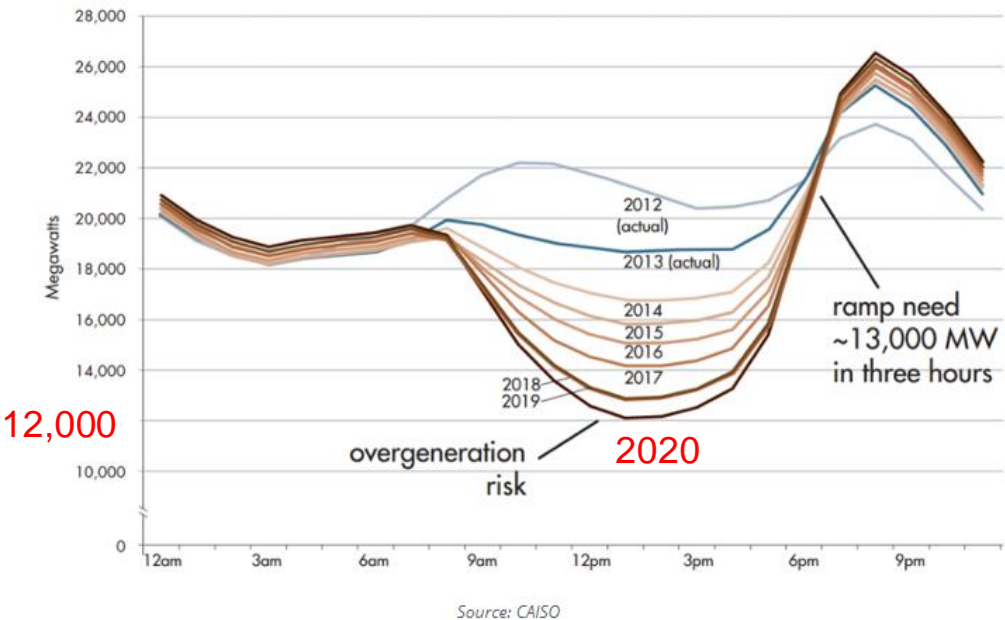


# The duck curve is coming faster and bigger in the U.S. than we thought

Unless we solve solar value deflation, solar growth will stagnate

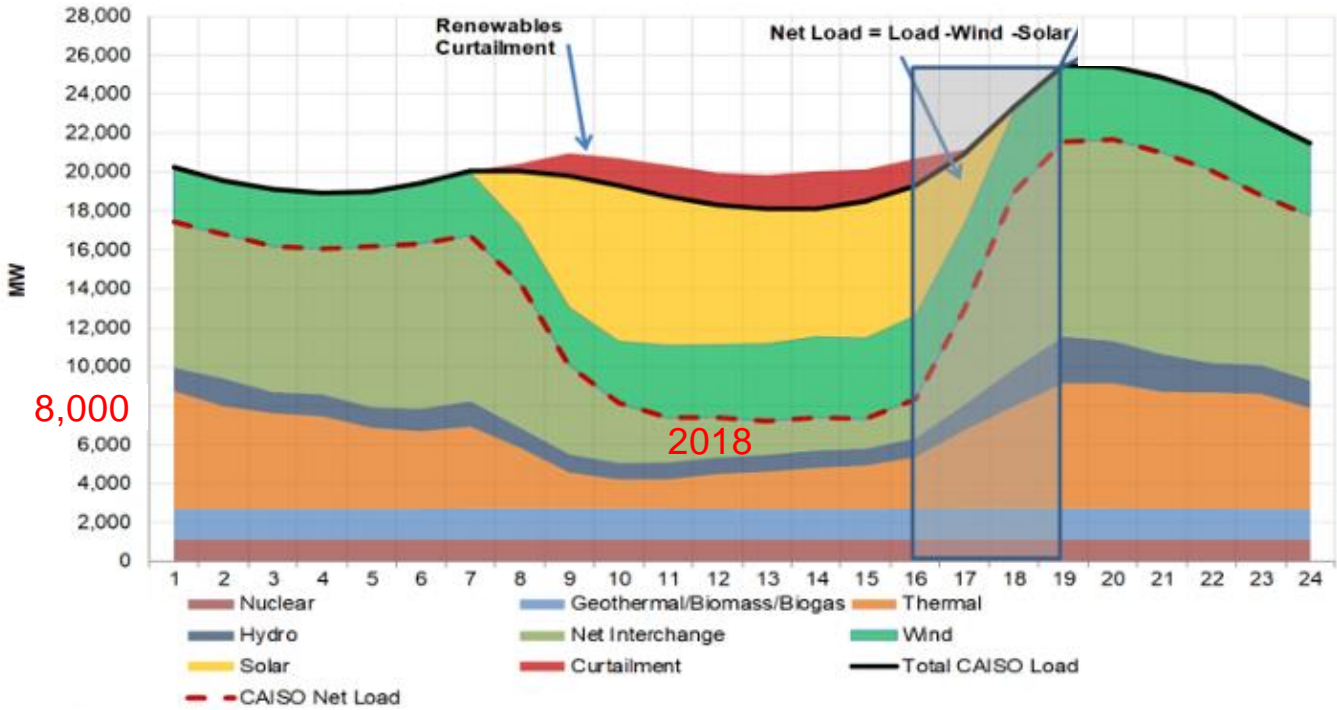
## Forecasted

Net load - March 31

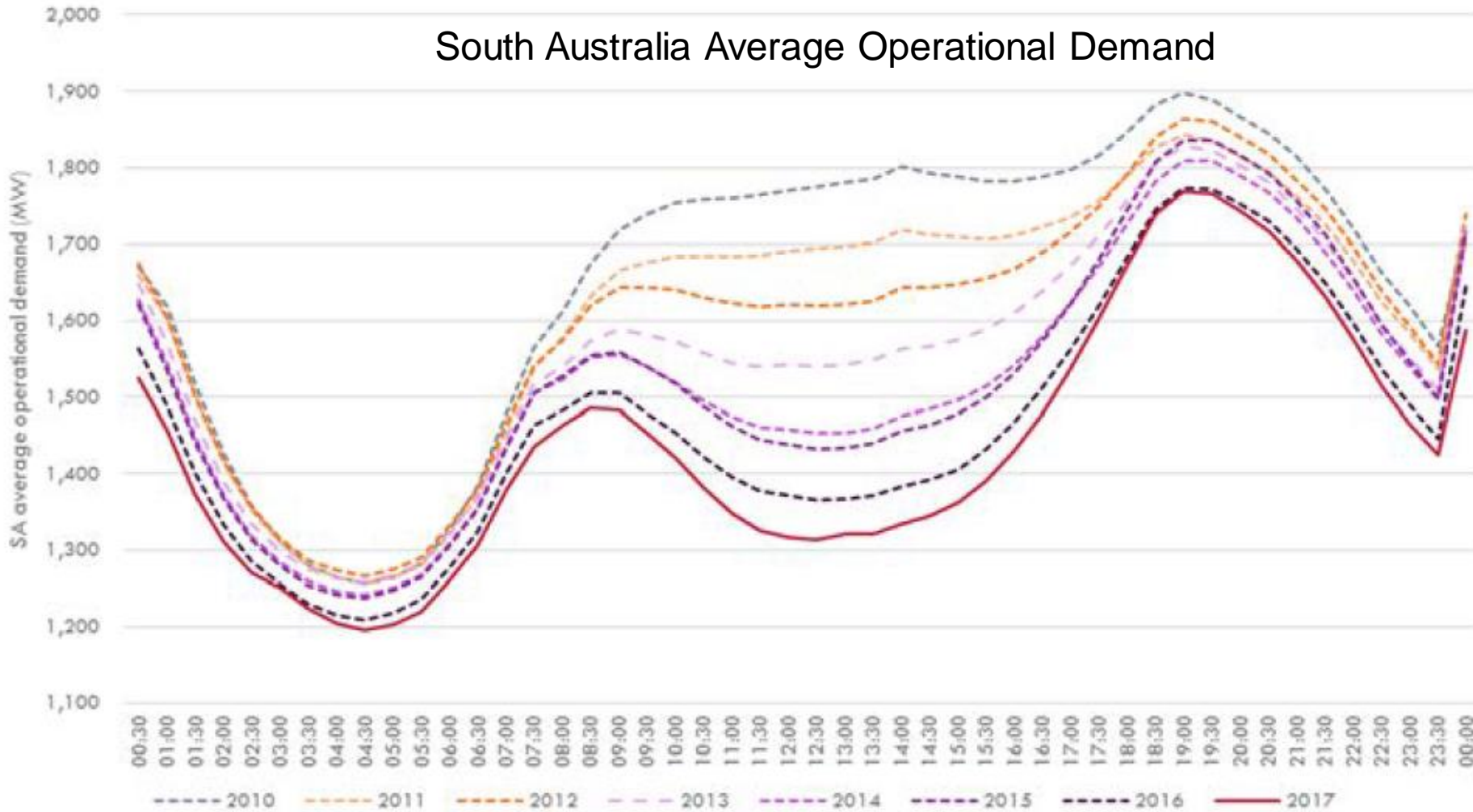


## Actual

Generation Breakdown --- 02/18/2018



A very similar picture is forming in Australia...



Source: AEMO, 2018



# AEMO's First Integrated System Plan Provided a Look Ahead on Growing Need for Storage

In the Future, Frequency Control & Ancillary Services (FCAS) Needs in Australia Will Be Very Different. Storage Will Be a Critical Source.

Ramp Rates Will Become a Lot Higher, Making Storage a “Must Have” In Next 5-7 Years

Figure 32 Projected FCAS requirements for increasing penetration of solar and wind generation

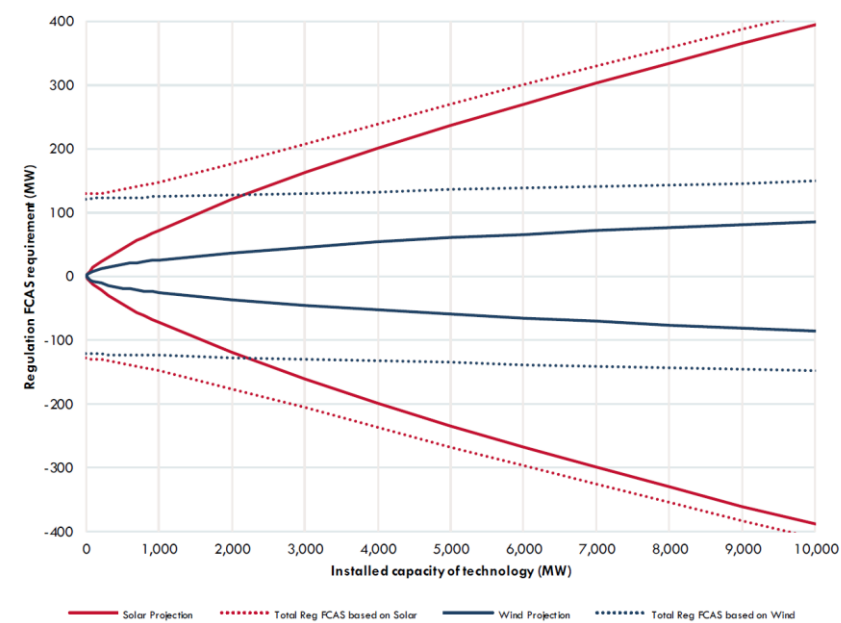
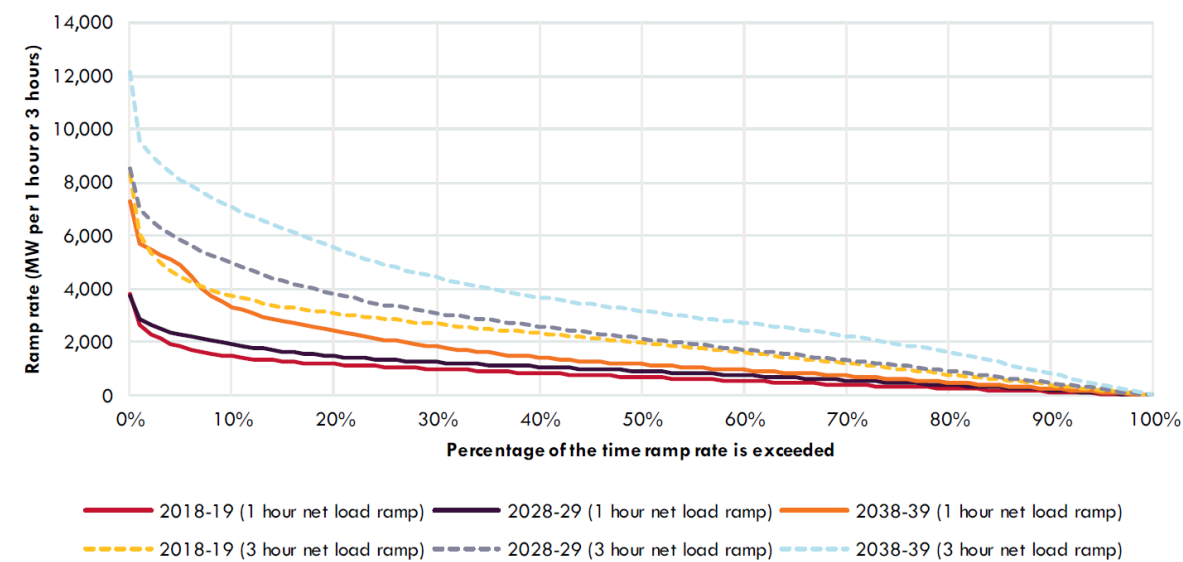


Figure 30 Projected change in ramp rate over the next 10 years, Neutral scenario

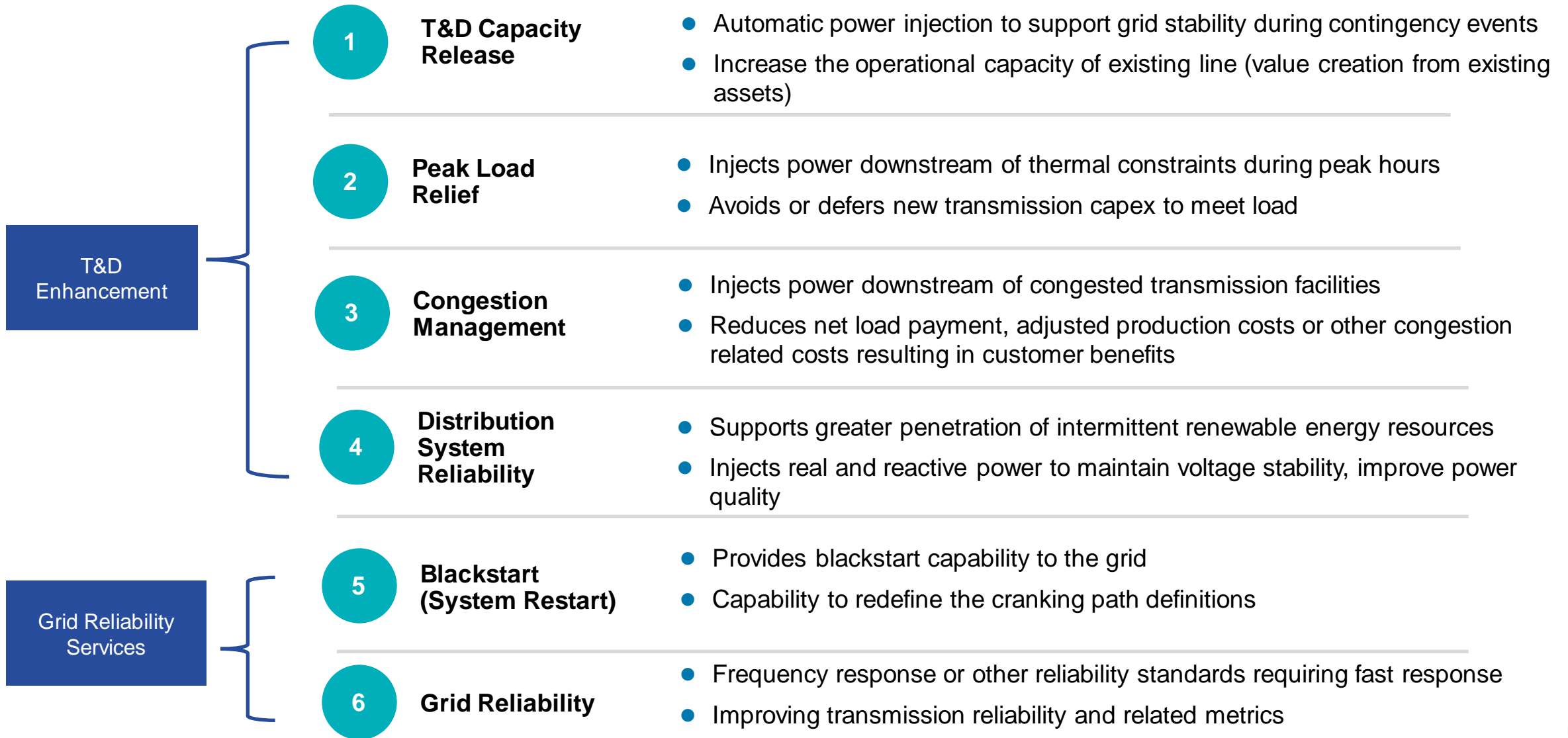


Source: AEMO ISP, 2018





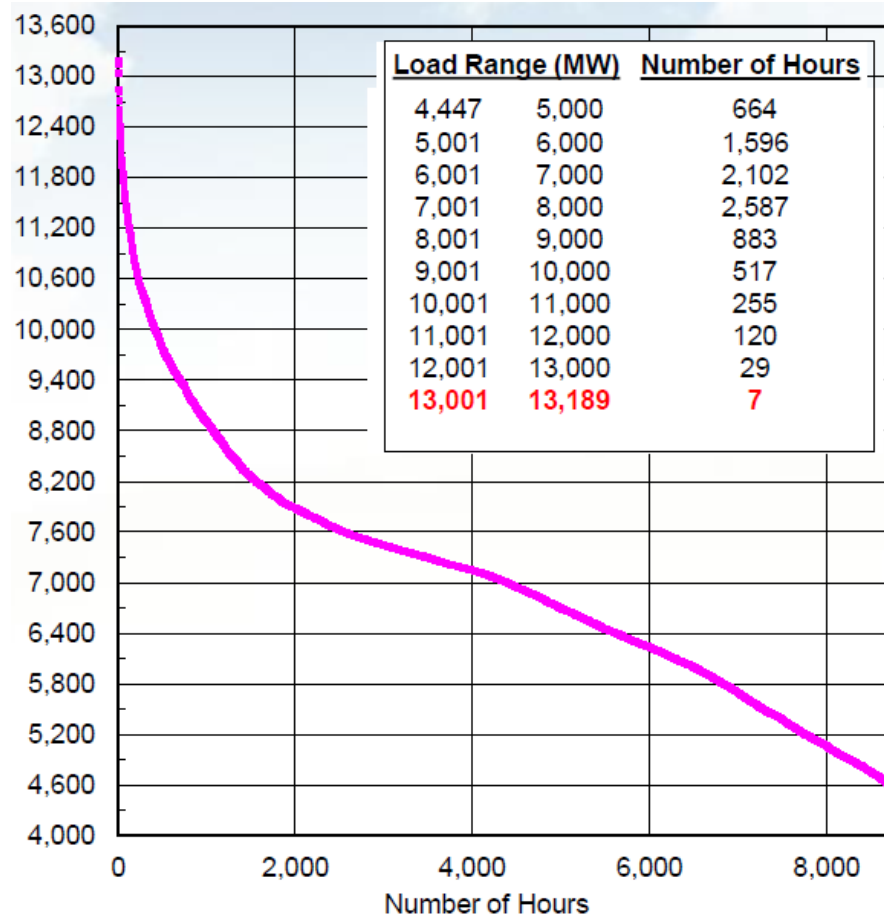
# Applications Across the Entire Domain of Transmission & Distribution (T&D)



2

## Storage is well suited for peak load/congestion relief

ConEdison Load Duration Curve (Illustrative)



Few hours where load is high – traditional T&D systems planning is performed based on deterministic power flow analysis for snapshot summer/winter peak conditions



Consideration of Critical Load at which violations occur could provide indications of feasibility of non-wires alternatives



Energy storage provides a unique capability to defer T&D investments

# Mix of price volatility and grid congestion in Australia

- Resource mix change: rapid adoption of renewables, accelerating coal retirements
- Limited flexibility & transfer capacity between regions, creating congestion points on network and increasing likelihood of curtailments
- Volatility creates risk and uncertainty for generators and generator/retailers

**Figure 1.** Average Wholesale Electricity Prices in Q2 2018 in Australia's NEM



Note: The average quarterly price is broken up into two parts, energy and volatility. Volatility refers to the contribution of high priced events (above \$300/MWh) to the average price more commonly known as cap returns. 'Energy' is therefore the remainder.

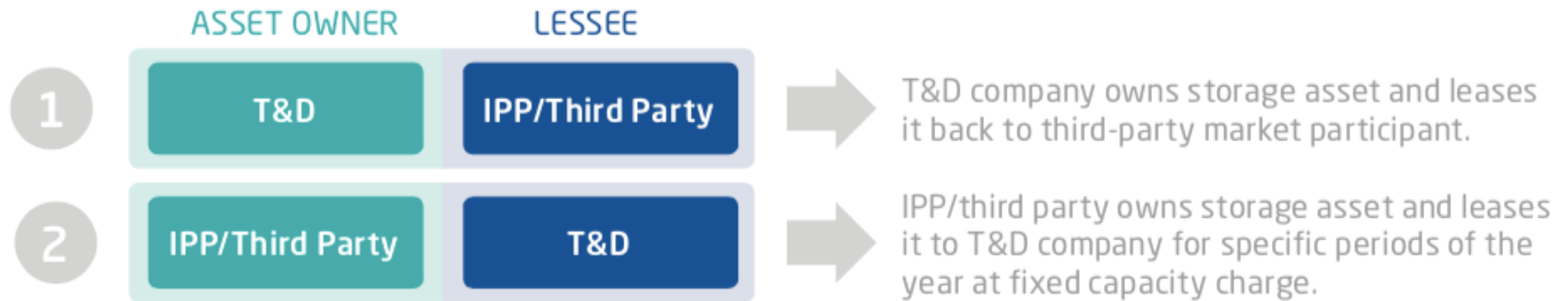
Source: AEMO Quarterly Energy Dynamics, Q2 2018, Aug 2018



# Ballarat project's commercial structure unlocks both network and market benefits

Offers paths forward for U.S. markets where utilities cannot own storage (e.g., Texas)

## Multiple Commercial Structures for Value Creation



- Layering of benefits:
  - Flexible peaking capacity to help meet peak electricity demand
  - Regulate frequency by participating in all Frequency Regulation & Ancillary Services (FCAS) markets
  - Potential for other network services via agreement with T&D network provider





# Potential for U.S.T&D Applications for Storage



# Transmission & Distribution Enhancement

## Arizona Public Service (APS)

Punkin Center, Arizona, United States

2 MW / 8MWh

### SERVICES

- Transmission upgrade deferral
- Peak management

### IMPACT

- Power reliability at half the cost of a transmission line



# In Arizona, APS Example Highlights Value Proposition for Peak Load Relief Application in the U.S.

Energy Storage for half the cost of transmission upgrade



Advancion®  
Energy Storage

01

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## SERVICES

- Peak demand management
- Transmission investment deferral

## IMPACT

- ✓ Defer or replace investment in 20-mi of transmission
- ✓ “We can take much smaller incremental steps to manage the need as it arises and not have to over-invest in some cases, as utilities have traditionally had to do in the past.”



▶ **2 MW Advancion® Array**  
Punkin Center, Arizona



# In U.S., FERC's 2017 Policy Statement on Storage Was a Win for Multi-Use Applications

- Beginning of year 2017, FERC issued a policy statement clarifying that storage could be used to addressing transmission needs while participating in other revenue-producing markets.
- This statement provided a strong signal towards encouraging multi-use applications, while reducing up-front cost for utilities seeking to leverage a storage asset for to meet T&D needs.

*Cost-based – reliability-oriented, T&D*  
*Market-based – wholesale market participation*

158 FERC ¶ 61,051  
UNITED STATES OF AMERICA  
FEDERAL ENERGY REGULATORY COMMISSION

18 CFR Part 35

[Docket No. PL17-2-000]

Utilization of Electric Storage Resources for Multiple Services  
When Receiving Cost-Based Rate Recovery

(Issued January 19, 2017)

AGENCY: Federal Energy Regulatory Commission.

ACTION: Policy Statement.

SUMMARY: The Commission issues this policy statement to clarify its precedent and provide guidance on the ability of electric storage resources to provide services at and seek to recover their costs through both cost-based and market-based rates concurrently. We are mindful that, by providing electric storage resources the opportunity to receive cost-based rate recovery concurrently with other revenue from market-based services (e.g., through organized wholesale electric markets), there can be implementation details



# CAISO selection of Storage as part of Regional Transmission Plan (PG&E OCEI) was a Win in 2018.

## Request Window Submission - Oakland Clean Energy Initiative

Pacific Gas & Electric (PG&E) proposed the Oakland Clean Energy Initiative (OCEI), targeting thermal overloads in Oakland area without local generation as a reliability need. PG&E proposed a combination of substation upgrades, in-front-of-the-meter energy storage, and preferred resources. The project includes the following:

1. Upgrades to Moraga 230/115 kV Transformer Bank 3 to remove limiting elements, as well as upgrades at Moraga 115 kV and Oakland X 115 kV substation buses;
2. Transmission line rerates on Moraga-C Claremont 115 kV Lines #1 and #2, currently underway and scheduled for completion in Q1 2018;
3. A minimum of 10MW / 4 hour of in-front-of-the-meter Utility Owned Energy Storage within the Oakland C and Oakland L 115 kV substation pocket;
4. Competitive procurement of an additional 10 MW-24 MW of preferred resources sited within the Oakland C and Oakland L 115 kV substation pocket, of which at least 19.2 MW (measured at 4 pm in September) must be load modifying in nature; and,
5. Continued reliance on transferring Alameda Municipal Power load from Cartwright (North) to Jenny (South) during peak loading conditions and after an N-1, in preparation for an N-1-1.

*BESS was found to be economic compared to other traditional transmission options in the California Regional Transmission Expansion Planning Process in 2018. Cost recovery for BESS proposed in this case would occur through transmission rates.*

	Estimated Capital Cost (2022 \$M)	Total Cost (2022 \$M)
OCEI	\$56-\$73 <sup>1</sup>	\$102 <sup>2</sup>
115 kV	\$193-\$217	\$367 <sup>3</sup>
230 kV	\$316	\$574 <sup>4</sup>
Generation	\$232	\$368 <sup>5</sup>

### Notes:

- 1 Proportion of CAPEX to contract spend will be determined by the most cost effective portfolio determined through the RFO
- 2 Calculated using unit costs of the expected portfolio, including land and O&M as appropriate
- 3 Based on the \$193 CAPEX estimate assuming 2022 installation date
- 4 Based on the CAPEX estimate assuming 2022 installation date
- 5 Based on the CAPEX estimate assuming 2022 installation date

The ISO review found that the OCEI project address all reliability issues identified in the Oakland area without local generation. The ISO is recommending the approval of the transmission regulated assets of the Oakland Clean Energy Initiative project for the substation upgrades at Moraga and Oakland X, rerating of Moraga-Claremont 115 kV Lines #1 and #2 and the installation of the battery storage at the Oakland C and Oakland L 115 kV substations that are estimated to cost \$56 to \$73 million with an in-service date of 2022. The ISO is recommending PG&E to seek approval through the CPUC procurement process the additional identified preferred resources for the Oakland Clean Energy Initiative.



# Global Markets are Looking at Storage as Transmission – Examples from Europe, Asia Pacific and US

## RTE – 2017-France – Project Ringo

### France's RTE unveils "virtual power lines" project

March 9 (Renewables Now) - France's electricity transmission system operator RTE unveiled a research project named RINGO that will seek to integrate energy storage solutions in "virtual power lines".

At a presentation of its innovation policy on Tuesday, RTE said it wants to build the "first power grid to combine electricity and digital solutions".

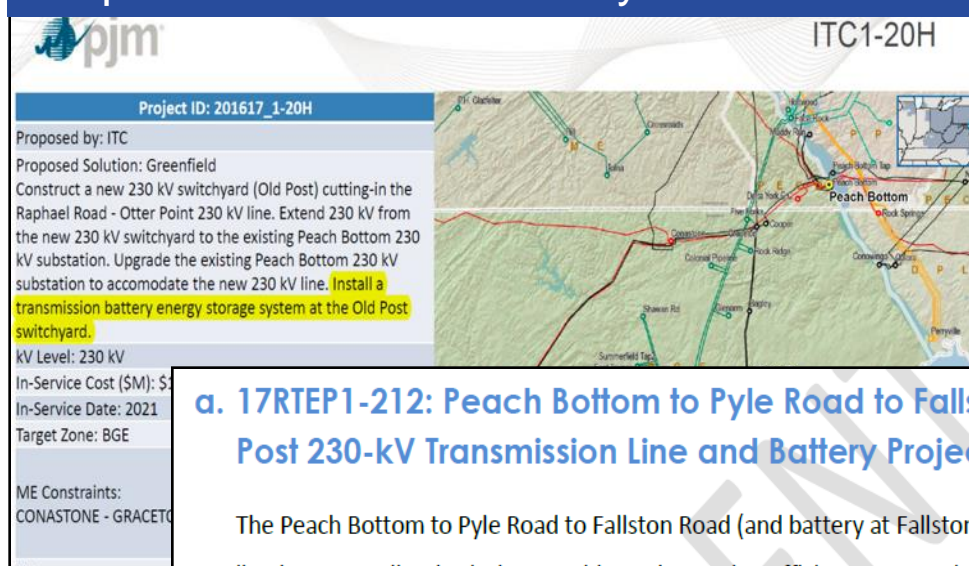
Besides plans for new generation substations which could potentially increase grid integration of renewable power by 30%, RTE is working on a concept of virtual power lines using energy storage as well as on an artificial intelligence solutions that could aid the dispatching process and optimise the management of electricity currents on the grid.

The "virtual power lines" concept essentially relies on using batteries to alleviate grid congestion. Instead of building back-up power lines to deal with congestions caused by physical limitations at critical points on the pathways linking power plants and population centres, RTE wants to deploy batteries to do the same.



RTE virtual power lines concept

## PJM – 2017 – Congestion Relief – ITC Proposal in Market Efficiency Window



### a. 17RTEP1-212: Peach Bottom to Pyle Road to Fallston Road to Old Post 230-kV Transmission Line and Battery Project

The Peach Bottom to Pyle Road to Fallston Road (and battery at Fallston Road) to Old Post 230-kV line is a streamlined solution to address the Market Efficiency congestion identified as a part of the 2016/17 RTEP Long Term Proposal Window. This project, referred to as 17RTEP1-212, consists of constructing approximately 37.5-miles of new 230-kV (36.5-miles single-circuit and 1.0-miles double-circuit) overhead line from the existing Peach Bottom substation (PECO) to a new ITC owned Pyle Road switchyard to a new ITC owned Fallston Road switchyard and to a new ITC owned Old Post switchyard. A new 20MW / 40MWh AES Advancion battery array is connected to the 230-kV system at the new Fallston Road switchyard.



# Global Markets are Looking at Storage as Transmission – Examples from Europe, Asia Pacific and US

## Australia – Nov 2018 Transgrid/Powerlink Over 1 GW BESS for transmission

Table E.1 Summary of potential credible options

Option description	Indicative total transfer capacity (MW) <sup>1</sup>		Estimated capex (\$m) <sup>2</sup>	Expected delivery time
	Northward	Southward		
Incremental upgrades to the existing network to increase transfer capacity				
Option 1A – Uprate Liddell to Tamworth Lines and install new dynamic reactive support at Tamworth and Dumaresq and shunt capacitor banks*	770	1,215	142	2-3 years
Option 1B – Uprate Liddell to Tamworth Lines only	535	1,030	28	2-3 years
Option 1C - Install new dynamic reactive support at Tamworth and Dumaresq and shunt capacitor banks	595	1,180	114	2-3 years
Option 1D – Sapphire substation cut into line 8C and a mid-point switching station between Dumaresq and Bulli Creek	535	1,165	45	1-2 years
A new single-circuit line from NSW to Queensland				
Option 2 – 330 kV single circuit between Braemar and Liddell	980	1,865	855	3-4 years
A new double-circuit line from NSW to Queensland				
Option 3A – 330 kV double circuit between Bulli Creek and Armidale*	770	1,593	560	3-4 years
Option 3B – 330 kV double circuit line between Braemar and Liddell via Uralla (and establishment of a Uralla 330 kV substation)	1,530	2,160	1,505	4-5 years
Option 3C – 330 kV double circuit line between Braemar and Uralla, 500 kV single circuits between Uralla and Wollar and between Uralla and Bayswater (and establishment of Uralla 500/330 kV substation)	1,695	2,540	2,039	5-6 years
High Voltage Direct Current options				
Option 4A – HVDC back-to-back	1,195	1,780	825	2-3 years
Option 4B – HVDC between Mudgeeraba and Lismore**	765	1,190	600	3-4 years
Option 4C – HVDC between Western Downs and Bayswater**	2,590	2,990	2,100	4-5 years
A grid-connected battery system				
Option 5 - Battery energy storage system	1,135	1,635	1,000	1-3 years

\* Option 1A is the ISP recommended Group 1 investment and Option 3A is the ISP recommended Group 2 investment. These

## India – Jan 2019 AP State Filing with Commission – 250-500 MW BESS

### Background:

AP Transco as a state transmission utility and SLDC as a system operator are contemplating to set up a battery energy storage system (BESS) with a capacity of 250 -500 MW with 2-4 hours of storage, under Opex Model, to address morning and evening/night peak deficits (shorter durations), intermittency problems owing to high RE penetration (15 - 30 mins) and also smoothening of curves. AP Transco and SLDC as a system operator, may plan to set up storage system under Opex Model by paying annuity charges to the Developer. AP Transco may invite bids for the selection of developer based on lowest quoted annuity charges (INR/Annum). Storage system can be planned either at sub-station level or at source/generation level or at a centralized location i.e. at a sub-station owned by AP Transco for charging. Storage system, at a centralized location would be a cost effective option on account of scale. The total annuity charges paid to the developer by AP Transco will be socialized and shall be recovered based on the applicability and the usage of the BESS.

### Storage systems are planned to be used for the following purposes

#### a) Peak Load Management (during the day and night):

Though there is surplus generation during day-time, Discoms are facing peak deficits for 2-3hrs during mornings and evenings, across the year. These deficits can be overcome by planning a thermal plant but it is an inefficient way as the plant will have lower utilization.

# Energy Storage is available and transforming power



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Lower emissions & renewable support



Greater reliability



Impacting market prices, procurement, and planning

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Dom. Republic



Germany



Italy



California



Portugal



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John Zahurancik | Chief Operating Officer  
[john.zahurancik@fluenceenergy.com](mailto:john.zahurancik@fluenceenergy.com)



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17 Countries



75 Projects



< 700  
MW



6,000+

GW-Hours of Delivered  
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## Intermission

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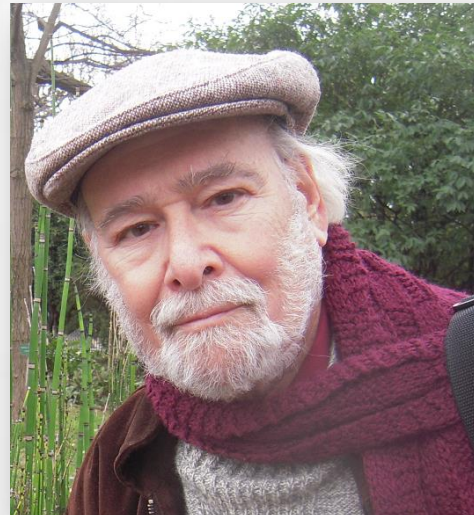
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# Opportunities & Next Steps: State & International Perspectives on Energy Storage

MODERATOR



**Tom Simchak**  
*Research and Programs  
Director*  
Energy Storage  
Association



**Imre Gyuk**  
*Director of Energy  
Storage Research in the  
Office of Electricity*  
U.S. DOE



**Kevin Moriarty**  
*Executive Chairman*  
1414 Degrees



**Scott Bordenkircher**  
*Director, Technology  
Innovation & Integration*  
Arizona Public Service  
Company (APS)

# Closing Remarks



**Sue Gander**  
*Division Director*  
Environment, Energy &  
Transportation,  
National Governors Association



## Adjourn to Evening Reception

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