

# State & Federal Energy Storage Technology Advancement Partnership (ESTAP)

## East Penn and Ecoult Battery Installation Case Study Webinar

March 26, 2013

Todd Olinsky-Paul  
Clean Energy States Alliance



# Housekeeping

- All participants will be in listen-only mode throughout the broadcast.
- You can connect to the audio portion of the webinar using VOIP and your computer's speakers or USB-type headset. You can also connect by telephone. If by phone, please expand the Audio section of the webinar console to select "Telephone" to see and enter the PIN number shown on there onto your telephone keypad.
- You can enter questions for today's event by typing them into the "Question Box" on the webinar console. We will pose your questions, as time allows, following the presentation.
- This webinar is being recorded and will be made available after the event on the CESA website at

[www.cleanenergystates.org/events/](http://www.cleanenergystates.org/events/)

# Thank You:

**Dr. Imre Gyuk**

U.S. Department of Energy,  
Office of Electricity Delivery and  
Energy Reliability

**Dan Borneo**

Sandia National Laboratories



# ESTAP is a project of CESA

Clean Energy States Alliance (CESA) is a non-profit organization providing a forum for states to work together to implement effective clean energy policies & programs:

- Information Exchange
- Partnership Development
- Joint Projects (National RPS Collaborative, Interstate Turbine Advisory Council)
- Clean Energy Program Design & Evaluations
- Analysis and Reports

CESA is supported by a coalition of states and public utilities representing the leading U.S. public clean energy programs.



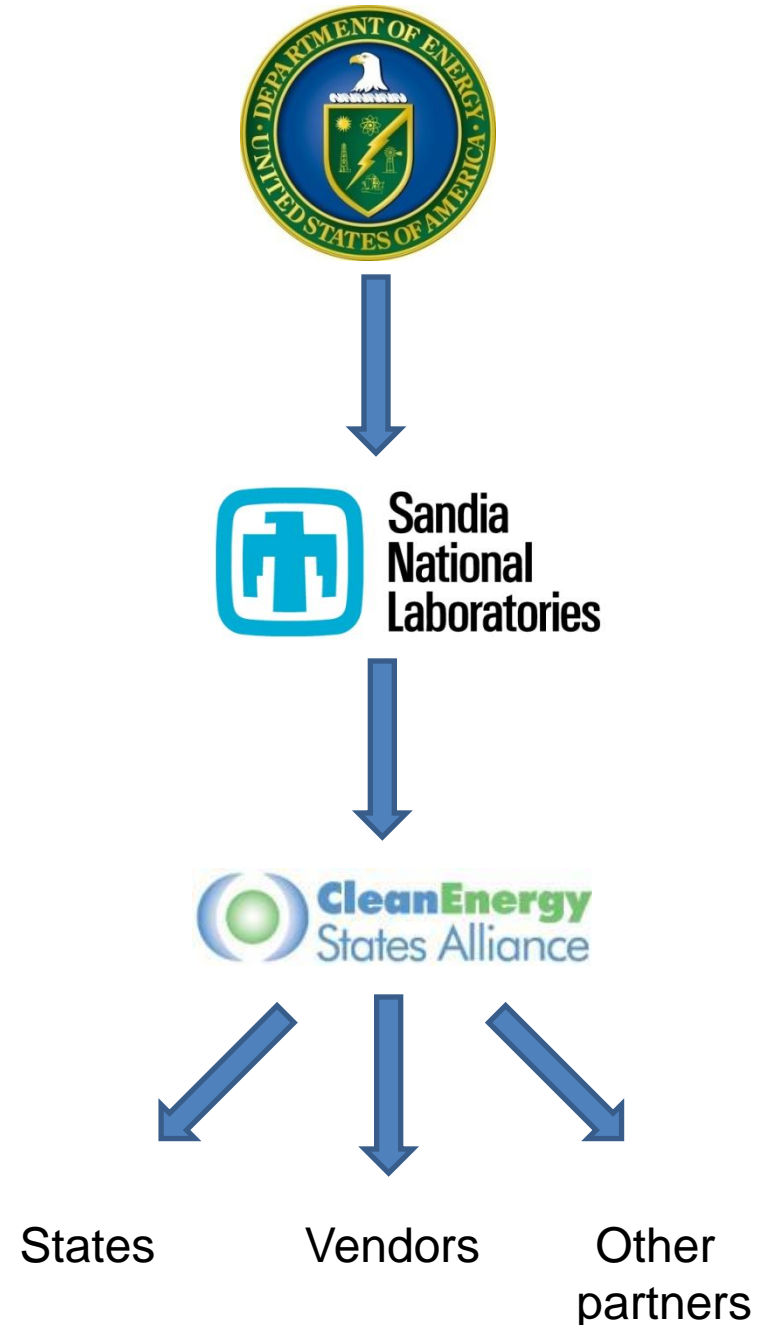
# ESTAP\* Overview

**Purpose:** Create new DOE-state energy storage partnerships and advance energy storage, with technical assistance from Sandia National Laboratories

**Focus:** Distributed electrical energy storage technologies

**Outcome:** Near-term and ongoing project deployments across the U.S. with co-funding from states, project partners, and DOE

\* (Energy Storage Technology Advancement Partnership)



# ESTAP Key Activities

- Disseminate information to stakeholders
  - ESTAP listserv >500 members
  - Webinars, conferences, information updates, surveys
- Facilitate public/private partnerships at state level to support energy storage demonstration project development
  - Match bench-tested energy storage technologies with state hosts for demonstration project deployment
  - DOE/Sandia provide \$ for generic engineering, monitoring and assessment
  - Cost share \$ from states, utilities, foundations, other stakeholders



# Contact Information

Project website:

[www.cleanenergystates.org/projects/energy-storage-technology-advancement-partnership/](http://www.cleanenergystates.org/projects/energy-storage-technology-advancement-partnership/)

CESA Project Director:

Todd Olinsky-Paul ([Todd@cleanegroup.org](mailto:Todd@cleanegroup.org))

Sandia Project Director:

Dan Borneo ([drborne@sandia.gov](mailto:drborne@sandia.gov))



# Today's Speakers

**Dan Borneo**, Sandia National Laboratories

**Imre Gyuk**, U.S. Department of Energy,  
Office of Electricity Delivery and Energy Reliability

**John Wood**, Ecoult

**Steve Willard**, PNM

Webinar recording will be available at  
[www.cleaneenergystates.org/events/](http://www.cleaneenergystates.org/events/)





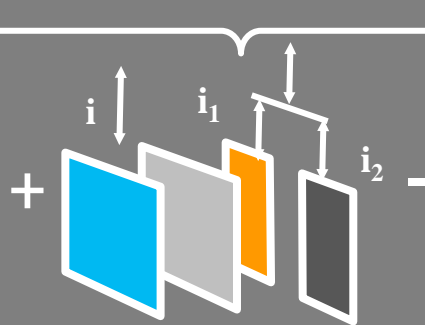
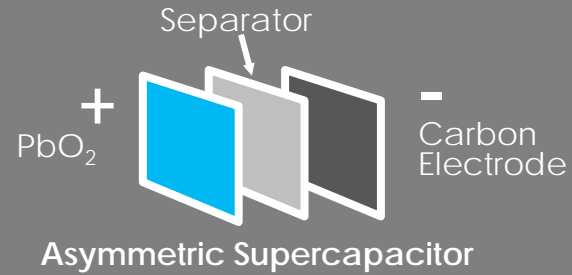
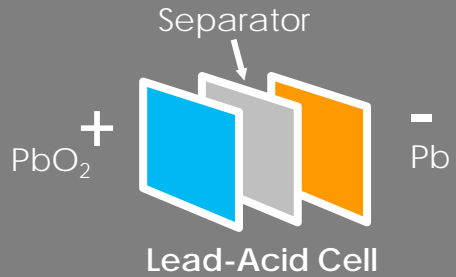
# Case Studies: MW Scale Energy Storage

Powered by Deka UltraBattery®



John Wood

## UltraBattery® Technology



# UltraBattery®



The New Dimension in a Lead Acid World

**Starter  
Battery**

Market Size:  
**\$15B**

**Motive  
Battery**

Market Size:  
**\$3.5B**

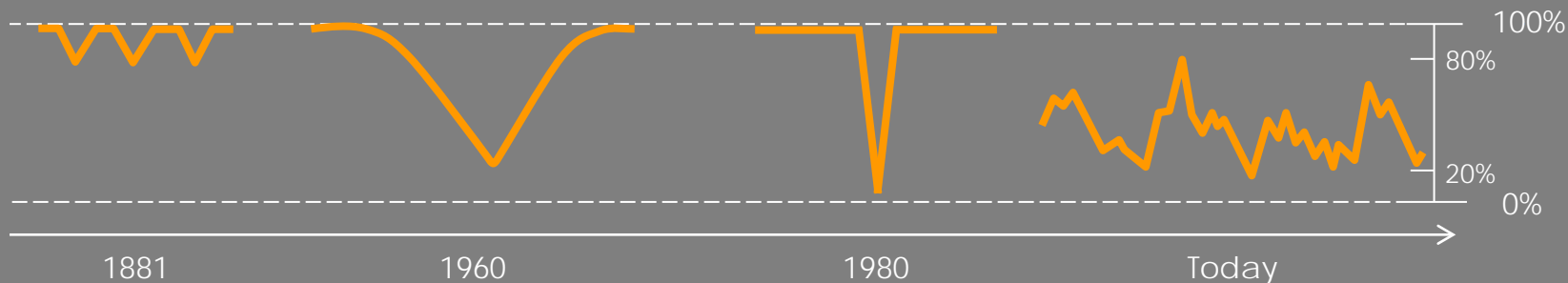
**Standby  
Battery**

Market Size:  
**\$6B**

**PSOC  
UltraBattery**

New Lead-Acid  
Market

State of Charge



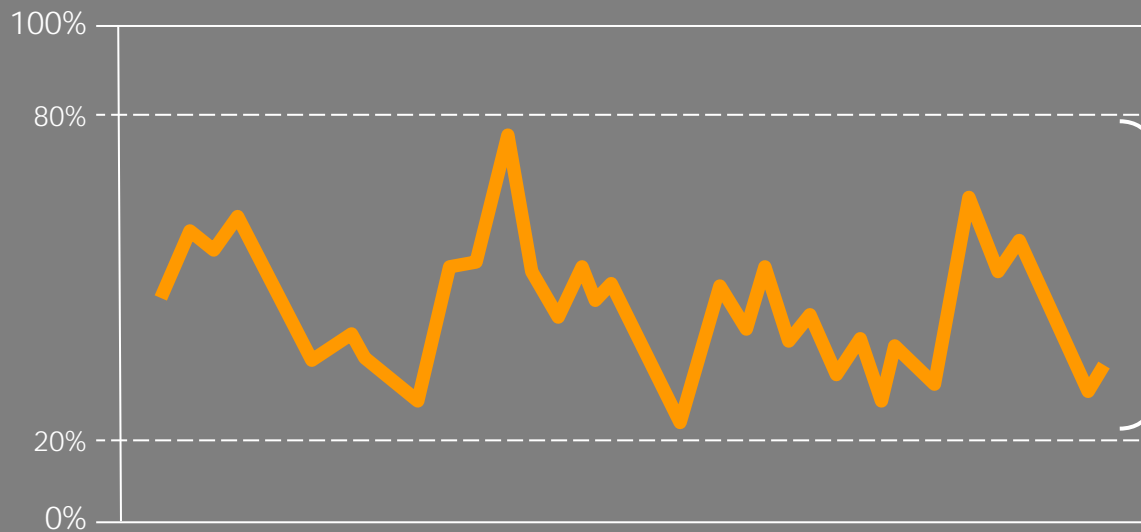
# UltraBattery®

The New Dimension in a Lead Acid World



## High Efficiency in Partial State of Charge Use

State of Charge



Lower Efficiency &  
higher rate of  
degradation

**UltraBattery®:**  
highly efficient &  
high longevity

**93% – 95%**  
**DC to DC**

Lower Efficiency and  
higher rate of  
degradation.

# Demonstration Projects



## Renewables Variability Management

Solar



Wind



## Grid Ancillary Services

Regulation Services



# PJM Frequency Regulation

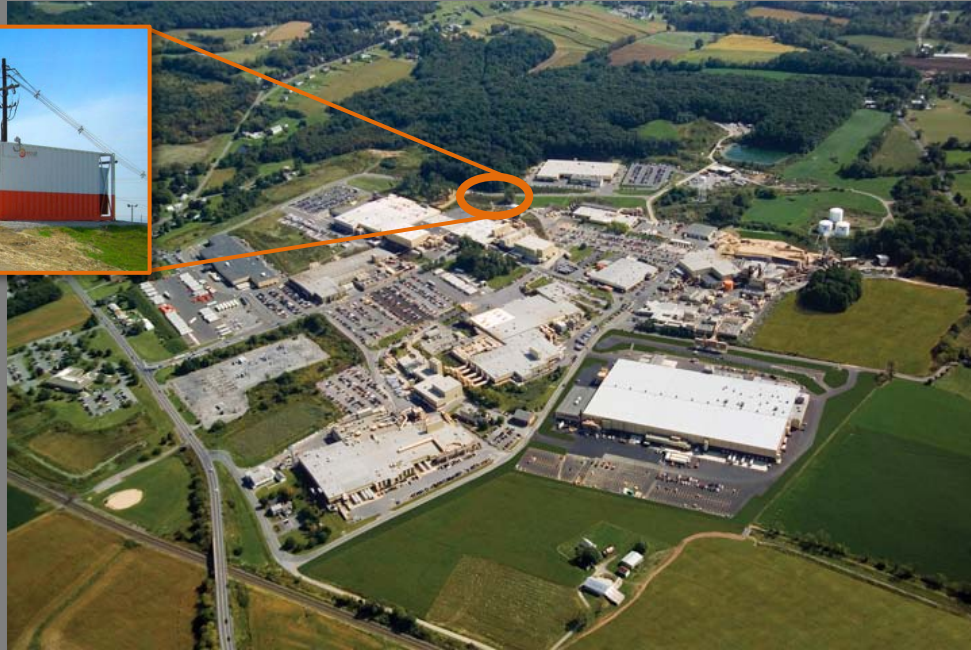
## Regulation Services





# PJM Frequency Regulation

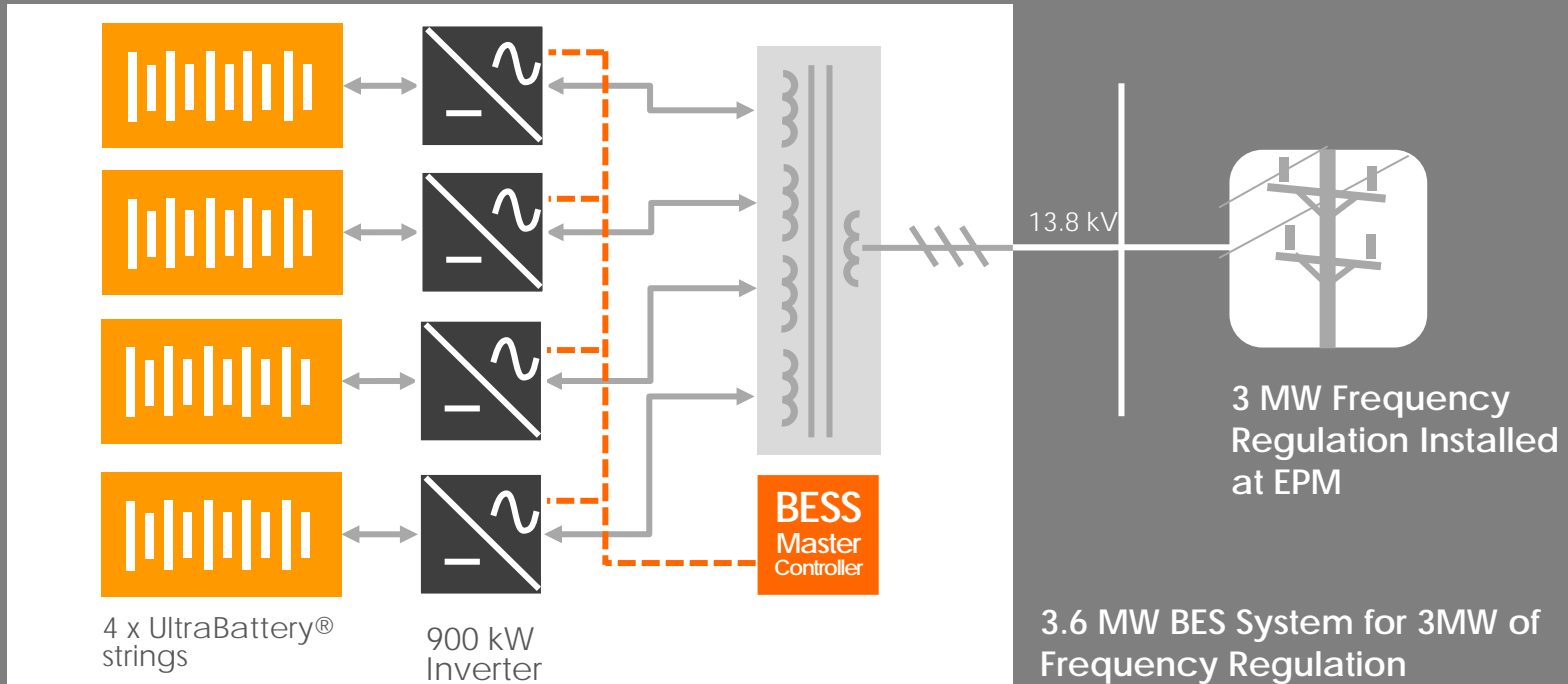
East Penn Manufacturing



# Electrical Single Line Diagram



PJM Frequency Regulation Project



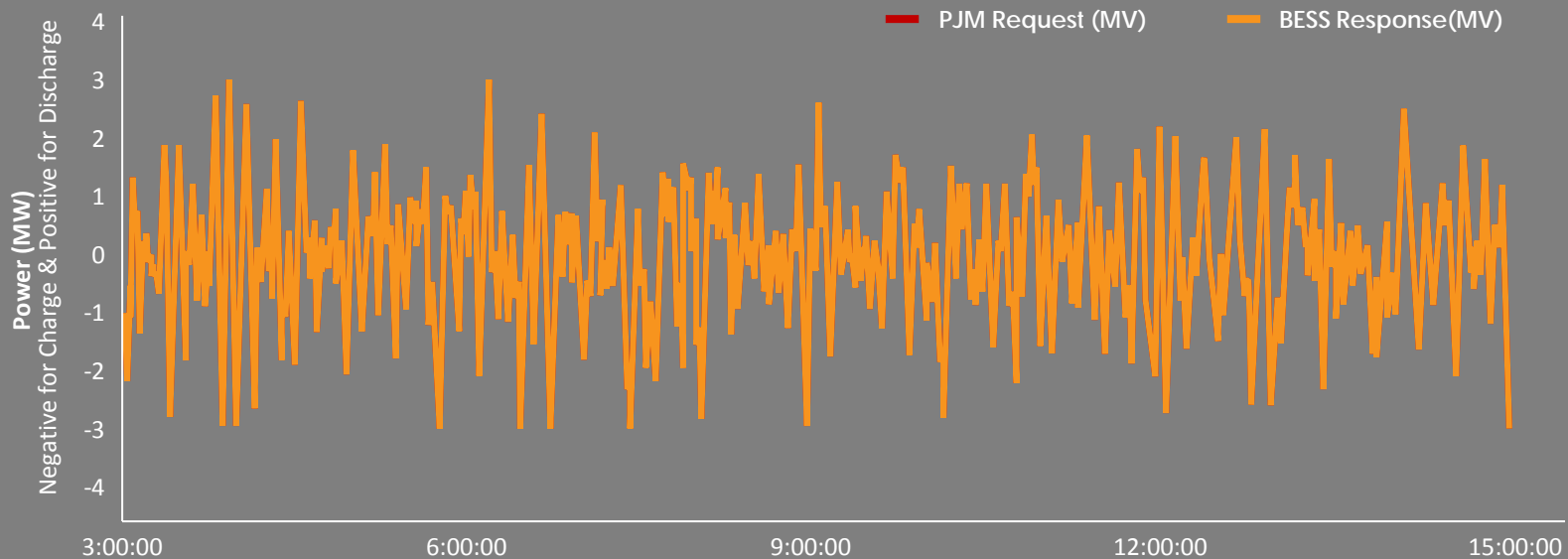


# Regulation Services on PJM

Accuracy of Signal



## PJM Request and BESS Response for Aug 30, 2012

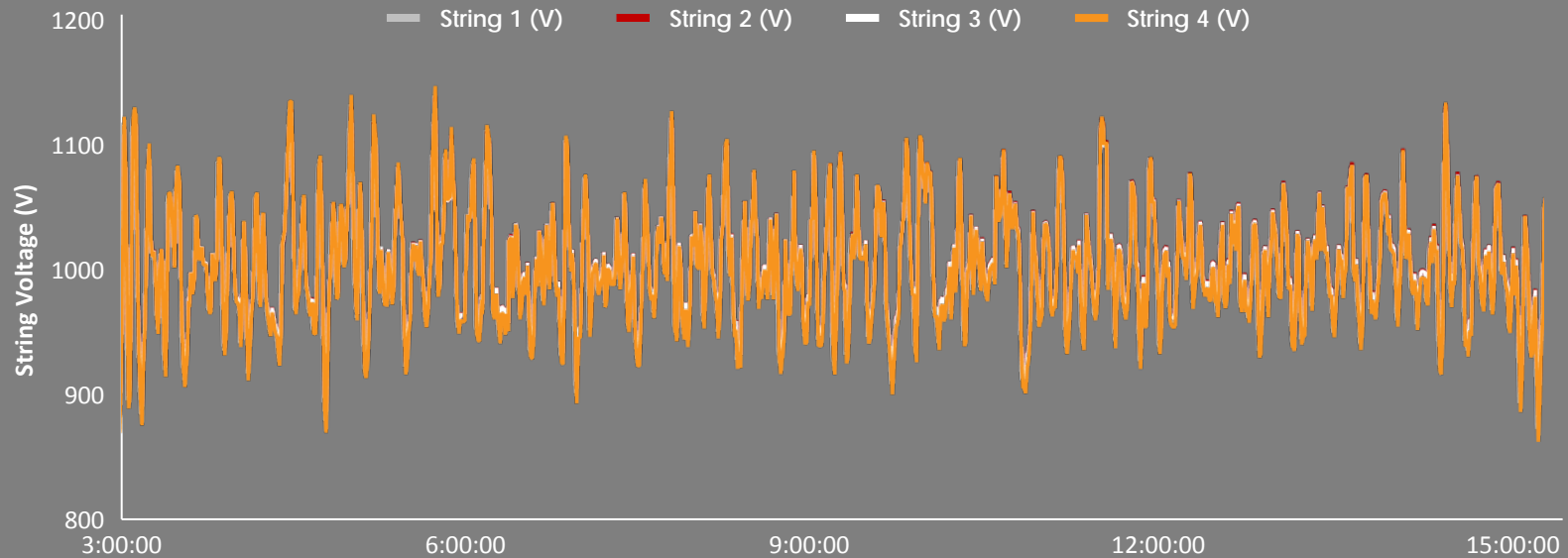


# Regulation Services on PJM

Voltage



## String Voltages – Aug 30, 2012

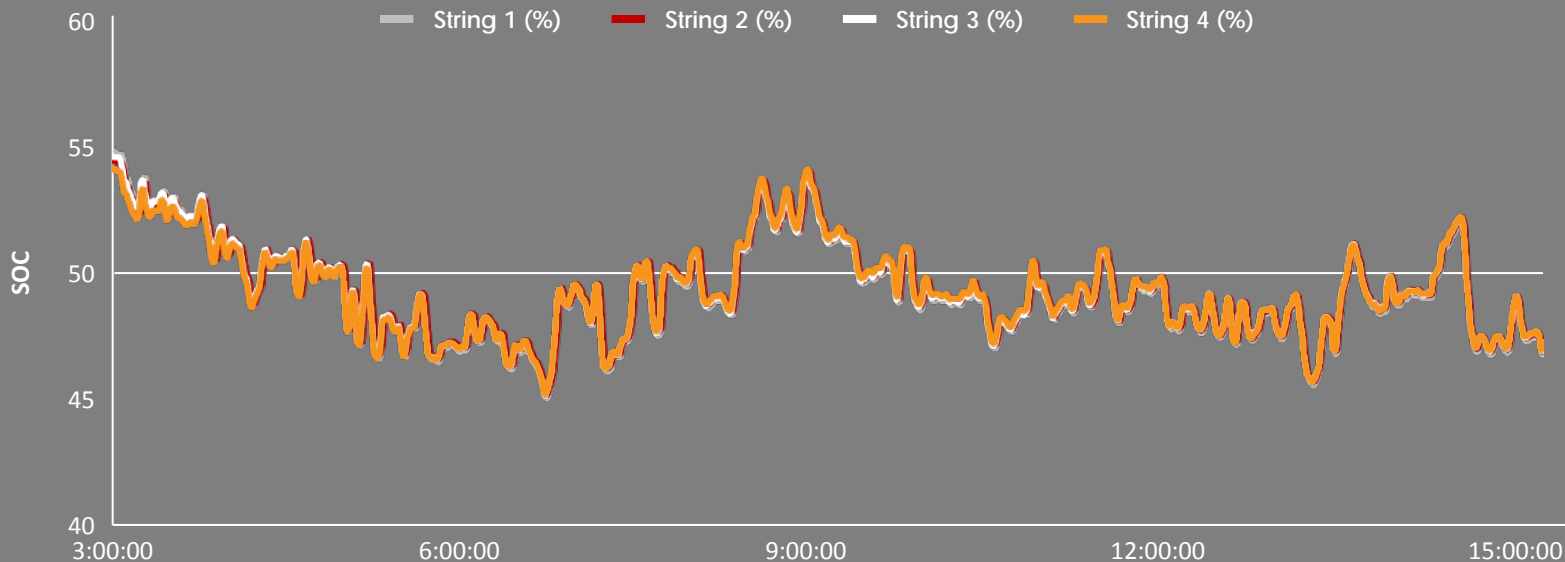


# Regulation Services on PJM

State of Charge



String SOC - Aug 30, 2012



# PJM System Performance



## PJM Energy Storage System – Power Rating

Energy (10 hr Rate - 100% Capacity)

**5.0 MWh**

Energy (Capacity at Rated Power - 100% Capacity)

**2.2 MWh**

Used Partial State of Charge Energy Band

**0.5 MWh**

Daily MWh Mileage (Charge + Discharge) per MW

**≈ 6.5**

Full Capacity Turnovers Per Day Normalized to 10 hr Rate

**≈ 4**

Total MWh Mileage (Charge + Discharge) to Date

**1.3 GWh**

Throughput for Last Week

**100 MWh**

Total Number of Hours of 1MW Regulation Service Supplied to PJM

**4930**

# PJM System Performance



## PJM Energy Storage System – Power Rating

Average Price Recently

≈ \$35/hr

Average PJM Score

≈ 96.90%

DC-DC Efficiency (Rate Dependent)

≈ 92%

AC-AC Efficiency

≈ 84%

Parasitic Losses

≈ 3%

Current Average Operational Availability (2 Days in 60 Allocated for Maintenance Activities)

≈ 96%

# Demonstration Projects



## Renewables Variability Management

Solar



Wind



## Grid Ancillary Services

Regulation Services



# PNM Prosperity Project

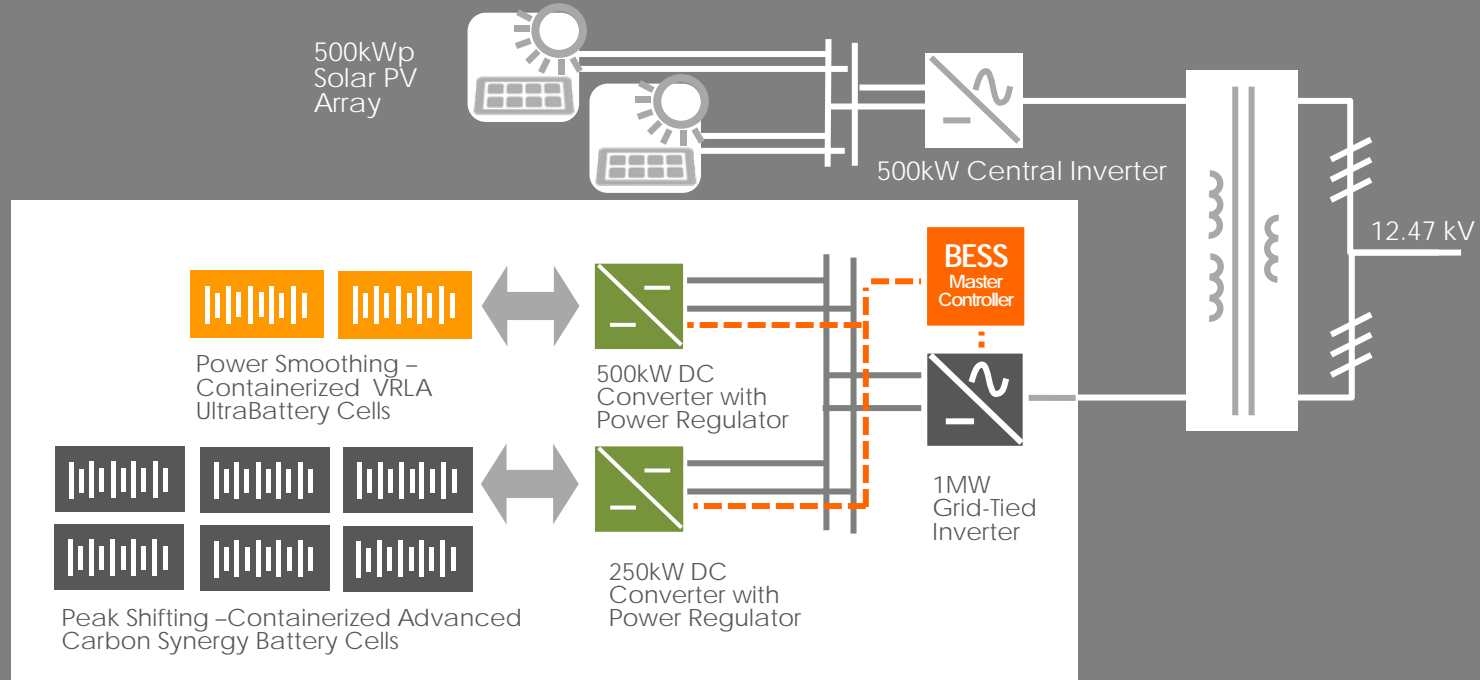
Solar Smoothing & Shifting/Firming



# Electrical Single Line Diagram



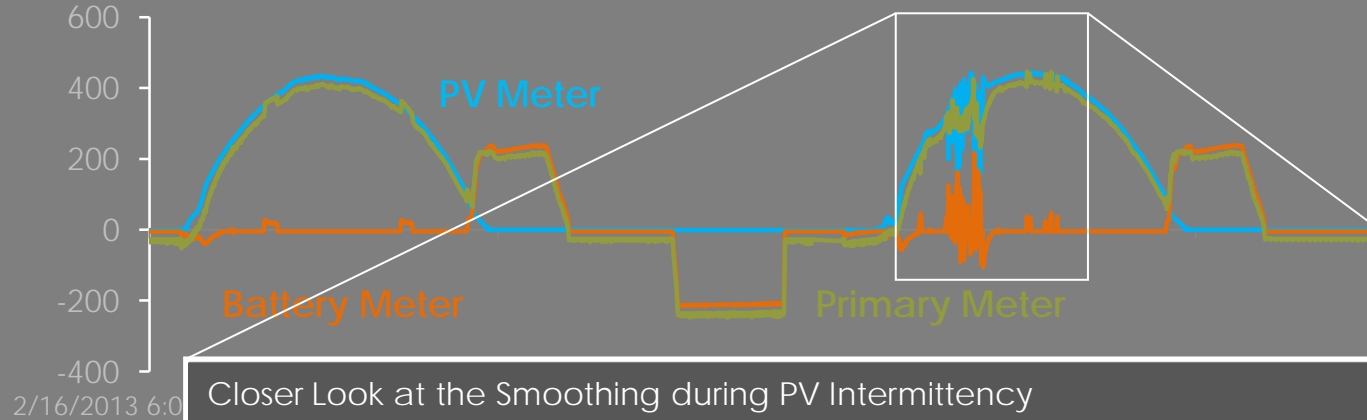
of PNM Prosperity Project Energy Storage System



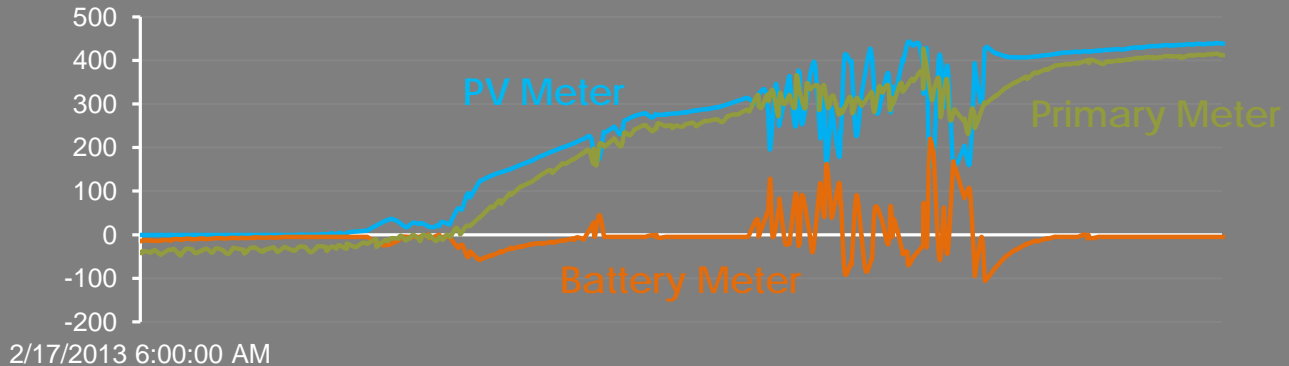


# Shoulder Shifting

## PNM Prosperity Project – PV Firming & Simultaneous Smoothing Example (Feb 2013)



### Closer Look at the Smoothing during PV Intermittency



# System Performance



## PNM Prosperity Project Energy Storage System

PNM Energy Storage System – Power Rating	Smoothing	Shifting
Energy (10 hr Rate - 100% Capacity)	1 MWh	3.0 MWh
Used Partial State of Charge Energy Band	300 kWh	1 MWh
Daily MWh Mileage (Charge + Discharge) per MW	≈ 0.2	≈ 0.5-1.0
Total MWh Mileage (Charge + Discharge) to Date	50 MWh	250 MWh
Throughput for Last Week	1.25 MWh	11 MWh

# Demonstration Projects



## Renewables Variability Management

Solar



Wind



## Grid Ancillary Services

Regulation Services



# Hampton Wind Farm

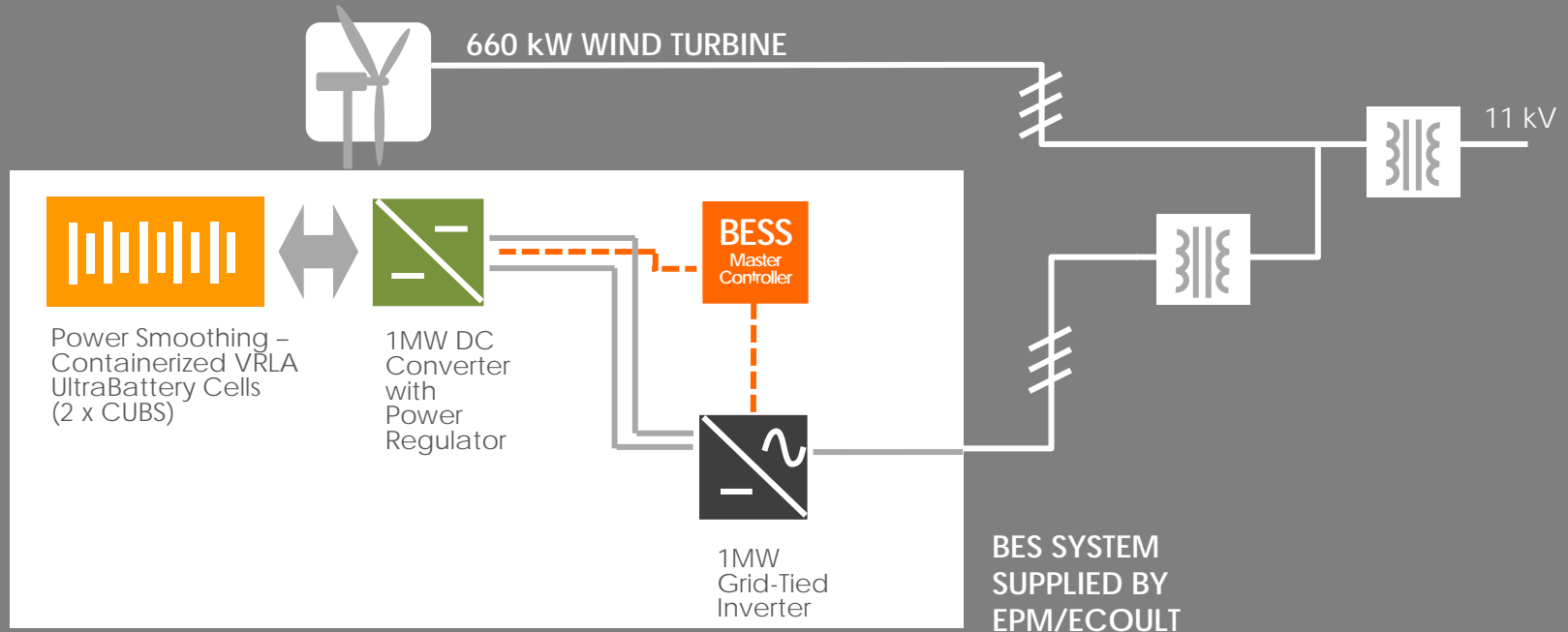
Wind Smoothing



# Electrical Single Line Diagram



Of Hampton Wind Farm Energy Storage System



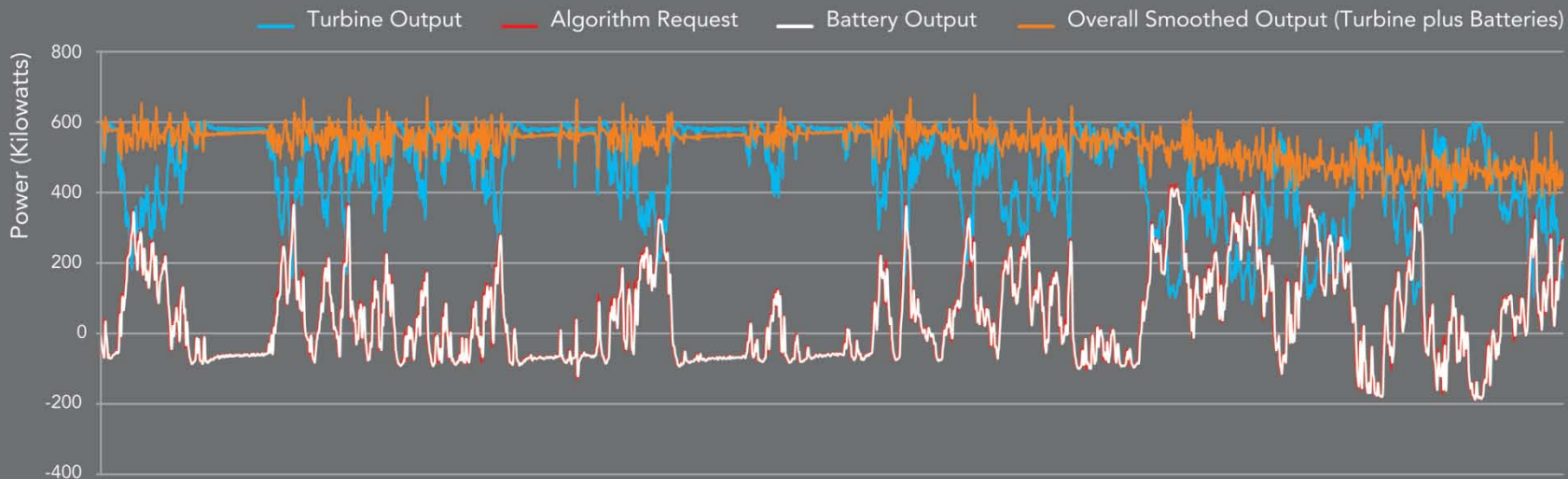
# Smoothing

Of Wind Output and Ramp Rate Reduction



## Hampton Wind Farm: Smoothing of Wind Power and Ramp Rate Reduction

28 September 2012



28/09/2012 10:42am

28/09/2012 11:31am

# Hampton System Performance



## Hampton Energy Storage System – Power Rating

Energy (10 hr Rate - 100% Capacity)

**1 MWh**

Energy (Capacity at Rated Power - 100% Capacity)

**500 kWh**

Used Partial State of Charge Energy Band

**400 kWh**

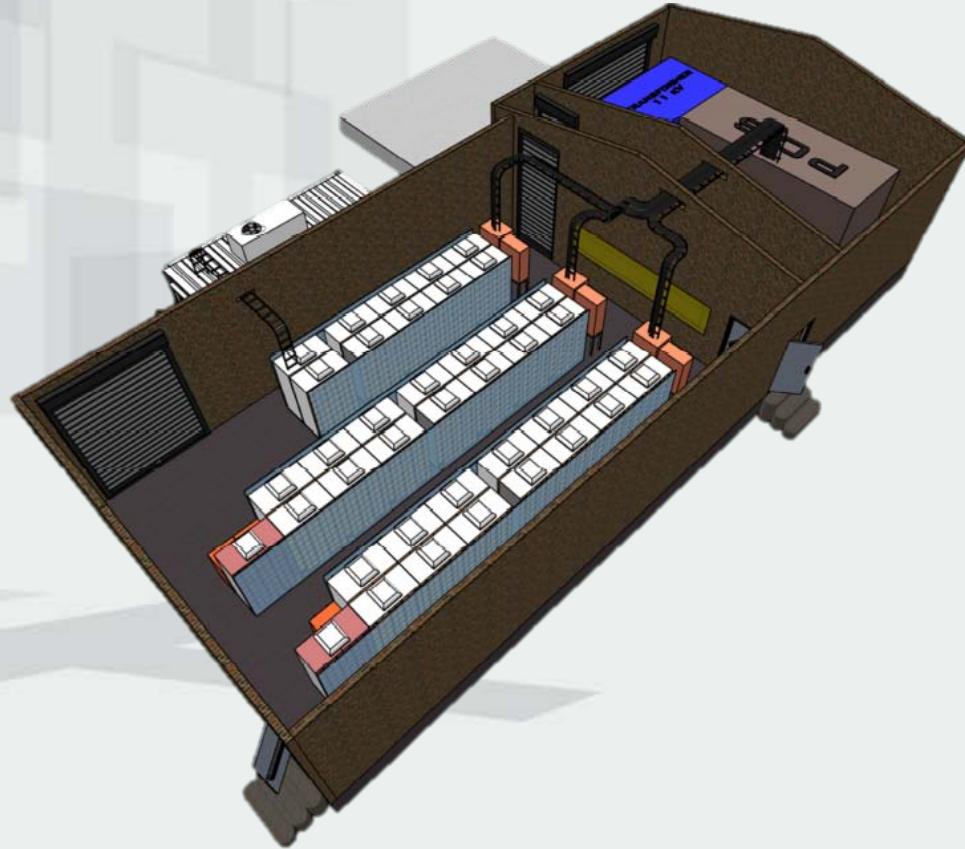


# Hydro Tasmania - KIREIP Project





# Hydro Tasmania - KIREIP Project

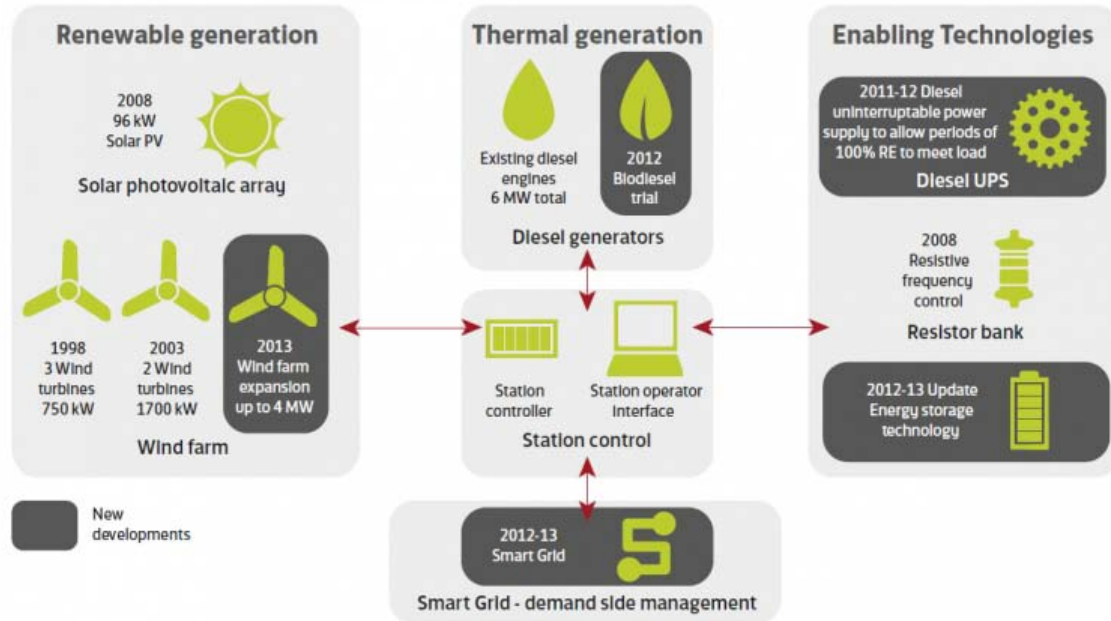


# Hydro Tasmania - KIREIP Project

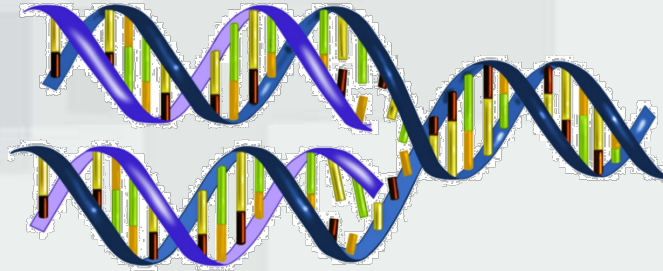


## King Island Renewable Energy Integration Project (KIREIP)

### Overview



# Dual Purpose

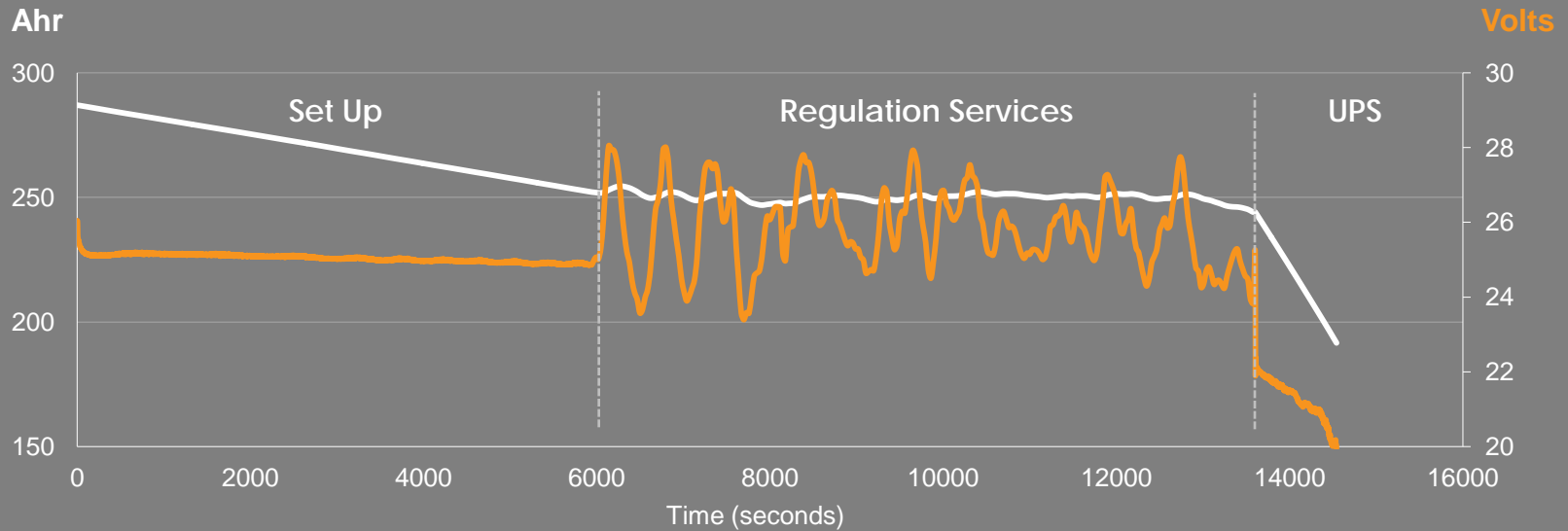


# Dual Purpose

## Test Results



### Ecoult UltraBattery® Test: Dual Purpose Regulation Services and UPS Event



# UltraBattery®



The New Dimension in a Lead Acid World

**Starter  
Battery**

Market Size:  
**\$15B**

**Motive  
Battery**

Market Size:  
**\$3.5B**

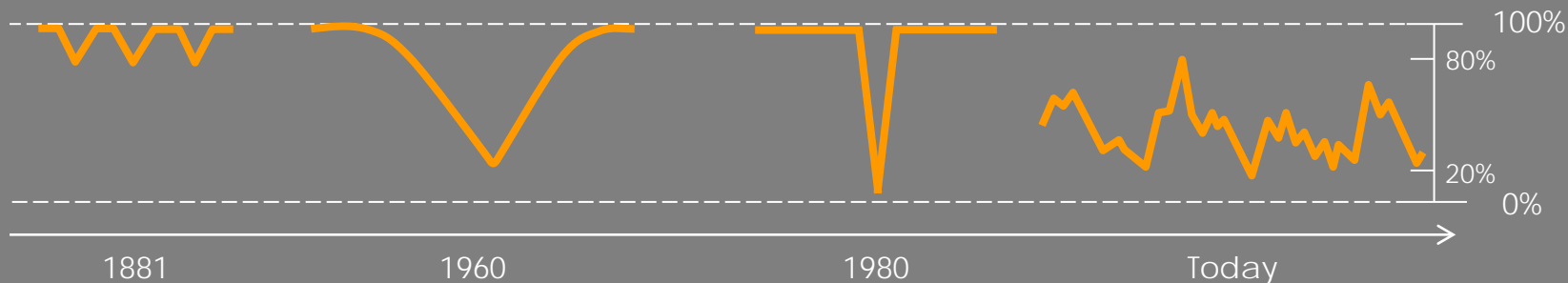
**Standby  
Battery**

Market Size:  
**\$6B**

**PSOC  
UltraBattery**

New Lead-Acid  
Market

State of Charge



# Thank You

John Wood, CEO Ecoul  
[www.ecoul.com](http://www.ecoul.com)

# Case Studies: MW Scale Energy Storage

Powered by Deka UltraBattery®



John Wood