

John Wood
Ecoult

Grid-Scale Energy Storage Demonstration for Ancillary Services Using UltraBattery[®]

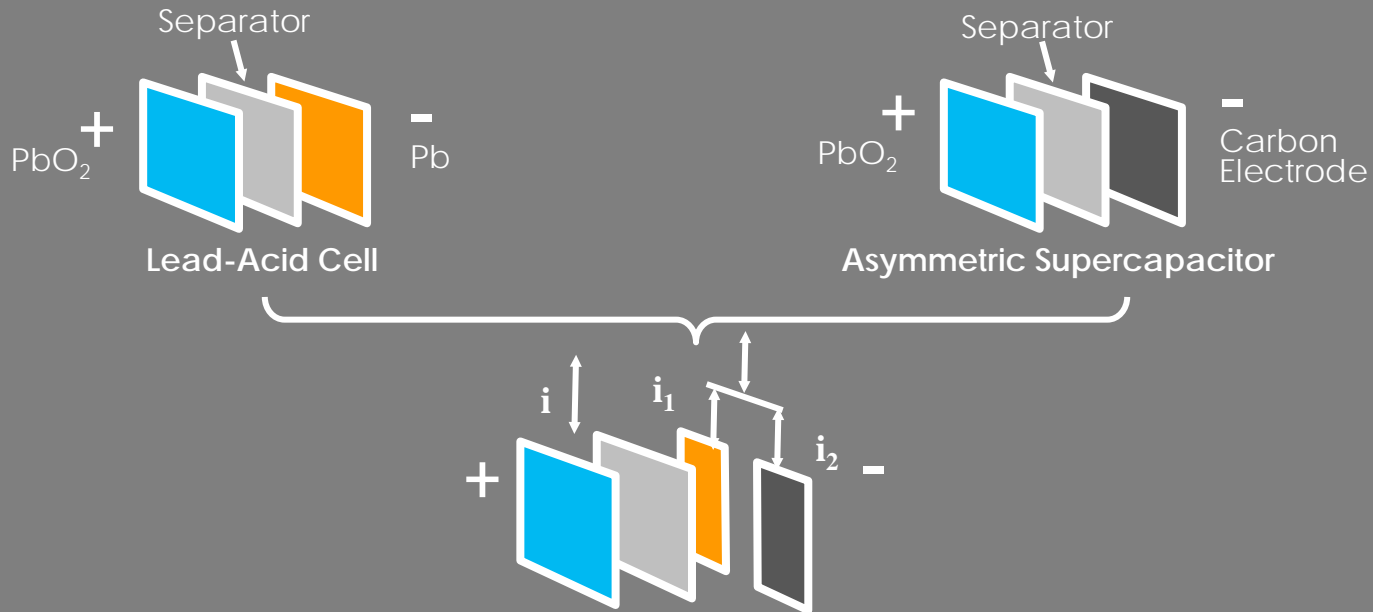
PJM Frequency Regulation



EAST PENN manufacturing co., inc.



UltraBattery® Technology



UltraBattery®

The New Dimension in a Lead Acid World



Starter
Battery

Market Size:
\$15B

Motive
Battery

Market Size:
\$3.5B

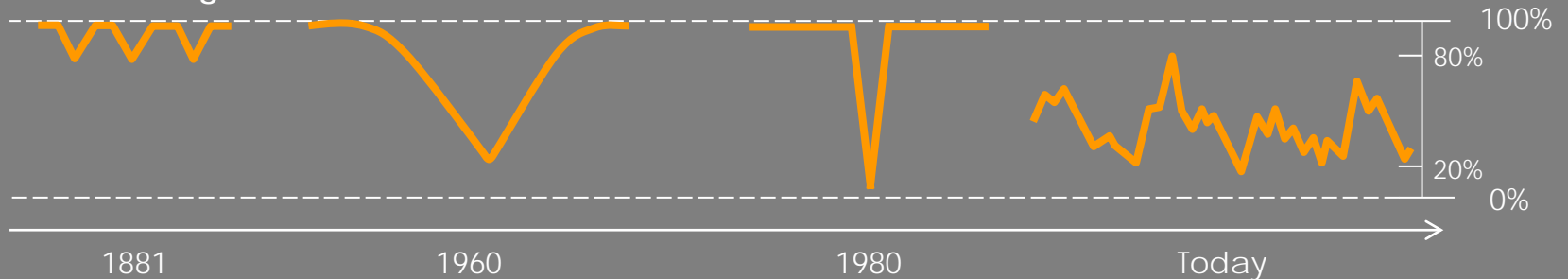
Standby
Battery

Market Size:
\$6B

PSOC
UltraBattery

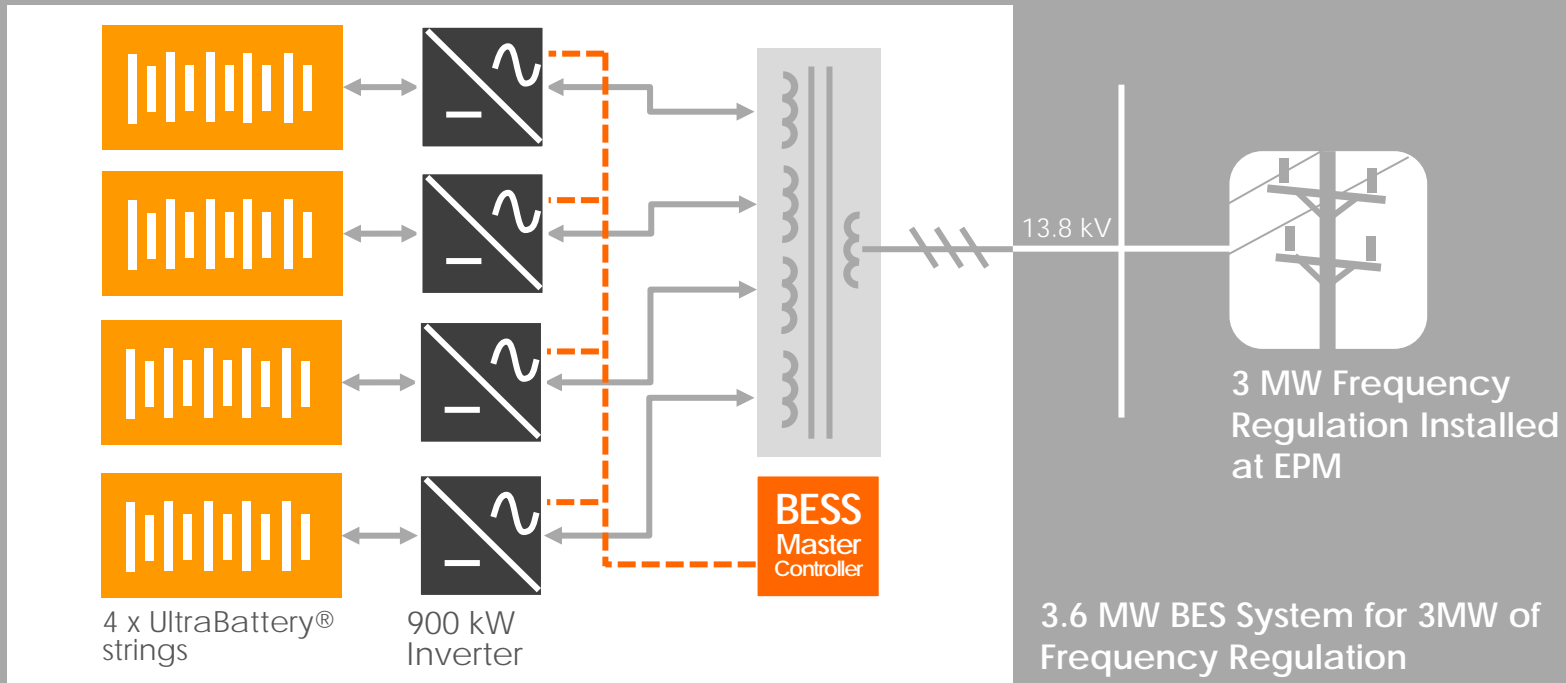
New Lead-Acid
Market

State of Charge



Electrical Single Line Diagram

PJM Frequency Regulation Project



Communications Framework



Secure Communications Framework

Control Interface RTU



BESS

System Control Processor

Master and Subsystem
Controllers

UltraBattery®
Storage Blocks



Battery Management
and Monitoring System

*BMM feeds back:
Temperature
State of Charge
Voltage*

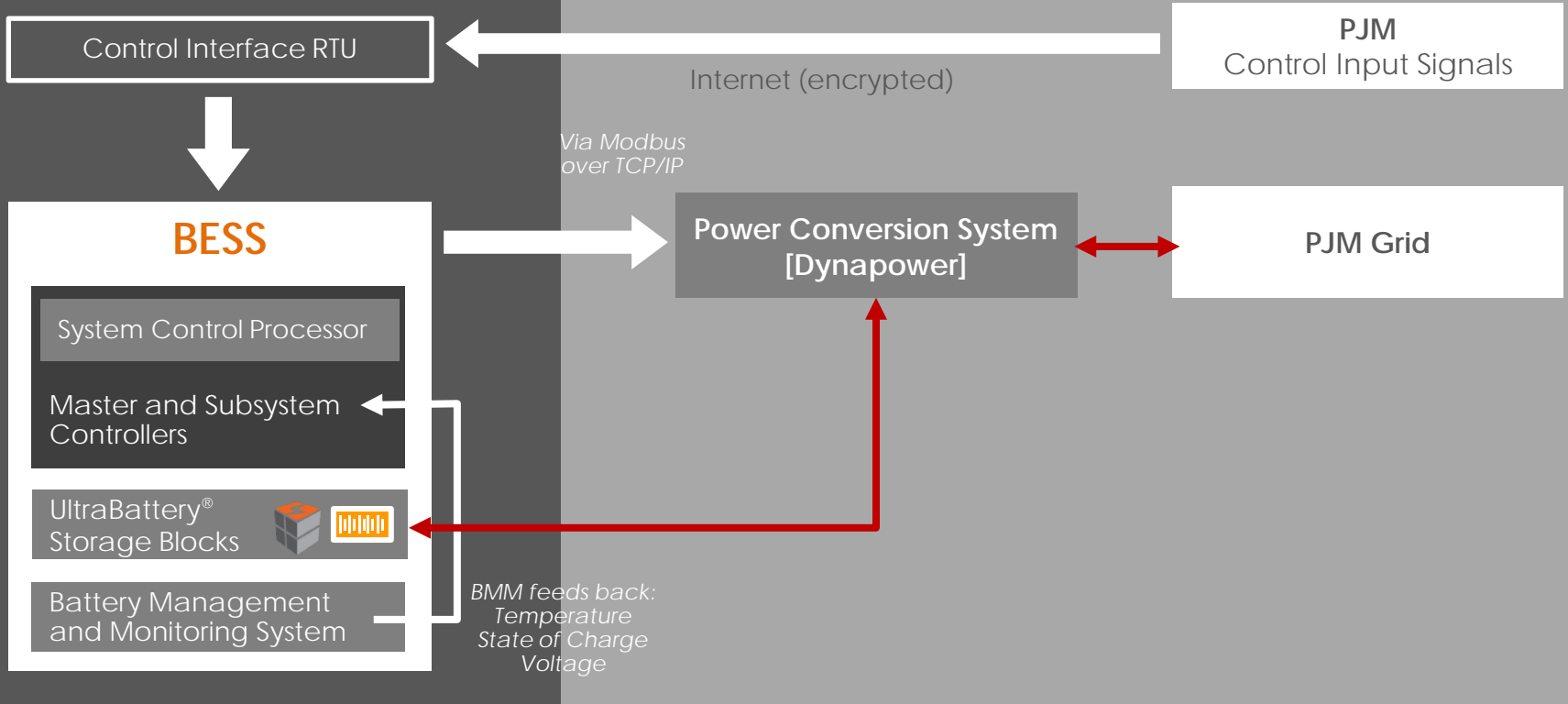
Internet (encrypted)

*Via Modbus
over TCP/IP*

Power Conversion System
[Dynapower]

PJM
Control Input Signals

PJM Grid



Commissioned on 15 June 2012



Operation Update



Staged Introduction



Observed Runs of 8, 16, and 24 hours at various power levels, including full 3MW rating

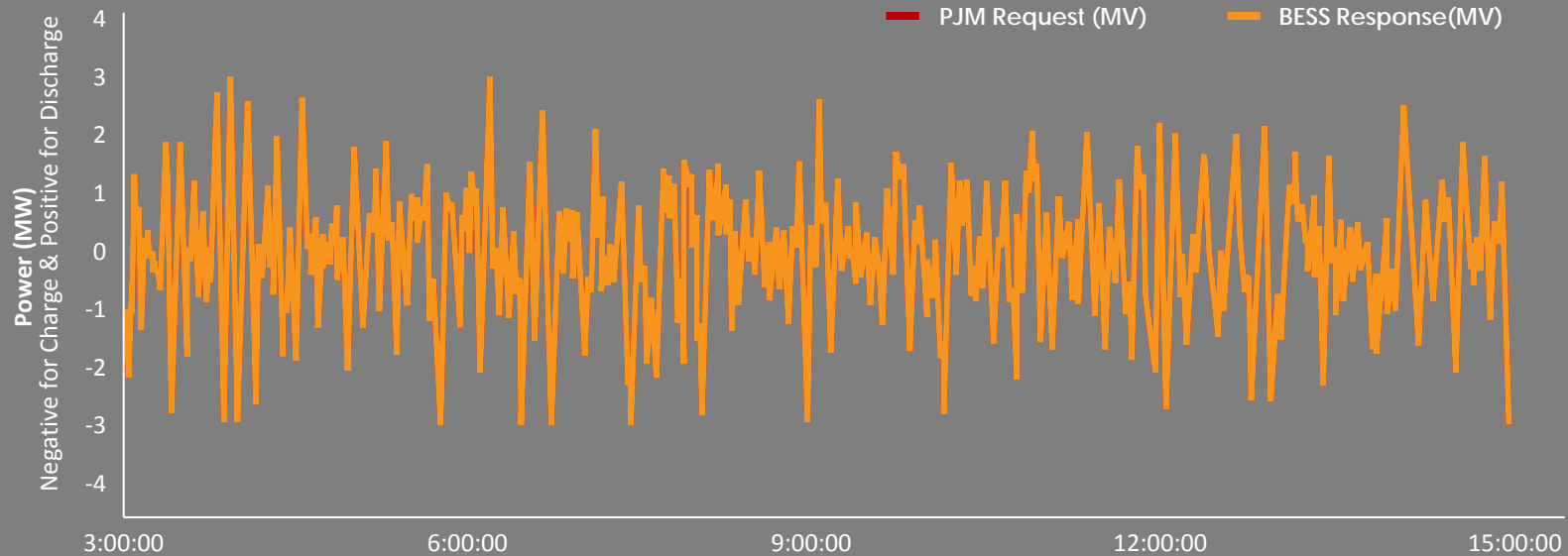


Bidding into PJM open market

Accuracy of Signal



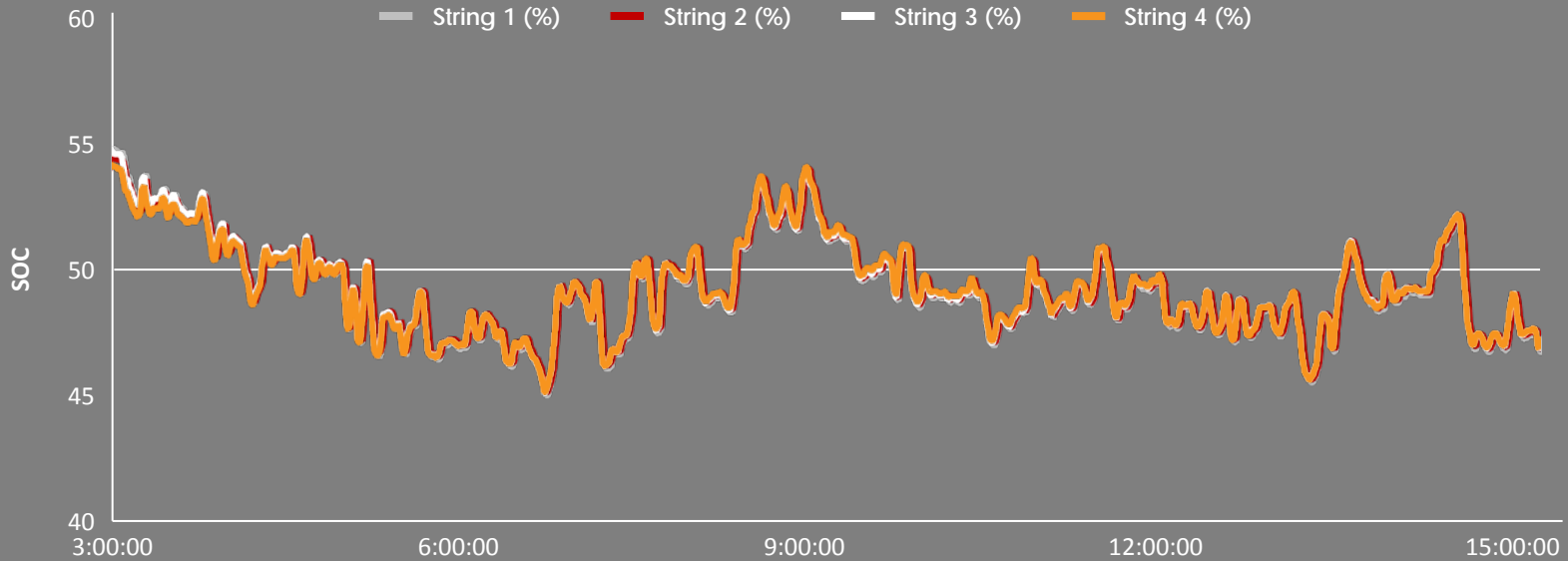
PJM Request and BESS Response for Aug 30, 2012



State of Charge



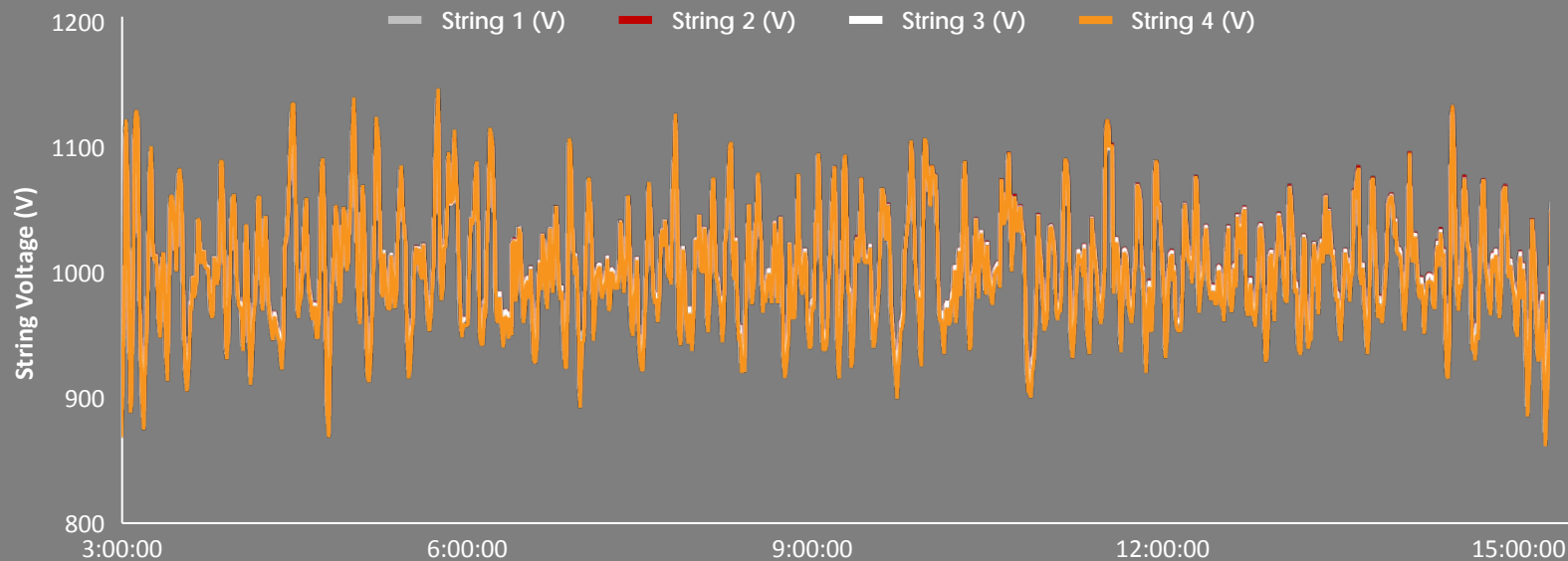
String SOC - Aug 30, 2012



Voltage



String Voltages – Aug 30, 2012



Next Steps



Accelerated characterization testing still continuing – capacity still at 100%

Tuning algorithms and SoC management

Optimising airflow for consistency of temperature across stacks

Continuous operation with Flexible Bid Strategy

Ecoult and UltraBattery®

The Energy Storage Solution of Choice



THANK YOU

John Wood

CEO Ecoult

john.wood@ecoult.com

Jeff Seasholtz

Project Manager

jseasholtz@eastpenn-deka.com

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