



**ENERGY  
NORTHWEST**

**John Steigers – Generation Project Developer**  
**Modular Energy Storage System**  
**Demonstration Project**

# Energy Northwest

- Joint Operating Agency – Established 1959; Richland WA
- At-cost provider of services and aggregated generation resources to 27 Public Power Member Utilities in WA State
- Owns and/or operates over 1,300 megawatts of nuclear, hydroelectric, and wind generation assets for public power
- Current development efforts underway include natural gas combined cycle, wind, small modular nuclear, photovoltaic solar, demand response, and distributed energy storage

# Modular Energy Storage Demonstration

- (1) Hardware ESS; Multiple Units Modeled
- Confirm Technical Performance Under Field Conditions
  - Intermittent Resources (Renewables)
  - Distribution System Support
  - Commercial/Industrial Support (“Behind the Meter”)
- Validate Operability, Reliability, and Durability
- Establish Basis for Value Proposition; Multiple Applications

# Demo Project Partners

**Powin Energy** – ESS Developer, Designer, and Manufacturer.  
Project Lead and Primary Funding; Contributes Equipment,  
Engineering, and Technical Support

**Energy Northwest** – Intermittent Resource Site Host

**City of Richland** – Distribution System Support Site Host

**Pacific Northwest National Laboratory** (PNNL) – Industrial &  
Commercial Site Host ; Control; Data Collection & Analyses

**Bonneville Power Administration** (BPA) System Characterization

# Powin Energy Inc. Modular Energy Storage System (ESS)

- Subsidiary of Powin Corporation of Tualatin OR
- Lithium-Ion Battery Storage Based
- Portable, Modular, Scalable
- Standard 20-foot Shipping Container



# Battery Energy Storage System

- 120 kW Charge/Discharge & 500 kWh Storage Capacity
- Self-Contained; Converters, Battery Management, Communications, and Environmental
- 480v<sub>AC</sub> 3-Phase Connection
- Cycle Efficiency 85(+) Percent
- Web-Based Control/Monitoring
- UL 1741 and IEEE 1547 Compliant



# Phase I – ESS Testing/Characterization

BPA's Ross Medium Voltage Test Facility; near Vancouver WA

Accomplished comprehensive testing/evaluation program under Energy Storage Test Protocols developed by PNNL

Confirmed performance parameters, including maximum charge/discharge rates (147/135 kW) and energy storage capacity (614 kWh)

Evaluated performance under multiple potential applications: Peak Shaving, Frequency Regulation, and Oscillation Damping

Identified incremental improvements for converter programming, environmental controls, and transport mobility

Phase I deployment completed in March 2013



## Phase I – ESS Testing/Characterization





# Phase II – Nine Canyon Wind Project

Near Kennewick WA; 67 turbines in 3 phases; 96 MW capacity

Identify benefits and challenges of operating with energy storage assets

Successfully demonstrated specific application focus areas

- Load Shifting – Use Case 1
- Manage to Schedule – Use Case 2
- Ramp Rate Management – Use Case 3

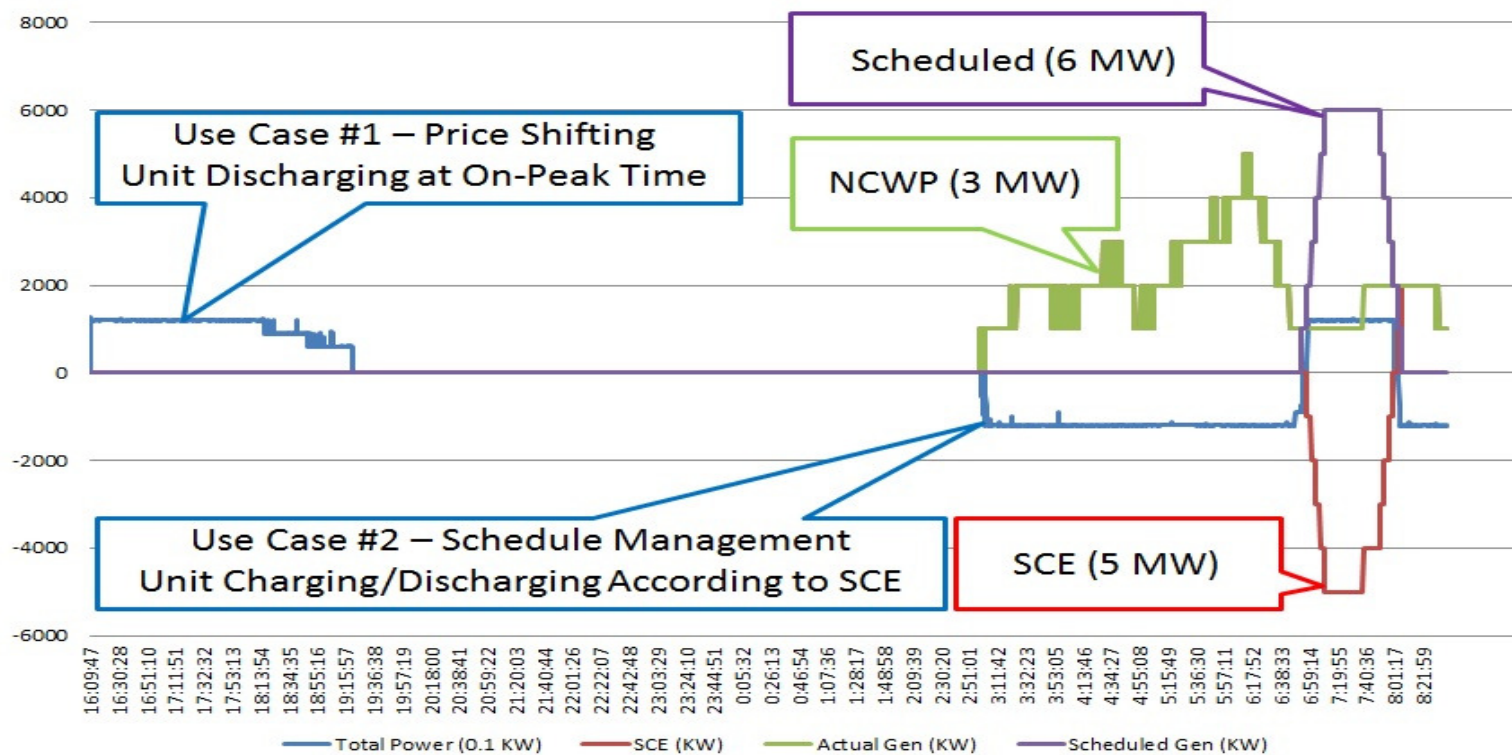
Phase II deployment completed in September 2013

## Phase II – Nine Canyon Wind Project



# Phase II – Nine Canyon Wind Project

Data From 16-17 October 2013



# Phase III – First Street Substation

City of Richland; 115/13.8kV; (2) LTC Transformers; (10) Distr. Feeders

Successfully demonstrated specific application focus areas

- System Peak Shaving – Use Case 4
- Use Cases 1, 2, and 3
- Automated real-time use case prioritization and dispatch

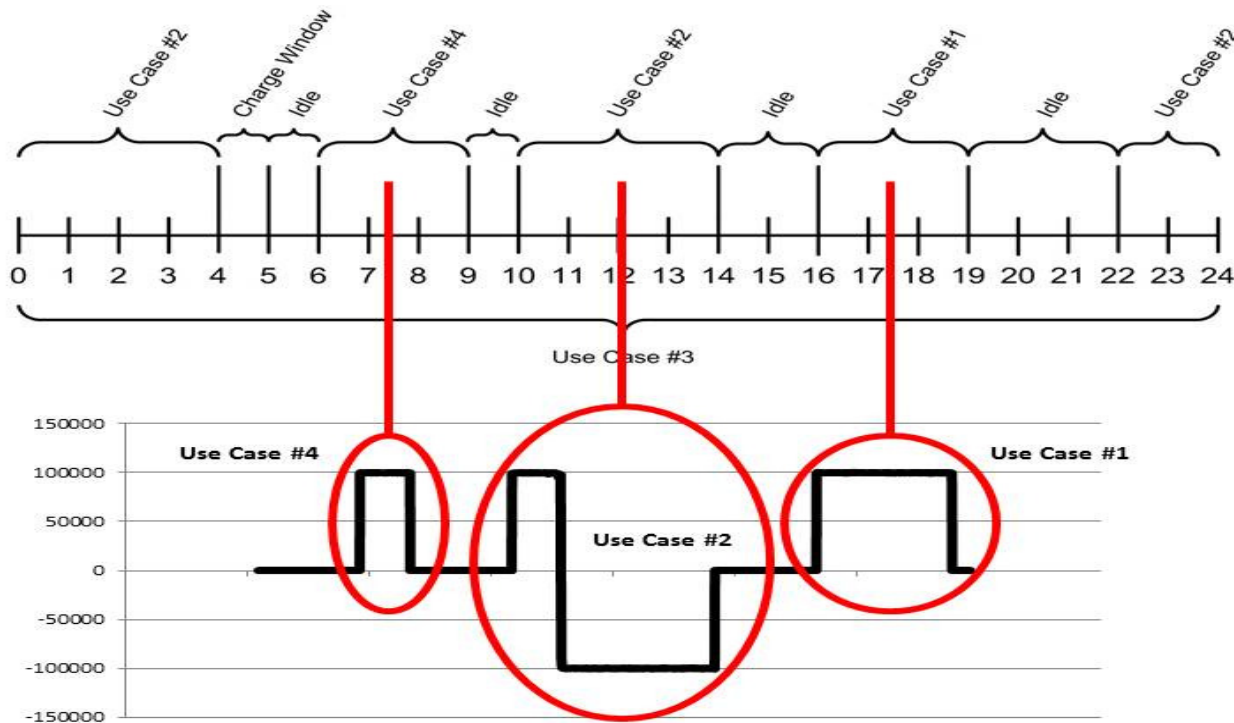
Phase III deployment completed in May 2014



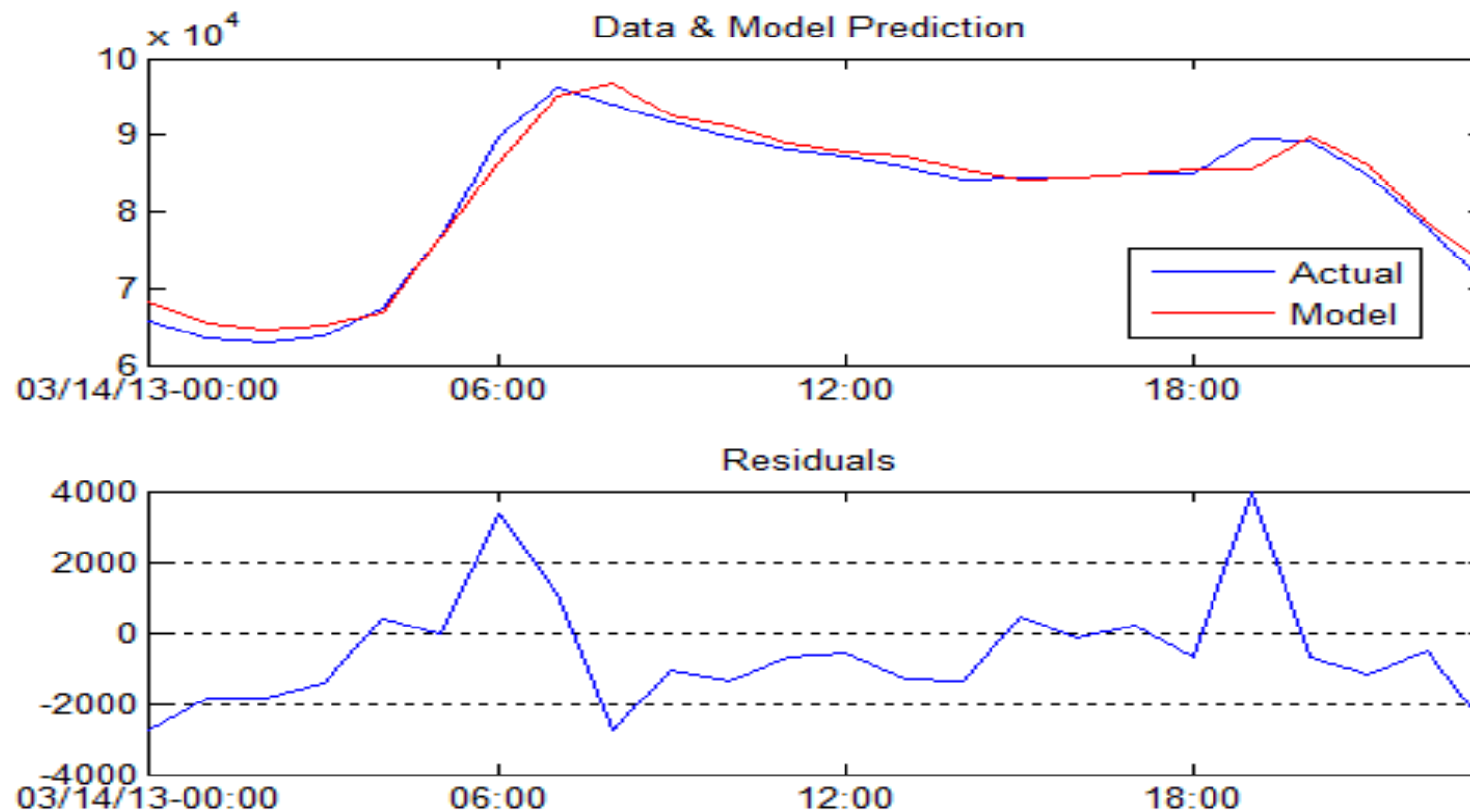
# Phase III – First Street Deployment



# Phase III – Automated Dispatch/Control



# Phase III – System Load Prediction Model





# Phase IV – PNNL Richland Campus

Federal national laboratory (Battelle NW & DOE); complex of offices, research/development, and support facilities; approximately 10 MW load; a commercial/institutional “behind the meter” deployment of the ESS

Expected focus applications are load shaping of on-site solar facility, peak load management, and support of and integration into multiple ongoing smart grid projects.

Project will continue to support Use Cases 1 – 4, further refining ESS tasking prioritization and dispatch methods.

Currently underway; Phase IV completion, and end of project, anticipated in September 2014

# Phase IV – PNNL Richland Campus



# Modular Energy Storage System Demonstration Project

## Questions/Comments/Suggestions?

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