



# Standards for Facilitating Grid Integration

*Isolated Power Systems  
Connect Conference*

**Cordova, AK  
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Sr. Technical Advisor

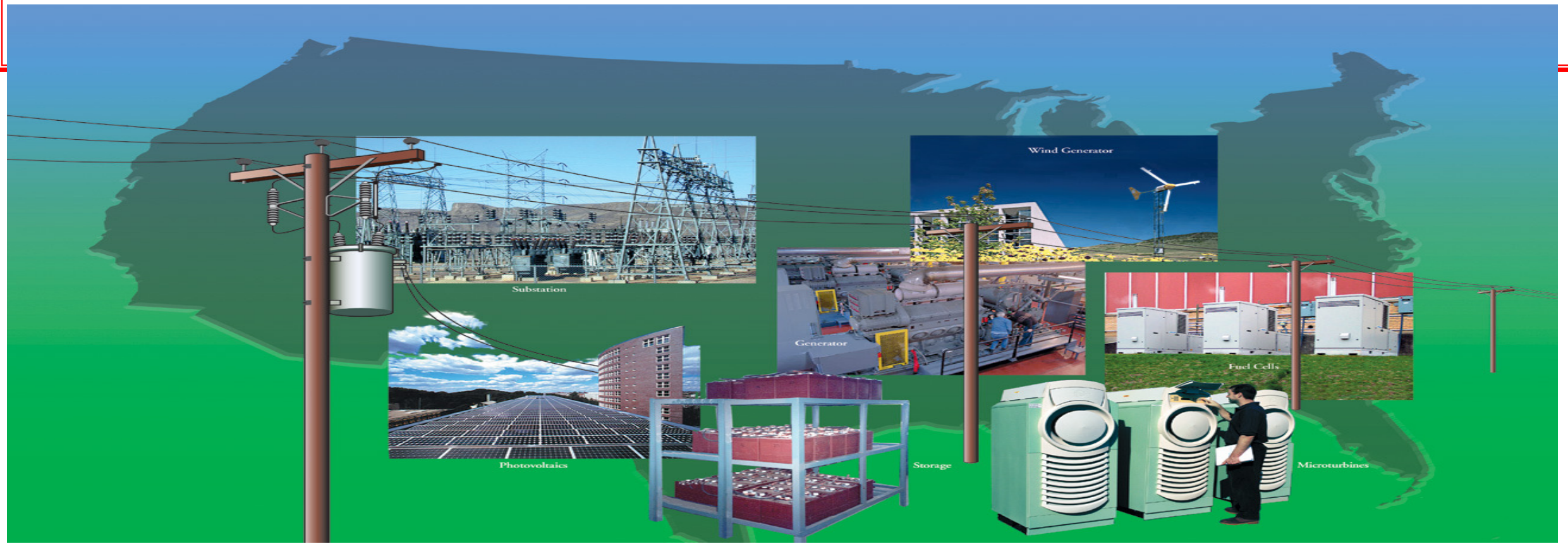


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# Legislation & Policy Driving Clean Tech Adoption

- Energy Policy Act (2005) Cites and requires consideration of IEEE 1547 Standards and Best Practices for Interconnection; all states use or cite 1547.
- Energy Independence and Security Act (2007) IEEE cited as a standards development organization partner to NIST as Lead to coordinate framework and roadmap for Smart Grid Interoperability standards and protocols {IEEE 1547 & 2030 series being expanded};



# Avoiding Barriers to Clean Tech Adoption

Category	Storage "End Use"
ISO/Market	<ul style="list-style-type: none"> <li>• Frequency regulation</li> <li>• Spin/non-spin/replacement reserves</li> <li>• Ramp</li> <li>• Black start</li> <li>• Real time energy balancing</li> <li>• Energy price arbitrage</li> <li>• Resource adequacy</li> </ul>
VER Generation	<ul style="list-style-type: none"> <li>• Intermittent resource integration: wind (ramp/voltage support)</li> <li>• Intermittent resource integration: photovoltaic (time shift, voltage sag, rapid demand support)</li> <li>• Supply firming</li> </ul>
Transmission/ Distribution	<ul style="list-style-type: none"> <li>• Peak shaving: off-to-on peak energy shifting (operational)</li> <li>• Transmission peak capacity support (upgrade deferral)</li> <li>• Transmission operation (short duration performance, inertia, system reliability)</li> <li>• Transmission congestion relief</li> <li>• Distribution peak capacity support (upgrade deferral)</li> <li>• Distribution operation (Voltage Support/VAR support)</li> <li>• Outage mitigation: micro-grid</li> </ul>
Customer	<ul style="list-style-type: none"> <li>• Time-of-use /demand charge bill management (load shift)</li> <li>• Power quality</li> <li>• Peak shaving (demand response), Back-up power</li> </ul>

1547-2003 vs. new CA 21 & 1547Revision



Source (original table): CA PUC Staff, AB2514 workshop, 3/25/2013



# DOE OE ES Reliability C&S Program Activity, Filling Gaps in Standards for Clean Tech

## Technical Standards Development Activities Supported by OE ES

- IEEE P2686 Battery Management System (BMS) Recommended Practice, *Rosewater, Searles*
- IEEE P2688 Energy Storage Management System (ESMS) Recommended Practice, *Schoenwald, Nguyen, Searles*
- IEEE P1679.3 Adv. Battery Characterization Guide (Flow battery volume), *Viswanathan*
- IEEE 2800 Inverter Based Resources Standard, *Elizondo*
- IEC TC-120, *N. American rep, Viswanathan*
- MESA Specifications, Testing & Certification program, *Kolln*
- SAE/IEEE, Coordinating IEEE 1547 and Emerging V2G Standards, *Asgeirsson*
- (future) NERC Gen. Availability Data System (GADS), update for large BESS, *Labs, EPRI*
- IEEE 1547 DER Interconnection Standard Revision project plan approved, *Vartanian, Schneider*
  - ✓ *This significant new IEEE Standard activity will begin early in 2023*

## ES Technical Standards or References Created or Updated

- **IEEE 1547.9 Guide for ES Interconnection completed**, *Ropp, Vartanian*
- MESA-DER Certification testing procedure completed, *Kolln*

# PNNL Energy Storage R&D Program

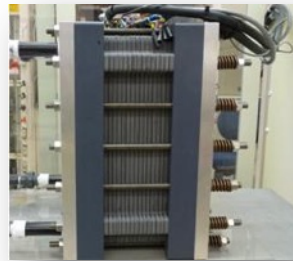


# Grid Storage Efforts at Pacific Northwest National Laboratory (PNNL)



## Cost Competitive Technologies

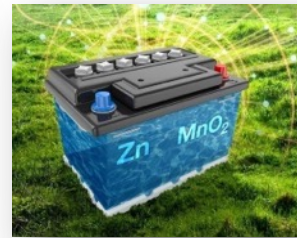
Redox Flow



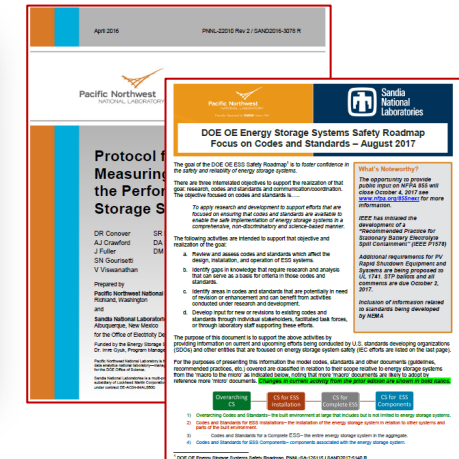
Sodium



Zn-MnO<sub>2</sub>



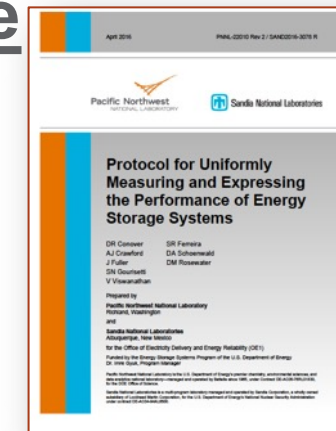
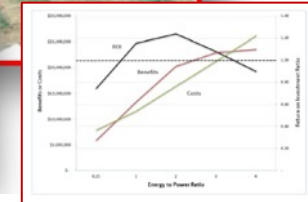
## Safety and Reliability



## Regulatory Support



## Industrial Acceptance



# Cordova Electric Coop Energy Storage Integration (CECESI) Project Objective & Expected Outcomes

- Cordova Electric Cooperative installed a 1MW/1MWh battery energy storage system (BESS) in 2019 with a primary objective of reducing diesel fuel consumption
- To support the BESS's primary objective, the CECESI project will:
  - further improve integration of the BESS into CEC's utility monitoring and controls environment,
  - support CEC's use of recorded operating data to verify the benefits from BESS operation, and
  - inform CEC's continued improvement to the BESS's dispatch algorithms





# CECESI 2020 Scope Update, Add Resiliency to Medical Center Load Service

- In 2020, the CECESI project scope was updated
- Addition of a microPMU at the Cordova Community Medical Center with the following goals:
  - Provide additional information on the interrelationships between grid operations and major load operations
  - Expand the CECESI optimization solution
  - Help to further reduce diesel fuel use
  - Explore extending load service reliability through better visibility





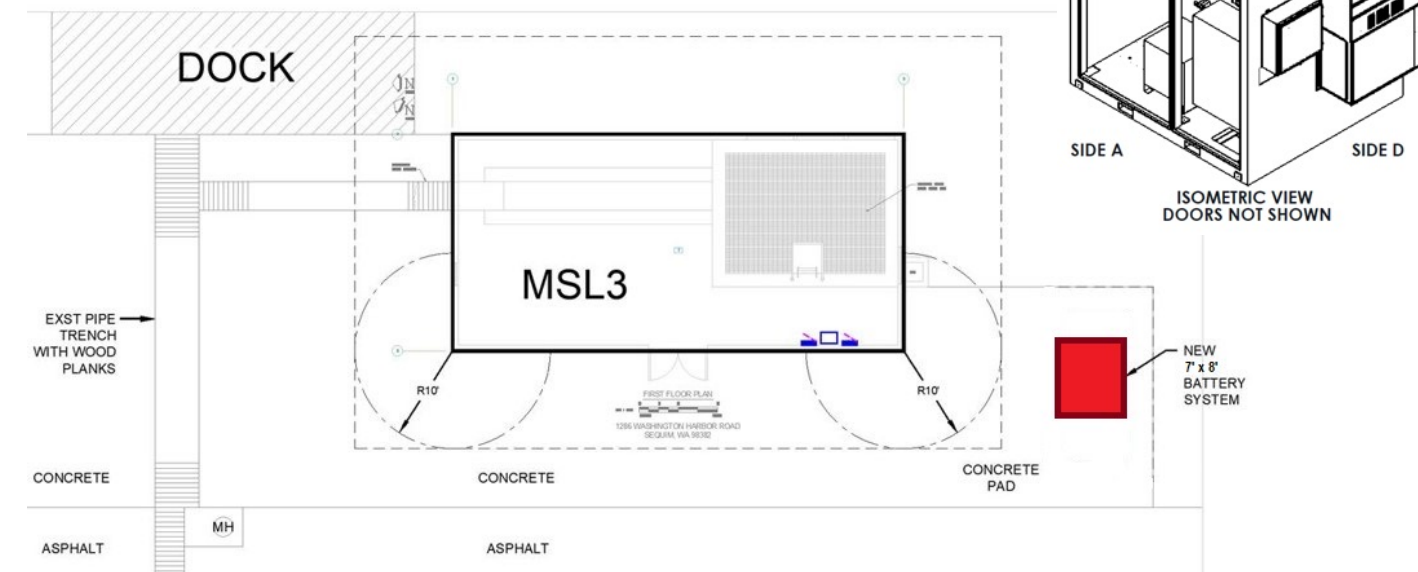
# Grid Integrated Marine Renewable Energy (GIMRE), at PNNL's Marine & Coastal Research Laboratory



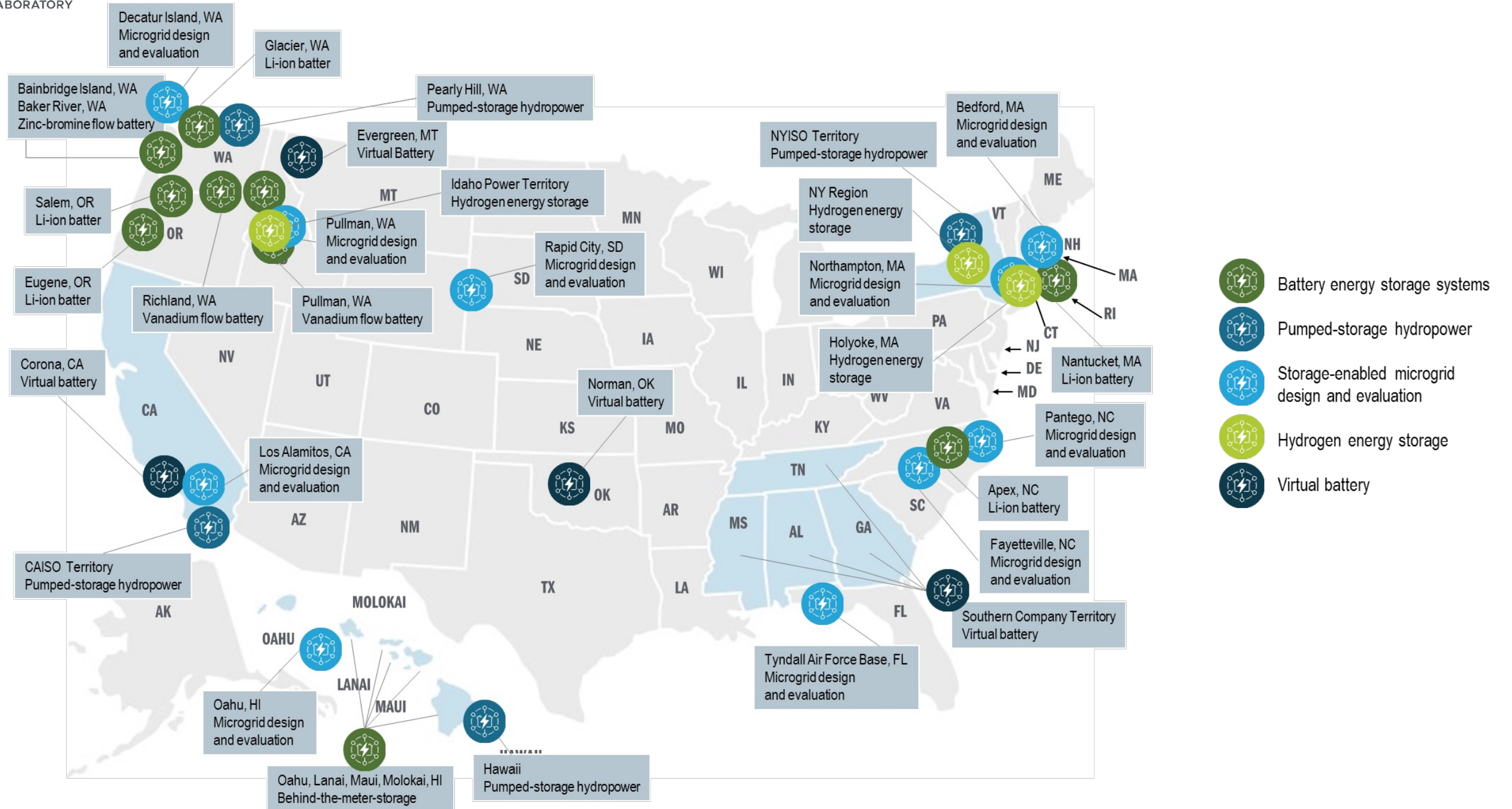
## GIMRE Project will use a 125kW/208kWh BESS to:

- Demonstrate BESS capabilities applied to mitigating the challenges of variable marine power output
- Demonstrate the feasibility of delivering clean MRE energy to loads while complying with electric utility interconnection requirements (IEEE 1547).
- Verify targeted performance metrics and electrical requirements that include grid disturbance ride through, utility voltage support, and interoperability with power systems communications and controls interfaces

Coming Summer 2023



# PNNL Support for Energy Storage Deployments





### GSL Vitals

- 85,000 square feet
- 105 workstations
- 30 Lab Modules
- Estimated Facility Cost: \$75 Million
- Leveraged Funding: \$35 Million from State of Washington, Battelle, Pacific Northwest National Laboratory

# Acknowledgements

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