



PNNL Energy Storage Introduction

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Wei Wang

Chief Scientist

Pacific Northwest National Laboratory

Richland, WA 99354



PNNL is operated by Battelle for the U.S. Department of Energy



Energy Storage Engagements Across the Nation

PNNL:



 **4,414** Staff

 **1,124** Peer-reviewed Publications

 **\$960M** Budget

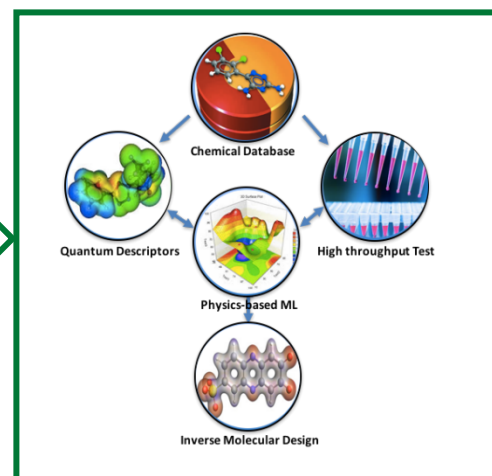
 **99** U.S. & Foreign Patents



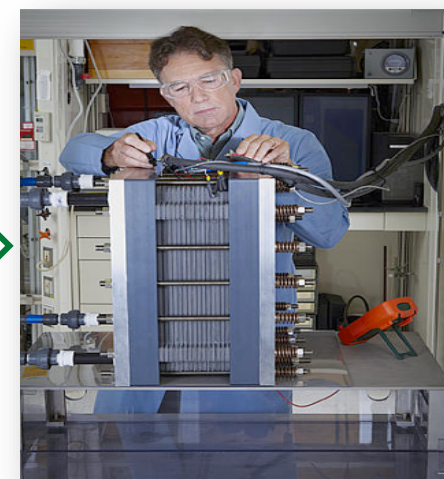
PNNL Energy Storage Research Strategy



**Economic and grid
scale analysis**



**Innovative synthesis:
Synthesis and
characterization of storage**



**Rapid prototyping and
validation**

Cost effective solutions

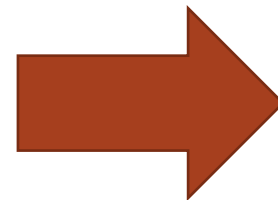
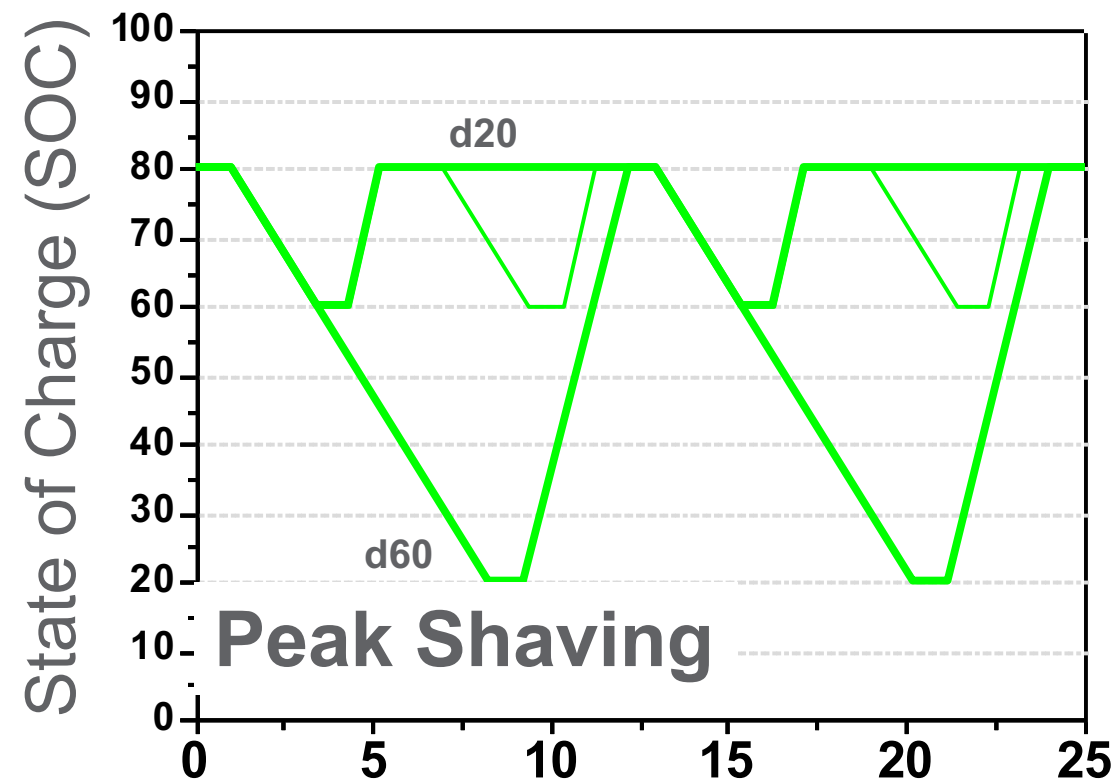
**Li-ion and Li metal
batteries
For EV and grid;**

**Advanced redox flow, Na
and Zn batteries for grid.**

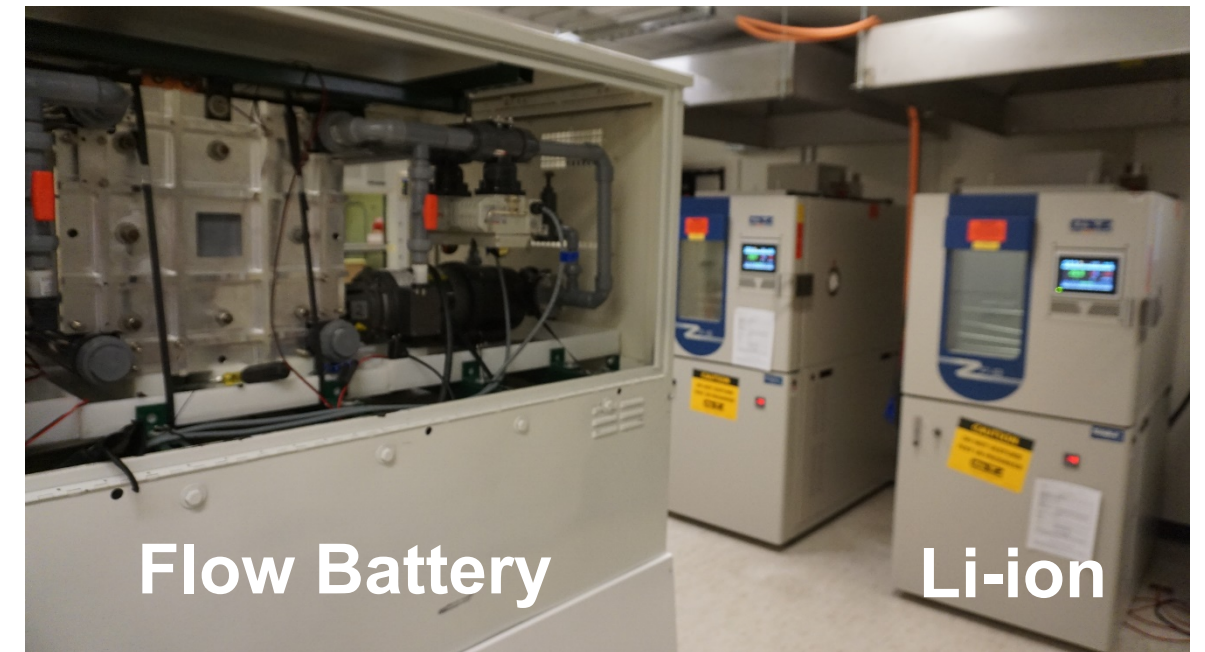
**Collaborate with
industry partners**

Vision and Strategy for Grid Storage Reliability

Common testing methodology for different technologies



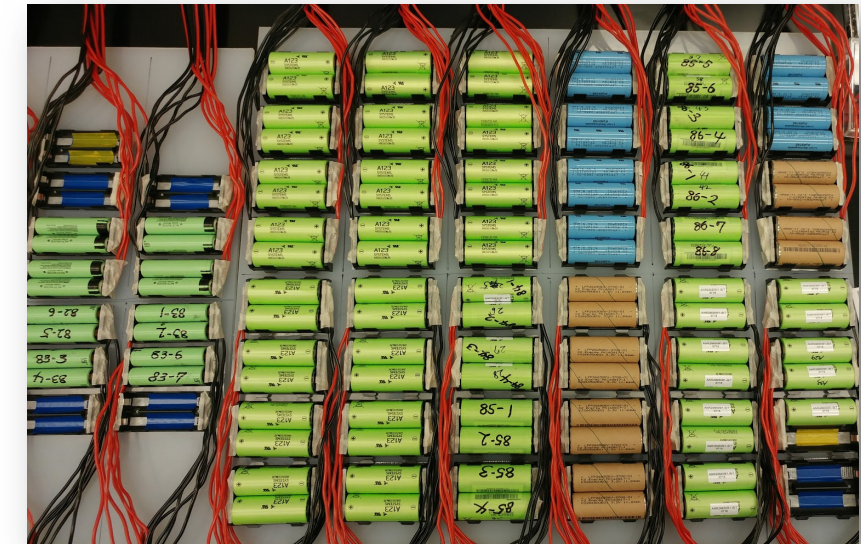
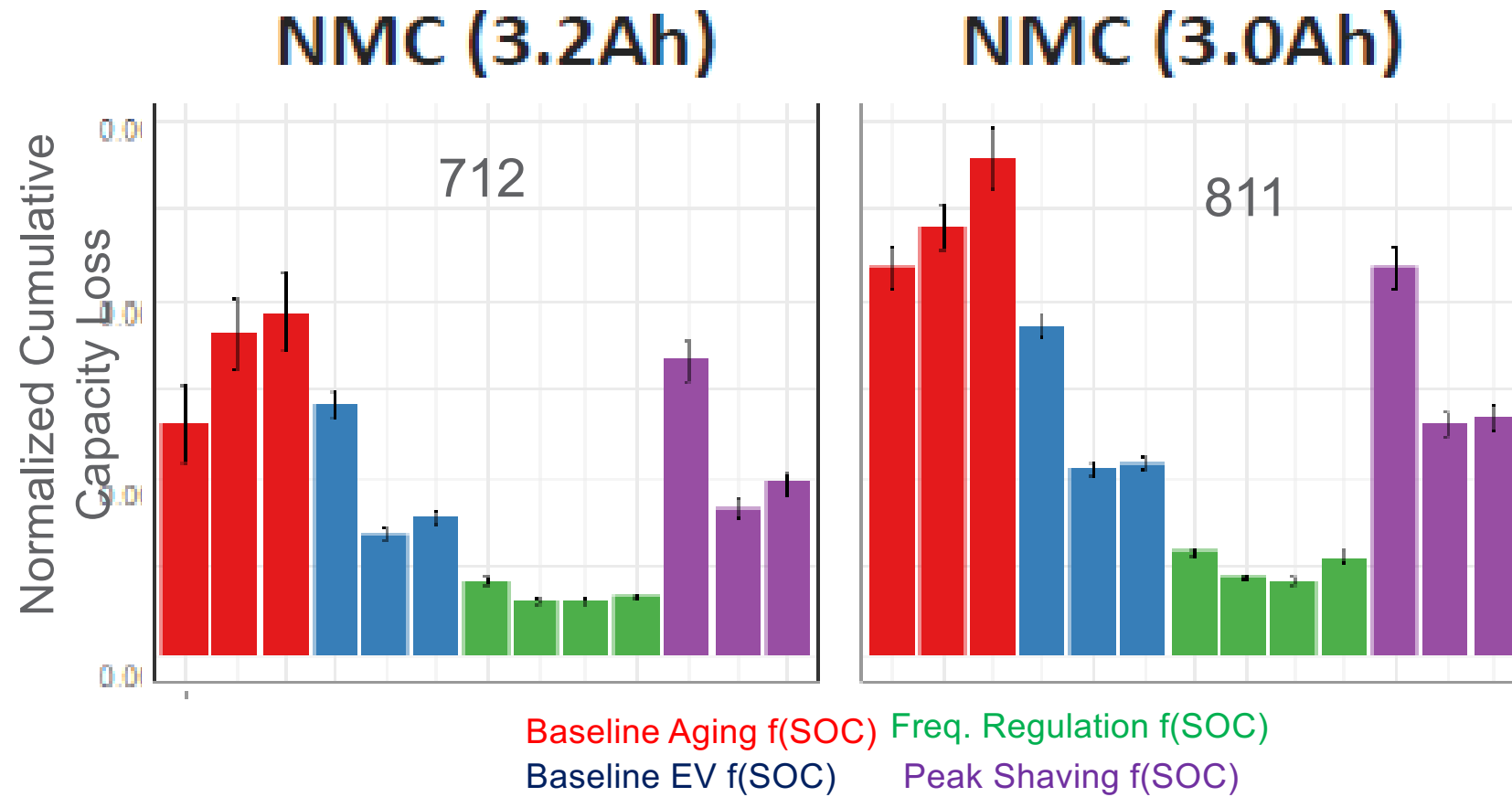
PNNL Reliability Test Lab



Pb-acid
Na-ion

Validating Safety and Reliability of Grid Storage

Continued testing on Li ion cells (NMC, NCA, LFP) showing impact of grid duty cycles



Grid Energy Storage Launchpad

Mission

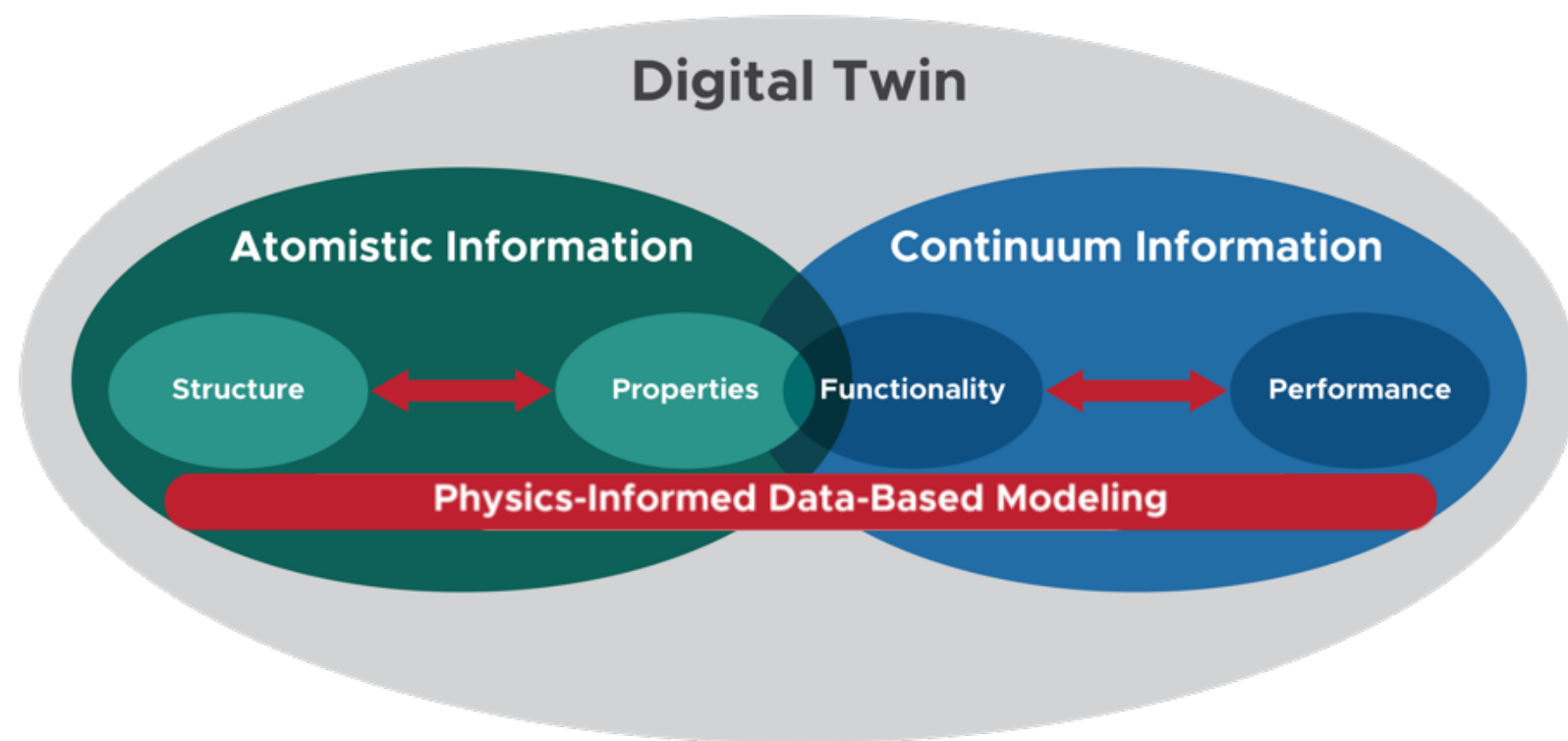
- **Validation**: This facility will provide independent testing of next generation grid energy storage materials and systems under realistic grid operating conditions
- **Acceleration**: The facility will reduce risk while speeding the development of new technologies by propagating rigorous grid performance requirements to all stages of storage technology development
- **Collaboration**: By linking the DOE and storage R&D communities in a new collaborative facility, this facility will lower barriers to solving key crosscutting industry challenges



Grid Storage Launchpad at PNNL:
Advancing the Next
Generation of Grid Energy
Storage Technologies

Energy Storage Materials Initiative (ESMI)

ESMI is a multi-year PNNL investment that will pioneer in the digital twin approach for an accelerated material discovery and validation for energy storage through physics-informed data-based models.



Thank you