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Energy Storage Control Efforts at PNNL: Overview and Key Lessons

Jan Alam
Power Systems Engineer

Contributing members
Patrick Balducci, Di Wu, Vish Viswanathan, Alasdair Crawford, Kendall Mongird

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DISCOVERY *in Action*

U.S. DEPARTMENT OF
ENERGY

"Controls" as a Capability in PNNL's ESS Industrial Acceptance Thrust Area

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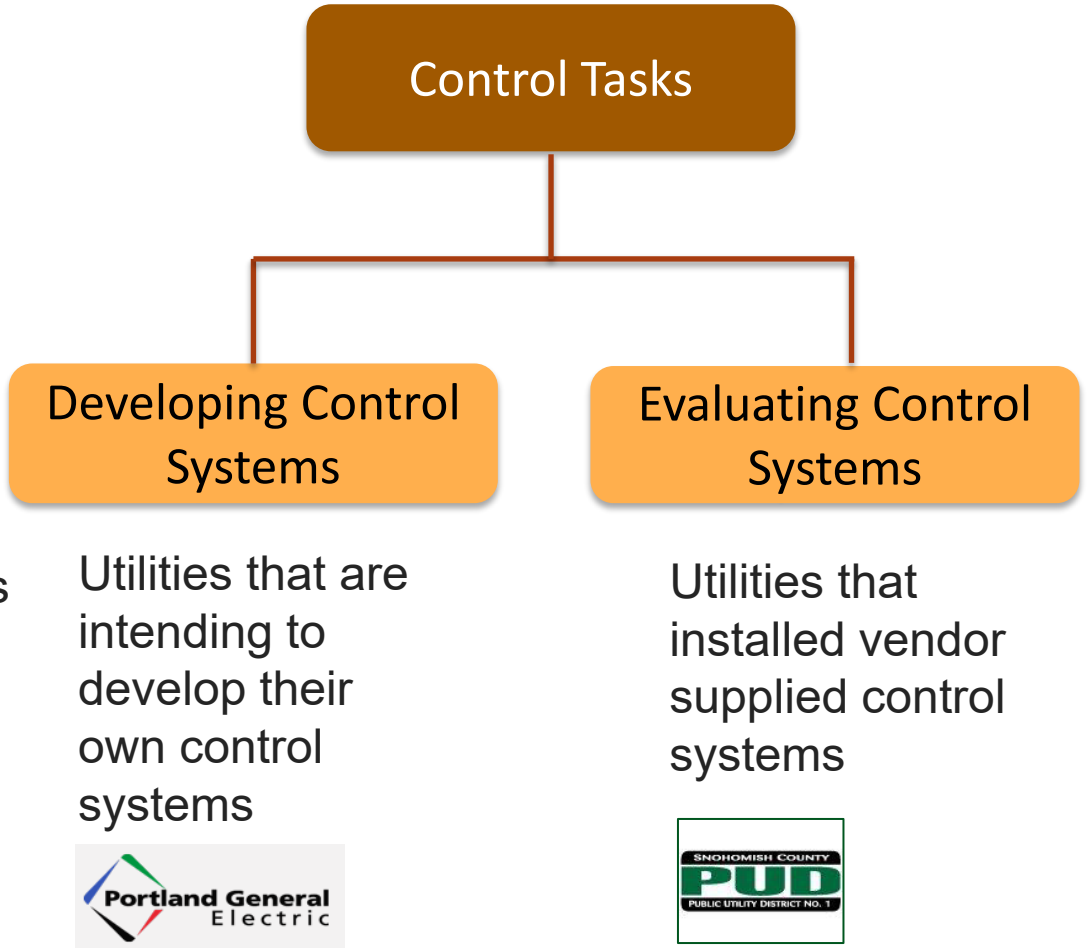
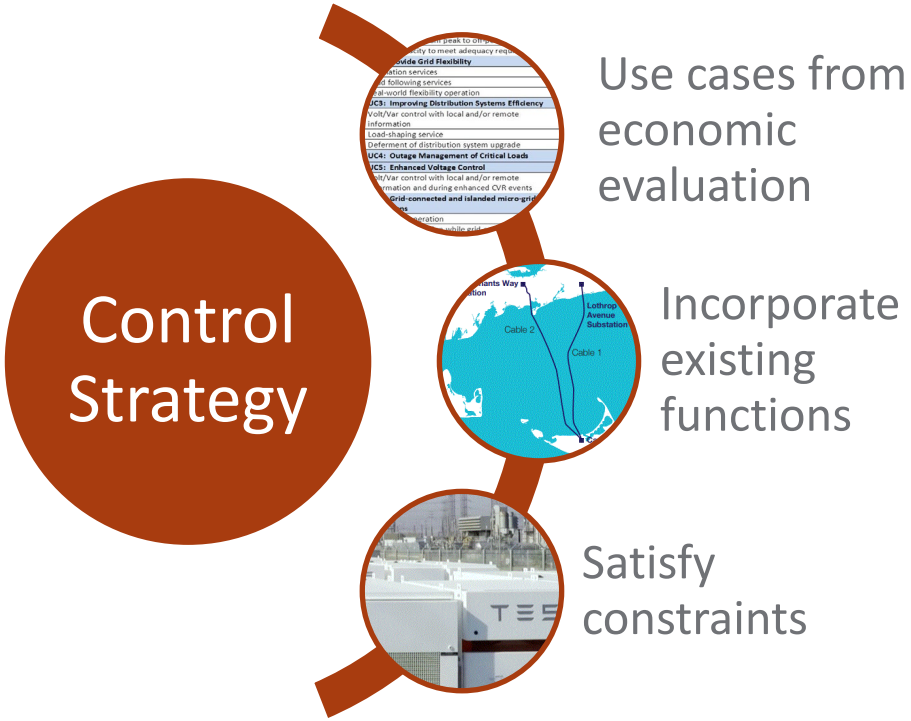
- PNNL's ESS Industrial Acceptance thrust area projects: ESS duty cycle development for various use cases
- Lessons/experience could be extended to help utilities realize the values anticipated
- Different mindsets: building own control systems/buying and customizing off-the-shelf systems
- PNNL supports both tracks – helps build/evaluate ESS control systems
- Economic value is a key driver in developing/evaluating control systems



Control Systems Development: Overview

- Design control strategies to implement Use Cases identified in economic evaluation task
- Accommodate existing distribution system improvement functions (e.g., Volt/VAR) with the ESS control scheme
- Assist in implementing the strategies using control systems
- Meet Use Case objectives while ESS operational limits (e.g., power limit, SoC, annual energy discharge) are not violated



Control Systems Development: An Example

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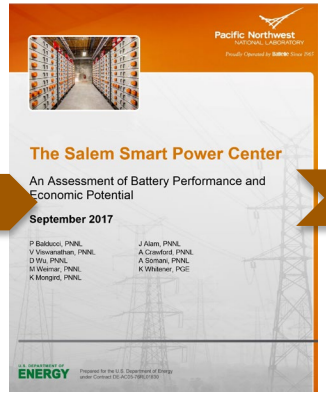
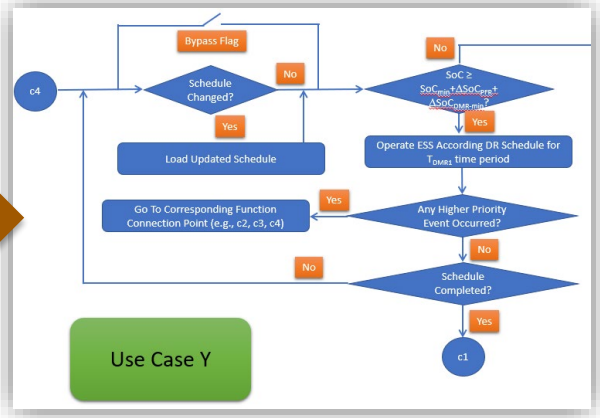
Salem Smart Power Center



Economic Evaluation

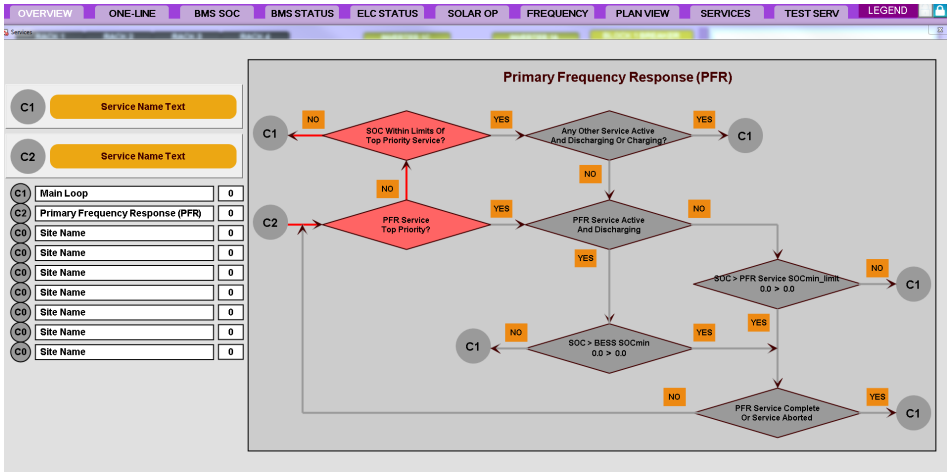


Control Systems Development

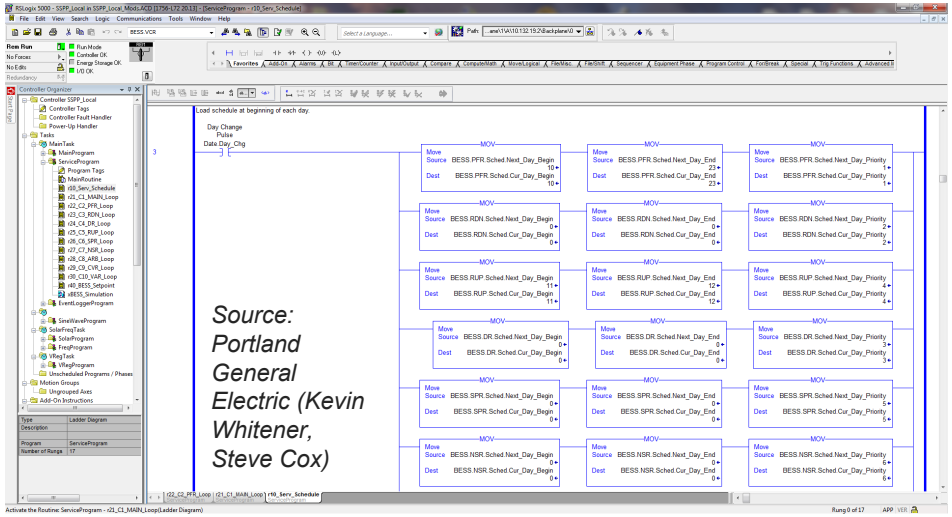
A few lessons … more to come

- Use case mapping across multiple business groups (e.g., energy trading, balancing area authority, demand response)
- Incorporating the ESS asset model with the existing operations planning tool is challenging – is asset capacity/capabilities worth the effort?
- Implementation challenges: use case control/monitoring function integration with existing system control, detailed understanding of the system, need for additional resources (e.g., programming)

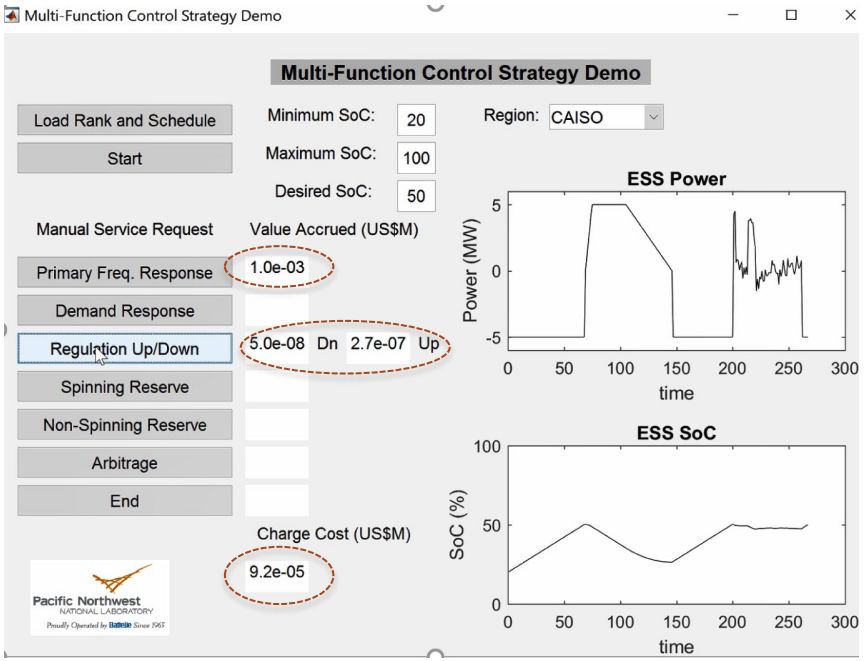
Control Systems Development: An Example



- Flow charts: from desktop to PLC

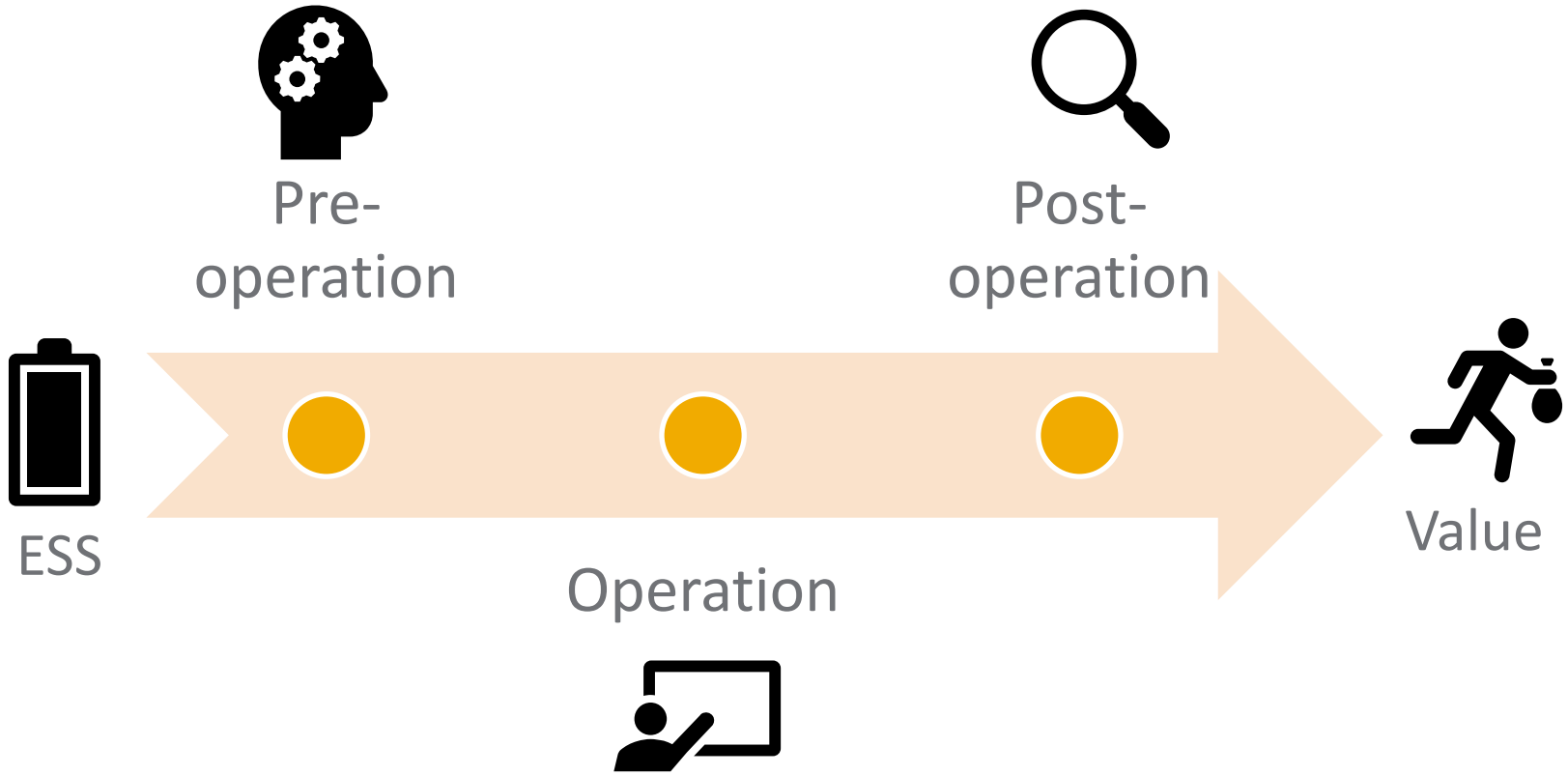


- Ladder logic diagram



- Value ‘on the fly’

Control Systems Evaluation: Background – A 'Value' Perspective



- Mostly an open-loop process
- Evaluation after the fact completes the loop
- Could help enhance the value

Control Systems Evaluation: Overview

- 'Off-the-Shelf' (and customizable) control systems for ESS value optimization
- Generally no dedicated process to keep track of value generated' vs. 'value that could have been generated'
- Reasons could be information, approach, something else (achievable/non-achievable)
- Analytics to determine the reasons could help improve controller performance, and hence value generated
- Launched a project with SnoPUD as a 'proof-of-concept' of this idea

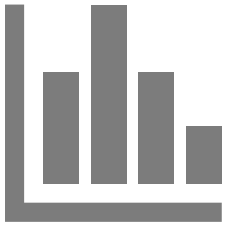
Example control systems …

DERO

Wave

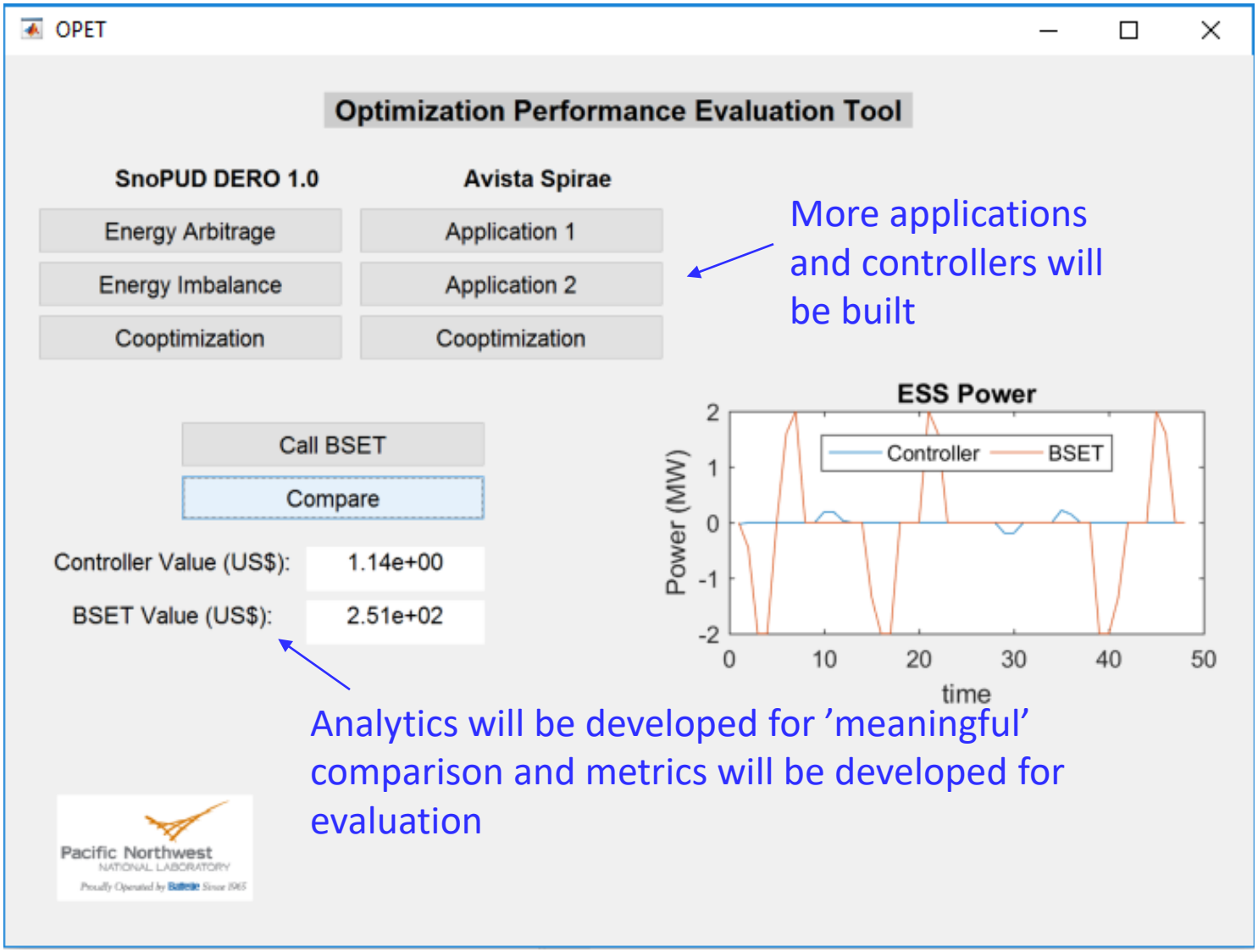
DEN.OS

Value generated



Value that could have been generated (with respect to a ref. value)

Control Systems Evaluation: An Example



Long-term Vision: *Creating industry awareness on the importance of tracking values to improve control strategies*

Acknowledgment

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Dr. Imre Gyuk - Energy Storage Program Manager, Office of Electricity Delivery and Energy Reliability, U.S. Department of Energy

Bob Kirchmeier - Senior Energy Policy Specialist, Clean Energy Fund Grid Modernization Program, Washington State Energy Office