



Energy Storage Reliability Codes and Standards Activities Update

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Doe OE Energy Storage Peer Review

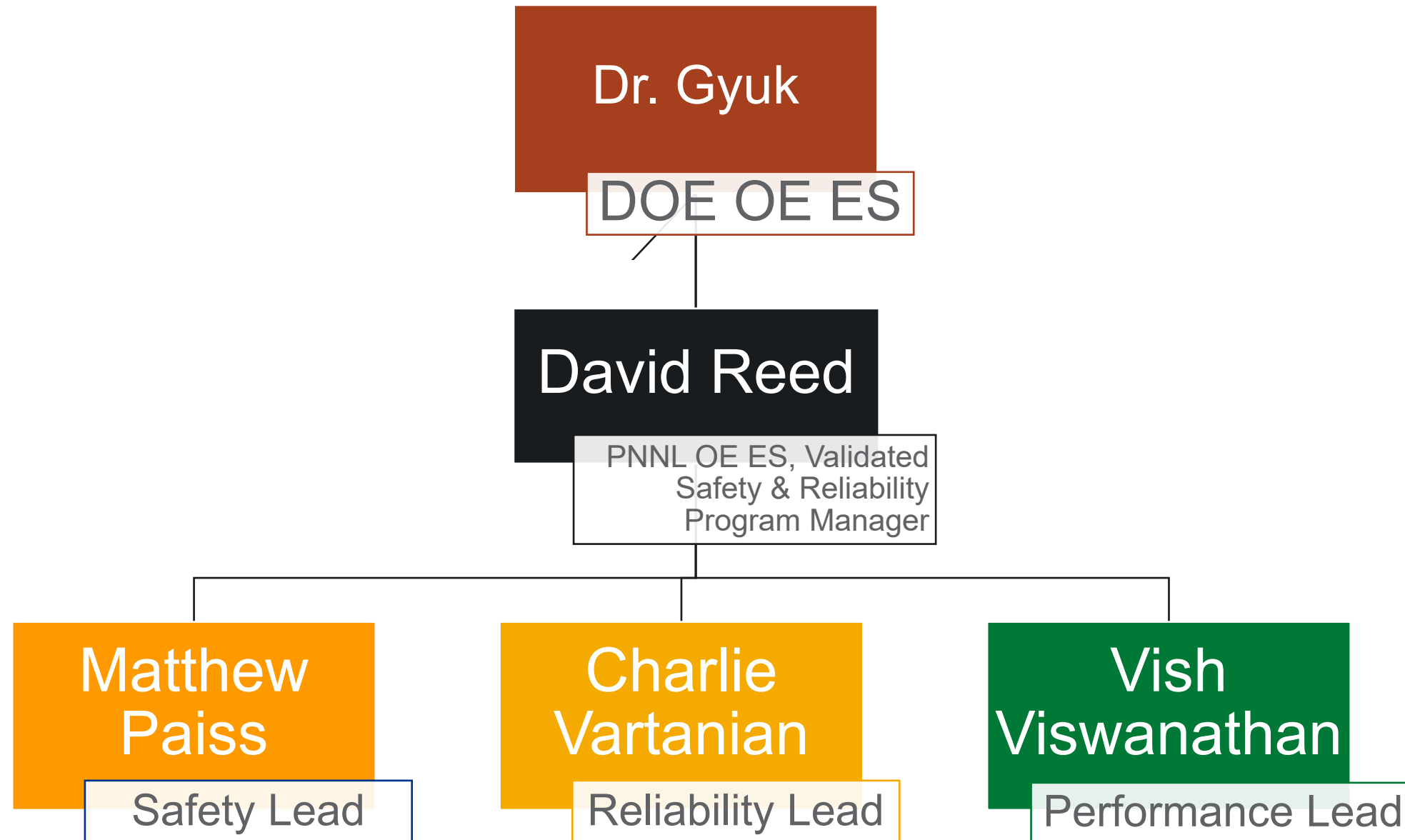


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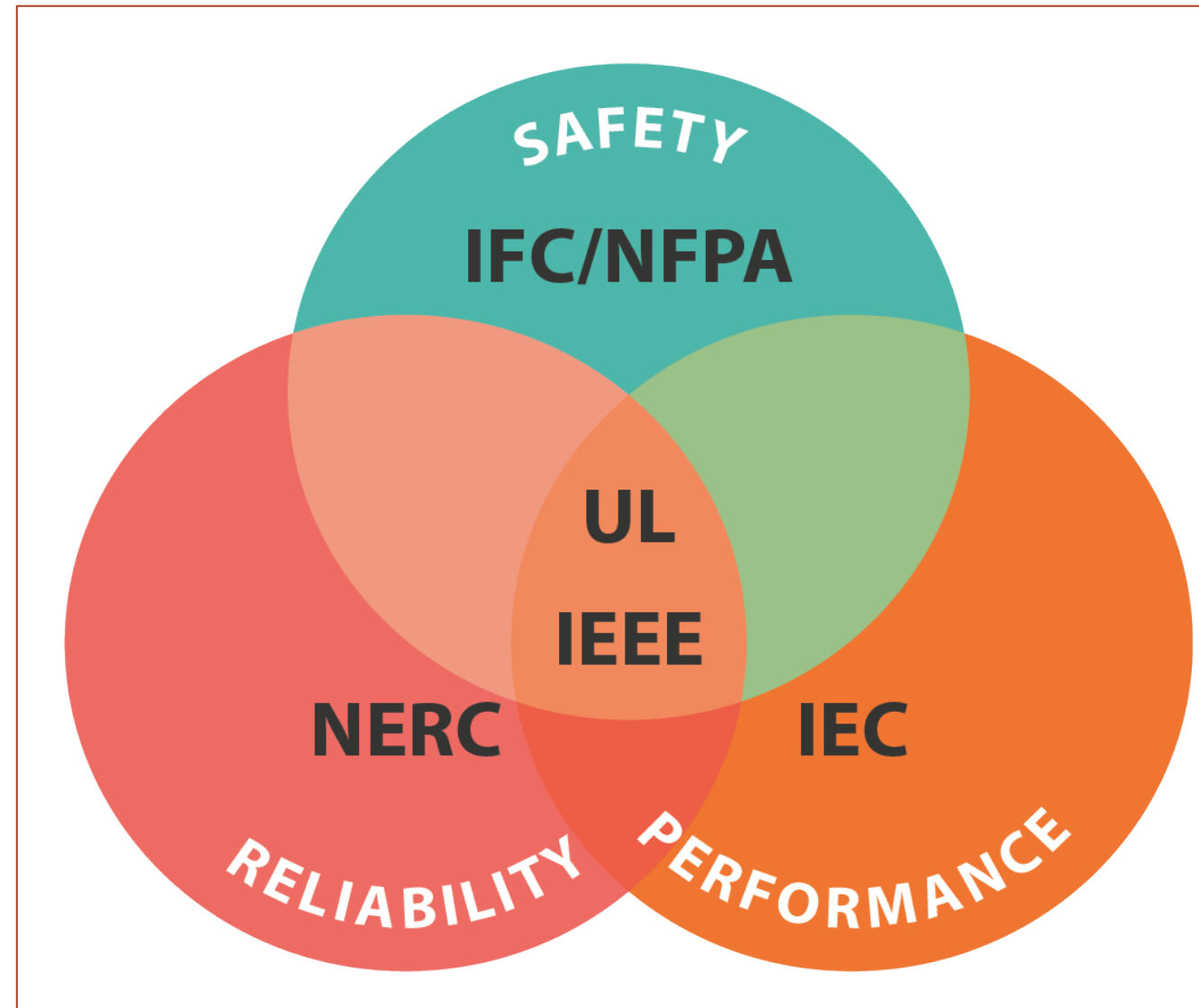
PNNL-SA-178067



PNNL OE ES's Safety, Reliability & Performance C&S Team



Coordinating Across Safety, Reliability and Performance ES Codes & Standards



PNNL OE ES's Codes & Standards (C&S) development activities include participation in:

Safety: NFPA 855, UL 9640, UL 1974

Reliability: IEEE, NERC

Performance: IEC TC 120, *EPRI ESIC (non-SDO)*, *MESA/SunSpec (non-SDO)*

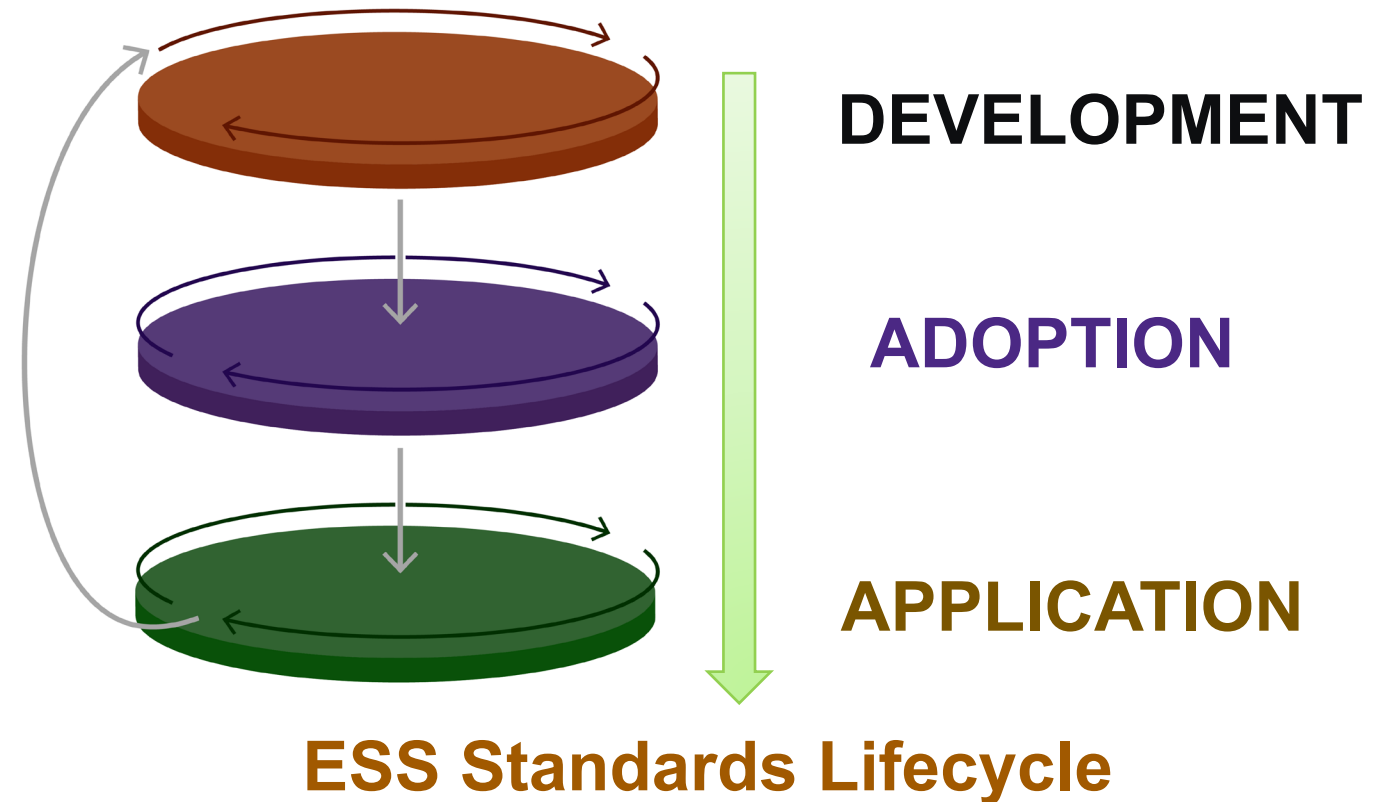
ES Reliability C&S Project Purpose

Purpose

- Foster deployment and effective use of energy storage technology through development, adoption, and application of reliability technical standards.

Impact

- Lower barriers to ESS adoption and improved reliability and resiliency of ESS's and power systems.





ES Reliability C&S Program Activity & Milestones, October 2022 Update

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 published, *Ropp, Vartanian***
- MESA-DER Certification testing procedure completed, *Kolln*

ES Reliability C&S Program, Looking Forward

- **Deploy GIMRE BESS December 2023**, start recording field performance results in FY23-FY24
 - BESS to meet interconnection compliance for a microgrid system
 - BESS was catalyst to attract \$4million additional WA State investment for the IRES microgrid project at PNNL-Sequim marine sciences lab
- Complete and report CECESI project results in FY23
 - Extending Cordova BESS applications and value with a resiliency use case in support of hospital load
- Start 2nd Life Re-rating protocol development & testing, FY23
- Propose a project to write an IEEE guide for interconnection of larger BESS to transmission, FY23

ES Reliability C&S Program, Challenges

- Formal Standards Developing Organizations (SDO's) are still in early stages of developing grid ESS standards:
 - The rapid pace of industry adoption and deployment of the technology is ahead of SDO's pace of creating and updating standards.
 - *Industry groups offer interim solution, and provide 'best practice' input to formal SDO's*
- Modern Grid Connected and Interactive ESS's are Predominately Inverter-Based Resources
 - 'Smart inverter' standards are still evolving, and are very PV-focused
 - ESS's have unique characteristics and capabilities that well thought out standards will support. Badly designed, or lack of, standards will be barriers to full utilization and benefit from ES.
- Examples of Specific Challenges with Solutions In Progress
 - P1547.9 scope impact from "net power" criteria. There will be similar V2G challenges, absent clear and standards.
 - Basic ES characteristics still not defined within IEEE, e.g. SoC, SoH
 - Example of major benefits enabled by C&S – *ES performing Fast Frequency Response to deliver inertia support to power systems. Opportunities to advance this ES benefit via P1547 Revision and future potential P2800.9 ES Transmission Interconnection*

Acknowledgement

Dr. Imre Gyuk, DOE – Office of Electricity, Energy Storage Program



ES Reliability C&S Project's collaborative industry partners include,

- *IEEE Standards Association*
- *MESA Alliance*
- *EPRI Energy Storage Integration Council (ESIC)*



Thank you

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