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Paper No. 22PESGM3943: IEEE P2688, ESMS Draft Recommended Practice Overview

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Motivation

- As grid deployment of energy storage systems (ESSs) increases, a well-designed Energy Storage Management System (ESMS) is critical to effectively operate one or more ESSs in grid applications.

- A need exists for recommended practices and standards to inform designers and integrators about the challenges of ESMS development and deployment.

Scope of ESMS Recommended Practice

- Covers the development and deployment of ESMS in energy storage applications.
- ESMS is an umbrella term that includes a range of systems that generally fall into one of several categories:
  - Power management systems (PMS)
  - Power plant controllers (PPC)
  - Energy management systems (EMS)
- For each category, ESMS contains software functions and hardware capabilities to address the requirements needed to operate ESSs in supply-side and demand-side applications.

ESMS Scope (cont.)

ESMS core functions:

- Dispatch of real and reactive power of single or multiple ESSs to provide grid services.
- Monitoring, estimation, and visualization of system states, including safety sub-system alarms.

ESMS hardware capabilities:

- Sensing
- Control
- Communication

Out of scope:

- Mobile applications such as electric vehicles, except as it relates to aggregated control of these resources.

Example ESMS Functions

Output regulation:

– Coordinate power output of distributed resources to achieve a group-level active power at the point of interconnection (POI).

Ramp rate control:

– Limiting up and down rate of change of power output.

Remote/scheduled dispatch:

– Receive signal or schedule from remote signal (e.g., SCADA or grid operator).

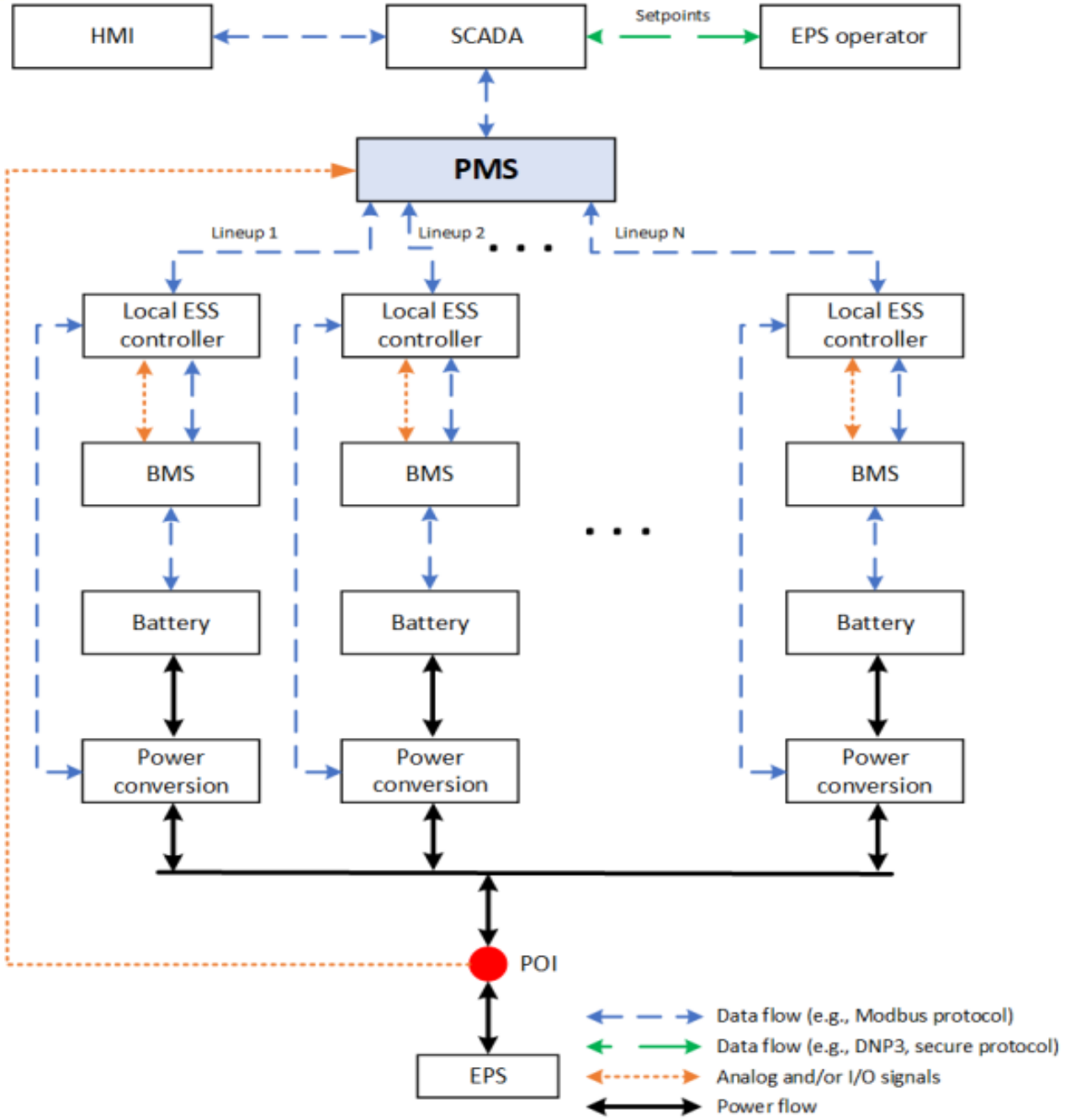
State of Charge (SOC) management:

– Dispatch power to maintain SOC balance across battery arrays.

Curtailment avoidance:

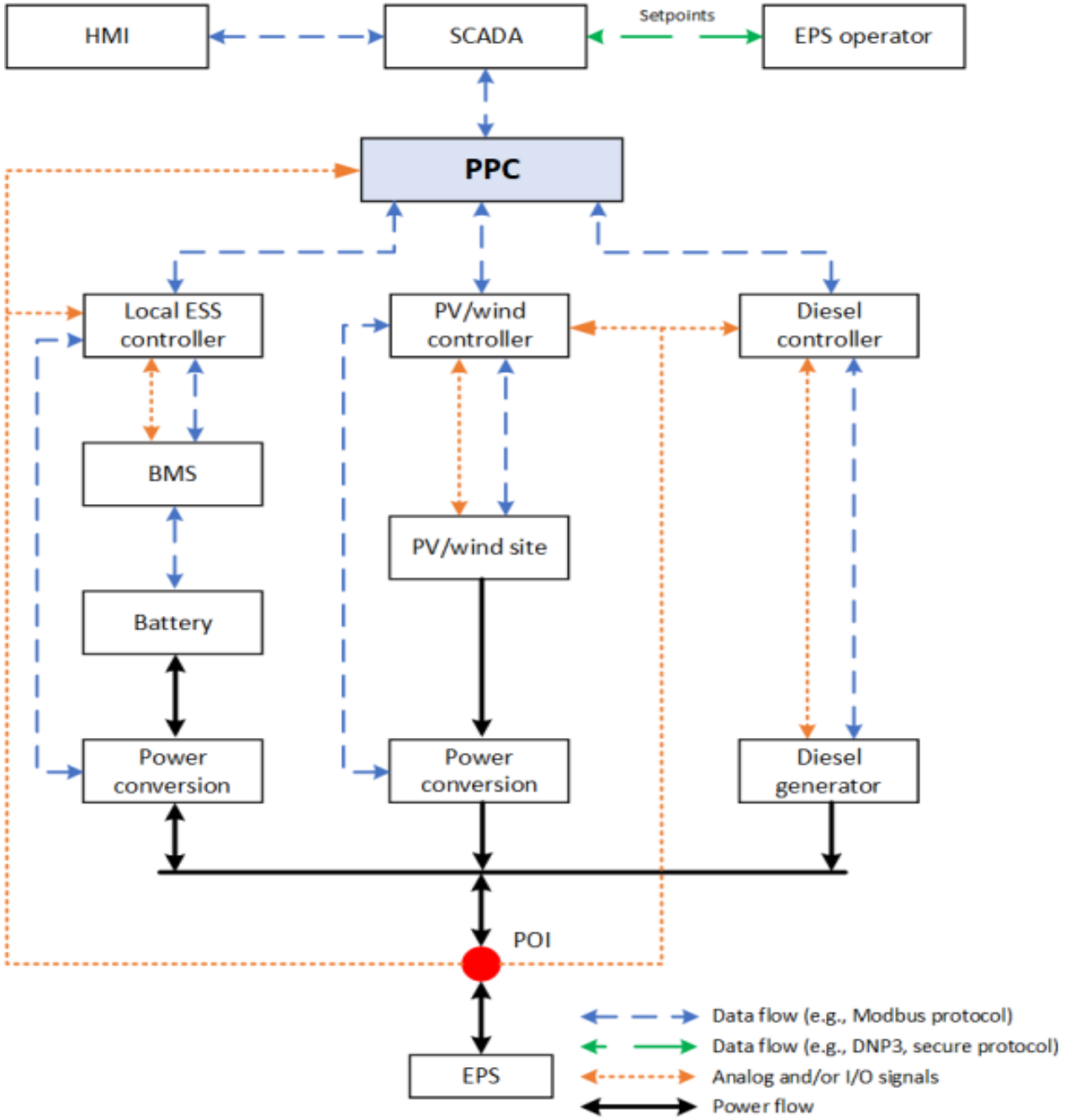
– Rather than curtail variable assets (e.g., PV and wind), use ESS to store curtailed energy.

ESMS as a Power Management System (PMS)



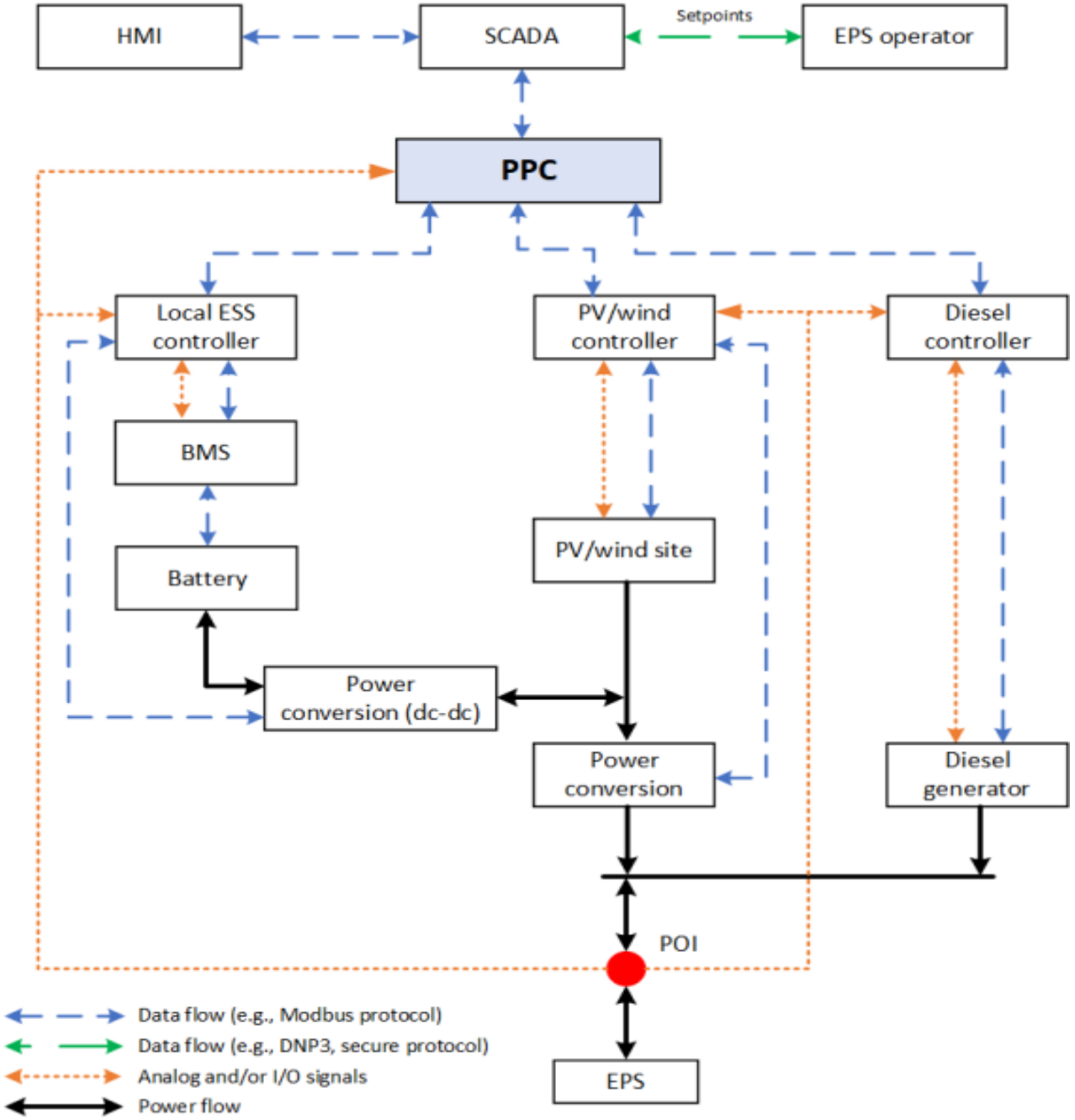
Note: Communication within the ESS is typically via Modbus protocol, although the battery system may use CANbus or CANopen protocol.

Note: Power conversion is bidirectional and can be a dc-ac converter, a dc-dc converter, or a combination of dc-dc and dc-ac converters.



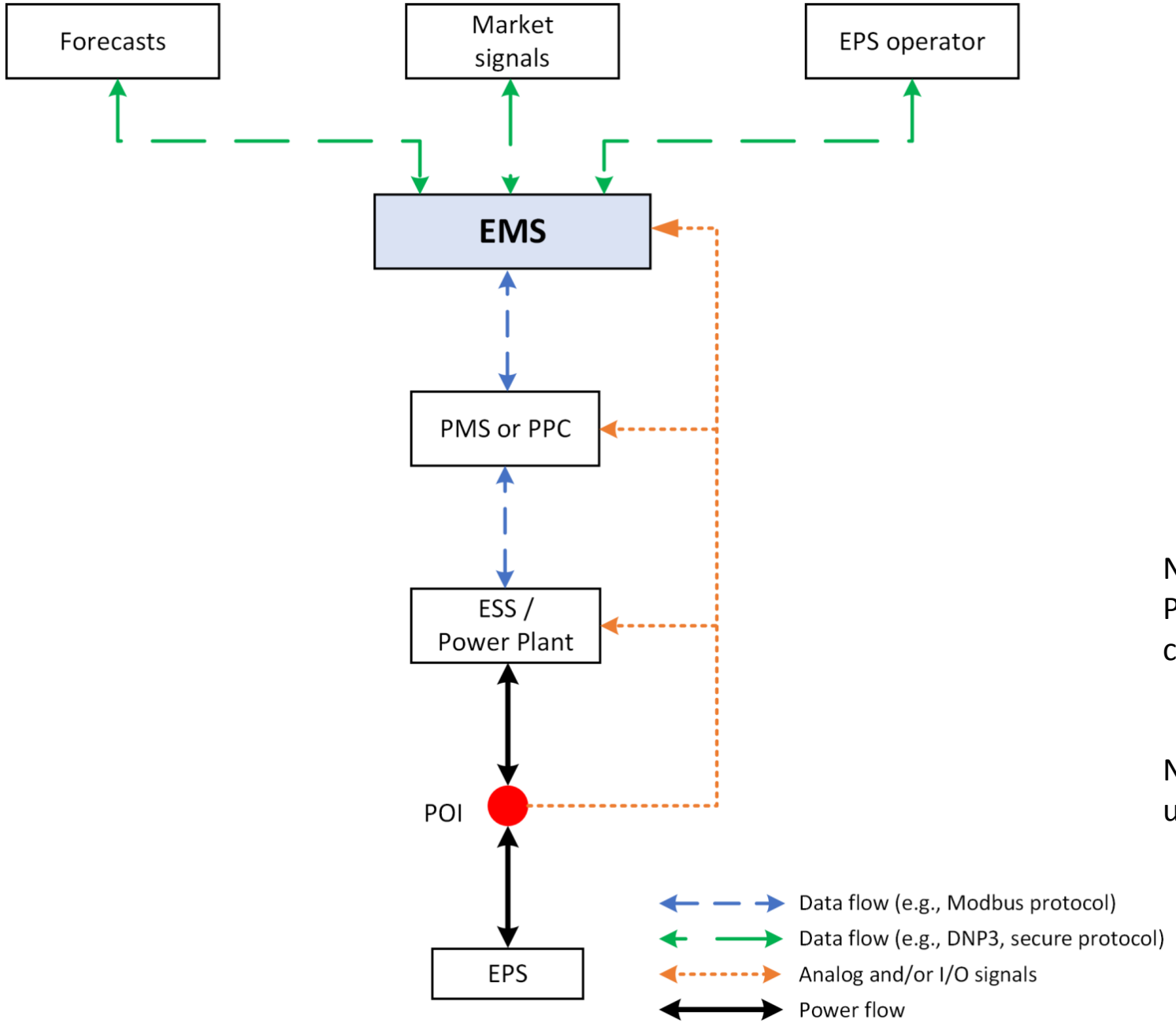
ESMS as a Power Plant Controller (PPC)

Example PPC with an ac-coupled ESS



ESMS as a Power Plant Controller (PPC)

Example PPC with a dc-coupled ESS



ESMS as an Energy Management System (EMS)

Note: EMS is a high-level controller that may have PMS or PPC functions integrated or may operate in conjunction with a separate PMS or PPC.

Note: EMS is typically a 'smart' device, such as using machine learning to optimize dispatch levels.

P2688 Project Schedule

1. Propose ESMS Project to ESSB – June 2020 ✓
2. Draft PAR, then submit to ESSB – July 2020 ✓
3. PAR Approval from ESSB – August 2020 ✓
4. PAR Approval from SA – Q1 2021 ✓
5. Form Working Group – Q2 2021 ✓
6. Kickoff Monthly ESMS WG meetings – Q3 2021 ✓
7. Write the Draft Recmd Practice – Q3 2021 – Q4 2023 (in progress)
8. Ballot the Draft Recmd Practice – Q1 2024
9. Approval and Publication – Q2 2024

P2688 Working Group Team

- WG Chair – Dave Schoenwald, SNL
- WG Vice Chair – Tu Nguyen, SNL
- WG Secretary – Slobodan Matic, GE
- PES/ESSB Standards Rep – Jim McDowall, Saft
- SCC21 Liaison – Charlie Vartanian, PNNL
- Topic Leads (more to be added):
  - ESMS Scope/Functional Descriptions – Jim McDowall, Saft
  - ESMS Grid Applications – Allen Zhang/Luke Jackson, Southern Co.
  - ESMS Safety – Chris Searles, Chris Searles and Associates

Challenges/Issues

Avoid duplication/clarify differences with related standards:

- IEEE P2686: Battery Management Systems (BMS) in Stationary Energy Storage Applications
- IEEE P1547.9: Interconnection of Energy Storage Distributed Energy Resources with Electric Power Systems
- IEEE 2800-2022: Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems
- IEEE 2030.11-2021: Distributed Energy Resources Management Systems (DERMS) Functional Specifications
- IEC: Communication standards

Next Steps

- Identify writing assignments for each clause/sub-clause:
  - Clause 4: Functional description of ESMS range of systems – mostly completed
  - Clause 5: ESMS technology description – approx. halfway completed
  - Clause 6: Configuration
  - Clause 7: System integration
  - Clause 8: Grid applications
  - Clause 9: Communications

} Sub-clauses identified
Writing tasks yet to be assigned

- Coordinate with IEEE PES Technical Committee on Power System Communication and Cybersecurity (PSCC) for communications and cybersecurity issues in ESMS

Acknowledgements

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- The speaker also thanks the Energy Storage Standards Board of the IEEE PES and the IEEE Standards Coordinating Committee 21 for their sponsorship of the P2688 Working Group.
- The speaker is especially grateful for the participation of the members of the P2688 Working Group towards the development of this recommended practice.

Questions? Interested in participating in P2688?

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