CleanEnergy States Alliance

Energy Storage and Cybersecurity

April 1, 2025

A Presentation of the Energy Storage Technology Advancement Partnership (ESTAP)

Webinar Logistics

We are now using Zoom Webinars!
Thank you for your patience as we get used to this platform. We encourage you to provide feedback in the post-webinar survey or via email.

All attendees are in “listen only” mode – your webcam and microphone are disabled.
The Chat function is also disabled for attendees.

Submit questions and comments via the Q&A panel 

Automated captions are available 

Speakers' bios will be made available in the chat

This webinar is being recorded. We will email you a webinar recording within 48 hours. This webinar will be posted on CEG’s website at www.cesa.org/webinars

Celebrating 20 Years of State Leadership

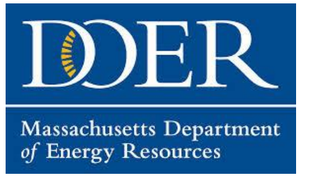
Clean Energy States Alliance

The Clean Energy States Alliance (CESA) is a national, nonprofit coalition of public agencies and organizations working together to advance clean energy.

CESA members—mostly state agencies—include many of the most innovative, successful, and influential public funders of clean energy initiatives in the country.

CleanEnergy States Alliance

www.cesa.org



Energy Storage Technology Advancement Partnership (ESTAP)

- Facilitate public/private partnerships to support joint federal/state energy storage demonstration project deployment
- Support state energy storage efforts with technical, policy and program assistance
- Disseminate information to stakeholders through webinars, reports, case studies and conference presentations

www.cesa.org/ESTAP

Webinar Speakers

Sai Ram Ganti
Electric Power Research Institute (EPRI)

Howard Gugel
North American Electric Reliability Corporation (NERC)

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Upcoming Webinars

Case Study: Cape Light Compact's Cape and Vineyard Electrification Offering (4/8)

Energy Resilience for Medically Vulnerable Multifamily Affordable Housing Residents: A Technoeconomic Analysis for Connecticut (4/10)

Load Growth and Electric System Reliability (4/22)

A Climate Resilient Energy Code for Multifamily Affordable Housing (4/29)

Read more and register at www.cesa.org/webinars

Cyber Security for Utility Scale Energy Storage Systems (ESS)

Challenges, Architectures and Learnings

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Scale of Battery storage

3.3-5v
2700mah

12v
80A

400~v
85kWh

50~v
14kWh

In order of MW

Grid connected/Grid Services

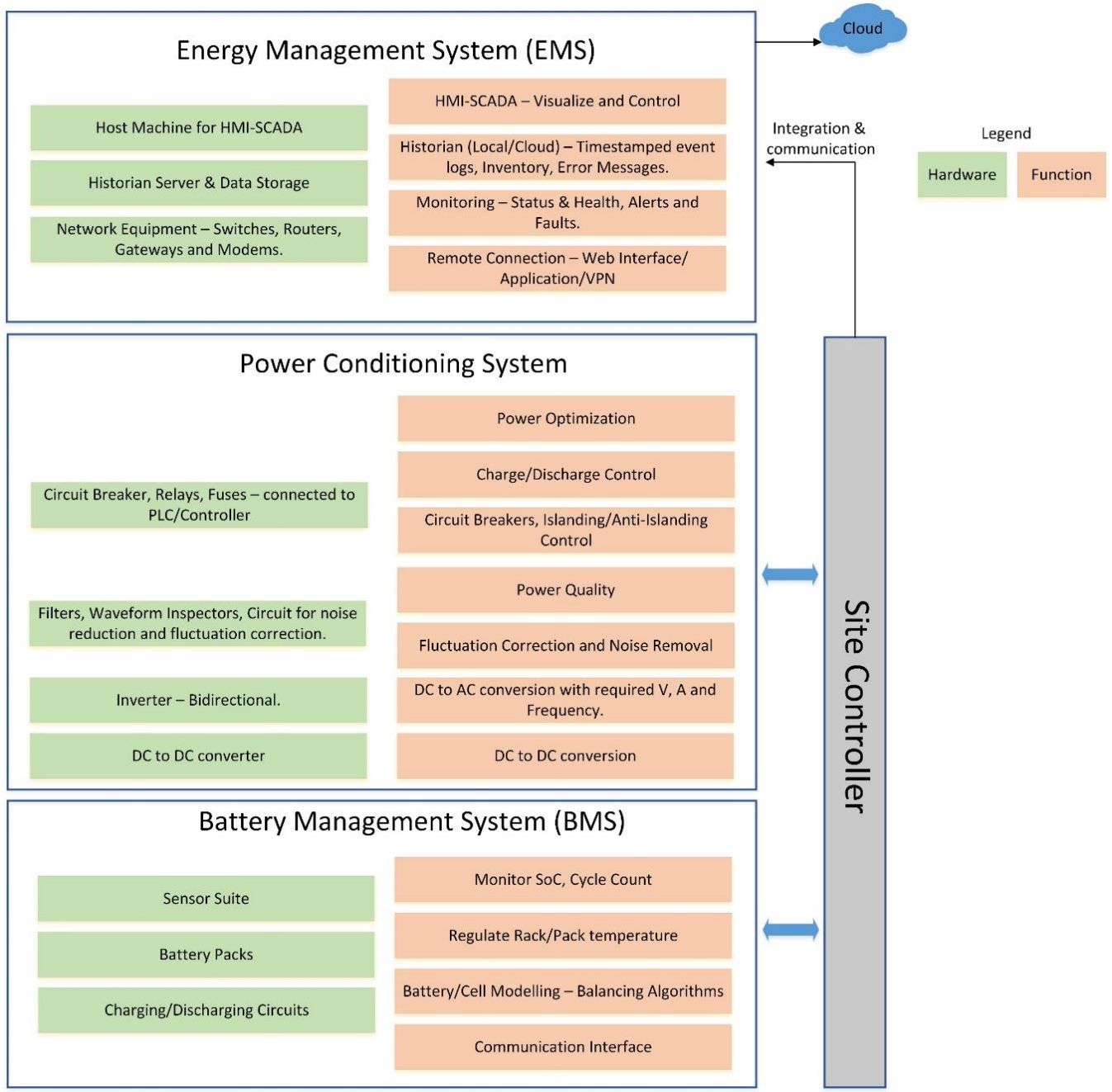
- Fundamental functionality remains same.
- Greater size = Higher impact on grid.
- What changes – complexity in charge/discharge, protection requirements and monitoring requirements.

Generic Storage System

Energy Management System (EMS)

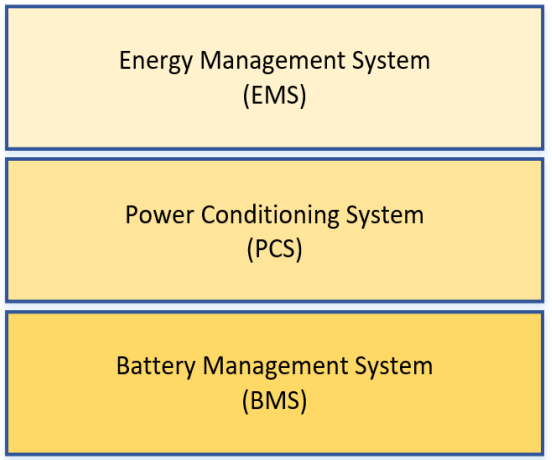
Power Conditioning System (PCS)

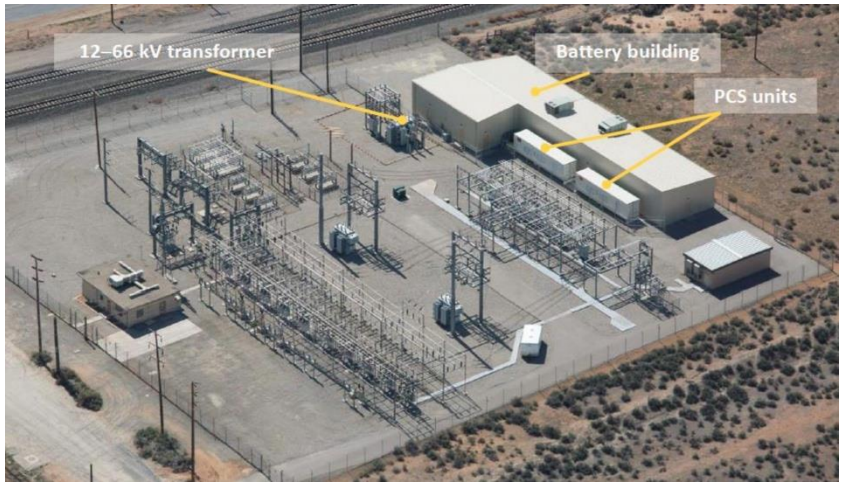
Battery Management System (BMS)



Challenges in Securing ESS

- Securing integration of 3rd parties and vendor remote access to the ESS.
- Developing and testing security controls for devices/systems that may not support complex processing or are latency sensitive.
- Gaps in interconnection requirements between utility and vendor offerings.
- Securing data across ESS operations (on-site and cloud).
- Developing risk prevention and mitigation strategies for different ESS architectures.
- Enabling physical security with strict electronic security perimeters.





A risk can be determined using – Impact & Likelihood

ESS Architectures

Utility Owned, Vendor Read Only

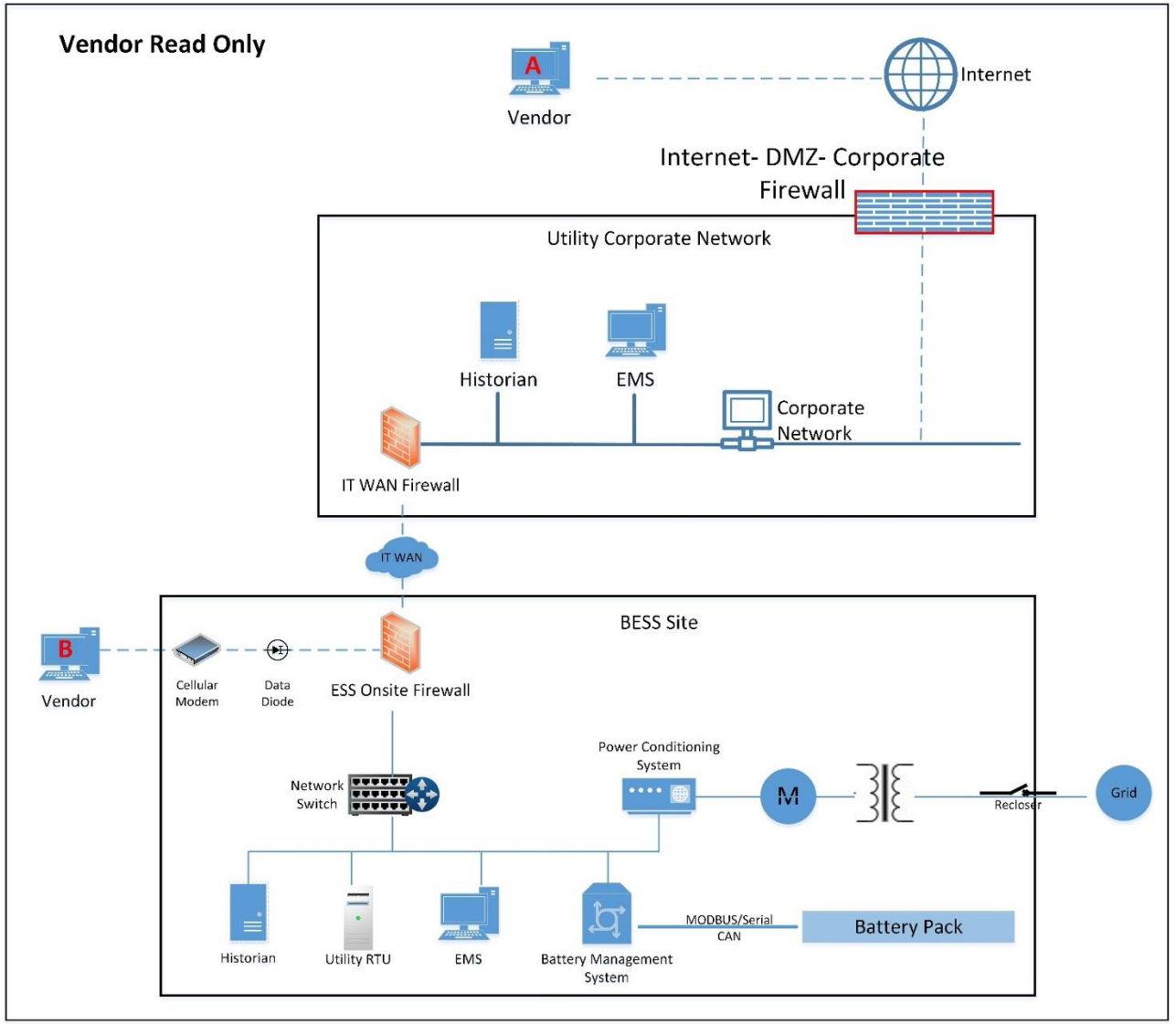
Read Only implementation

- **Vendor Access Option A:** Vendor authenticates on Utility Corporate Network and connects to the ESS. Read-only may be implemented via firewall rules and access controls.
- **Vendor Access Option B:** Vendor uses a Cellular Modem on the site through a Data Diode along with Firewall Rules/unidirectional gateway and connect to the ESS.

Cyber Security

- Data security for vendor access.
- Cellular modem access controls and lateral access across the ESS.
- Remote Terminal Unit (RTU) Security.
- Deep Packet Inspection (DPI) at low-level/east-west communication.

A data diode is a physical device that allows unidirectional flow of data.



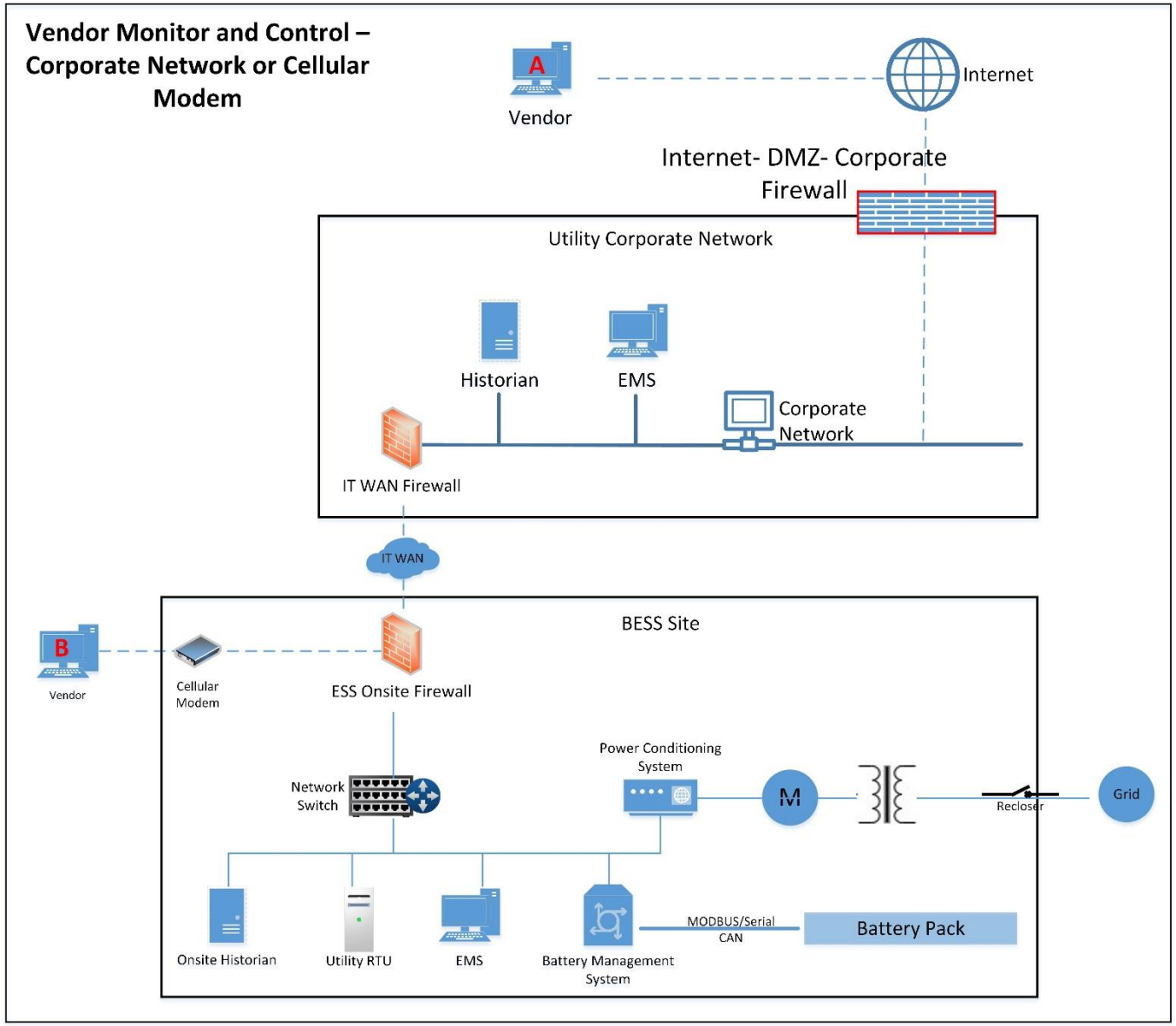
Utility Owned, Vendor Monitor & Control

Monitor and Control implementation

- **Vendor Access Option A:** Vendor authenticates through Utility Corporate Network + Firewall Rules + Session Monitoring and connects to the ESS.
- **Vendor Access Option B:** Vendor has access to the ESS via the cellular modem to monitor and control.

Cyber Security:

- Evaluate Vendor's Control processes. (Thresholds, override capabilities, safety and availability factor)
- Evaluate Vendor's security practices on the Enterprise Network.
- Consider data security for onsite and offsite historians.



Learnings

- Majority of large-scale ESS have remote monitoring and data acquisition for alarm management, performance analysis and warranty purposes.
- Firmware update methods in the order: OTA/Wireless, Remote, cloud and in-person.
- Crucial to have east-west monitoring and security at the control and process level.
- Establish electronic security zones based on the function of each physical device. These zones help define the requirements of a given component.
- Whitelist critical assets after determining baseline traffic.
- Remote access and vendor requested data may be staged in a separate secure environment.

Architecture Variables

Point of Interconnection:
Transmission, Distribution
Generation, Behind the Meter
Microgrid

Ownership:
Utility owned and operated
Utility owned and 3rd party operated
3rd party owned and operated

Access Level:
Vendors, Aggregators, Manufacturer, Utility
Monitor, Control, Warranties, O&M,
Emergencies

Grid Services:
Market Services, Capacity Deferral, Black Start,
Reliability, etc.

Questions?

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NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Battery Storage and Cybersecurity

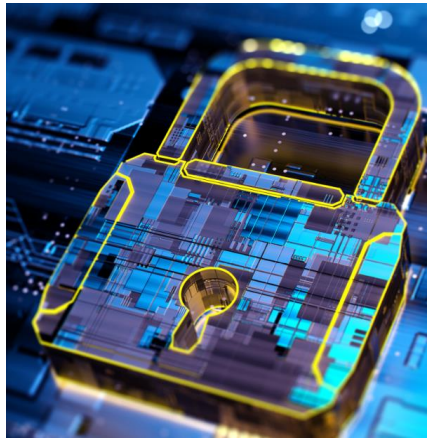
Howard Gugel, Senior Vice President of Regulatory Oversight
NERC

NERC's Mission

- Assure the reliability, resilience, and security of the North American Bulk Power System (BPS)
  - Develops and Enforces Reliability Standards
  - Annually assesses seasonal and long-term reliability
  - Monitors the BPS through system awareness
  - Educates, trains, and certifies industry personnel

Critical Infrastructure Interdependencies

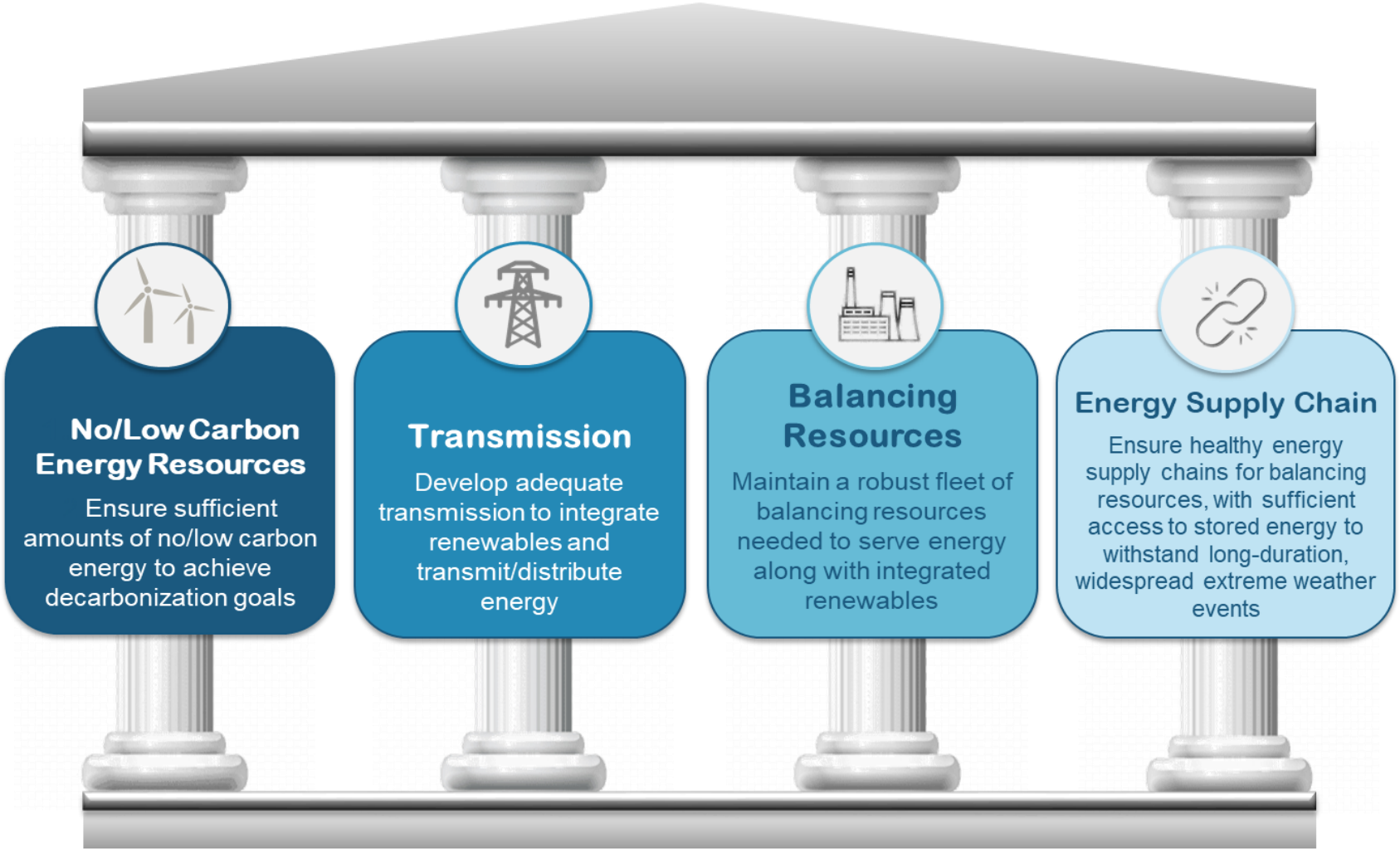
Security Risks



Extreme Events

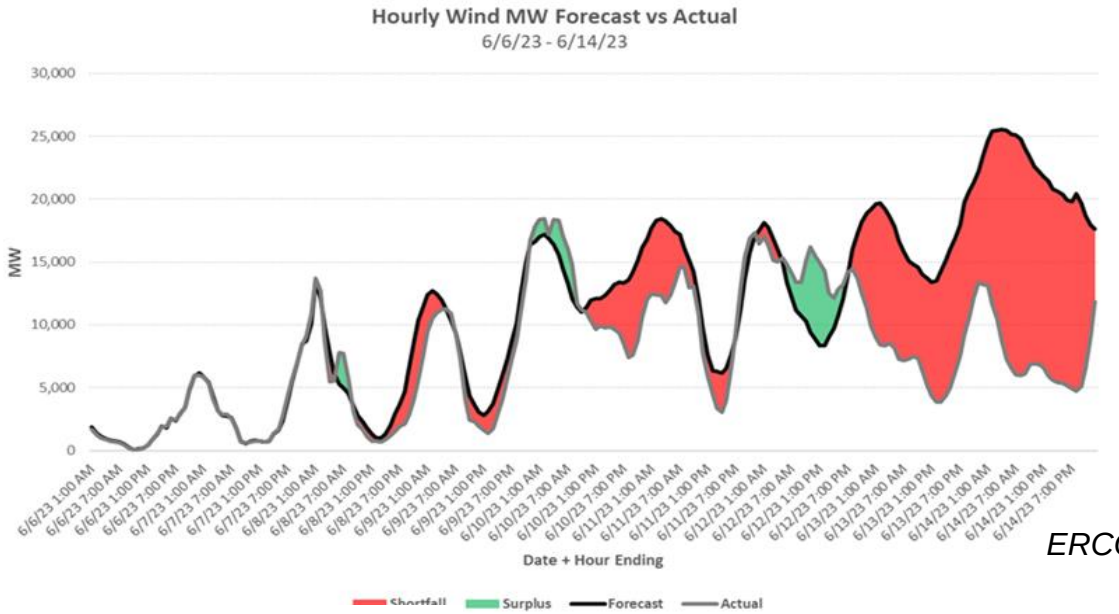
Grid Transformation

The Four Pillars of the Energy Transition

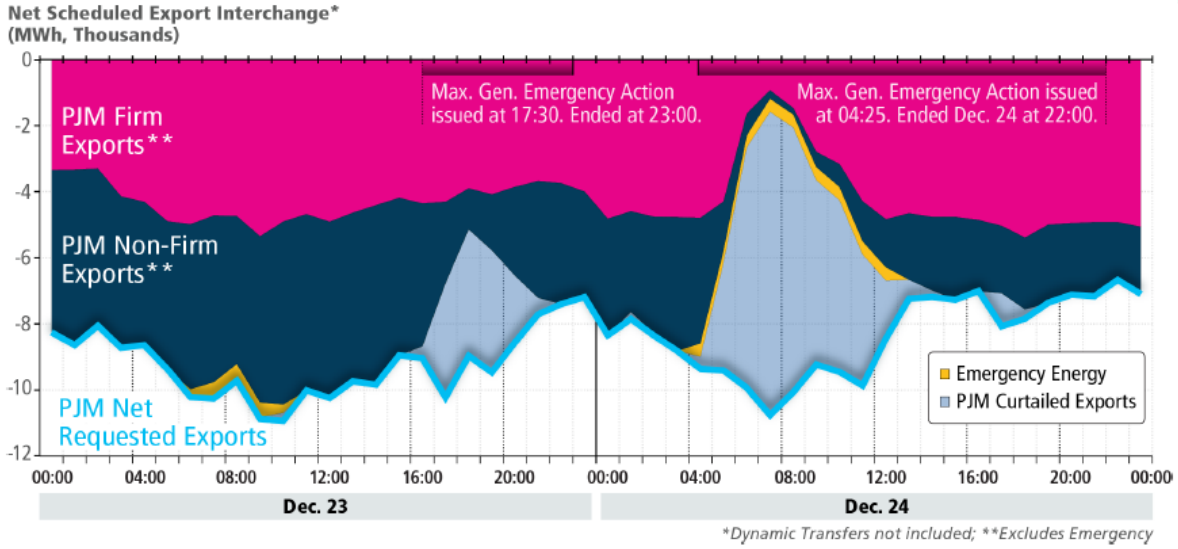


Reliability Concerns

ERCOT, SPP, MISO: *A "wind drought" caused 60 GW of installed wind capacity to generate 300 MW*



ERCOT

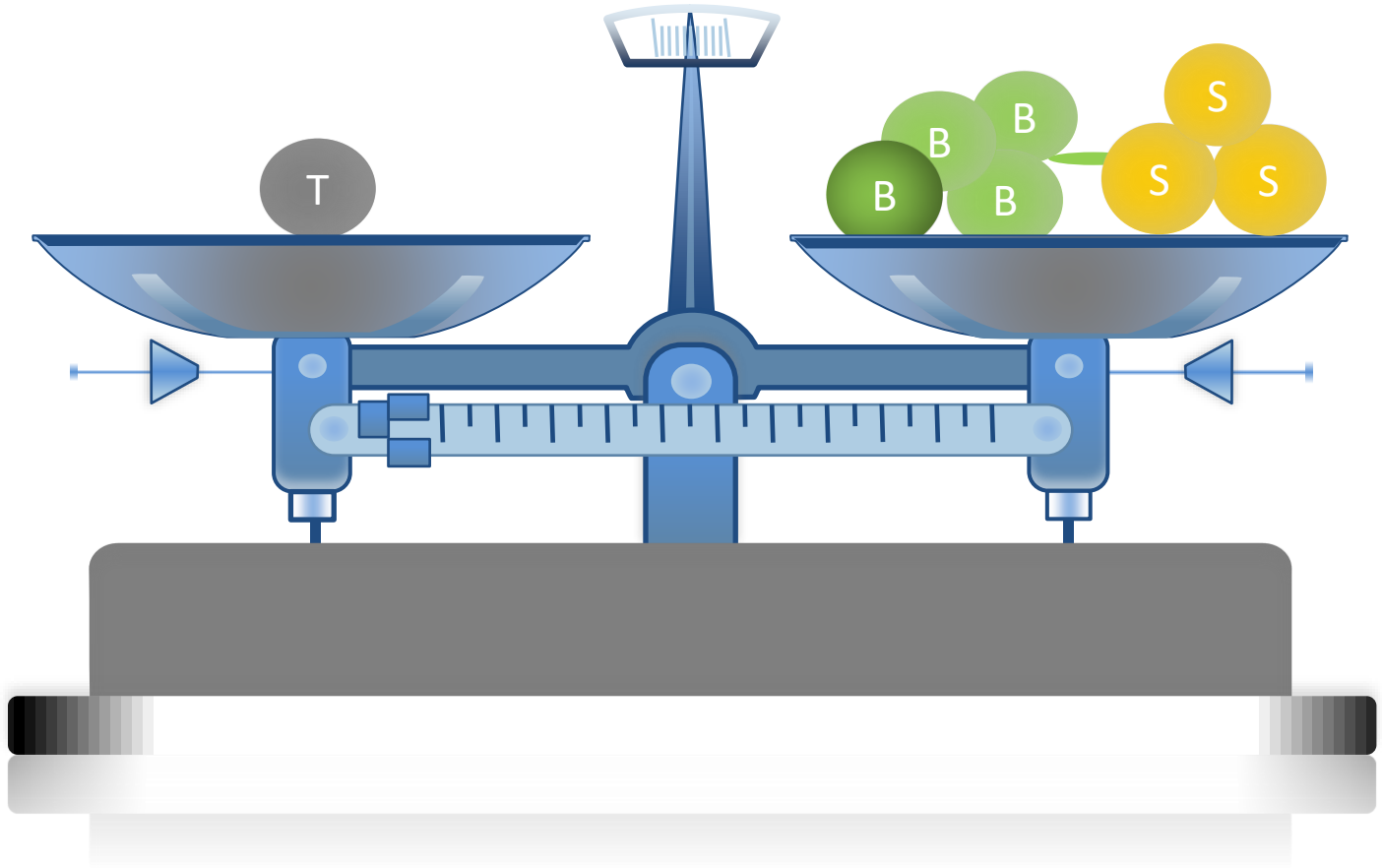


PJM: *Transmission system during extreme cold weather limited the ability to export to support southern neighbors*

Base load compared to hybrid

Retire 100 MW Base Load Generation

- *100 MW Traditional Base Load generates 2400 MWh*



300 MW Solar + 400 MW Batteries

- *Assume 8 hours of sunlight*
- *Assume no losses in conversion*

Usage

- *100 MW **solar** for 8 hours (800 MWh)*
- *400 MW **storage** for 4 hour discharge (1600 MWh)*

Storage

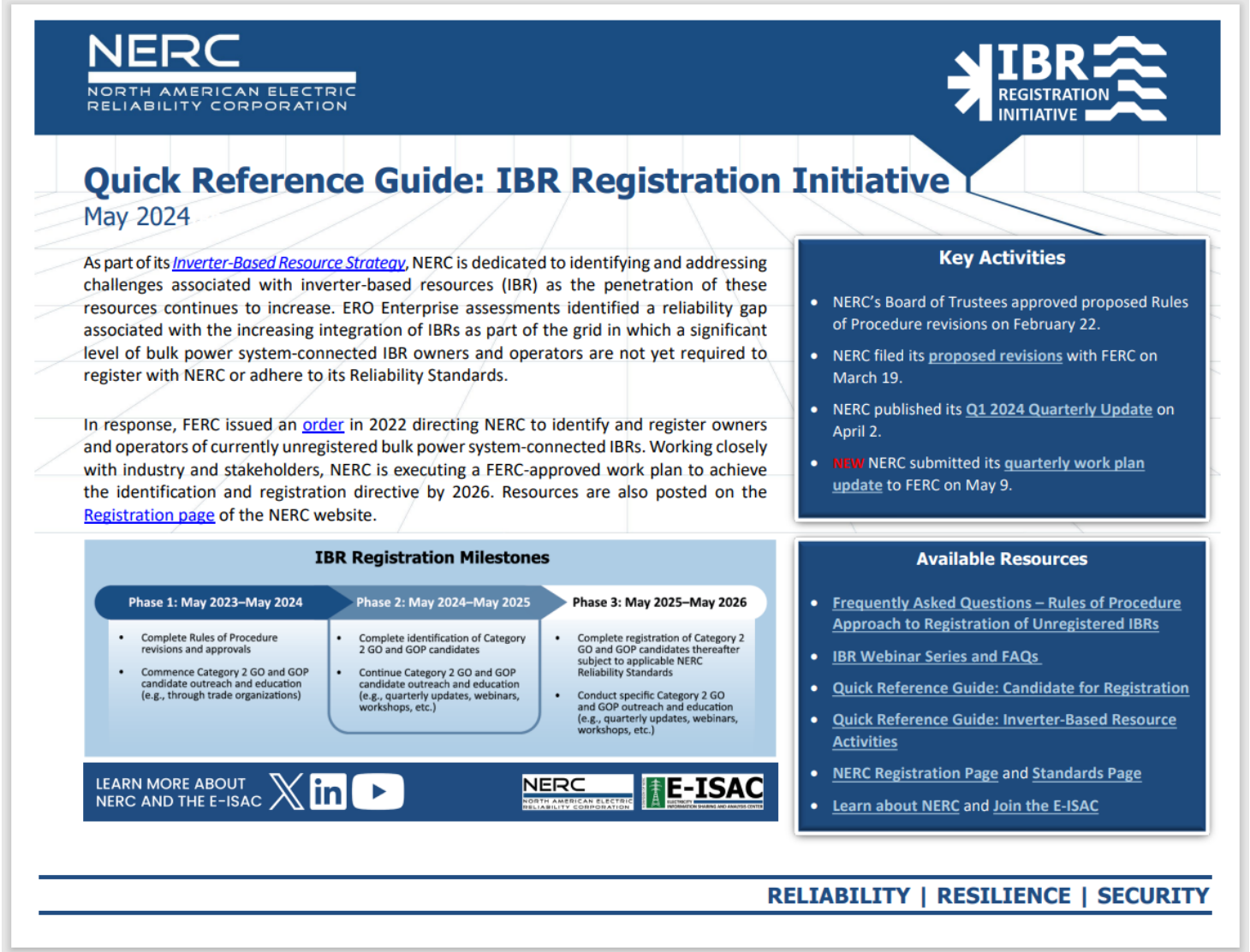
- *200 MW **solar** to charge storage 8 hours (1600 MWh)*

Cybersecurity concerns

- Remote connectivity
- “Common mode” issues
- Supply chain
- Address with NERC registration

Communications Efforts

- Current Communications Products:
  - Strategic Communications Plan
  - Talking Points
  - Quick Reference Guides
  - FAQs
  - Fact Sheets
  - Educational Materials
  - Quarterly Updates
  - EROCG Monthly Updates



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IBR REGISTRATION INITIATIVE

Quick Reference Guide: IBR Registration Initiative

May 2024

As part of its *Inverter-Based Resource Strategy*, NERC is dedicated to identifying and addressing challenges associated with inverter-based resources (IBR) as the penetration of these resources continues to increase. ERO Enterprise assessments identified a reliability gap associated with the increasing integration of IBRs as part of the grid in which a significant level of bulk power system-connected IBR owners and operators are not yet required to register with NERC or adhere to its Reliability Standards.

In response, FERC issued an order in 2022 directing NERC to identify and register owners and operators of currently unregistered bulk power system-connected IBRs. Working closely with industry and stakeholders, NERC is executing a FERC-approved work plan to achieve the identification and registration directive by 2026. Resources are also posted on the Registration page of the NERC website.

Key Activities

- NERC's Board of Trustees approved proposed Rules of Procedure revisions on February 22.
- NERC filed its proposed revisions with FERC on March 19.
- NERC published its Q1 2024 Quarterly Update on April 2.
- NEW NERC submitted its quarterly work plan update to FERC on May 9.

IBR Registration Milestones

Phase 1: May 2023–May 2024	Phase 2: May 2024–May 2025	Phase 3: May 2025–May 2026
• Complete Rules of Procedure revisions and approvals • Commence Category 2 GO and GOP candidate outreach and education (e.g., through trade organizations)	• Complete identification of Category 2 GO and GOP candidates • Continue Category 2 GO and GOP candidate outreach and education (e.g., quarterly updates, webinars, workshops, etc.)	• Complete registration of Category 2 GO and GOP candidates thereafter subject to applicable NERC Reliability Standards • Conduct specific Category 2 GO and GOP outreach and education (e.g., quarterly updates, webinars, workshops, etc.)

Available Resources

- Frequently Asked Questions – Rules of Procedure Approach to Registration of Unregistered IBRs
- IBR Webinar Series and FAQs
- Quick Reference Guide: Candidate for Registration
- Quick Reference Guide: Inverter-Based Resource Activities
- NERC Registration Page and Standards Page
- Learn about NERC and Join the E-ISAC

LEARN MORE ABOUT NERC AND THE E-ISAC

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RELIABILITY | RESILIENCE | SECURITY

Questions and Answers