ACCELERATING INNOVATION

Remote Integrated Operations

For Those About to ROCC: Amp Up Operations with Remote Operation Control Centers

Emerson, Power and Water Solutions

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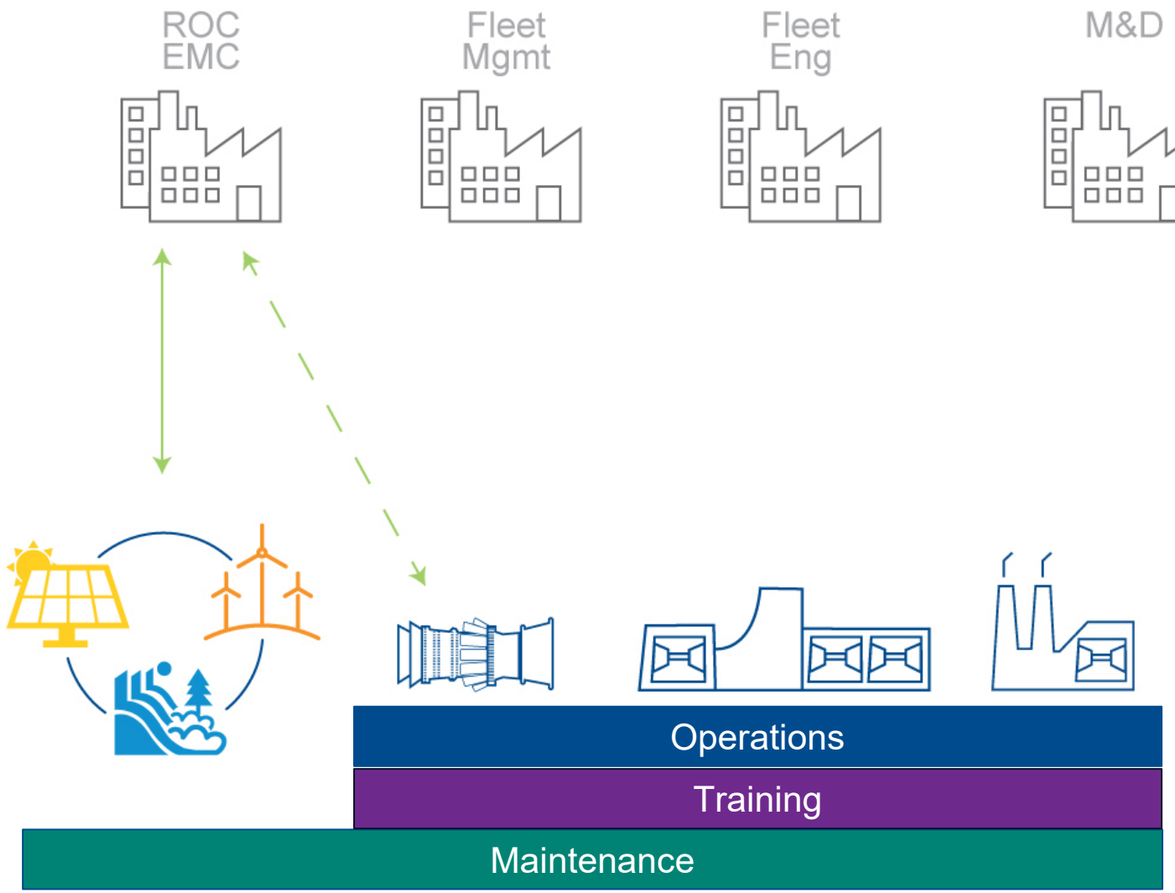
Morgan Lewis, Director, Product Marketing

EMERSON

Remote “Integrated” Operations

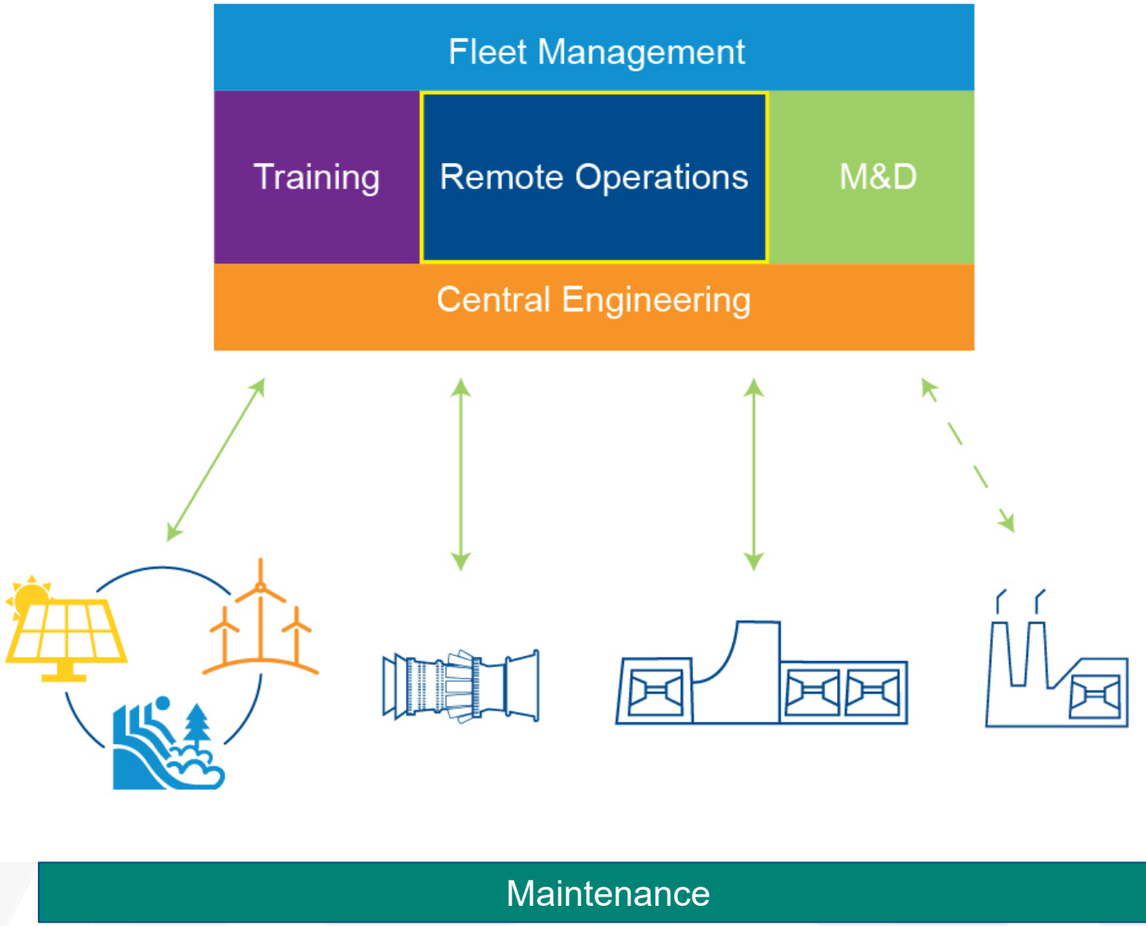
TODAY



Imagine If…

TOMORROW

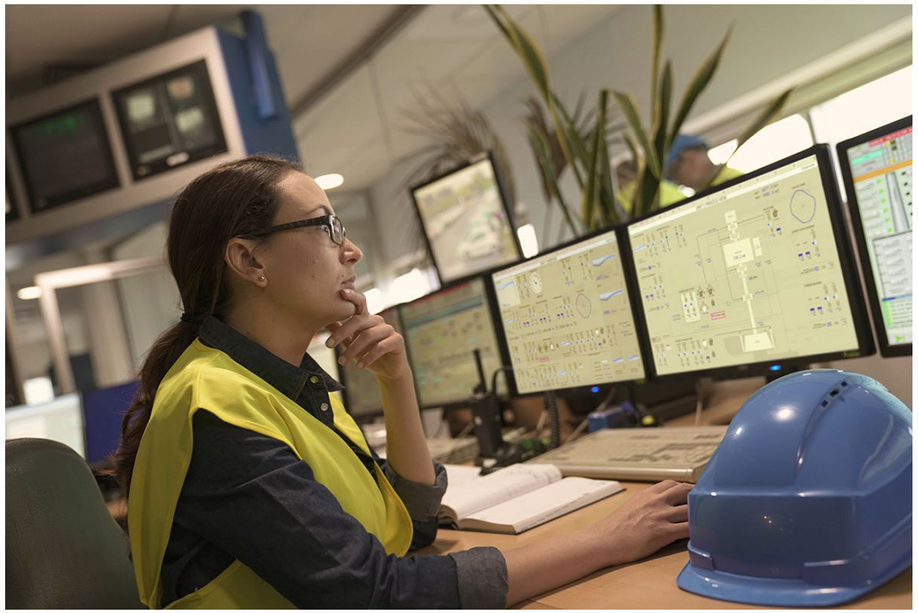
Remote ***Integrated*** Operations Center



ROCCs – Question #1

Why would you consider a ROCC from a commercial perspective?

- More responsive with cycling assets induced by renewables
- Experience from remotely operating renewable assets
- Ease of dispatch: 24-hour availability and bulk power marketing
- Recruitment/retention concerns
- Consistency of operations across fleet
- Common operating platform
- Disaster response
- Cost savings



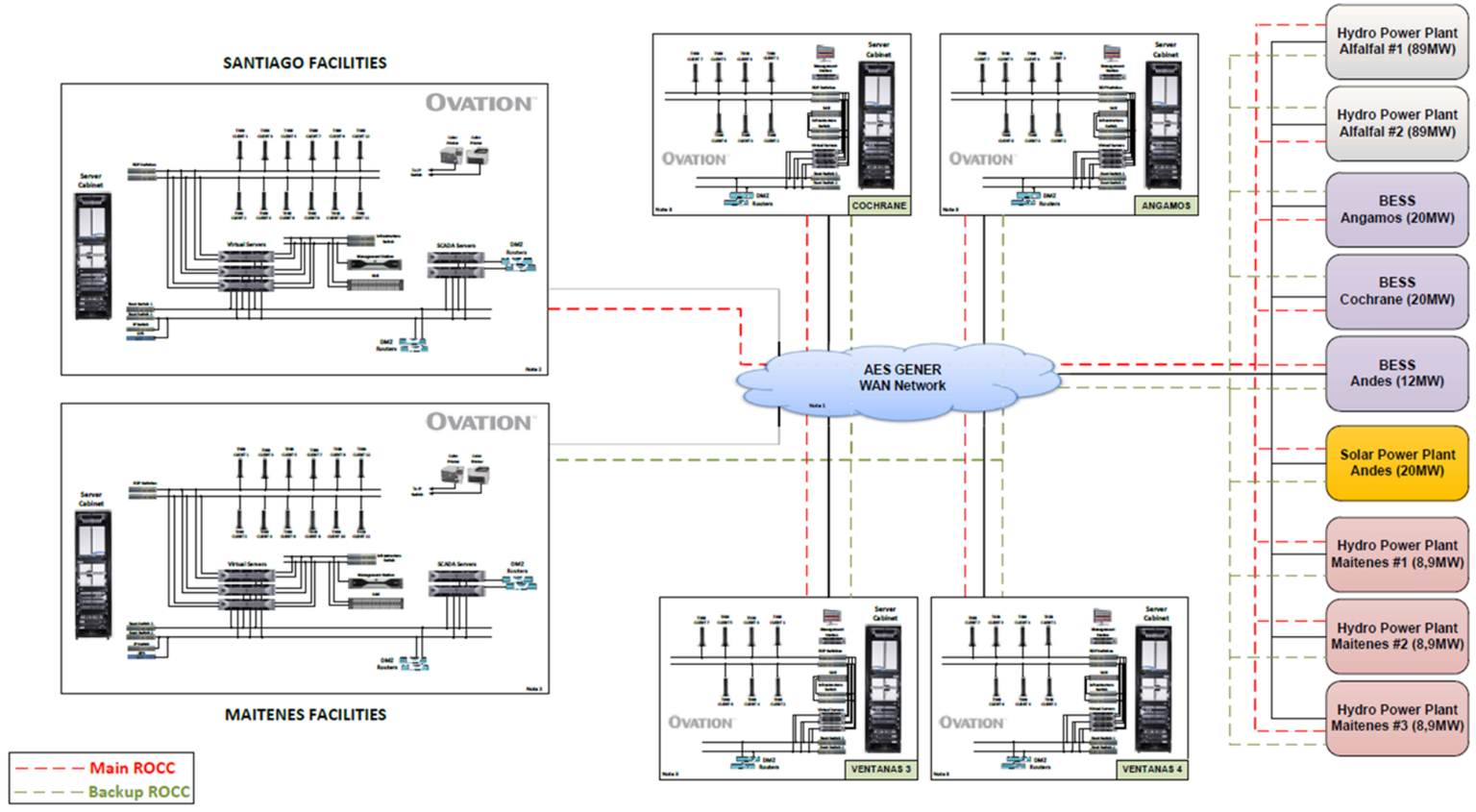
CASE STUDY: AES Gener/Chile

Multiple Sites

- Cochrane (2 Units): 550MW, coal-fired,
- Angamos (2 Units): 558MW, coal-fired,
- Ventanas 3 & 4 (2 Units): 432MW, coalfired,
- Maintenes 1, 2 and 3: 26.7MW, hydro
- Alfalfal 1 & 2: 178 MW, hydro
- Andes: 20MW, solar
- 3 x Battery Energy Storage Systems: 52MW

Drivers

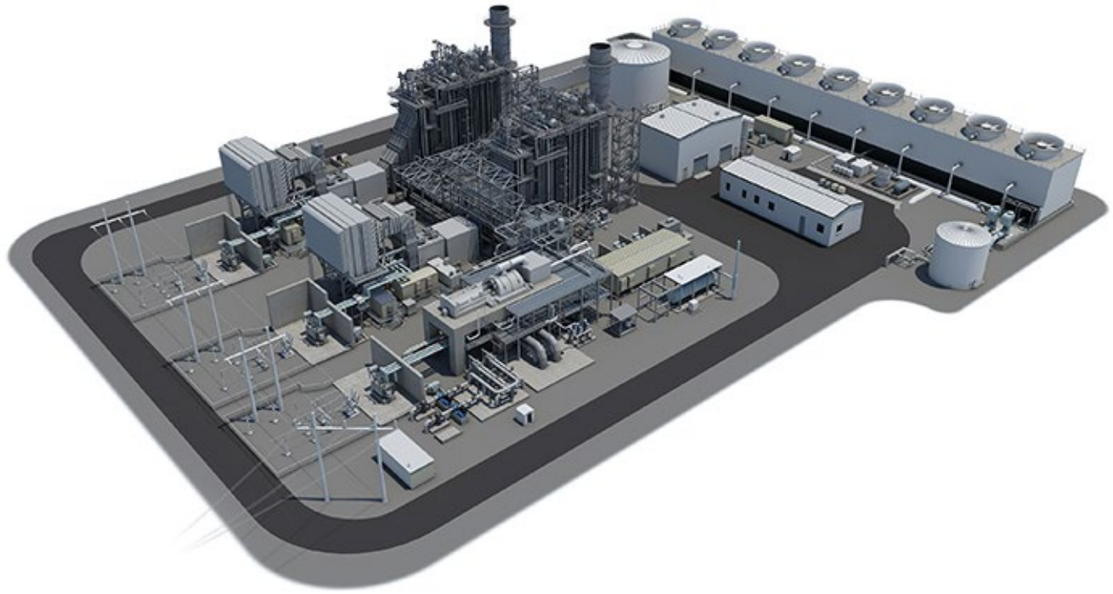
- Reduce manpower
- Optimize knowledge base – bring best operators to ROCC to serve all stations
- Consistency of operations across fleet
- Centralization of information



ROCCs – Question #2

What operational benefits can a ROCC provide?

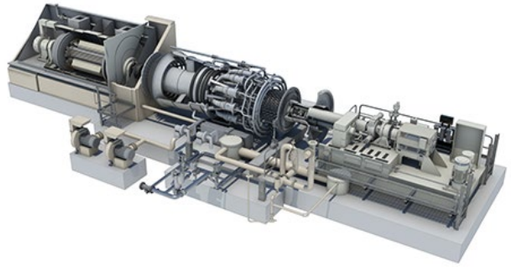
- Top, most experienced operators
- Shared best practices
- Site comparisons
- Single historian for pulling comparative data
- Fleet-wide unit/equipment availability and capability
- Ease of dispatch: better decision making on which units to dispatch



Remote Operation Considerations

CENTRALIZED REMOTE OPERATIONS CENTER (ROC)

- All units immediately **dispatchable 24/7**
- Site availability not tied to personnel availability or weather-restricted travel
- **Total visibility** of fleet status
- Dispatch maintenance upon alert of issue
- Access to all plant alarms
- **Compare operational performance** across fleet



UNIT/SIZE CONDITION AWARENESS

- “Remote Start” does not provide full plant status where full integration of controls at ROC **provides full alarm and diagnostic information**
- Ability to run **automated pre-start checks** to ensure readiness
- **Alleviates safety issues** of dispatching personnel at middle of night – grogginess, weather, road conditions, site conditions, etc.

ENHANCED CAPABILITIES

- Expand remote monitoring and control to encompass more BOP systems
- Ability to use **secure remote viewing** of gas turbine screens
- Add vibration monitoring to BOP pumps and motors
- Possible addition of site surveillance with **AI detection software**
- **Exploiting** consolidated data

Net Result: Increased Dispatch Opportunities and O&M Savings

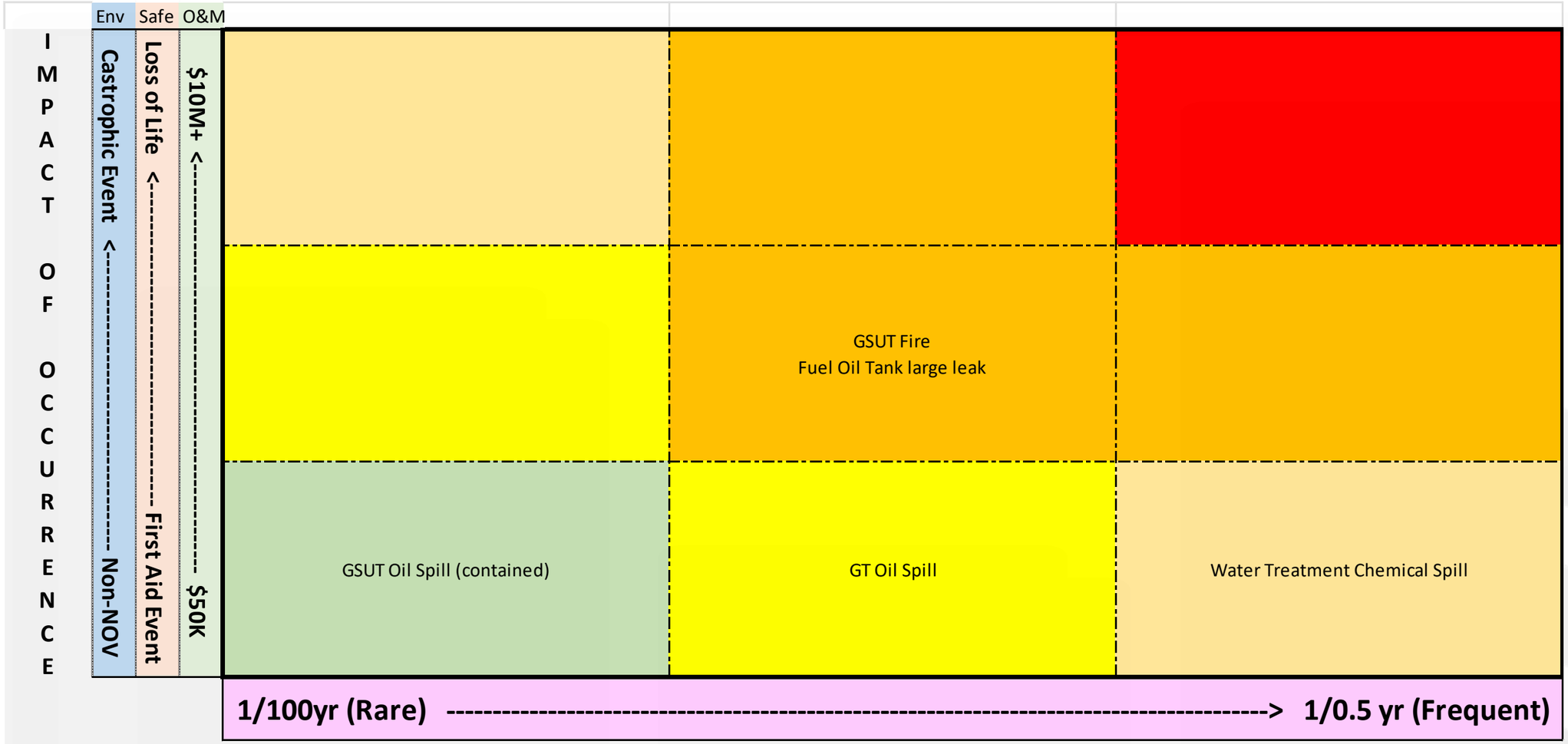
ROCCs – Question #3

Why wouldn’t your company consider a ROCC?

- Cost – Not just for the ROCC…
- Cybersecurity
- Incentive (or lack of it)
  - What is your KPI metric?
- Culture
- Risk

Site Risk Assessment: Is it Culture, Perception, or Reality?

What's holding you back?

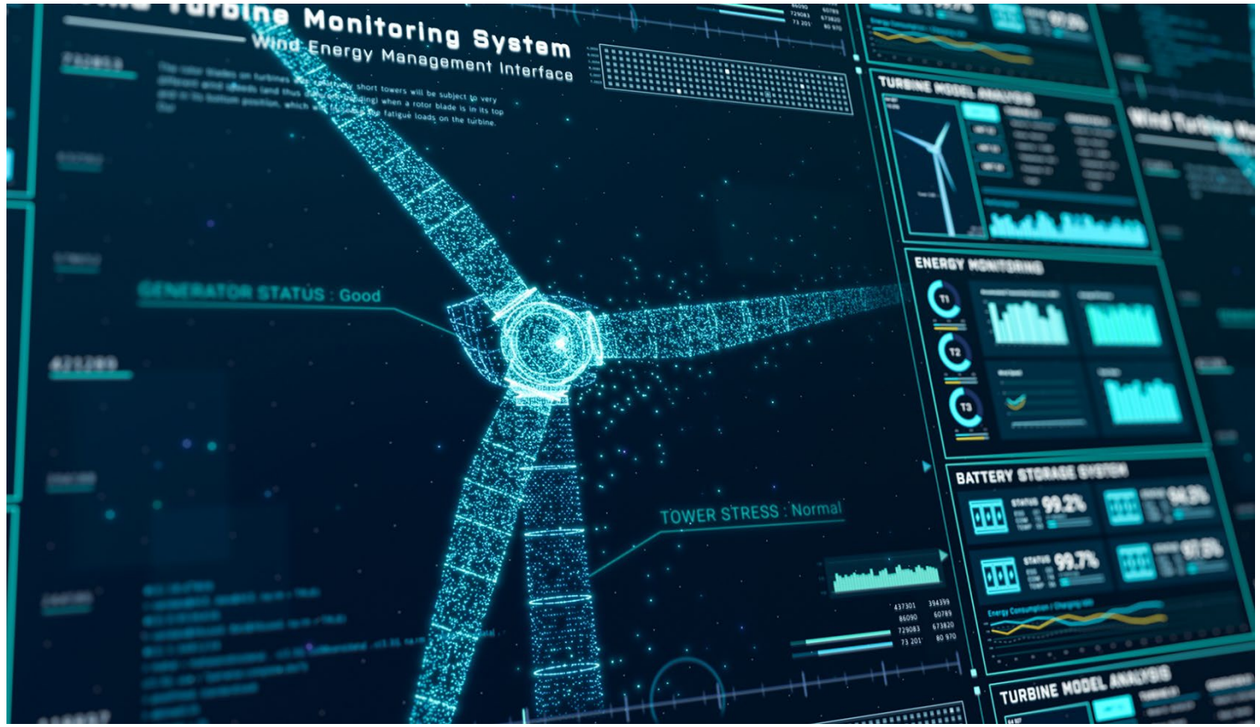


Evaluate risk (likelihood vs impact) for each item of concern

ROCCs – Question #4

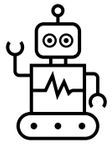
What benefits might new technologies bring to ROCCs?

- Enhanced situational awareness (ex. Autopilot, machine vision)
- Advanced diagnostics
- Faster responses
- Automated responses
- Robotic automation



What Advanced Technology is Achieving Today

Robots & Drones

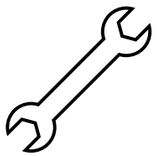


Crawling robots to assess, report and repair assets

Drones surveying wind turbines, solar panels for defects and optimization

Predictive Analytics and Diagnosis

Machine learning models trained to understand operational issues



Diagnostic engine to offer root cause analysis, fixes, and knock-on operational effects

Multifactor Dispatch

Fleet balancing of multi-objective optimization tasks

Centralized dispatch of assets to make better financial decisions

Knowledge Accretion and Acceleration

AI Agents deployed to ensure regulatory compliance and internal knowledge transfer

Decision support models through incorporation of best practices

Traditional ROCC

Recent Remote Operations Projects

Southeast US Regulated Utility

- 12 Combined Cycle Power Blocks
- 2 Simple Cycle Sites / 8 CTs
- Over 14GW of generation
- 7F, FT-4

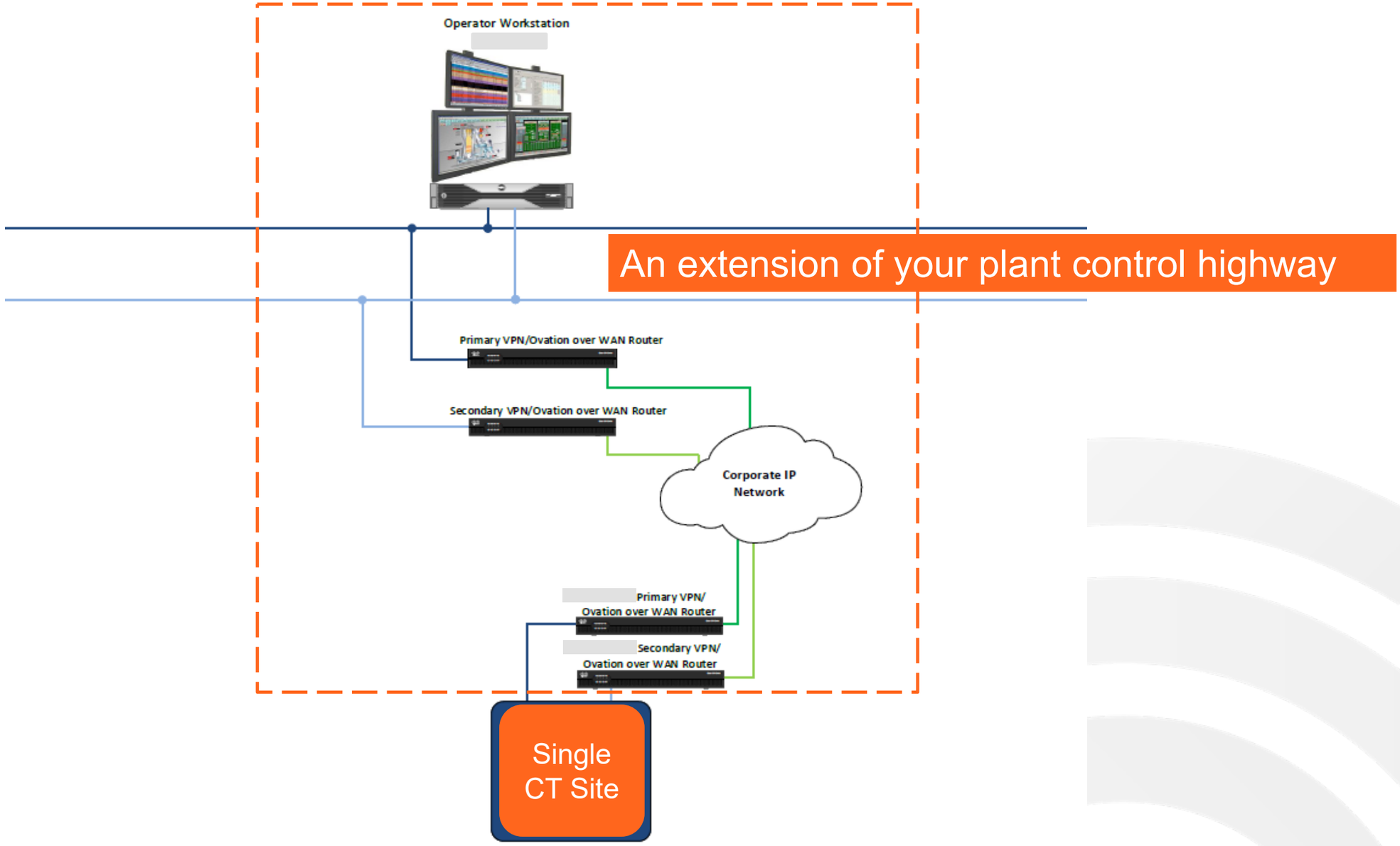
Midwest US Regulated Utility

- 11 Simple Cycle Sites
- 34 units, 2690 MW
- 7F, LM6000, 7E, 7B, W501D, others

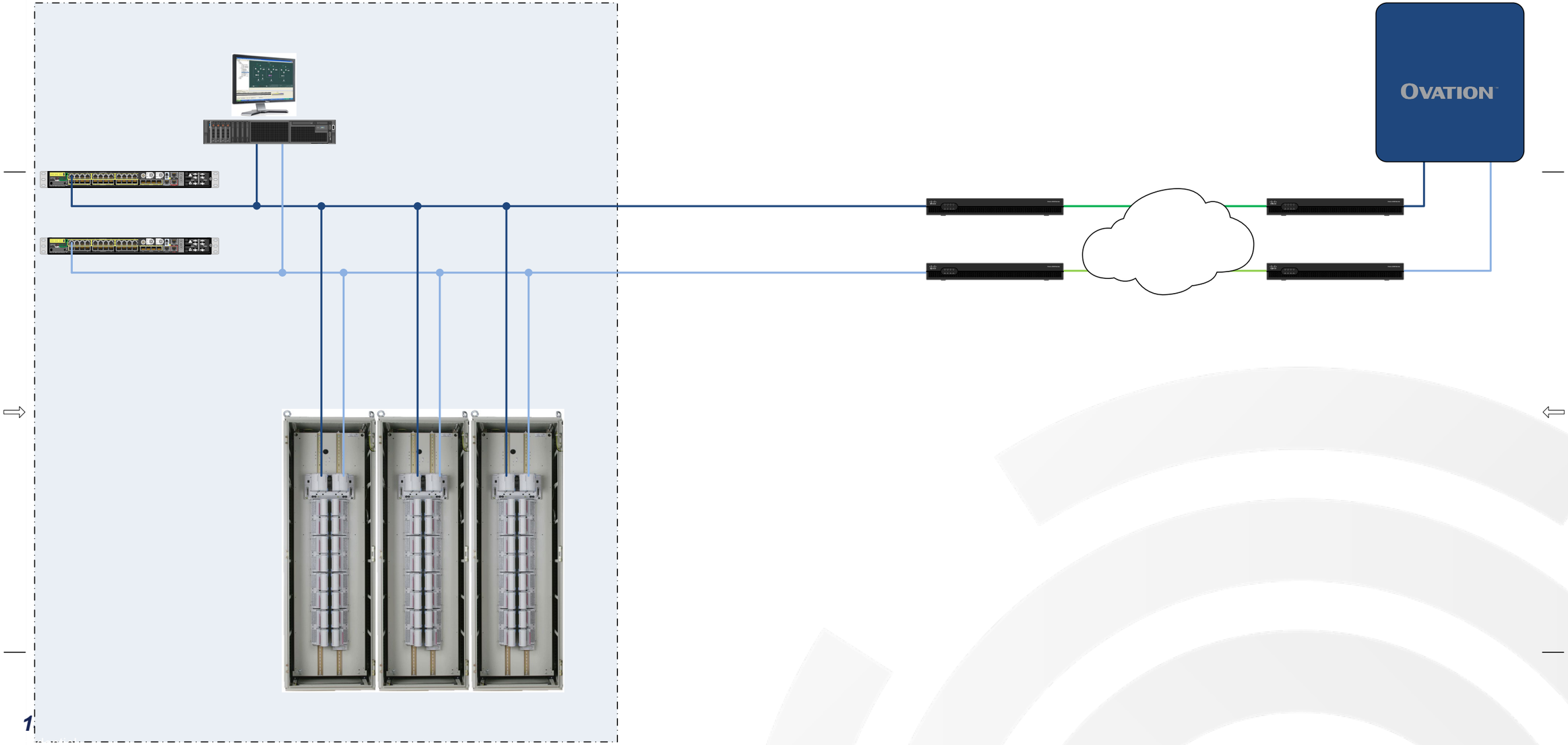
Central East US Regulated Utility

- 8 Simple Cycle Sites
- 50 units,4800 MW
- 7E, 7B, W501D, W501F

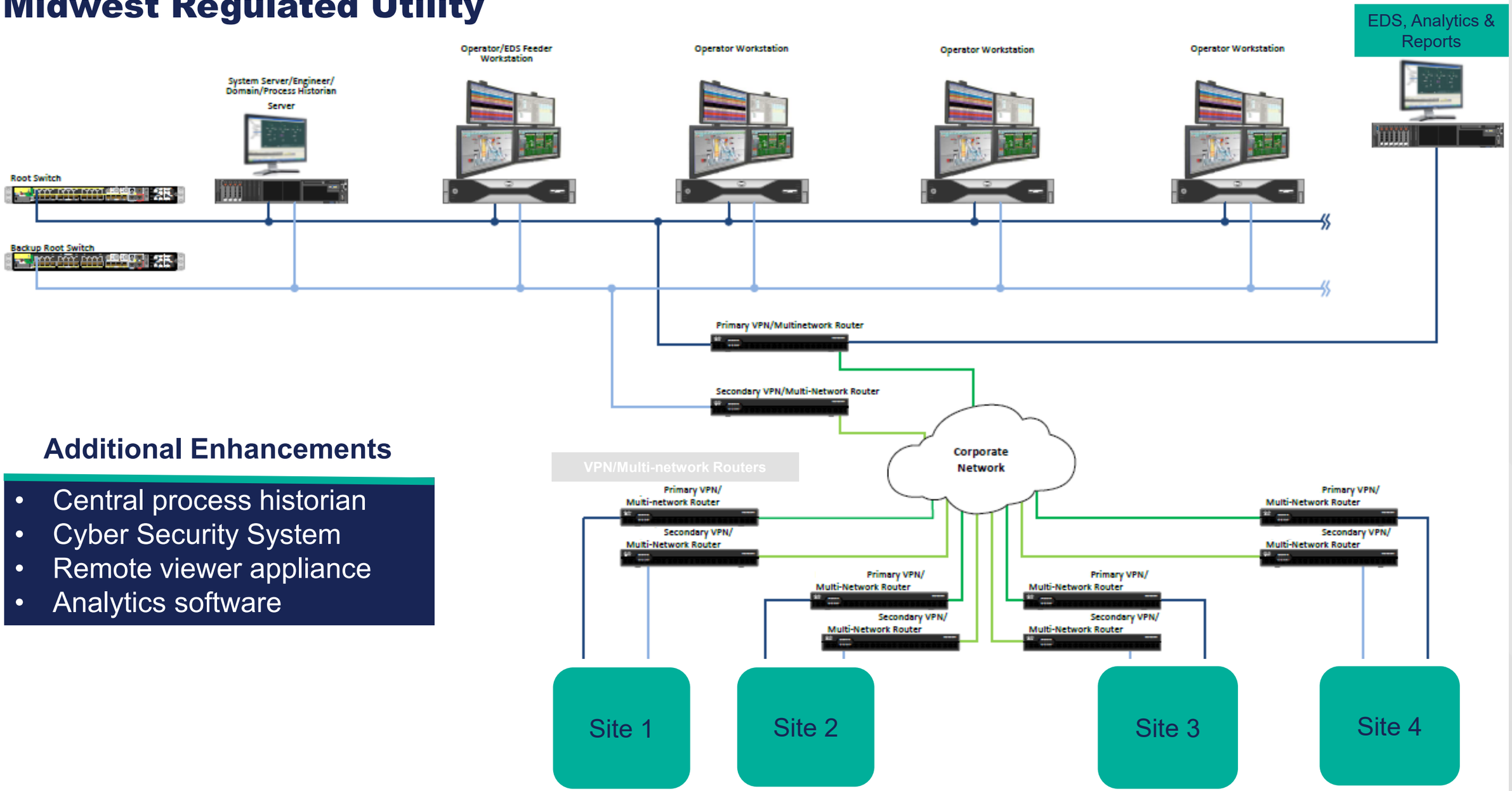
Basic Install or Corporate Pilot at Another Facility



Plant-Level Architecture



Consolidated Remote Operations Control Center (ROCC)
Midwest Regulated Utility



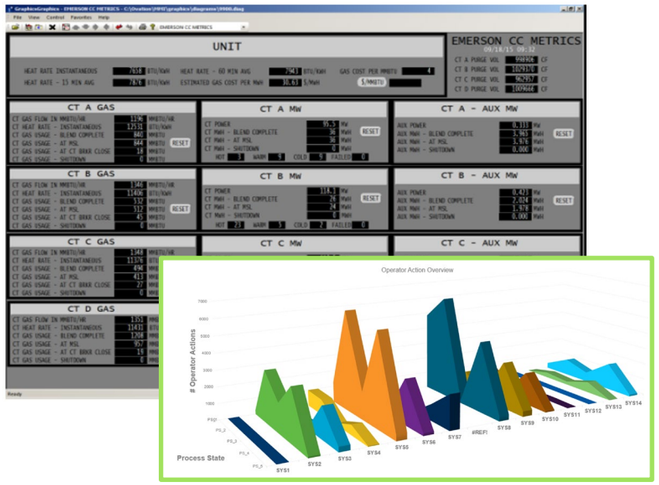
Additional Enhancements

- Central process historian
- Cyber Security System
- Remote viewer appliance
- Analytics software

Steps to Automating Plant Operations to Reduce Burden on ROCC Operators

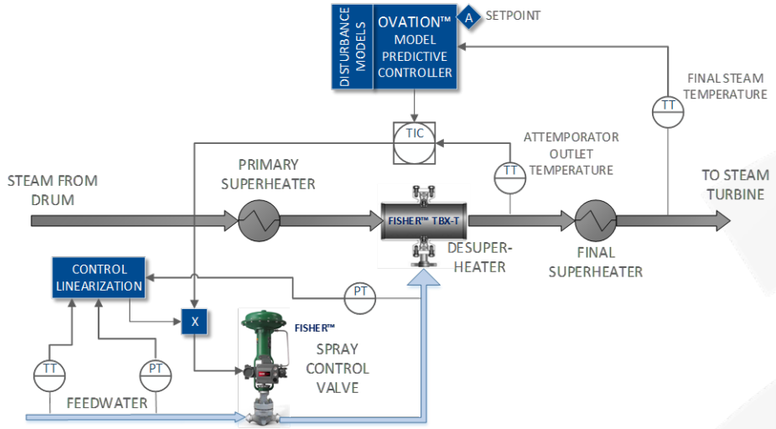
OPERATION ANALYSIS

- Operational benchmarking
- Assess technology gaps
- Define improvement roadmap



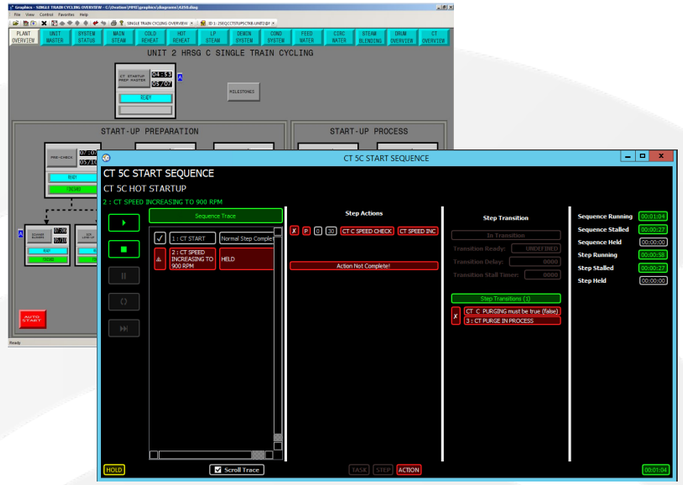
ADVANCED POWER APPLICATIONS

- Smooths troublesome processes
- Improves control resilience
- Enhances situational awareness

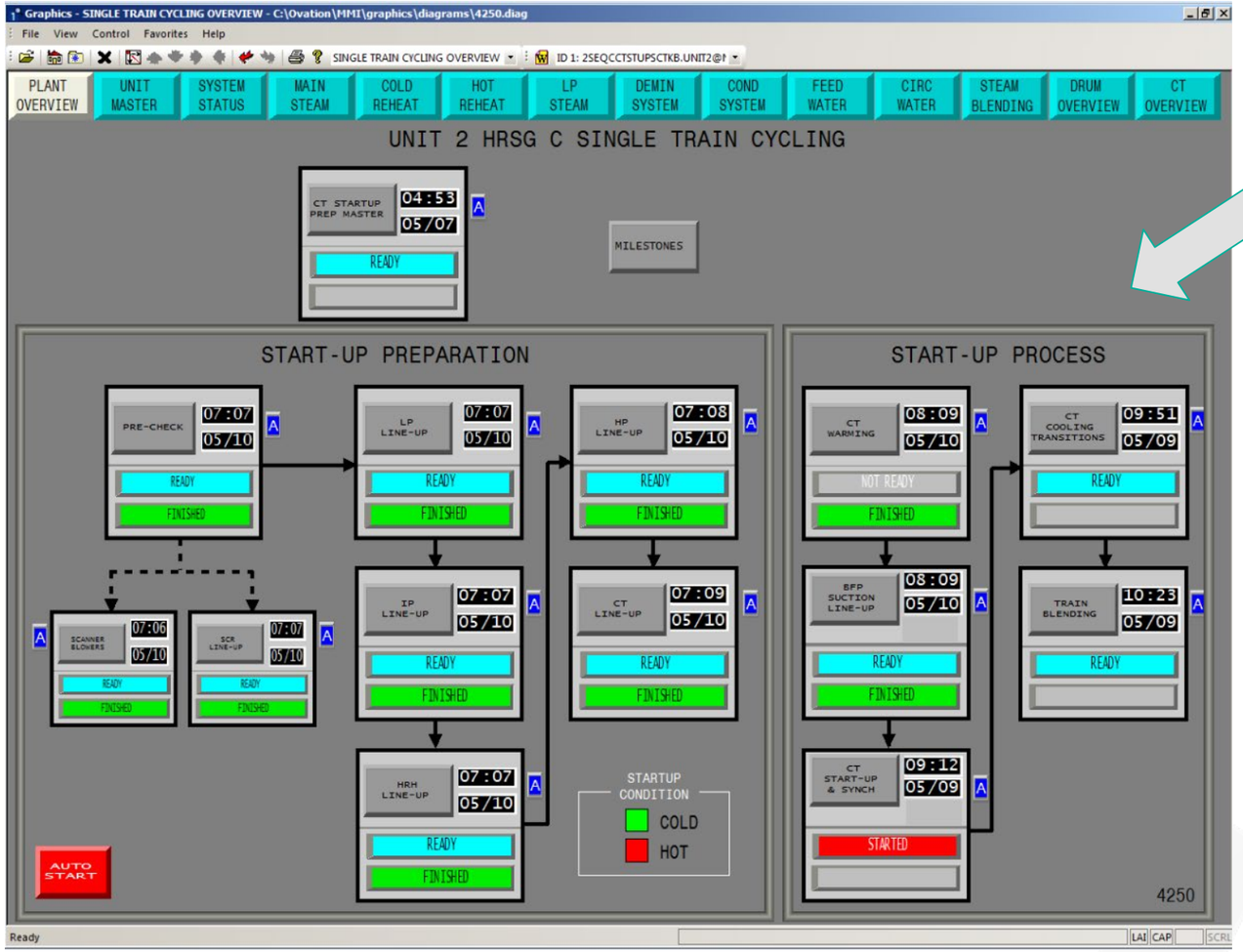


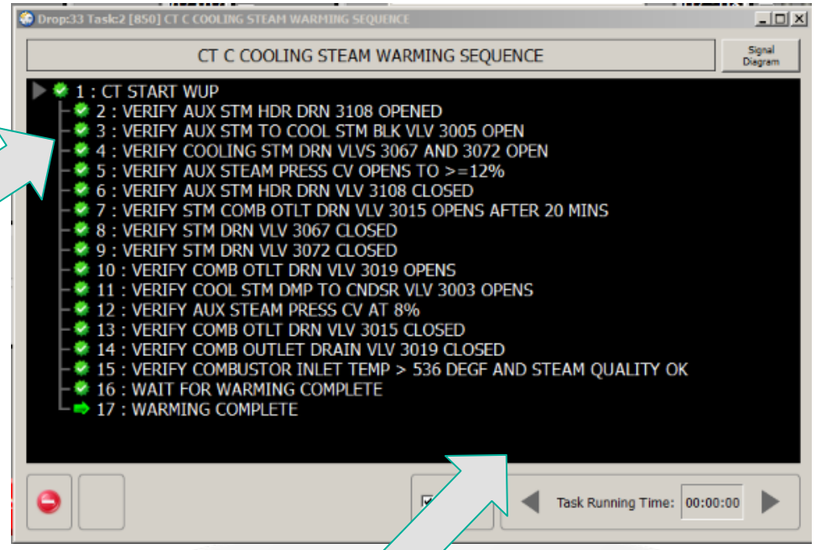
SEQUENTIAL AUTOMATION

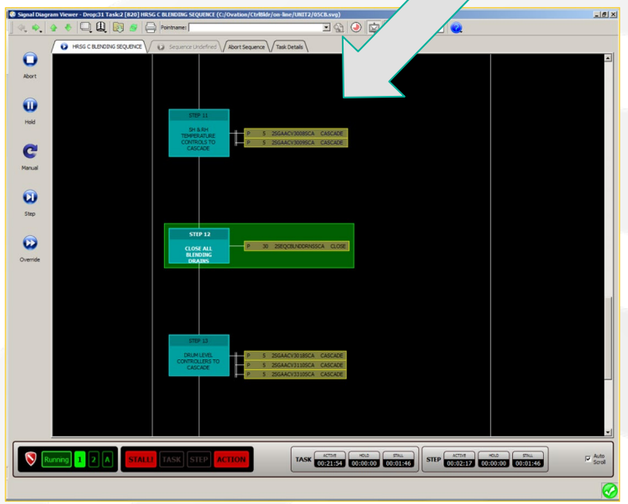
- Creates a ‘virtual operator’
- Improves operational efficiency
- Multiple plant reliability
- Maximizes human performance



Sequencing for Improved Starting Reliability from ROCC







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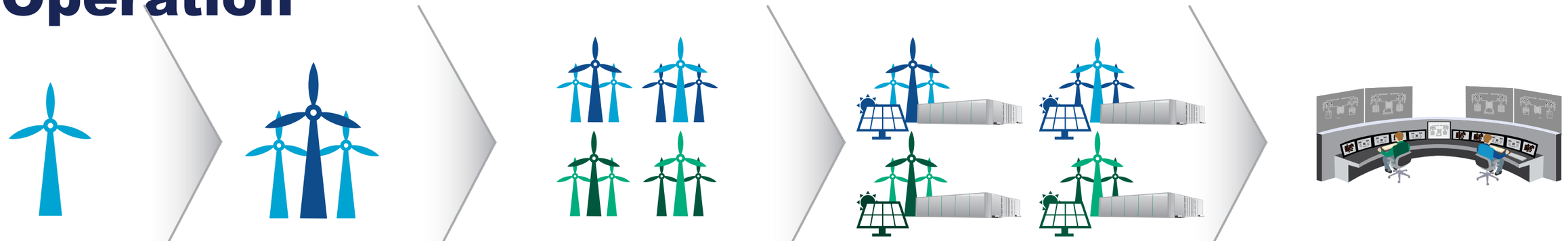
Renewable ROCC

What's Different About Renewable ROCCs?

- Consider how renewables are operated
  - Monitored vs controlled
- Number of generating assets
  - Typically well over 1000 "units"
- Dispatch of intermittent power
- Individual small generators criticality is lower
  - Operations and events happen slower
- Skill sets for operators are different
- Aggregation of data more valuable
  - Much more data -> 25pts/MW vs 1000/MW
- Diversity of generating assets…

One Platform Uniting Renewable Portfolios, Including Wind Fleets, for Effective, Efficient Operation



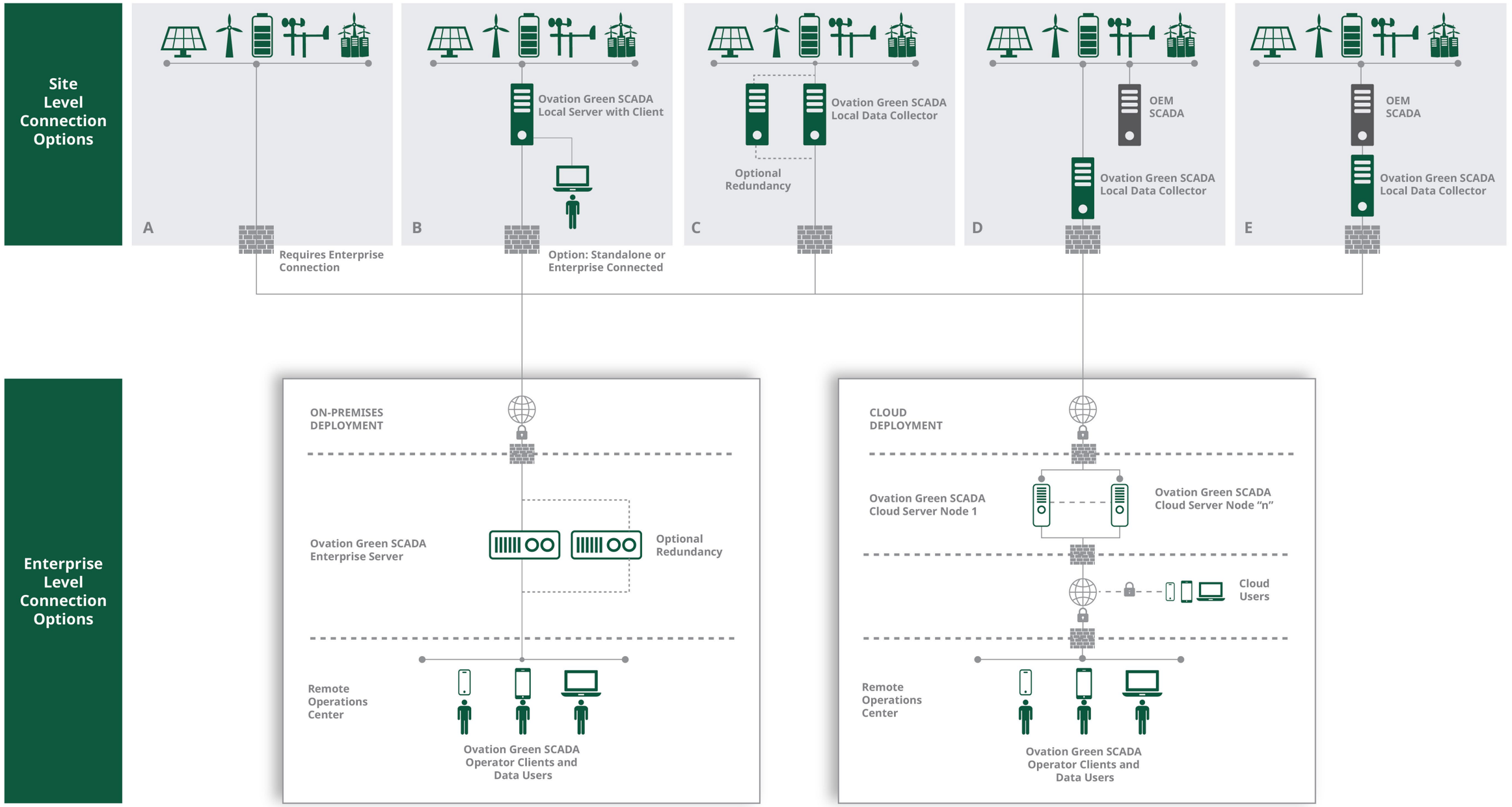
Unified Asset Management and SCADA Software

Multi-Asset, Interoperable, OEM-Independent

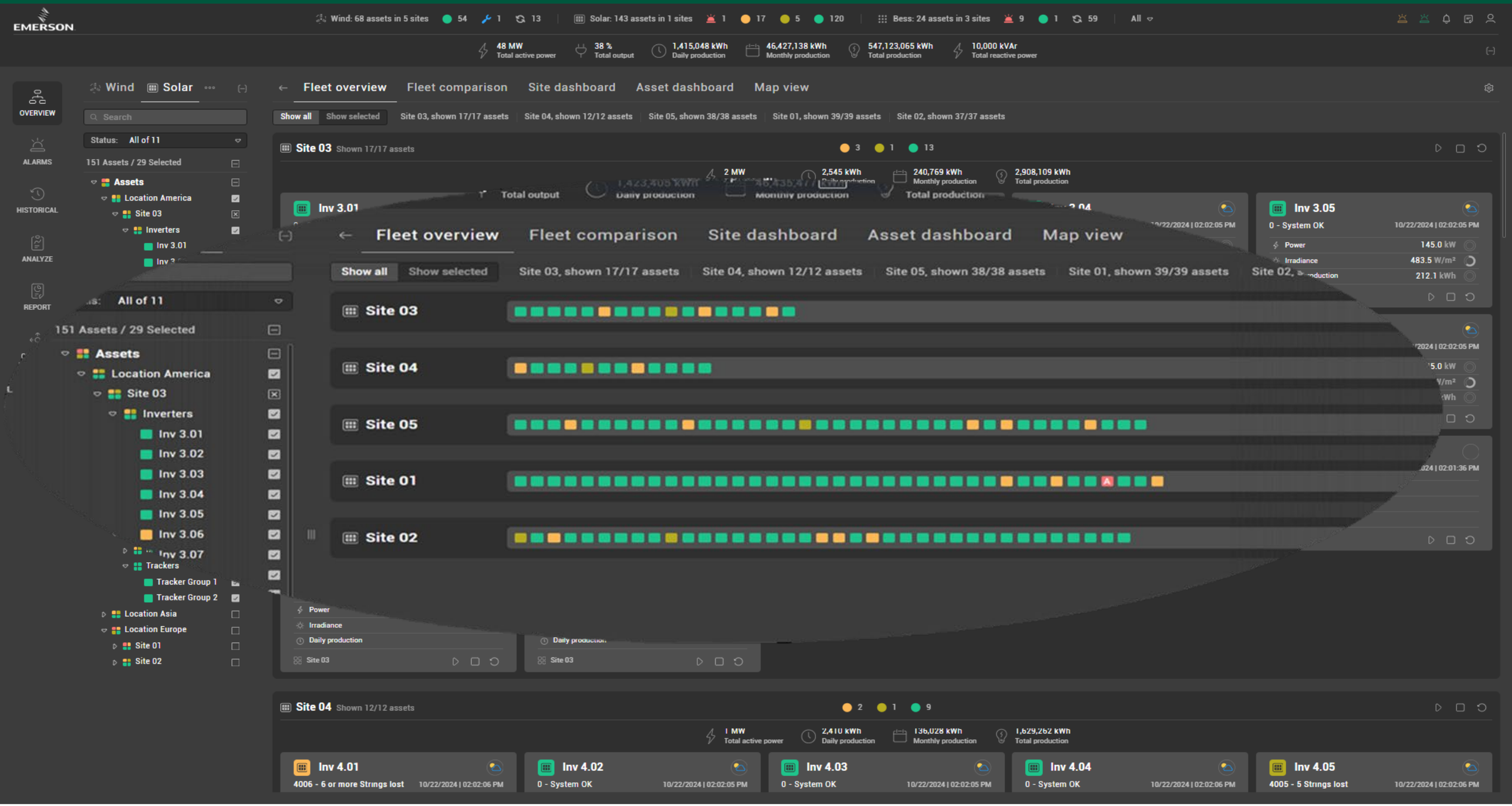
- Fleet-wide view with unified KPI dashboards, reports, alarms, diagnostics and trends
- Ideal for remote operation centers using the same operating screens for all models of turbines, solar inverters, or energy storage systems
- NERC GADS and industry-specific reports for the entire fleet
- Self-maintenance via tunable parameters and maintenance controls
- High-resolution data via direct, native communication with wind controls
- Connectivity to third-party systems (CMMS, M&D, historian)

OVATION™ GREEN

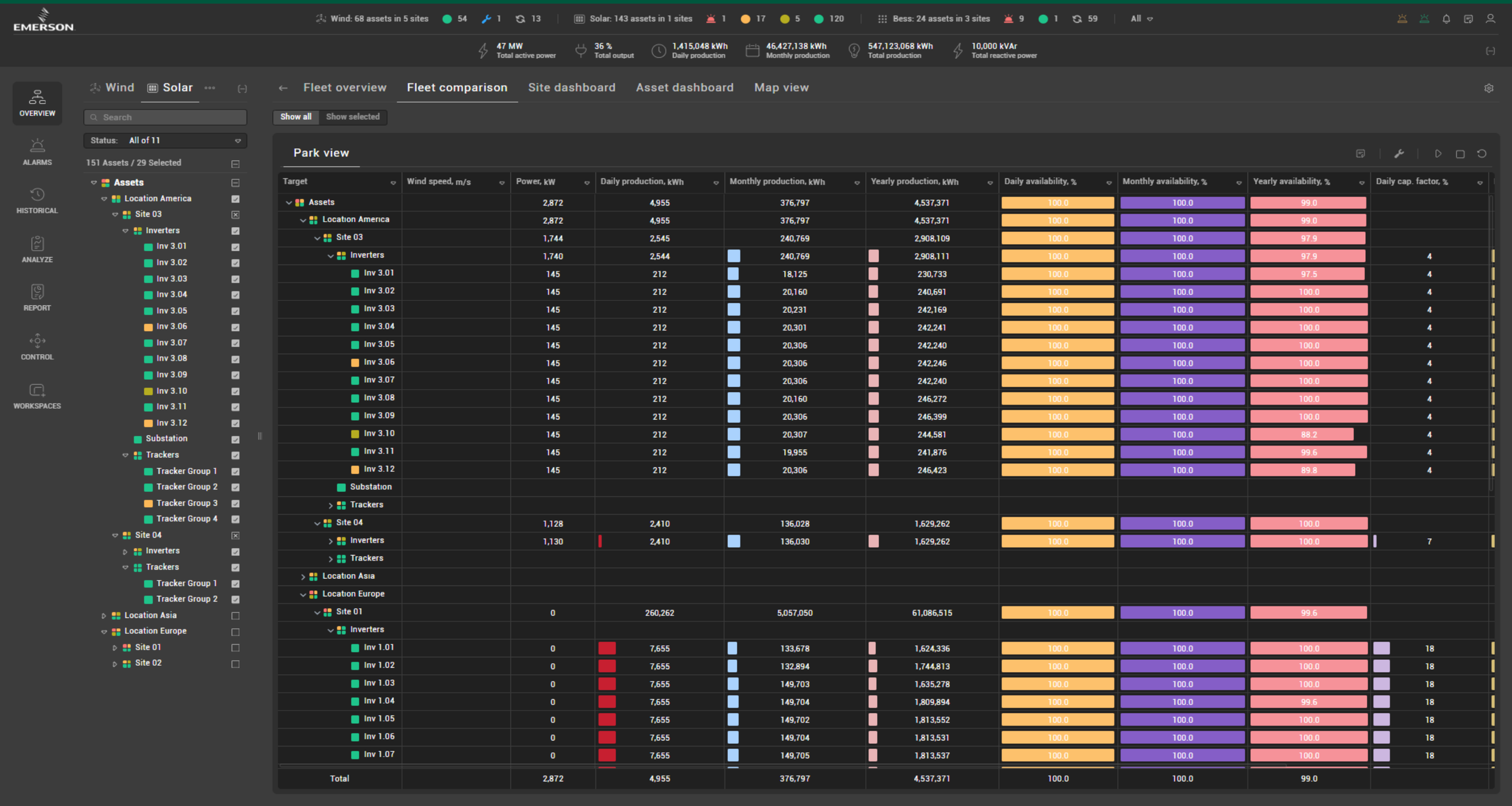
SCADA Integration of Control and Data Across Your Fleet



Leveraging SCADA for Operations – Solar PV Fleet Overview Dashboard

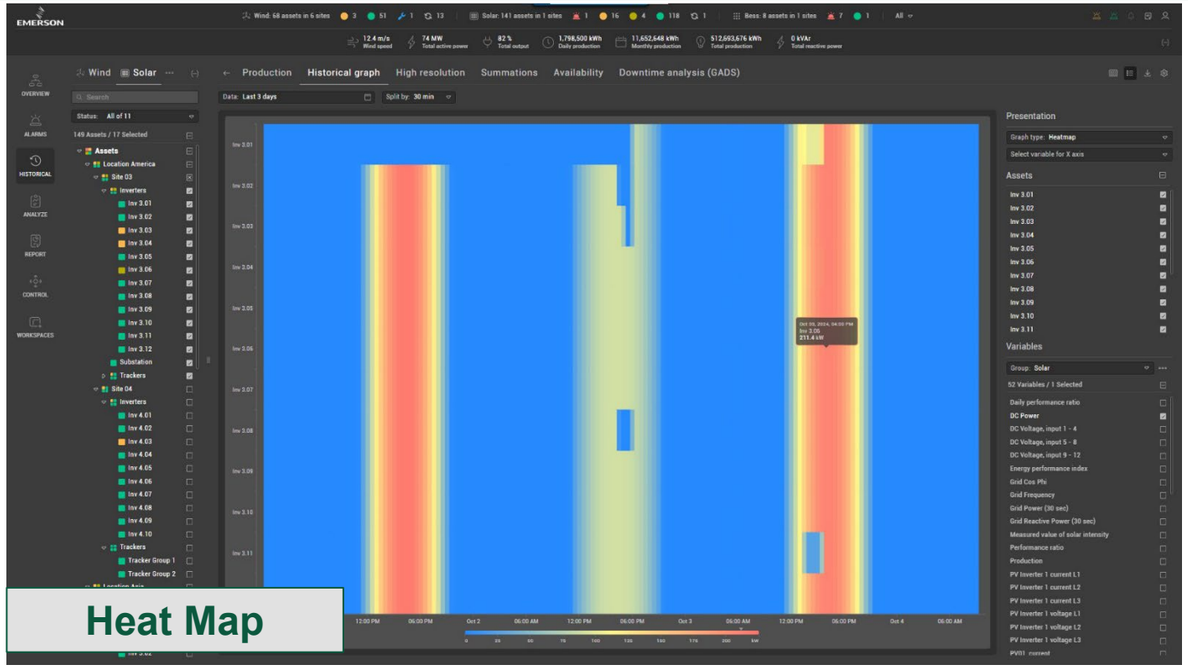


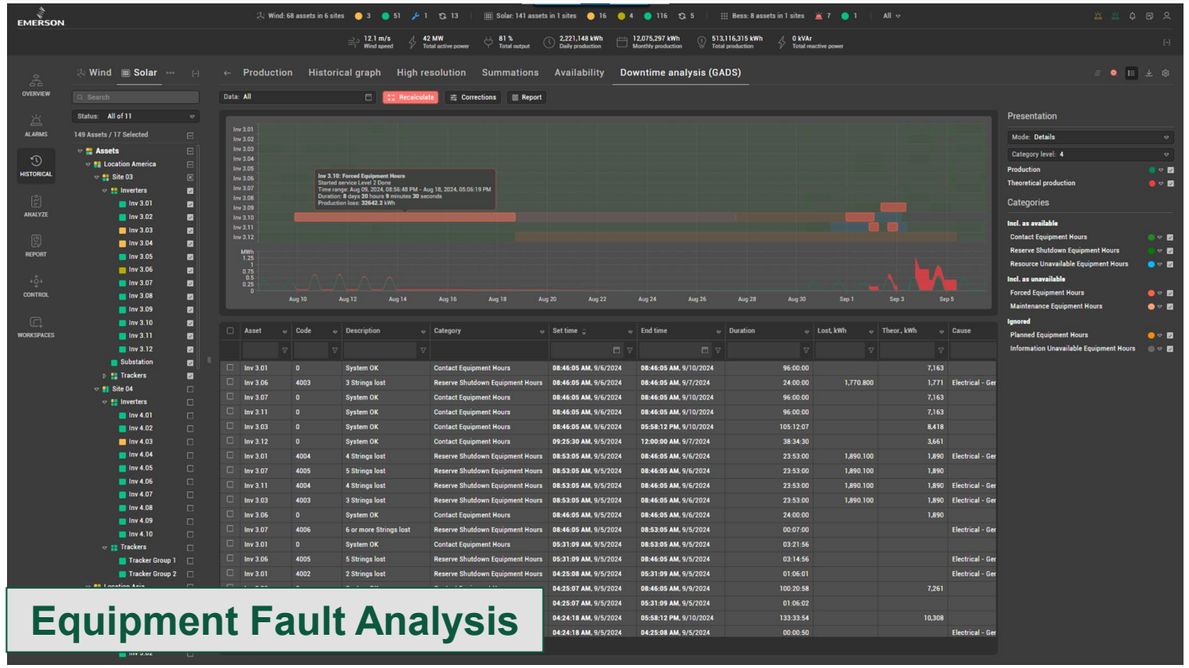
Leveraging SCADA for Operations - Solar PV Fleet (Multiple Sites) Comparison

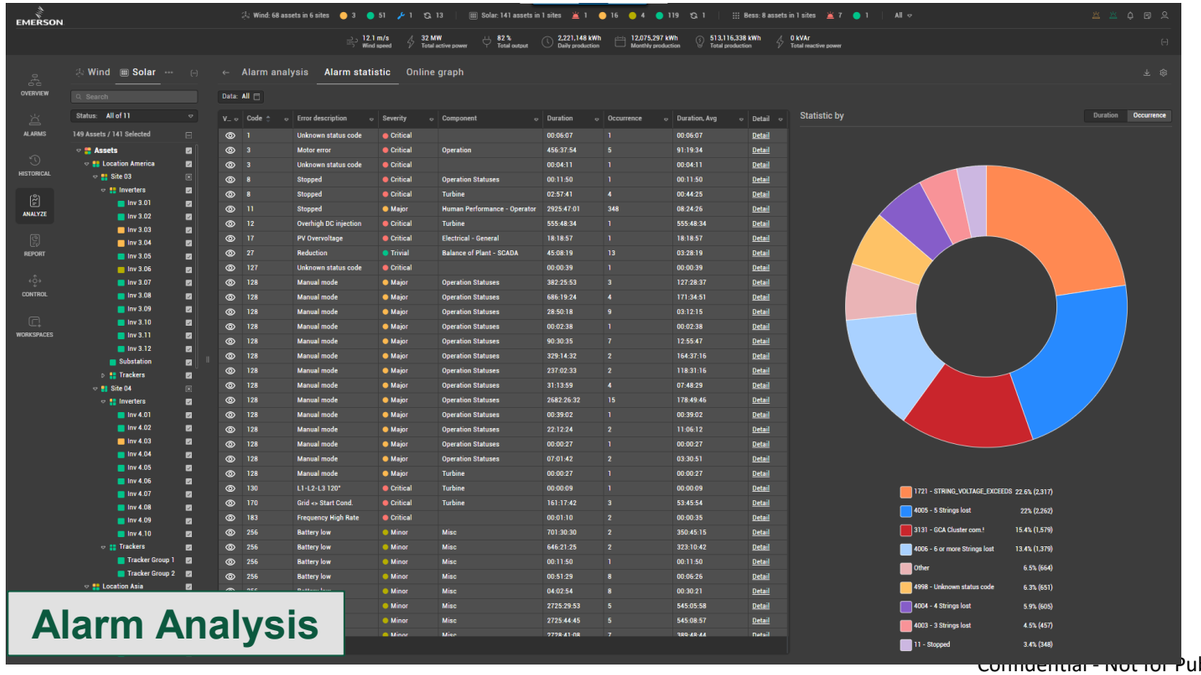


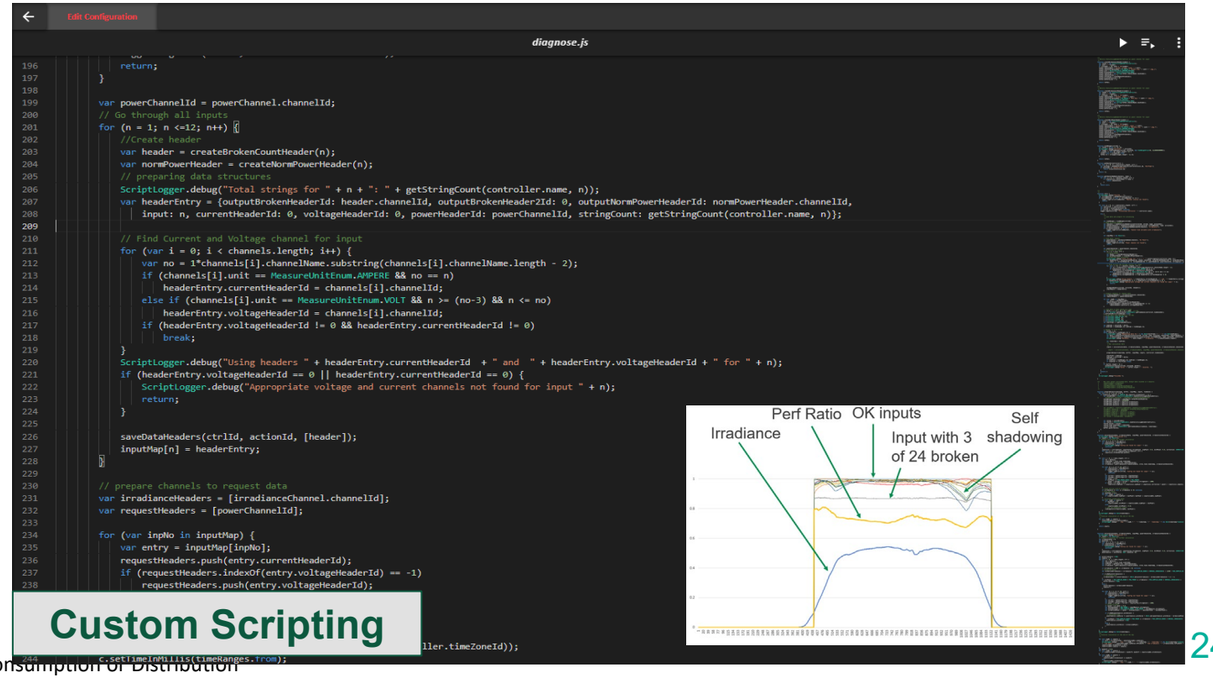
Target	Wind speed, m/s	Power, kW	Daily production, kWh	Monthly production, kWh	Yearly production, kWh	Daily availability, %	Monthly availability, %	Yearly availability, %	Daily cap. factor, %
Assets		2,872	4,955	376,797	4,537,371	100.0	100.0	99.0	
Location America		2,872	4,955	376,797	4,537,371	100.0	100.0	99.0	
Site 03		1,744	2,545	240,769	2,908,109	100.0	100.0	97.9	
Inverters		1,740	2,544	240,769	2,908,111	100.0	100.0	97.9	4
Inv 3.01		145	212	18,125	230,733	100.0	100.0	97.5	4
Inv 3.02		145	212	20,160	240,691	100.0	100.0	100.0	4
Inv 3.03		145	212	20,231	242,169	100.0	100.0	100.0	4
Inv 3.04		145	212	20,301	242,241	100.0	100.0	100.0	4
Inv 3.05		145	212	20,306	242,240	100.0	100.0	100.0	4
Inv 3.06		145	212	20,306	242,246	100.0	100.0	100.0	4
Inv 3.07		145	212	20,306	242,240	100.0	100.0	100.0	4
Inv 3.08		145	212	20,160	246,272	100.0	100.0	100.0	4
Inv 3.09		145	212	20,306	246,399	100.0	100.0	100.0	4
Inv 3.10		145	212	20,307	244,581	100.0	100.0	88.2	4
Inv 3.11		145	212	19,955	241,876	100.0	100.0	99.6	4
Inv 3.12		145	212	20,306	246,423	100.0	100.0	89.8	4
Substation									
Trackers									
Site 04		1,128	2,410	136,028	1,629,262	100.0	100.0	100.0	
Inverters		1,130	2,410	136,030	1,629,262	100.0	100.0	100.0	7
Trackers									
Location Asia									
Location Europe									
Site 01		0	260,262	5,057,050	61,086,515	100.0	100.0	99.6	
Inverters									
Inv 1.01		0	7,655	133,678	1,624,336	100.0	100.0	100.0	18
Inv 1.02		0	7,655	132,894	1,744,813	100.0	100.0	100.0	18
Inv 1.03		0	7,655	149,703	1,635,278	100.0	100.0	100.0	18
Inv 1.04		0	7,655	149,704	1,809,894	100.0	100.0	99.6	18
Inv 1.05		0	7,655	149,702	1,813,552	100.0	100.0	100.0	18
Inv 1.06		0	7,655	149,704	1,813,531	100.0	100.0	100.0	18
Inv 1.07		0	7,655	149,705	1,813,537	100.0	100.0	100.0	18
Total		2,872	4,955	376,797	4,537,371	100.0	100.0	99.0	

Leveraging SCADA for Operations

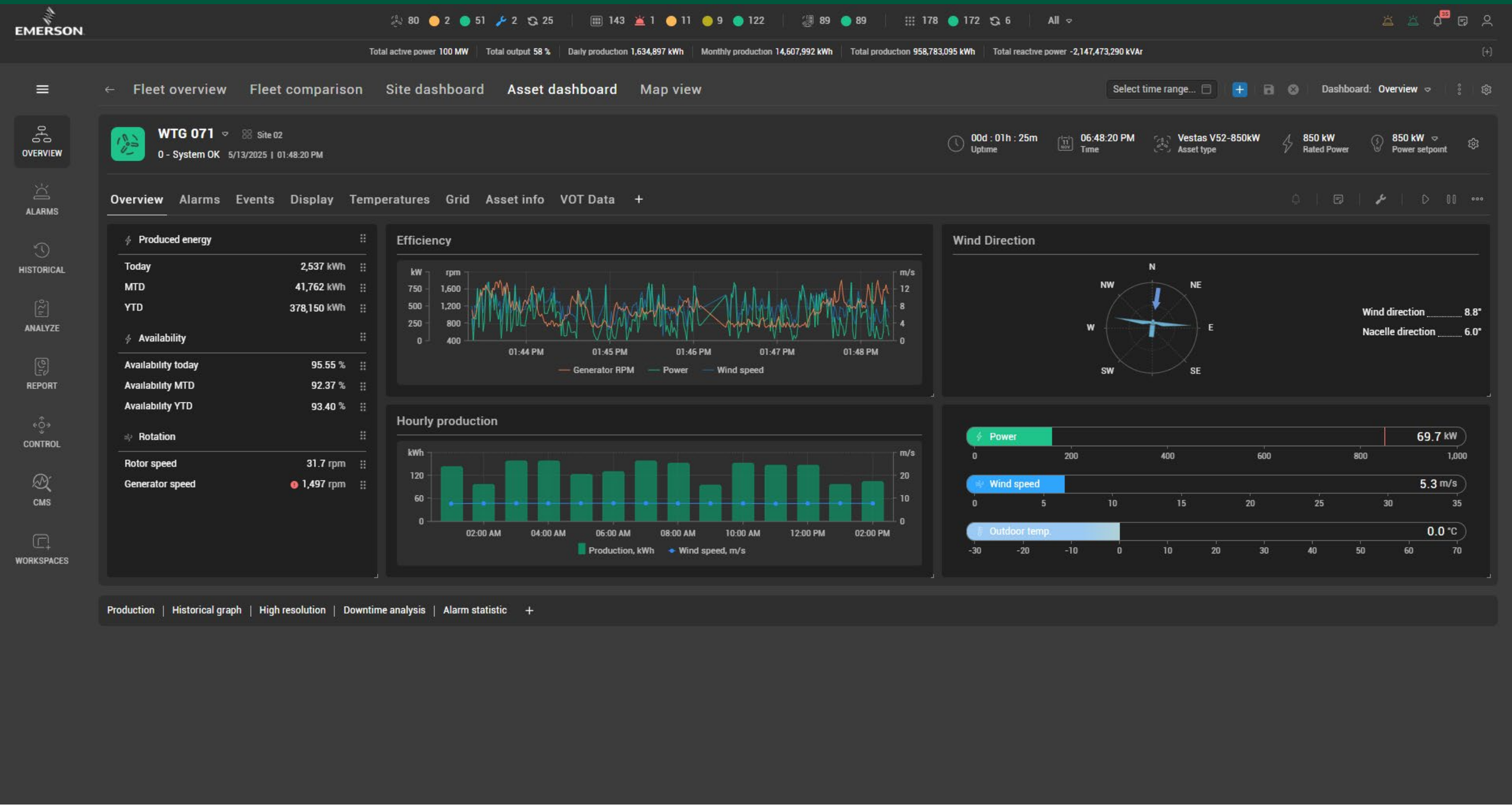




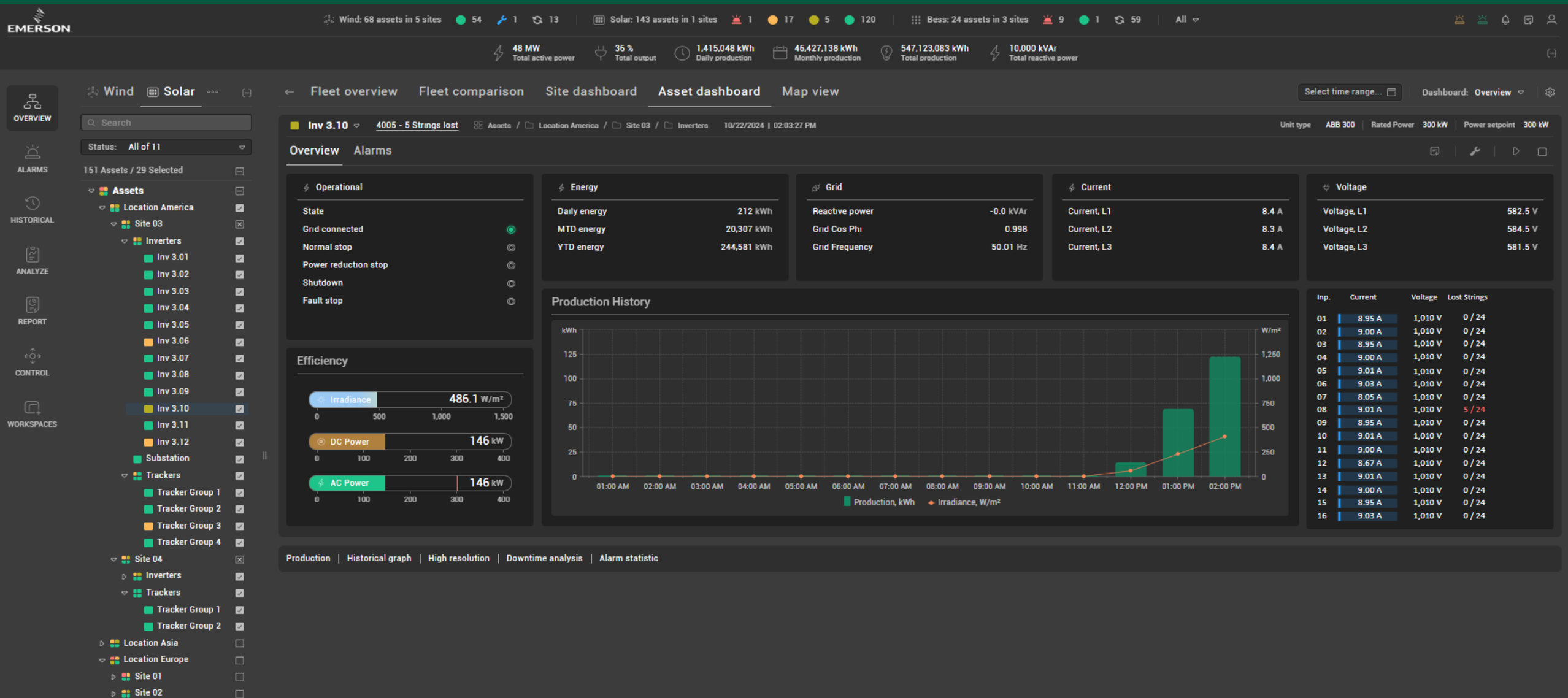




Leveraging SCADA for Operations – Wind Turbine Operation



Leveraging SCADA for Operations – Solar PV Inverter Dashboard



Leveraging SCADA for Operations – BESS BMS Overview Dashboard

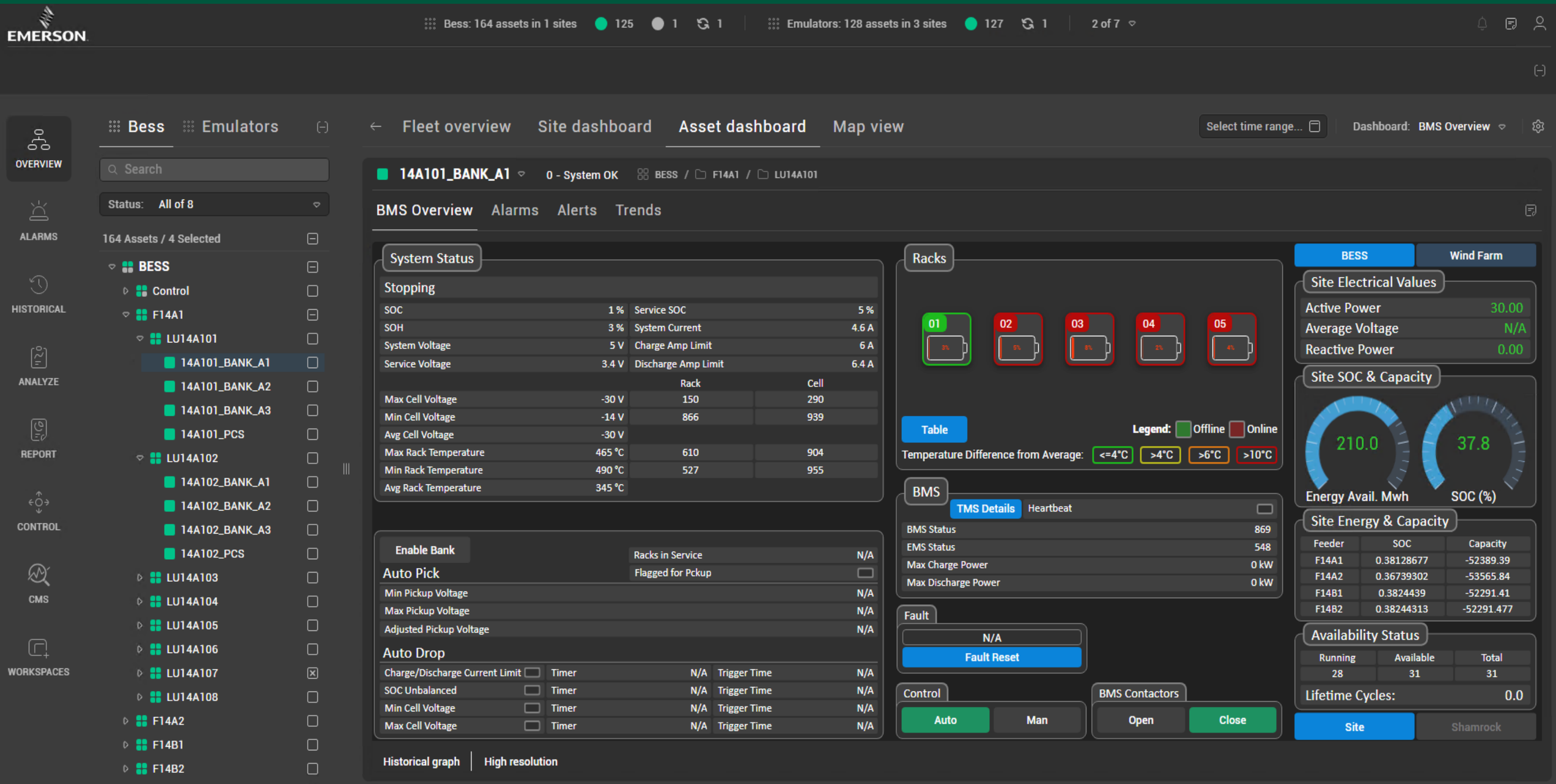


Exhibit #39 – Power Industry Solutions

Find More Information

- https://www.emerson.com/en-us/automation/control-and-safety-systems/distributed-control-systems-dcs/ovation-distributed-control-system/remote-operations
- www.emerson.com/en-us/automation/brands/ovation/ovation-4

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Thank You

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