



ACCELERATING
INNOVATION

Remote Integrated Operations

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

Emerson, Power and Water Solutions

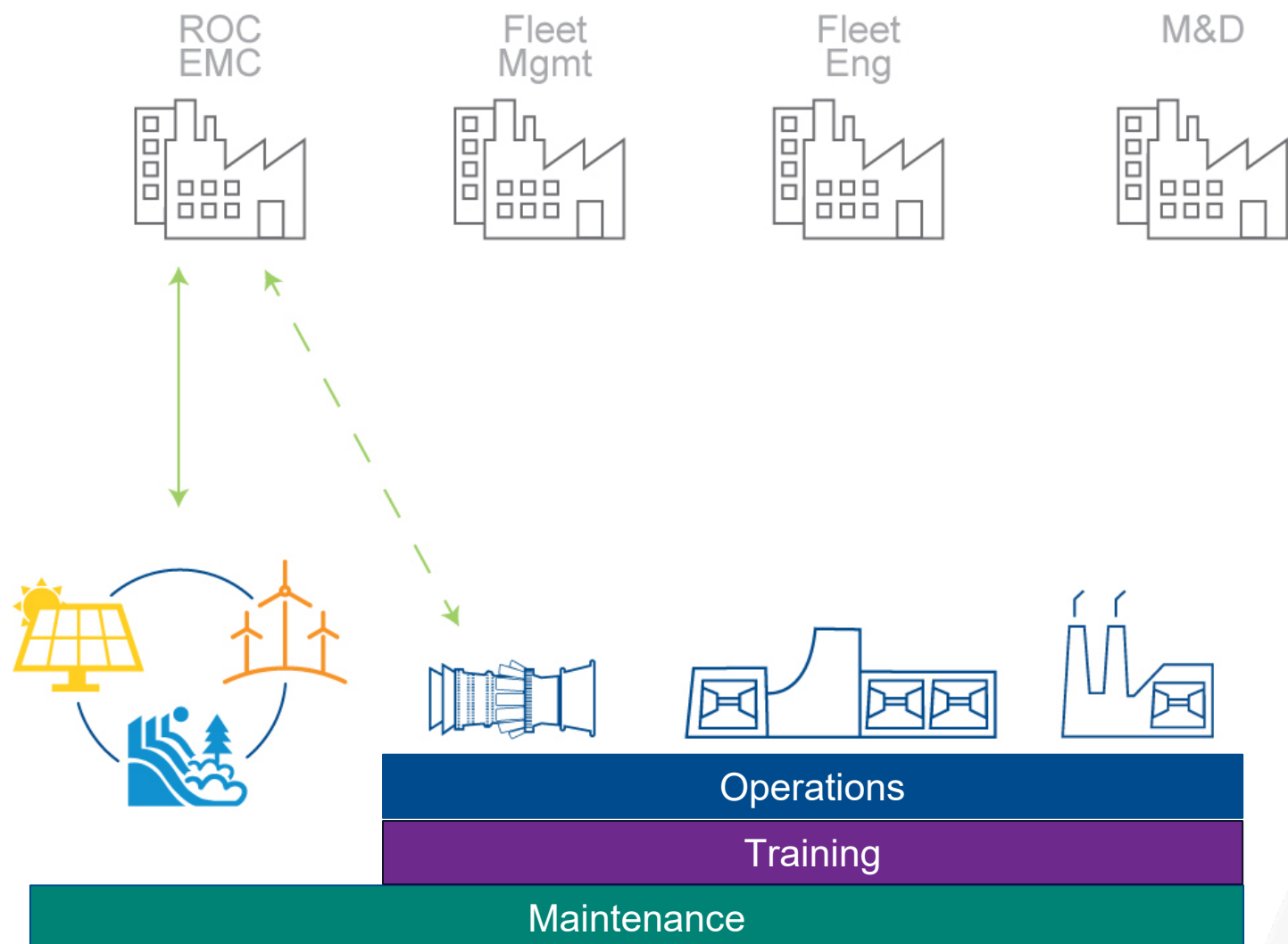
Brett Benson, Director, Global Renewable Solutions Marketing

Morgan Lewis, Director, Product Marketing



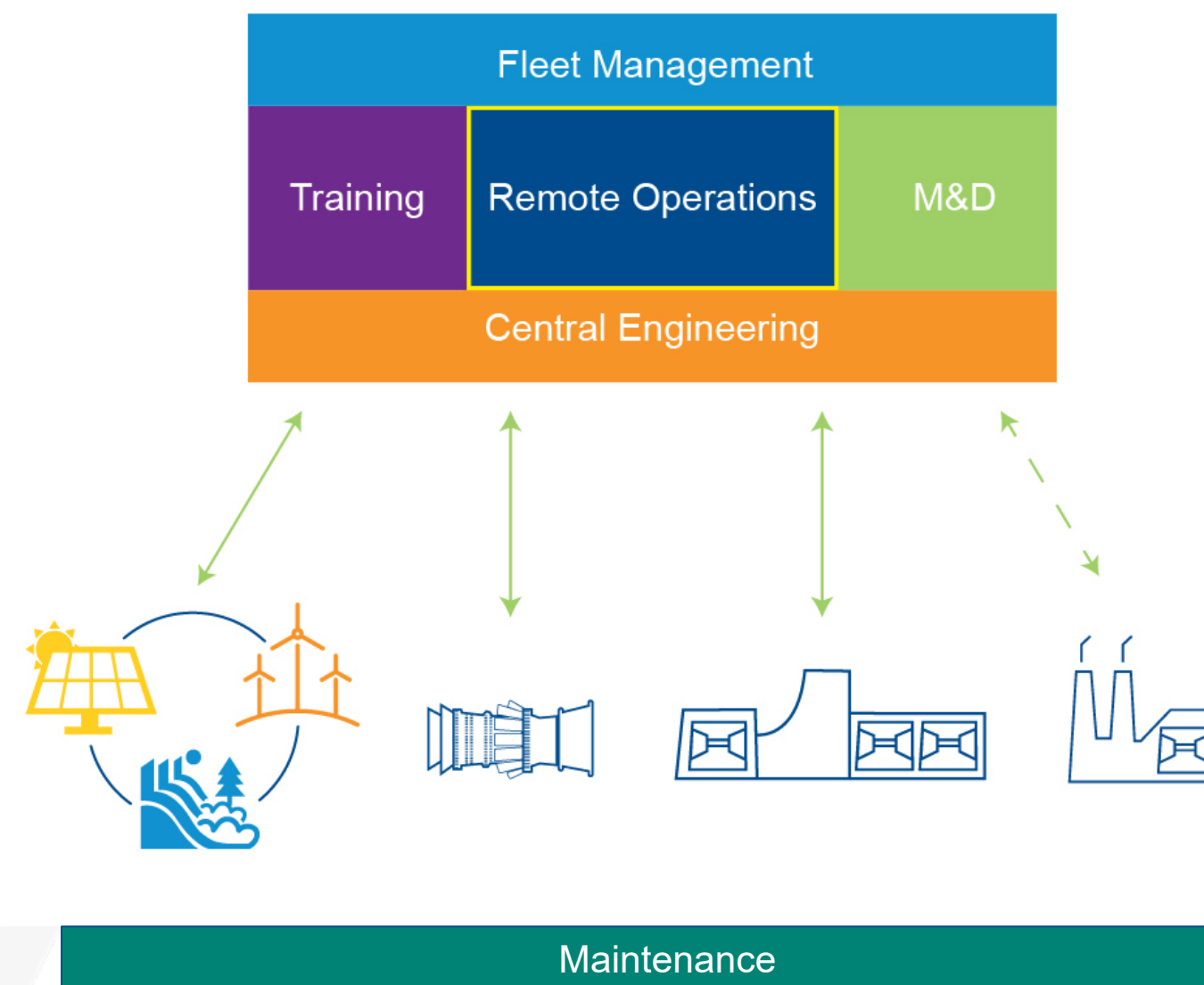
Remote “Integrated” Operations

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



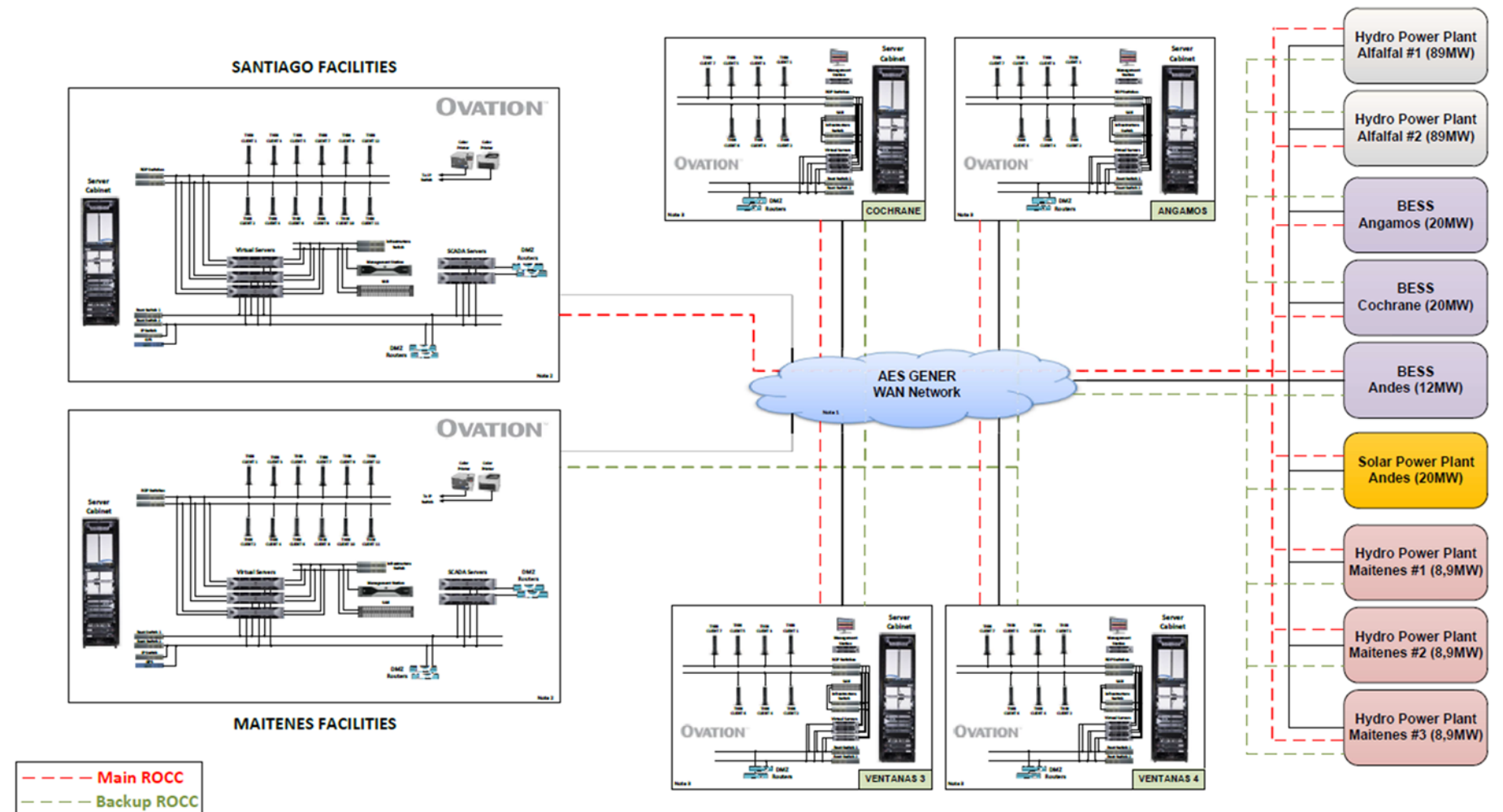
CASE STUDY: AES Gener/Chile

Multiple Sites

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

Drivers

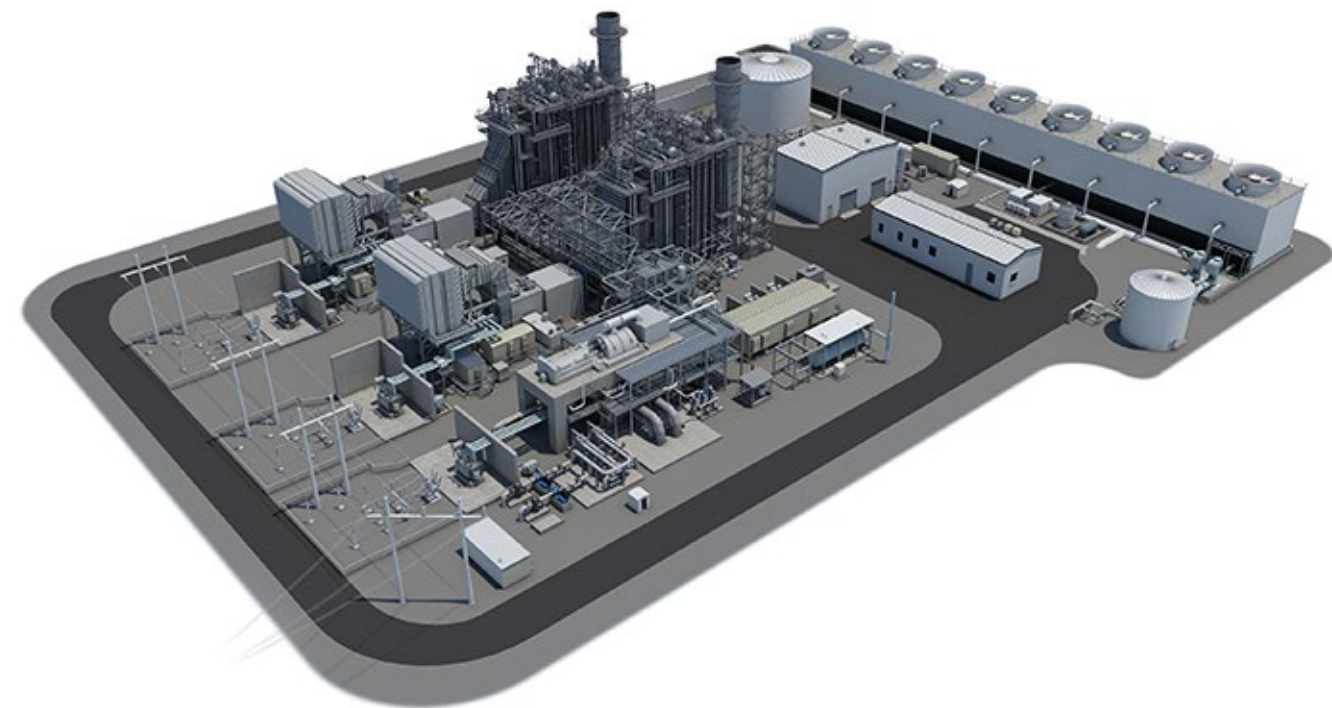
- Reduce manpower
- Optimize knowledge base – bring best operators to ROCC to serve all stations
- Consistency of operations across fleet
- Centralization of information



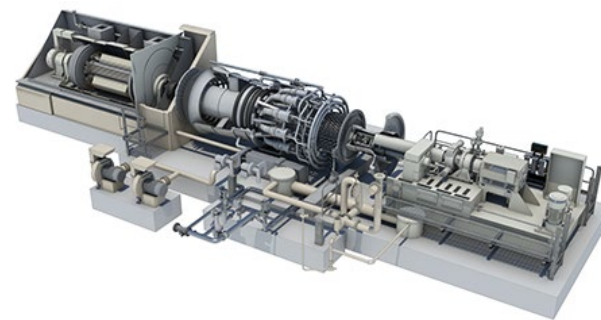
ROCCs – Question #2

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

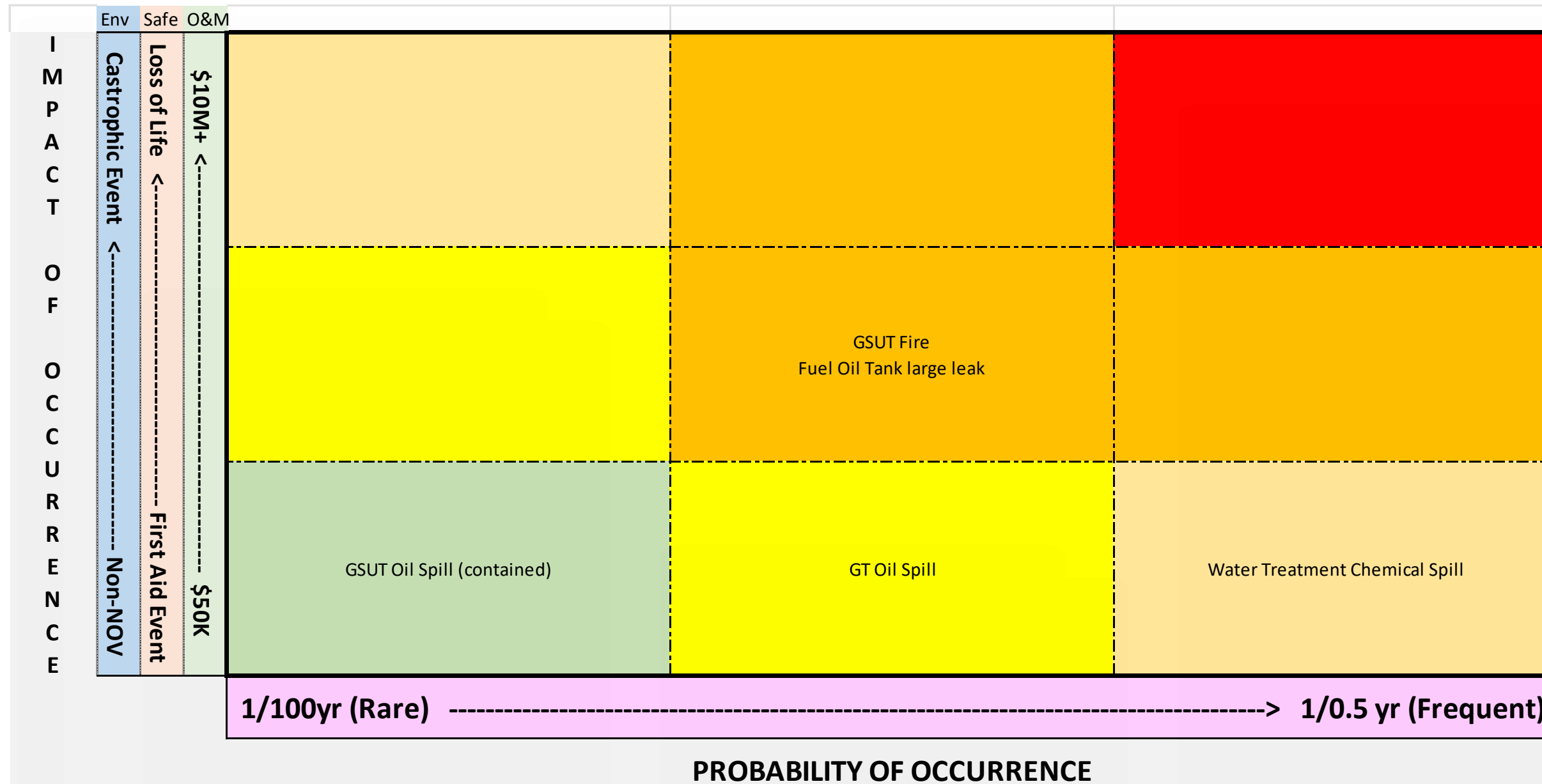
Why wouldn't your company consider a ROCC?

- 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

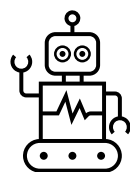
What benefits might new technologies bring to ROCCs?

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

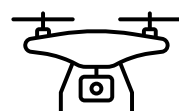


What Advanced Technology is Achieving Today

Robots & Drones



Crawling robots to assess, report and repair assets

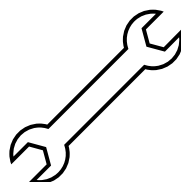


Drones surveying wind turbines, solar panels for defects and optimization

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

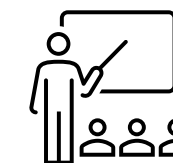


Fleet balancing of multi-objective optimization tasks



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

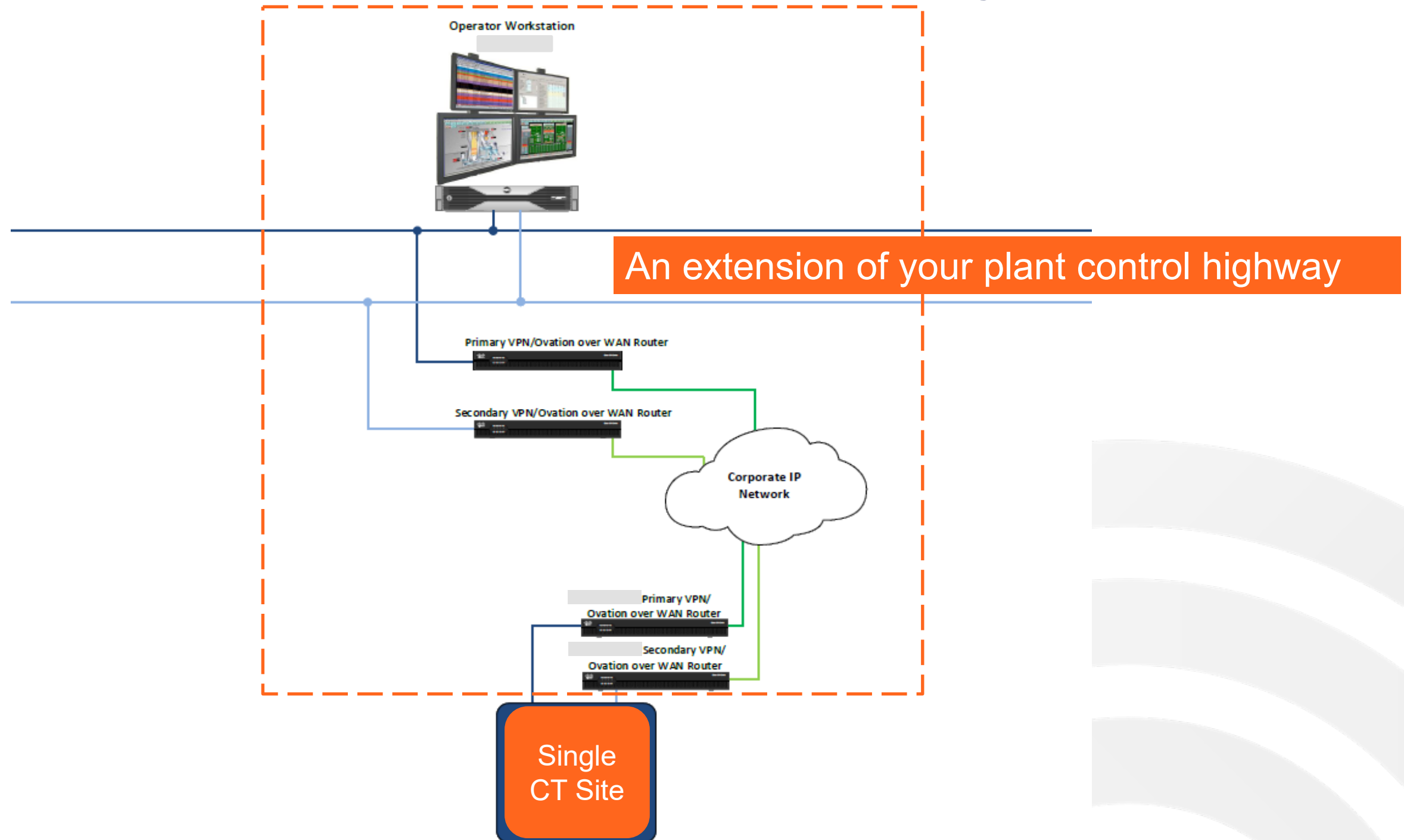
- 11 Simple Cycle Sites
- 34 units, 2690 MW
- 7F, LM6000, 7E, 7B, W501D, others

Central East US Regulated Utility

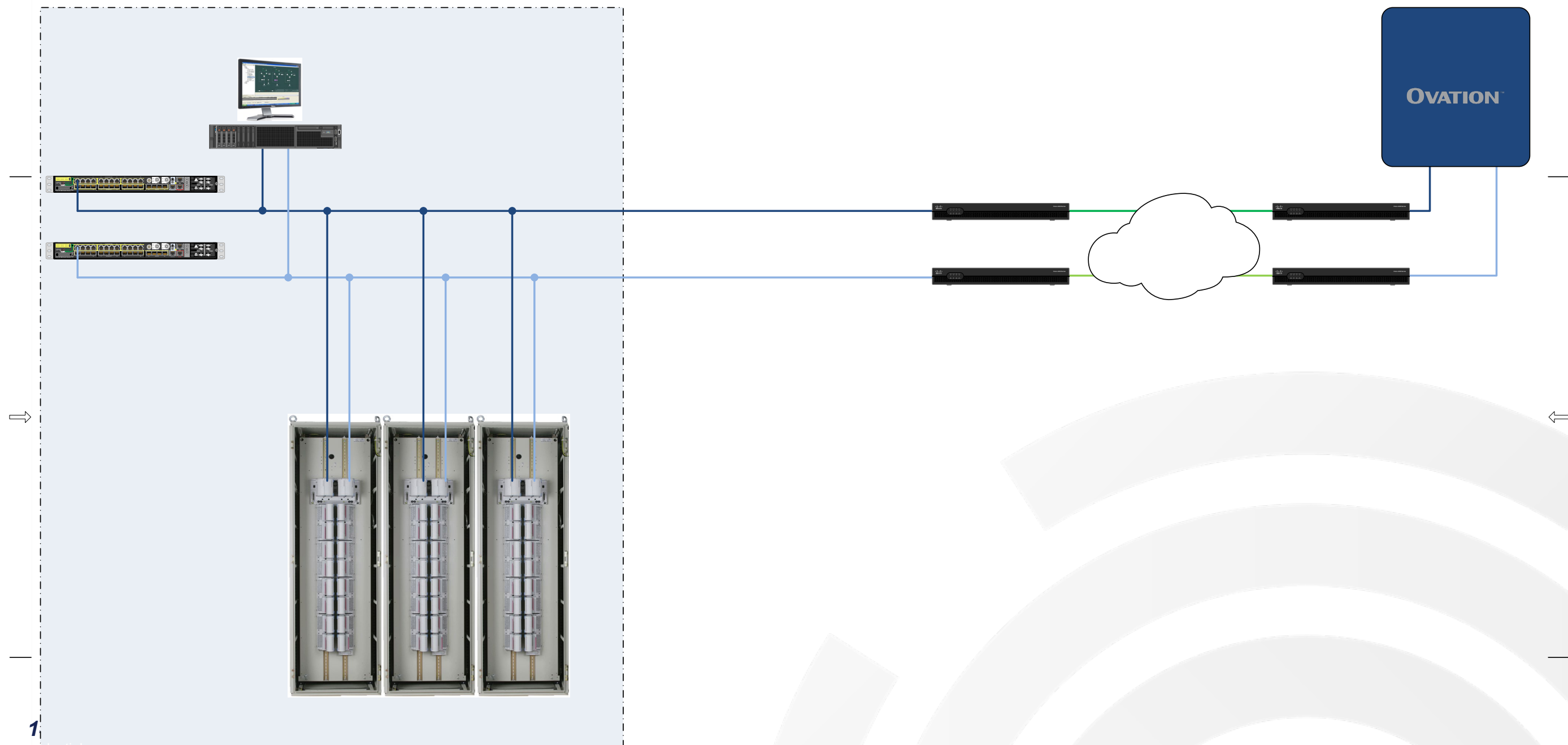
- 8 Simple Cycle Sites
- 50 units, 4800 MW
- 7E, 7B, W501D, W501F



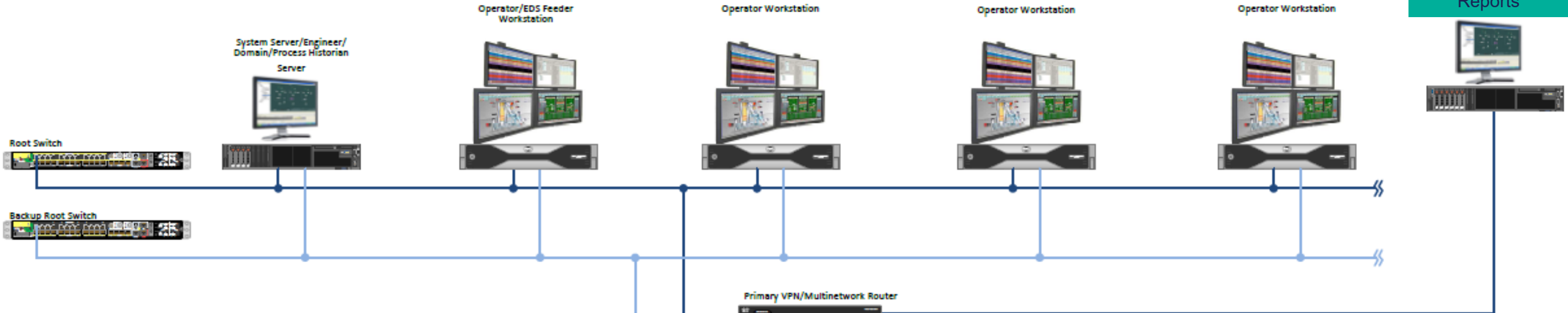
Basic Install or Corporate Pilot at Another Facility



Plant-Level Architecture

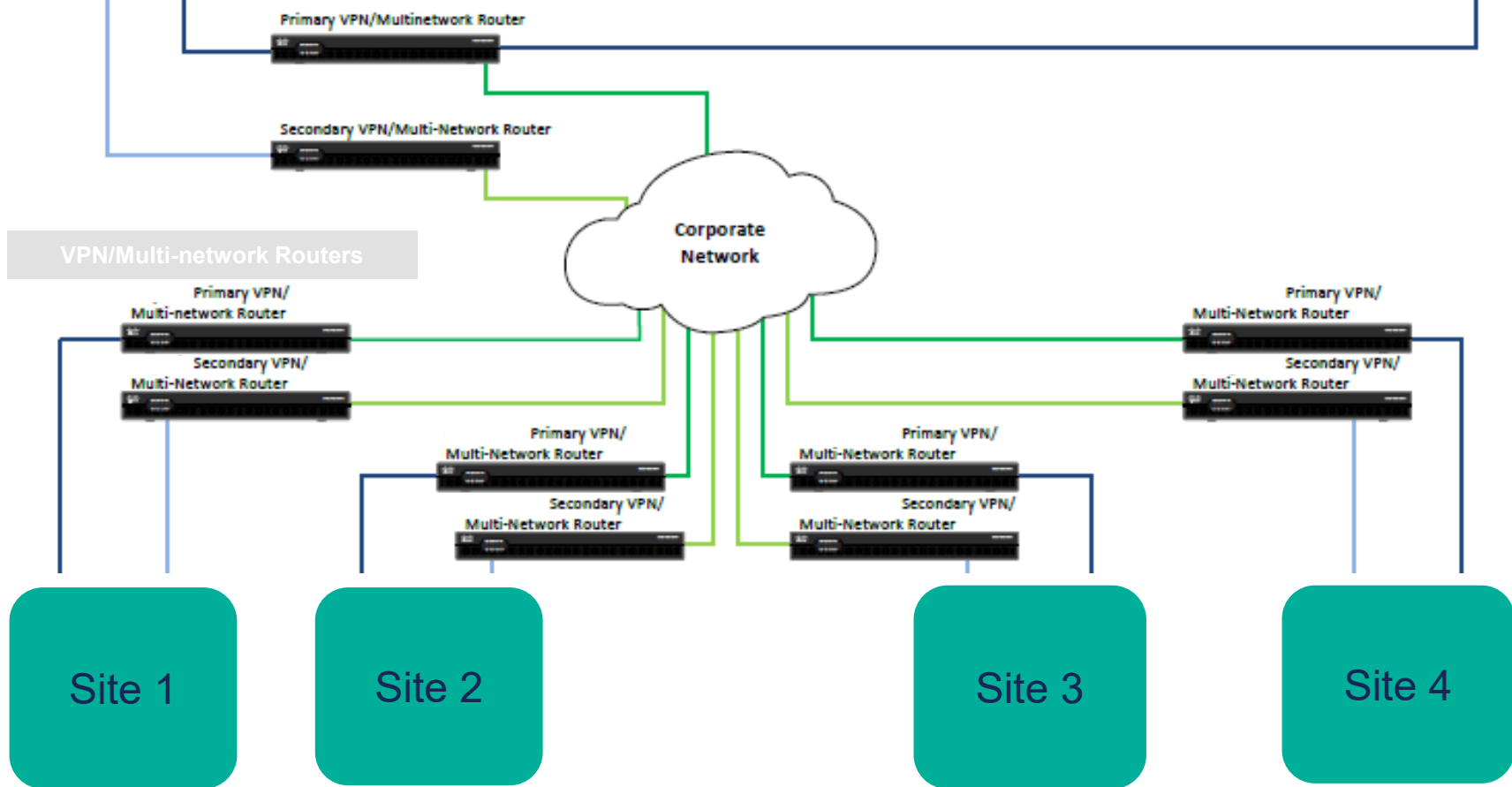


Consolidated Remote Operations Control Center (ROCC) Midwest Regulated Utility



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

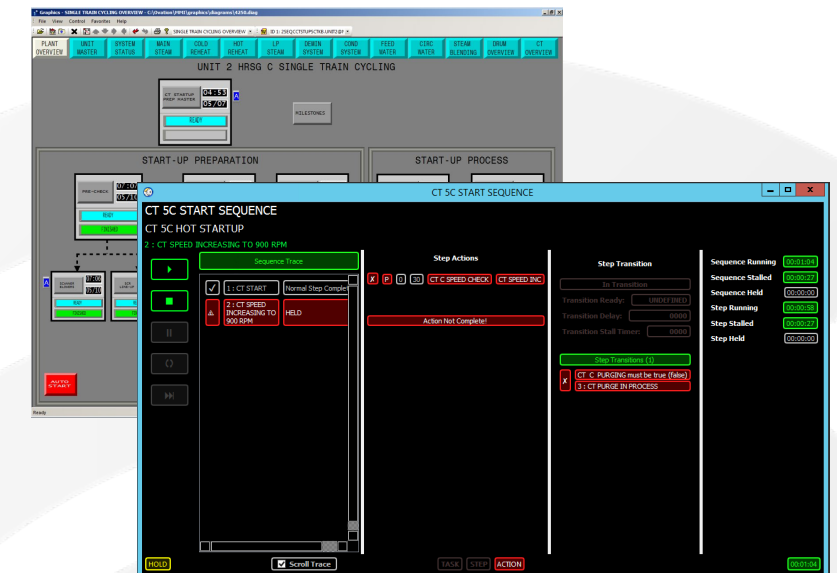
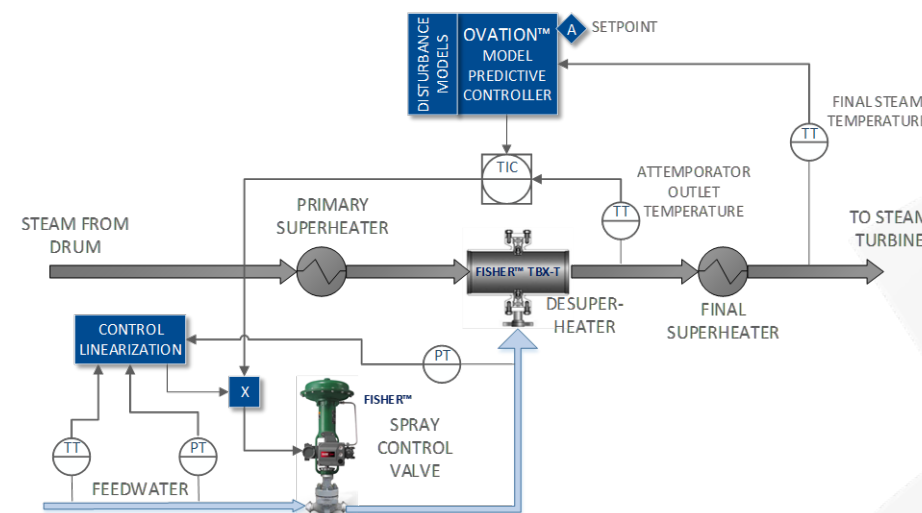
- Operational benchmarking
- Assess technology gaps
- Define improvement roadmap

ADVANCED POWER APPLICATIONS

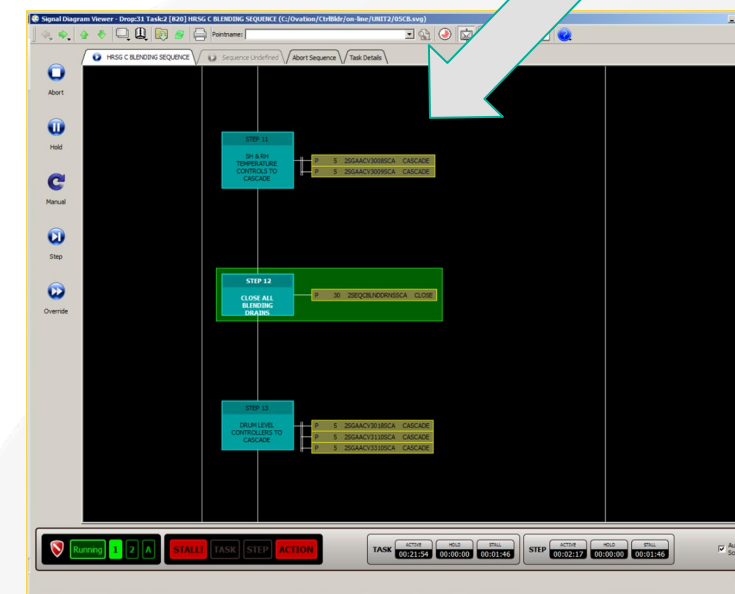
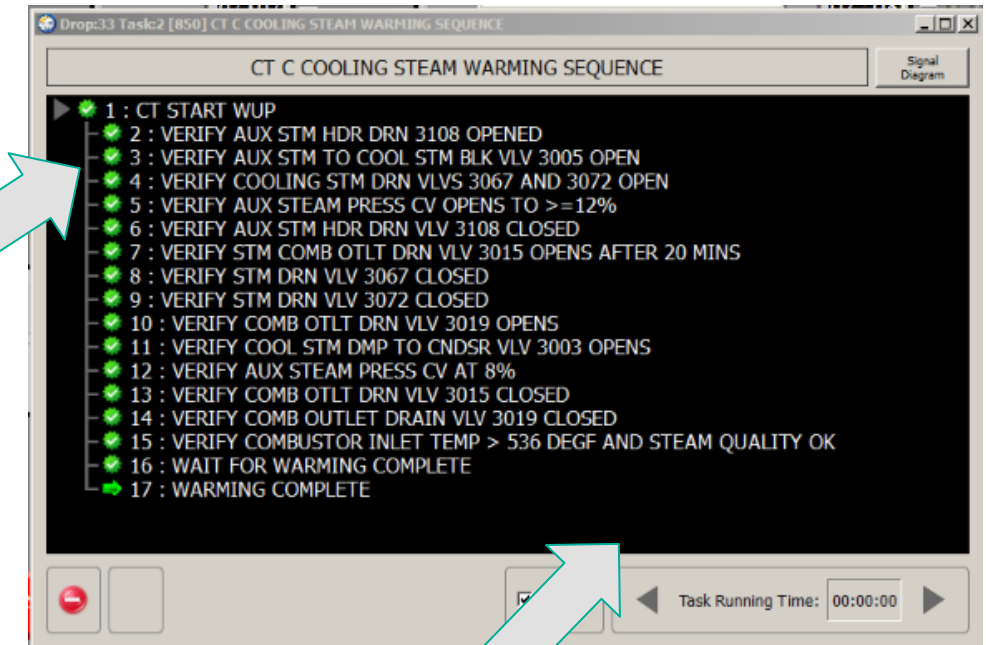
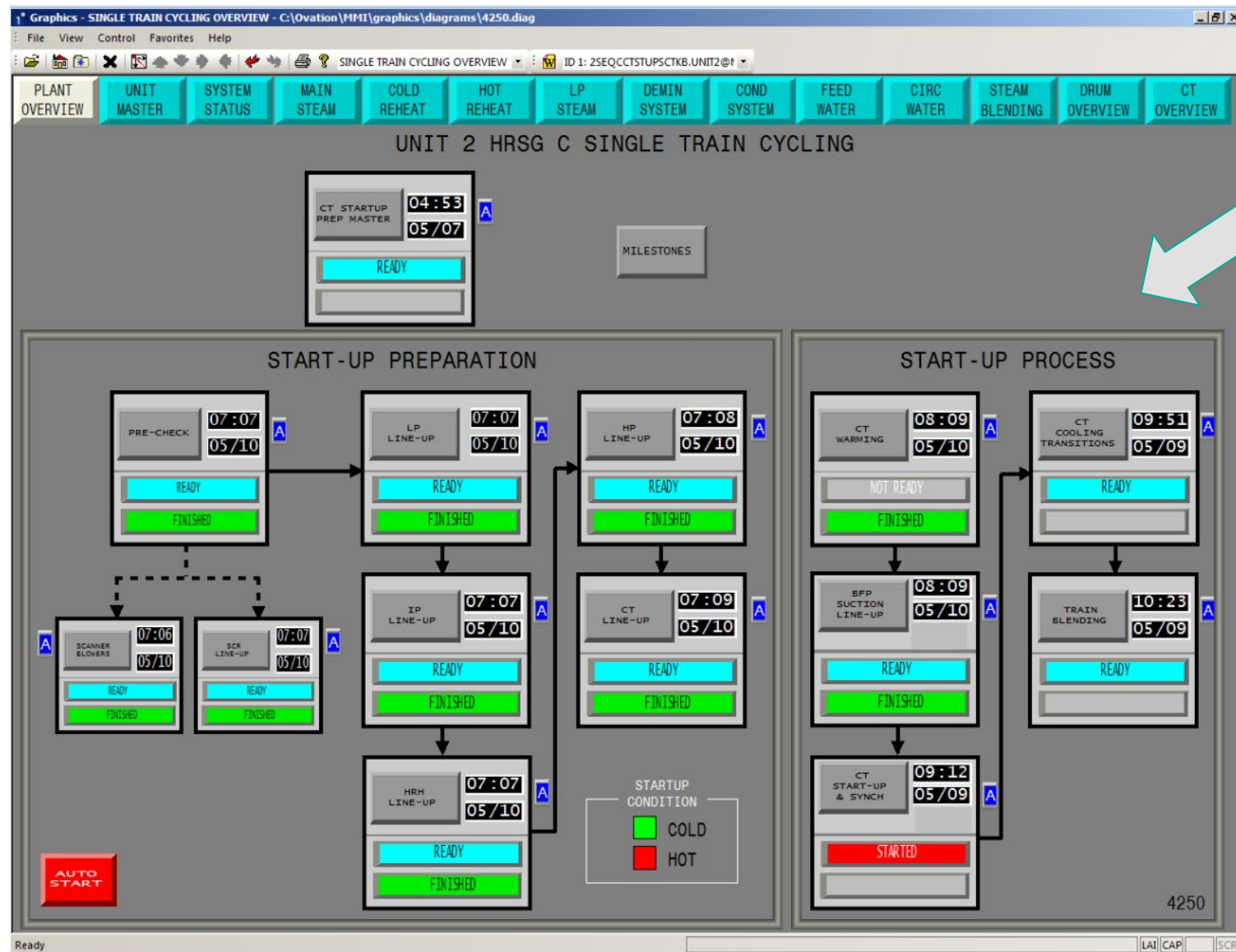
- Smooths troublesome processes
- Improves control resilience
- Enhances situational awareness

SEQUENTIAL AUTOMATION

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



Sequencing for Improved Starting Reliability from ROCC



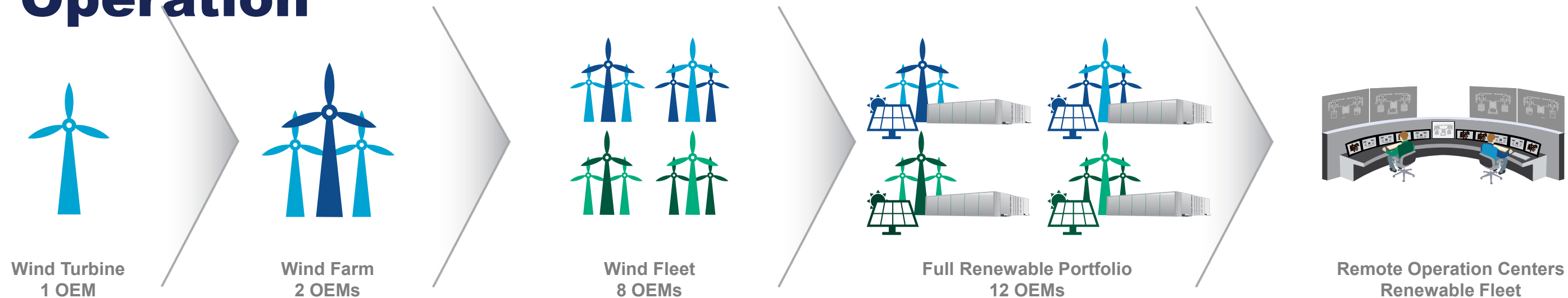
Renewable ROCC

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

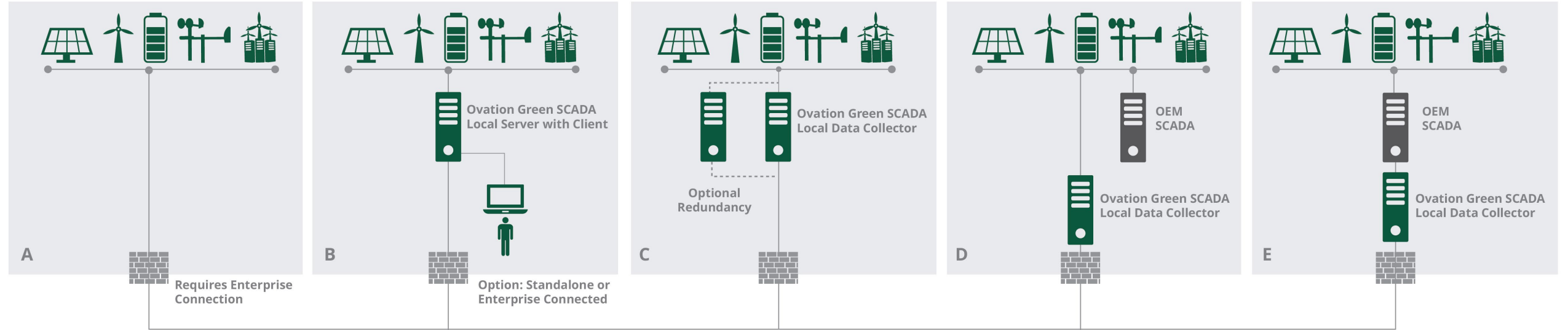


Unified Asset Management and SCADA Software

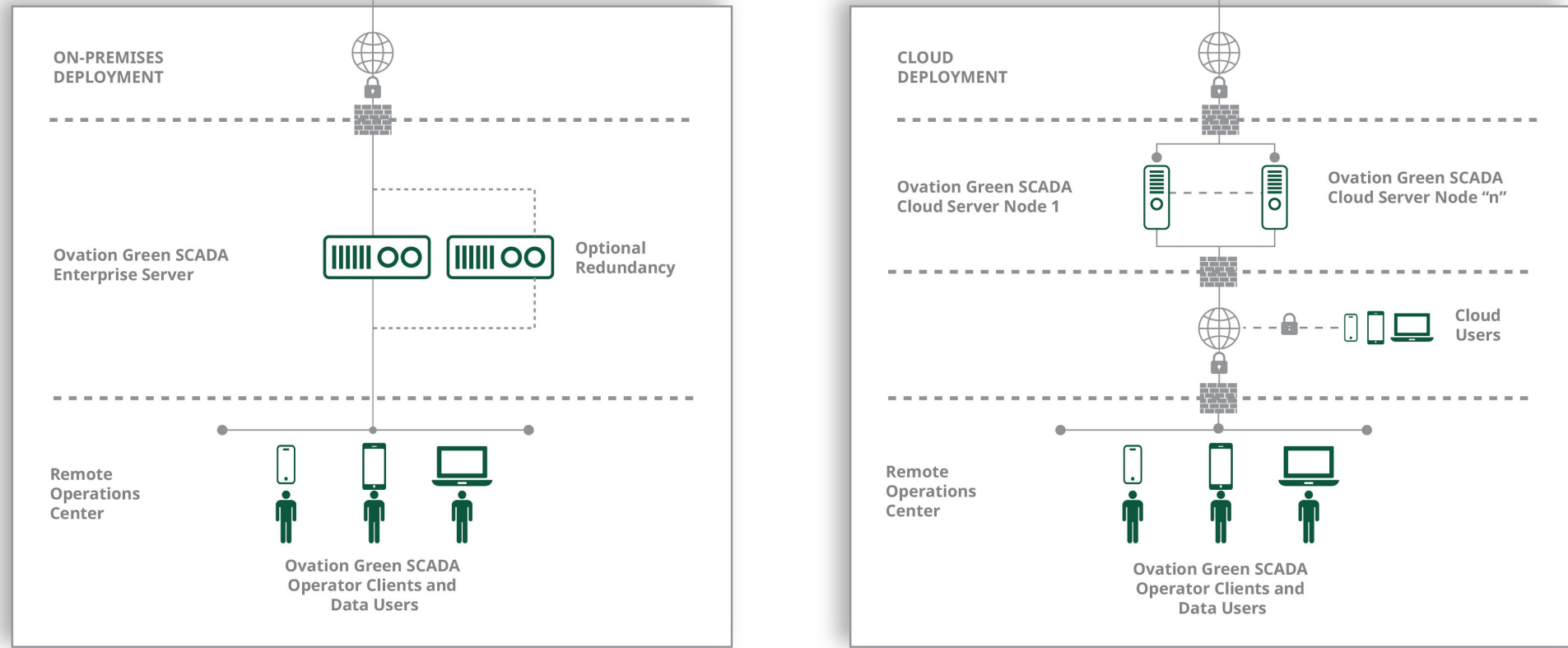
Multi-Asset, Interoperable, OEM-Independent

- 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)

Site Level Connection Options



Enterprise Level Connection Options



Leveraging SCADA for Operations – Solar PV Fleet Overview Dashboard

EMERSON

Wind: 68 assets in 5 sites 54 1 13 | Solar: 143 assets in 1 sites 1 17 5 120 | Bess: 24 assets in 3 sites 9 1 59 | All

48 MW Total active power | 38 % Total output | 1,415,048 kWh Daily production | 46,427,138 kWh Monthly production | 547,123,065 kWh Total production | 10,000 kVAR Total reactive power

Wind Solar Fleet overview Fleet comparison Site dashboard Asset dashboard Map view

Search

Status: All of 11

151 Assets / 29 Selected

Assets

- Location America
 - Site 03
 - Inverters
 - Inv 3.01
 - Inv 3.02
 - Inv 3.03
 - Inv 3.04
 - Inv 3.05
 - Inv 3.06
 - Inv 3.07
 - Trackers
 - Tracker Group 1
 - Tracker Group 2
 - Location Asia
 - Location Europe
 - Site 01
 - Site 02

151 Assets / 29 Selected

Site 03 Shown 17/17 assets

3 1 13

Inv 3.01 2 MW 1,423,405 kWh Daily production 46,435,471 kWh Monthly production 547,123,065 kWh Total production 10/22/2024 | 02:02:05 PM

Inv 3.05 0 - System OK 10/22/2024 | 02:02:05 PM

Power	145.0 kW
Irradiance	483.5 W/m ²
Daily production	212.1 kWh

Site 03 Site 04, shown 12/12 assets Site 05, shown 38/38 assets Site 01, shown 39/39 assets Site 02, shown 37/37 assets

Site 03 Site 04 Site 05 Site 01 Site 02

Power Irradiance Daily production Site 03

Site 04 Shown 12/12 assets

2 1 9

1 MW Total active power | 2,410 kWh Daily production | 136,028 kWh Monthly production | 1,629,262 kWh Total production

Inv 4.01 4006 - 6 or more Strings lost 10/22/2024 | 02:02:06 PM

Inv 4.02 0 - System OK 10/22/2024 | 02:02:05 PM

Inv 4.03 0 - System OK 10/22/2024 | 02:02:05 PM

Inv 4.04 0 - System OK 10/22/2024 | 02:02:06 PM

Inv 4.05 4005 - 5 Strings lost 10/22/2024 | 02:02:06 PM

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

Search

Status: All of 11

151 Assets / 29 Selected

Assets

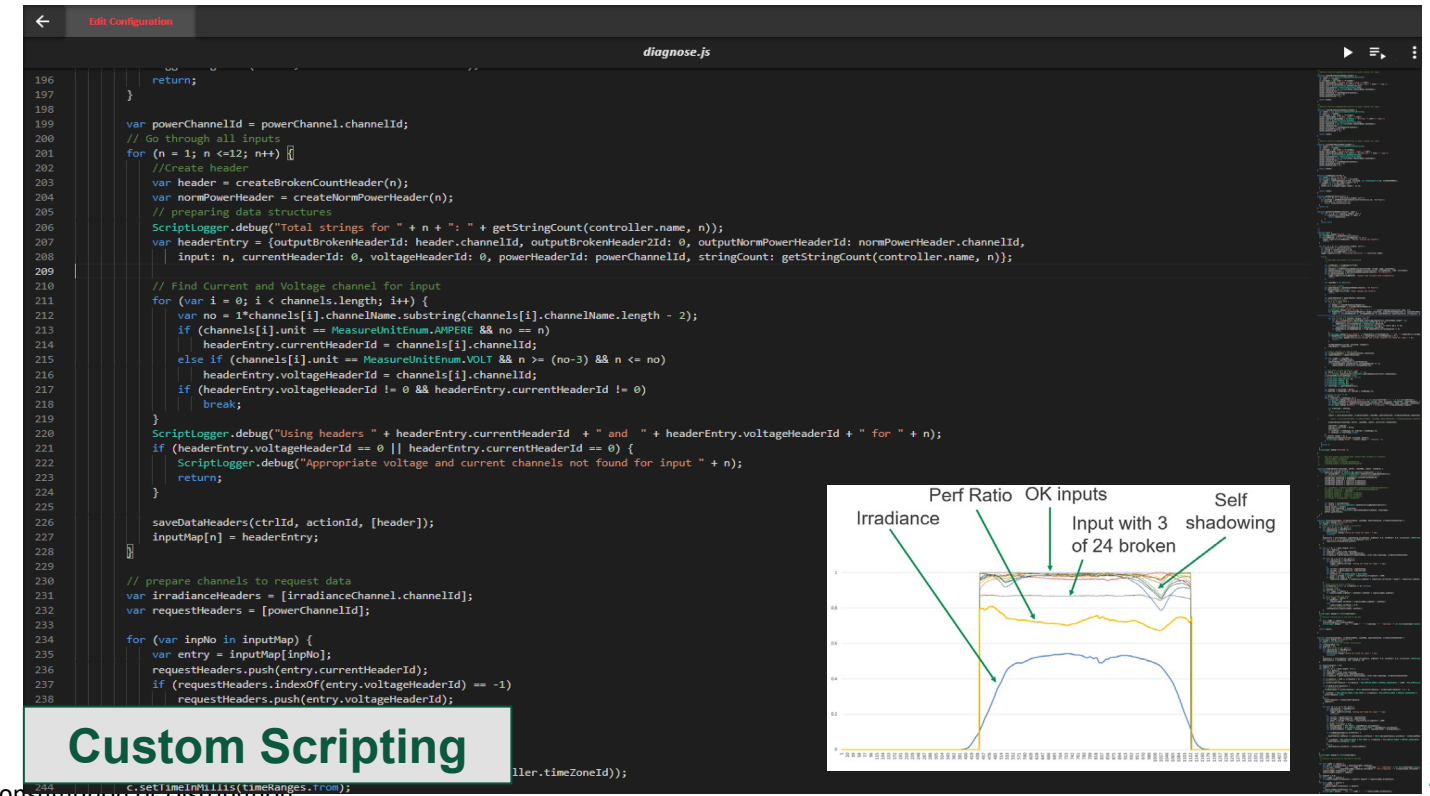
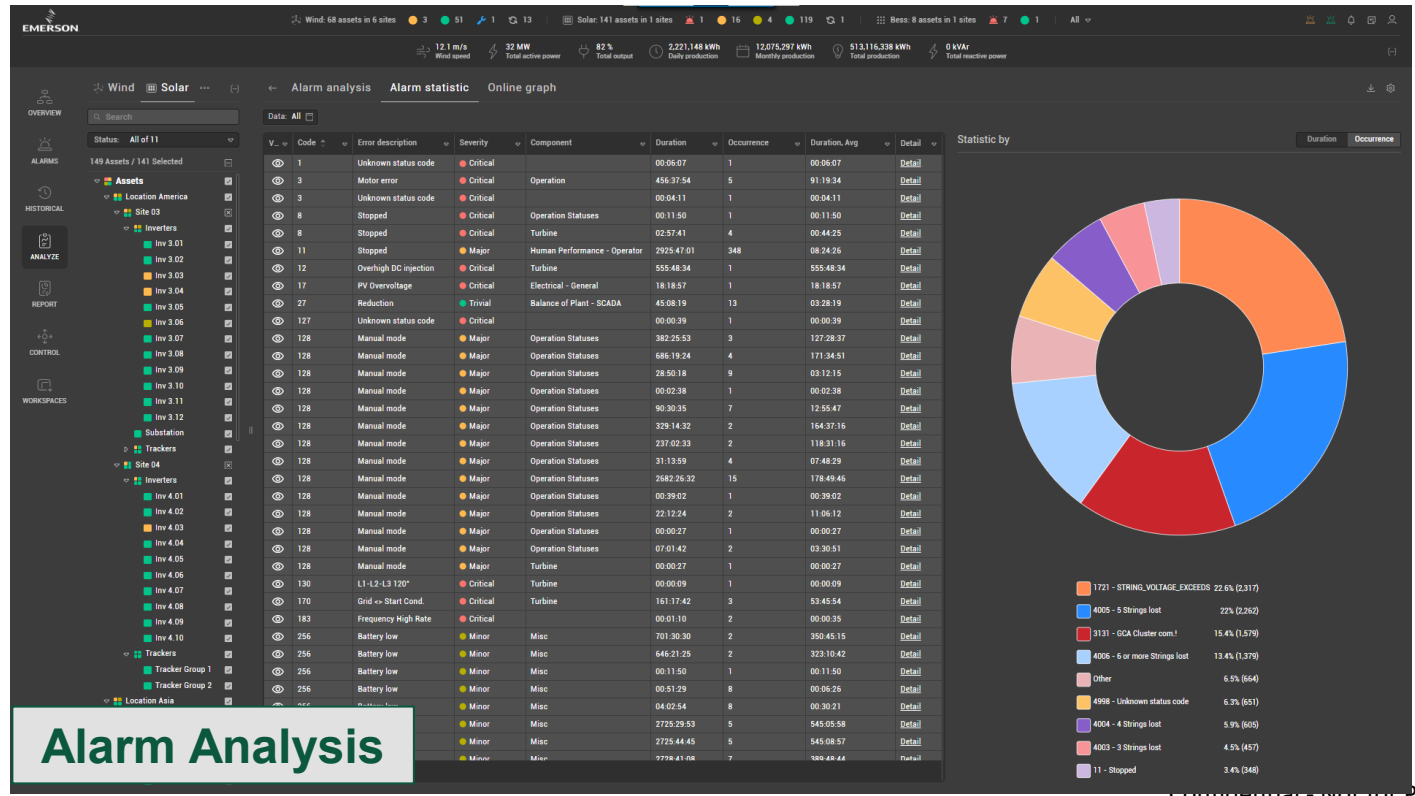
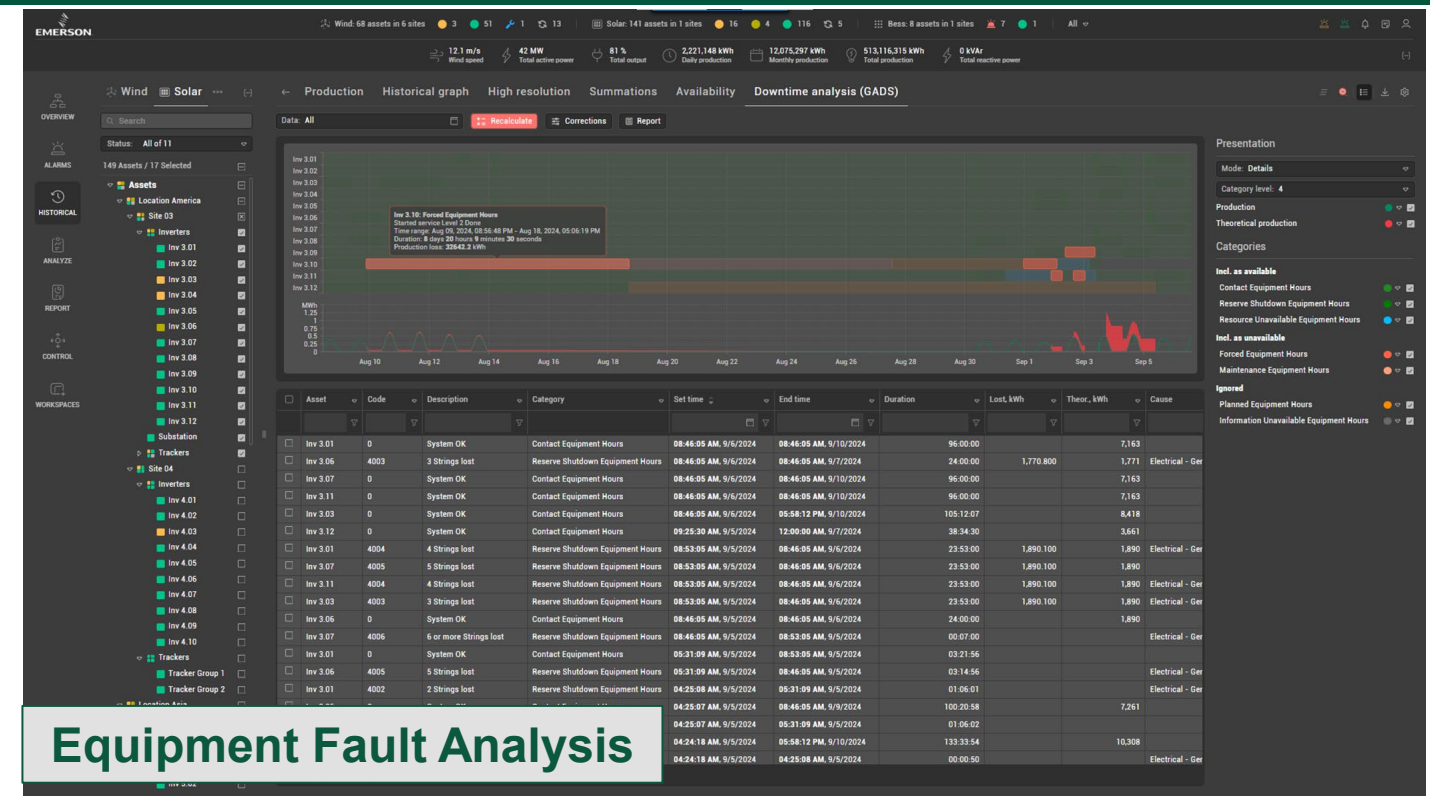
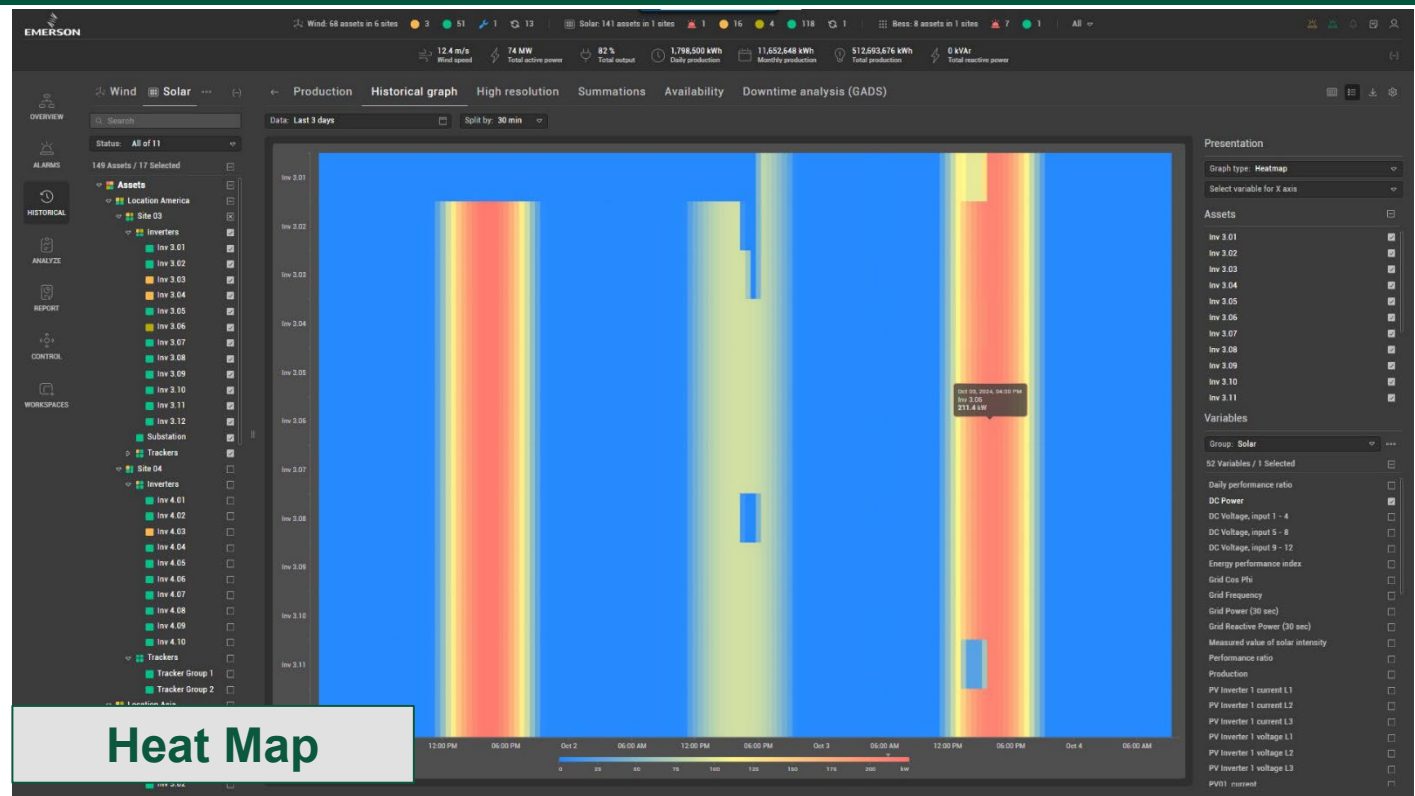
- Location America
 - Site 03
 - Inverters
 - Inv 3.01
 - Inv 3.02
 - Inv 3.03
 - Inv 3.04
 - Inv 3.05
 - Inv 3.06
 - Inv 3.07
 - Inv 3.08
 - Inv 3.09
 - Inv 3.10
 - Inv 3.11
 - Inv 3.12
 - Substation
 - Trackers
 - Tracker Group 1
 - Tracker Group 2
 - Tracker Group 3
 - Tracker Group 4
- Site 04
 - Inverters
 - Trackers
 - Tracker Group 1
 - Tracker Group 2
- Location Asia
- Location Europe
 - Site 01
 - Site 02

Show all Show selected

Park view

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

Total active power 100 MW | Total output 58 % | Daily production 1,634,897 kWh | Monthly production 14,607,992 kWh | Total production 958,783,095 kWh | Total reactive power -2,147,473,290 kVAR

WTG 071 Site 02
0 - System OK 5/13/2025 | 01:48:20 PM

00d : 01h : 25m Uptime | 06:48:20 PM Time | Vestas V52-850kW Asset type | 850 kW Rated Power | 850 kW Power setpoint

Produced energy

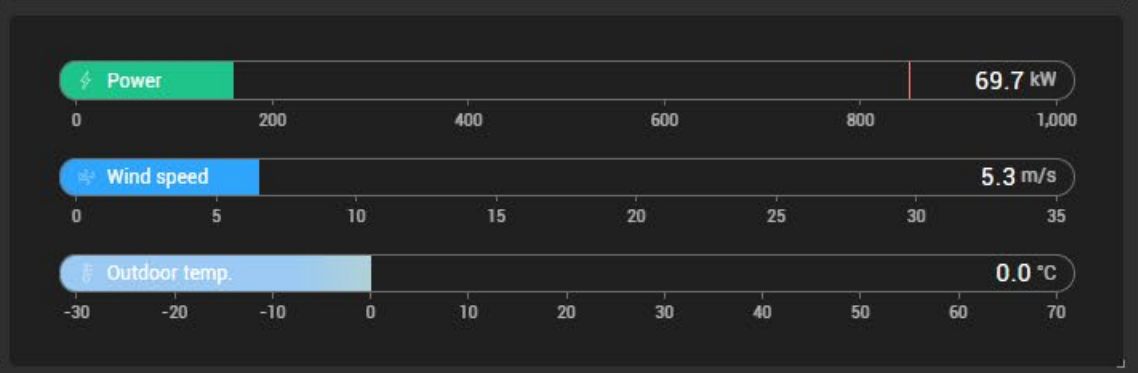
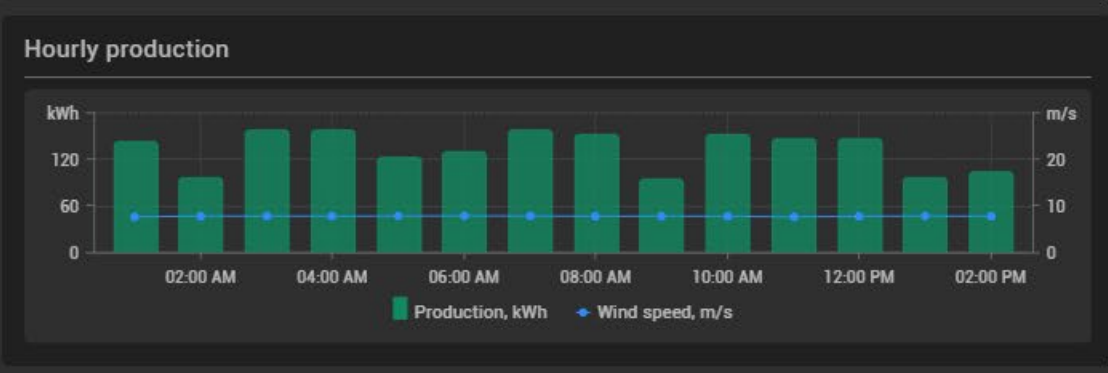
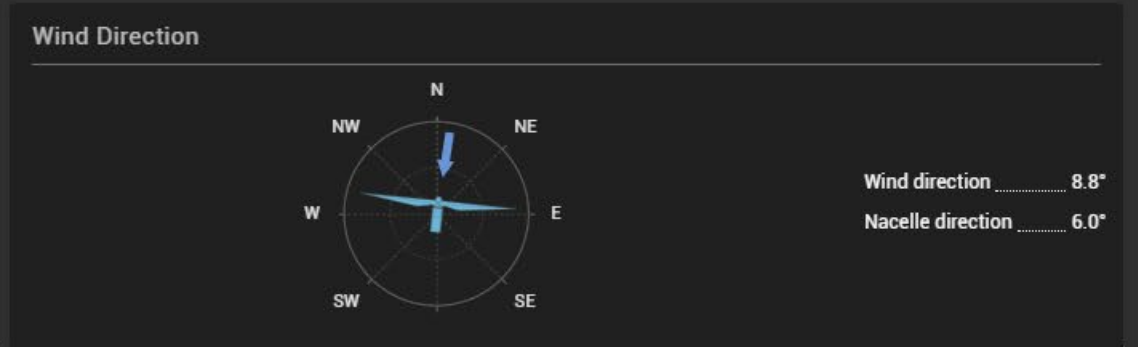
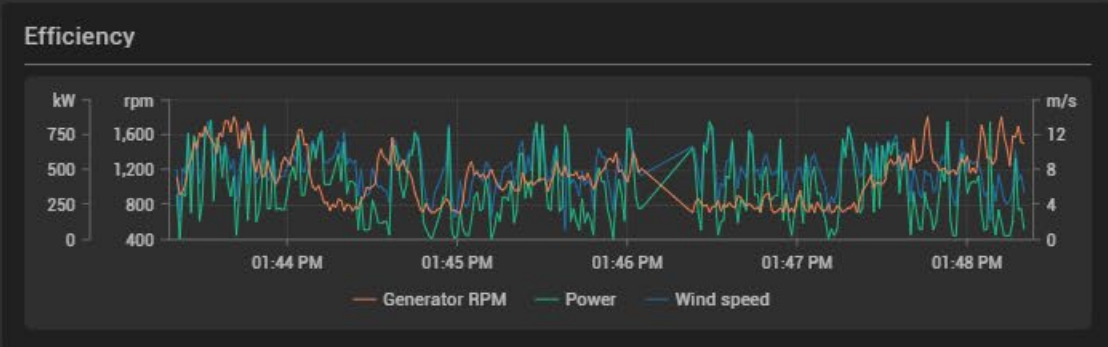
Today	2,537 kWh
MTD	41,762 kWh
YTD	378,150 kWh

Availability

Availability today	95.55 %
Availability MTD	92.37 %
Availability YTD	93.40 %

Rotation

Rotor speed	31.7 rpm
Generator speed	1,497 rpm



Leveraging SCADA for Operations – Solar PV Inverter Dashboard

OVERVIEW

ALARMS

HISTORICAL

ANALYZE

REPORT

CONTROL

WORKSPACES

Search

Status: All of 11

151 Assets / 29 Selected

Assets

- Location America
 - Site 03
 - Inverters
 - Inv 3.01
 - Inv 3.02
 - Inv 3.03
 - Inv 3.04
 - Inv 3.05
 - Inv 3.06
 - Inv 3.07
 - Inv 3.08
 - Inv 3.09
 - Inv 3.10**
 - Inv 3.11
 - Inv 3.12
 - Substation
 - Trackers
 - Tracker Group 1
 - Tracker Group 2
 - Tracker Group 3
 - Tracker Group 4
- Site 04
 - Inverters
 - Trackers
 - Tracker Group 1
 - Tracker Group 2
- Location Asia
- Location Europe
 - Site 01
 - Site 02

Inv 3.10 4005 - 5 Strings lost Assets / Location America / Site 03 / Inverters 10/22/2024 | 02:03:27 PM

Unit type ABB 300 Rated Power 300 kW Power setpoint 300 kW

Overview Alarms

Operational

State

- Grid connected ●
- Normal stop ●
- Power reduction stop ●
- Shutdown ●
- Fault stop ●

Energy

- Daily energy 212 kWh
- MTD energy 20,307 kWh
- YTD energy 244,581 kWh

Grid

- Reactive power -0.0 kVAR
- Grid Cos Phi 0.998
- Grid Frequency 50.01 Hz

Current

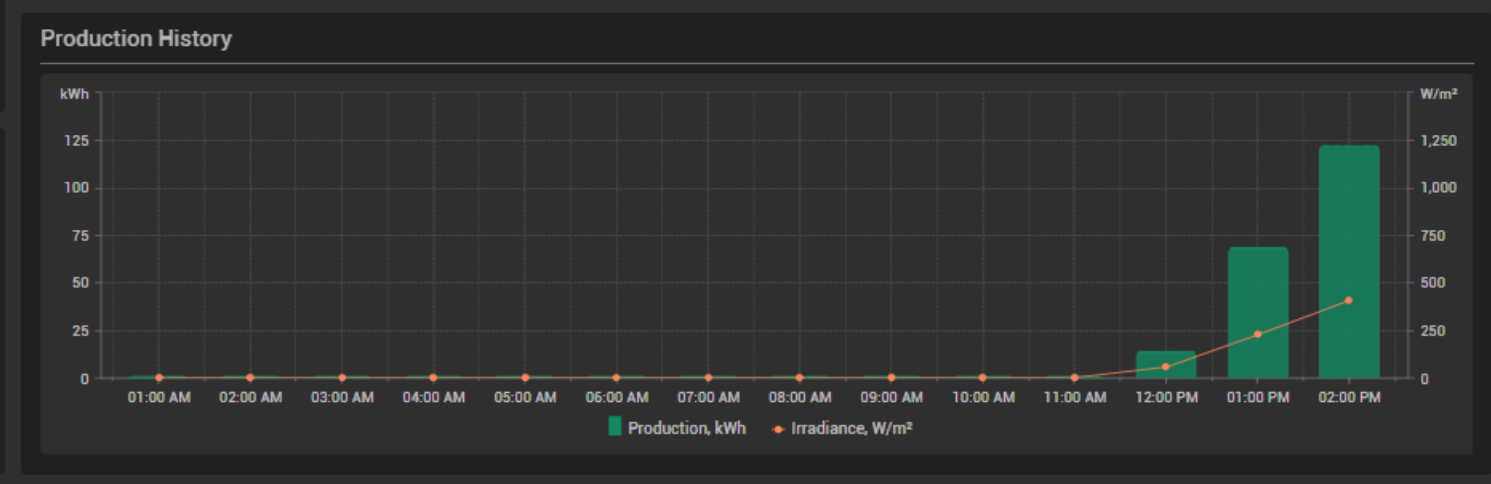
- Current, L1 8.4 A
- Current, L2 8.3 A
- Current, L3 8.4 A

Voltage

- Voltage, L1 582.5 V
- Voltage, L2 584.5 V
- Voltage, L3 581.5 V

Efficiency

- Irradiance 486.1 W/m²
- DC Power 146 kW
- AC Power 146 kW



Inp.	Current	Voltage	Lost Strings
01	8.95 A	1,010 V	0 / 24
02	9.00 A	1,010 V	0 / 24
03	8.95 A	1,010 V	0 / 24
04	9.00 A	1,010 V	0 / 24
05	9.01 A	1,010 V	0 / 24
06	9.03 A	1,010 V	0 / 24
07	8.05 A	1,010 V	0 / 24
08	9.01 A	1,010 V	5 / 24
09	8.95 A	1,010 V	0 / 24
10	9.01 A	1,010 V	0 / 24
11	9.00 A	1,010 V	0 / 24
12	8.67 A	1,010 V	0 / 24
13	9.01 A	1,010 V	0 / 24
14	9.00 A	1,010 V	0 / 24
15	8.95 A	1,010 V	0 / 24
16	9.03 A	1,010 V	0 / 24

Leveraging SCADA for Operations – BESS BMS Overview Dashboard

OVERVIEW

ALARMS

HISTORICAL

ANALYZE

REPORT

CONTROL

CMS

WORKSPACES

Bess **Emulators**

Search

Status: All of 8

164 Assets / 4 Selected

- BESS**
 - Control
 - F14A1
 - LU14A101
 - 14A101_BANK_A1
 - 14A101_BANK_A2
 - 14A101_BANK_A3
 - 14A101_PCS
 - LU14A102
 - 14A102_BANK_A1
 - 14A102_BANK_A2
 - 14A102_BANK_A3
 - 14A102_PCS
 - LU14A103
 - LU14A104
 - LU14A105
 - LU14A106
 - LU14A107
 - LU14A108
 - F14A2
 - F14B1
 - F14B2
 - Substation

Fleet overview | Site dashboard | **Asset dashboard** | Map view

Select time range... | Dashboard: BMS Overview

14A101_BANK_A1 0 - System OK BESS / F14A1 / LU14A101

BMS Overview | Alarms | Alerts | Trends

System Status

Stopping

SOC	1 %	Service SOC	5 %
SOH	3 %	System Current	4.6 A
System Voltage	5 V	Charge Amp Limit	6 A
Service Voltage	3.4 V	Discharge Amp Limit	6.4 A

	Rack	Cell
Max Cell Voltage	-30 V	150
Min Cell Voltage	-14 V	866
Avg Cell Voltage	-30 V	
Max Rack Temperature	465 °C	610
Min Rack Temperature	490 °C	527
Avg Rack Temperature	345 °C	955

Enable Bank

Racks in Service	N/A
Flagged for Pckup	<input type="checkbox"/>

Auto Pick

Min Pickup Voltage	N/A
Max Pickup Voltage	N/A
Adjusted Pickup Voltage	N/A

Auto Drop

Charge/Discharge Current Limit	<input type="checkbox"/>	Timer	N/A	Trigger Time	N/A
SOC Unbalanced	<input type="checkbox"/>	Timer	N/A	Trigger Time	N/A
Min Cell Voltage	<input type="checkbox"/>	Timer	N/A	Trigger Time	N/A
Max Cell Voltage	<input type="checkbox"/>	Timer	N/A	Trigger Time	N/A

Racks

Table

Temperature Difference from Average: <=4°C >4°C >6°C >10°C

Legend: Offline Online

BMS

TMS Details Heartbeat

BMS Status	869
EMS Status	548
Max Charge Power	0 kW
Max Discharge Power	0 kW

Fault

N/A

Fault Reset

Control

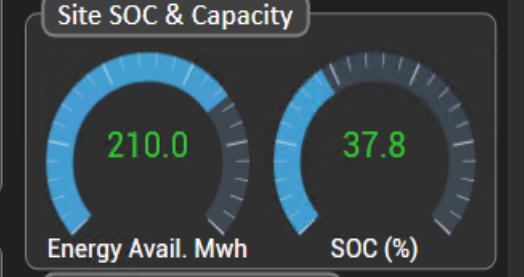
BMS Contactors

Auto Man Open Close

BESS **Wind Farm**

Site Electrical Values

Active Power	30.00
Average Voltage	N/A
Reactive Power	0.00



Site Energy & Capacity

Feeder	SOC	Capacity
F14A1	0.38128677	-52389.39
F14A2	0.36739302	-53565.84
F14B1	0.3824439	-52291.41
F14B2	0.38244313	-52291.477

Availability Status

Running	Available	Total
28	31	31

Lifetime Cycles: 0.0

Site Shamrock

Historical graph | High resolution

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

Contacts



Morgan Lewis

Morgan.Lewis@Emerson.com

412-963-4636



Brett Benson

Brett.Benson@Emerson.com

704-285-7038



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Thank You

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