Advanced Monitoring and Diagnostics:

Experience at Luminant
and the
Benefits of Industry Collaboration

Presented by: *Charles Pike, Manager, M&D Services*

Luminant

Energy Future Holdings - Overview

Luminant

Wholesale Power Generation
15,400 megawatts of generation:
2,300 MW Nuclear
8,000 MW Coal
5,110 MW Natural Gas
700 MW of Wind (purchased)

TXU energy

Retail Electricity Provider

Deregulated Competitive Market

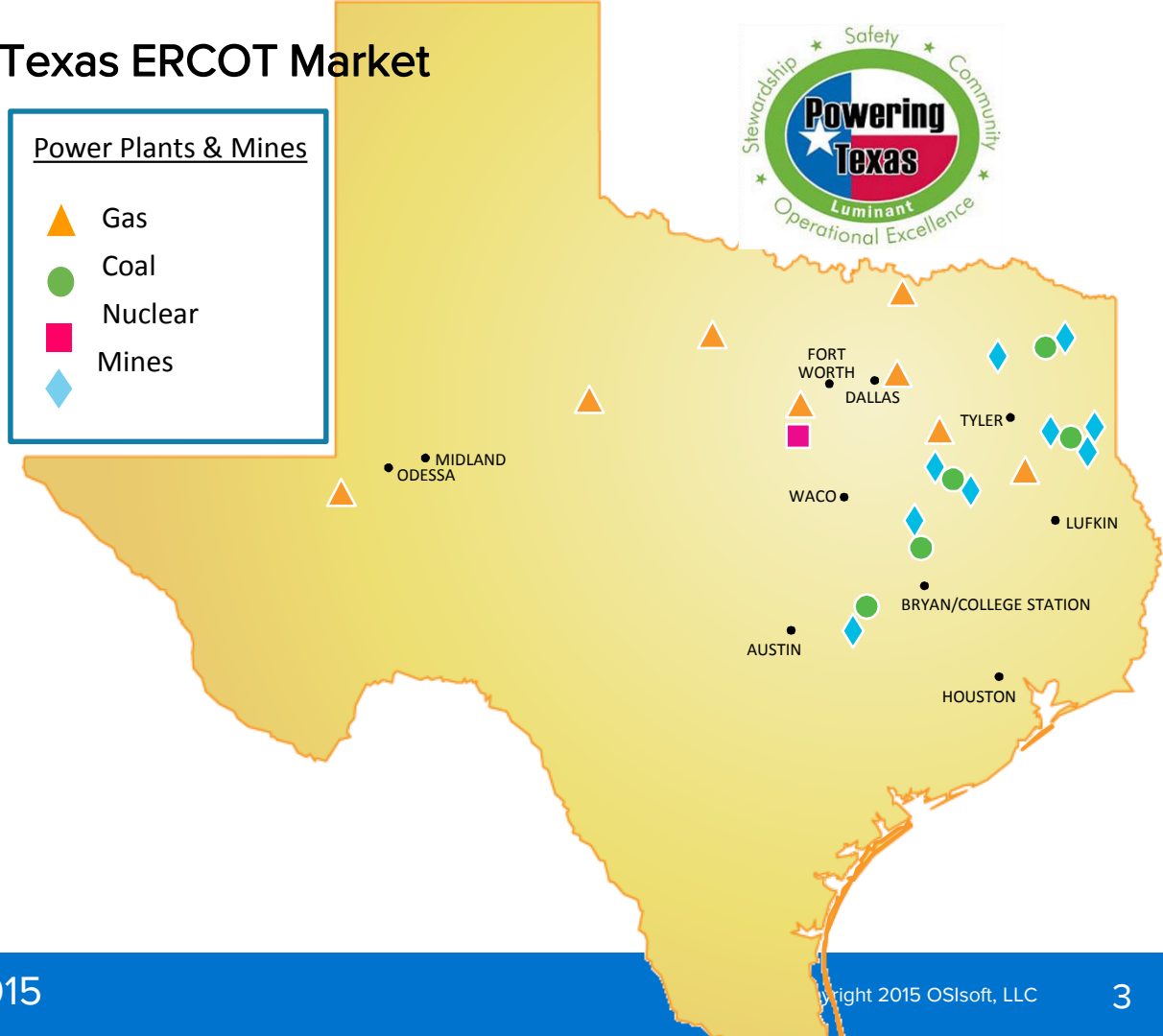
ONCOR

Transmission and Distribution

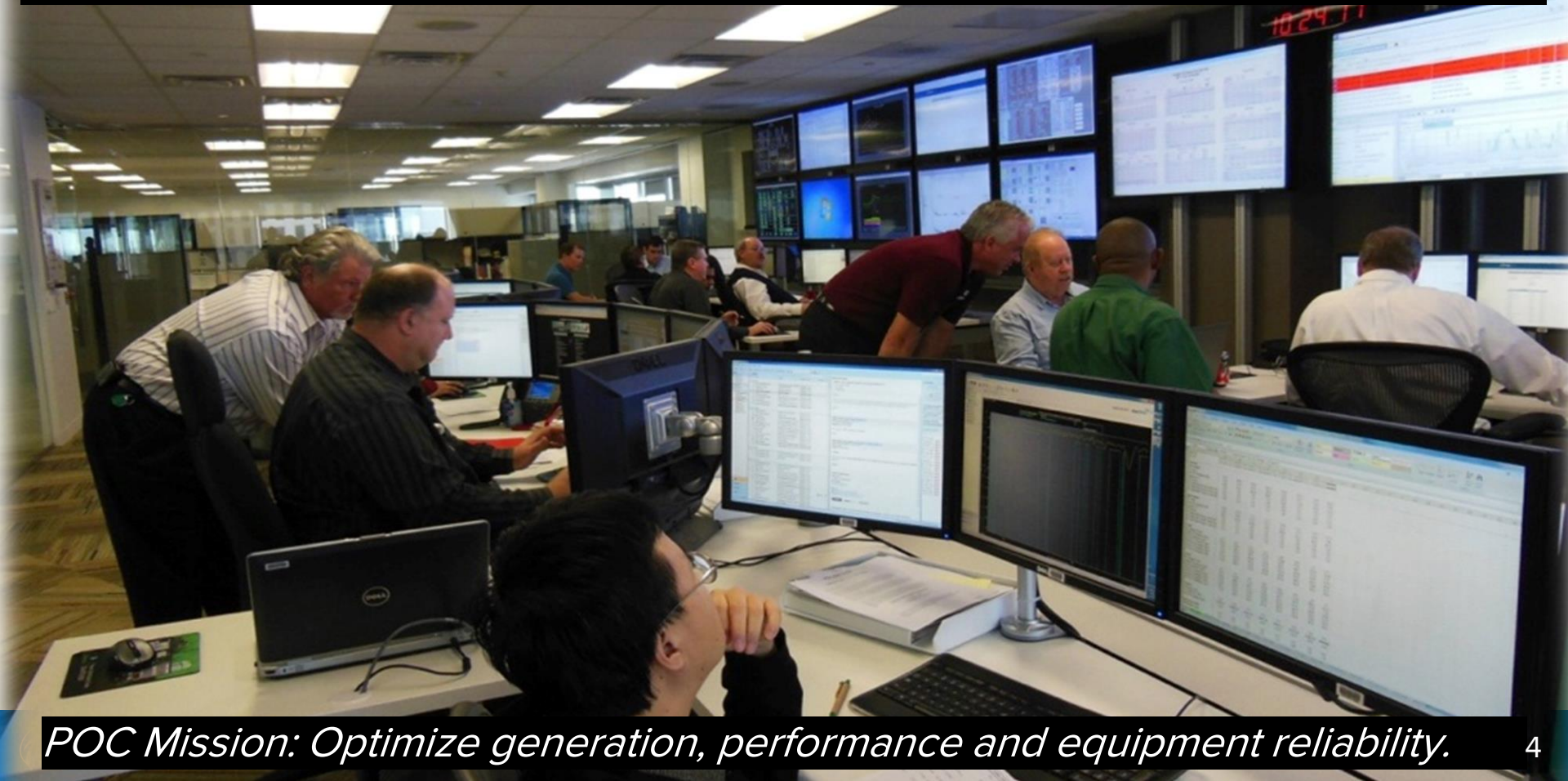
Regulated

Luminant's Footprint in the Texas ERCOT Market

- 13,772 MW, including new clean-air generation
- Coal emissions reduced by more than 20% since 2005
- Top U.S. coal producer
- Top-performing U.S. nuclear plant
- Potential nuclear expansion
- Major U.S. wind purchaser



The Luminant Power Optimization Center has been serving the Luminant fleet of power plants for over 10 years…

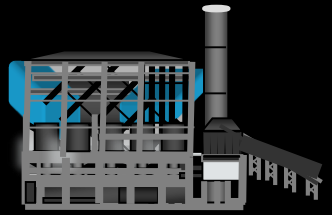


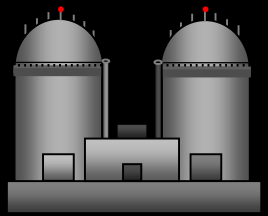
POC Mission: Optimize generation, performance and equipment reliability.

POC Value Stream…

Immediate Opportunities

Long Term Improvements





Asset Health Programs

Engineering Trending

Outage Planning

Plant Systems

Digital Control System

Plant Process Computer

Turbine Vibration Monitoring

Partial Discharge Motor Monitoring

Boiler Tube Leak Detection

Process Chemistry

Plant Data Historian

Emissions Management System

Wireless Vibration Monitoring

Bowl Mill Diagnostics

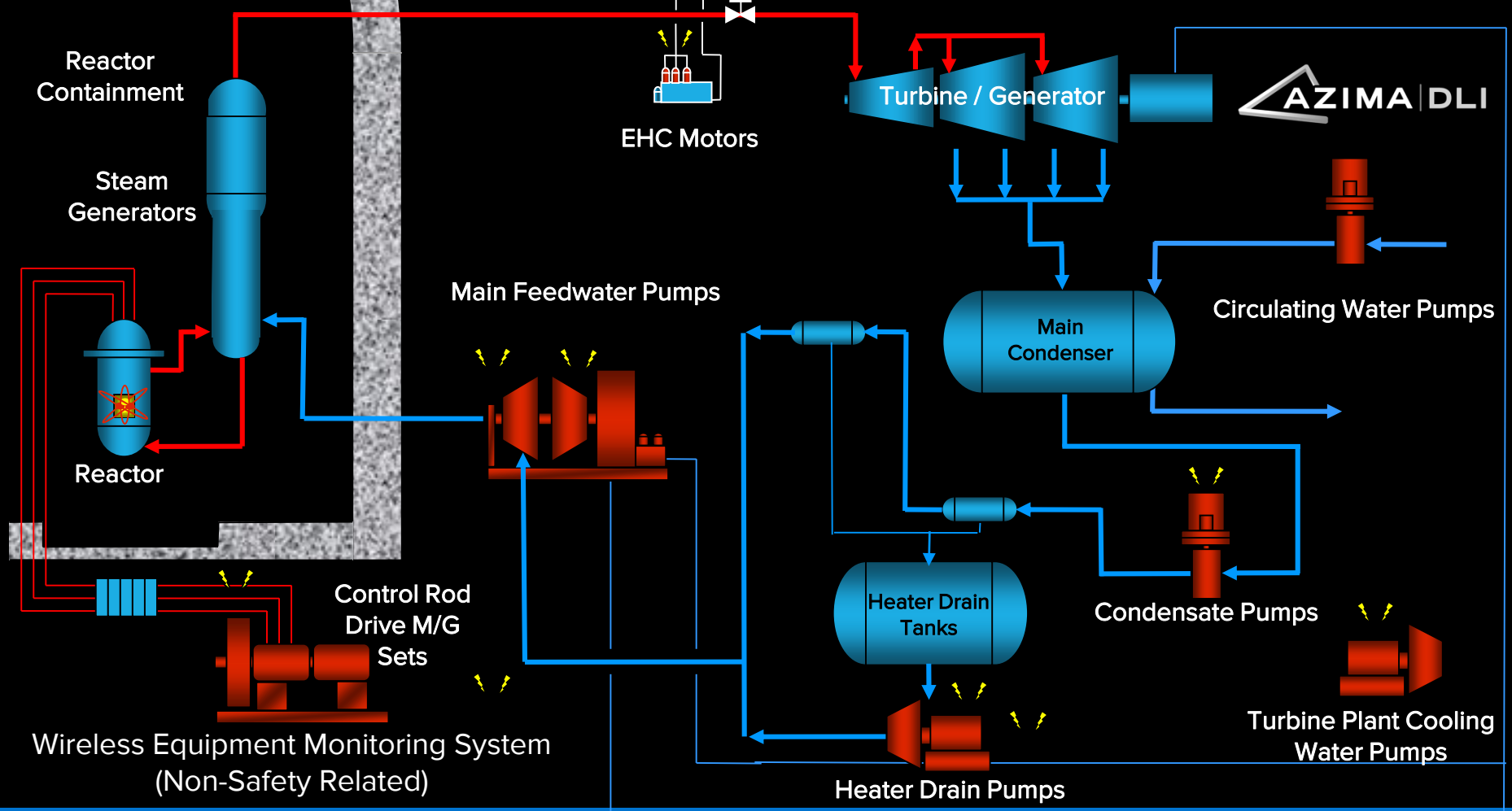
Generation Challenges

Performance Degradation

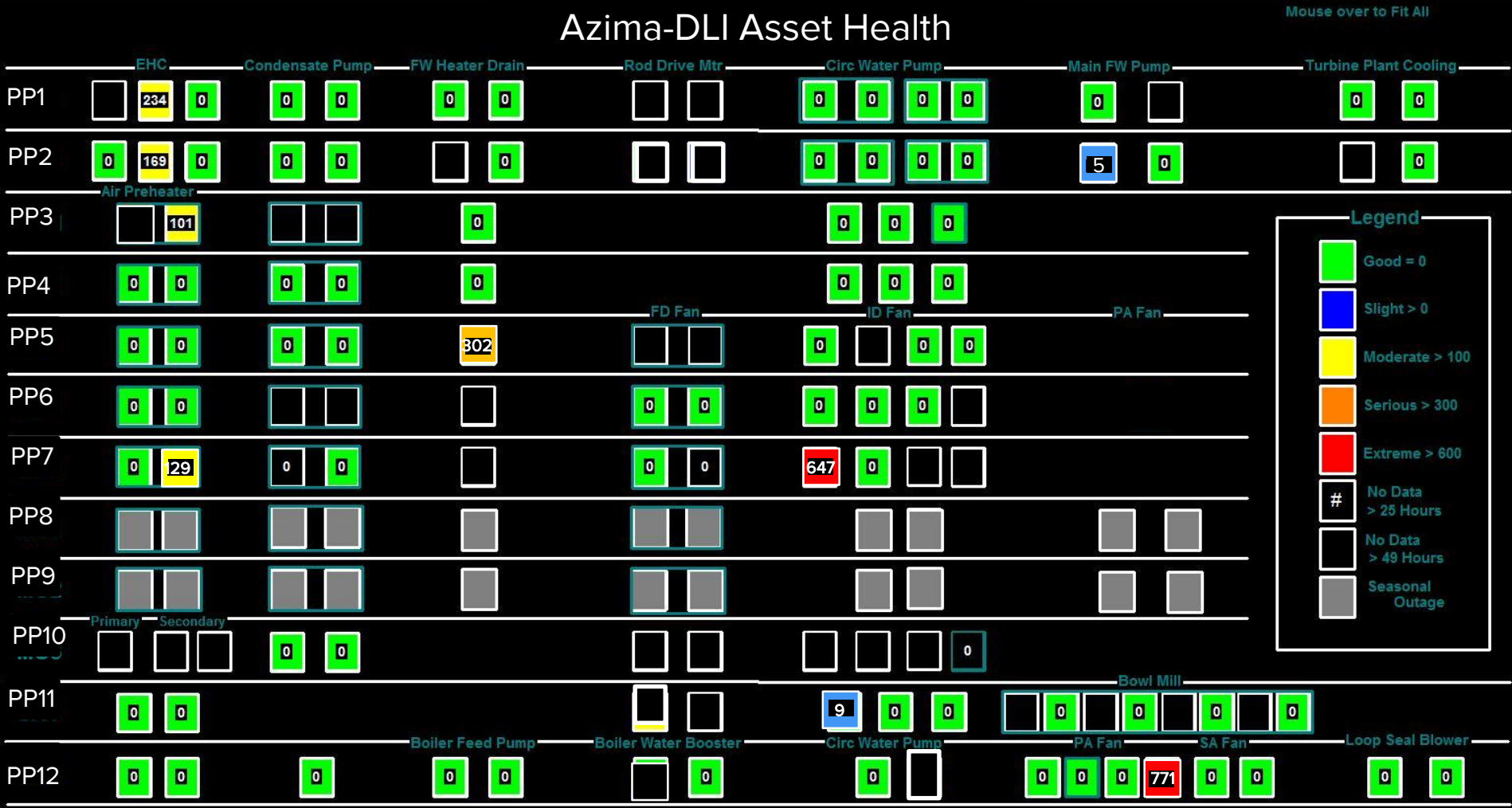
Faulty Instrumentation

POC Client Services

- 24x7 Predictive Monitoring & Diagnostics of Critical Equipment, Plant Systems and Performance
- Plant Start-up and Coastdown Reviews
- Online Chemistry Trending and Analysis
- Online Cycle Isolation Monitoring
- Fleet Watchlist – Reliability and Performance
- Course of Action Program – Emergent Issues
- Expanded Monitoring – Emergent Equipment Issues
- Automated Notifications
- Enterprise Cyber-Security Monitoring



Azima-DLI Asset Health

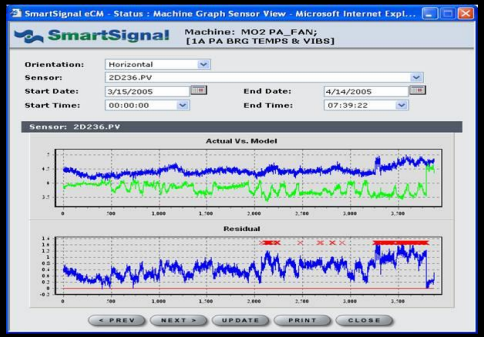


Predicting Failure – Primary Air Fan *(the shot heard around the world)*

Plant	Coal Plant
Component	Primary Air Fan
Event Date	15-Apr-05
POC Indication	**High Vibration**
Action Taken	Plant Notification & Subsequent Investigation
Issue Identified	Internal Oil Leak
Corrective Action	Repaired during Planned Outage
Consequence Avoided	Potential Plant Derate Avoided

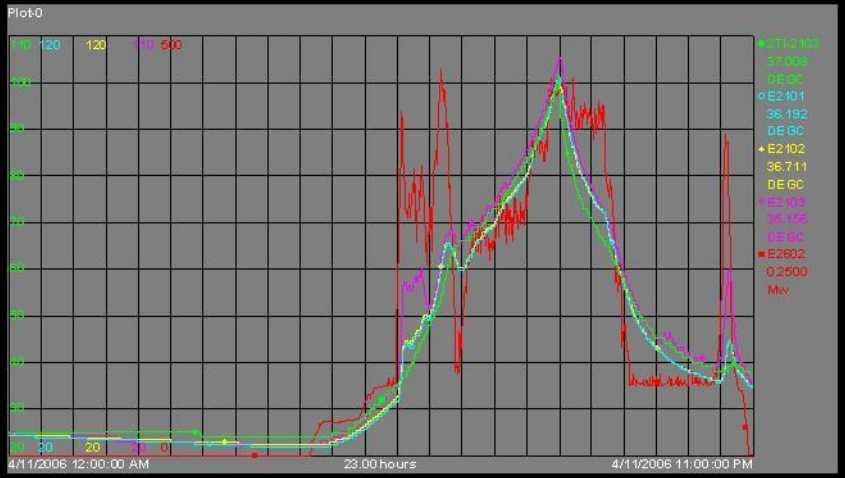
Benefit Analysis

- Generation Loss Avoided (MWhr)
- Probability of Impact (%)
- Duration of Impact (Hrs.)
- MCPE ($)
- Potential Lost Revenue ($)
- Fuel Cost ($)
- Potential Lost Margin ($)
- Revenue ($)
- Avoided Repairs (Parts & Labor)



Predicting Failure – Main Power Transformer

Transformer



Winding temperatures peaked at 105°C and returned to 40°C following restoration of cooling fans and oil pumps.

The POC received a Cockpit alarm for a HI winding temperature for a Main Transformer and contacted the Control Room. Plant Operations quickly determined that the cooling fans and oil pumps were not in service and restored normal cooling. Having just returned from a unit outage, a breaker was found to be out of position, effectively blocking the Control Room alarm for high winding temperature. The restoration of normal cooling potentially avoided a catastrophic failure of the transformer and certainly avoided a major inspection.

Avoided Inspection Costs

Potential Lost Revenue

Modeling Plant Control Systems – Steam Generator Level Control

Additional Examples of Remote M&D Contributions to Operations

- A low-flow alarm for generator primary cooling water was identified associated with a system pressure drop. Maintenance personnel determined that an associated transmitter caused the event.

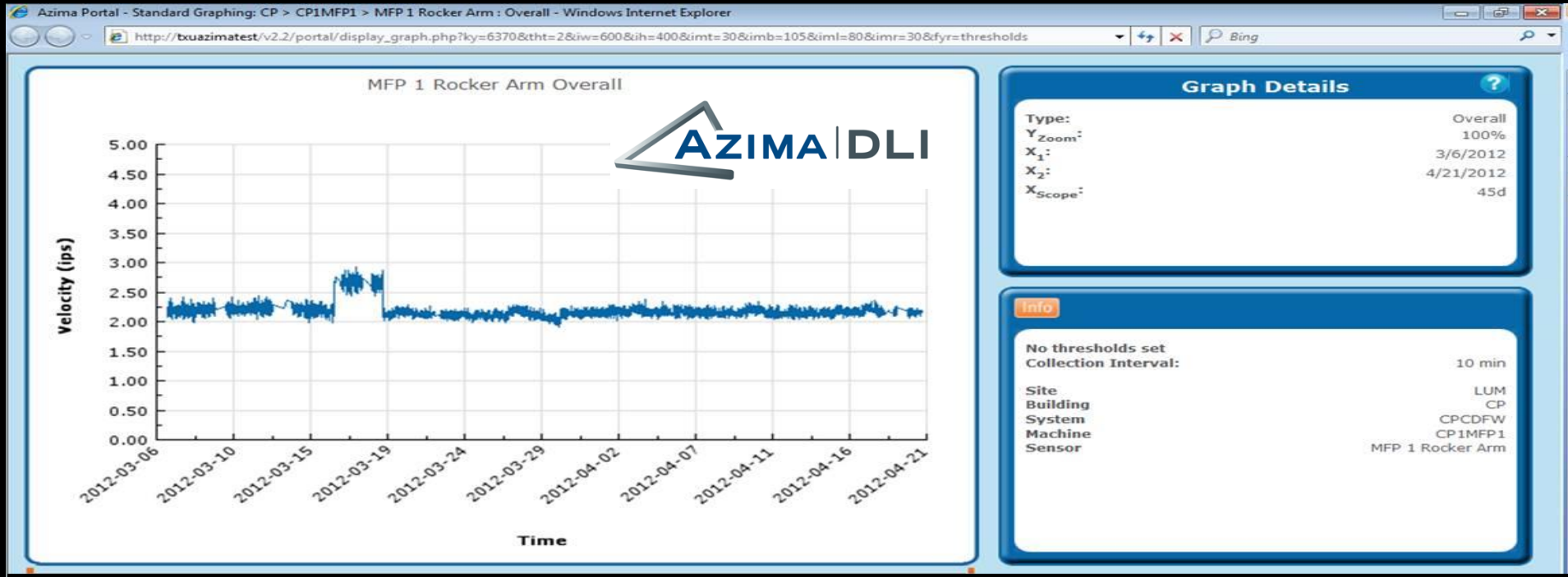
- A high-temperature alarm was received on a condensate pump motor stator. The temperature was 35°F higher than normal. Operators investigated and replaced the cooling system filters.

- Identified a vibration issue on a main feedwater pump and assisted station personnel in developing an action plan to keep the pump in service until the next refueling outage.

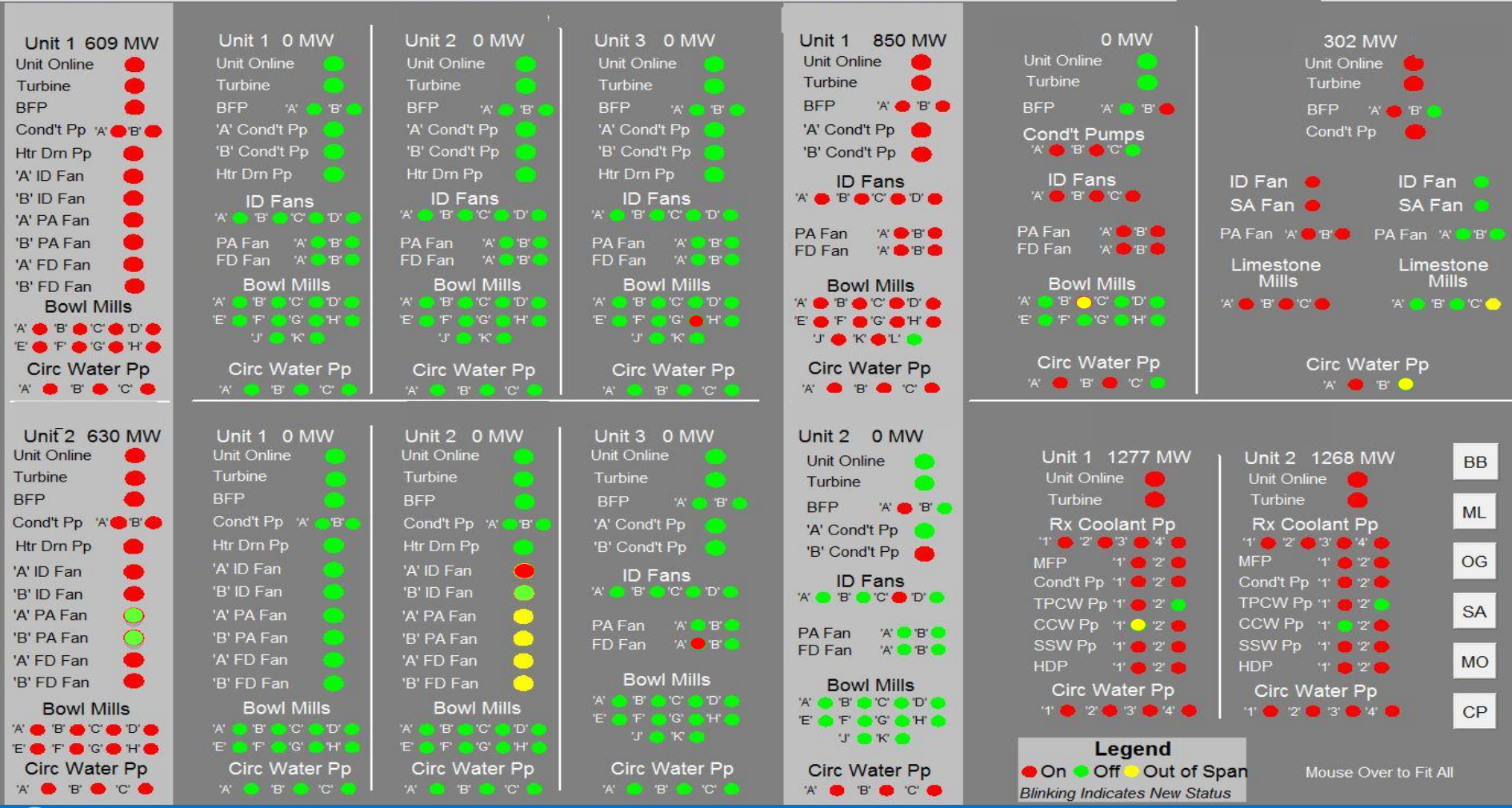
- Identified a high vibration alarm on a control rod drive motor generator set. Performance Optimization Center personnel analyzed the vibration data and identified that the motor inboard bearing might have insufficient grease. Following greasing, vibration on the motor returned to normal levels.

- Identified elevated temperatures on the circulating water pump motor. Operations personnel identified that lubrication and cooling water flow required adjustment to maintain motor bearing temperatures within the expected operating band.

POC services include mobile crash cart capabilities utilizing wired and wireless communications



This enables enhanced monitoring analysis of emerging equipment and process performance challenges



POC contributions to nuclear operations have received industry recognition by:

Institute of Nuclear Power Operations

World Association of Nuclear Operators

INPO Strength: Equipment Reliability

2008 INPO Evaluation – Comanche Peak

10x7 Monitoring of Critical Equipment

WANO Strength: Equipment Reliability

2012 WANO Peer Review – Comanche Peak

24x7 Real Time Operational Support

The Future…

Technology Convergence & Industry Collaboration

Strengthening Industry Operating Experience Programs

Industry Transformation in the Information Age

It's all about Its all about Big Data…

How will the nuclear industry be positioned to fully benefit from its potential?

The convergence of technologies and industry collaboration will enable a new age of Operational Excellence

Plant Information

Telecommunications

Scientific Application

Internet of Things

Satellite

Digital

Wireless Mobility

Automated Maintenance Scheduling

Plant Actualization

Analog

Internet

Condition Based Maintenance

Prognostics

Pattern Recognition

Exception Monitoring

SCADA

Global

Diagnostics

Predictive Maintenance

National

Automated Data Collection

Regulation

Fleet Wide

Alarming

Legislation

Autonomous Operation

Industry Regulation

Self-

Standards

Technium

Expanding Industry Operating Experience programs to include operational data will enable the development of fault signature models accelerating the advancement of prognostic capabilities

Prognostics

Fault Signatures

Pattern Recognition

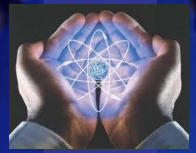
Analysis

Diagnostics

Nuclear Safety

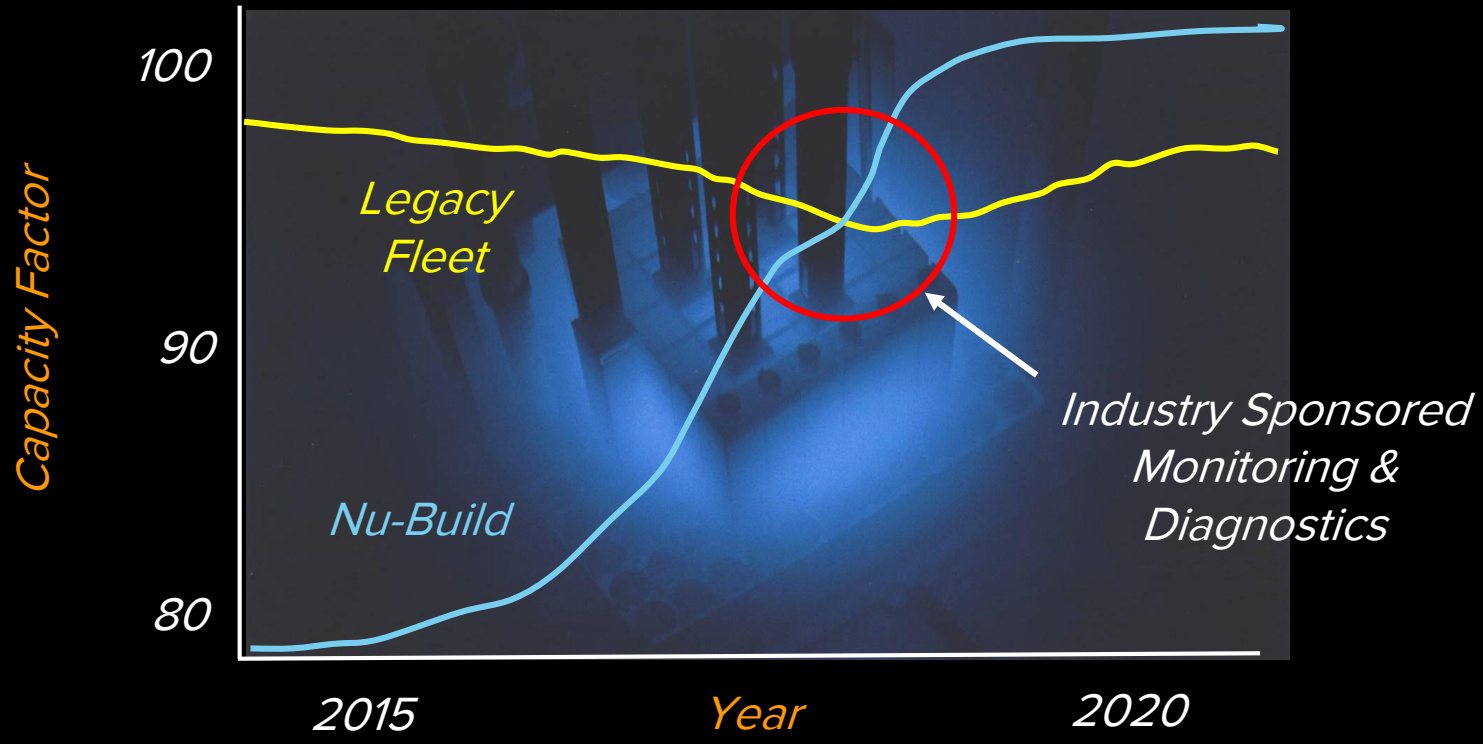
Performance Reliability

Monitoring

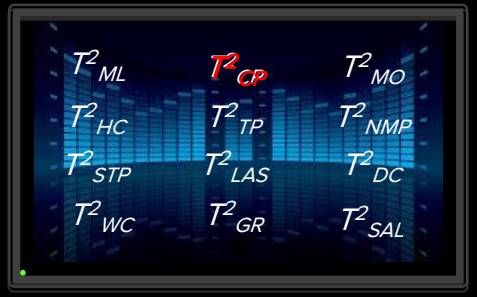


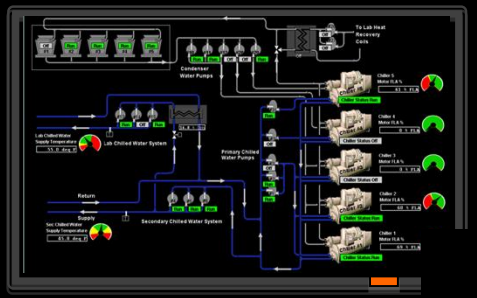
The "Internet of Things" will enable us to strengthen safety, reliability and performance…

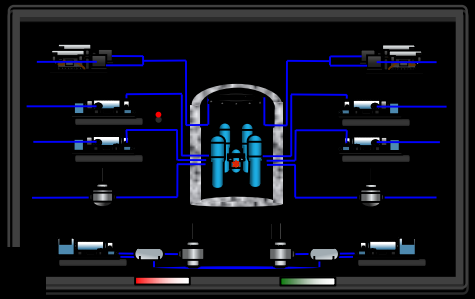
Industry sponsored Remote Monitoring & Diagnostics will play an important role as next generation nuclear facilities come on-line and similarly support legacy nuclear fleet.



Centralized monitoring will bring about Energy Industry transformation as a part of the Information Age…







… welcome to the Age of BIG DATA…!

NUCLEAR SAFETY

EQUIPMENT RELIABILITY

FLEET PERFORMANCE

CYBER SECURITY

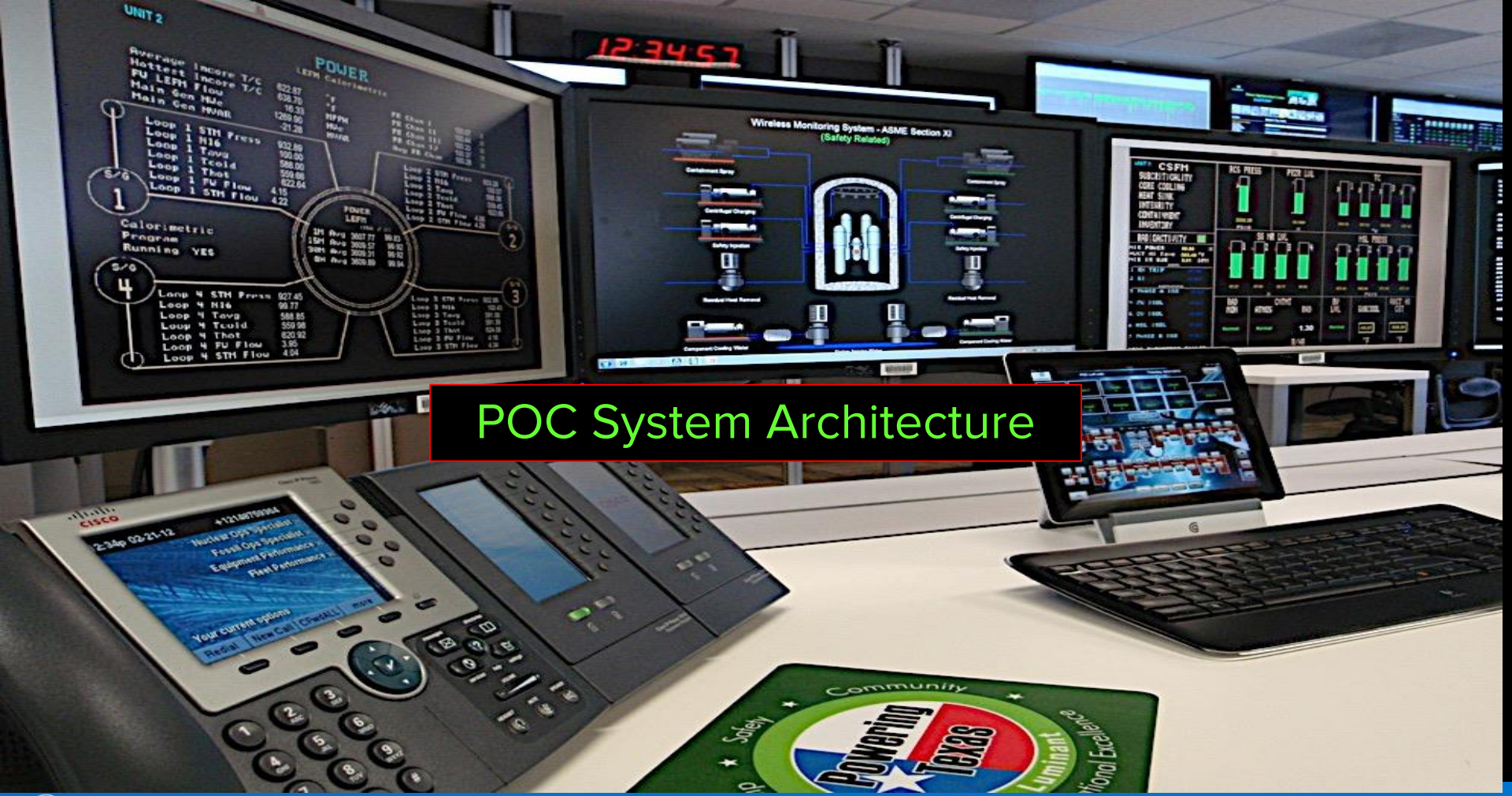
Global priorities are bringing about a radical transformation of the electric utility industry.

Utilities are challenged with keeping pace with global demands while delivering safe, reliable and affordable power…

…and while reducing the impact on the environment…

…working together, we can make a difference…

Power Optimization Center

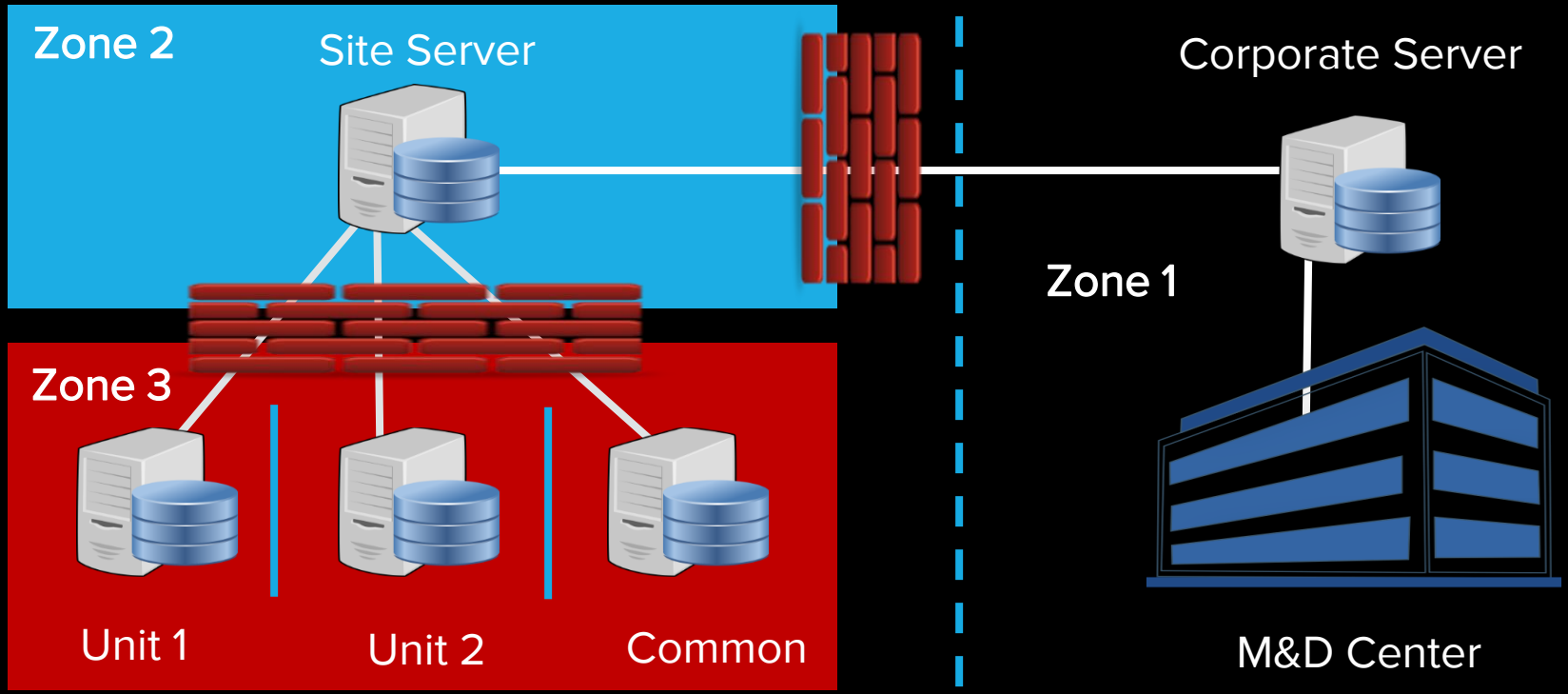


System Architecture Luminant

Zone 2 – at generation sites & does not have ability to impact power generation production

Zone 3 - at generation sites & does have ability to impact power generation production

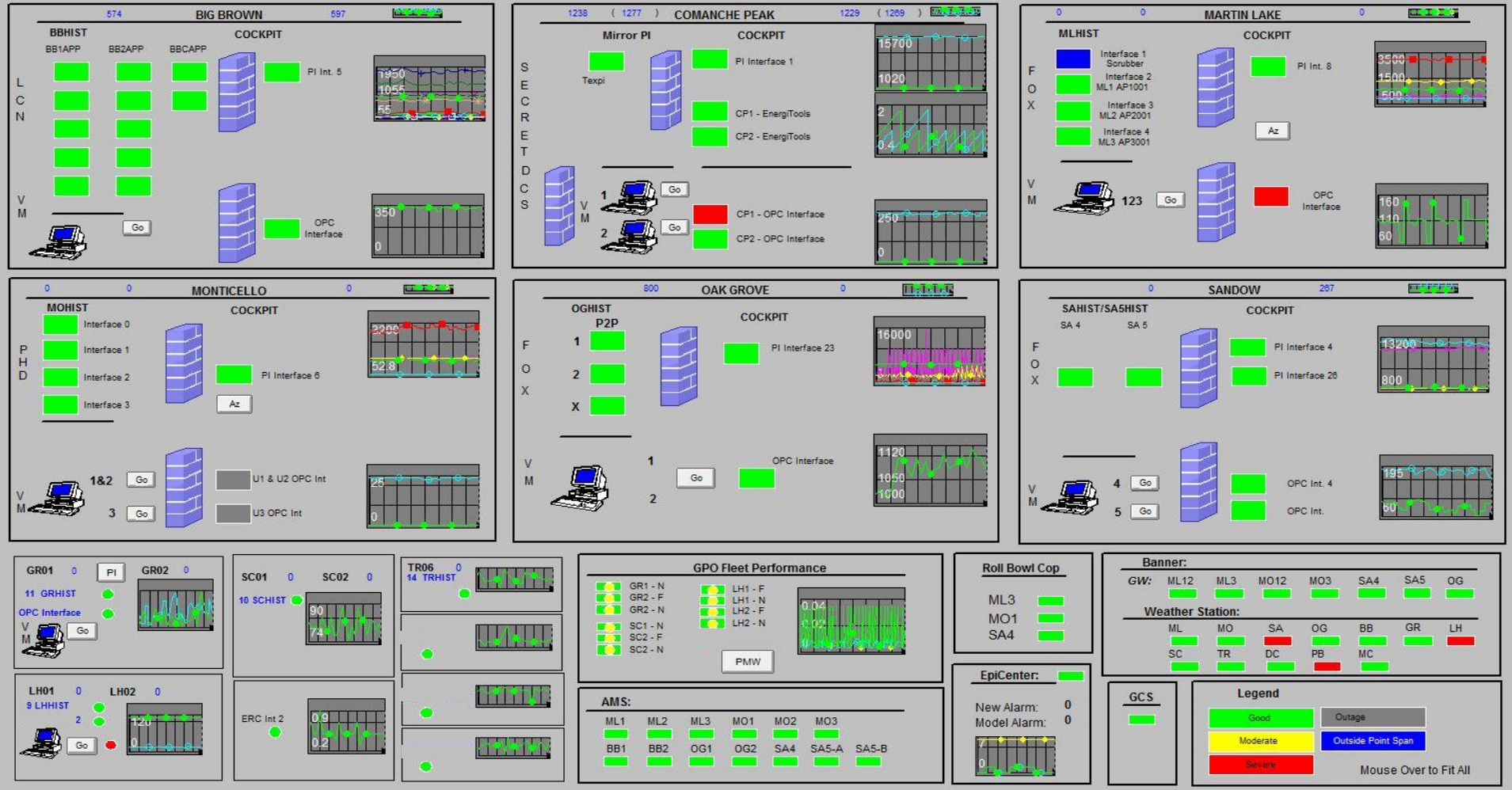
Zone 1 – not at generation sites & does not have ability to impact power generation production



- 29 Historians
- 500,000 tags
- 150 interfaces
- 17 years of data

Technology Stack used at Luminant

PI DataLink	Notifications	PI ProcessBook	
PI ACE	Asset Framework	Data Access	Module Database
OPC DA/HDA	PI SDK	PI SMT	Tag Configurator
Allen Bradley RSLinx	AutoPoint Sync (PI APS)	ESC Stack Vision	Foxboro AP51
Foxboro AW70	Honeywell PHD	IT Monitor	MCN Health Monitor
Modbus Ethernet	Modbus Serial PLC	OLEDB Comm Connector	OPC
PI to PI	Universal File & Stream Loader		Westinghouse Ovation



Contact Information

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Luminant

Questions

Please wait for the microphone before asking your questions

State your
name & company

Please don't forget to…

Complete the Survey
for this session

The Power of Data
DECISION READY IN REAL-TIME

Evaluation Form (Seminar Location - Date)

Name:_____ Company: _____

Email:_____

Quality and content of the presentations	Poor	Good	Excellent	N/A
Welcome	○	○	○	○
The Journey To Real-Time Operational Intelligence	○	○	○	○
The Power of Connection	○	○	○	○
Tank Level Management System	○	○	○	○
Using the PI System to Aid in Troubleshooting Operational Aspects of Oil and Gas Well Drilling and Completion	○	○	○	○
Unleash your Infrastructure	○	○	○	○
Information on the Spot	○	○	○	○
Wrap-up/Seminar Conclusion	○	○	○	○

Quality and organization of the seminar				
Choice of date	○	○	○	○
Time allowed for lunch/breaks	○	○	○	○
Choice of presentations	○	○	○	○
Pace and time allowed for the presentations	○	○	○	○

감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado