

OSIsoft®

USERS 2013 CONFERENCE

The Power of Data

THRIVING

IN A

WORLD OF

CHANGE

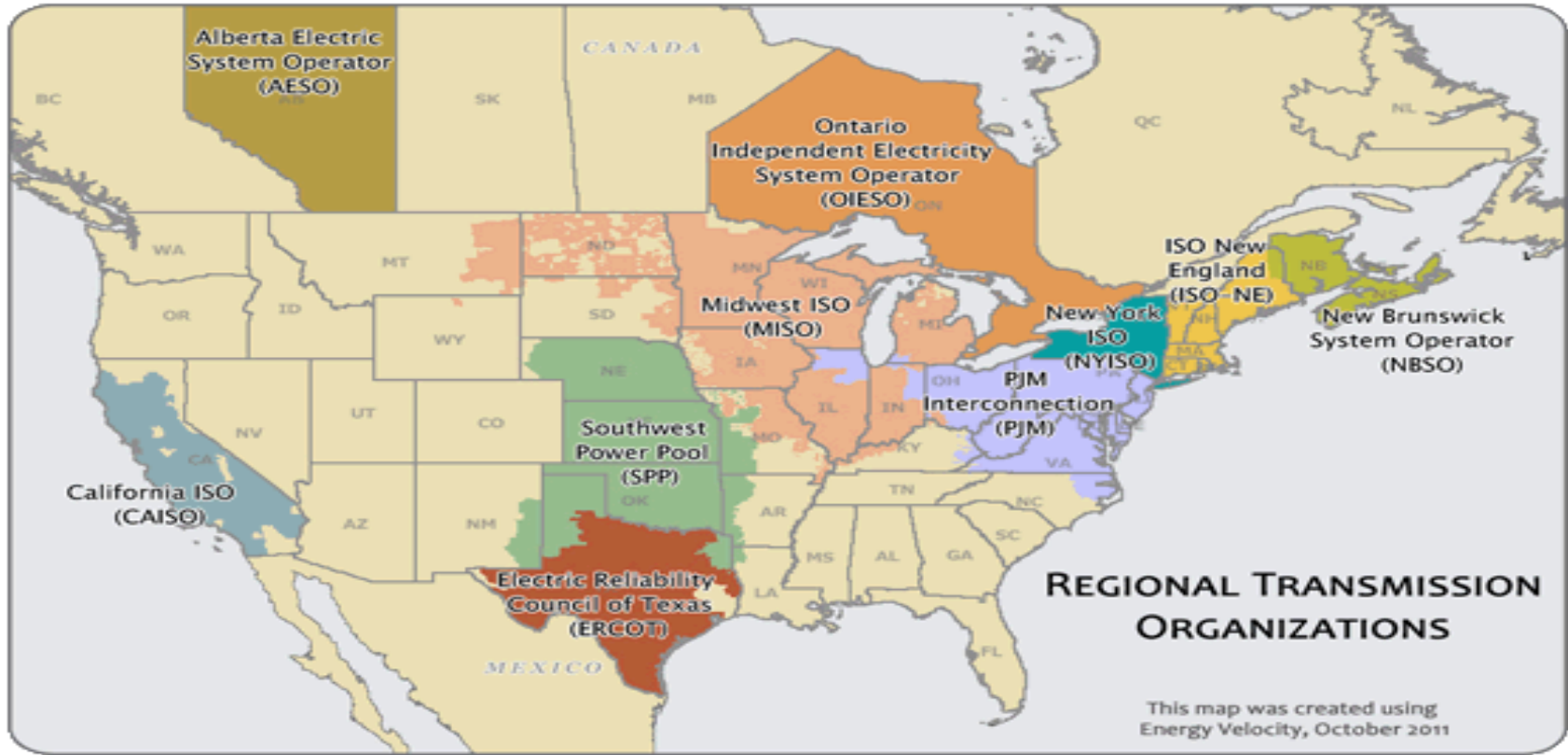


PJM PI System Updates

Tom Keyser

PJM Transmission System
Operator

Regional Transmission Organizations



PJM Territory



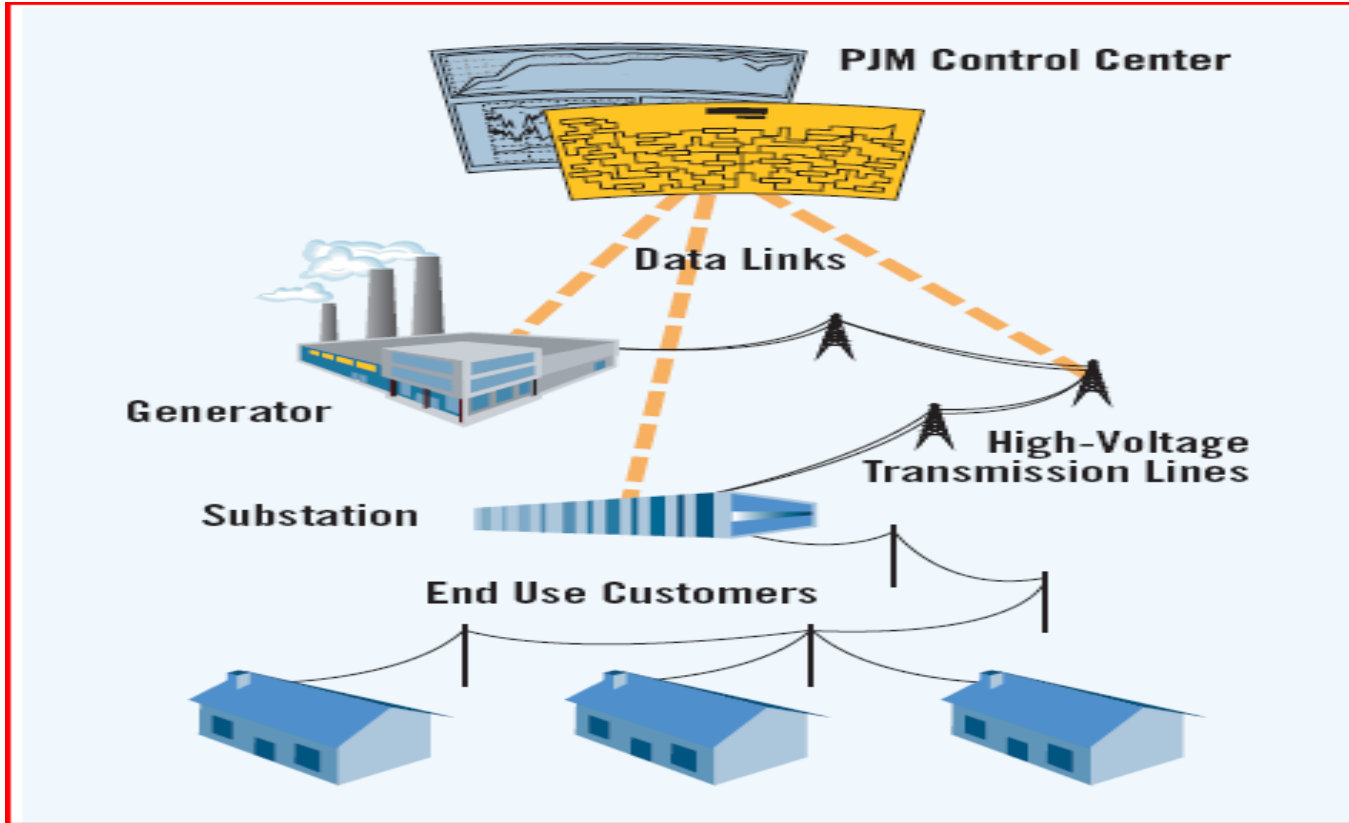
PJM History

- Founded in 1927, PJM Interconnection is an independent and impartial organization that manages the transmission system and operates the wholesale electricity market.
- Valley Forge, PA.
- Three original members were utilities from Pennsylvania (P), Jersey (J), and Maryland (M) – thus PJM.

PJM Overview

- PJM is a Regional Transmission Organization (RTO)
 - Coordinates the movement of wholesale electricity in all or parts of 13 states and Washington D.C.
 - Operates wholesale electricity market
 - Manages the high-voltage electricity grid to ensure reliability for more than 60 million people
 - Peak Demand is ~163,000 MW
 - Peak Capacity is ~185,000 MW
 - PJM territory includes 6,000 substations
 - 62,000 miles of transmission lines (69KV-765KV)
 - Dispatch 1,200 Generators

PJM Control Center



EMS and Market System

- Siemens Spectrum EMS - Monitor Transmission System
 - 2 fully redundant EMS systems
- Alstom - Energy Market Systems
 - Run a Security Constrained Economic Dispatch
 - Day ahead and real-time market

PJM PI System

- Currently uses over 1.4 Million tags
- 36 Production Servers
- 6 Dispatch Training Servers – EMS Simulator
- 22 Test Servers
- 13 Stage Servers

System Overview

- In 2012 PJM upgraded to PI Server 2010
- Plan to upgrade to PI Server 2012 this year
- Project to add State Estimator data completed in 2012
- Installed PI AF, currently working on models
- PJM uses PI ACE for Calculation and Analytics
- PI Web Services
- Synchrophasor Data

PI Client Overview

- OSIsoft WebParts in Microsoft SharePoint web environment to share data with NERC (North American Electric Reliability Corporation) and FERC(Federal Energy Regulatory Commission)
- PI ProcessBook displays for dispatcher real-time monitoring, training and during simulations and restoration drills
- PI ProcessBook displays for after event analysis
- PI DataLink (in Excel) for engineering analysis and reporting

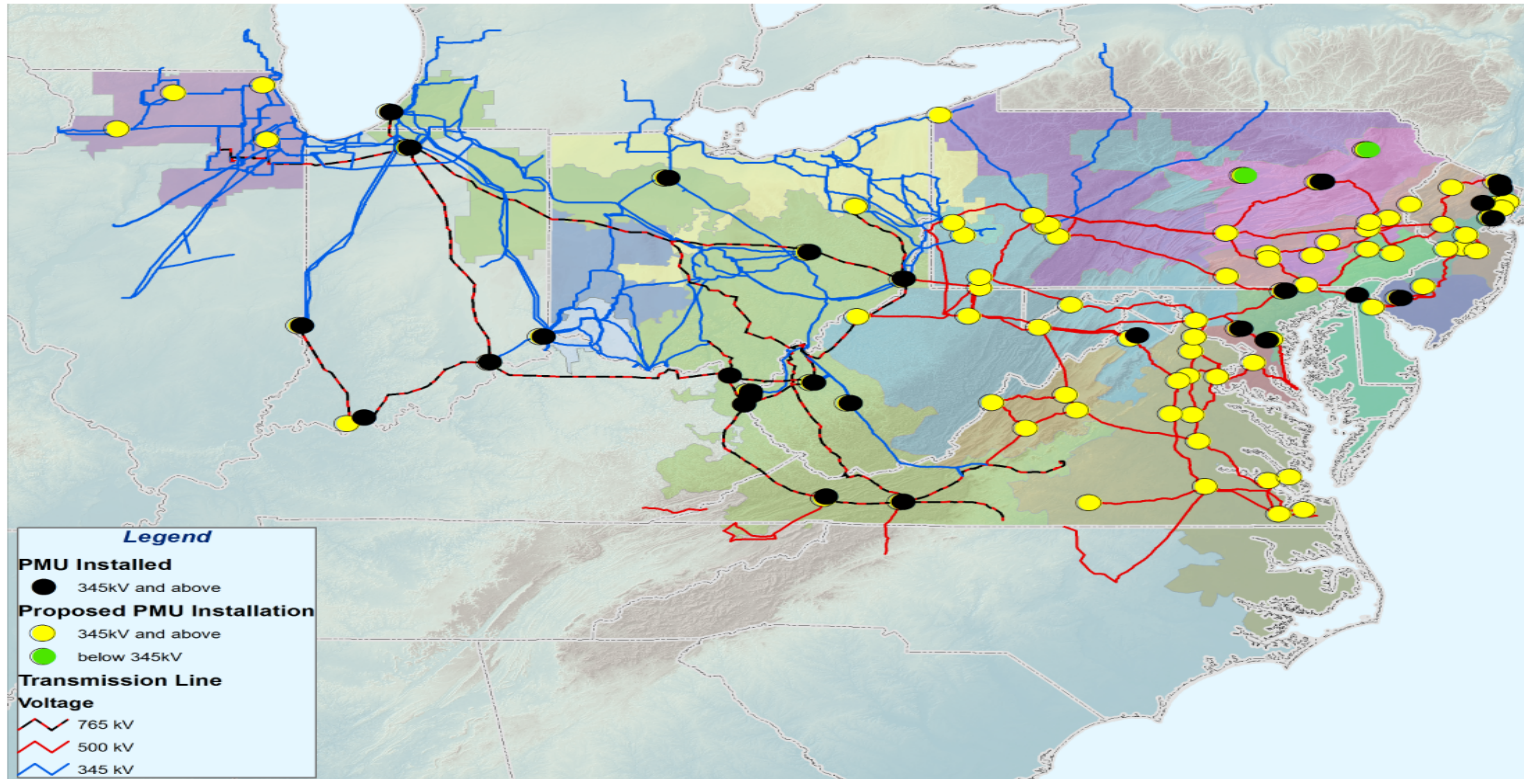
Data Collected in PI System

- Real-time SCADA data – voltages, MW, MVAR, loads, Circuit Breaker Status
- State Estimator data
- Market data – Generator bid information, Dispatch rates, LMPs (Locational Marginal Pricing)

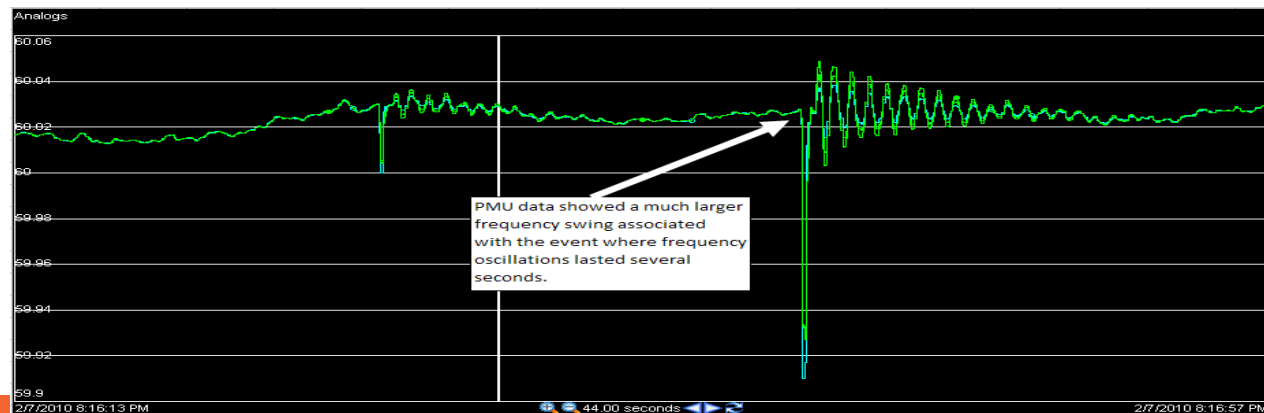
Synchrophasor Data

- 360 PMUs installed in 90 substations by end of 2013
- Covering 10 states
- Approx 2000 PI tags collecting data
- 30 samples per second
- Estimated 1TB data per month collected
- Future - PJM will also collect phasor data from roughly 150 substations external to PJM

PMU Deployment



Value of Synchrophasor Technology



**Phasor data
provides
granularity
not possible
in SCADA**

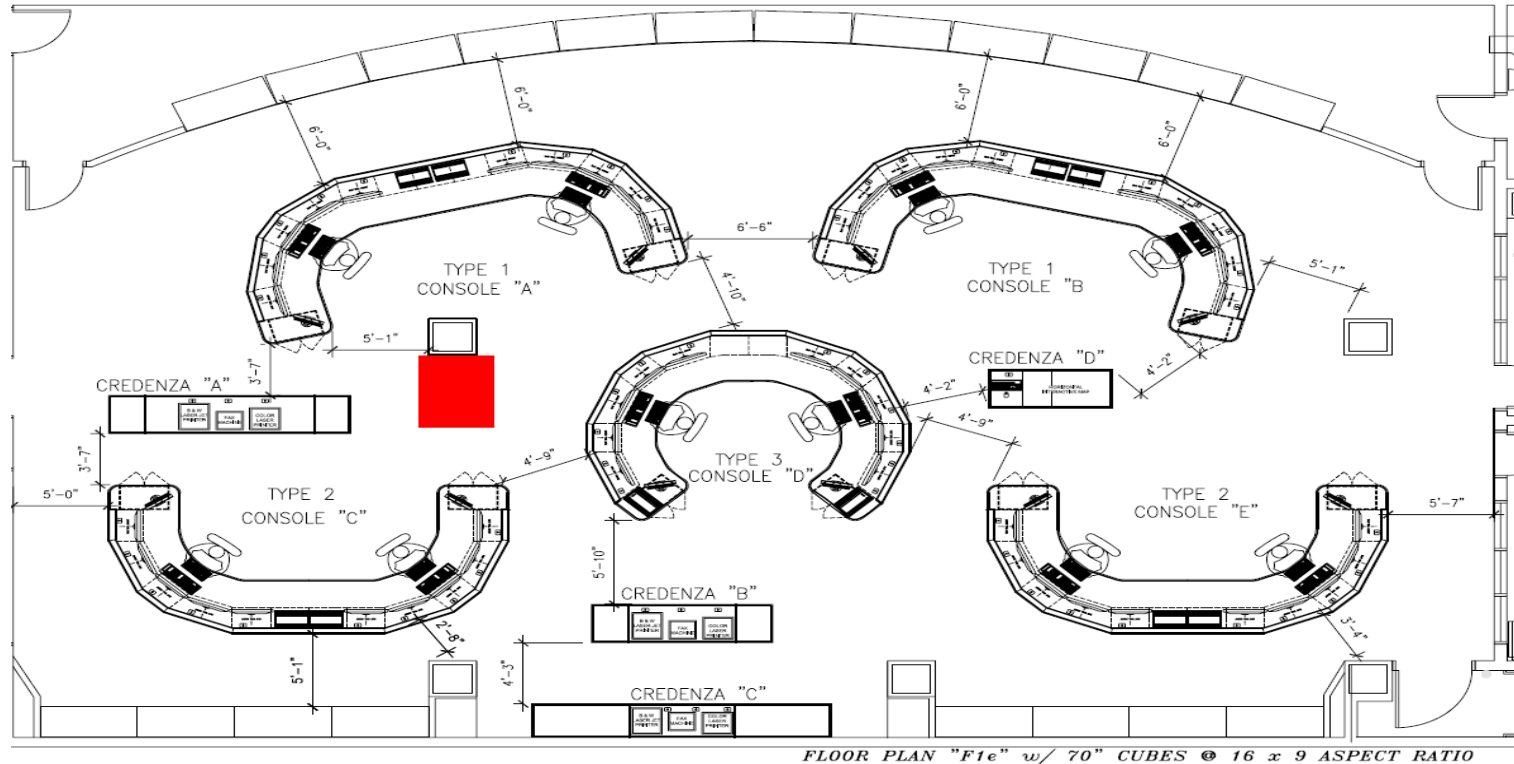
Synchrophasor for on-line Applications

- Wide-area situational awareness
- Stability, oscillations and voltage monitoring
- Alarming
- Dynamic line ratings and congestion management

Control Room Displays

- Voltages
- Frequency
- Generation (steam, CTs, wind and hydro, etc.)
- Loads
- Tielines between transmission companies
- Oneline area overviews
- MW Reserves

Control Room Layout



Generation Dispatcher Wall



Picture Tour – Far Left

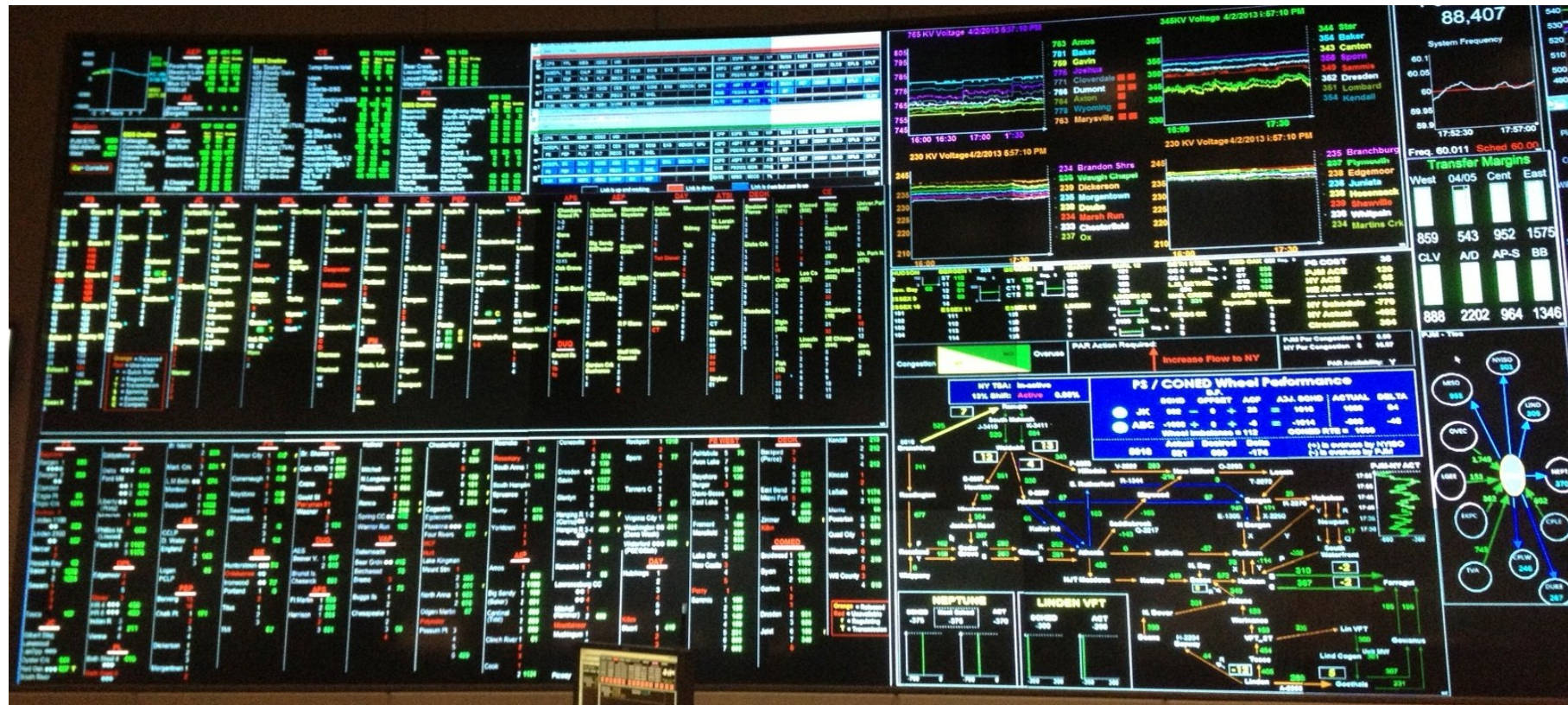


Picture Tour

Generation and Transmission



Picture Tour – Left side



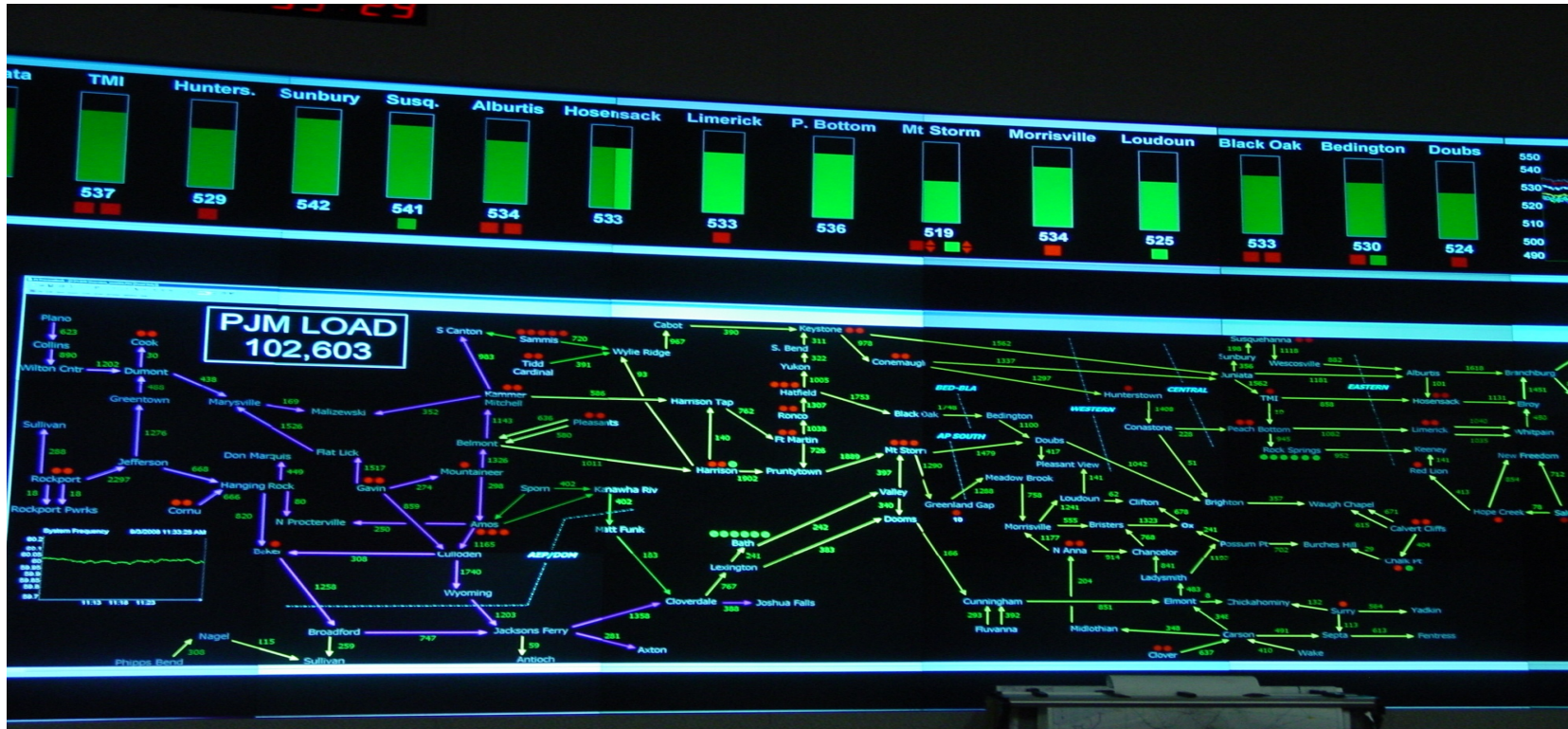
Picture Tour – Center



Picture Tour – Right side



Transmission – Detail Shot



Generation – Detail shot



C2: Front Video Wall Gen. and Trans.



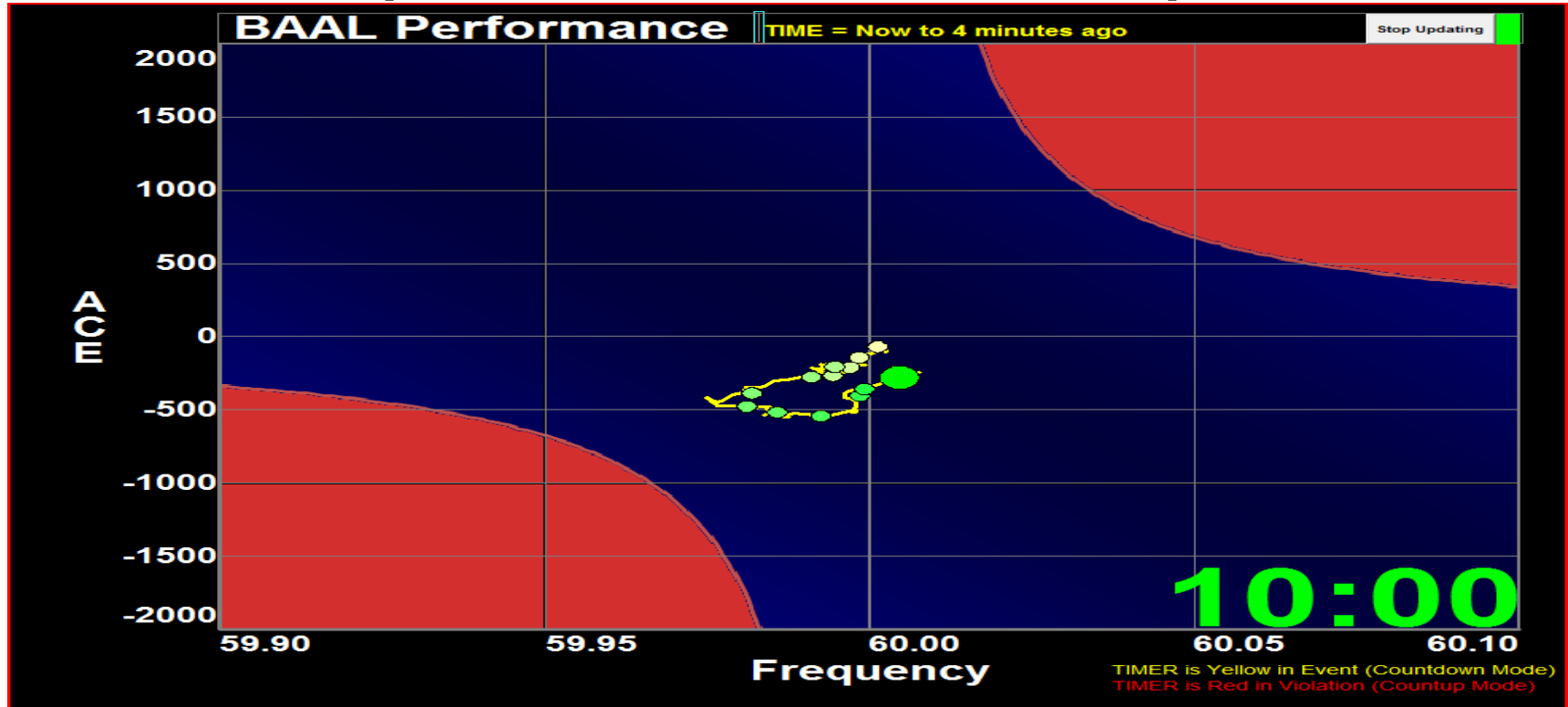
C2: Rear Video Wall



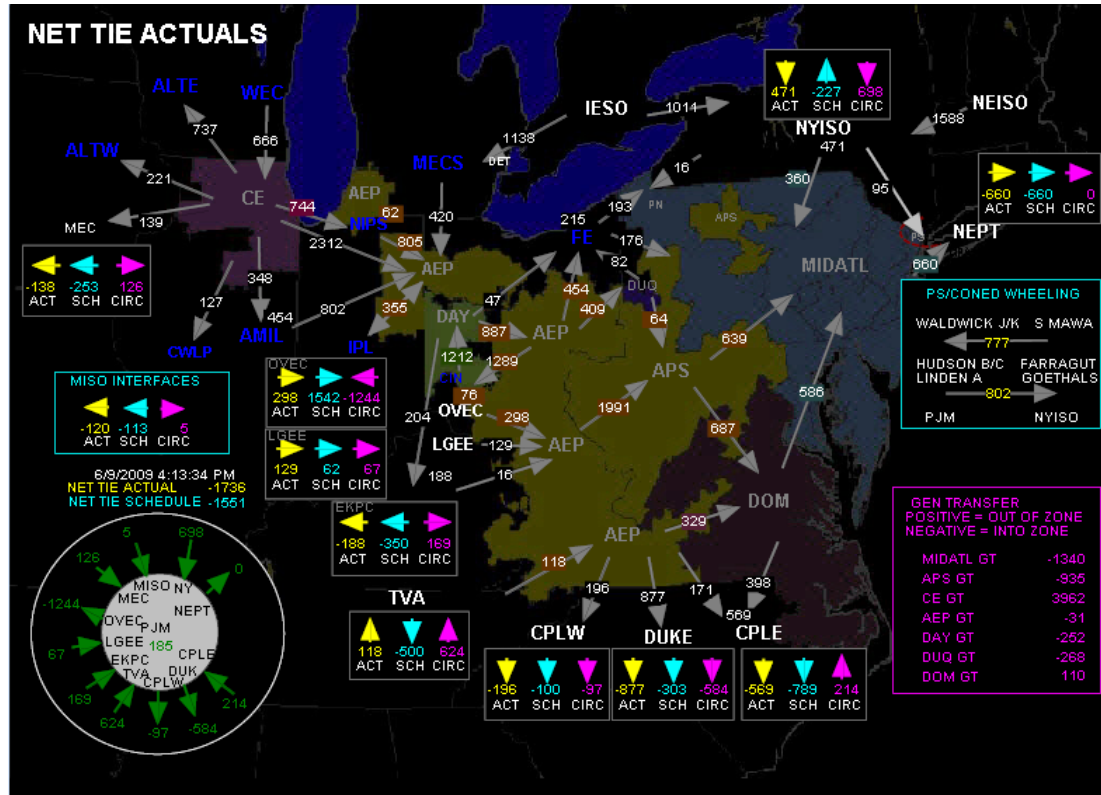
C2: Picture Tour



Balancing Authority ACE Limit (Area Control Error)



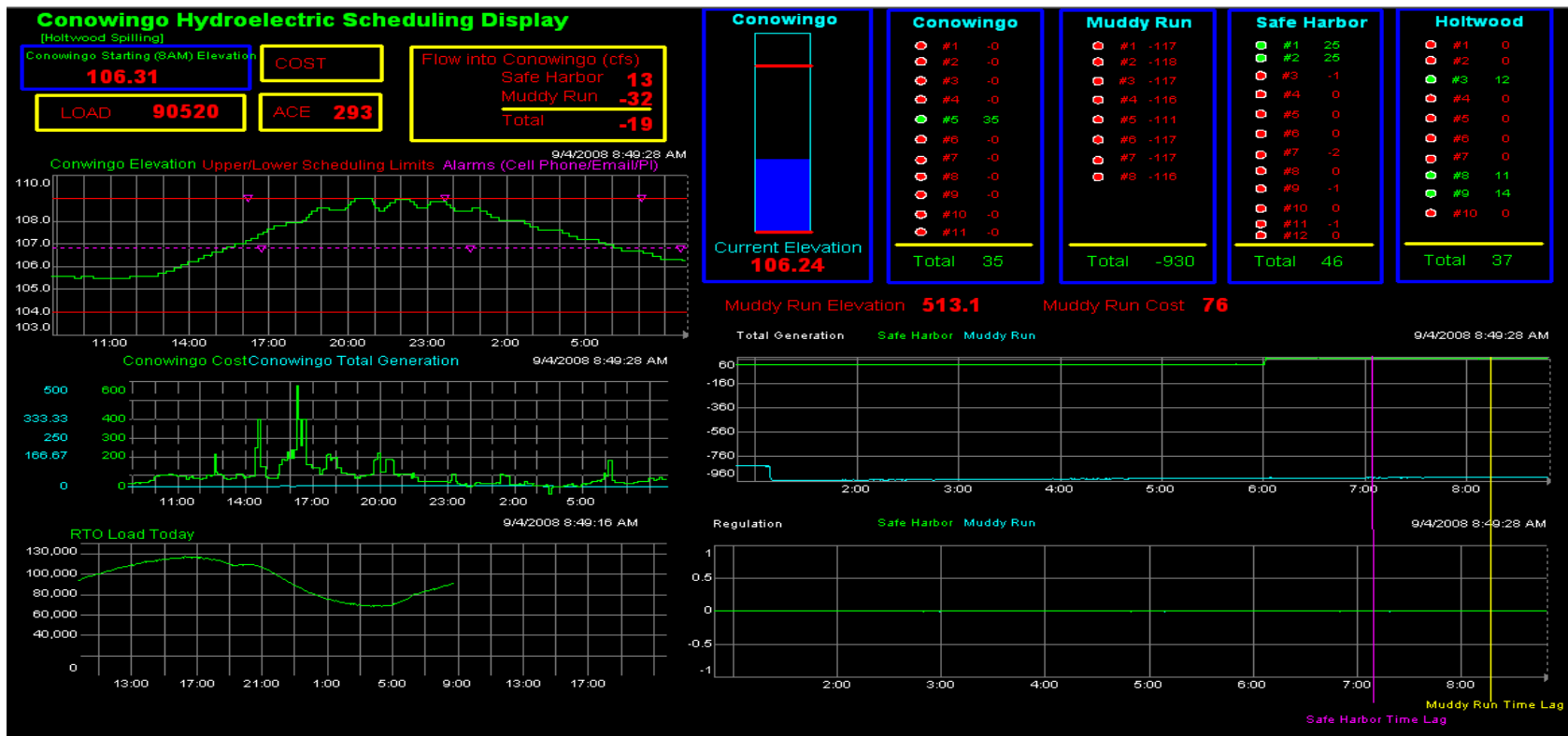
Tie Flows



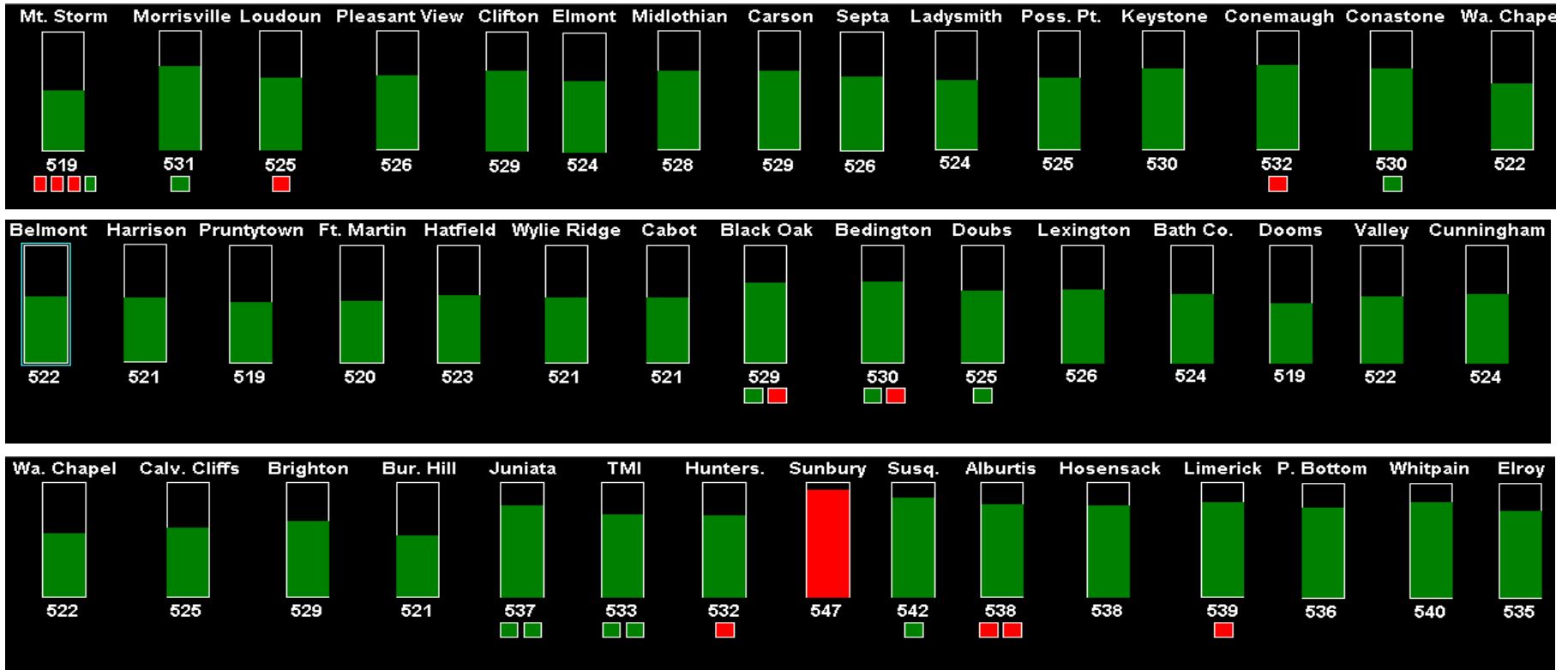
ACE deltas between site EMS's



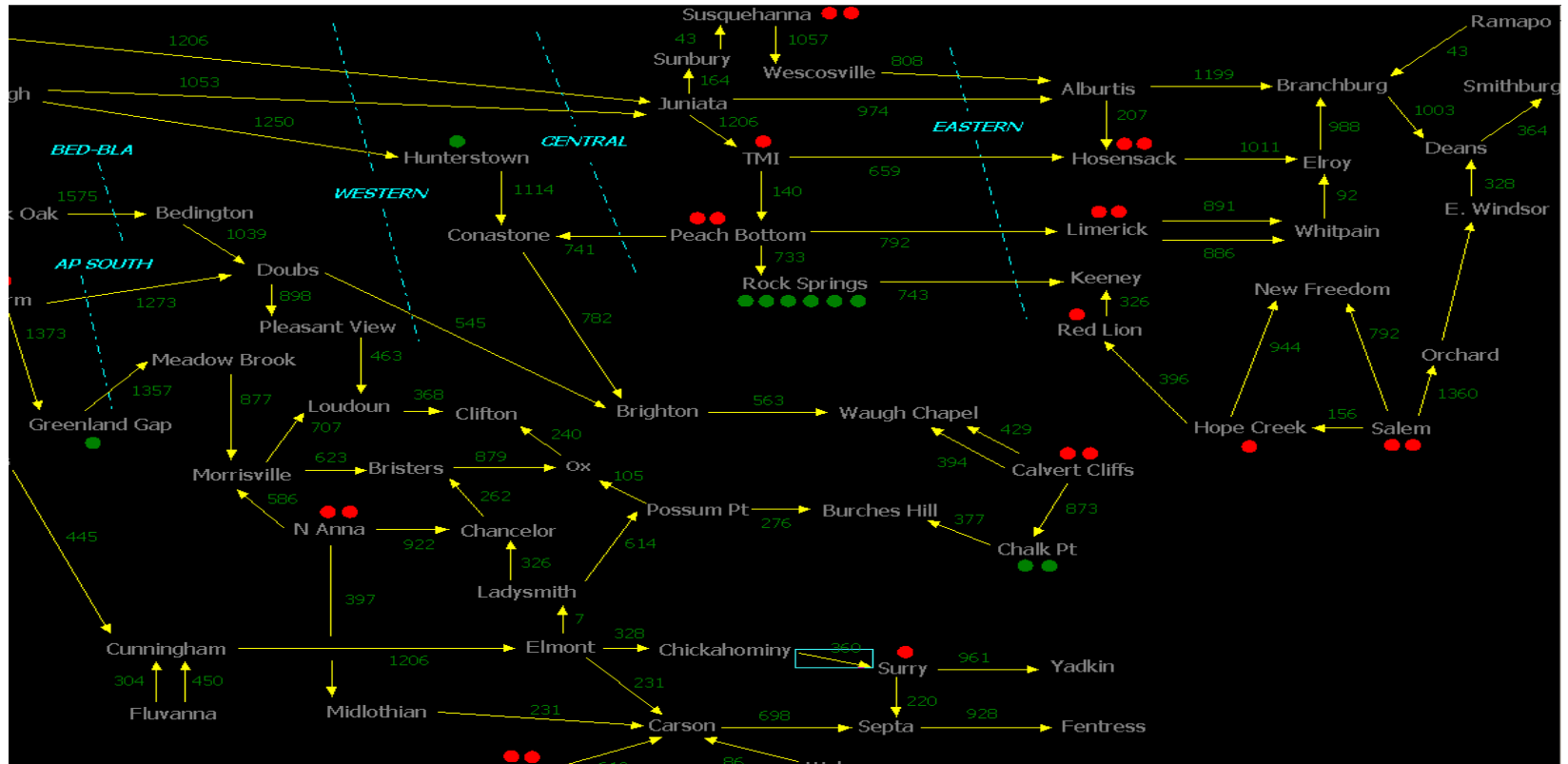
Hydro Generation Scheduling



Transmission Bus Voltage

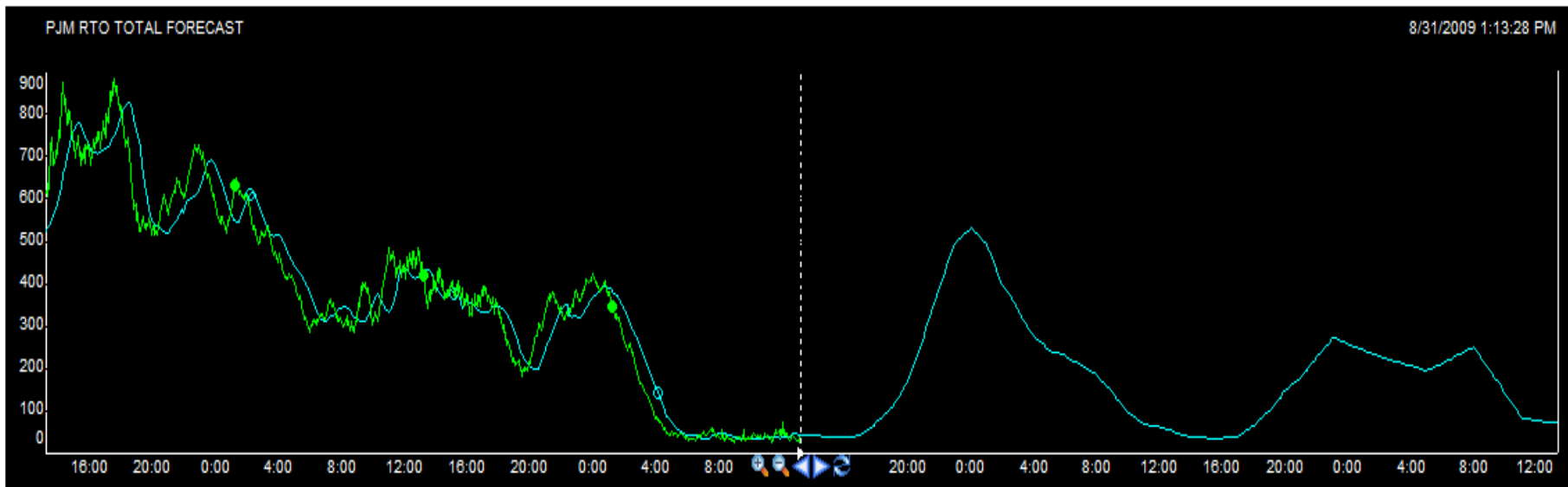


EHV Transmission Map



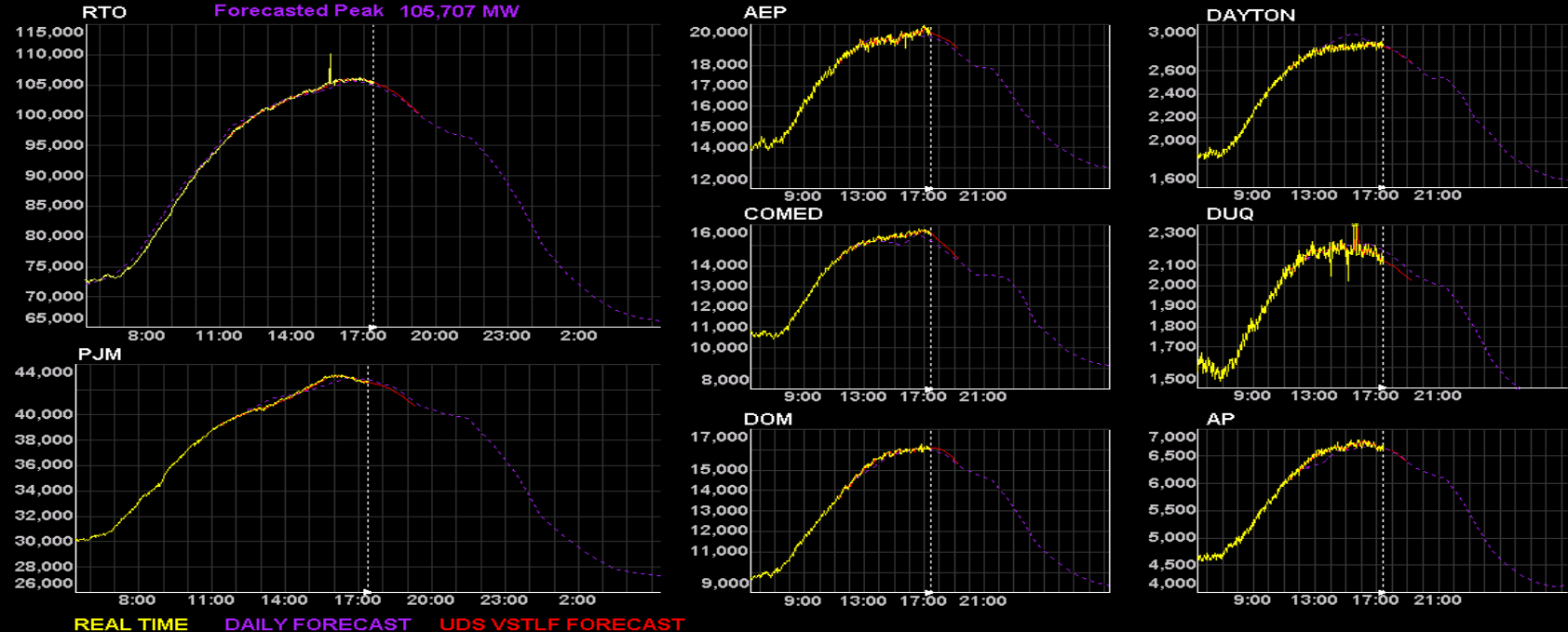
Wind Power Forecasting

- Future data is seamlessly combined with historical and real-time data

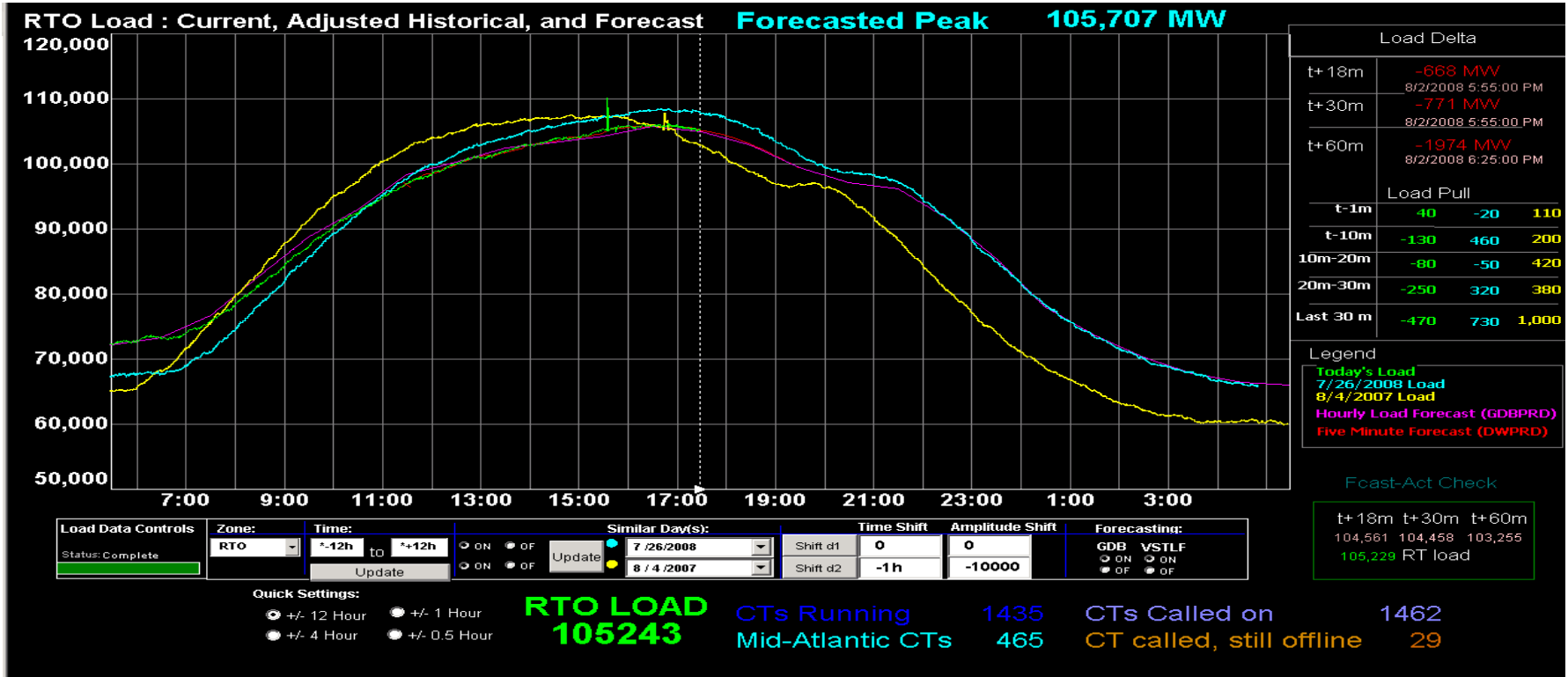


Actual & Forecasted Loads

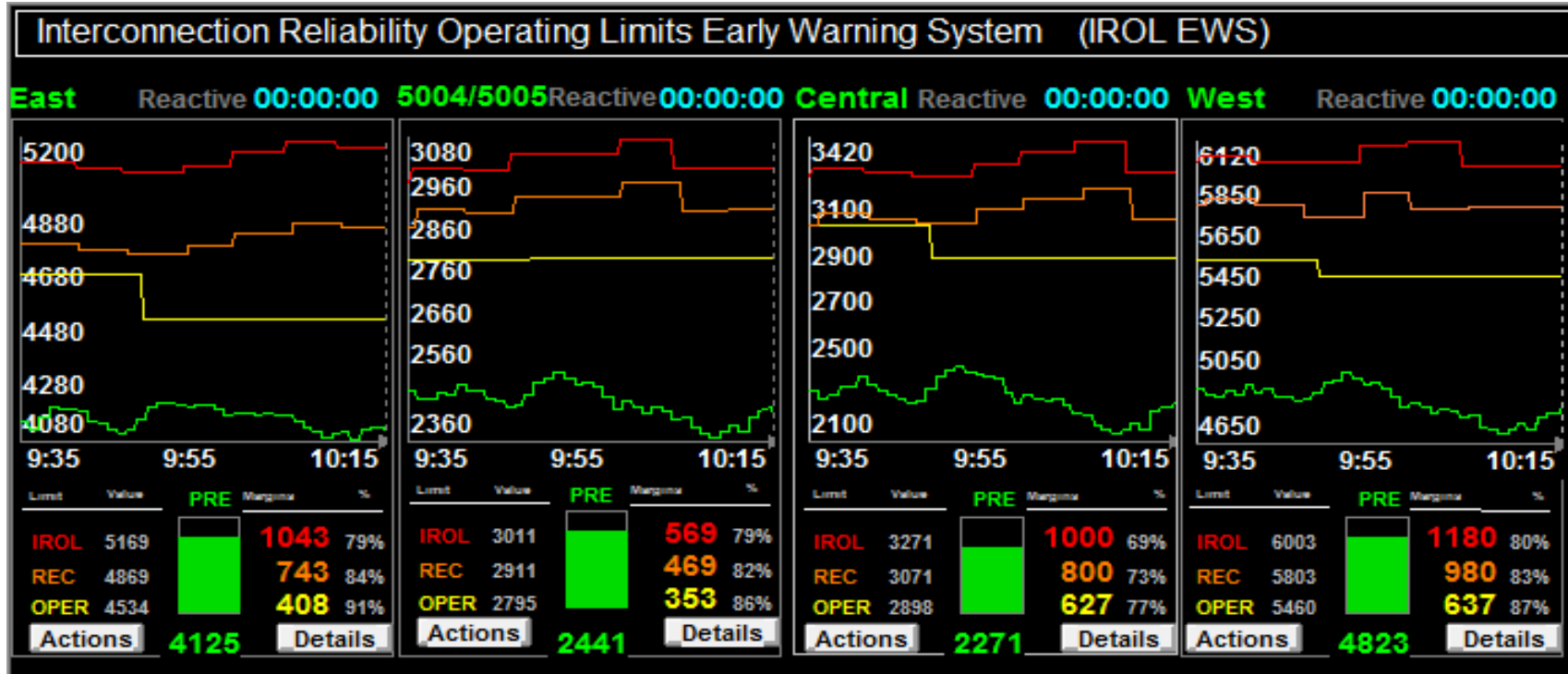
Zonal Actual & Forecasted Loads - Past 12 Hours & Next 12 Hours



Load Forecast and Historical Load Curves



Interconnection Reliability Operations Limits Early Warning System





THANK

YOU

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