

Overview of Control Area / Balancing Authority Functional Requirements

Matt Wolf
Manager – Operations Support
May 5, 2010

Outline of Presentation

- **Importance of “balancing” power production with power demand.**
- **Overview of Balancing Authorities (BAs).**
- **Describe how an EAI Balancing Area is projected to look as a stand-alone balancing authority.**
- **Overview of the cost of establishing a BA.**
- **Implications for EAI generation requirements.**

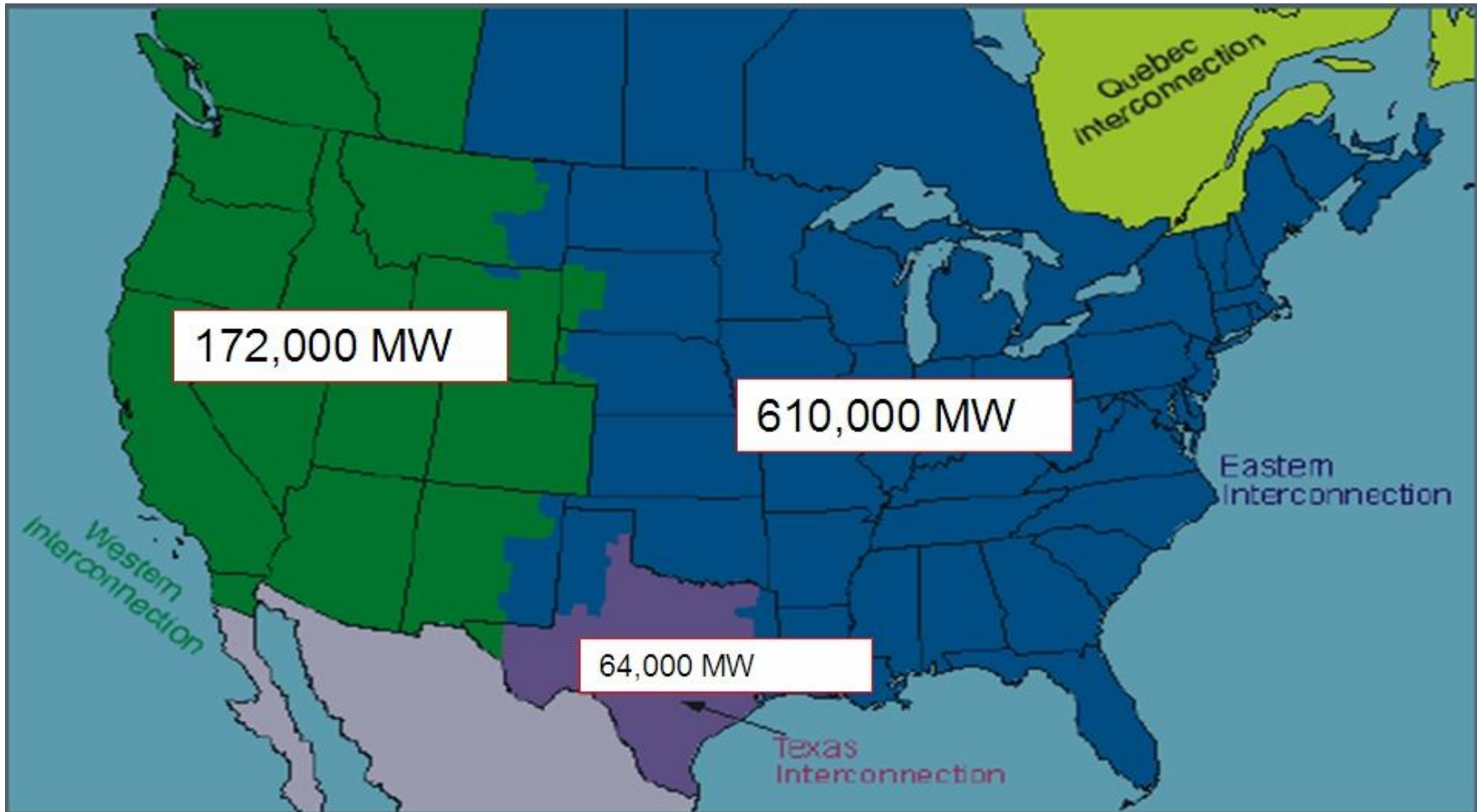
General

- **For purposes of this presentation the following terms are interchangeable:**
 - Control Area - (old terminology)
 - Balancing Area - (generators, loads, transmission within a metered boundary)
 - Balancing Authority - (responsible entity)
- **This presentation is focused on generation operation aspects of a balancing area.**
 - It is not addressing the transmission operations aspects of the balancing area.
- **The information specific to the Entergy Arkansas area presented below is preliminary and based on current historical sources of information and current NERC standards.**

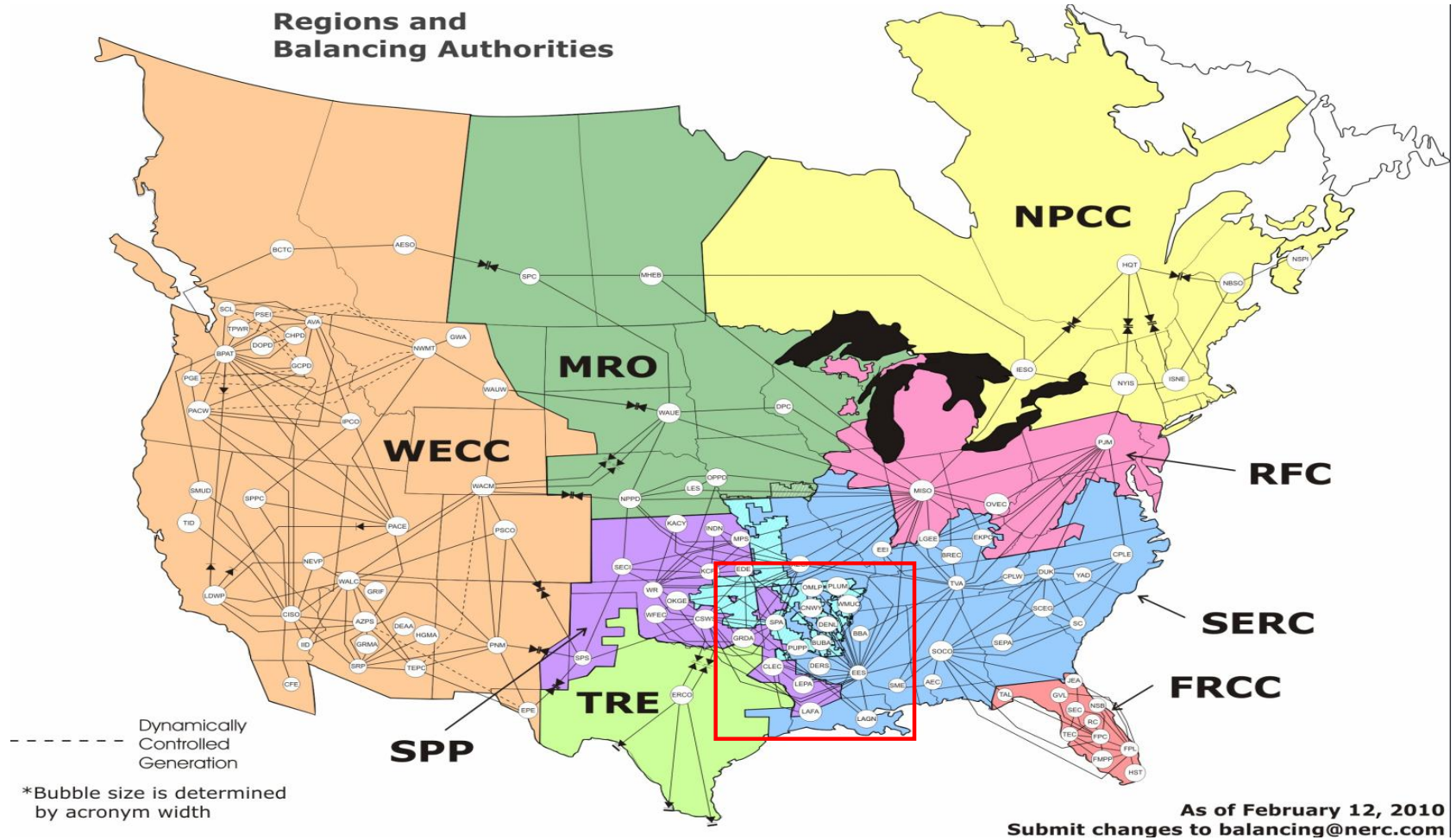
The Importance of “Balancing”

- **Maintain Interconnection Frequency**
 - The power grids in the US and Canada are designed to operate at or near 60 Hz.
 - If there is more generation than demand, frequency goes up.
 - If there is less generation than demand, frequency goes down.
- **Control the flow of power.**
 - Avoided overloading transmission lines.
 - Avoided the inadvertent exchange of energy.

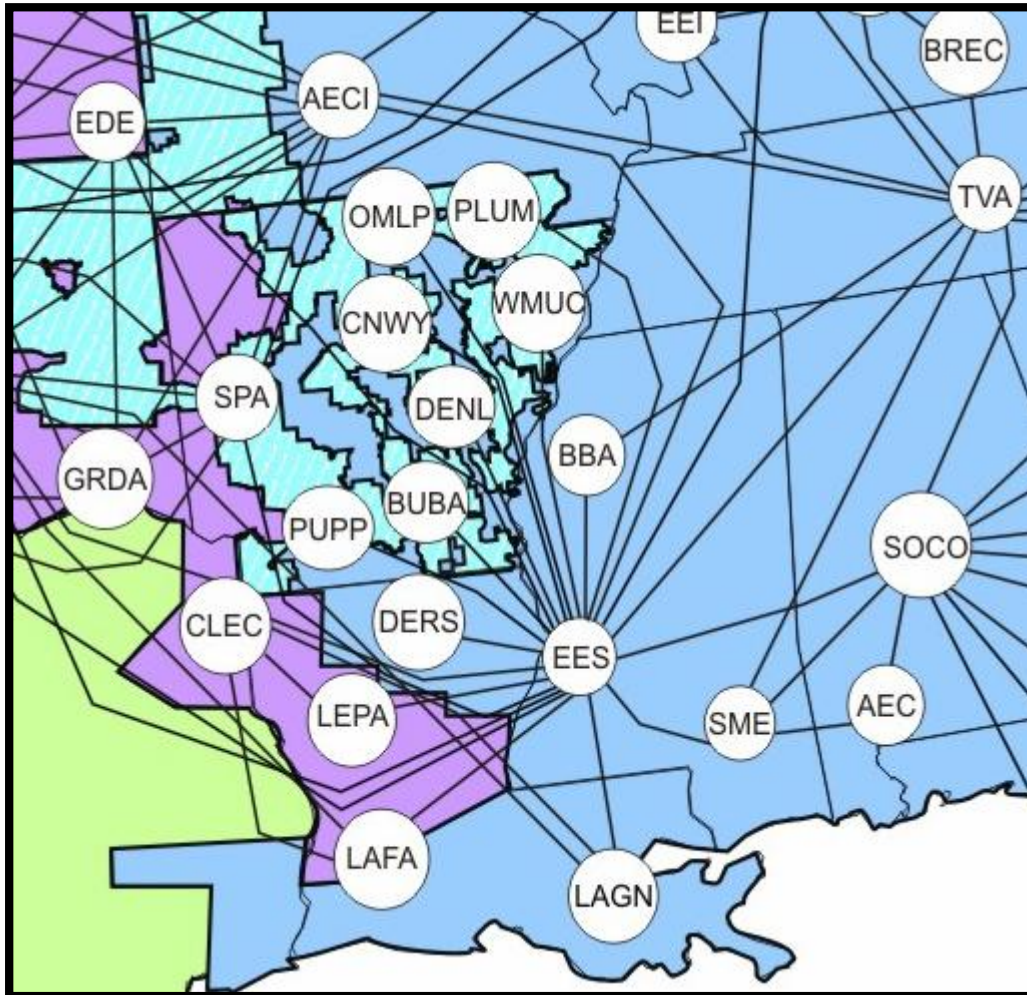
Major US “Interconnections”



NERC Balancing Authorities



Entergy Area Balancing Authorities



- Over 100 balancing authorities in the US and Canada
- Largest: 136,000 MW Peak
- Smallest: 38 MW Peak
- The load on the Entergy transmission system is currently served by approximately 12 different balancing authorities.

What is a Balancing Authority?

- **NERC definition of Balancing Authority**

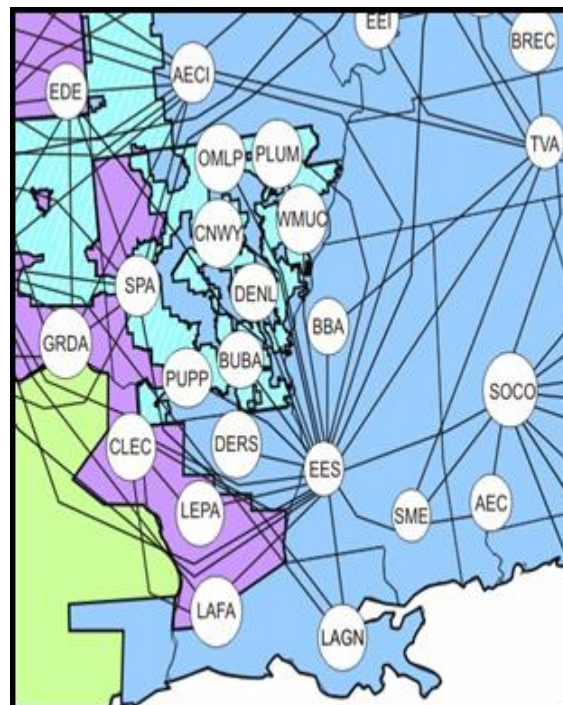
“One of the regional functions contributing to the reliable planning and operation of the bulk power system. The Balancing Authority integrates resource plans ahead of time, and maintains in real time the balance of electricity resources and electricity demand.”

- **Basically, what does a Balancing Authority do?**

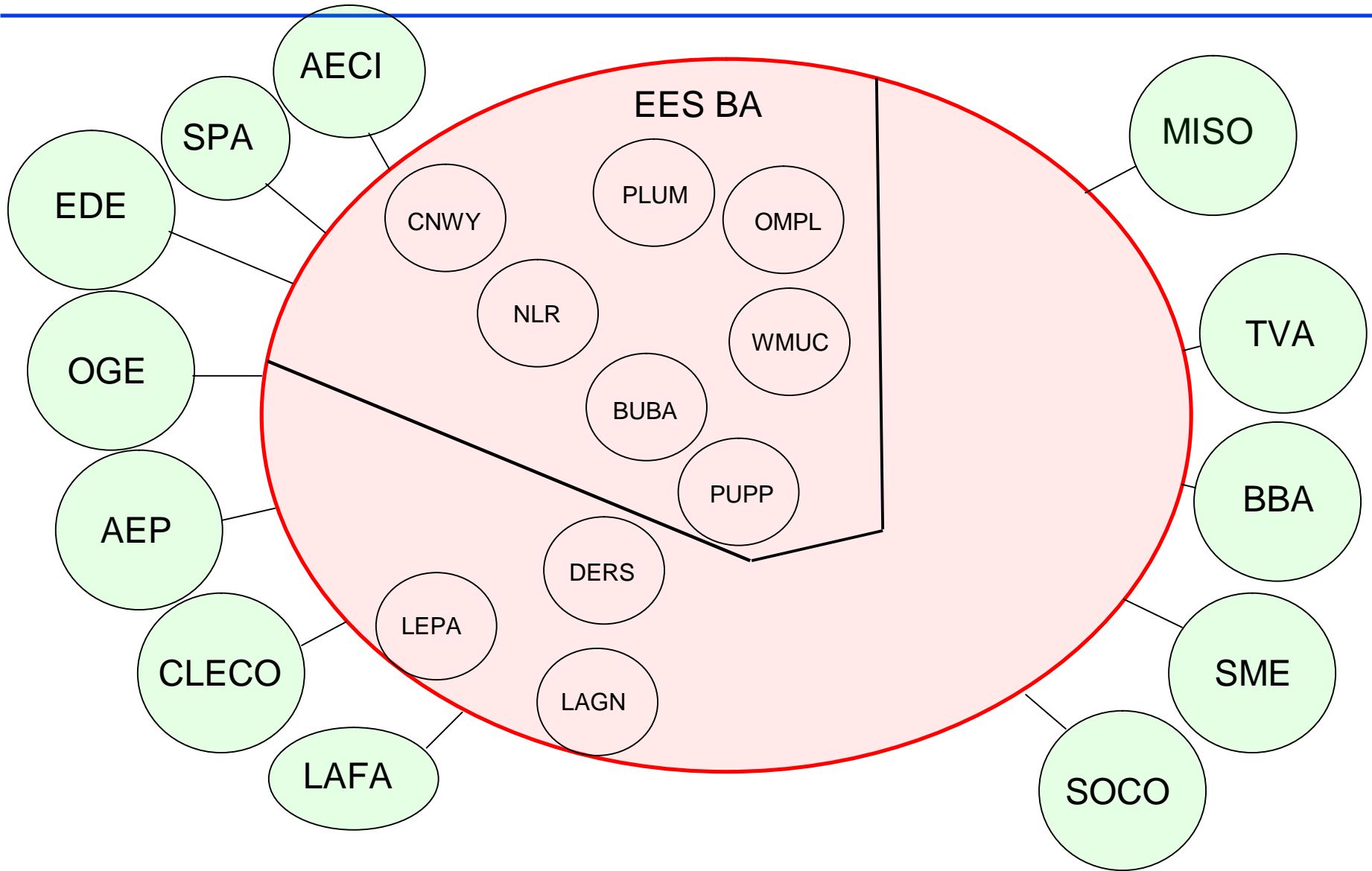
1. Continuously balances the Control Area's net scheduled interchange with its actual interchange by dispatching generation units used for regulation.
2. Helps the entire Interconnection regulate and stabilize the alternating current frequency.

Entergy Arkansas

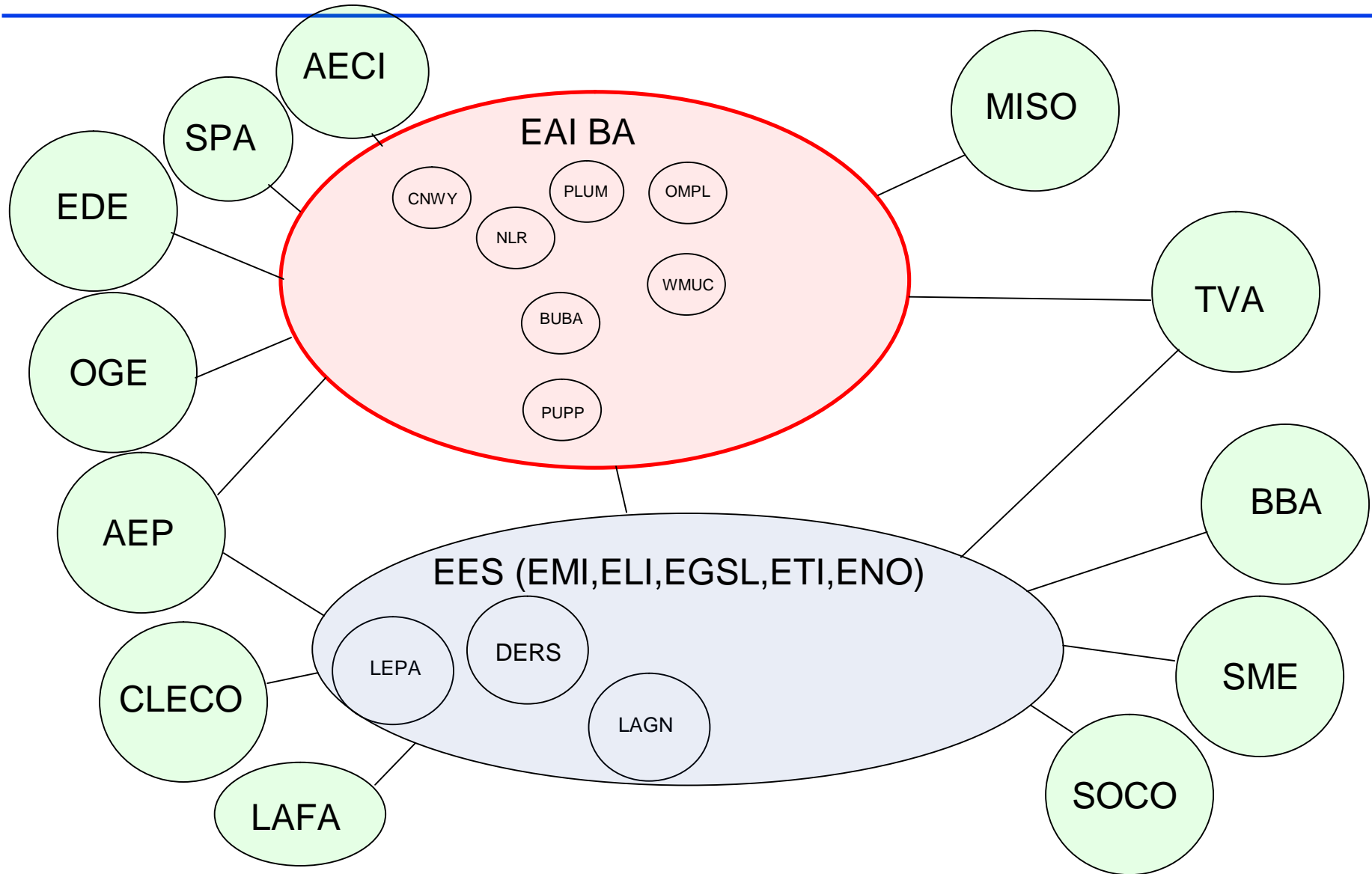
- **EAI is currently in the Entergy Electric System (EES) Balancing Authority (BA).**
- **EAI must provide a BA solution by December 19, 2013.**
- **One strategy EAI is considering for post-2013 operations would require it to operate in a new BA that is separate from the EES BA.**
- **EAI plans to explore other alternatives for providing BA functions over the next year.**
- **The schedule and risk of other alternatives such as the SPP consolidated BA will be considered.**
- **Regardless of the final decision, EAI's generation plan should provide resources that are capable of serving its load as if it operated a Balancing Authority.**



Entergy Electric System BA Configuration Today

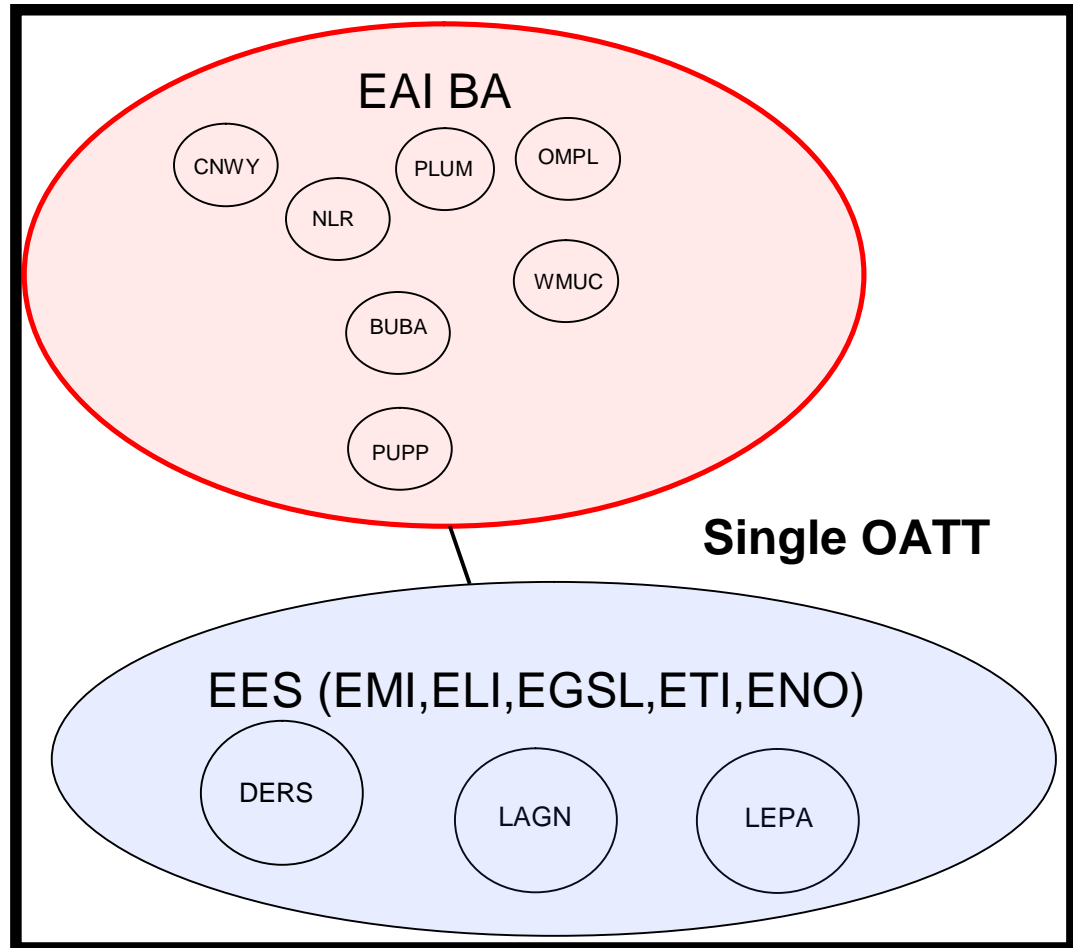


How the BA arrangement might look in 2013 if “EAI Operates its Own BA”



Key point

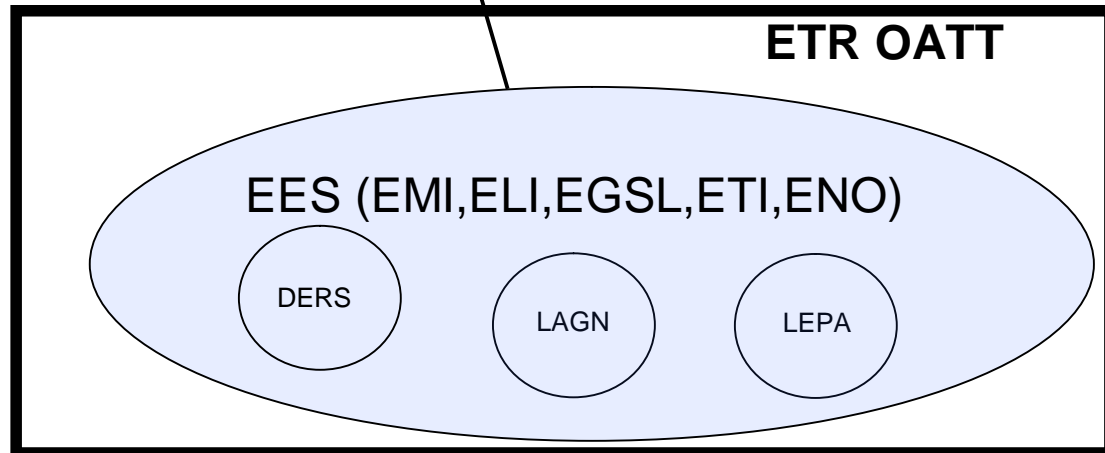
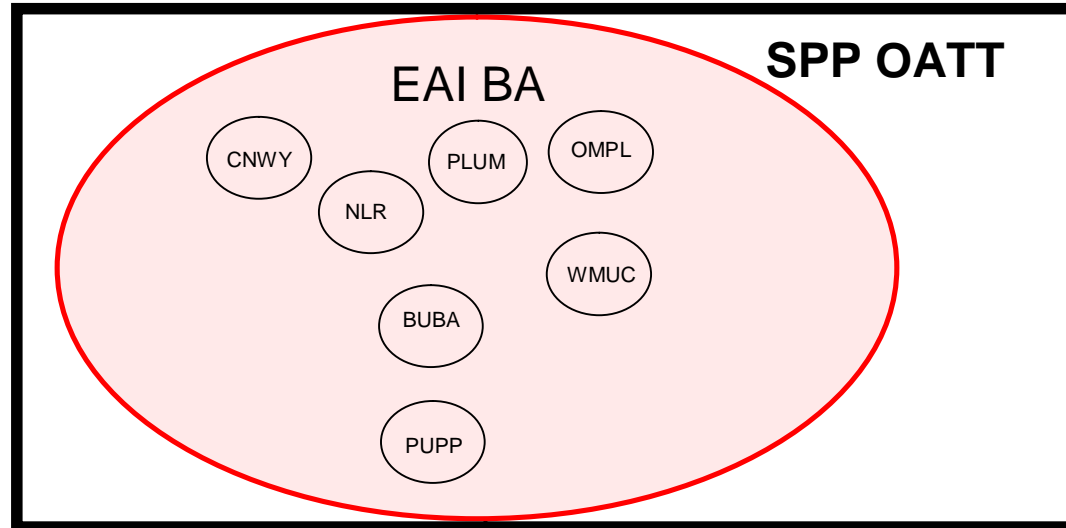
If EAI continues to operate under the ETR OATT, EAI transmission facilities would be planned and operated under the ETR OATT and ICT along with the transmission facilities of the other ETR Operating Companies



SPP Option

If EAI moves to the SPP OATT, EAI transmission facilities would be planned and operated under the SPP OATT along with the transmission facilities of the other SPP Companies.

The EAI BA may just become a “Balancing Zone” in the SPP Consolidate Balancing Authority.



What would it take to set up an EAI BA?

- **Preliminary estimates were developed in 2008 and 2009.**
- **Conservative assumptions were used in order to bound the cost.**
 - Build and equip a new building.
 - Duplicate almost all functions that are currently being conducted by the System Planning and Operations department in Entergy Services, Inc.
 - Buy and install a new generation management system.
 - Upgrade some tie line meters.
- **Results (\$ 2009)**

| | |
|-------------------|------------------|
| Startup Cost: | ≈ \$23 MM |
| Run Cost: | ≈ \$14 MM/year |
| Less ESI Charges: | ≈ (\$ 6) MM/year |
| ===== | |
| Net Run Cost: | ≈ \$8 MM/year |
| Employees: | ≈ 64 FTEs |
- **The implementation of this plan for EAI self provision of BA functions is expected to take approximately two years.**


Implications for Generation Supply

Area Control Error or “ACE”

The logo for Area Control Error (ACE) is rendered in a large, bold, blue font with a red outline. The letters are slightly shadowed, giving them a three-dimensional appearance.

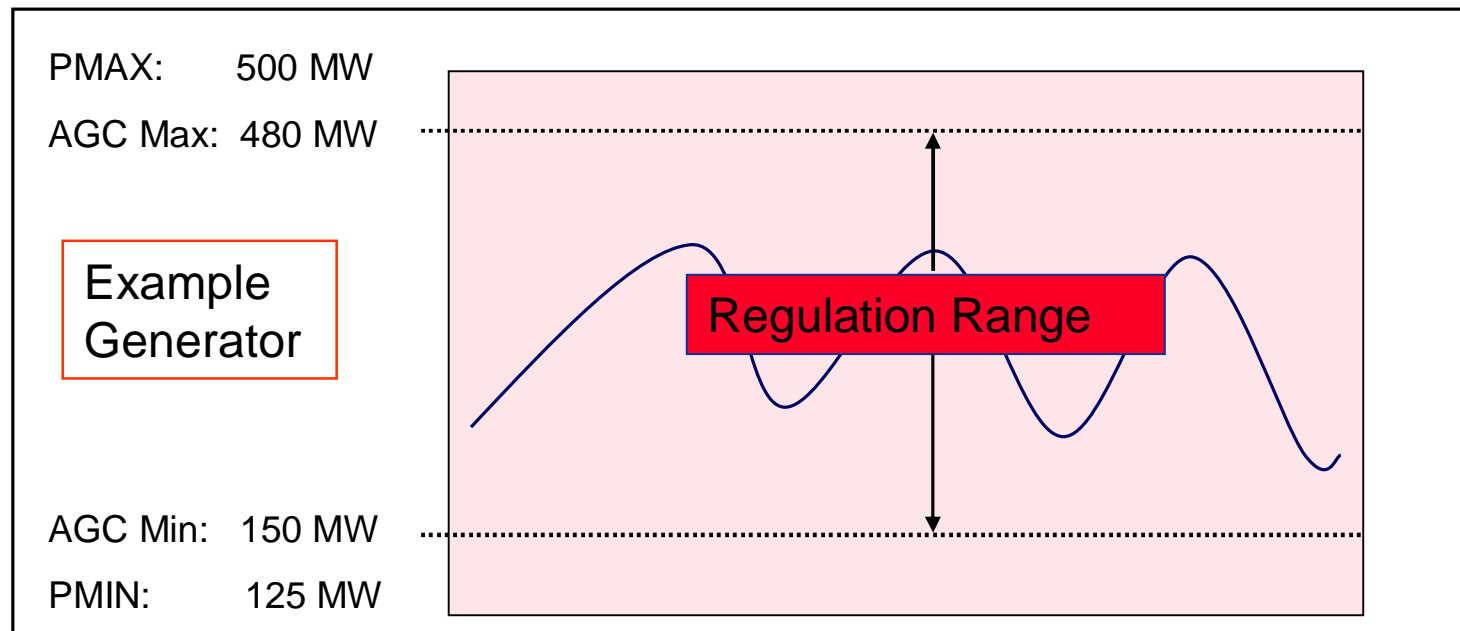
- **Dispatchers have a single real-time measure that tells them how well they are doing.**
- **It incorporates both balance and frequency control.**
- **The goal of a generation dispatcher is to maintain “ACE” as close to zero as possible.**

Three key NERC Metrics based on ACE

- **Control Performance Standard 1 or CPS1**
 - Uses **1 minute averages** of ACE in the calculation.
 - Measure whether a BA is doing their part to help control frequency over the long-term.
 - **Control Performance Standard 2 or CPS 2**
 - Uses **10 minute averages** of ACE in the calculation.
 - Measure how well a BA is balancing over a period of a month.
 - 90% of the ten minute periods in a month must be within a certain tolerance.
 - **Disturbance Control Standard or DCS**
 - Uses two ACE readings (before and after).
 - Measures how well a BA or a group of BAs respond to sudden loss of supply.
 - Basically, a BA or reserve sharing group has 15 minutes to replace the sudden loss of supply.
 - **The current standards are not carved in stone and may change over time. For example, the Entergy BA is currently participating in a proof-of-concept field trial that may lead to a replacement for CPS 2.**
- 
- Regulation Reserves**
- Load Following**
- Contingency Reserves**

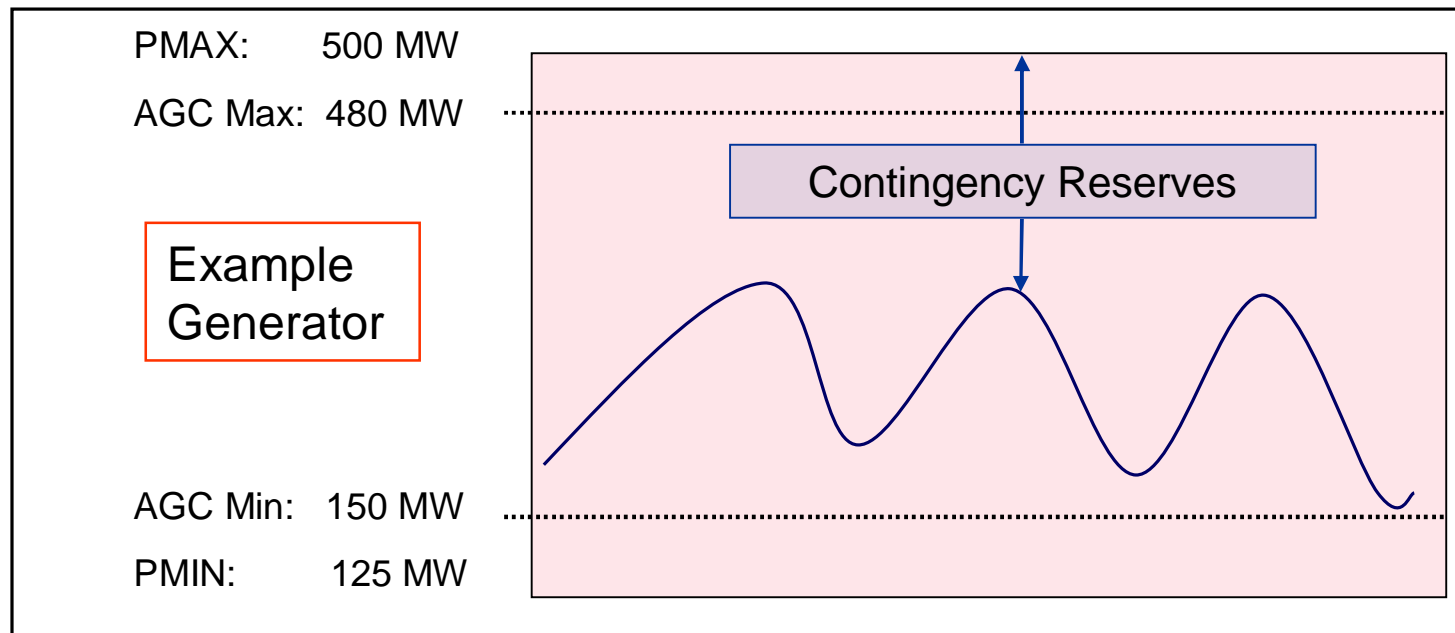
Sources of Regulation Reserves

- Normally supplied by generators that have the ability to be dispatched up or down by a remote computer. (Commonly referred to as automatic generation control or AGC.)
- Need a flexible fuel supply.
- The amount a unit can contribute is limited by the **ramp rate** and the **room** between its current dispatch level and its AGC max. or min. capability.



Sources of Contingency Reserves

- Can be supplied by generators that are online (spinning) and have room to move up.
- Can also be supplied by “quick-start” generators that can be started and turned up within 15 minutes.
- Also need a flexible fuel supply.
- The amount generator can contribute is also limited by **ramp rate** and the **room** between its current dispatch level and its maximum capability.
- Can be supplied by demand response controlled by the system operator.



Contingency Reserves

- Today, the Entergy BA participates in the SPP Reserve Sharing Group whereby it shares contingency reserves with other member of the group. If a large unit trips off-line in the Entergy BA, it receives assistance from other BAs that are members of the RSG and vice versa.
- For an EAI BA, providing contingency reserves to cover its single largest contingency would be difficult.
(Approximately 1,000 MW in 15 minutes.)
- Continued participation in a contingency reserve sharing group can reduce the amount of contingency reserves EAI would need to carry by as much as 85%.

What would an EAI BA look like? (based on the current general configuration)

- Peak load of approximately 6,000 MW.
 - » The demand will be mostly comprised of the customers of EAI and AECC.
 - » The Entergy OATT would have provision for load imbalance service for other wholesale customers that may be in the BA.

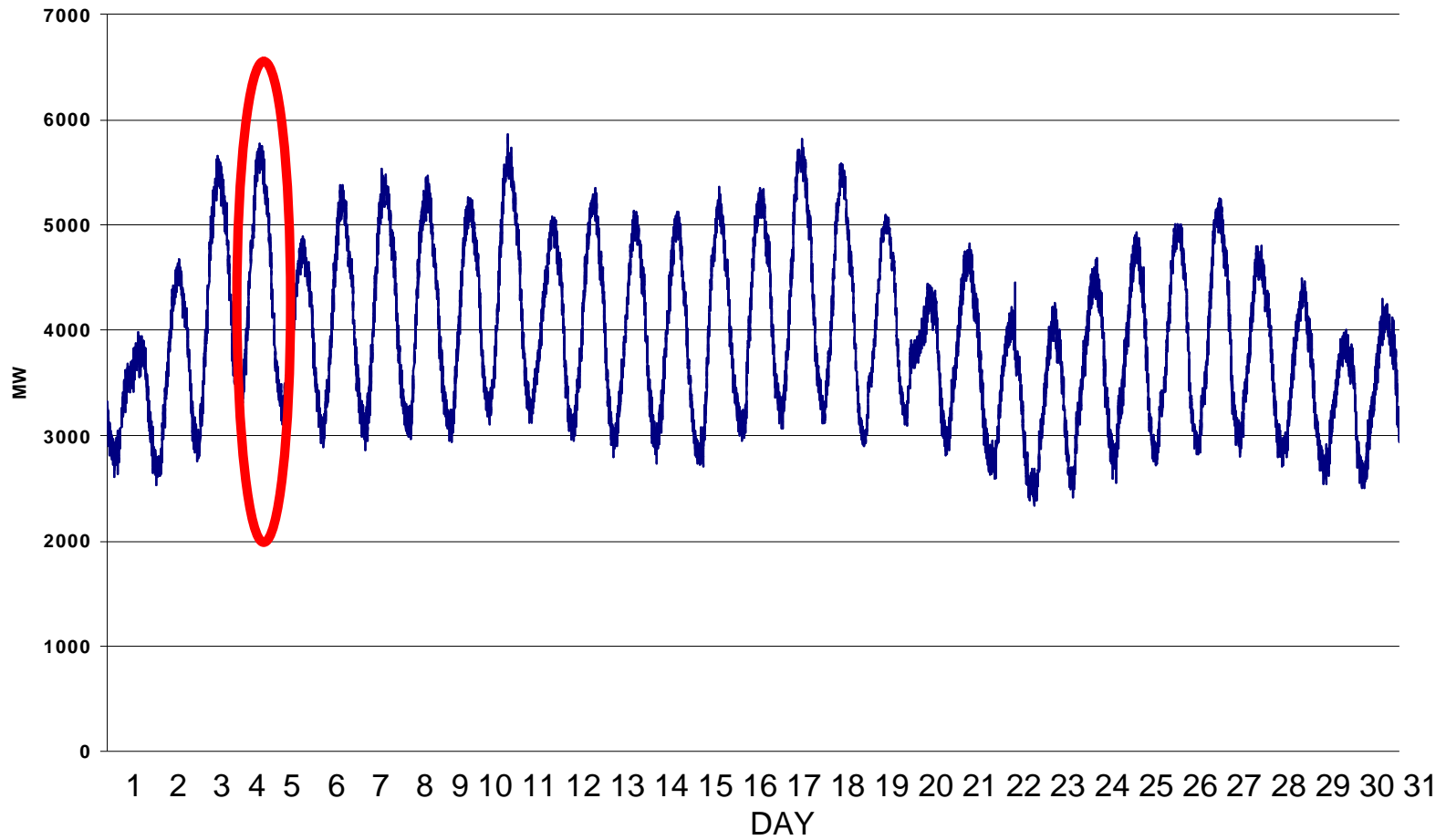
- There would be four generators in the BA that would not be dispatched by the EAI dispatcher.
 - » These independently dispatched generators would, at times, create additional imbalances by over or under generating.
 - » The Entergy OATT would have provision for providing regulation and imbalance energy to these generators.

EAI BA Characteristics

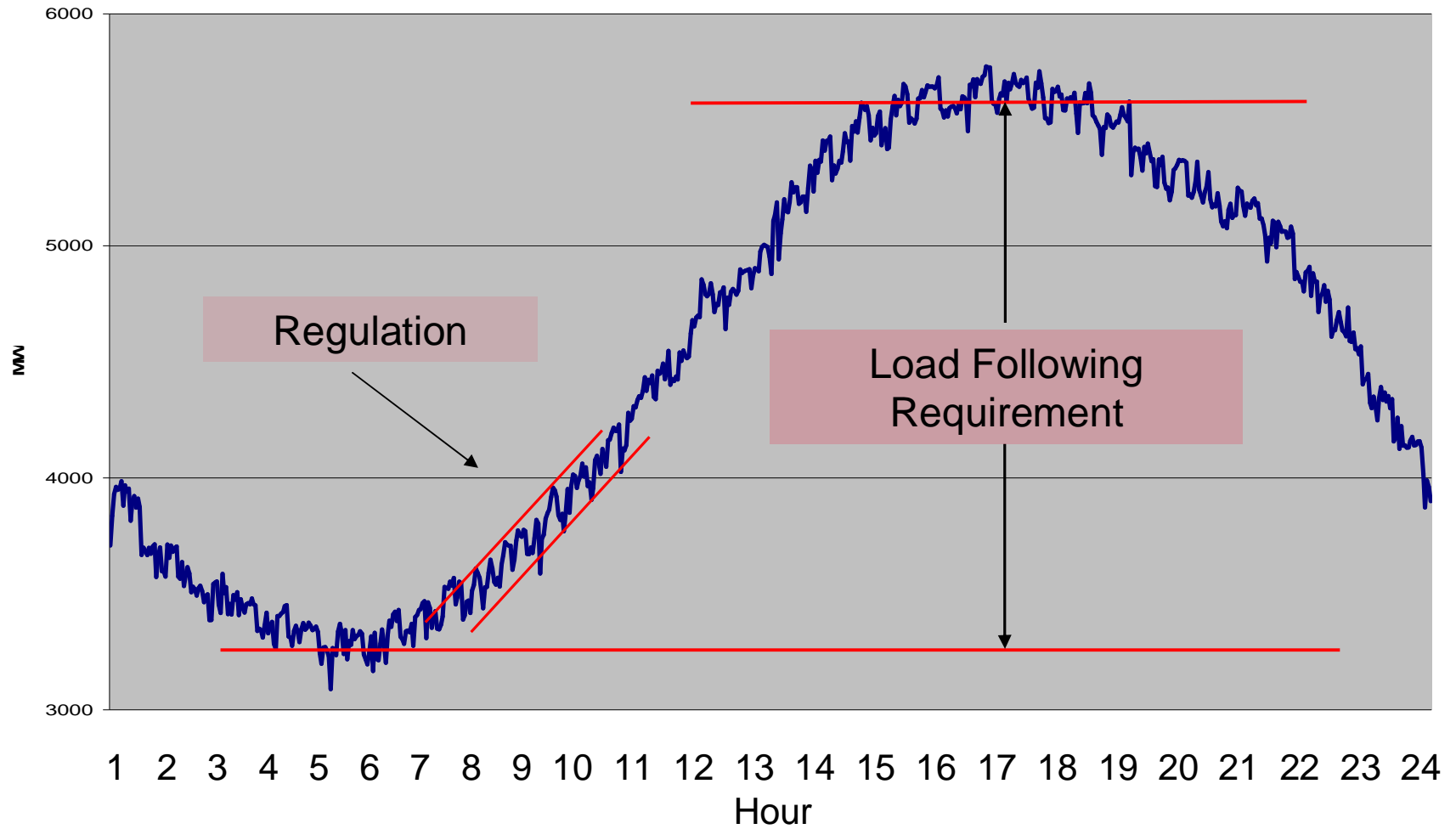
- A significant regulation burden due to one highly varying industrial customer.
 - » Increases the need for more regulation reserves.

- Six EAI dispatched generators with a maximum capability of over 800 MW.
 - » Increases the need for access to contingency reserves.

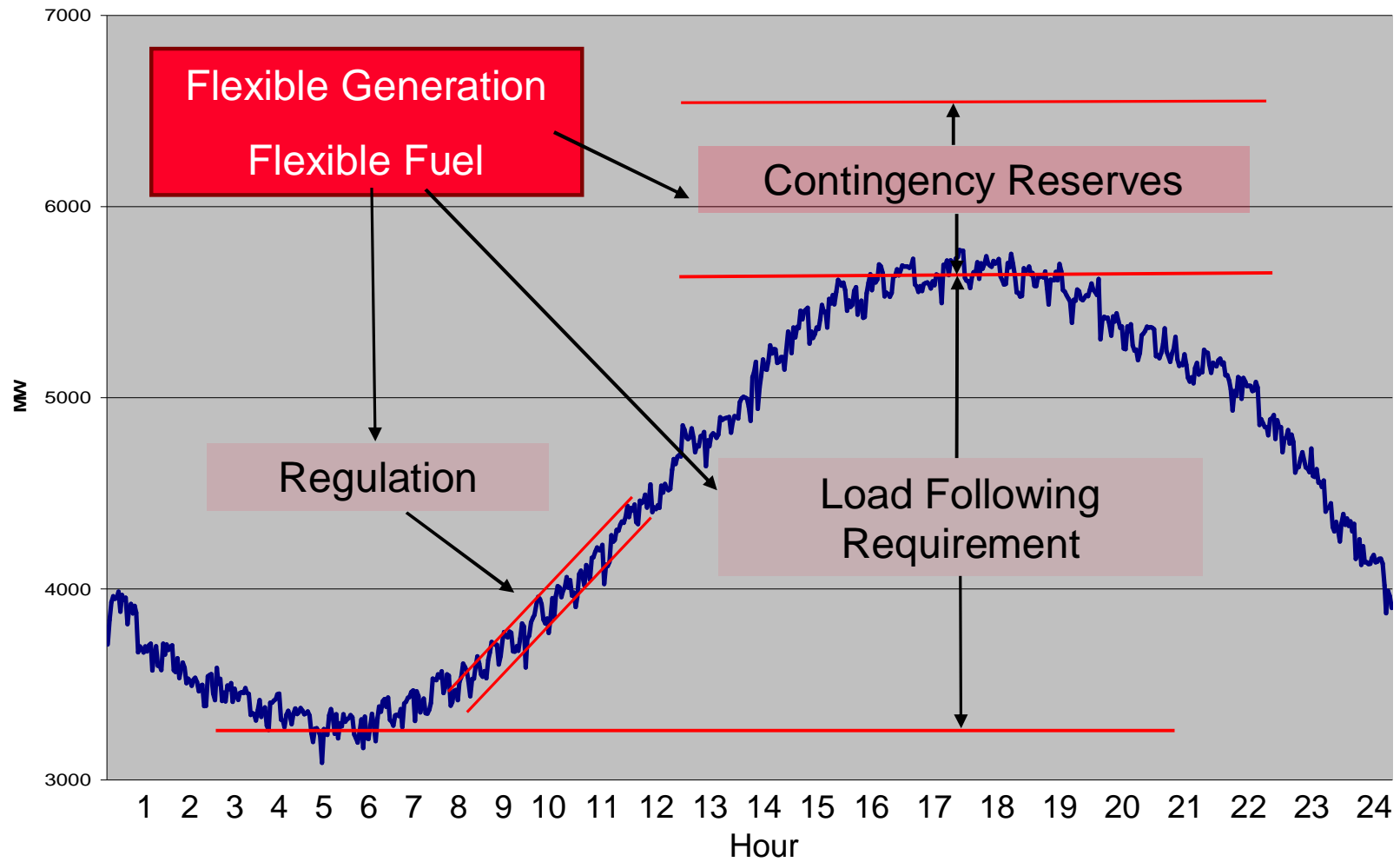
August 2009 Actual Load Data (Includes AECC)



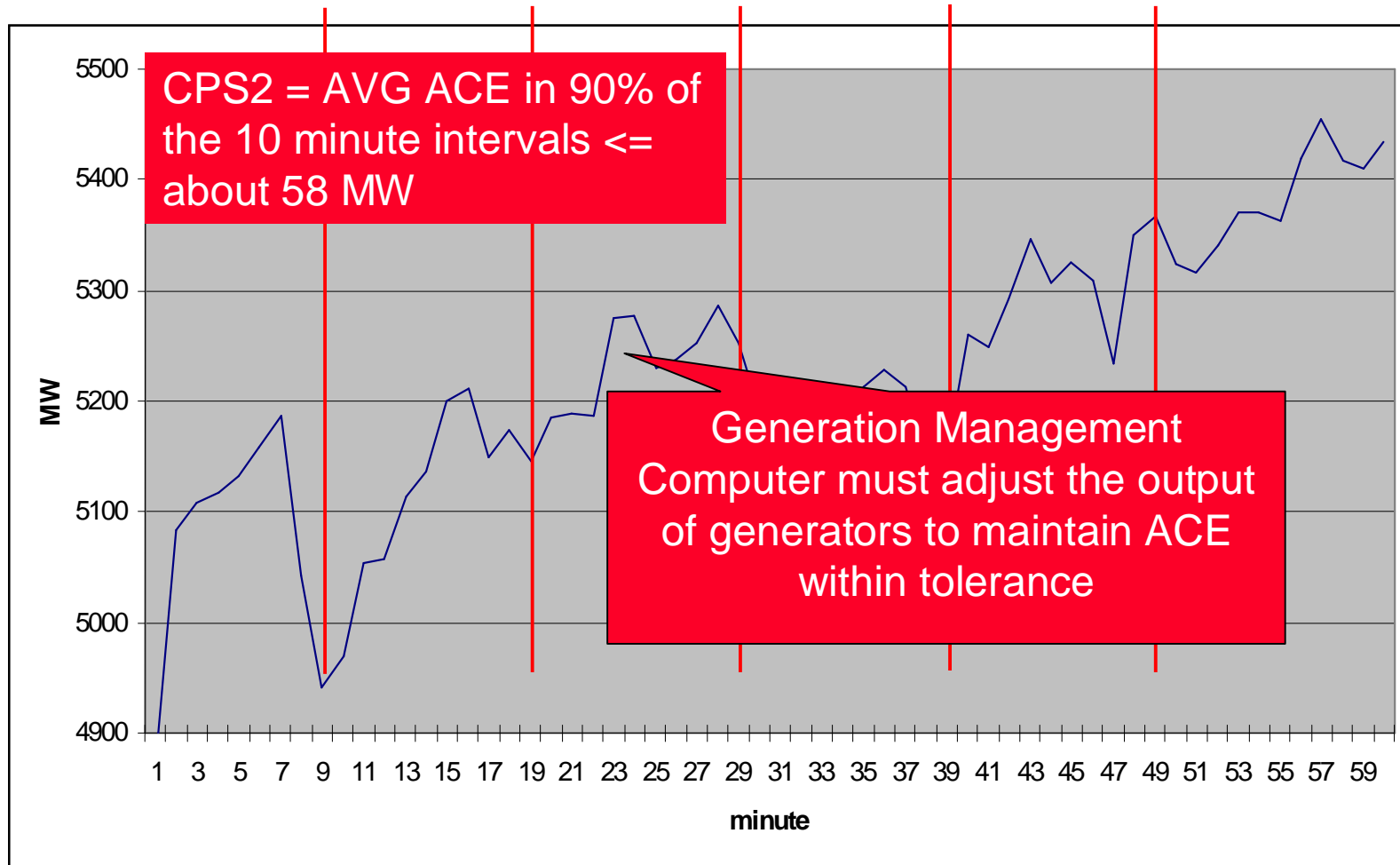
August 4, 2009



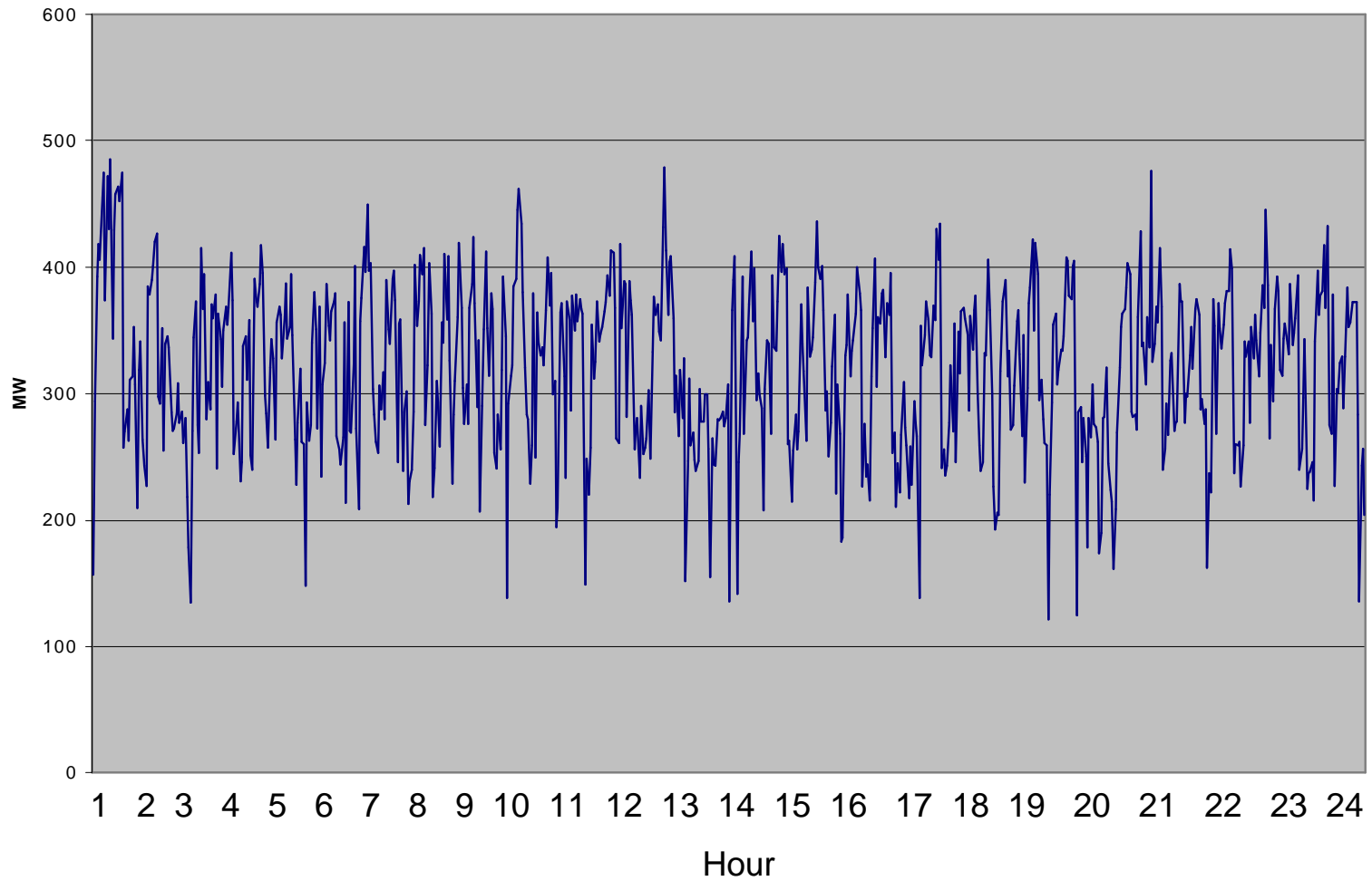
August 4, 2009



Regulation of Dynamic Changes in Load Hour Ending at 1:00 pm on August 4



Example Industrial Load



Factors that Affect the Generation Supply Plan to Meet the Requirements for BA Performance

- **Frequency Support for the eastern Interconnection**
- **Changes in transactions (ramp periods) with other balancing areas.**
 - Must be managed carefully.
 - Changes in transactions by third parties can be very problematic.
- **Imbalances from independently dispatched generators.**
- **Imbalances from internal third party loads.**
- **Changes in the output of Qualified Facilities (QFs).**

Other Considerations

- **Contingencies will happen:**
 - Generators trip or become constrained due to electromechanical/mechanical issues
 - Generator response times can vary
 - Telemetry can fail
 - Transmission and fuel supply constraints will occur
- **There will also be planned outages of both transmission and generation resources.**
- **It is important that contingency and regulation reserves be properly dispersed among multiple generators.**
- **To ensure adequate supply in real time, a higher planning target will be used on a day-ahead basis.**

Preliminary Estimates

- **Regulation Capacity Needs for Load**
 - Need to be able to **achieve** a system ramp of approximately 20 MW/minute.
 - Need to maintain regulation room of about +/- 200 MW.
- **Contingency Reserves Needs**
 - Assuming current Contingency Reserve Sharing Arrangements
 - » Estimated to be approximately 150 MW / 15 minutes.
- **Again, flexible fuel supplies are critical.**

Summary

- **EAI will continue to analyze the functional requirements for a balancing authority as the study continues**
- **EAI's Transition Plan will include provisions for the supply for generation resources and fuel supply arrangements that will allow EAI to meet the required performance levels for providing EAI's BA functions**
- **EAI will monitor developments in SPP**
 - Consolidated balancing area
 - ACE diversity Interchange
- **EAI will be investigating the feasibility of other third party arrangements.**
 - Other reserve sharing groups
 - Purchases of regulation service

Supplemental

ACE - Simple Balancing Authority Example

Schedule to BA 1 = 100 MW

Schedule to BA 2 = -50 MW

=====

Net schedule = +50 MW

If Actual Interchange = 0 MW

And

Frequency = 60 Hz

Then

ACE = -50 MW

