Assuring the Reliable Operation of the Western Interconnection

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Utility Variable Generation Integration Group
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PEAKRELIABILITY
assuring the wide area view

Peak Reliability Facts

- **Founded: Jan 1, 2014**
  - Preceded by WECC RC est. Jan 1, 2009
- **System Load: ~ 150,000 MW**
- **Offices:**
  - Vancouver, WA – HQ
  - Loveland, CO
- **Registered Functions:**
  - Reliability Coordinator
- **RC Area:**
  - 37 Balancing Authorities
  - 55 Transmission Operators

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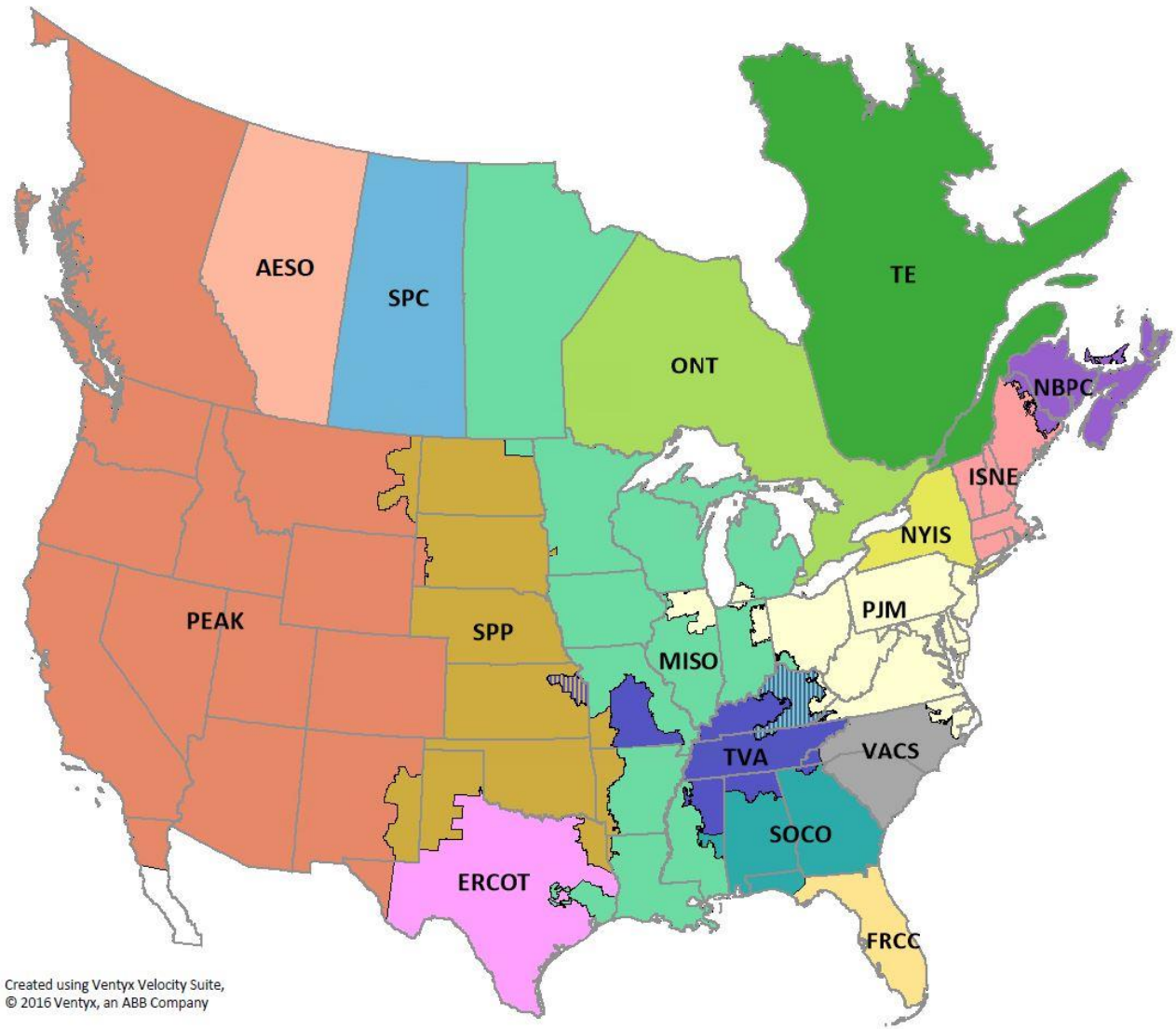
NERC Reliability Coordinators

As of June 1, 2015



- Alberta Electric System Operator
- Electric Reliability Council of Texas
- Florida Reliability Coordinating Council
- Hydro Quebec TransEnergie
- ISO New England, Inc.
- Midcontinent ISO
- New Brunswick Power Corporation
- New York Independent System Operator
- Ontario Independent Electricity System Operator
- Peak Reliability
- PJM Interconnection
- Saskatchewan Power Corporation
- Southern Company Services, Inc.
- Southwest Power Pool
- BAs receive RC services from SPP or TVA
- Tennessee Valley Authority
- BAs receive RC services from TVA or MISO
- VACAR South

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Reliability Coordination

- FERC/NERC Requirements:
  - Highest level of authority responsible for the reliable operation of the Bulk Electric System (BES)
  - Authority to prevent or mitigate generation and transmission emergencies in day-ahead and real-time
  - Wide Area view of BES (situational awareness)
  - Pre- and post-Contingency BES monitoring, analysis, and direction

Generation By Fuel Type - Peak West-wide System Model (WSM)

Generation Fuel Type

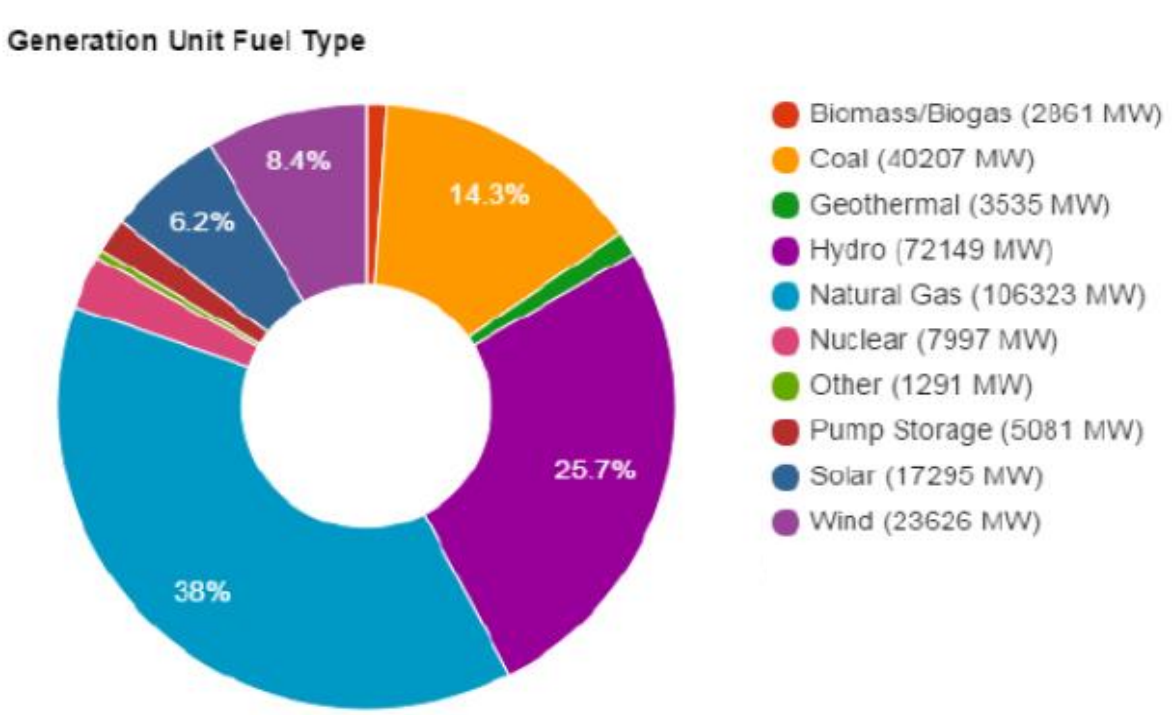

Figure 3: Generation Fuel Type

Total Generation Capacity: 282713 MW

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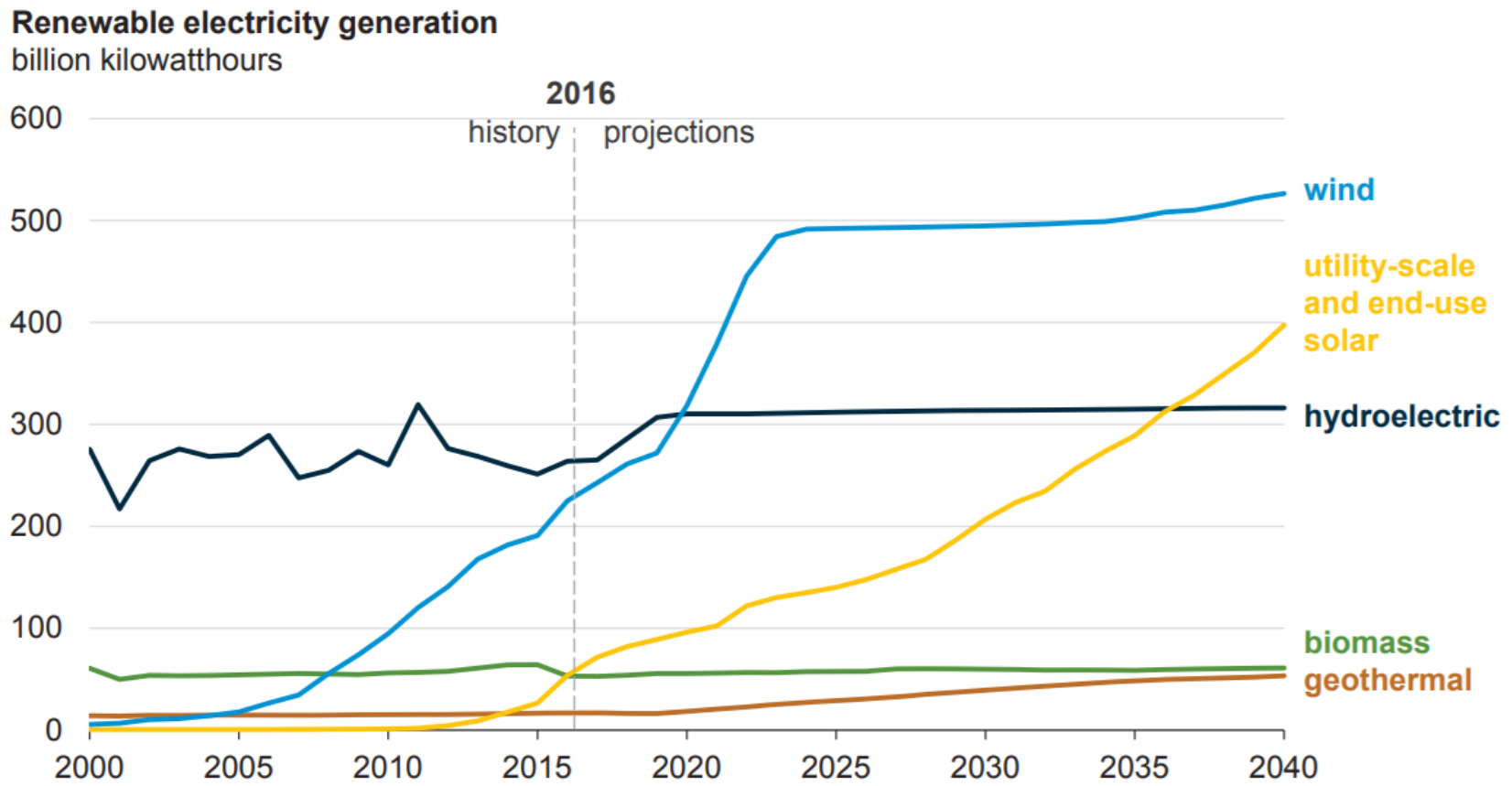
Renewable Energy Generation Projection



U.S. Energy Information Administration

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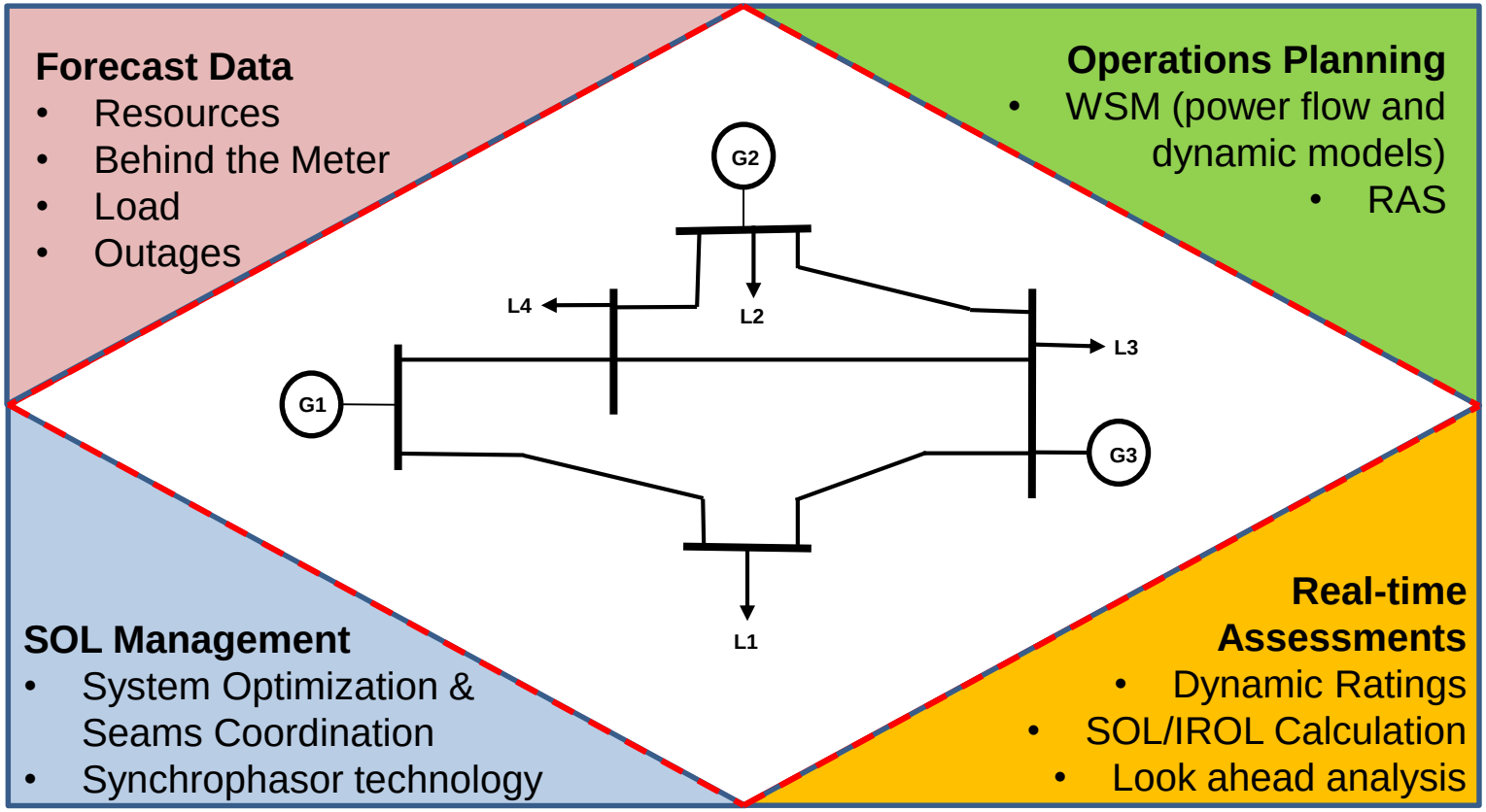
Some Reliability Considerations

- How do we manage reliability issues due to:
  - Displaced generation resources
  - Over generation
  - SOL exceedances
  - Frequency response and system inertia decline
- Two western interconnection areas of focus
  - Maximize transmission utilization
  - Optimize generation dispatch

Expanding Boundaries of Reliable Operation (Simplified Overview)



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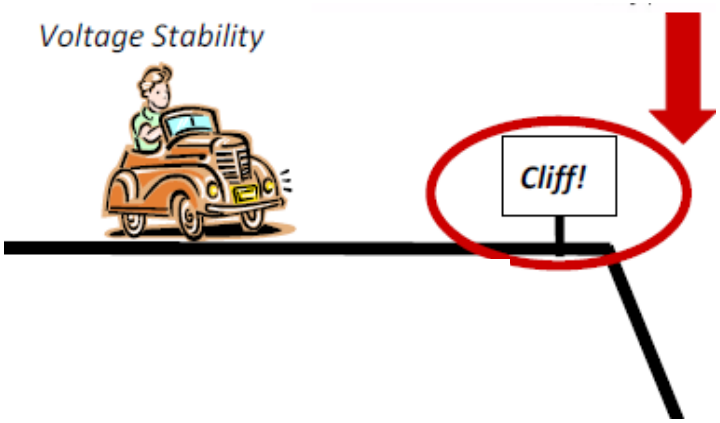
Managing Reliability in Future Generation Paradigm

Real-time Assessments

- Identify, calculate, and operate to all limits on the system
  - Calculations require wide area tools and data



- Benefits:
  - Increased transfer capacity
  - Decreased mitigation required (costs money)
  - Increase in system flexibility to support renewable resources and energy markets

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Dynamic Facility Ratings

- Ambient temp
- Amp limited (based on actual voltage)
- For monitoring – sent via ICCP
- Used for alarming and analytics

White line: dynamic rating distribution
Yellow line: average seasonal value

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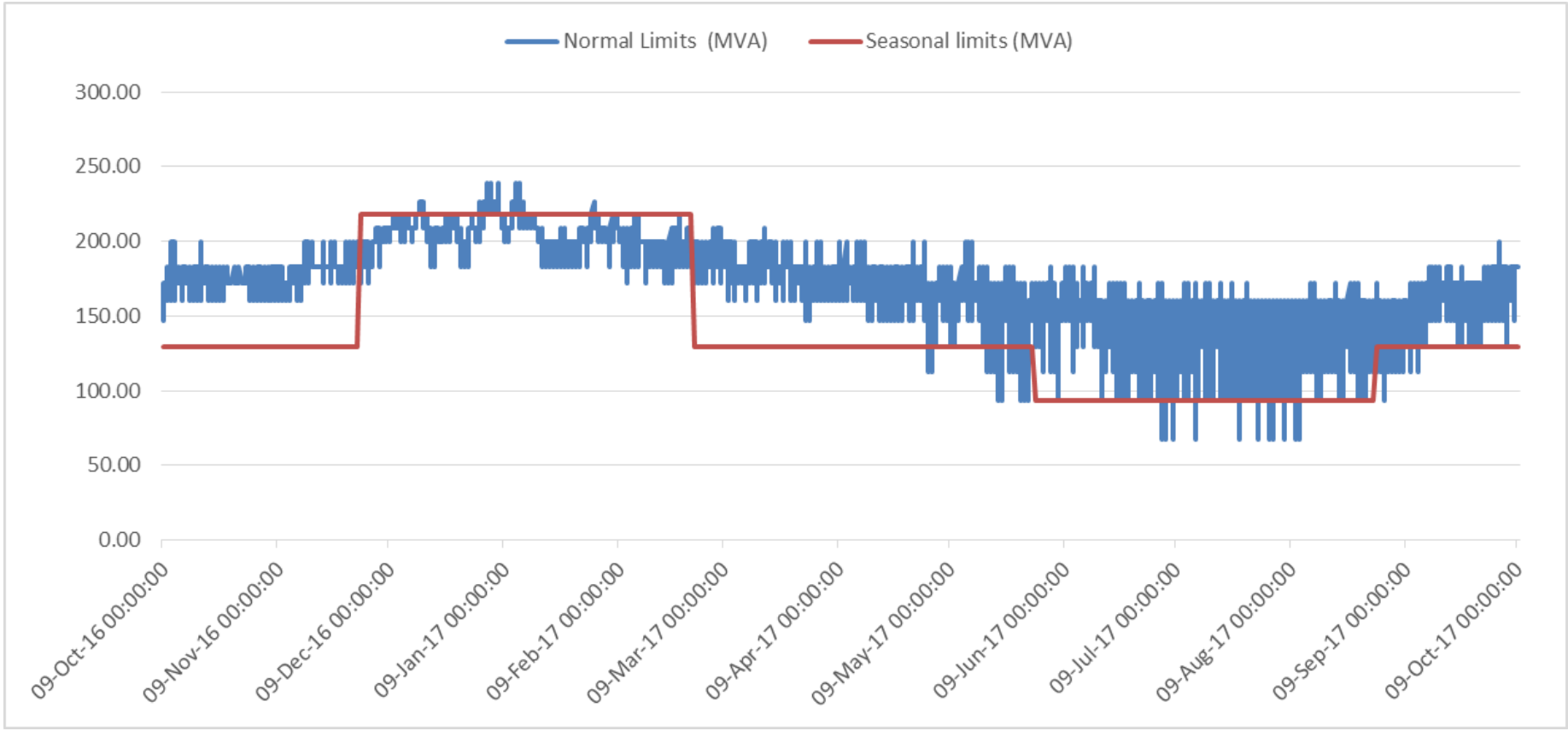
Dynamic vs. Static Facility Ratings



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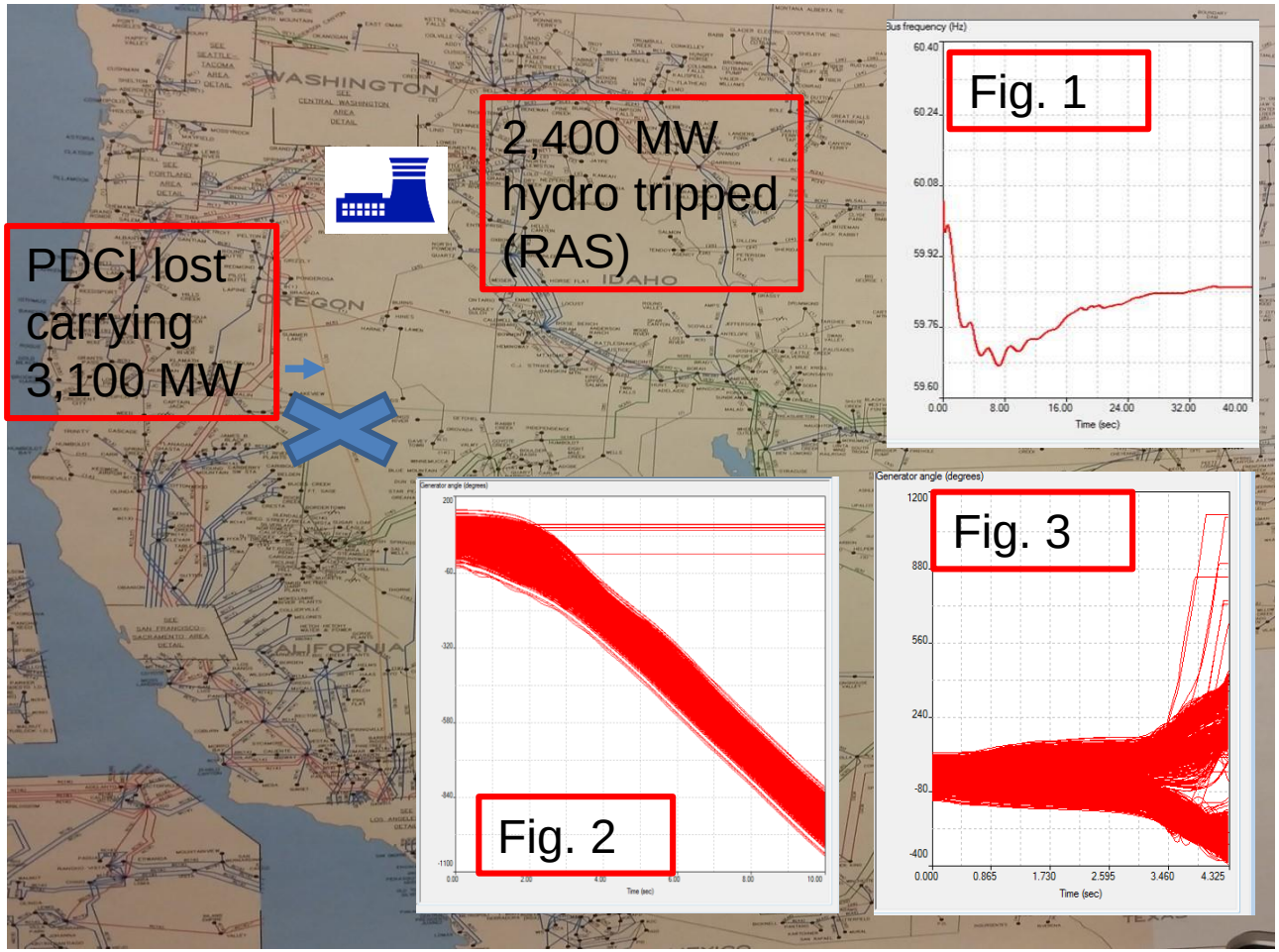
Transient Stability – PDCI Trip



1. System Frequency
2. System stable (actual)
3. System unstable (if insufficient gen dropped)

- Knowing real limits helps reliability and efficiency!

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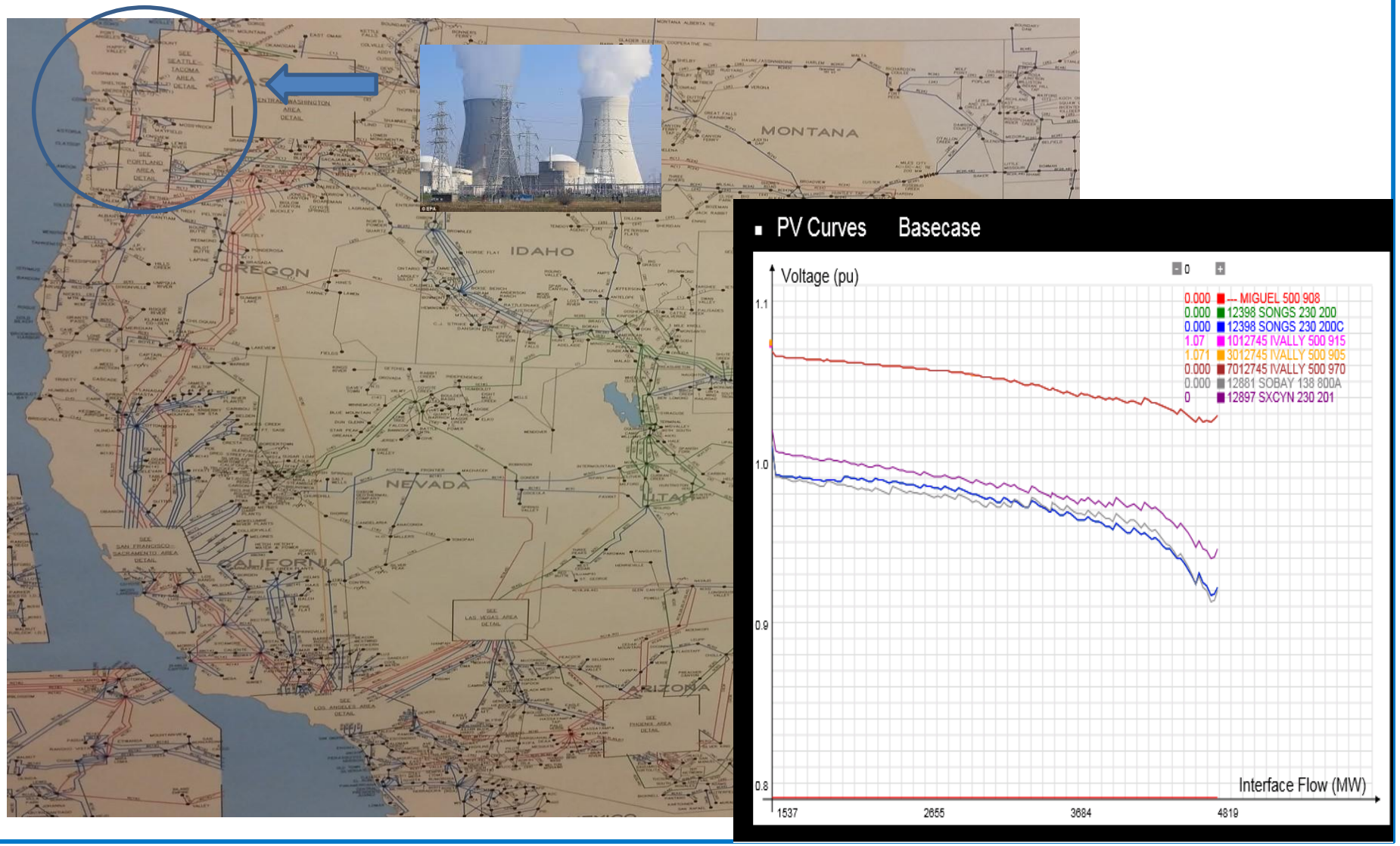
Voltage Stability



Enhanced Curtailment Calculator

- ECC “dissects” the flow into individual contributions
- Assign relief obligations based on cause

SE Time Stamp	Element	Flow Direction	Start Time	End Time	Latest Pre-Contingency Flow (MW)	Latest Post-Contingency Flow (MW)	Latest Congestion (%)	Max Congestion (%)	Limit Type	Normal Limit
05/05/2017 14:54	Path 36 (N>S)	FORWARD	03/23/2017 15:10	In Progress	733.9	733.9	67.5	67.5	Normal	1087

	Element Impacts	Source	Sink	Impact MW 05/05 15:05	Actual MW 05/05 15:05	TDF (%) 05/05 15:05
	Total Impact			719.9		
−	Total Tags			778.1		
+	Total Off-Path Tags			641.4		
+	Total On-Path Tags			136.7		
+	Total Dyn. Sched. / Pseudo-Tie			29.6		
+	Total GTL			299.8		
+	Total ACE			19.3		
+	Total DC Line (Untagged)			-117.7		
+	Total Phase Shifter (Off-Neutral Tap/Angle Flow)			-3.2		
	Unaccounted Flow			-286.1		

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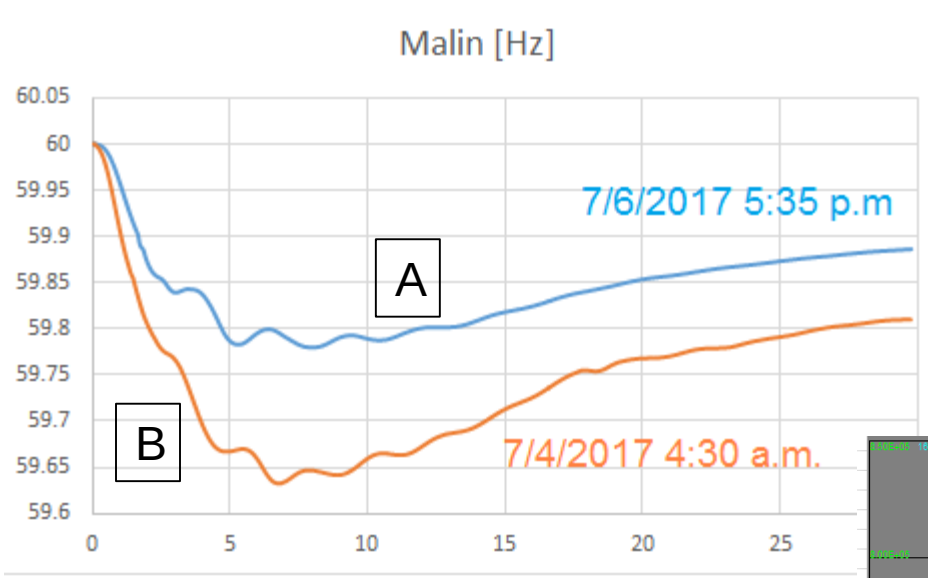
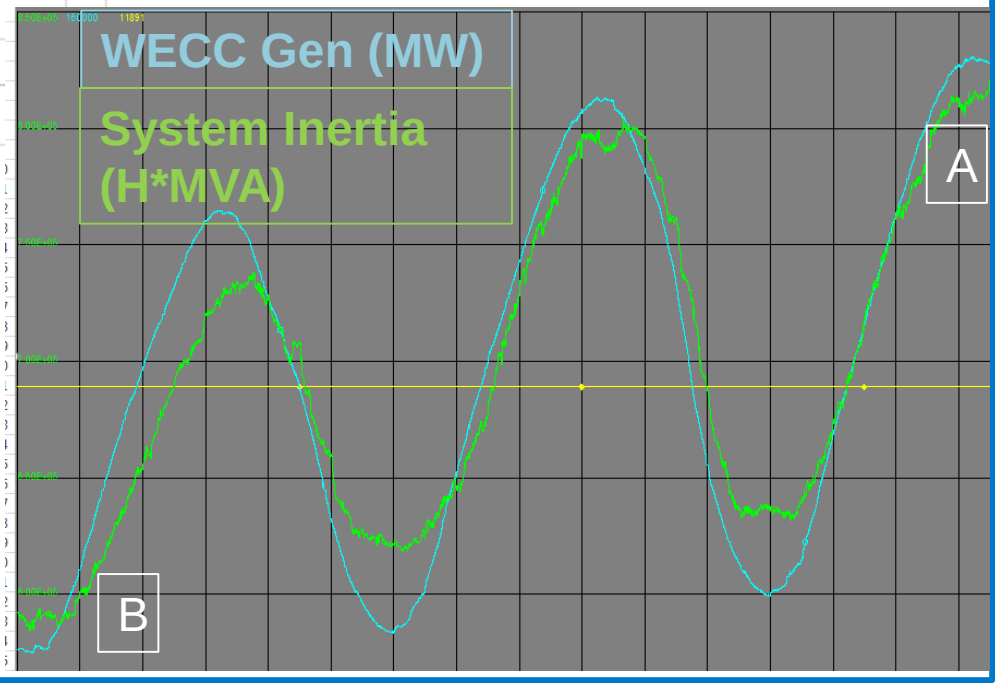
Frequency Response Observations

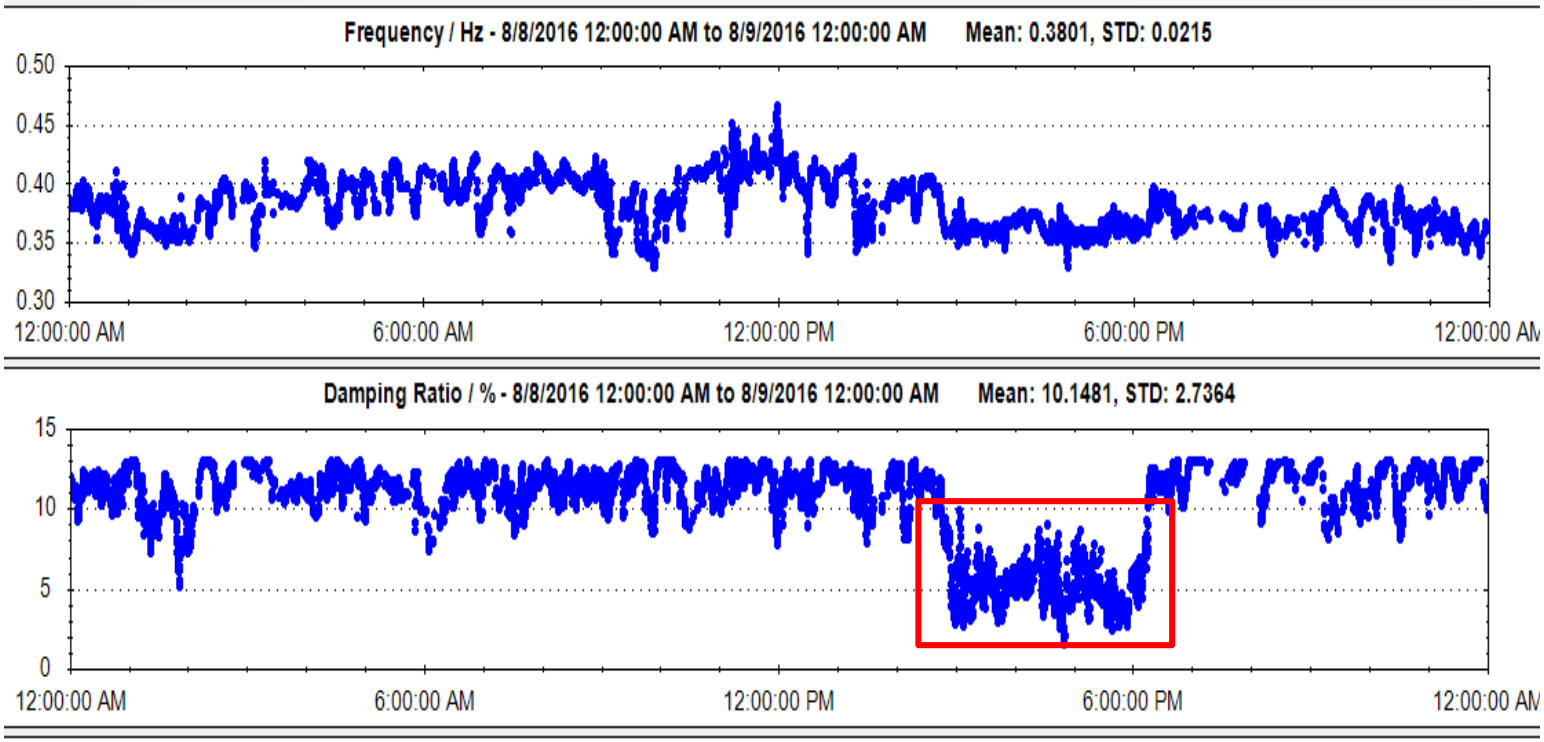


- A – High load, high inertia
- B – Light load, low inertia

- Low gen condition has less inertia and less primary frequency response



Modal Analysis Progress



- Further analysis showed distinct drop for 3 hours on 8/8/16
- ~0.4Hz frequency consistent with inter-area N-S mode (Alberta mode)

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Takeaways

- Know the boundary of reliable operations
- Observe and measure system performance in real-time to stay within that boundary
- “Efficient” operations doesn’t just mean optimize generation; also means maximize transmission utilization
- Technology and analytics are here to support this new paradigm

Questions?

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