Integrated Grid Planning Symposium: Operational Reliability in Hawaii

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Essential Reliability Services

- Frequency Support
  - Voltage & frequency ride through
  - Inertia, fast frequency response, primary frequency control
- Ramping & Balancing
  - Flexible capacity
  - Congestion management
  - Regulation
  - Ramping
- Voltage Support
  - Static VAR reserve
  - Dynamic VAR reserve
  - Ride-through capability
- Impacts on changing system, retirements, replacement resources
- Tracking impacts and sufficiency guidelines
  - Using system data across N. America

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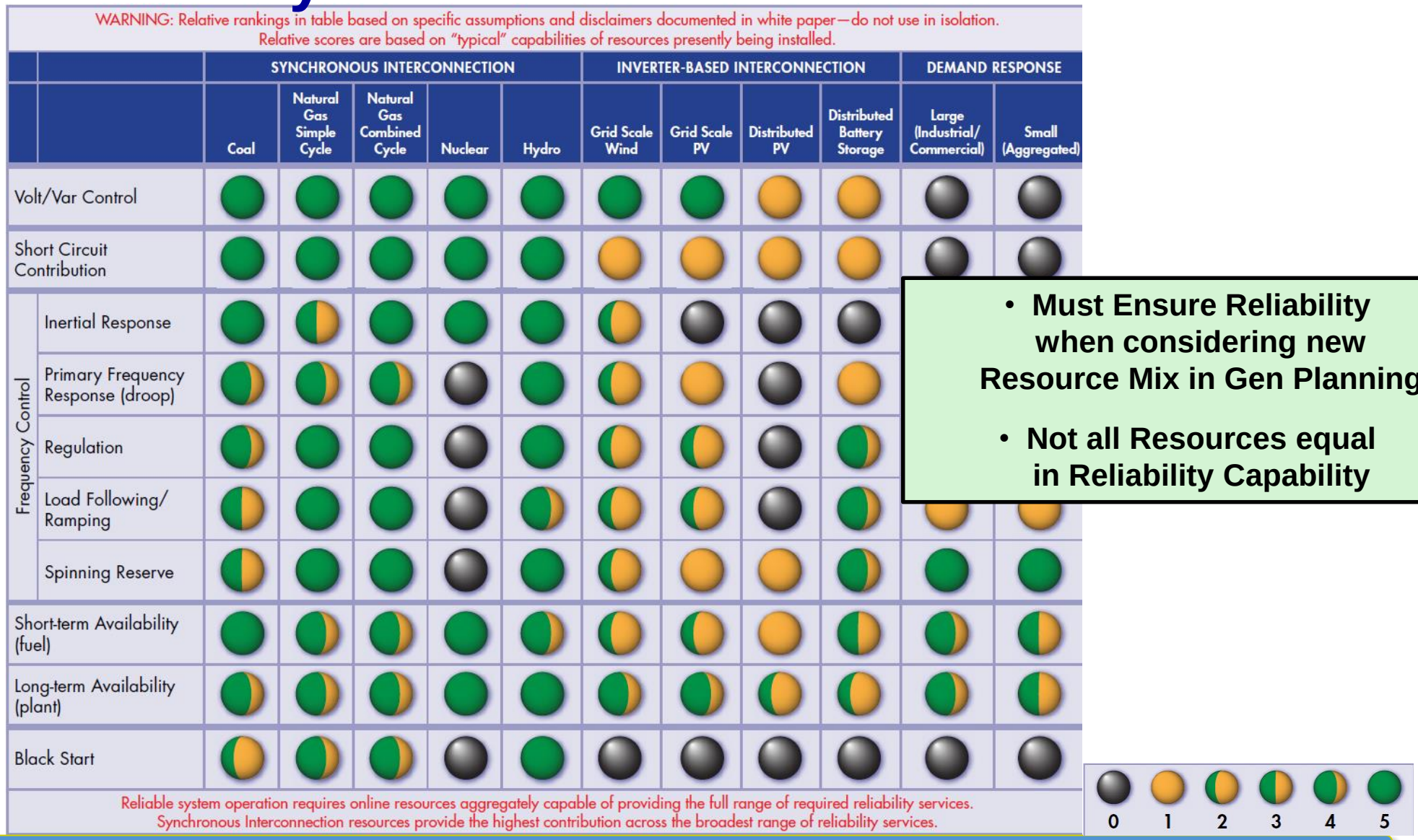
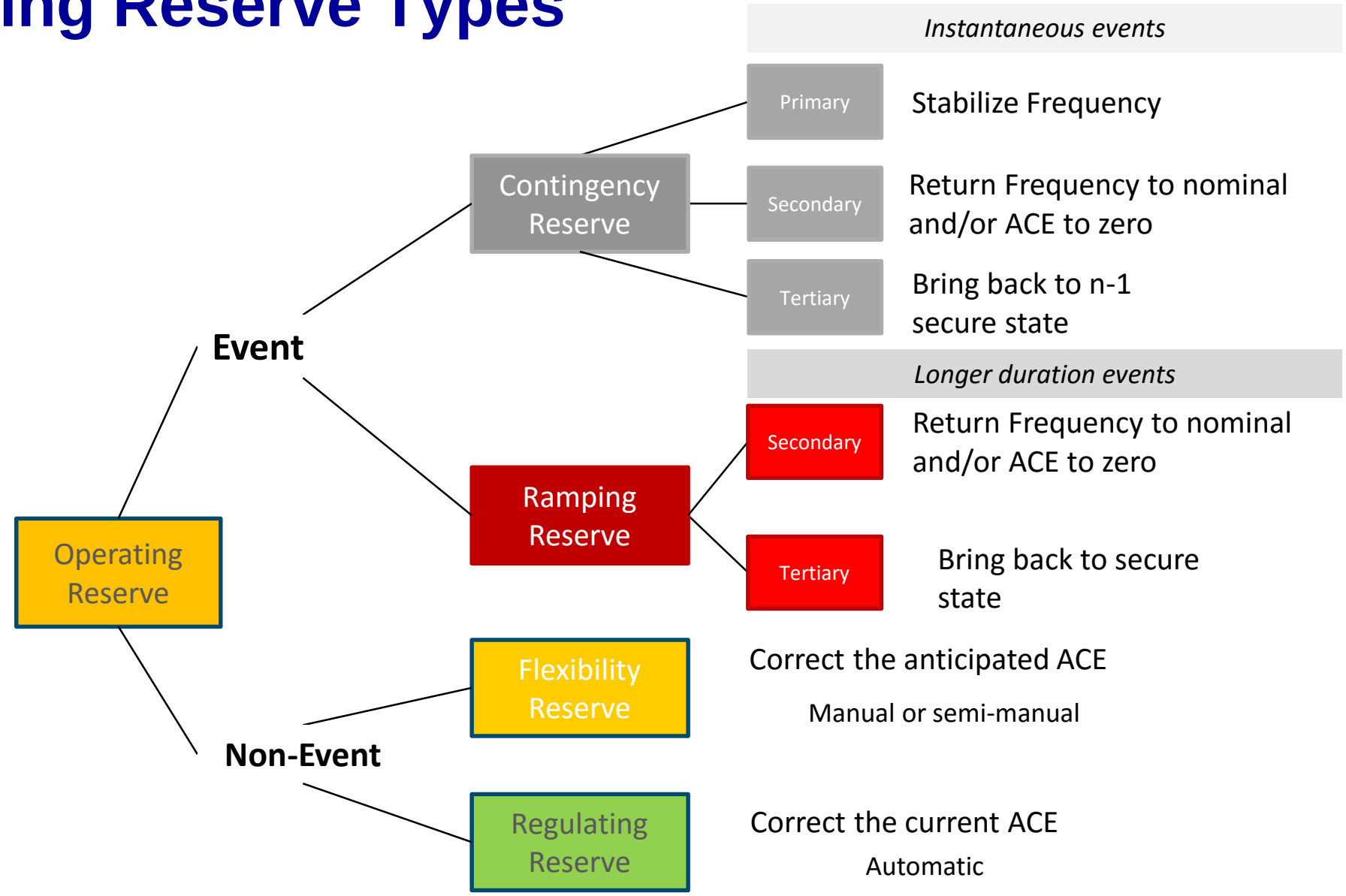
Resource Reliability Contributions



- **Must Ensure Reliability when considering new Resource Mix in Gen Planning**
- **Not all Resources equal in Reliability Capability**

EPRI whitepaper (2015): ***Contributions of Supply & Demand Resources to Required System Reliability Services (3002006400)***

Operating Reserve Types



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Three Central Needs for Operating Reserve

Operating Reserve: Power, ramp, energy capacity **held** in one scheduling process, **released** and potentially **deployed** in later scheduling process

1. Hold capacity now to meet the **variability** that occurs **within** the **current** scheduled time interval.

2. Hold capacity now to prepare for **anticipated variability** that occurs **after** the current time interval.

3. Hold capacity now to prepare for **uncertain outcomes** that are different from those used in scheduled time intervals.

Based on the report from 2015: EPRI, Operating Reserve Determination, Palo Alto, CA: 2015. 3002006112.
https://membercenter.epri.com/Programs/067417/pages/productabstract.aspx?ProductId=000000003002006112

Reserve requirements dependent on scheduling process

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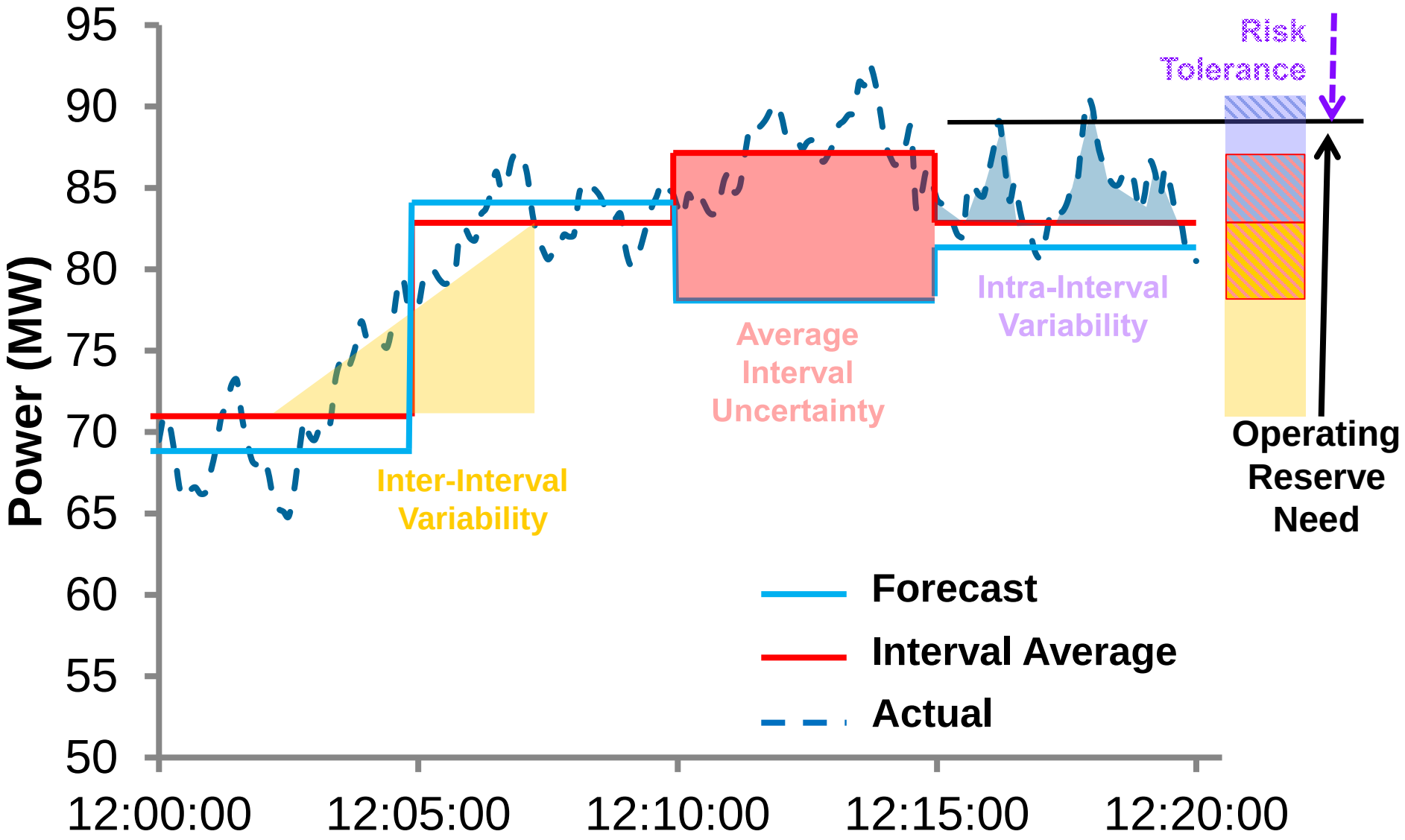
Three Central Reserve Needs



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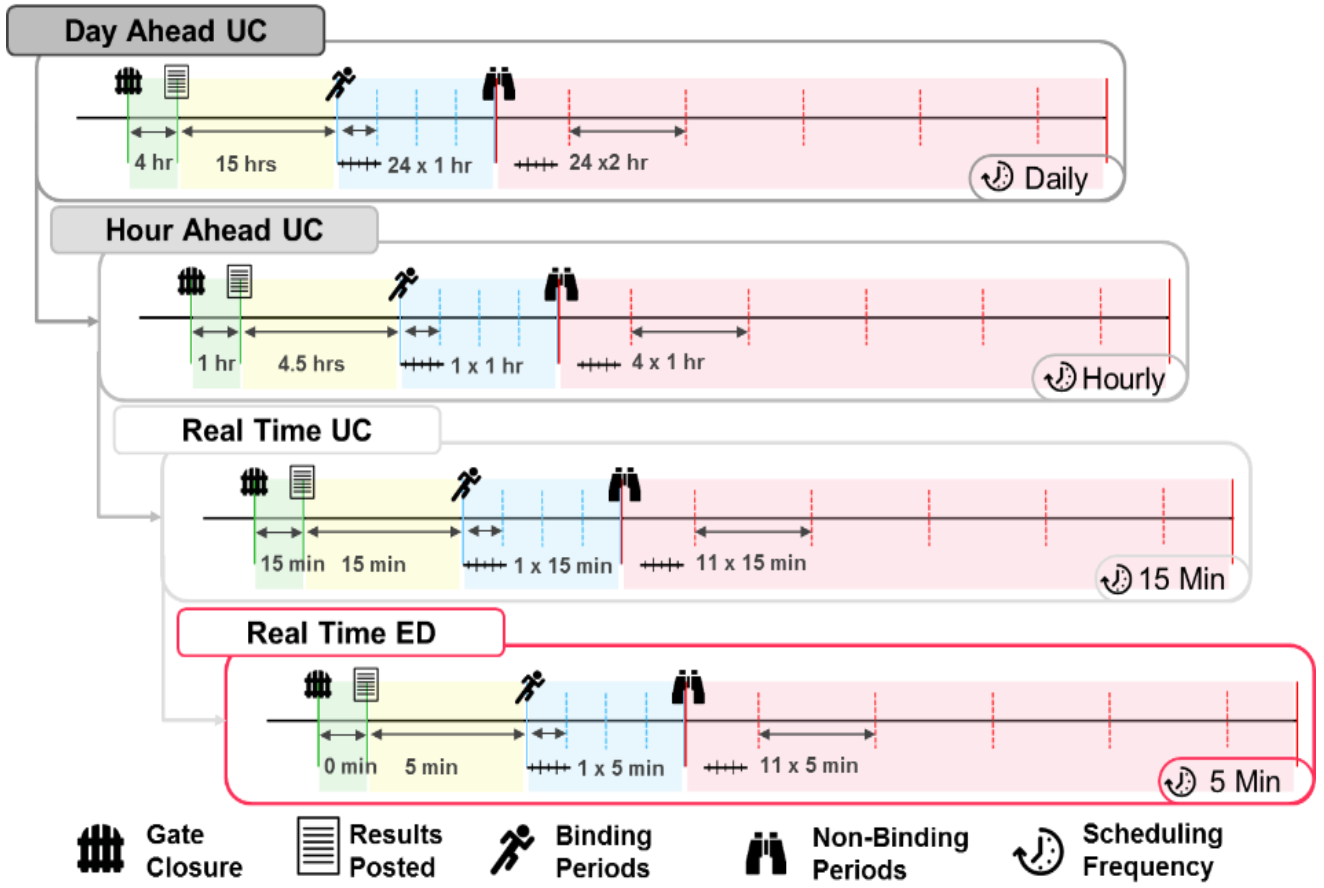
Scheduling Process Influences Reliability

- Capture unique aspects of utility/ISO scheduling practices
- Scheduling resolution – impacts variability needs
- Scheduling horizon – impacts uncertainty needs
- Simulation tool to capture unique aspects
  - Consider timescale of reserve most concerned about



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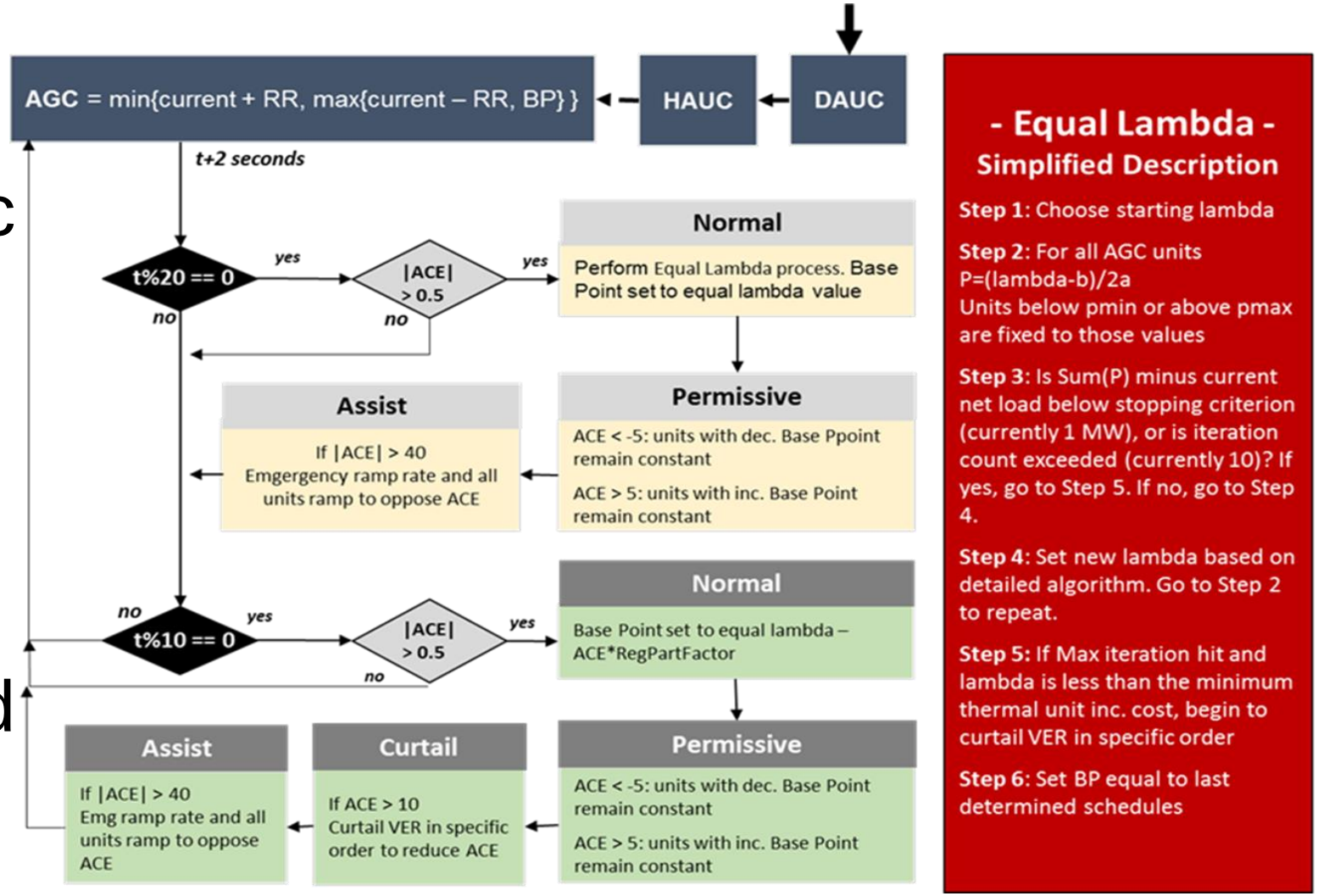
Scheduling Process – Unique Aspects of HECO

- Economic scheduling – 20 sec basis
- Use Lambda Iteration instead of SCED-LP
- Reserve held hour ahead, not released until 20s process



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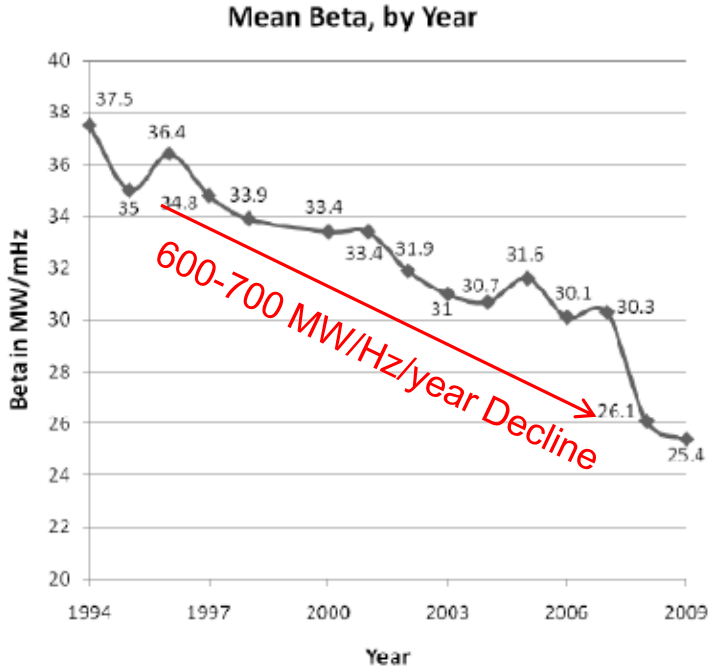
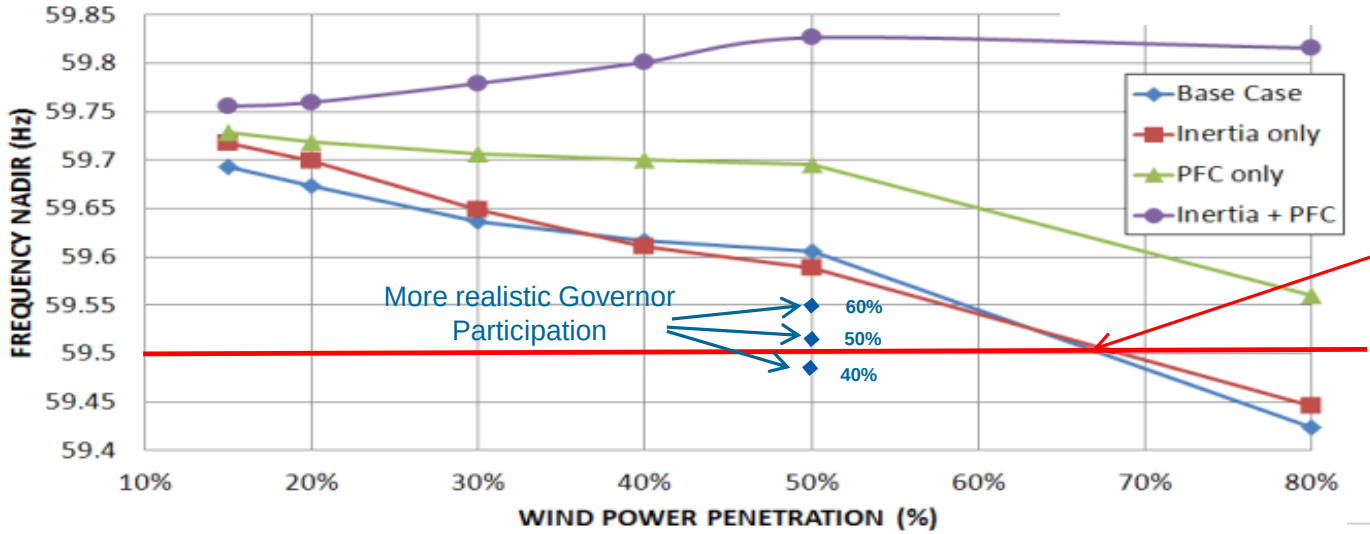
Frequency Response Becoming More of a Concern

- Current issues exist
  - Governor dead bands
  - Blocked governors
  - Operational modes (e.g., sliding pressure)
- Variable renewables (wind and PV) are non synchronous resources and do not inherently provide inertia or frequency control



J. Ingleson and E. Allen, "Tracking the Eastern Interconnection Frequency Governing Characteristic," IEEE Power and Energy Society General Meeting 2010.



E, Ela et al., *Active Power Control from Wind Power: Bridging the Gaps,* NREL Technical Report, December 2013.

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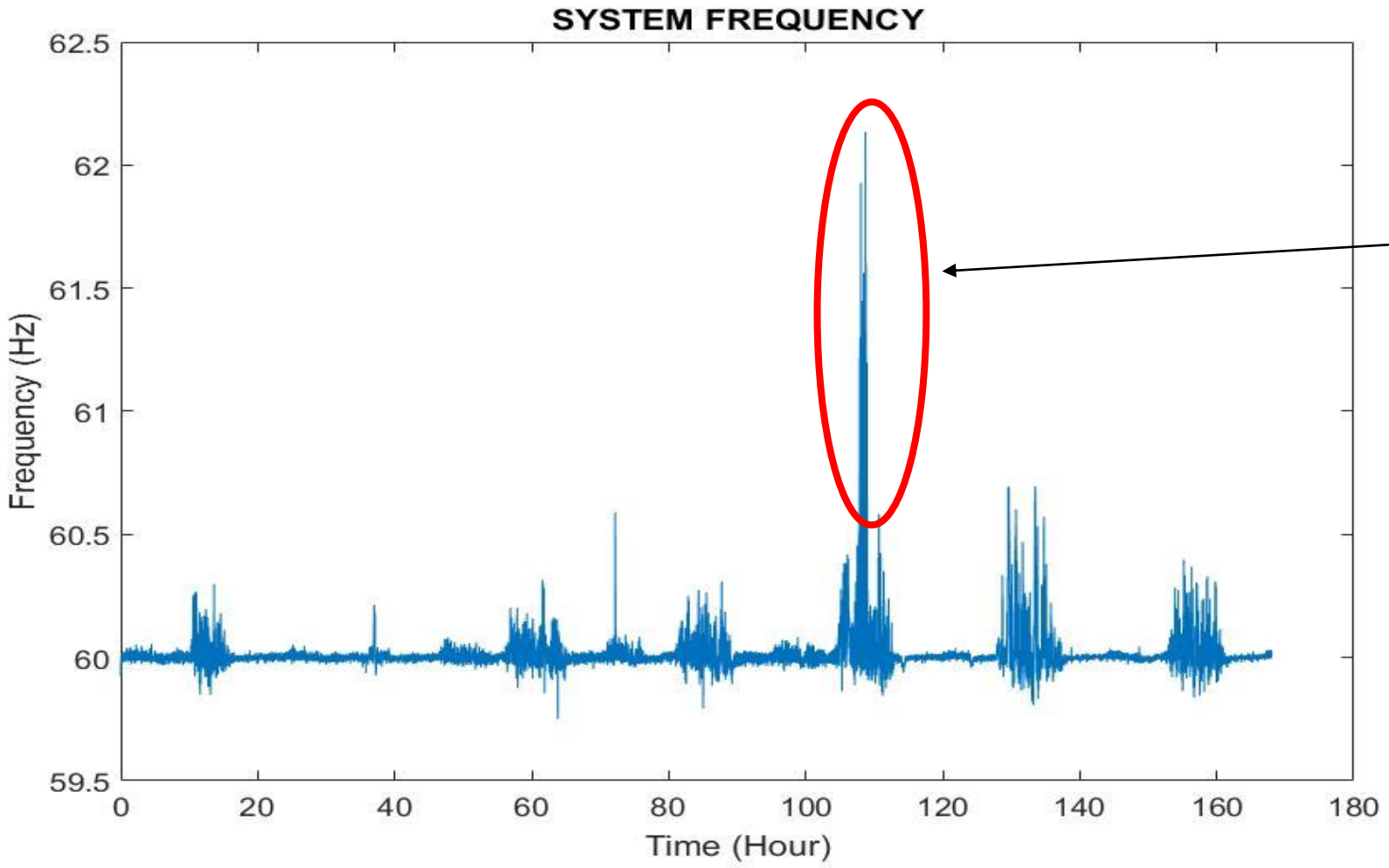
System Frequency – Over-Frequency Challenge



Units backed at min-gen
Renewables not providing over-frequency response

1-week HECO Winter Simulation, normal conditions (no contingencies)

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HECO Study Overview and Conclusions

- Evaluate current, proposed (now existing), and recommended operating reserve requirement methods on Oahu as well as other operational recommendations
- Study impacts of higher VER
  - Utility scale: 108 MW to 287 MW; DPV: 291 to 564MW
- Simulation using FESTIV tool (commitment, dispatch, AGC)
- Metrics: Costs, ACE, frequency error, HECO compliance, head room risk
- Conclusions:
  - Cycling of mid-merit resources for balancing can provide economic benefits
    - However, other reasons for must-run status must be considered
  - Combined use of cycling and advanced dynamic reserve requirements can provide economic and reliability benefits
    - **Estimated $21M annual savings in addition to improved reliability**
  - VER Curtailment during high ACE required on future system
  - Evaluate frequency responsiveness as part of reserve providers

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