

Resilience & Reliability Assurance

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Resilience Workshop

May 30, 2018

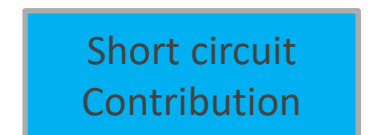
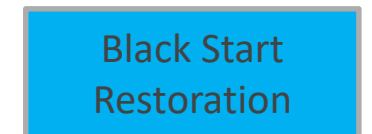
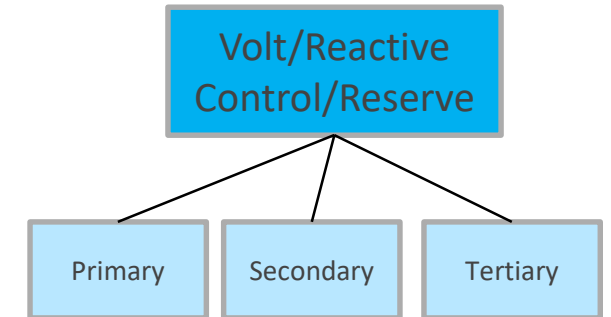
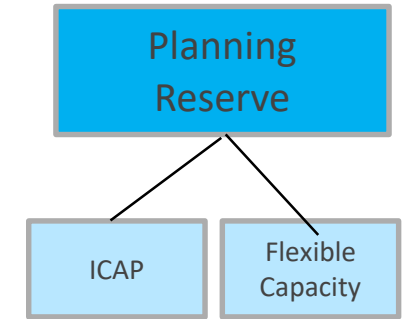
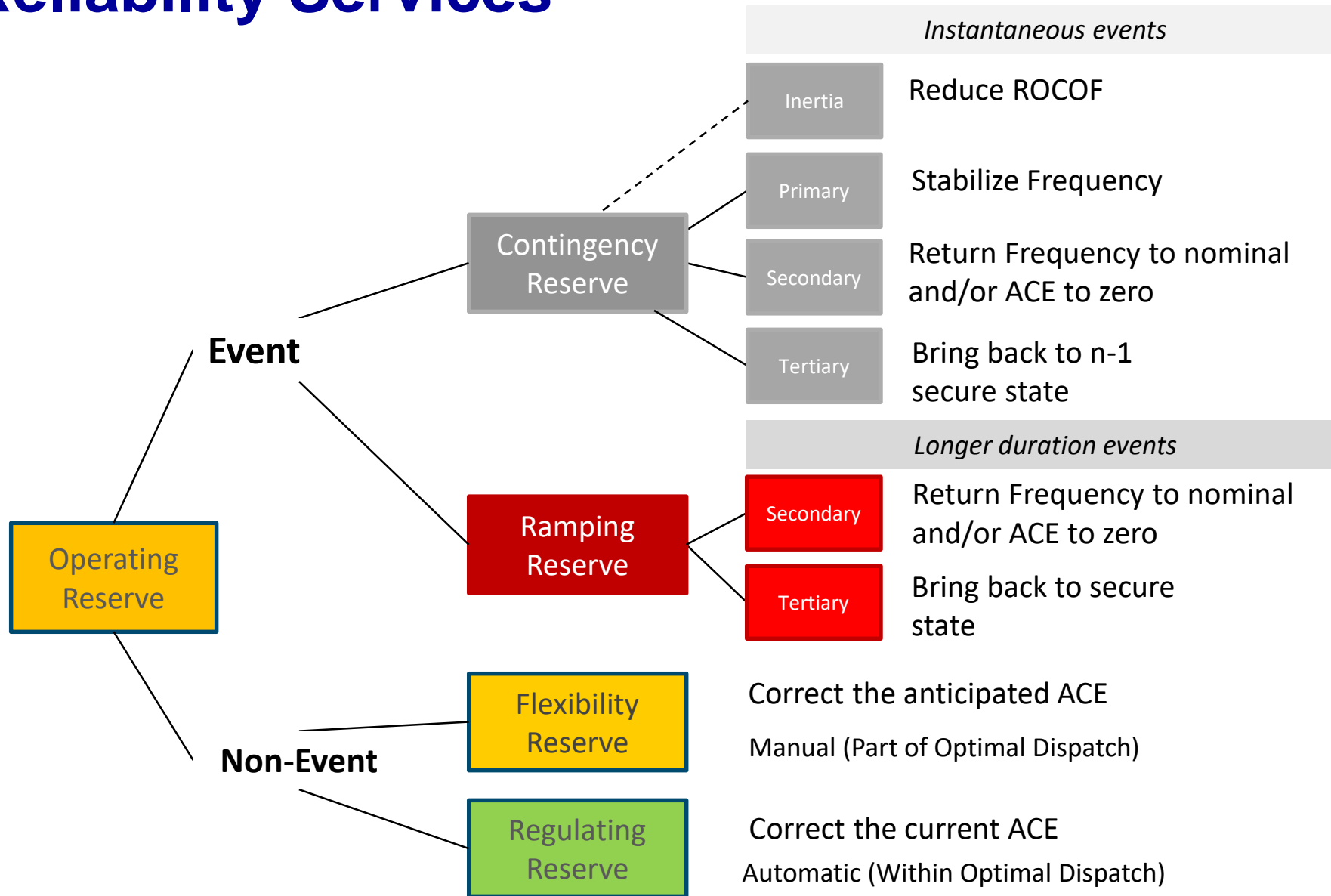
Washington, DC



Summary on Resilience and Reliability Incentives

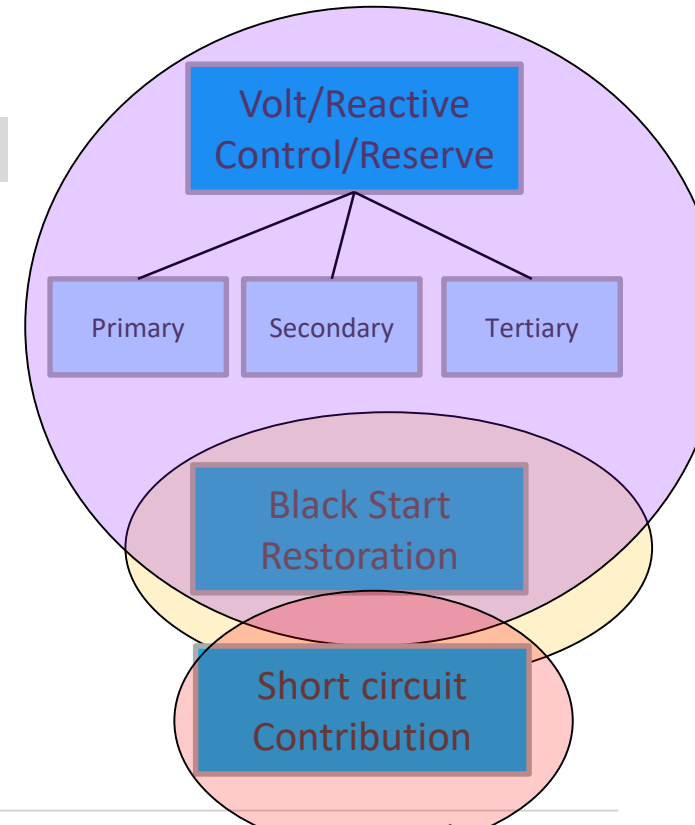
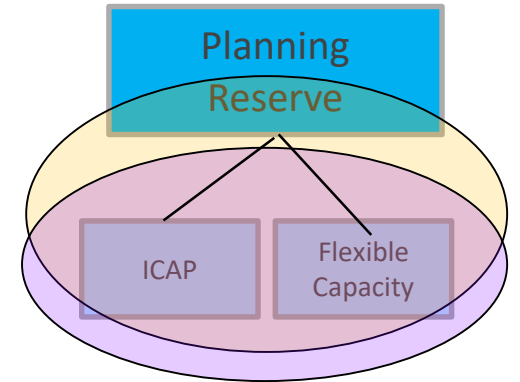
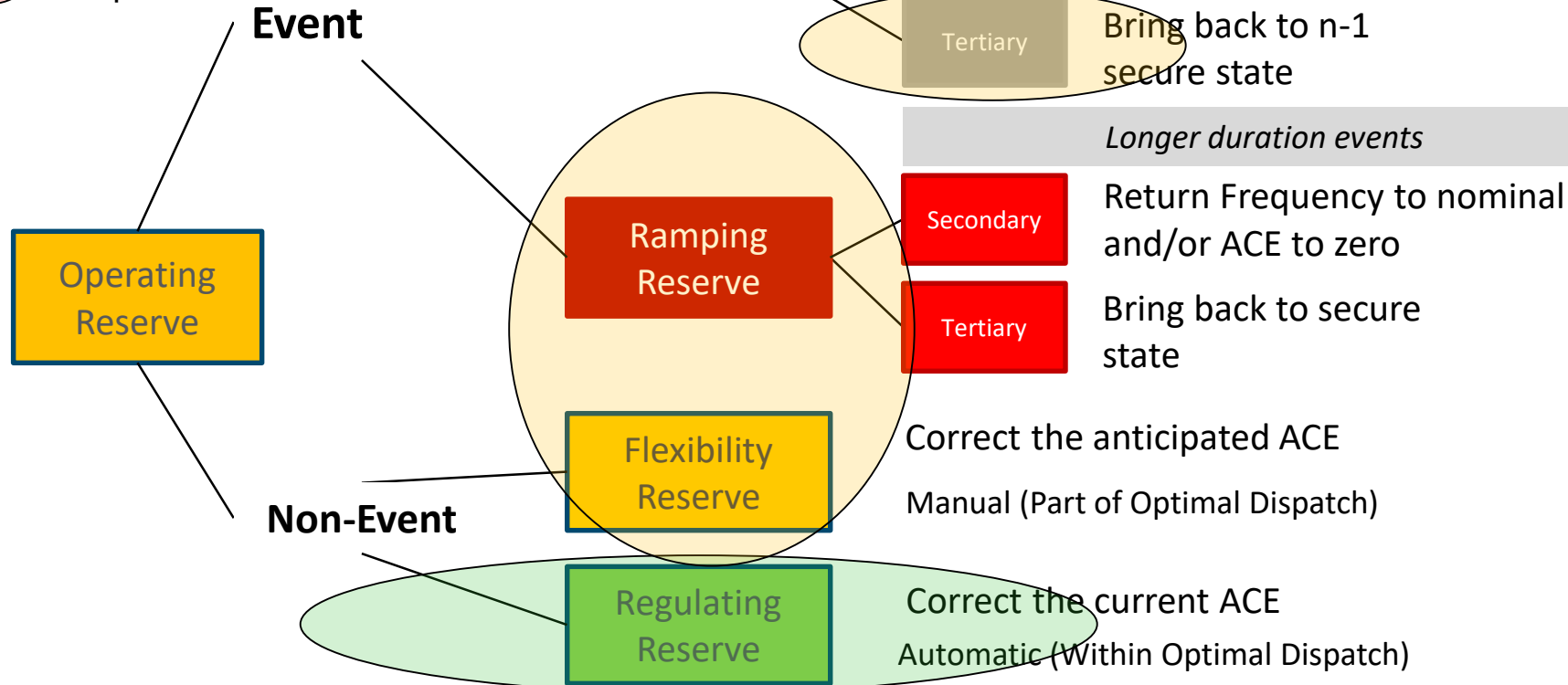
- Definition of resilience relative to reliability important
 - Supplier resilience (new definition): “the ability to harden supply resources, including associated fuel and all supply components against—and quickly recover from—high impact, low frequency (HILF) events.”
 - Supplier resilience one part of overall power system resilience– it may be the only type that is possible to incentivize through market structures in power-supply based markets
 - Transmission and distribution outages affect entire system regardless of fuel supply
 - Metrics (or calculation method for metrics) for reliability, resilience, and recovery and linkages across may need re-evaluation
- Existing mechanisms for incentivizing supplier resilience across markets
 - Capacity Performance (PJM, ISO-NE)
 - Min oil / Dual Fuel Constraints and Cost Recovery (NYISO)
 - Reserve and Transmission Shortage Pricing (all ISOs)
 - Emergency Pricing Procedure (MISO) and Scarcity Pricing (NYISO)
- Market design must be performance-based and technology neutral, probably
 - Could be add-on attribute of existing service rather than new attribute
 - Resilience affects: Operations, planning, and recovery phases
 - Can resilience simply be “keep doing what you’re doing, but make sure to include events beyond faults and ‘typical’ generator outages in your calculations”?

Reliability Services



Reliability Services

- Competitive auctions
- Sometimes Competitive auctions
- Cost recovery
- No known compensation



Reliability Services

- Some reliability attributes are not currently incentivized:
 - Primary frequency response, inertia, short circuit have no known compensation
 - Volt/VAR, black start, operational resilience (e.g., dual fuel requirement) have cost-based recovery and not market-based compensation
- Sometimes auctions and market-based pricing for certain services may be impractical

Reasons why a market product may not be implemented	Example
Too complex to design (e.g., software complexity)	Volt/VAR support
Too specific to certain local areas (little to no competition)	Volt/VAR support
System inherently has more than sufficient amounts of the service	Synchronous Inertia
Costs for the service may be small, so cost of administering market product may outweigh benefits	Black start (restoration) service
A specific resource requirement rather than a system-wide need	Low Voltage Ride Through

The examples are used for illustrative purposes only and the reason may not be necessarily true for each example in each region.

Energy prices during extreme events

- Generally, energy prices during large-scale T&D outages do not increase substantially compared to events with supplier outages.
- With T&D outage, demand decreases. LMP set as marginal cost to meet next increment of a lower demand
- From BPS perspective, high price signal not necessarily needed. Additional power has nowhere to go unless at location of outage (e.g., DER, microgrids incentive?).

Event and location	Polar Vortex NYISO – Zone J (1/2-1/10/2014)	Superstorm Sandy – NYISO Zone J (10/28 – 11/2/2012)	Hurricane Harvey – Houston Zone / South Zone (8/25 – 8/31/2014)
Average LMP	\$184/MWh	\$32/MWh	\$23/MWh / \$37/MWh
Maximum LMP	\$1,422/MWh	\$283/MWh	\$175/MWh / \$1,594/MWh
15-min Intervals above \$500/MWh (%)	8%	0%	0% / 1%

R&D / next steps on resilience and reliability incentives

- **General:** Further research on system-wide and regional supplier resilience metrics and relation to overall power system resilience and reliability
 - 1-day-in-10 years + resilience, is still 1-day-in-10-years
 - Extreme events do not affect the target, only calculation how to meet target
- **Planning:** Evaluate if and how extreme events may be incorporated into resource adequacy calculations (e.g., LOLE, ELCC)
- **Operations:** Incentivizing for reliable operations during HILF events
 - Is it as simple as “model the contingency in commitment/dispatch”?
 - What if it is lower probability than other contingencies (e.g., n-2)?
- **Operations and Planning:** Evaluate the ways in which uncompensated reliability services may be valued efficiently and reliably that provide greater benefits than cost of implementation and administration
- **Recovery:** Evaluate what “resilience attributes” may be beneficial for black start resources during certain events (e.g., not relying on black start resource that is flooded)
- **Markets:** Evaluate price formation impacts relating to pricing when certain constraints (e.g., integer, non-convex) do not trigger price signal
- **Markets:** During load curtailments due to T&D outages, evaluate local price signals



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