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Energy Assurance and the Changing Resource Mix

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PJM April 5, 2019

RELIABILITY | ACCOUNTABILITY




Major Discussions

- Reliability Risk Priorities
- NERC Activities and Recent Special Assessment on Generation Retirements
- NERC Technical Committee Action
- Next Steps

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Reliability Risk Priorities

What's Changing?

- Higher penetration of renewables – variable resources
  - Other than wind – most are inverter-connected
  - Ramping needs increase for load following
- Retirement of large fossil-fired generation plants
- Emergence of distributed energy
- Loss of dynamic reactive support for voltage control
  - Possible reduced system inertia
  - Lower levels of synchronizing torque
  - Increasing use of power electronics
- Changing System Inertia
  - Trade-offs between inertia and Primary Frequency Response

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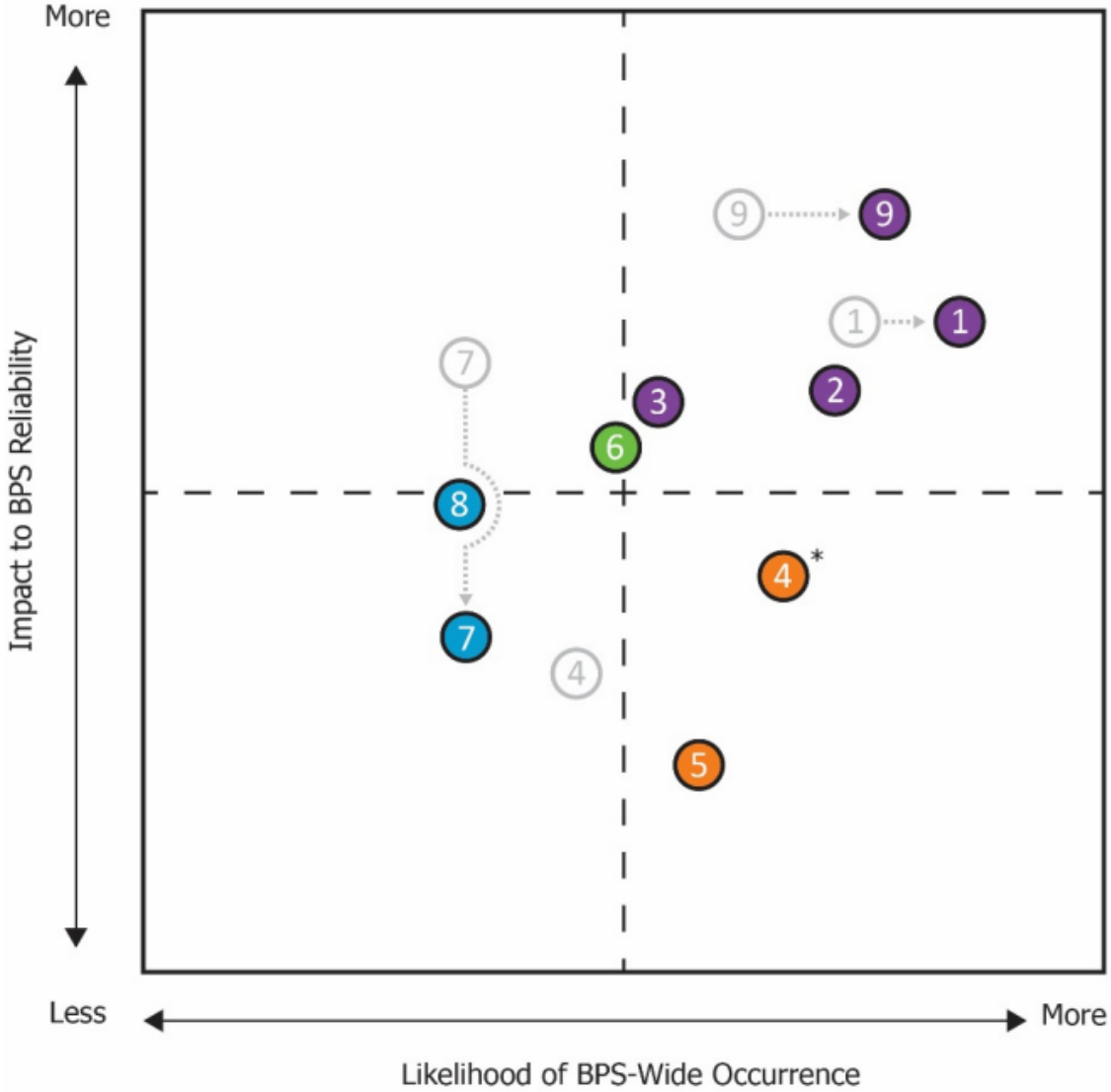
NERC Risk Priorities

Inherent Risk Mapping



Risk Profiles

1. Changing Resource Mix
2. BPS Planning
3. Resource Adequacy
4. Increasing Complexity in Protection and Control Systems
5. Human Performance and Skilled Workforce
6. Loss of Situational Awareness
7. Extreme Natural Events
8. Physical Security Vulnerabilities
9. Cybersecurity Vulnerabilities

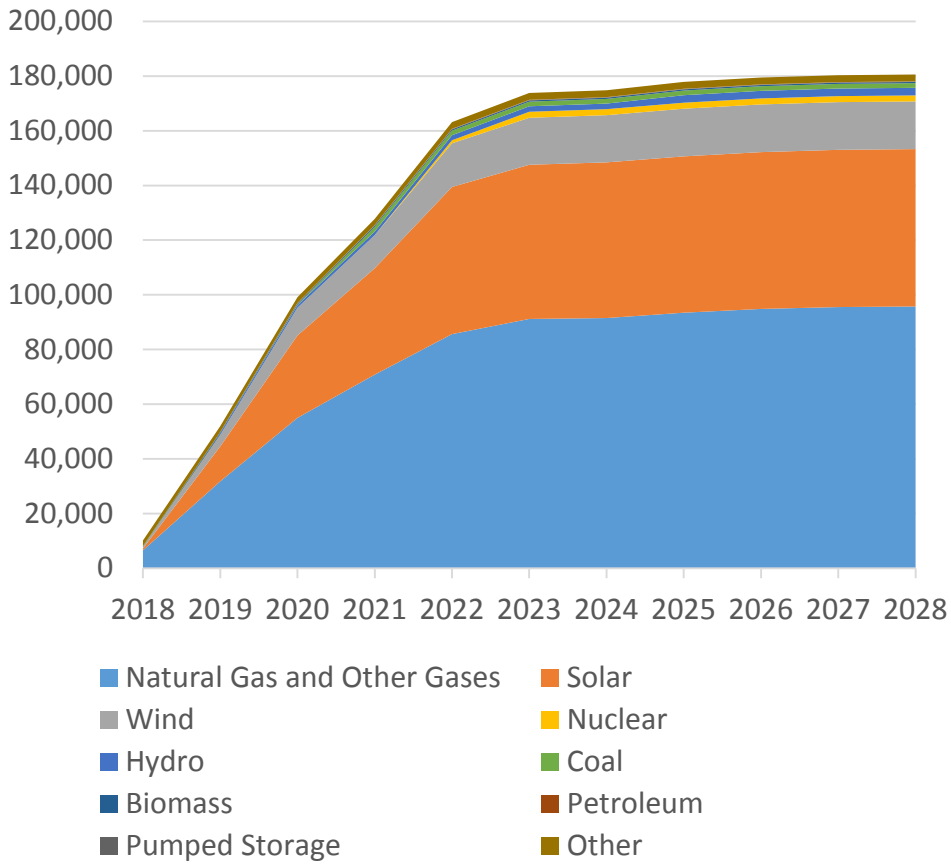
** Profile 4 has shifted focus from 2016*

Risk Mapping

- Higher likelihood, higher impact
- Higher likelihood, lower impact
- Lower likelihood, higher impact
- Lower likelihood, lower impact

2018 Long-Term Reliability Assessment Key Finding

Tier 1 and 2 New Peak Capacity Additions – 10 Year

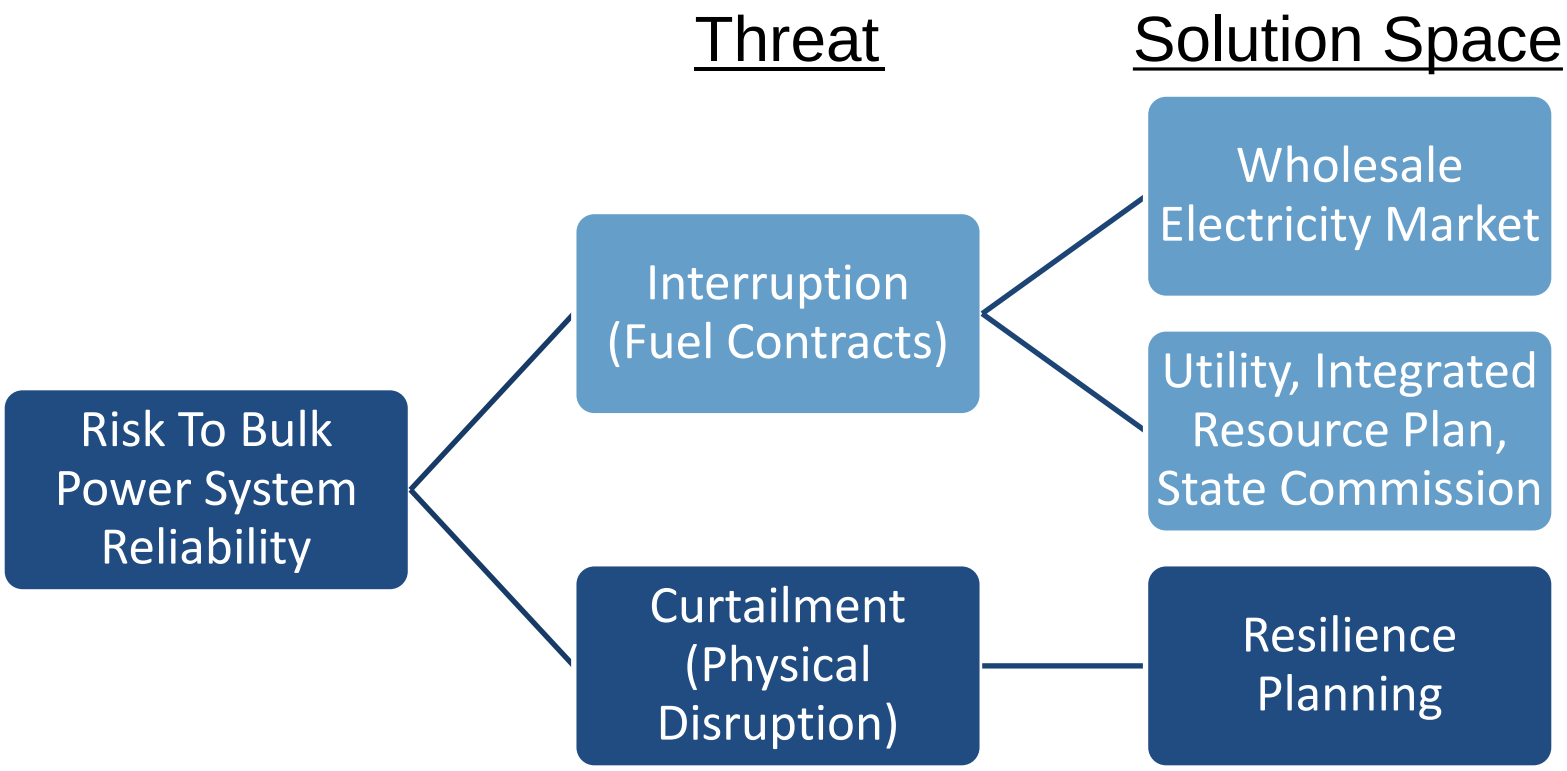


Assessment Areas with More Than 50% Natural Gas as a Percent of Total Capacity		
Assessment Area	**2022 (MW)**	**2022 (%)**
FRCC	42,003	**78.1%**
WECC-CAMX	42,536	**68.2%**
Texas RE-ERCOT	51,867	**63.3%**
NPCC-New England	16,308	**52.3%**
WECC-SRSG	16,774	**51.8%**
WECC-AB	8,514	**51.8%**

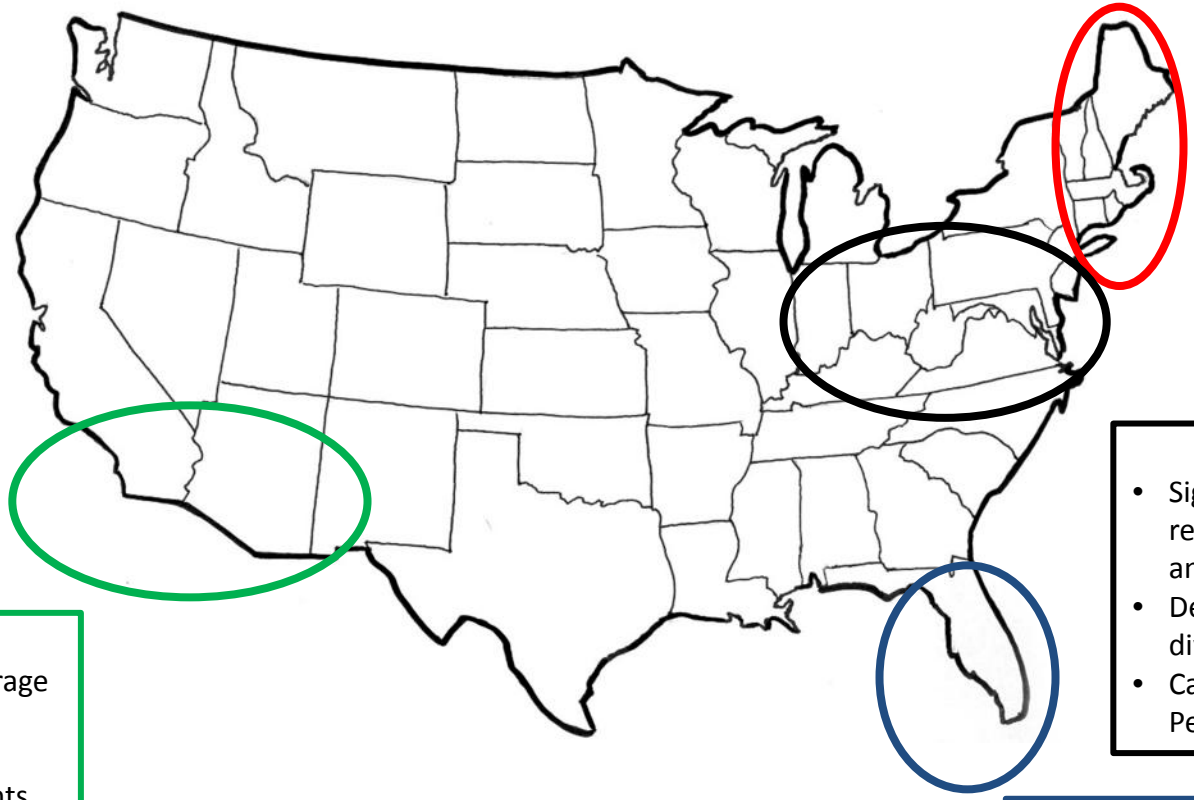
- 96 GW of natural gas in next 5 years, NERC-Wide

Gas – Electric Interdependency

- Increased dependence on natural gas for generating capacity can amplify the bulk power system's vulnerability to disruptions in fuel supply, transportation, and delivery.



Regional Fuel Assurance Conditions



New England
- Infrastructure constrained
- Limited firm service
- "Anti-gas" sentiments
- Pay-for-Performance

PJM
- Significant baseload retirements anticipated
- Declining fuel diversity
- Capacity Performance

CA/DSW
- Aliso Canyon/storage constraints
- System flexibility
- Pipeline constraints
- "Anti-gas" sentiments (CA)
- Limited firm service
- LDC Curtailment queue

Florida
- Firm service in place
- Dual fuel acceptable
- 78%+ gas on peak
- Lack of fuel diversity

What is Energy Assurance?

- Having certainty in the aggregate ability of all resources to serve expected demand
- Limited risk in fuel supply chains
  - Contracts in place
  - On-site fuel storage
  - Emergency provisions for deliveries
- Statistically and probabilistically confident in energy source production
  - Adequacy evaluations such as LOLH and EUE-type metrics
- Robust, secure and reliable energy infrastructure that is also resilient — able to rapidly restore

Generation Retirement Scenario:

2018 Special Reliability Assessment

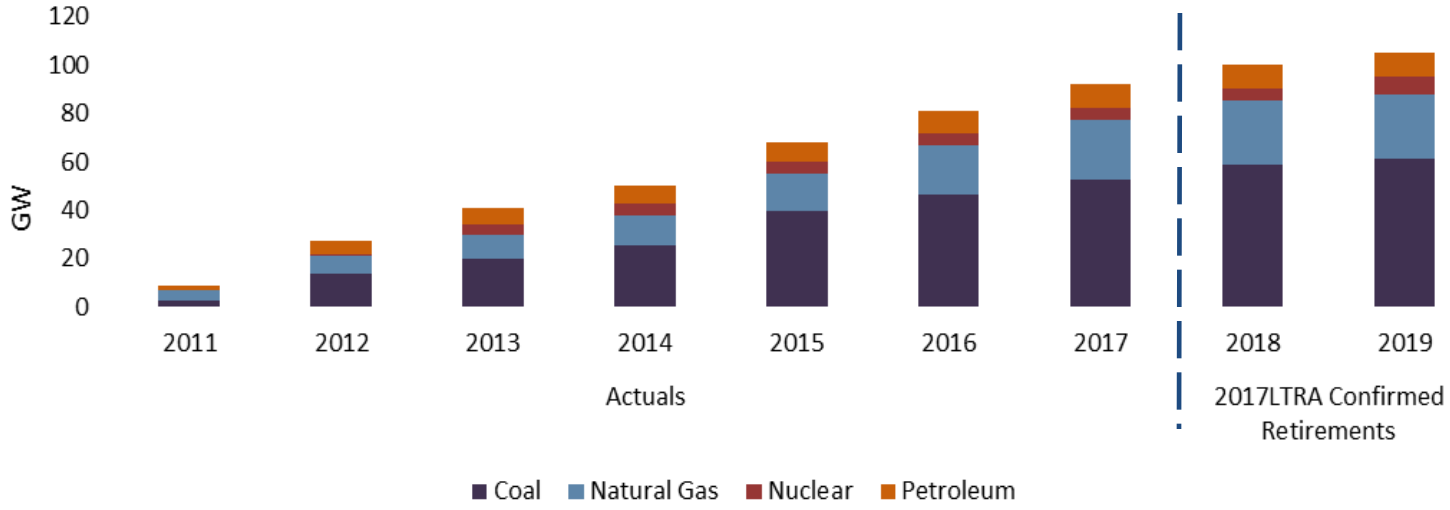
Assessment Objectives

Objective

Apply stress-test scenario to examine the potential impacts of an accelerated generator retirement scenario:

- Resource adequacy
- Transmission adequacy
- Managing extreme events (e.g., extreme weather, fuel disruptions)

As a stress-test, the scenario is not a predictive forecast.

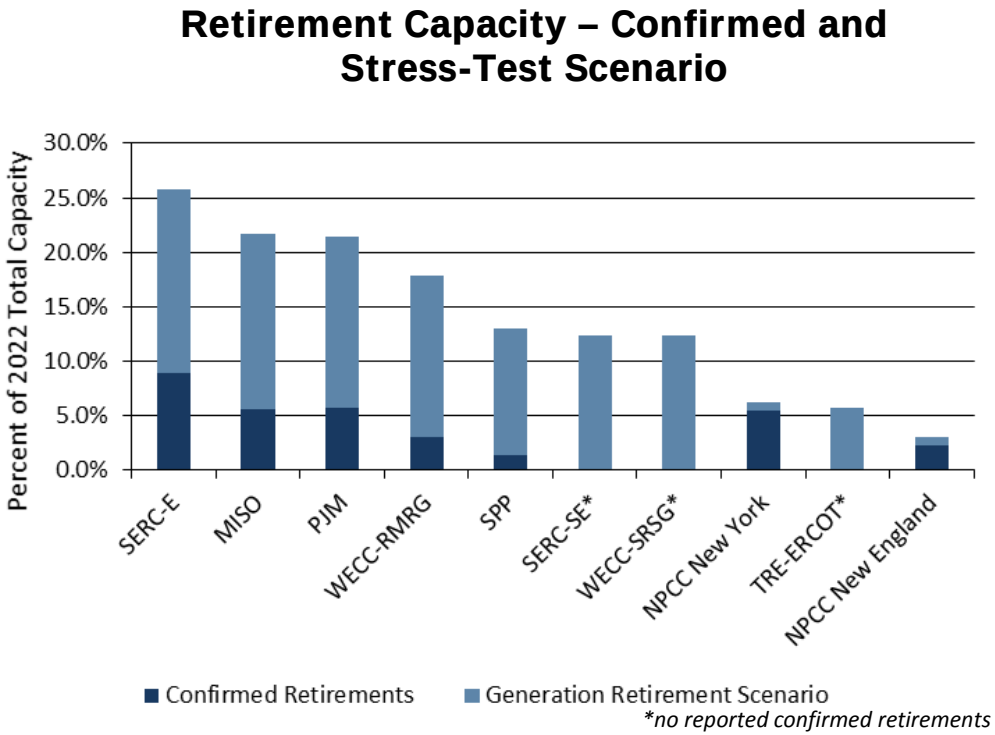


Findings

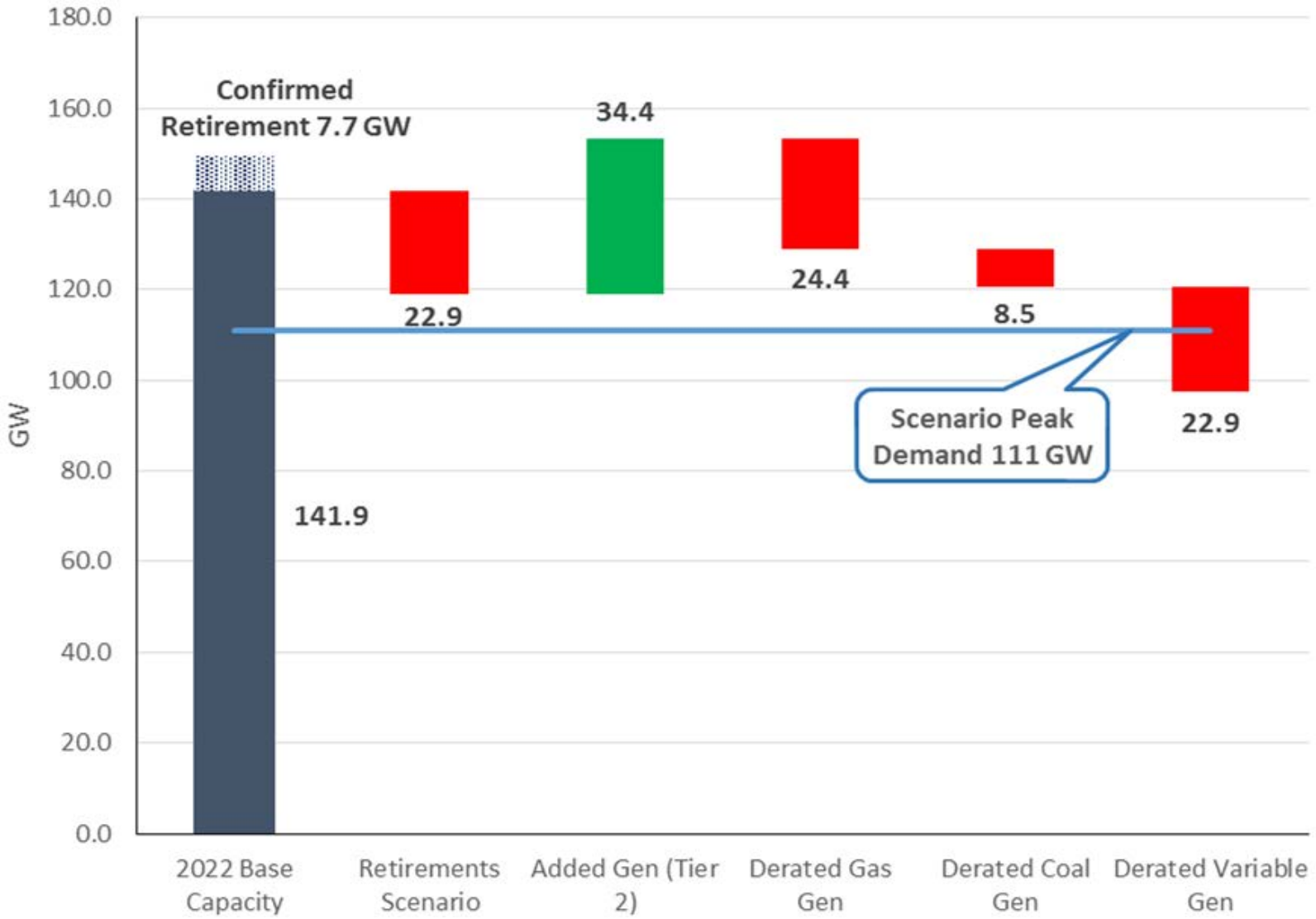
- The scenario affirms that with risk-informed planning, regulatory and market-based tools can assure continued supply adequacy of the bulk power system.
- Transmission upgrades or reinforcements could be necessary to allow retirements to occur, which takes time.
- New natural gas infrastructure is needed to support the changing resource mix.
- Maintaining back-up fuel inventories will be a key factor in assuring reliability in the future.

Stress-Test Scenario Approach

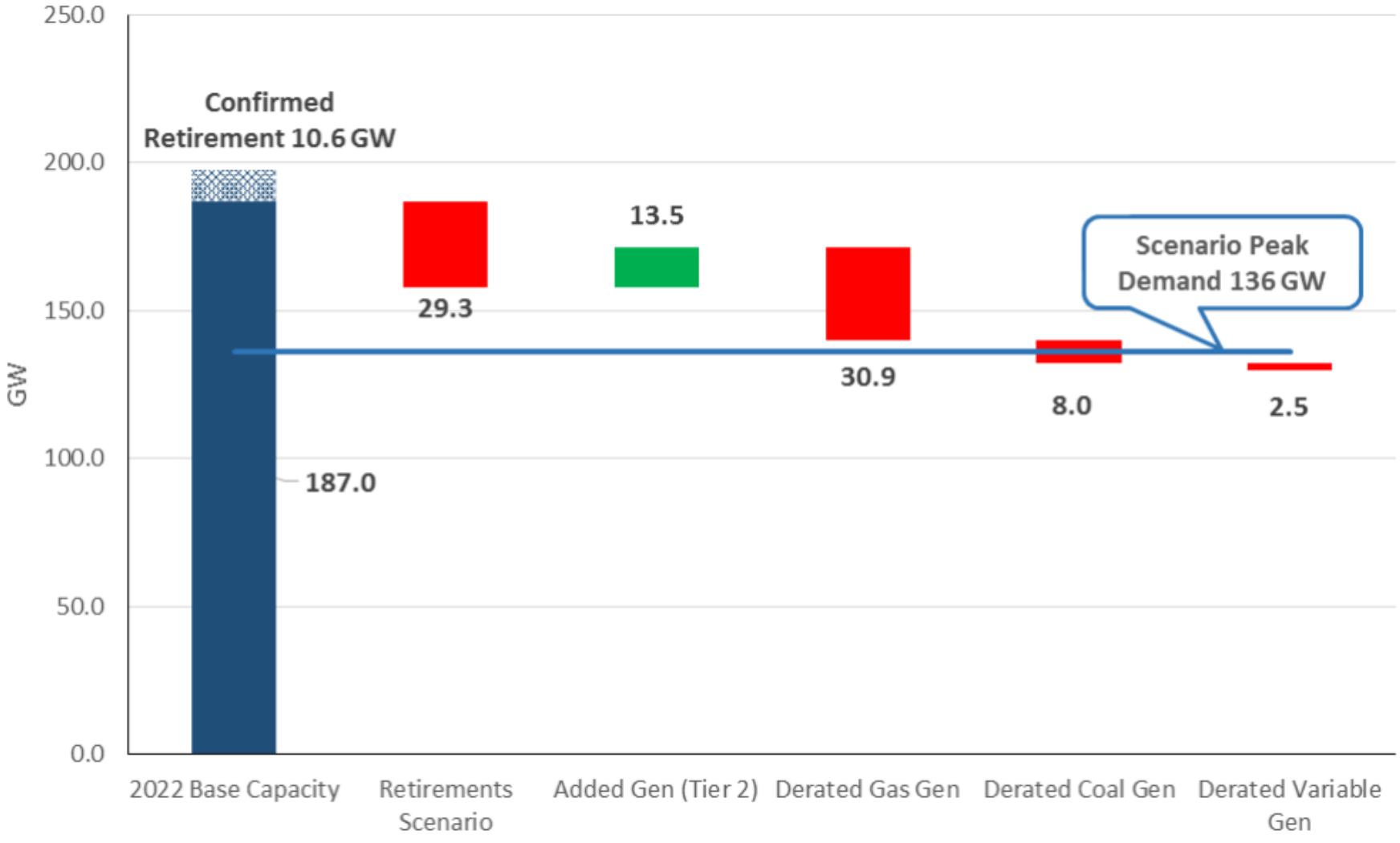
- Using EIA retirements data as reference case, the stress-test scenario shortens EIA's timeframe from 2025 to 2022.
- Accelerated retirements include:
  - Coal-fired generation reduced by 30%
  - Nuclear generation reduced by ~45%
- Replace capacity with Tier 1 and Tier 2 resources (includes natural gas, wind, solar).
- Compare with reference margin levels.
- Further analyze effect of extreme conditions.



Example of Polar Vortex Risk Analysis (Extreme Event Case) - MISO



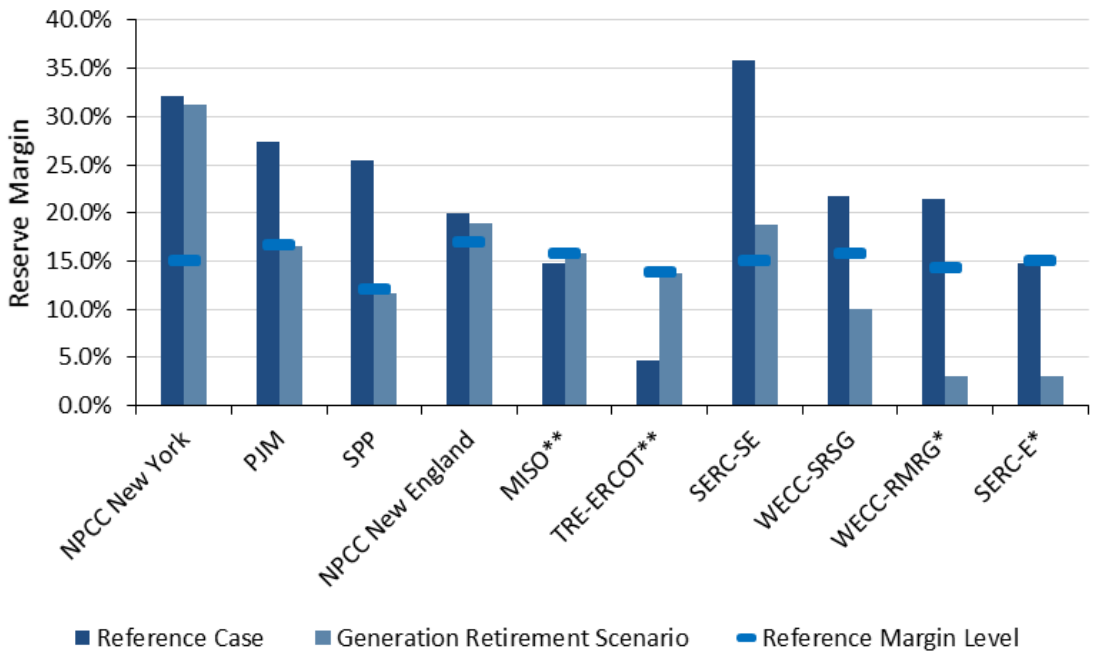
Example of Polar Vortex Risk Analysis (Extreme Event Case) - PJM



Resource Adequacy Finding

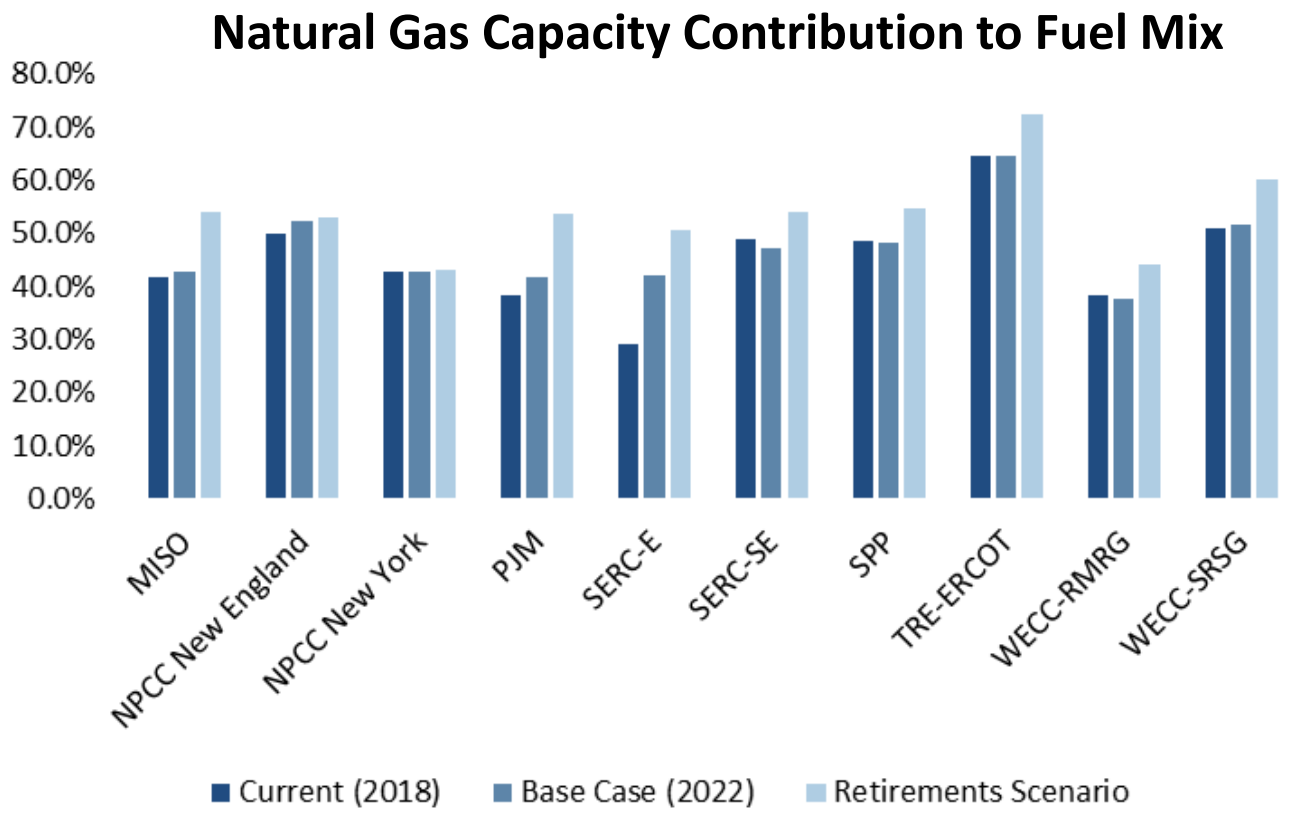
- In four of ten areas studied, planned generation resources are not sufficient to make up for retirements and meet reference margin.
- **Recommendation:** Continue to implement planning processes and market mechanisms that help mitigate reliability risks by managing the pace of retirement.

2022 Peak Reserve Margins



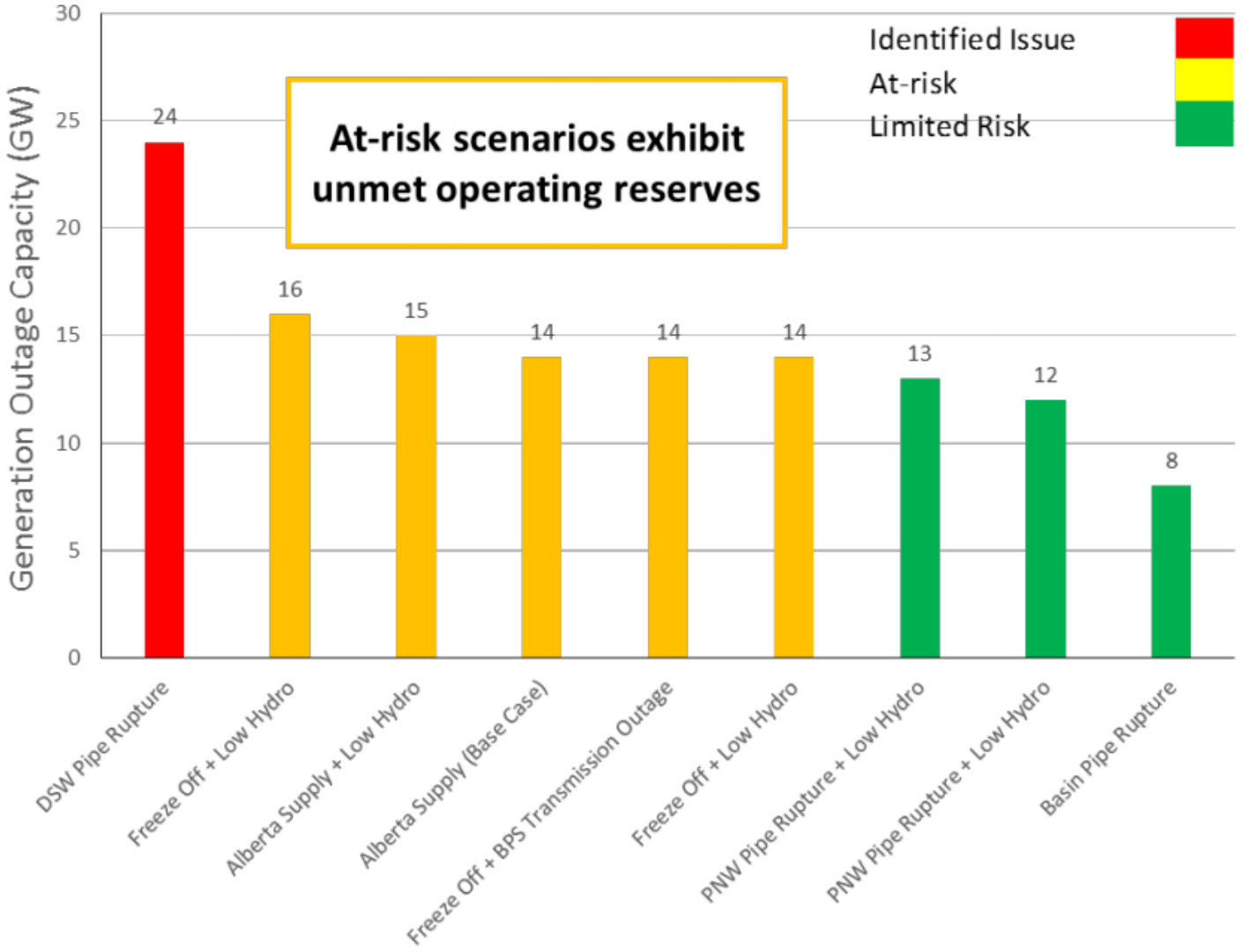
**Actual Planning Reserve Margin is near or below 0%*
***Chart depicts the projected 2022 Planning Reserve Margin Reference Case for Texas RE/ERCOT of around 4.6% based on 2017 LTRA data and announced retirements. Accelerated Retirement Scenario Planning Reserve Margin of 13.8% assumes new generation is installed to make up for known and accelerated retirements.*

Fuel Assurance Finding



- The proportion of natural gas-fired generation increases as a result of studied retirements
- **Recommendation:** Incorporate fuel assurance analysis in generator retirement processes

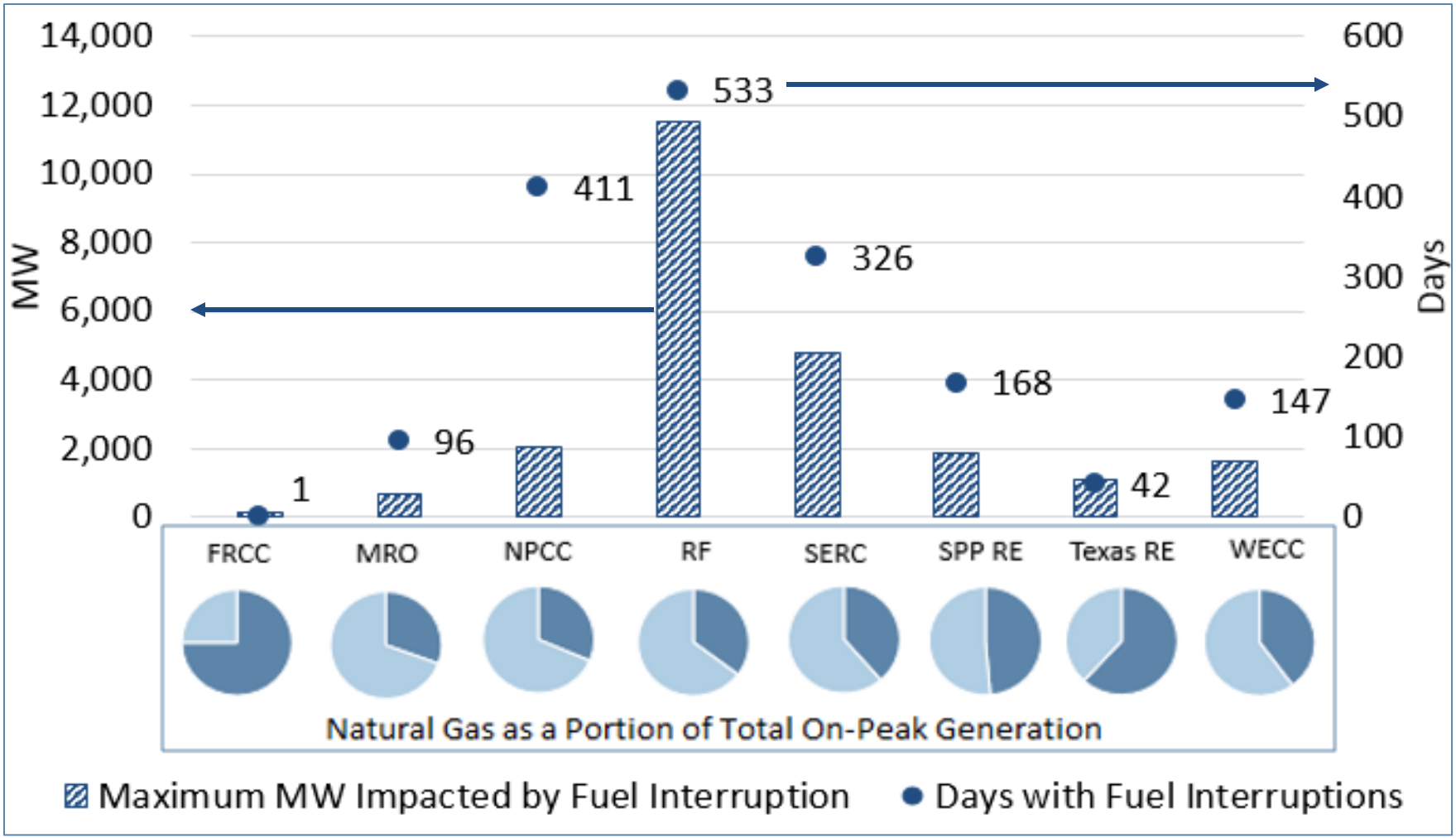
Outage Risk Evaluations Helps Prioritize Mitigation Planning - WEST



See the Western Interconnection Gas-Electric Interface Study:
https://www.wecc.biz/Administrative/WECC%20Gas-Electric%20Study%20Public%20Report.pdf

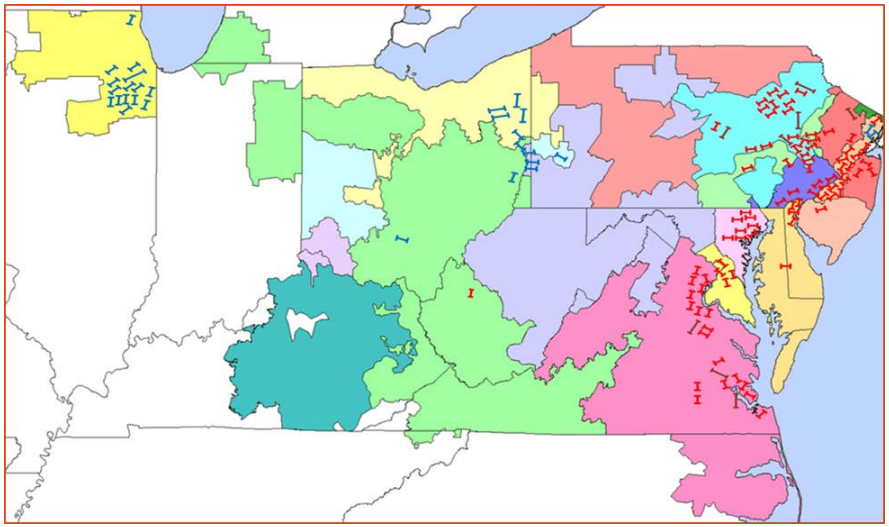
Generation Availability Statistics on Unit Forced Outages

Reported GADS Outages of Natural Gas Generation Due to "Lack of Fuel" (2012-2015)

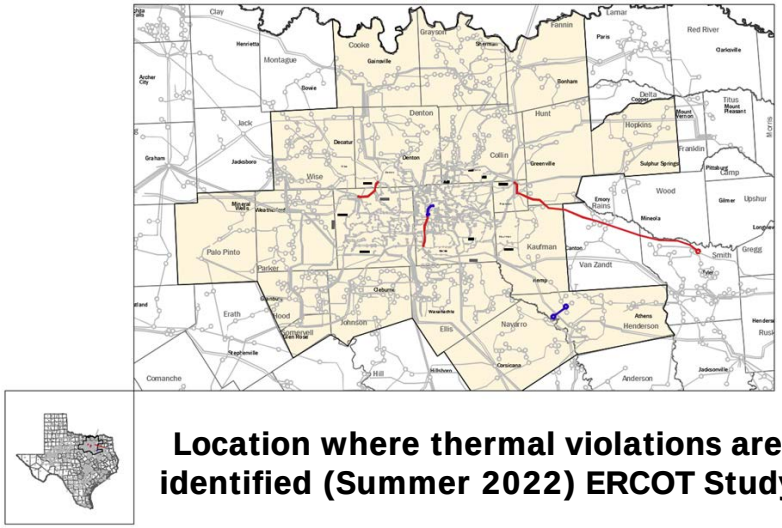


Transmission Study Finding

- Transmission upgrades, generation dispatch and operating procedures are needed for reliability.
- Use of mechanisms to manage pace of retirements may be needed.



Location where thermal violations are identified (Summer 2022) PSEG Study



Location where thermal violations are identified (Summer 2022) ERCOT Study

- **Recommendation:** Provide regulatory flexibility to respond to changing infrastructure needs.

Next Steps on Energy Assurance

Key Findings – Severe Disruptions Report

- Aliso Canyon has unique characteristics differing from most natural gas storage facilities
- Natural gas facility disruptions have varying impacts dependent on location and infrastructure density
- NERC's transmission simulations demonstrates operational challenges in the event of natural gas disruptions
- Demand for natural gas has altered storage dynamics
- Mitigation strategies (e.g., dual fuel) can reduce potential impacts
- Natural gas supply sources have become more diversified
- Recent FERC Orders continue to promote coordination
- Comprehensive planning by Planning Coordinators can significantly increase resilience

Recommendations NERC

- NERC should consider enhancing its Reliability Guidelines and/or Reliability Standards related to transmission planning and extreme event assessments
- NERC should enhance its Generator Availability Data System (GADS) database for better granularity in generator outage causes

Electric Gas Working Group

- Primary attention for the development of guidance and/or guidelines regarding considerations on fuel related risks in BPS
- Scope approved by NERC Planning Committee in March, 2019
- Over 80 industry participants in working group
- Reliability guideline outline completed
- Guideline to be completed in calendar year 2019
- Benefits to coordinating with PJM “Valuing Fuel Security” efforts
- Continued support of proactive approach to address issues before they pose significant threats or challenges

Closing Remarks

Moving Forward

- Annual Reliability Assessments will track progress including:
  - Accommodating resource mix changes into planning
  - Determining appropriate capacity and energy limitation values for adequacy evaluations
- Electric-Gas Working Group established to develop “fuel assurance guidelines”
- Support markets in development of market enhancements supporting energy assurance
  - NERC can help establish technical, risk, and consensus-based guidance for “criteria” development
- Continuing work on pipeline disruptions
- Input from stakeholders from all sectors important

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Thank you! Questions?