



Summary of Impacts of Environmental Regulations in the ERCOT Region

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Study Purpose and Background

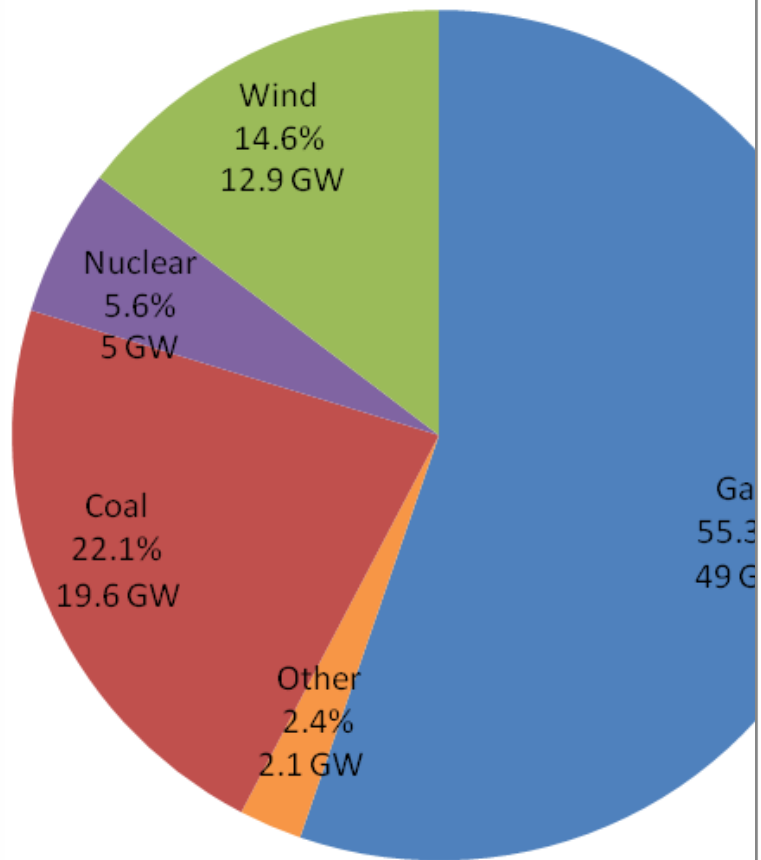
- Several new regulations have been proposed or finalized since ERCOT conducted its last major study of the potential impacts of environmental regulations in 2011.
- In combination, these rules appear to have the potential to have a significant impact on grid resources.

Study Process Overview

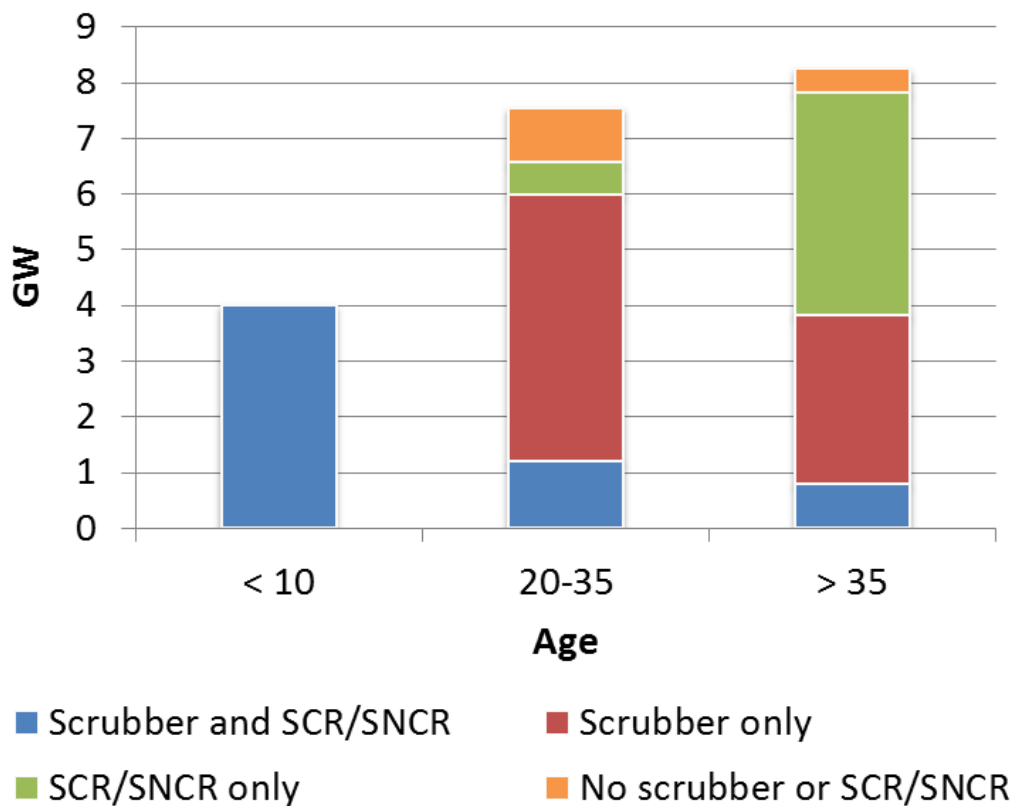
- Reviewed proposed and finalized environmental regulations
 - Discuss with staff of the Texas Commission on Environmental Quality, United States Environmental Protection Agency, and knowledgeable stakeholders
- Conducted a survey of resource owners in ERCOT
 - Status of existing environmental controls
 - Unit emissions rates
 - Current compliance strategies
 - Potential by-unit impacts of environmental regulations
- Conducted system grid simulation modeling to analyze potential near-term and long-term impacts to grid reliability

Energy in the ERCOT Region - 2014

ERCOT Generation Capacity by Fuel (% and GW)



Coal Capacity by Age and Controls



SCR = Selective catalytic reduction
 SNCR = Selective non-catalytic reduction

Generation Development in ERCOT

Projects Currently in the Interconnection Queue:

Fuel Type	Screening Study (MW)	Full Study (MW)	IA Executed (MW)	Total (MW)
Natural Gas	4,594	16,694	9,574	30,862
Coal	0	0	240	240
Wind	1,400	13,276	9,256	23,932
Solar	620	5,420	385	6,425
Storage	0	594	0	594
Total	6,614	35,984	19,455	62,053

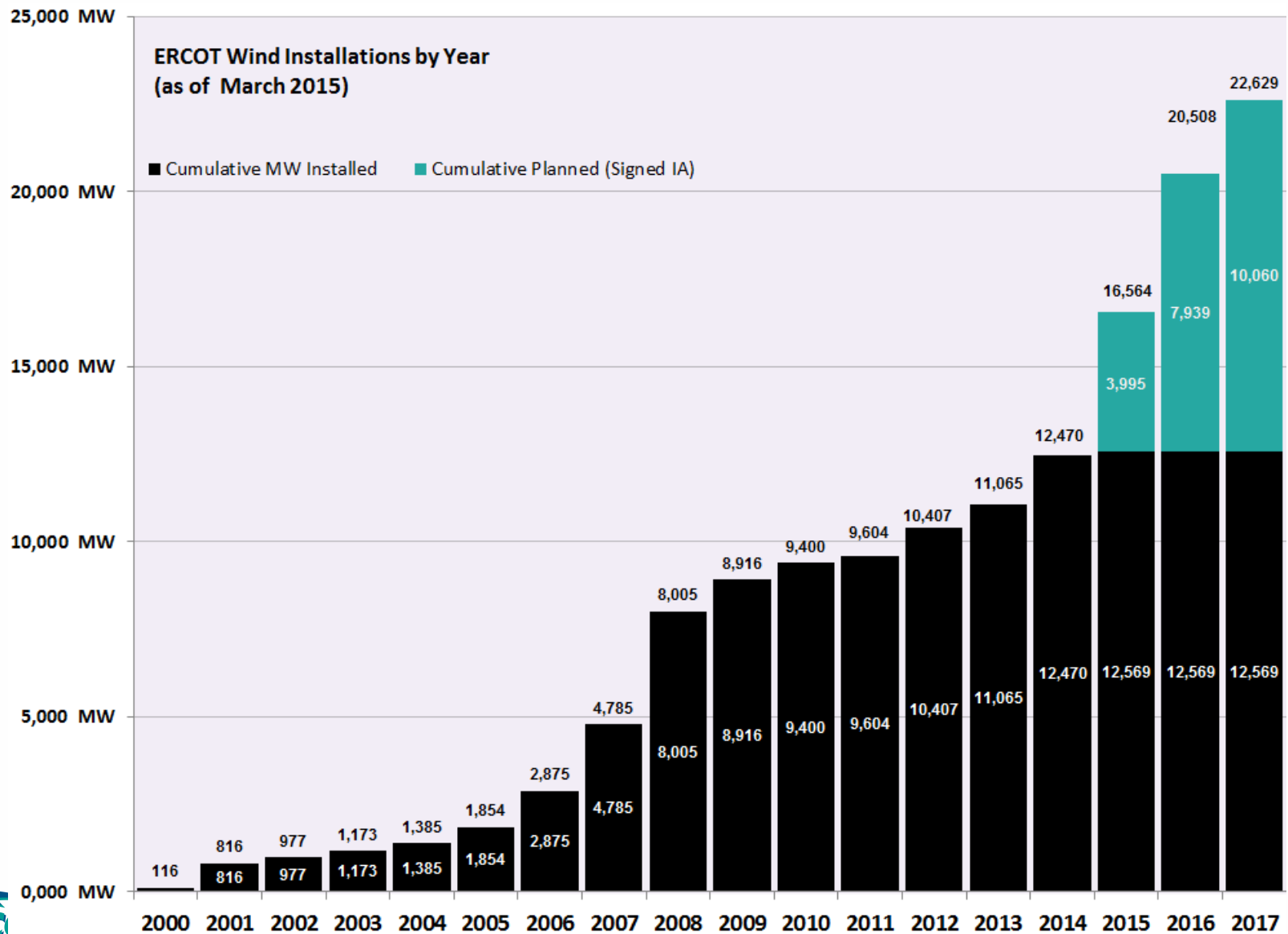
Information available at the Resource Adequacy page on the ERCOT web-site:

<http://www.ercot.com/gridinfo/resource/index.html>



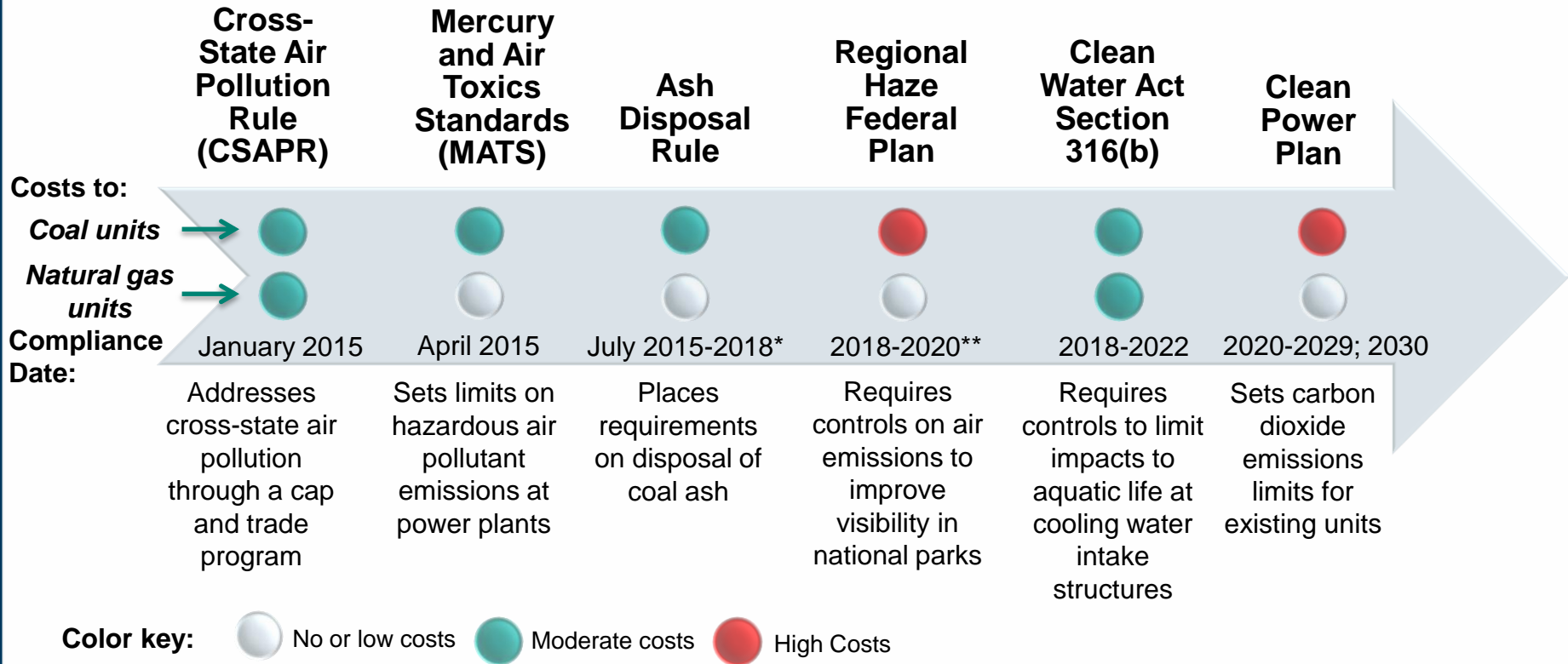
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Wind Generation Development in ERCOT



Environmental Regulations

- There are several proposed and recently finalized environmental regulations that could impact grid reliability in ERCOT:

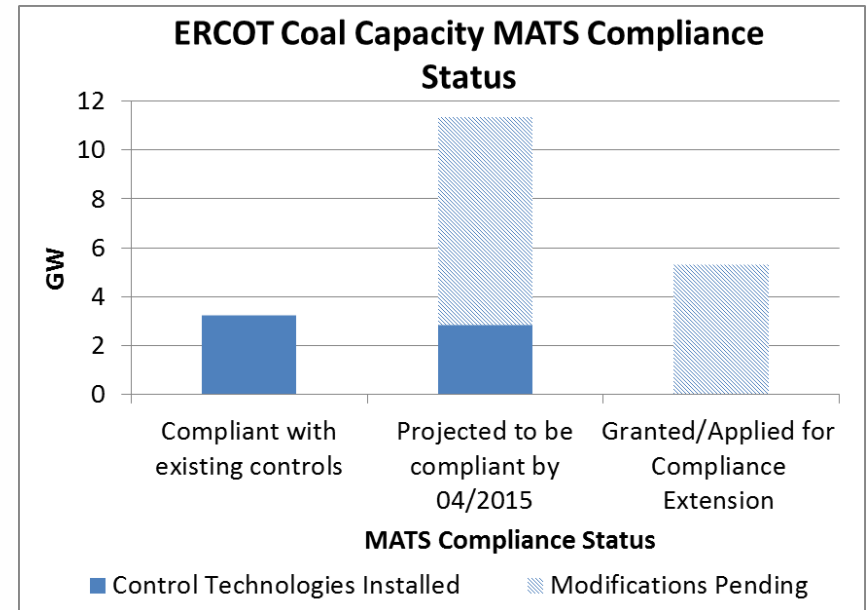


*Longer timeframes for facilities required to close. Does not include the proposed Steam Electric Effluent Limitation Guidelines (ELG) rule.

**Subject to timing of final rule

Generator Survey Results

- **CSAPR:** Over half of coal capacity predicted some action necessary for CSAPR compliance*
 - Most natural gas units did not anticipate that compliance actions would be required
- **MATS:** Most coal units reported compliance strategies
 - Many had not yet implemented modifications at time of survey
 - Several units have obtained extensions from TCEQ
- **Ash disposal rule:** Many coal units reported they would need to take some action to comply**
- **CWA 316(b):** 43 units (14,200 MW) reported they may need to make modifications for compliance
- **Regional Haze & Clean Power Plan:** Survey responses indicated unit emissions rates and installed controls***



*The survey was distributed prior to the U.S. Court of Appeals ruling granting EPA's motion to lift the stay on CSAPR in October 2014.

**The survey was distributed prior to the publication of the final coal ash disposal rule in December 2014.

***Due to the timing of the Regional Haze proposal (November 2014) and the uncertainty of compliance options for the Clean Power Plan, it was not possible to ask more specific questions about unit compliance strategies for these regulations at the time of the survey.

Simulation Methodology

- Used ERCOT stakeholder-vetted methodologies consistent with ERCOT's Long Term System Assessment (LTSA)
- Modeled six scenarios:

Scenario	Regulations Included in Scenario		
	CSAPR	Regional Haze	CPP
1. Baseline			
2. CSAPR Limits	✓		
3. CSAPR Limits and Regional Haze	✓	✓	
4. CSAPR and CO ₂ Limits	✓		✓
5. CSAPR Prices and \$20/ton CO ₂ Price	✓		✓
6. CSAPR Prices and \$25/ton CO ₂ Price	✓		✓

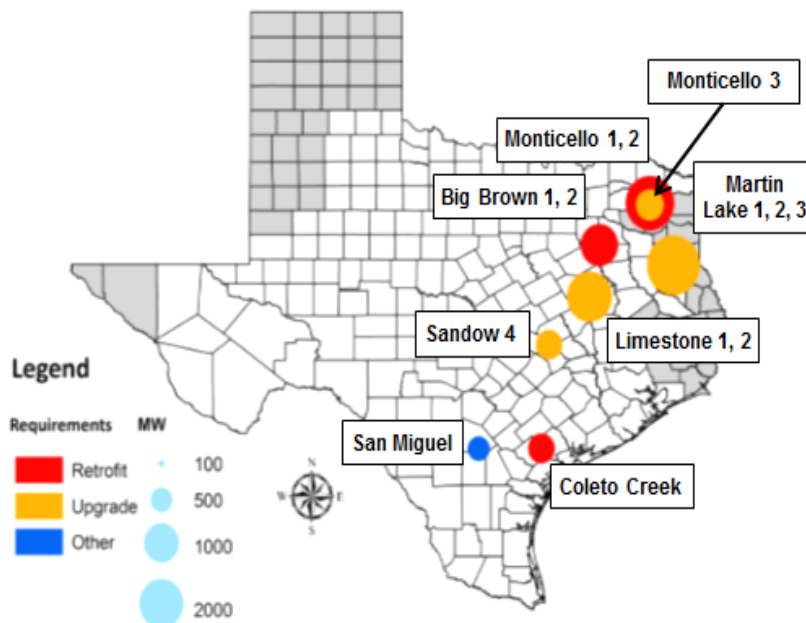
- Modeled Regional Haze by adding costs of scrubber retrofits for affected units
- Modeled Clean Power Plan as a limit and as an emissions fee
 - Scenario with emissions limit allows model to select the most cost-effective way to achieve compliance, similar to EPA's methodology
 - Scenarios with emissions fees simulate a potential approach to achieve compliance, and allow an initial assessment of likely increases in wholesale power prices

Grid Simulation Results

ERCOT study results with Regional Haze Implementation

- 3,000 to 8,500 MW of coal unit retirements over next 5 to 7 years

Regional Haze Affected Units in ERCOT



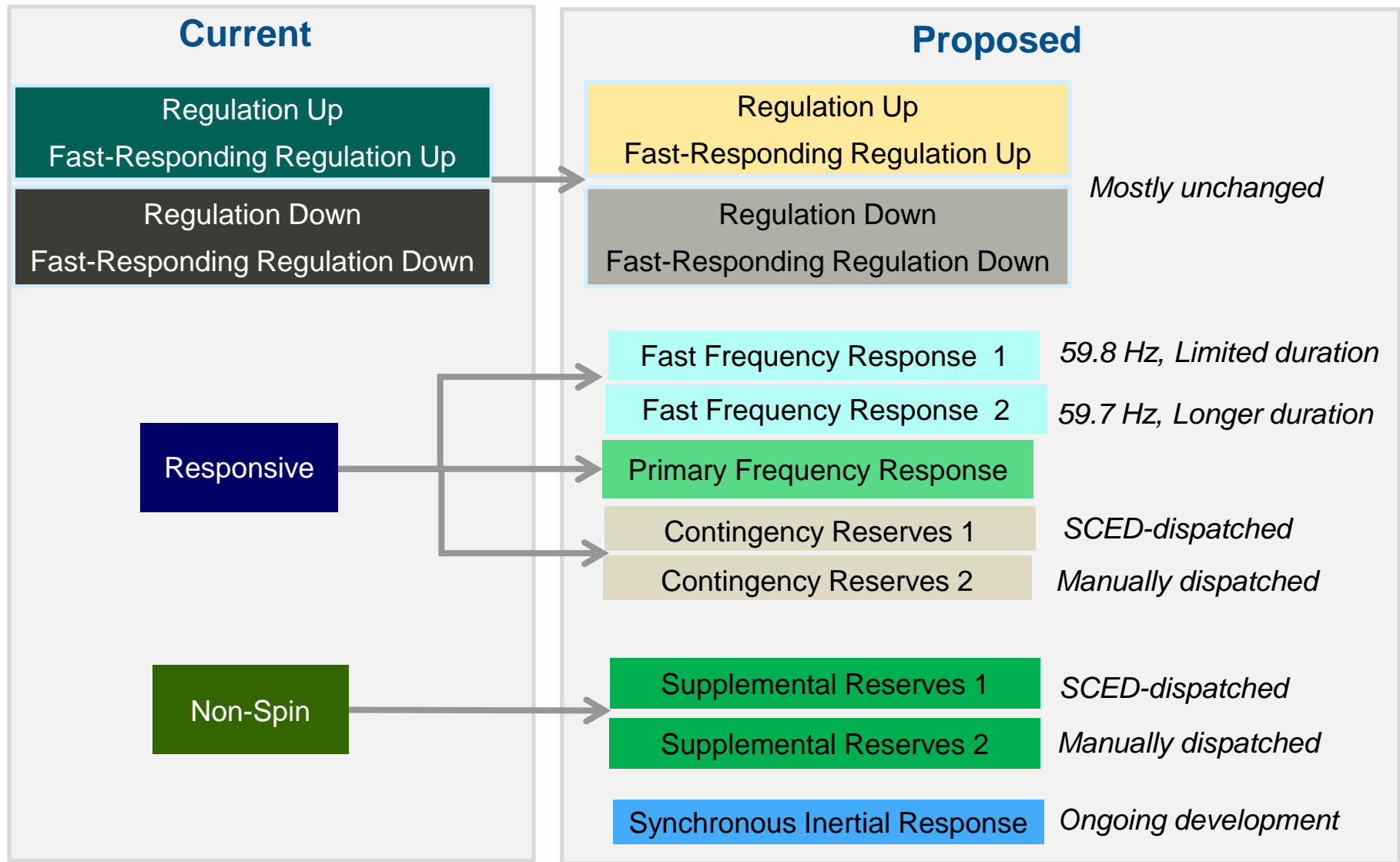
ERCOT study results with Clean Power Plan Implementation

- Up to 9,000 MW of coal unit retirements by 2022
- 33,000 MW total renewable capacity in scenarios with Clean Power Plan
- Includes over 15,000 MW renewable capacity additions, most of which is solar

Possible Grid Impacts

- Resource Adequacy: if future unit retirements occur without sufficient notice for the market to respond with new investment, there could be periods with reduced reserve margins and increased risk of system scarcity events.
- Transmission Reliability: the retirement of legacy units may result in localized transmission constraints that may affect transmission reliability and grid congestion.
 - Transmission improvements require four to five years for planning, routing approval, and construction.
 - Reliability-Must-Run contracts may not be an option if units are retired for environmental compliance reasons.
- Renewables Integration: while ERCOT has been very successful at integrating renewable generation, grid operations with the levels of renewables seen in future scenarios will be a challenge. At high levels of renewable penetration, any must-take requirements on renewable output to achieve environmental compliance goals could affect grid reliability.

Summary of Proposed Future Ancillary Services



Questions?

