



## **Item 8.1.2: West Texas Synchronous Condenser Project**

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Reliability and Markets Committee Meeting

ERCOT Public  
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# Synchronous Condensers in West Texas

- **Purpose**

- Provide an update on the study that identifies the need for the addition of synchronous condensers in West Texas

- **Voting Items / Requests**

- No action is requested of the R&M Committee or Board; for discussion only

## Key Takeaways:

- Synchronous Condensers are uniquely suited devices that provide a variety of grid support.
- System strength issues are an emerging nationwide issue.
- Synchronous Condenser Project is one part of an overall strategy to strengthen the West Texas part of the ERCOT system.
- Synchronous Condenser additions add measurable improvements to system strength and resiliency.
- The ERCOT recommendation will be followed by Transmission Service Provider (TSP) submitted Regional Planning Group (RPG) projects to install the six synchronous condensers.

# Synchronous Condensers

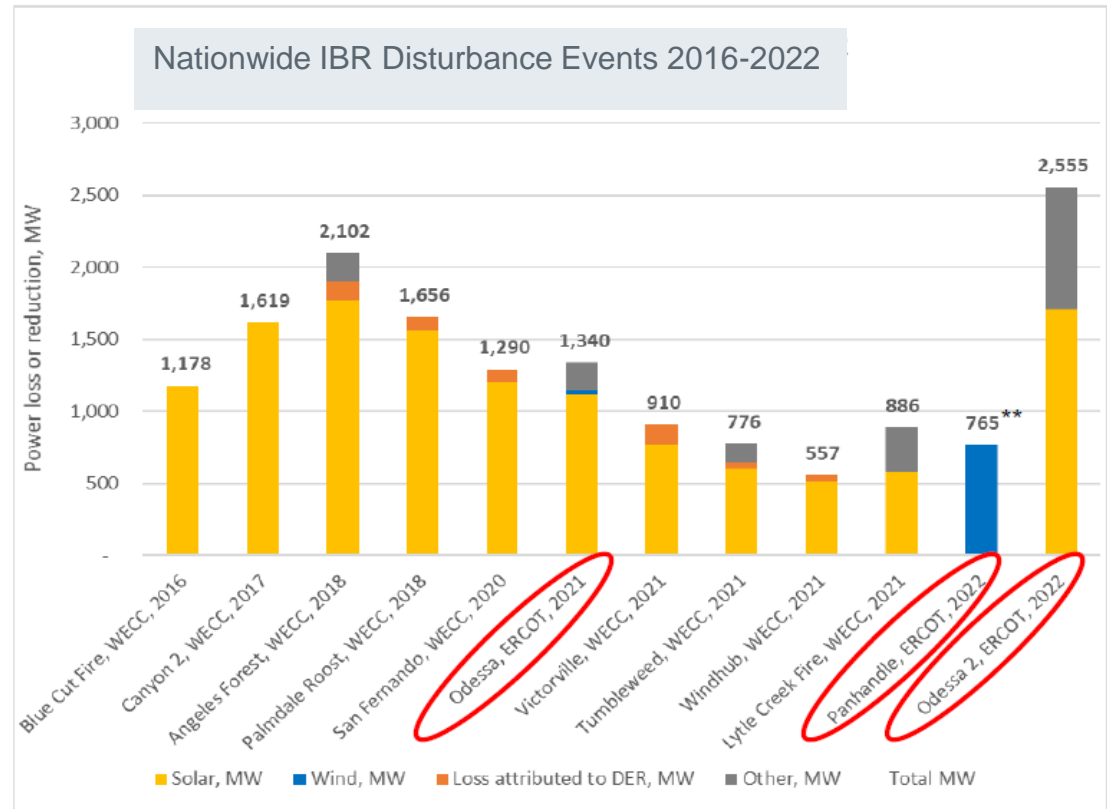
- A synchronous condenser is basically a large motor that has the ability to reinforce the transmission grid through: (1) dynamic voltage support; (2) inertia; and (3) system strength support, similar to a synchronous generator, but without MW injection.
- Two synchronous condensers were installed in 2018 at ERCOT Panhandle to provide the required voltage and system strength support.

Device	MW	Dynamic Reactive Support	System Strength	Inertia
Synchronous Generator	x	x	x	x
Statcom/SVCs		x		
Synchronous Condensers		x	x	x
Inverter-base Resource (grid following)	x	x		

**Key Takeaway:** Synchronous Condensers are uniquely-suited devices that provide a variety of grid support.

# System Strength in West Texas

- Inverter-based resources (IBRs) in West Texas have experienced rapid and continued growth
- Because the West Texas area (WTX) has a prevalence of IBRs and few synchronous generation resources, system strength is low in the area.



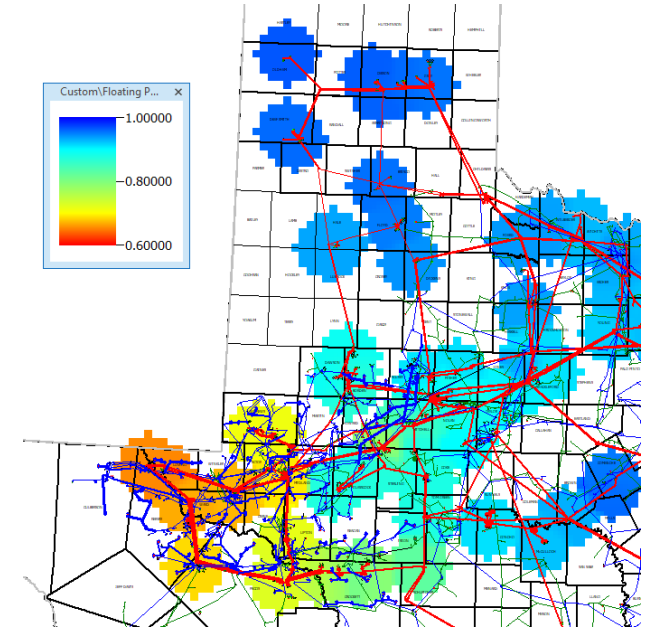
- Faults in the area result in widespread low voltages, and the risk that a large number of IBRs do not ride-through these faults (e.g., Odessa events)

**Key Takeaway:** System strength issues are an emerging nationwide issue



# Purpose of the Synchronous Condenser Project

- The purpose of the project is to strengthen the West Texas system and reduce the reliability risk by:
  - limiting the number of IBRs that would be subjected to conditions that could result in a large number of unit trips for any single fault, as well as
  - providing resilience for IBR control and model uncertainty
- ERCOT is also working on enhancing requirements for IBRs to ride-through such events (NOGRR 245). This NOGRR is targeted for approval at the October Board.
- Both improvements are needed to mitigate the widespread IBR trips; neither is sufficient alone
- This project is not intended to increase transfer capability related to the GTCs in WTX. GTC exit strategies require additional transmission construction.
- Changes to how Large Loads are interconnected and additional requirements for inverter based resources will also help strengthen the West Texas part of the ERCOT grid.



**Key Takeaway:** Synchronous Condenser Project is one part of an overall strategy to strengthen the West Texas part of the ERCOT system.

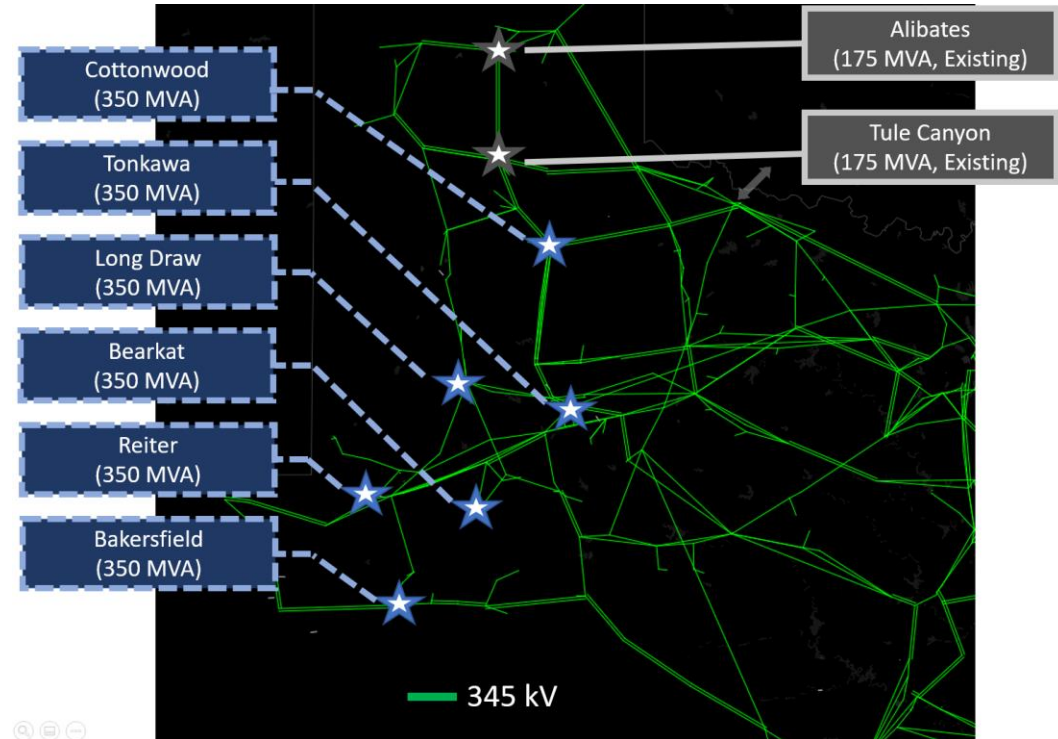
## Key Findings: Study Results

- Condensers at six locations (a total of 2,100 MVA) were identified to provide effective improvement to West Texas (WTX) part of the ERCOT grid.
- Adding condensers at these six locations provides significant improvement in system responses for critical faults even under stressed system conditions:
  - Average enhancement of 11% in the system strength (voltage stiffness, measured in the WTX short circuit current level)
  - Average reduction of 21% in the number of 345-kV and 138-kV buses and 22% in IBRs that encounter severe voltage dips (less than 0.85 p.u.) during major transmission faults in the WTX region
  - Adding even more synchronous condensers may offer some marginal improvement, however the potential benefits (e.g., voltage dip) are anticipated to be diminished

**Key Takeaway:** Synchronous Condenser additions add measurable improvements to system strength and resiliency.

# Conclusion and Recommendation

- ERCOT recommends synchronous condensers at the following six 345 kV substations; Cottonwood, Tonkawa, Long Draw, Bearkat, Reiter, and Bakersfield
  - Approximately 350 MVA capacity at each location
  - Around 3,600 Ampere (A) of three-phase fault current contribution to the 345-kV point of interconnection (POI)
  - A combined total inertia of 2,000 MW-seconds (MW-s) or above at each location, incorporating synchronous condenser with flywheel for frequency support



**Key Takeaway:** The ERCOT recommendation will be followed by TSP submitted RPG projects to install the six synchronous condensers.

## Next Steps

- TSPs (Oncor, LCRA TSC, WETT) are preparing for the RPG submittal(s)
- Cost estimates and in-service dates will be provided by TSP's RPG submission
- ERCOT may use this study in lieu of ERCOT Independent Review and seek endorsement from the Board