

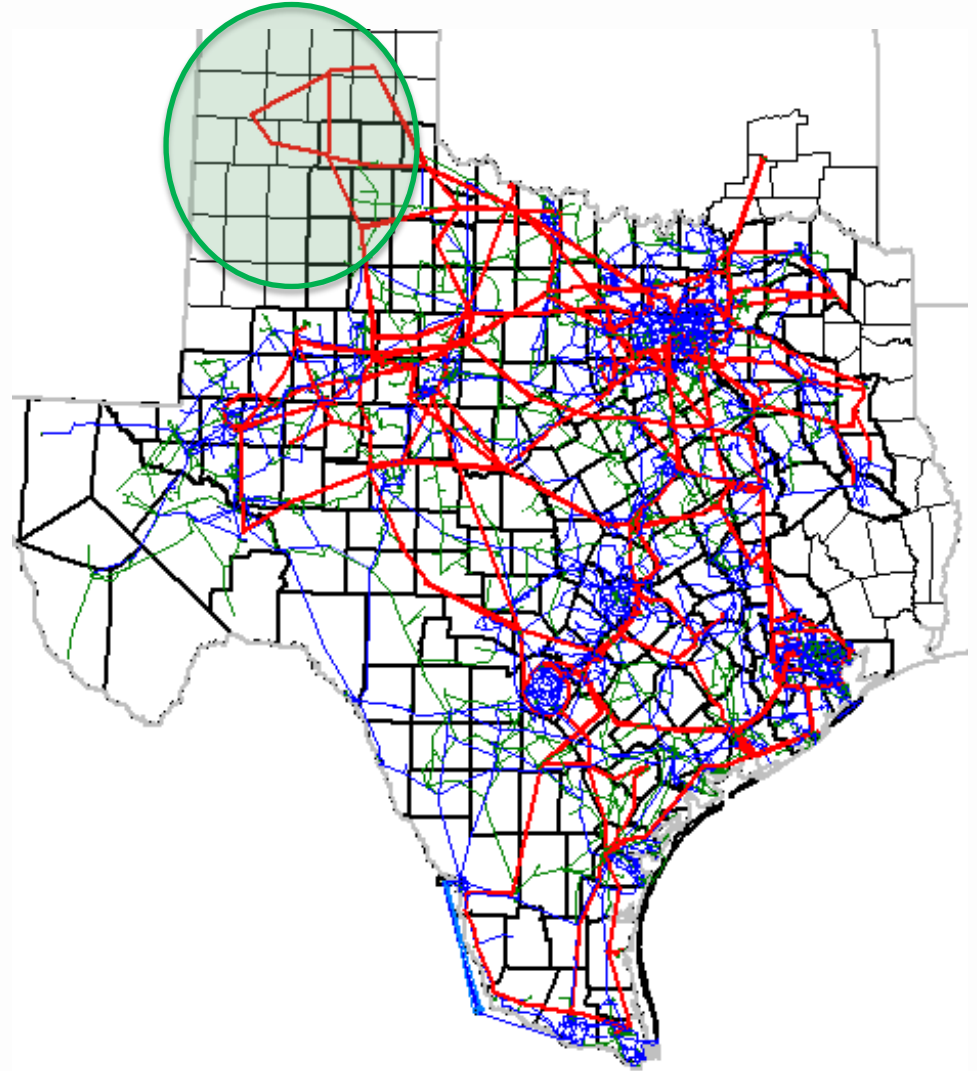


Synchronous Condenser Needs

ERCOT System Planning
ERCOT Regional Planning Group (RPG) Meeting
11-15-2013

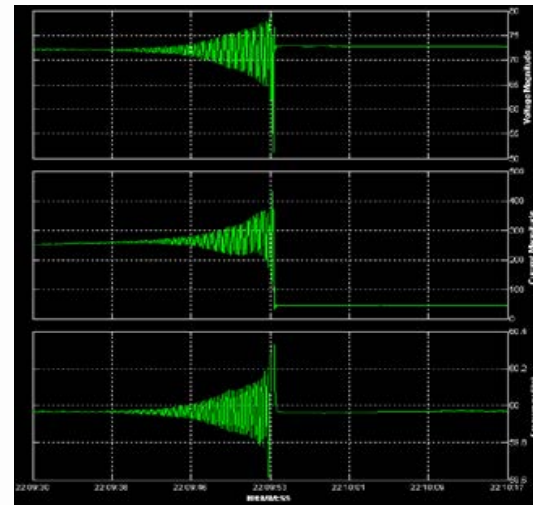
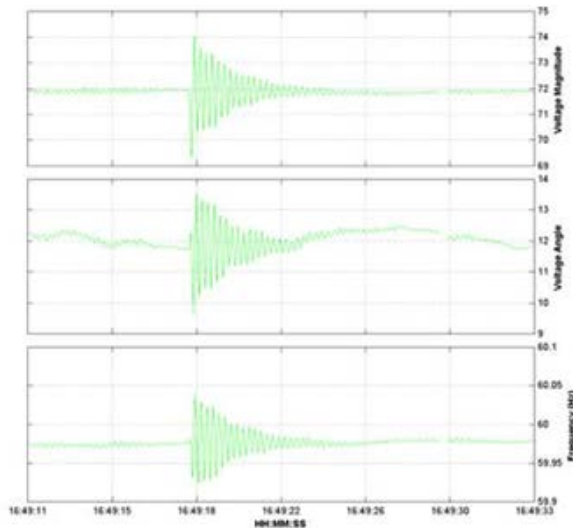
Panhandle Grid Characteristics

- Minimal/no local load
- Minimal/no sync generation
- 11 GW wind capacity in GINR
- Voltage stability and grid strength challenges
- Low short circuit ratio



Weak Grid Challenge

- Weak: low short circuit contribution
- Stability challenges are typically due to the transfer constraints, not thermal limits.
- Control and coordination of power electronic sources becomes difficult
- Example: wind farm control challenge under weak grid condition (actual PMU measurement)



Synchronous Condenser

- Synchronous machine operating without a prime mover.
- Provide reactive power compensation and additional short circuit power capacity.
- Provide inertia support

Synchronous Condenser Concerns

- New or re-power synchronous machine as condenser
 - Cost, maintenance, reliability, and operation performance
- Performance
 - Start up / Shunt down
 - Steady state (normal operation), Dynamic (disturbance)
 - Power consumption
- Sub-synchronous oscillation