Long-Term West Texas Export Special Study - Update

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Outline

- Progress Update
- Preliminary Results and Observations
- Next Steps

Progress Update

Tasks	Description	Status	Comments
1	Study Case Developments	In Progress	Steady State Cases (Complete) Economic Cases (Complete) Dynamic Cases (In Progress)
2	Year 2030 Simulation and Improvement Identification	In Progress	
3	Year 2023 Simulation and Improvement Identification	In Progress	
4	Roadmap Development	Not Started	
5	Reports	Not Started	

Preliminary Study Cases Overview

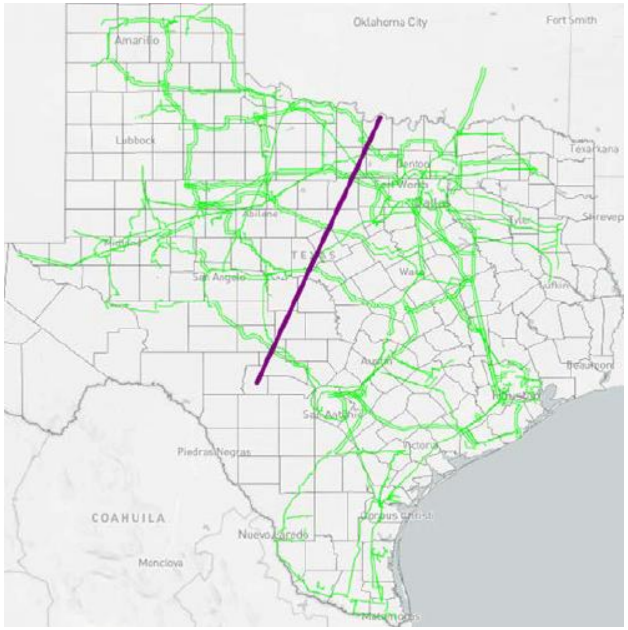
Scenarios	Wind Capacity	Solar Capacity	Battery Capacity	System Load in the Reliability Case
2023[(1)]	~37 GW	~15.5 GW	~1.3 GW	~42 GW
2030[(2)]	~60 GW	~27.7 GW	~1.9 GW	~48 GW

(1). Include planned projects met Planning Guide 6.9(1) by 12/31/2020

(2). Based on the 2020 Long Term System Assessment Y2030 Current Trends scenario

Assumptions

- West Texas (WTX) export flow in the base case is measured as the sum of the flow on the existing 16 345 kV circuits
  - Riley – Krum West Switch DCKT 345 kV
  - Jacksboro Switching – Willow Creek Switch and Jacksboro Switching – Henderson Ranch Switch DCKT 345 kV
  - Graham SES – Parker Switch DCKT 345 kV
  - Clear Crossing – Willow Creek Switch DCKT 345 kV
  - West Shackelford Station – Sam Switch and West Shackelford Station – Navarro DCKT 345 kV
  - Brown Switch – Killeen Switch DCKT 345 kV
  - Big Hill – Kendall DCKT 345 kV
  - Jacksboro Switching – Krum West Switch SCKT 345 kV
  - Comanche Switch – Comanche Peak SES SCKT 345 kV



For illustration purpose

Assumptions (continued)

- Reliability Assessments
  - Energy Storage Resources (ESRs) are dispatched at 0 MW with voltage support capability
  - Synchronous generators in West Texas are assumed offline under high West Texas export transfer condition
- Economic Assessments
  - 90% of the calculated stability limit is applied in the economic assessments, which is consistent with the Transmission and Security Operating Procedure

Consideration of Improvements

- Identify cost-effective system improvements to provide both near-term and long-term benefits to address the following challenges and improve WTX export capability
  - Steady state thermal and voltage constraints
  - Stability constraints
  - Curtailment

Preliminary Observations: Steady State Voltage Stability Assessment

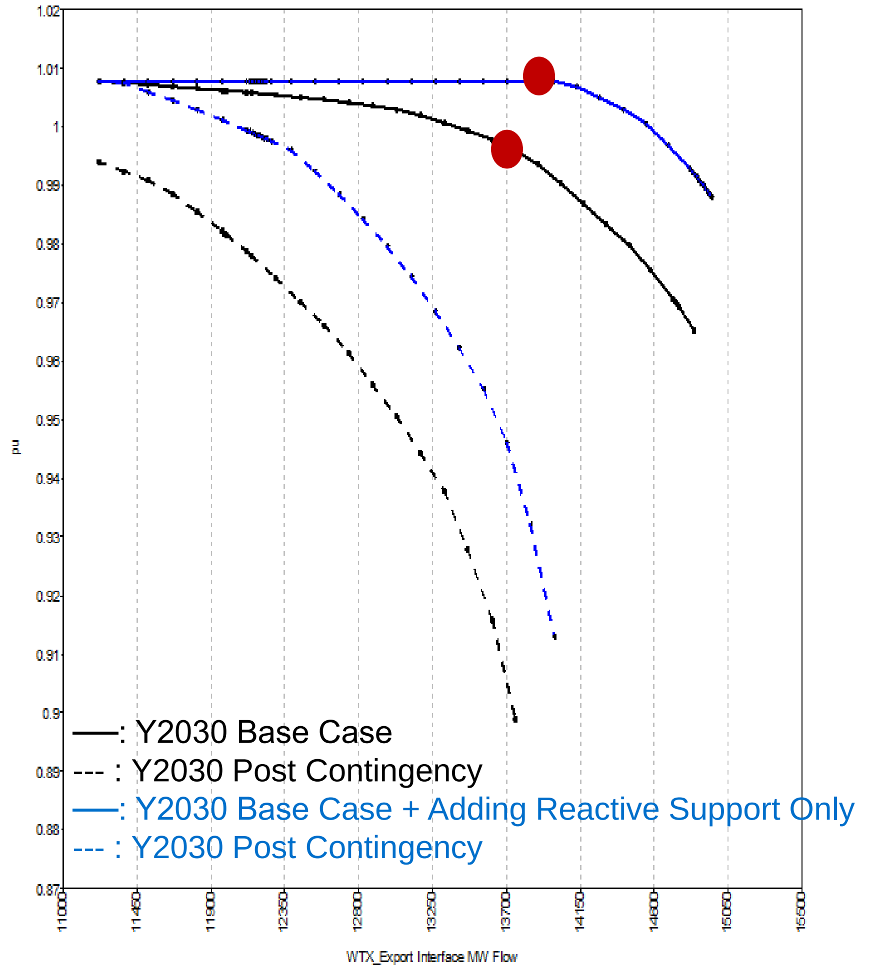
- Estimated West Texas export capability (flow on the existing 16 345 kV circuits)
  - Y2023: ~12.3 GW
  - Y2030: ~13.7 GW

  - The improvement of transfer capability in Y2030 could be due to the additional projected resources included in Y2030

Preliminary Observations: Steady State Voltage Stability Assessment

1. Voltage instability (collapse) occurs at voltage levels within acceptable operational voltage range
2. Impact of adding reactive support only
   – Improve transfer capability but may not be effective (>1 MVAr/MW)
   – Risk of reducing situational awareness => no/limited voltage decline before voltage collapses
3. Dynamic simulation could identify more restrictive voltage stability limits

Selected West Texas 345 kV Bus Voltage



Preliminary Observations: Steady State Voltage Stability Assessment

- A new 345 kV double-circuit export path is estimated to provide ~1GW increase in WTX transfer capability - impact can vary depending on but not limited to:
  - The location of new path
  - The length of new path
    - In short lines, line rating usually limits the power transfer on a line
    - In longer lines, voltage drop and angle separation, primarily due to line impedance, limit the power transfer on a line

$$P = \frac{V_S V_R \sin \delta}{X_L}$$

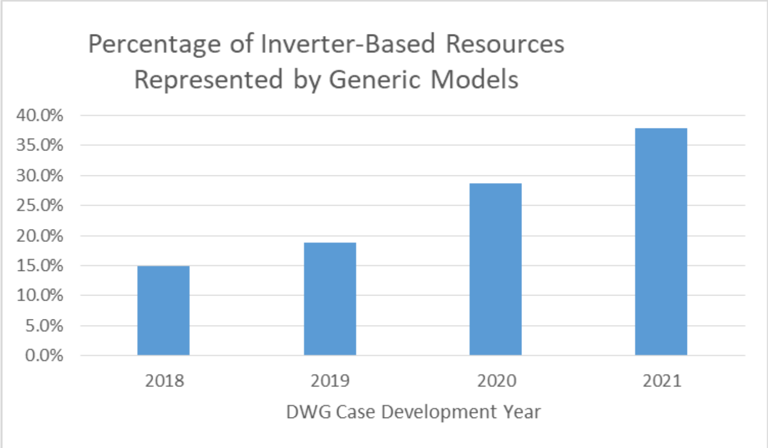
  - Additional non-wire improvement options like reactive support devices
  - Different technology such as low impedance EHV circuits (345-kV, 500-kV, etc.) or VSC-HVDC

Preliminary Observations: Dynamic Stability

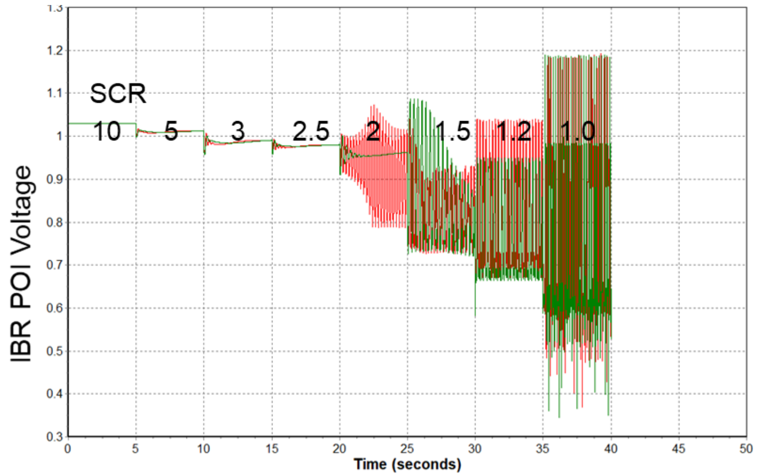
- Increasing Inverter-Based Resources (IBRs, including wind, solar and battery) use generic models
  - In this study, a placeholder model will be used for the projected resources and existing resources if needed to mitigate the numerical instability issue

- Approved PGRR075 and PGRR085 in 2020 and 2021 on **dynamic model quality and validation tests** would help Resource Entities and Interconnection Entities identify and address model issues before submitting models

http://www.ercot.com/mktrules/issues/PGRR075
http://www.ercot.com/mktrules/issues/PGRR085
http://www.ercot.com/content/wcm/lists/168284/ERCOT_Model_Quality_Guideline.zip



Generic model performance under different SCRs



SCR: short circuit ratio, indicator of system strength

Next Steps

- ERCOT plans to complete the study in Q2 2021 and will provide regular updates at future RPG meetings.

Appendix: Methodology