Southern Cross Transmission (SCT) DC Project – Study Results

ERCOT Transmission Planning

ERCOT Regional Planning Group Meeting
March 12, 2019

PUCT Order 46304 Directive 6 and Directive 8

- The purpose of this planning study is to address the following PUCT directives.
  - Directive 6: ERCOT shall study and determine what transmission upgrades, if any, are necessary to manage congestion resulting from power flows over the Southern Cross DC tie, make any necessary revisions to its standards, guides, systems, and protocols as appropriate, and certify to the Commission when it has completed these actions.
  - Directive 8: ERCOT shall (a) study and determine whether Southern Cross Transmission or any other entity scheduling flows across the Southern Cross DC tie should be required to provide or procure voltage support service or primary frequency response, or their technical equivalents, (b) implement any necessary revisions to its standards, guides, systems, and protocols, as appropriate, and (c) certify to the Commission when it has completed these actions. (Note: primary frequency response has already been addressed by another ERCOT study)

Study Objectives

Study Scenarios (Steady State and Dynamic Stability)	Summer Peak	350 MW Import
	HWLL	2100 MW Export
Sensitivity Scenarios (Dynamic Stability Only)	Summer Peak	2000 MW Import/ 2100 MW Export
	HWLL	2000 MW Import/ 2100 MW Export

- This presentation addresses:
  1. SCT transfer limits without upgrades
  2. Transmission upgrades required to achieve SCT study scenario transfers based on the developer-provided SCT capability
  3. Transmission upgrades required to achieve SCT study scenario transfers assuming SCT is required to provide voltage support service (VSS) per Nodal Protocol 3.15
  4. Additional transmission upgrades required to achieve SCT sensitivity scenario transfers

1. SCT Transfer Limits Without Upgrades

SCT Transfer Limits[3]		Assessment	Violation	
Direction	Flow MW		Type	Contingency
Import to ERCOT	~ 540	Steady State/Dynamics	Thermal Overload (1)	NERC P7
Export from ERCOT	~1300	Steady State/Dynamics	Voltage Collapse (2)	NERC P7

(1) Based on 2% Power Transfer Distribution Factor (PTDF) and Outage Transfer Distribution Factor (OTDF) cutoffs
(2) Voltage Collapse is assumed at 0.80 p.u. voltage
(3) For this transfer limit analysis, generation re-dispatch was not attempted to solve the identified thermal overload.

2. Directive 6: Transmission Upgrades (Study Scenario Transfers)(Developer-Provided SCT Capability)

Study Scenarios (Steady State and Dynamic Stability)	Summer Peak	350 MW Import
	HWLL	2100 MW Export

- Two short-listed transmission upgrade options were identified to meet the SCT study scenario transfers

Option	Description
A	• 3 x 175 Mvar Synchronous Condensers at 345 kV Panola Substation • 540 Mvar Dynamic Reactive Device at 345 kV Rusk Substation
B	• A new 38 mile double-circuit 345 kV line from Martin Lake to Panola • 2 x 175 Mvar Synchronous Condensers at 345 kV Panola Substation

*The synchronous condensers are considered to provide both the dynamic reactive support and system strength required to support the SCT LCC-HVDC transfers on the ERCOT grid
**The selection and implementation of dynamic reactive devices at Rusk (SVC, STATCOM, or Sync Condenser) will be determined by the TSPs and shall be reviewed by ERCOT.

2. Comparison of Transmission Upgrade Options (SCT Study Scenario Transfers)

Based on Developer Provided SCT Capability		
Items	Option A	Option B
Achieve Study Scenario Transfers	Yes	Yes
Estimated SCT Export Limits	2100 MW	2100 MW
Estimated SCT Import Limits	~ 540 MW	~ 530 MW
Cost Estimates*	$182 - 202 Million	$185 - 205 Million
Additional Right-of-Way Requirement	No	~ 38 miles
Operation Flexibility	--	Better

* The cost estimates were based on the inputs from TSPs

3. Directive 8 (VSS): Transmission Upgrades (SCT Study Scenario Transfers)

- If SCT is assumed to meet the Voltage Support Service as required in the ERCOT Nodal Protocol Section 3.15.
  - SCT was modeled with 690 Mvar Synchronous Condensers

Option	Description	Cost Estimates
Mod-A	• 480 Mvar Dynamic Reactive Device at 345 kV Rusk Substation	$70 – 90 Million (1)
Mod-B	• A new 38 mile double-circuit 345 kV line from Martin Lake to Panola	$102-123 Million

(1) This cost estimate is based on 2*275 Mvar dynamic reactive devices.
*The synchronous condensers are considered to provide both the dynamic reactive support and system strength required to support the SCT LCC-HVDC transfers on the ERCOT grid
**The selection and implementation of dynamic reactive devices at Rusk (SVC, STATCOM, or Sync Condenser) will be determined by the TSPs and shall be reviewed by ERCOT.

4. Additional Transmission Upgrades (SCT Sensitivity Scenarios)

Sensitivity Scenarios (Dynamic Stability Only)	Summer Peak	2000 MW Import/ 2100 MW Export
	HWLL	2000 MW Import/ 2100 MW Export

- Angular instability was identified for East Texas generators at high SCT import levels.
- In addition to the identified transmission upgrades required to achieve the target transfer levels, a new EHV (e.g. 345 kV) transfer path between East and North Central Texas would be required to address the angular instability at full import capability.

4. Additional Transmission Upgrade Options (SCT Sensitivity Scenarios)

- Three short-listed transmission upgrade options were identified to meet the SCT sensitivity scenario transfers
- These options were only studied for dynamic stability

Option	• Description
Sen-A	• A new 92 mile single-circuit 345 kV line from Rusk to Trinidad
Sen-B	• A new 81 mile single-circuit 345 kV line from Rusk to Forest Grove
Sen-C	• A new 23 mile single-circuit 345 kV line from Nacogdoches to Herty North to Lufkin • A new 117 mile single-circuit 345 kV line from Lufkin to Jewett

QUESTIONS?

Please submit comments to: ben.richardson@ercot.com

Appendix

- Presented Scope at April 2018 RPG: http://www.ercot.com/calendar/2018/4/24/138683-RPG
- Scope Revision, Assumptions, Status Update at November 2018 RPG: http://www.ercot.com/calendar/2018/11/27/138709-RPG