

Study to Identify Impact on Frequency Overshoot due to Southern Cross DC Tie Trip while Exporting

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This report summarizes the study and approaches which ERCOT is undertaking to evaluate what modifications to existing and additional ancillary services, if any, are necessary for the reliability interconnection of the Southern Cross DC tie.

# Regulation Up and Down Service

Per the current methodology, two factors influence how much the minimum amount of Regulation Up/Down service will be needed: the 5-min variations of net-load and historical regulation resource deployment. With the interconnection of SCT, ERCOT believes that the ideal solution would be to impose ramp restrictions (these are addressed in [Directive 3](http://www.ercot.com/mktrules/puctDirectives/southernCross/159967)) and to fully integrate DC Tie schedules into ERCOT Generation To Be Dispatched (GTBD) calculation. Although this approach will need to be formally approved by stakeholders as part of a broader evaluation of Directive 3 along with the Regulation Service component of Directive 9, these changes would ensure that the interconnection of the Southern Cross DC tie will not have any impact on the quantities of Regulation Up and Down services.

# Non-spinning reserve services (NSRS)

When determining the minimum amount of NSRS, per the current AS Methodology ERCOT will apply a floor on the final Non-Spin requirement equal to the largest unit (MSSC). This floor will only be applied to On-Peak Hours, which are hour ending 7 through 22. NERC’s BAL-002 Standard requires ERCOT to determine ERCOT’s MSSC. Per BAL-002-2, MSSC is the Balancing Contingency Event that would result in the greatest loss of resource (MW) output which is currently 1375 MW.

Scenario 1:

If the SCT DC Tie is limited to imports equal to or less than the existing ERCOT MSSC (1375 MW), then no MSSC change is required upon interconnection of the SCT DC Tie. **Therefore there would be no impacts to NSRS requirements that are based on the current MSSC.**

Scenario 2:

ERCOT’s MSSC will change upon interconnection of the SCT DC Tie i.e. if it is allowed to generally import higher than the current MSSC (1375 MW). If SCT DC Tie is importing at its maximum capacity (2000 MW), the new floor for Non-Spin requirement for current AS Methodology will be 2000 MW, which would result in additional NSRS needed for the year of 2018, as depicted in Fig 1.



Fig. 1. Additional NSRS needed (MW) for the year of 2018 if MSSC becomes 2000 MW

# Responsive Reserve services (RRS)

There is no impact of SCT DC Tie on RRS when it is importing (treatment similar to a generator). A trip of the DC Tie while importing could cause frequency to decline similar the Generator trip. On the other hand, losing DC Tie while exporting could lead to a frequency overshoot. The current RRS study methodology and requirements are designed to protect frequency only for loss of generation event.

## SCT DC Tie Operating in Importing Mode

Per the current RRS methodology, the RRS quantity to be procured at ERCOT is determined to cover the risk for the instantaneous loss of 2750 MW (per NERC BAL-003 Resource Contingency Criteria (RCC)). As the maximum importing capacity of SCT DC Tie (2000 MW) does not exceed 2750 MW, the current RRS quantitates remains sufficient after SCT DC Tie is integrated. This could be subject to future changes if NERC revises the RCC definition[[1]](#footnote-1).

# SCT DC Tie Operating in Exporting Mode

The loss of SCT DC Tie operating in exporting mode could cause a frequency overshoot. It is considered as a reliability concern if the frequency overshoot is too high, leading to a cascading effect by tripping generator on over-speed protections. The magnitude of frequency overshoot depends on system inertia level, number of generators with governor response capability, and the capacity available to provide downward frequency response.

A dynamic simulation study will be conducted to examine the effect of the frequency overshoot as a result of SCT DC Tie trip when it is exporting power. The key assumptions are summarized as follows.

1. The lowest inertia case (130 GW·s) will be built to represent the worst case scenario. As such, the base case (power flow) from a previous operation condition on 10/27/ 2017 3:00 am will be used. Detailed case information is summarized in Table 1.

Table 1. Case Information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Time Stamp | Inertia (GW\*s) | Load (MW) | Wind  (MW) | Synchronous Gen (MW) |
| 10/27/2017 3:00 AM | 130 | 28558 | 15253 | 13593 |

1. The SCT DC tie will be assumed to be exporting at 2100 MW.
2. All governors of on-line synchronized generators will be in service to provide frequency response.
3. The study will also simulate primary frequency response from wind generation at 0GW, 5GW, 10 GW, 15 GW and 20 GW output. Please note roughly 80% of wind in ERCOT is primary frequency response capable.
4. The maximum allowed high frequency is 60.6 Hz. Below is a snapshot of ERCOT generation resources’ over-frequency characteristics from the operating guide.

Table 2. Generation Resources Over-Frequency Trip



1. In the scenario, where frequency overshoot exceeds 60.6 Hz, additional sensitivity studies will be conducted to identify the maximum limit on the export (less than 2100 MW).

1. [Project 2017-01 Modifications to BAL-003-1.1](https://www.nerc.com/pa/Stand/Pages/Project201701ModificationstoBAL00311.aspx) is currently reviewing the Resource Contingency Criteria (RCC) [↑](#footnote-ref-1)