**February 5, 2019**

**Southern Cross Transmission Comments**

**on Directive 9 ancillary services requirements studies**

Southern Cross Transmission LLC (SCT) appreciates the opportunity to provide these comments regarding ERCOT’s Directive 9 studies regarding ancillary services requirements as discussed at the January 16, 2019 meeting of the Performance Disturbance Compliance Working Group (PDCWG).

**1. Non-Spinning Reserve Service (NSRS)**

**1-1 Removal of the NSRS floor**

The latest draft of the SCT ancillary services impact study (version 10, distributed to the PDCWG by e-mail on Jan. 21, 2019) contains several references to the NSRS floor which is no longer in effect since the Dec. 11, 2018 ERCOT Board decision to remove the floor in the 2019 ancillary services procurement methodology document. The NSRS section of the Directive 9 study document should be revisited and updated.

ERCOT’s response:

The first draft of “SCT ancillary services impact study” began in Oct. 2018, before the ERCOT Board approved the removal of the NSRS floor in the 2019 Ancillary Services Methodology in Dec. 2018. The NSRS section of the Directive 9 study document will be revised to reflect these recent changes to the Ancillary Services Methodology.

**2. Responsive Reserve Service (RRS)**

**2-1 Resource Contingency Criteria (RCC)**

ERCOT appears to have offered two different understandings of the relationship between the SCT DC Tie and ERCOT’s RCC. In the draft Directive 9 study report presented at the September 2018 PDCWG meeting (version 2), ERCOT stated on page 3, “Per the current RRS methodology, the RRS quantity to be procured at ERCOT is determined to cover the risk for the instantaneous loss of 2,750 MW (per NERC BAL-003 RRC). As the maximum importing capacity of the SCT DC Tie (2000 MW) does not exceed 2,750 MW, the current RRS quantities remain sufficient after the SCT DC Die is integrated. This could be subject to future changes if NERC revises the RCC definition.”

However, in version 10 of the draft report circulated to the PDCWG in January 2019, ERCOT wrote in Section 3.3 (there are no page numbers on draft v10), “NERC has explained that ERCOT’s RCC is based on largest N-2 loss-of-resource event criteria. Currently, the loss of 2 STP units is recognized as the largest N-2 loss-of-resource event and as a result ERCOT’s current RCC is 2,750 MW. Upon interconnection of the SCT DC Tie there is a potential that ERCOT’s RCC may change.” In the accompanying footnote, ERCOT notes that NERC is currently reviewing the RCC definition.

These are obviously two different statements and Southern Cross Transmission assumes ERCOT now believes the most recent version is accurate. But ERCOT’s evolving understanding raises a number of questions:

The Oct. 2012 NERC document cited by ERCOT updating its understanding of the RCC definition does not, in fact, say “N-2 loss-of-resource event criteria” as stated by ERCOT in Section 3.3. Rather, it states that for ERCOT, the RCC “would be the loss of the two largest generating units in the interconnection.” The applicable N-2 event for each of the 3 North American Interconnections are all co-sited units (STP 1&2 in ERCOT, Palo Verde 1&2 in the West, and Nelson DC Bi-poles 1&2 in the East). Can ERCOT please explain the basis for its assumption that NERC criteria would require the RCC to be the SCT DC Tie plus one STP unit? Does it matter that the SCT DC Tie and either STP unit will be located hundreds of miles apart? Does it matter that one is a generating unit and the other is a DC Tie? Why or why not?

SCT understands there is a NERC standard drafting process underway for BAL-003 which could alter the RCC definition and therefore understands ERCOT’s reference to that process in the draft report. However, it is not clear to SCT exactly how that standard may change or what such a change would mean to ERCOT and SCT is wary of projecting possible future standards into the current Directive 9 effort, particularly any policy recommendations based upon such a projection.

ERCOT’s response:

ERCOT’s initial draft of the Directive 9 study report relied on Attachment A to NERC Reliability Standard BAL-003-1.1, which shows that the Resource Contingency Criteria (RCC) currently used to calculate ERCOT’s Interconnection Frequency Response Obligation (IFRO) under BAL-003-1.1 is 2750 MW, which is the aggregate capacity of the two largest generating units in the ERCOT Interconnection, South Texas Project units 1 and 2. Subsequently, however, ERCOT determined that the appropriate RCC to use for this study would be the largest N-2 event, which is not necessarily 2750 MW. Under this approach, the introduction of the Southern Cross DC Tie would change the largest N-2 event in the ERCOT System to be the loss of the Southern Cross DC Tie at full import (contingency event one) plus the loss of one of the STP units (contingency event two), which totals 3,375 MW. Under the current language of BAL-003, it is appropriate to view the loss of the Southern Cross DC Tie as a single event because it presents a single point of failure on the system.

This approach is consistent with Attachment A to BAL-003, which explains that “[t]he default [Interconnection Frequency Reserve Obligation (“IFRO”)] listed in Table 1 is based on the resource contingency criteria (RCC), *which is the largest category C (N-2) event* identified except for the Eastern Interconnection, which uses the largest event in the last 10 years.” This conclusion is also supported by NERC’s *2012 Frequency Response Initiative Report* (<https://www.nerc.com/docs/pc/FRI_Report_10-30-12_Master_w-appendices.pdf>), which evaluated the “largest N-2 loss-of-resource event” for each region in recommending IFRO values for each region. As the report notes, ERCOT’s largest N-2 event was at that time, “the loss of the two largest generating units in the interconnection.” However, neither Attachment A nor the report suggests that only the loss of generation would count as a qualifying contingency event.

ERCOT is aware of nothing in BAL-003, including Attachment A, or in any other NERC document, including the 2012 Frequency Response Initiative Report, which suggests that location between contingencies is material to determining the IFRO or the RCC.

ERCOT notes that a NERC standard drafting team is currently reviewing proposed changes to BAL-003 (<https://www.nerc.com/pa/Stand/Pages/Project201701ModificationstoBAL00311.aspx>). If the criteria for determining the RCC changes, ERCOT will need to determine whether the change would impact RRS procurement, and if so, what the impact would be. However, ERCOT cannot speculate as to whether this proposal will ultimately be adopted and, accordingly, ERCOT is proceeding with its study based on the current version of BAL-003.

**2-2 RRS Study Case Selection and Preliminary Study Results**

In the “SC Overshoot” presentation made at the Jan. 16, 2019 PDCWG meeting, ERCOT displayed preliminary results showing “RRS Quantity Increases” (p. 9) resulting from a simulated RRS Study using the cases found on p.5. While SCT understands the study scope includes evaluating RRS impacts when no import limit is imposed upon the SCT DC Tie and SCT understands ERCOT’s desire to study impacts under various system inertia conditions, SCT is unsure of the value of the low inertia cases given that they all occur during conditions in which a 2,000 MW import to the ERCOT market is highly unlikely, e.g., 2 a.m. in March, midnight in October, etc. Given that system economics do not support such import scenarios, SCT does not think the results of these scenarios are useful foundations for policymaking recommendations. If ERCOT believes the off-peak hours and off-peak season case studies of high import volumes are instructive, it would be helpful for ERCOT to explain why. In the alternative, it would be useful if ERCOT would document why such cases are not particularly instructive for the purpose of determining RRS requirements for the ERCOT system.

ERCOT’s response:

Per ERCOT’s 2019 Ancillary Service Methodology, the minimum amount of RRS is determined by the projected future inertia conditions and a need to protect the grid against the loss of RCC. Under this methodology, ERCOT does not consider how RCC resources may operate. Because ERCOT is unaware of any restriction that would preclude Southern Cross from importing across the tie during low inertia conditions, ERCOT believes it appropriate to evaluate these as plausible system conditions, consistent with the methodology.

**3. Frequency Overshoot Study**

**3-1 Case Selection**

The addition of Cases 4 and 5 to the frequency overshoot study raises a few questions and concerns:

**3-1-1** As a procedural matter, SCT is concerned that subsequent to the PDCWG’s agreement with the Directive 9 ancillary services requirements study scope, ERCOT gathered additional input from a closed meeting of the Dynamics Working Group in mid-Nov. 2018 and modified the study scope by adding new cases and new assumptions. Not only was the study modified in a non-public setting which excluded SCT, but neither SCT nor the stakeholders were notified of the changes until ERCOT publicly released interim study results to PDCWG in mid-Jan. The ERCOT stakeholder process allows certain working groups to hold closed meetings to discuss sensitive material but a process also exists for those groups to hold an open public meeting prior to their closed door sessions. SCT is disappointed that ERCOT did not utilize that process in this instance, despite SCT’s request. While the DWG-recommended additions to the study address interesting questions, SCT counsels that the directives stemming from PUCT Docket No. 45624 are narrowly scoped by the PUCT to address SCT integration issues, they are not background against which to explore broader system issues, particularly given the direct assignment to SCT of the study costs associated with the directives. As discussed further below, SCT is not convinced that piggybacking early stage theoretical work regarding possible future system wide load dampening characteristics onto the Directive 9 study is appropriate.

ERCOT’s response:

PUCT Docket No. 45624 directs ERCOT to study the impact of the interconnection of the SCT DC Tie on Ancillary Services and to examine the need for developing a new Ancillary Service. ERCOT has been working closely with PDCWG to develop initial study scope for Directive 9. Given the importance of the models and cases to the impact study for Directive 9, ERCOT sent the draft of initial study scope to both PDCWG and DWG for review and feedback. At the Dec. 13 meeting of DWG—which was not closed to the public—ERCOT staff discussed the feedback from DWG on the model assumption and case build-up, and modified the study scope as requested by DWG to study sensitivity of load damping on frequency overshoot studies. At the Jan. 16 PDCWG meeting, ERCOT staff presented the update on the study scope and the preliminary study results.

Based on ERCOT’s observations that (1) inertia in the ERCOT Interconnection is trending lower, (2) system inertia and frequency overshoot are closely related issues, (3) the planned interconnection for SCT is several years into future, and (4) in October 2018, ERCOT system inertia reached another lowest point, ERCOT added additional low-inertia cases to demonstrate the potential frequency overshoot issues under lower inertia conditions than those described in the draft study scope. ERCOT disagrees with SCT that the scenarios evaluated as part of the frequency overshoot study were improperly considered as part of Directive 9.

DWG’s recommended additions are also appropriate as they make the study results more credible by considering the declining trend in the load damping ratio, which is also recommended in the Berkeley National Labs report.[[1]](#footnote-1) The additional cases were also designed to study the impact of lowering inertia on frequency overshoot if SCT were to trip while exporting 2100 MW.

**3-1-2** In the Jan. 16 presentation to PDCWG in the table on page 2, “Scenarios Used for Frequency Overshoot Study,” for Case No. 4, it appears the Load column value should be 30.4 GW, not 26.9 GW as published. During the PDCWG discussion, SCT understood ERCOT to say the Case 4 load had to be lowered in order to keep system inertia down to 120 GW\*s. Is that correct?

SCT understands the table on page 2 was originally completed prior to running the overshoot studies and was meant to provide a high-level overview of the cases. Now that adjustments have been made to refine the cases and specific values are known, SCT recommends the overshoot scenarios table should be updated with actual values as shown below:



ERCOT’s response:

The table has been updated. Note that the number in the “load” column is less than the sum of Wind and Gen Columns due to the existence of power losses. Also, in this study, the loss of the SCT DC Tie is modeled as tripping 2,100 MW of Load. For each one of the scenarios, we tripped 2,100 MW of existing ERCOT load to simulate frequency overshoot.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Scenario Name | Inertia (GW·s) | Load(GW) | Wind(GW) | Synchronous Gen (GW) |
| Scenario 0 | 130 | 34,069 | 15,510 | 19,273 |
| Scenario 1 | 130 | 34,251 | 10,000 | 24,579 |
| Scenario 2 | 130 | 32,278 | 5,000 | 27,552 |
| Scenario 3 | 130 | 32,254 | 3,500 | 29,055 |
| Scenario 4 | 120 | 30,177 | 3,500 | 26,979 |
| Scenario 5 | 110 | 27,469 | 3,500 | 24,270 |

**3-1-3** SCT is unsure what value is derived from studying a 2,100 MW export in Cases 3-5 given the very low wind production in those scenarios and correspondingly low economic prospects for a 2,100 MW export during such conditions. Perhaps it would make sense in those scenarios to back the export level down in incremental steps to see where the “break points” occur in low system inertia conditions. Although ERCOT provided such export limits for select 0% DR study runs in its interim results, ERCOT did not do so for any of the 2% DR study runs.

ERCOT’s response:

ERCOT’s reliability studies cannot speculate about Southern Cross’s economic prospects, as this would require ERCOT to know future costs and system conditions in other regions in addition to charges that Southern Cross (or the subsequent tie operator or owner) might impose on transactions, among other variables. Because there is nothing that currently prohibits a tie from exporting 2,100 MW under these conditions, ERCOT believes this is a reasonable scenario to study.

With respect to the suggestion to identify a “break point,” that is exactly what ERCOT has done in identifying the potential flow limit. In its study, ERCOT backed down the export level in incremental steps until the overshoot did not exceed 60.6 Hz. The corresponding export level is the limit shown on page 4 in the Jan. 16 presentation on PDCWG. Export limits with 2% DR is shown in the table below. We will update the study report with this table included.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 130 GW·s | 120 GW·s | 110 GW·s |
| Limit on SC DC tie export (0% DR) | 2,000 MW | 1,745 MW | 1,488 MW |
| Limit on SC DC tie export (2% DR) | 2,100 MW | 2,100 MW | 1,830 MW |

**3-2 Study Methodology and Assumptions**

In addition to the procedural concerns regarding the addition of 0% load dampening ratio (DR) sensitivity in the frequency overshoot study, SCT is also concerned about the technical merits of its inclusion in the frequency overshoot study. Although the use of variable speed motors is an identified emerging issue in system planning and system protection analysis, it strikes SCT as both odd and inappropriate that the Directive 9 study is the first time ERCOT has performed an RRS analysis using a 0% DR assumption. To the best of SCT’s knowledge, ERCOT does not yet have any evidence-based projections for this phenomenon and SCT thinks it unreasonable to assume that all load dampening characteristics will disappear from the ERCOT system during a time frame applicable to the interconnection of the SCT DC Tie given the vast number of existing motors throughout the ERCOT system that would need to be replaced with variable speed units. Although ERCOT’s interest in this emerging issue may be genuine, this particular study is not the appropriate place to conduct such early stage analysis.

ERCOT’s response:

ERCOT decided to conduct additional studies to consider sensitivities evaluating different load damping ratios at the recommendation of DWG. As shown in the study results, load damping ratio has considerable impacts on system frequency overshoot and thus the export limit of SCT DC Tie. The goal of the study is to provide a comprehensive evaluation of reliability risk upon the interconnection of SCT DC Tie. The load damping ratio should be considered given its importance and recent declining trend. Please refer to the table in ERCOT’s comments to 3-1-3 for export limits with both 2% and 0% LR.

**3-3 Study Results**

**3-3-1** In the Jan. 16 presentation to PDCWG on page 4, “Limit Imposed on SC DC Tie Export,” two different limits are published in the key at the top and the results at the bottom for Case 5 (DR=0). One is 1,538 MW, the other is 1,488 MW. During the PDCWG discussion, ERCOT agreed to investigate which is the correct value and make the correction.

ERCOT’s response: The correct value is 1,488 MW. ERCOT will correct it in the final report and presentations.

**3-3-2** For both the procedural concerns and technical reasons described above, SCT does not support inclusion of the DR sensitivity cases (DR=0) in the study results. As demonstrated by ERCOT’s interim results, half of the 0% DR cases fail to arrest the frequency excursion at or below 60.6. An unsurprising result, perhaps, given the erasure of the entire system’s dampening characteristic – a fundamentally different system characteristic than exists today. For Cases 4-5, system load was lowered almost to the annual minimum, wind was throttled down to 3.5 GW, and system inertia was set below any level yet experienced in ERCOT.

Case 5 with 2% DR is the one failing case that provides policymaking value to the Directive 9 effort. The load and generation assumptions are credible for a stress case scenario and although the system inertia value of 110 GW\*s is well below ERCOT’s historically low system inertia reading of 127 GW\*s last October and well above the 100 GW\*s level ERCOT has identified as “critical inertia,” SCT recognizes the general trend and appreciates the accompanying general concern that system inertia is likely to continue to decline with further wind and solar penetration and that ERCOT’s critical inertia level will also, therefore, likely rise in the future absent some mitigating measure such as implementation of Fast Frequency Response (FFR) service. SCT believes Case 5 with 2% DR is a useful extreme study and the identified export limit should be considered in the study results and recommendations.

ERCOT’s response:

The goal of this study is to provide a comprehensive understanding on how the interconnection of SCT DC Tie would impact ERCOT’s future ancillary service need. Therefore, ERCOT believes it is necessary to evaluate future scenarios that take into account different load damping ratios. The cases have been constructed based on the input and feedback from PDCWG and DWG and recent operational experiences at ERCOT. ERCOT believes these cases are reasonable and appropriate.

**4. NPRR 863 considerations**

**4-1 NPRR 863 status**

In the three months which have passed between public stakeholder discussions of the SCT Directive 9 studies, NPRR 863 has continued to advance toward adoption, having been recommended by TAC on Jan. 30, 2019. Heretofore, NPRR 863 and the SCT Directive 9 studies have been on parallel, yet, distinct tracks. Now that NPRR 863 appears to be headed for adoption and implementation (at least the FFR component, if not the ECRS component) prior to SCT’s planned in-service date, SCT wonders if it is useful and possible to consider the Directive 9 questions under the assumption that at least the FFR portion of NPRR863 is effective, if not the entire NPRR. Given ERCOT’s stated expectations of improved system frequency control during low inertia conditions post-NPRR 863, does it not make sense to consider the SCT DC Tie under such an improved system operating scenario?

ERCOT’s response:

Under NPRR863, which has now been approved by the Board (to be effective upon system implementation), the introduction of FFR would not affect the frequency overshoot study because FFR responds only to under- frequency events.

Even though FFR is expected to improve system frequency response especially in low inertia conditions, the increase in RCC when no import limit is imposed on SCT DC Tie would still lead to additional RRS requirement. If SCT DC tie is limited to importing 1375 MW, then there would be no incremental RRS need.

1. “Frequency Control Requirements for Reliable Interconnection Frequency Response,” Joseph H. Eto, John Undrill, Ciaran Roberts, Peter Mackin, and Jeffrey Ellis, Lawrence Berkeley National Laboratory, February 2018. [↑](#footnote-ref-1)