

Switchable Generation in ERCOT



REVISION HISTORY

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EXECUTIVE SUMMARY

This white paper documents ERCOT’s current practices for modeling, operating, and accounting for Switchable Generation Resources (SWGRs) in the ERCOT Interconnection (grid). The concept of switchable generation is that Resources “switch” from being synchronously connected from the ERCOT Interconnection (grid) to the Eastern Interconnection and vice versa. This switching must be coordinated to ensure reliability processes are properly addressed.

The purpose of this ERCOT Whitepaper is to:

1. Describe the current ERCOT rules and procedures (ERCOT Protocols, Operating Guides, Other Binding Documents, etc.) under which SWGRs operate within the ERCOT Region.
2. Describe areas of **Challenges** to the ERCOT market and grid operations areas.
3. Layout **Potential Changes** for discussion by stakeholders.
4. Identify areas with an **ERCOT Recommendation** to clarify protocols and/or guides or update processes where necessary. ERCOT will sponsor language to propose the recommended changes or support stakeholder submitted language. The purpose of these clarifications and/or improvements is to:
 - a. Provide ERCOT with the ability to manage grid reliability and markets effectively; and
 - b. Provide Generation Resource operators with maximum flexibility and efficient use of their Switchable Generation Resources via clear and unambiguous ERCOT rules; and
 - c. Provide market participants transparency in disclosure reports as to SWGR operations

OVERVIEW OF SWGR AND RELIABILITY COORDINATOR OPERATIONS

A Switchable Generation Resource (SWGR) is defined in the ERCOT Protocols as “A Generation Resource that can be connected to either the ERCOT Transmission Grid or a non-ERCOT Control Area.” The RC for a SWGR is determined by the RC area in which a SWGR is synchronously connected to at that time. The SWGR is subject to the operating rules in that RC area. Coordination Agreements that exist between the RCs govern switching of SWGRs between areas. This arrangement is shown in Fig. 1 below.

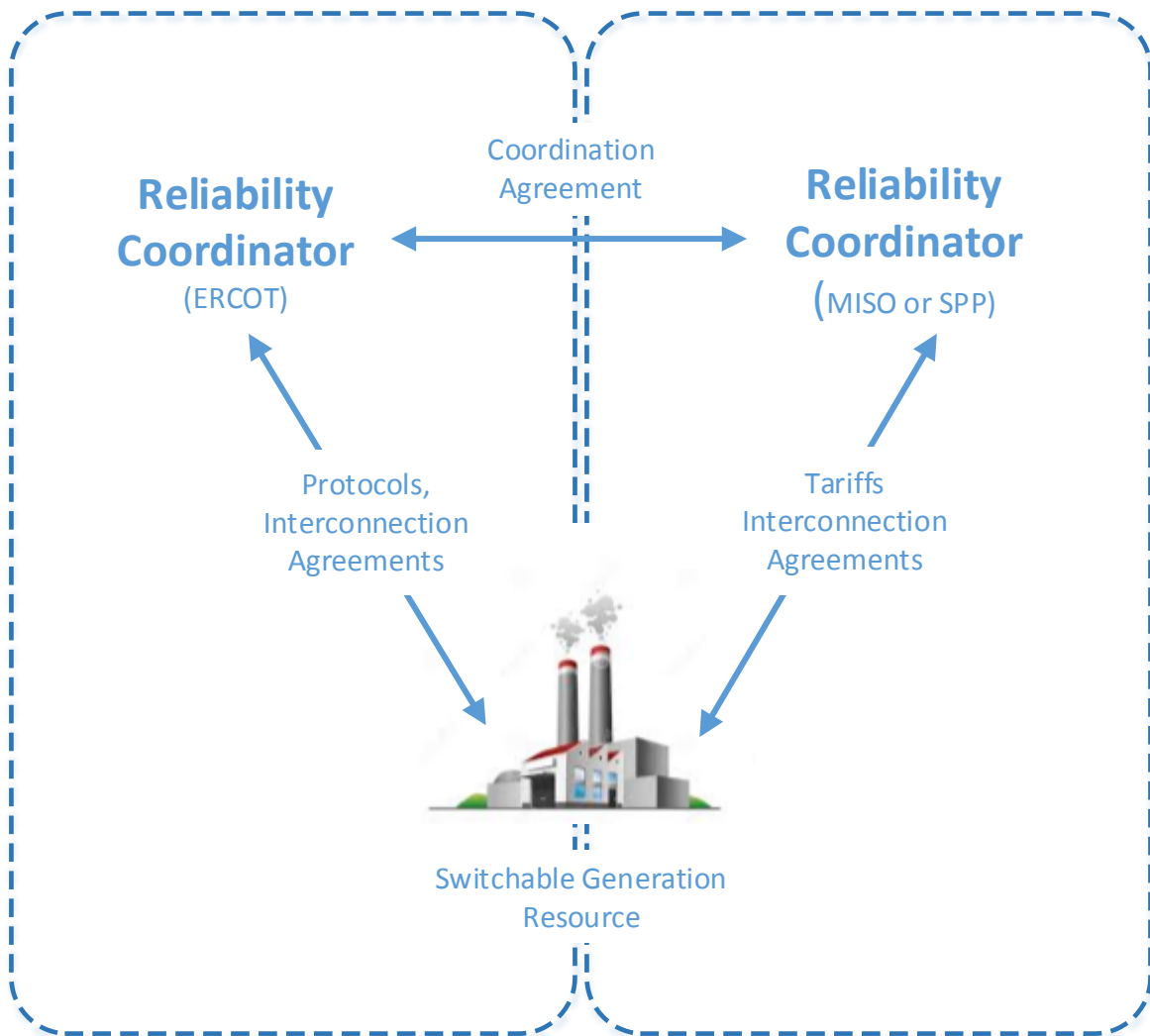


Fig. 1

ERCOT ISO is the single Reliability Coordinator (RC) for the ERCOT Interconnection (grid) while Southwest Power Pool (SPP) and Midcontinent Independent System Operator (MISO) are RCs in

the Eastern Interconnection responsible for reliability coordination for the respective SWGRs when interconnected to their area.

Current RC to RC agreements can be found at the following links:

SPP Coordination Agreement:

http://www.ercot.com/content/mktrules/guides/procedures/SPP%20Coordination%20Agreement_022814_doc.doc

MISO Coordination Agreement:

http://www.ercot.com/content/mktrules/guides/procedures/Tenaska_Frontier_Operating_Guide.doc

MODELING, DEFINITIONS, AND THE INTERCONNECTION PROCESS

There are currently six (6) facilities that fall under the SWGR definition connected to the ERCOT grid.

- A. Tenaska Kiamichi is a natural gas-fired combined-cycle generation facility located in Pittsburg County, Oklahoma.
- B. Tenaska Gateway is a natural gas-fired combined-cycle generation facility located in Rusk County, Texas.
- C. The Tenaska Frontier facility is a natural gas-fired combined-cycle generation facility located in Grimes County, Texas
- D. The Frontera Generation facility is a natural gas-fired combined-cycle generation facility located in Hidalgo County, Texas.
- E. Antelope Station is a natural gas-fired reciprocating engine driven generation facility located in Hale County, Texas.
- F. Elk Station is a natural gas-fired simple-cycle combustion turbine driven generation facility located in Hale County, Texas.

The modeling and telemetry requirements for SWGRs are no different than those of other ERCOT Resources. Modeling changes must be submitted into the ERCOT Model Management Information System via the Resource Asset Registration Form according to the “90-day” timeline, found in Section 3 of the Protocols. A SWGR goes through the same Generation Interconnection and qualification testing process as any other ERCOT Resource. No special priority is given to either type of request. The Standard Generation Interconnection Agreement (SGIA) is a PUCT-approved document.

Challenge: As the number of SWGRs increases it will become more important to provide a modeling designation to these types of units in order to keep track of their unique operational characteristics, the ability to switch from one grid to another grid. The potential for a unit to be in another Control Area is a key operational consideration for analysts to consider when using ERCOT cases for operational or planning studies. A unit with SWGR status may also need to be accounted for differently in system reports. In the past, it has been possible for those using the ERCOT cases or designing reports to track SWGRs manually due to their small number.

Potential Change: The addition of a modeling designation in the Network Model Management System (NMMS) would be useful for tracking SWGRs in both operational and planning cases, as well as in other ERCOT grid reports. The modeling designation would show what SWGRs had the potential to operate in another area, but would not be indicative of a commitment to operate in a designated Control Area.

ERCOT Recommendation: ERCOT recommends RARF updates to include a new designation for units that can switch between ERCOT and non-ERCOT control areas (SWGRs). This designation would be used to identify SWGRs in ERCOT systems.

OPERATIONS

CURRENT OPERATING PLAN (COP) SUBMITTAL REQUIREMENTS

SWGRs are required to submit COPs just like all other Resources. Protocol Section 3.9.1, Current Operating Plan (COP) Criteria, requires each QSE representing a Resource to submit a COP for all hours for the next seven operating days to reflect the QSE's expected operation of the Resource. Currently, an SWGR with intentions to operate in another grid has the options to telemeter the Resource as either:

- OUT – Off-Line and unavailable
- EMR – Available for commitment only for ERCOT-declared Emergency Condition events

Challenge: SWGRs switched into another grid currently submit a COP status of OUT or EMR. For ERCOT and market participants, it is unclear if the SWGR is operational in another Control Area. This information is pertinent if ERCOT needs to request that a non-ERCOT Control Area release the SWGR during an ERCOT-declared Emergency Condition.

Potential Change: There are two potential enhancements to consider that could provide both ERCOT and Market Participants additional transparency.

The first potential change would be to make the COP status "EMR" a requirement for SWGRs, which are switched out of the ERCOT grid and not on Outage, to indicate that the Resource could be made available to ERCOT during an ERCOT-declared Emergency Condition. There are several potential issues with this approach including transparency issues in the disclosure reports.

A second more comprehensive change would include the COP status below:

- EMRSWGR - Indicating a SWGR is only available to ERCOT during an ERCOT-declared Emergency Condition and a release by non-ERCOT control area.

SWGRs would use "OUT" status only at times they are taking a physical outage and are unable to generate.

ERCOT Recommendation: ERCOT recommends adding protocol language to add the proposed new COP resource status, EMRSWGR, for SWGRs.

NOTICE FOR SWITCHING UNDER NORMAL OPERATIONS

For this paper, Normal Operations are defined as non-emergency conditions. Currently, a SWGR wishing to switch is treated the same as a resource requesting a decommitment as detailed in protocol section 6.4.7, QSE-Requested Decolmitment of Resources and Changes to Ancillary Service Resource Responsibility of Resources.

If an SWGR requests to switch during the operating period the SWGR must make its request to ERCOT verbally and ERCOT may perform a study to determine if ERCOT will remain secure with the resource switched out of ERCOT. If ERCOT requires the resource for reliability the resource may be committed through a RUC process.

If an SWGR requests to switch during the adjustment period the SWGR must update its COP indicating the change in resource status, currently EMR or OUT proposed EMRSWGR.

Challenge: The current protocol language in Nodal Protocol section 6.4.7, was written with non-SWGRs in mind. If a non-SWGR decommits it will be available to be picked up by the RUC process. The SWGR will decommit and telemeter a Resource Status of EMR or OUT, proposed EMRSWGR, which is unavailable to the RUC engine.

If the SWGR has a commitment in a non-ERCOT RC during the RUC study period and the SWGR is considered available as any other resource in the RUC process, there could be adverse reliability impacts in the non-ERCOT RC.

Potential Change: Add protocol language to Nodal Protocols section 6.4.7 to outline the procedure for the SWGRs request to switch out as well as requirements that an SWGR request only be denied if the SWGR needs to remain in ERCOT to assist with an Emergency Condition.

ERCOT Recommendation: ERCOT recommends adding the protocol language to outline the procedure and requirements for an SWGR switch.

ERCOT REQUESTING SWGR SWITCH FOR EMERGENCY CONDITIONS

An Emergency Condition is defined in ERCOT Protocols as “An operating condition in which the safety or reliability of the ERCOT System is compromised or threatened, as determined by ERCOT.” Protocol 6.5.9.3.1 Operating Condition Notice states “ERCOT will issue an Operating Condition Notice (OCN) to inform all QSEs of a possible future need for more Resources due to conditions that could affect ERCOT System reliability. The OCN is the first of four levels of communication issued by ERCOT in anticipation of a possible Emergency Condition. The other

levels include an Advisory, Watch, and Emergency Notice. This paper emphasizes the issuance of an OCN for the sake of clarity, but in actual practice any of the four levels could be used as the notice of an Emergency Condition.

A SWGR wishing to switch into or out of the ERCOT grid updates its COP to reflect the switch. If an SWGR switching out will cause ERCOT adverse reliability impacts ERCOT can commit the Resource using the RUC process or a Dispatch Instruction. If the SWGR has left the ERCOT grid, ERCOT can contact the reliability coordinator, as outlined in RC to RC agreements, the SWGR is connected to and request that the SWGR be released for generation in the ERCOT grid.

Challenge: Currently, there have been no Emergency Conditions when an SWGR was either kept in the ERCOT grid when indicating they would not be available to ERCOT, or switched into ERCOT from a non-ERCOT control area. However, there could be circumstances in the future where an SWGR is needed in ERCOT for voltage stability, localized congestion issues or system capacity needs during an Emergency Condition. The process below outlines the interaction between ERCOT and the SWGR. The Coordination Agreement documents will focus on the interaction between RCs. Both documents should be in agreement.

Potential Change: The Coordination Agreements with non-ERCOT control areas need to be further developed to include clear instructions for operating in Emergency Conditions and should be consistent with one another, when possible. Part of this clarification should include the need for ERCOT to obtain operational information from the SWGR to assess whether the SWGR can be available to assist during the timeframe of the Emergency Condition.

Define SWGR release in the protocols, and the RC to RC agreements, as a verbal directive from the controlling RC stating the SWGR can switch to requesting RC. Once the SWGR is given a release the resource is committed to the requesting RC. The requesting RC will not be controlling RC until the breaker is open on the side of the RC that was controlling RC at the time of the request.

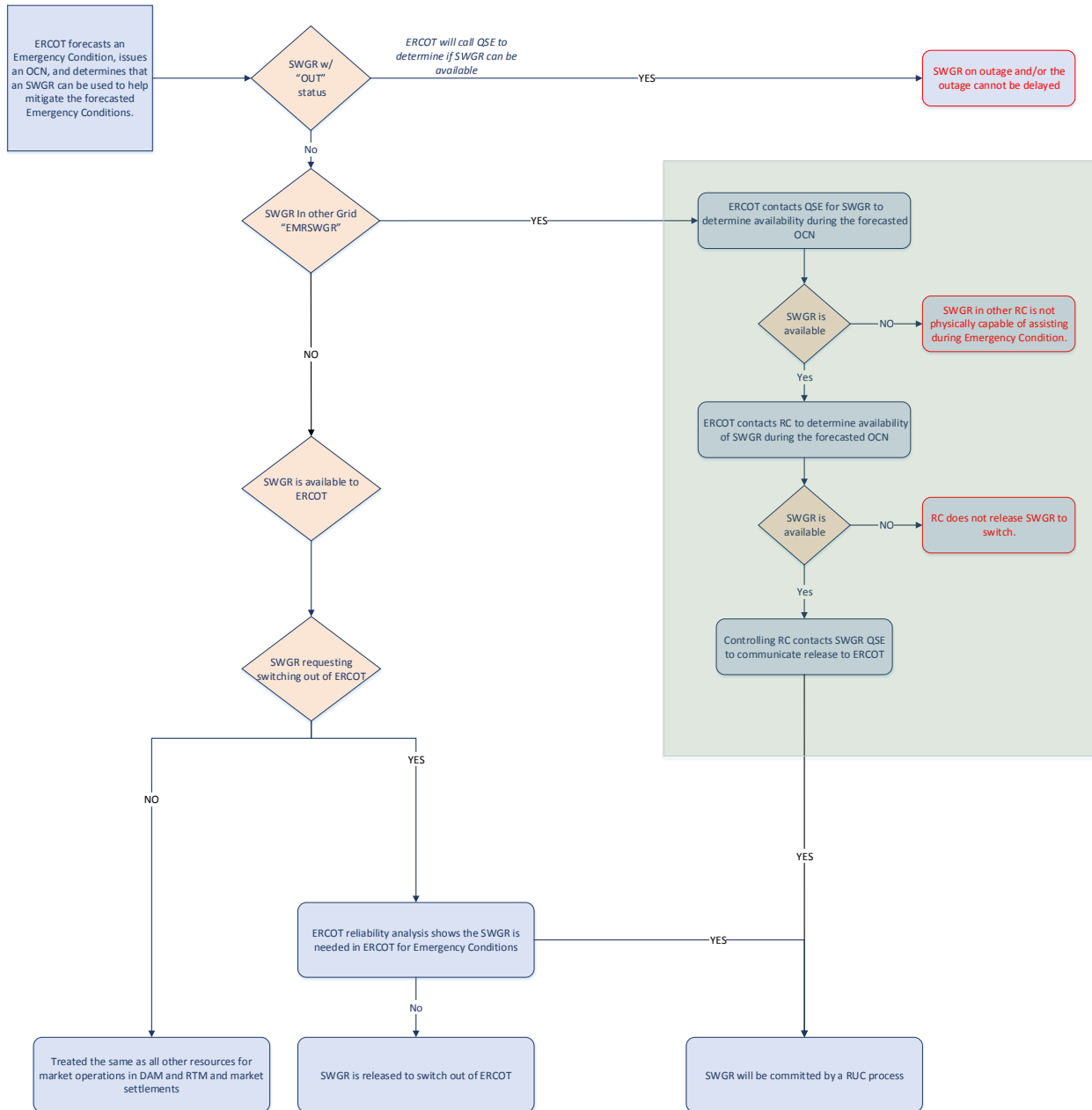
Add Protocol language requiring a SWGR to be available to ERCOT during Emergency Conditions if they are physically capable and the non-ERCOT control area releases the SWGR. The requirement should be tied to an additional settlement treatment as discussed in the section real-time settlement for suspended switching operations.

See Figure 2 on the next page outlining the paths for an SWGR during an Emergency Condition.

ERCOT Recommendation: ERCOT recommends an update to the RC to RC agreements to clarify both parties' responsibilities and expectations on communications during emergency conditions. ERCOT also recommends adding new protocol language outlining the procedures,

requirements, and settlements for SWGRs when responding to ERCOT direction during Emergency Conditions.

Fig. 2



OUTAGE SUBMITTAL REQUIREMENTS

ERCOT Protocols define an Outage as: *“The condition of a Transmission Facility or a portion of a Facility, or Generation Resource that is part of the ERCOT Transmission Grid and defined in the Network Operations Model that has been removed from its normal service.”* See Protocol Section 2. SWGRs are required to submit Outages into the ERCOT Outage Scheduling system when they are down for maintenance or repair. This is the same as any other Resource in the ERCOT grid. SWGRs are not required to submit Outages for the time when they are operating in another grid.

Challenge: ERCOT Outage Scheduling may need to rely on a SWGR to support a future transmission or resource Outage. Planned Outages may be submitted from 3 days up to a several months in advance of their start. The ERCOT Outage Coordinator does not currently have an operating plan beyond the 7 day ERCOT COP. Current processes consider any generation to be available if it is not shown in the Outage Scheduler as “Out”. This makes it difficult to schedule and coordinate Outages in the vicinity of SWGRs.

Potential Change: There are several possible changes that could remedy the lack of SWGR information for Outage study and coordination.

1. A new, “Notice Only”, or similar, Outage type could be provided that SWGRs would use to indicate to ERCOT Outage Coordinators when they expect to operate in another Interconnection. The Outage type, if entered beyond 7 days, would be automatically accepted in the system and would not require ERCOT approval. The absence of the Outage would by default, indicate the availability of the SWGR to the ERCOT grid. The Outage would be non-binding and could be changed at any time. The new outage type would provide ERCOT with an indication of the SWGR’s expected availability for future Outage approval horizons. The COP would need to be subsequently updated as well to reflect any changes within the 7 day COP period. A SWGR that is not operational due to maintenance would use one of the existing ERCOT Outage types for Resources.

2. As indicated above, an Outage is defined in part as the “removal from normal service” of a piece of equipment. This definition could be interpreted to include a SWGR’s operation in another grid. SWGRs would follow the same rules as other Resources for submitting Outages. This approach would provide ERCOT Outage Coordinators with SWGR Outage information that could be used to coordinate transmission Planned Outage requests in the vicinity of SWGRs.

ERCOT Recommendation: ERCOT does not recommend any changes in outage types or notifications. While more SWGR-related outage information could be useful, the number and location of SWGRs do not warrant the changes necessary to ERCOT systems.

BLACKSTART SERVICES

Subject to meeting all applicable requirements, SWGRs are eligible for consideration in ERCOT Black Start restoration plans. SWGRs have some operational characteristics that could potentially make them excellent Black Start Resources.

MARKET OPERATIONS

DAY AHEAD MARKET (DAM) UNDER NORMAL OPERATIONS

SWGRs submit offers in the DAM in the same way as any other Resources. Their obligations are the same as a non-SWGR unit.

CONGESTION REVENUE RIGHTS (CRR)

The CRR model does not include generation units, but rather resource nodes. The inclusion of an SWGR's ERCOT resource node in the CRR model is not directly dependent on the grid in which the SWGR is expecting to operate. The availability of a SWGR is treated in the same way as the availability of any other Resource.

Challenge: To date, there has been no congestion problems associated with the switching of a SWGR in or out of the ERCOT grid. However, there is a potential for a SWGR to affect congestion and CRR positions. This will be monitored by the Independent Market Monitor (IMM).

Potential Change: None at this time

ERCOT Recommendation: None at this time

MARKET SETTLEMENTS

REAL-TIME SETTLEMENT FOR SUSPENDED SWITCHING OPERATIONS

In the current ERCOT Protocols there is no settlement consideration for the lost opportunity a SWGR incurs, if ERCOT suspends a SWGR's ability to switch into another grid by committing the unit through a RUC process or if ERCOT requests the SWGR switch into ERCOT during or in anticipation of Emergency Conditions. Currently, the SWGR compensation is determined through the RUC process. The SWGR can include a purchase power agreement as part of their verifiable cost, if it meets the criteria in the ERCOT Protocols.

Challenge: SWGRs potentially have commitments and opportunities in other power regions that are not specifically addressed in current ERCOT settlements.

Potential Change: Add language to ERCOT Protocols and verifiable cost manual to address the unique costs associated with SWGRs.

There are multiple options on how to financially settle the SWGR during suspended switching operation intervals.

1. $A = \text{Make whole to the resource cost} + \text{penalty from contractual obligations} + \text{penalty from market obligations}$
2. $B = A + \text{lost opportunity cost}$
3. $C = B - \text{RUC Clawback}$

ERCOT Recommendation: ERCOT recommends that an SWGR be eligible for make whole payments as well as additional settlement treatment to cover contractual penalties, and penalties from market obligations.

PLANNING

ACCOUNTING FOR SWGRS IN PLANNING CASES

SWGRs are included in all ERCOT planning cases and do not receive any special designation. The data for planning cases is pulled from the same database that is used to build the operational models.

Challenge: As the number of SWGRs increase it will become more important to provide a modeling designation to these types of units in order to keep track of the unique operational characteristics. With a traditional generator, an Outage is the primary reason a unit may not be available for reliability purposes. A SWGR may not be available due to obligations in another grid. Analysts need to be able to easily recognize a SWGR and take its status into consideration for accurate studies and report design. In the past, it has been possible to track SWGRs manually due to their small number.

Potential Change: The addition of a SWGR modeling designation in the RARF, incorporated in NMMS and passed into planning cases, would enable analysts to account for SWGR availability in planning studies. The effect a SWGR has on the grid should be considered differently than a non-SWGR during both reliability and economic planning analysis.

ERCOT Recommendation: ERCOT recommends the addition of an SWGR modeling designation in the RARF, incorporated in NMMS and passed into planning cases, to enable analysts to account for SWGR availability in planning studies.

CAPACITY, DEMAND AND RESERVES REPORT (CDR)

The CDR reports SWGR capacity as two line items: “Switchable Capacity”, and “Switchable Capacity Unavailable to ERCOT”. Section 3.2.6.2.2 of the Protocols specifies the two variables and associated data sources used to report these two line items:

Seasonal Net Max Sustainable Rating for Switchable Generation Resource—The Seasonal net max sustainable rating for the Peak Load Season is as reported in the approved Resource asset registration process for each Generation Resource for the year that can electrically connect (i.e., “switch”) from the ERCOT Region to another power region.

Capacity of Unavailable Switchable Generation Resource—The amount of capacity reported by the owners of a switchable Generation Resource that will be unavailable to ERCOT during the Peak Load Season s and year i pursuant to paragraph (2) of Section 16.5.4, Maintaining and Updating Resource Entity Information.

Paragraph (2) of Protocol Section 16.5.4 is as follows:

If a Resource Entity has a Switchable Generation Resource with a contractual requirement in a non-ERCOT Control Area during the summer or winter Peak Load Seasons, it shall report to ERCOT in writing the Peak Load Seasons for which the identified capacity will not be available to the ERCOT System for the subsequent ten years. The initial communication and subsequent updates to previously reported unavailable capacity shall be filed with ERCOT as soon as possible, but in no event later than ten Business Days after the information is obtained. The communications should reflect the Resource Entity's best estimate of the required information at the time the filing is made. ERCOT shall use the provided data for preparation of the Report on Capacity, Demand and Reserves in the ERCOT Region and other planning purposes.

SEASONAL ASSESSMENT OF RESOURCE ADEQUACY (SARA)

For the SARA, ERCOT uses the CDR definitions for SWGR capacity, and proposes no methodology changes. The SARA is not covered by ERCOT Protocols or Other Binding Documents. However, at the direction of the Wholesale Market Subcommittee, the SAWG is evaluating options to codify the SARA in the Protocols to improve transparency regarding how ERCOT prepares them.

COORDINATION WITH NON-ERCOT INTERCONNECTIONS

COORDINATION AGREEMENTS BETWEEN RELIABILITY COORDINATORS

Currently there are 2 separate documents that identify coordination for SWGRs with ERCOT and the other reliability entities. The agreements are structured to aid in coordination and outline expectations for reliable operations. While these agreements cannot capture the full universe of possibilities, they do provide a framework for identifying the parties involved in any necessary additional coordination and general principles to adhere to while utilizing Good Utility Practice. These agreements coupled with ERCOT Protocols, NERC Reliability Standards, and other regional rules are expected to provide all necessary coordination. Any changes identified should be captured in the agreements or ERCOT Protocols as appropriate.

Challenge: Establishing a review process to keep the agreements up to date.

Potential Change: Coordinated annual reviews should attempt to capture both current and any anticipated issues to incorporate into the agreements. These reviews should also consider operational and outage coordination input over the previous year's experiences.

ERCOT Recommendation: ERCOT recommends to review Coordination Agreements on an annual basis and modify if necessary to capture both current and any anticipated issues and provide consistency across ERCOT Protocols and Other Binding Documents.