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| PrincipleNumber | 1.3 | Principle Title | Offering and Awarding Ancillary Services in Real-Time |
| Date Posted | October 2, 2019 |
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| Executive Summary | Real-Time Co-Optimization (RTC) will allow Qualified Scheduling Entities (QSEs) to offer and be awarded Ancillary Services (AS) in Real-Time. |
| Principle Description | The purpose of Key Principle 1.3, Offering and Awarding Ancillary Services in Real-Time is to outline the key mechanisms and timelines for submitted AS Offers, as well as those considered and awarded under RTC. Specifically, this principle addresses the following concepts: (a) AS Offer structure and timing; (b) QSE telemetry for updating available capacity from AS Offers; (c) Under-frequency relay (UFR) Load Resource scheduling for Responsive Reserve (RRS) UFR and ERCOT Contingency Reserve Service (ECRS); (d) On-Line hydro Generation Resource (hydro Generation Resources not operating in ONRR mode) scheduling for RRS, Non-Spinning Reserve (Non-Spin), and ECRS; and(e) Constraints to be used for the RTC clearing process.  |
| RTCTF Discussion  | On 6/21/19, ERCOT provided a presentation and whitepaper discussing constraint formulation for RTC. There was specific discussion on KP1.3 subsections (1), (2), and (4).On 7/12/19, RTCTF discussed comments that ERCOT received, and ERCOT provided a presentation looking at telemetered ramp rates and constraints for Combined Cycle Generation Resources (CCGRs).On 8/9/19, South Texas Electric Cooperative Inc. (STEC) presented proposed changes to KP1.3, with a focus on the treatment of hydro Resources (subsection (3)). ERCOT also presented on a number of topics related to KP1.3, including discussion on subsections (5) through (9). On 8/27/19, ERCOT continued presentions on KP1.3, including subsection (9). ERCOT staff also presented material introducing KP1.3 subsections (10) through (13).On 9/19/19, RTCTF reviewed ERCOT’s examples of AS deployment and re-procurement, including impacts to Load Resources. RTCTF reviewed Siddiqi proposal, but group consensus was to continue forward on ERCOT’s proposal in subsection (8). RTCTF modified (9) to include Real-Time feedback to impacted QSEs with mitigated AS limits related to AS infeasibility. |
| TAC Action Requested |  |
| TAC Action Summary |  |
| ERCOT Opinion  |  |
| Board Action Requested |  |
| Board Action Summary |  |

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| Proposed Principle Language |

# *Principle Concepts for TAC Endorsement*

None

# *Principle concepts Previously Endorsed by TAC*

None

# *Principle Concepts in DisCussion at RTCTF*

1. QSEs will have ability in Real-Time to indicate whether a Resource is temporarily unable to provide AS due to operational constraints.
2. UFR Load Resources will be able to self-provide RRS UFR and ECRS; the amount of which will based on Day-Ahead Market (DAM) and AS trades.
3. On-Line hydro Generation Resources not operating in ONRR mode will be able to maintain RRS, Non-Spin, and ECRS on those Resources through modification of the Mitigated Offer Cap (MOC).
4. RTC will account for will frequency responsive capacity of a CCGR when awarding AS that is required to be frequency responsive.
	1. In Real-Time, QSEs will supply data informing ERCOT systems, on the portion of the total CCGR MW output that is being provided from the CCGR’s frequency responsive capacity, and, the high and low limits of the CCGR’s frequency responsive capacity.
	2. Utilizing these additional Real-Time data provided by the QSE informing ERCOT systems of the CCGR’s frequency responsive parameters, RTC will limit frequency responsive AS awards to be within the frequency responsive capability limits.
	3. In addition to the Real-Time data, a QSE representing a CCGR will be able to update its energy and AS offer curve every five minutes in Real-Time to account for changing physical parameters and system conditions and to ensure the entire CCGR MW output is co-optimized in a manner that keeps the CCGR indifferent to providing energy versus AS.
	4. If an ERCOT manual instruction or RTC award for energy or AS results in a non-optimal solution, the CCGR will be held harmless and made-whole to its cost, including lost opportunity costs.
5. RTC will not change limitations on sub-categories of AS products (e.g., FRRS, FFR, and RRS and ECRS provided via UFR).
6. Off-Line Resources providing Non-Spin that are in startup due to a manual deployment of Non-Spin by ERCOT will continue to be eligible for being awarded Non-Spin for the first 25 minutes following the deployment.  The eligible capacity will be based on the High Sustained Limit (HSL) of the Resource less its Base Point instruction.
7. Resources operating in quick-start mode that are in startup due to a deployment from ERCOT will continue to be eligible for being awarded ECRS and Non-Spin.  The eligible capacity will be based on the HSL of the Resource less its base point instruction.
8. During each execution, RTC awards for energy (Base Points) and AS will be based on taking a fresh look at the pool of Resources available to provide energy and AS.
	1. Energy awards (Base Points) will be relative to Resource capability (limits, ramp rates).
	2. AS awards will be relative to Resource capability (limits, ramp rates, etc.) and the ASDCs irrespective of the quantity of AS already being deployed.
9. Within RTC, ERCOT operators will have the ability to manually mitigate the amount of AS being awarded to Resources that, when deployed, may violate transmission constraints. ERCOT will notify QSE in Real-Time of any AS capability that has been derated by ERCOT including unit’s new AS limit in MW.

**{AS Offer Structure and Proxies}**

1. RTC will utilize the AS Offer structure that will be in place with the implementation of Nodal Protocol Revision Request (NPRR) 863.
2. The AS Offer submission window will be consistent with the Energy Offer Curve (EOC) submission window. In Real-Time, QSEs will be able to update their energy and AS offer curve every five minutes.
3. Proxy AS Offers will be created for Resources for use in the Real-Time Market (RTM) using the following guidelines:
	1. The proxy offer will be a linked AS Offer across all AS products that a Resouce is qualified to provide. For Generation Resources, the proxy offer MW will be HSL.
	2. For each AS where the Resource has a submitted AS Offer, the price in the proxy AS Offer for that AS will be set equal to the maximum of the Resource’s highest offer price for that AS plus a factor “K”, where “K” is a configurable parameter with a value close to zero, and a proxy price floor for that AS.
4. For each AS where the Resource has a submitted AS Offer, the price in the proxy AS Offer for that AS will be set equal to the maximum of: (1) the Resource’s highest offer price for that AS plus factors “K” and “L”, where “K” and “L” are configurable parameters designed to ensure that proxy AS offers increase monotonically with MW and across AS according to AS quality, respectively; and (1) a proxy price floor for that AS plus an “L” factor as described above if necessary to enforce AS quality-value linkage.
5. For each AS where the Resource does not have a submitted AS Offer and is not a Load Resource, the price in the proxy AS Offer for that AS will be set equal to a proxy price floor for that AS. Proxy AS Offers will not be created for Load Resources that have not submitted an AS Offer.
6. The system will be designed to allow different proxy price floors for instances in which the same AS can be provided by either Off-Line or On-Line Resources (i.e., the proxy price floor for an offline Non-Spin offer may be different than the the proxy price floor for an online Non-Spin offer).
7. The RTC optimization will enforce various Resource specific AS constraints to ensure the AS awards are feasible, considering both QSE submitted AS offers and RTC created proxy AS Offers.
8. Proxy AS Offers will not be created for Resources for use in the DAM.

# *Future Decision Points and Issues for Developing Principle Concepts*

1. Additional concepts related to constraint formulaton (e.g., treatement of Resources with an ONRR status)
2. Changes to validation of AS trades (related to AS self-provision in Real-Time)

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| Applicable Protocol Section(s) |  |
| Impacted System(s) / Application(s) |  |

# *Appendix Material with additional details*

1. QSEs will have the ability in Real-Time to indicate whether a Resource is temporarily unable to provide AS due to operational constraints.

Details under development:

* For scenarios where the reduced AS capability is less than the QSE-submitted AS Offer (MW), QSEs can, via Resource-specific telemetry, inform ERCOT of the reduced AS capability (MW) by specific AS type from a Resource.
* Under RTC, ERCOT systems will use Resource-specific telemetered values to limit AS awards.
* ERCOT will be proposing to add new Resource-specific telemetry points (analog – MW) for each AS type/subtype:
	+ Regulation Up (Reg-Up) capability;
	+ Regulation Down (Reg-Down) capability;
	+ Fast Responding Regulation Up Service (FFRS-Up) capability;
	+ Fast Responding Regulation Down Service (FFRS-Down) capability;
	+ RRS PFR capability;
	+ RRS UFR capability;
	+ RRS FFR capability;
	+ ECRS capability; and
	+ Non-Spinning Reserve (Non-Spin) capability.
* Future discussion will also address whether a QSE with a submitted telemetered Ramp Rate up for a Resource with a High Dispatch Limit (HDL) that is greater than the Resource’s telemetered MW, should be able to indicate that the Resource is unable to provide Reg-Up, ECRS and/or Non-Spin.
1. UFR Load Resources will be able to self-provide RRS UFR and ECRS; the amount of which will based on DAM and AS trades.
2. MOCs for On-Line hydro Generation Resources not operating in ONRR mode shall allow for RRS, Non-Spin, and ECRS to be maintained on those Resources.

Details under development:

* Under RTC, UFR Load Resources will not be capable of arming and disarming UFR relays based on non-zero/zero AS awards if treated like Generation Resources
	+ New Resource-specific telemetry points (analog – MW) will be added for RRS UFR, RRS FFR and ECRS, allowing ERCOT visibility into MW service quantities self-provided by a UFR Load Resource.
		- System-wide RRS and ECRS AS Demand Curves (ASDCs) will be reduced by the validated amount of UFR Load Resource self-provided service quantities.
		- ERCOT is in the process of developing validation processes and rules regarding these new telemetry values.
			* The 60% limitation rule (per NPRR 863) for system-wide RRS from UFR Load Resources and FFR and the annually determined limit from FFR will be maintained.
			* Telemetered UFR Load Resource self-provided RRS, ECRS MW amounts with respect to DAM awards and AS Trades under normal conditions and scarcity conditions will be reconciled.
* Under RTC, On-Line hydro Generation Resources not operating in ONRR mode must adhere to constraints imposed by governmental agencies or by treaty regarding the operations of those Resources. These Resources often have the opportunity to provide incremental energy in response to a deployment of AS and are therefore good candidates to provide AS, but cannot regularly exchange the AS capacity for an incremental energy deployment. The MOC for On-Line hydro Generation Resources shall be set equal to the submitted Energy Offer Curve.
1. RTC will account for will account for frequency responsive capacity of a CCGR when awarding Regulation and RRS PFR.

Details under development:

* An On-Line CCGR can have portions of its capacity that are not frequency responsive (e.g., duct burner, etc.). Therefore, under RTC, Real-Time results should not be such that awarded Regulation and/or RR PFR (or portions thereof) could be coming from CCGR capacity that is Non-Frequency Responsive Capacity (NFRC).
* ERCOT will be proposing an enhanced mathematical model of CCGR, and new telemetry to account for frequency responsive capacity of a CCGR for awarding Regulation and RRS PFR.
* A CCGR should be held harmless between providing energy and AS and should be made-whole to its cost, including lost opportunity costs, when the the RTC engine does not co-optimize a CCGR.