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| PrincipleNumber | 1.3 | Principle Title | Offering and Awarding Ancillary Services in Real-Time |
| Date Posted | October 24, 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 synchronous condenser fast-response 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 presentations 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.On 10/9/19, RTCTF discussed KP1.3 subsections (1) through (15) and reached consensus on subsections (1), (2), (3), (4)(a), (4)(b), (5), (6), (7) (8), (10), and (11). |
| TAC Action Requested | On 10/23/19, TAC vote to endorse KP1.3 subsections (1), (2), (3), (4)(a), (4)(b), (5), (6), (7) (8), (10), and (11) for purposes of informing the Board. |
| TAC Action Summary |  |
| ERCOT Opinion  |  |
| Board Action Requested |  |
| Board Action Summary |  |

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| Proposed Principle Language |

# *Principle Concepts for TAC Endorsement*

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 Synchronous Condenser Fast-Response 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 frequency responsive capacity of a CCGR when awarding AS that is required to be frequency responsive.

a. 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.

b. 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.

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.

a. Energy awards (Base Points) will be relative to Resource capability (limits, ramp rates).

b. AS awards will be relative to Resource capability (limits, ramp rates, etc.) and the ASDCs irrespective of the quantity of AS already being deployed.

10) RTC will utilize the AS Offer structure that will be in place with the implementation of Nodal Protocol Revision Request (NPRR) 863.

11) The AS Offer submission window will be consistent with the Energy Offer Curve (EOC) submission window. QSEs will be able to update their Energy and AS Offer Curves in Real-Time.

# *Principle concepts Previously Endorsed by TAC*

None

# *Principle Concepts in DisCussion at RTCTF*

4) RTC will account for frequency responsive capacity of a CCGR when awarding AS that is required to be frequency responsive.

c. 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.

d. 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.

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.

c. All Resources providing FFR shall be considered during the RTC runs following an automatic deployment of FFR, including continued awarding of FFR and economic dispatch of the Resource up to the Resource’s limits. The RTC runs will consider the Resource’s energy and AS offers as well as the physical capabilities (e.g., HSL, ramp rates, etc.) of the Resource at the time of execution.

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. ERCOT will exclude any such manually mitigated AS amounts from the AS imbalance calculation.

12) Proxy AS Offers will be created for Resources that do not have a valid AS offer curve for the entire operating range of the Resource for use in the Real-Time Market (RTM) and will be consistent with the following guidelines:

a. The proxy offer will be a linked AS Offer across all AS products for which a Resource is qualified to provide. For Resources that are not Load Resources, the proxy offer MW will be equal to the Resource’s HSL.  For Load Resources, the proxy offer MW will be equal to the Resource’s Maximum Power Consumption (MPC).

b. For each AS, the price in the proxy AS Offer for that AS for the Resource will be set equal to:

i. For Reg-Up and RRS, the maximum of a proxy offer price floor for that AS, the Resource’s highest submitted offer price for that AS, the Resource highest price offer for ECRS (submitted or proxy), and the Resource’s highest price offer for Non-Spin (submitted or proxy).

ii. For ECRS, the maximum of a proxy offer price floor for ECRS, the Resource’s highest submitted offer price for ECRS, and the Resource’s highest price offer for Non-Spin (submitted or proxy).

iii. For Non-Spin, the maximum of a proxy offer price floor for Non-Spin and the Resource’s highest submitted offer price for Non-Spin.

iv. For Reg-Down, the maximum of a proxy offer price floor for Reg-Down and the Resource’s highest submitted offer price for Reg-Down.

c. Each of the AS proxy offer price floors will be a separate configurable parameter that can be set equal to a defined $/MWh value.

d. The system will be designed to allow different proxy offer price floors for instances in which the same AS can be provided by either Off-Line or On-Line Resources (i.e., the proxy offer price floor for an offline Non-Spin offer may be different than the proxy offer price floor for an online Non-Spin offer).  It will also be designed to allow different proxy offer price floors for different subcategories of AS (i.e., the proxy offer price floor for a PFR-type RRS offer may be different than the proxy offer price floor for a UFR-type RRS offer).

e. 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.

a. The proxy offer will be a linked AS Offer across all AS products for which a Resource is qualified to provide. For Generation Resources, the proxy offer MW will be HSL.

b. 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.

b. 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 (2) a proxy price floor for that AS plus an “L” factor as described above if necessary to enforce AS quality-value linkage.

b. 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 up to the HSL of the Resource.

c. 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.

c. For each AS where the Resource does not have a submitted AS Offer, the price in the proxy AS Offer for that AS will be set equal to a proxy price floor for that AS set at no less than the higher of: (1) the DAM MCPC for the corresponding AS in the corresponding hour; and (2) $0.01 above the 95th percentile of competitively-supplied Real-Time AS Offers for the respective AS. Proxy AS Offers will be created for qualified On-Line AS products for Load Resources that have not submitted an AS Offer.

c. For each AS where the Resource has not submitted an AS Offer, the price in the proxy AS Offer for that AS up to the HSL of the Resource will be set equal to zero {Note that the IMM in filed initial comments before the PUC in Project 48540 question 9, states:

“Withholding should not be allowed. Much like Resources are required to offer their full capacity for energy production when On-Line, resources should be required to offer their full AS-qualified capacity while online. Under current market design, if a Resource does not submit an energy offer for the entire amount of available capacity, ERCOT systems generate a 'proxy energy offer on behalf of the Resource. The price assumed for any such proxy energy offer is the highest price contained in the Resource submitted offer. In contrast, the IMM recommends that the default offer for any qualified AS capacity that is not actively priced should be $0/MWh because Resources available to offer energy in Real-Time are generally able to offer AS at no additional cost. If circumstances arise that preclude the availability of particular AS while a Resource is On-Line, the Resource should be required to submit either an Outage or change of status reflecting that limitation”.

The IMM further reiterated this in its Reply Comments in the same project question 9, A. Prohibitions on Withholding; stating:

 “… In contrast, the IMM recommends that the default offer for any qualified and available AS capacity that is not actively priced should be $0/MWh under the presumption that the marginal cost of providing AS from online, AS-available, AS-qualified capacity is zero.”}.

d. 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 proxy price floor for an online Non-Spin offer).

e. 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.

13) Proxy AS Offers will not be created for Resources for use in the DAM.

15) When a Resource is unable to provide AS due to operational constraints that Resource’s energy Base Point must be set at the current MW output because the inability to provide AS also would indicate that the Resource is unable to move its energy dispatch. {RTC TF should discuss in this condition, whether the Resource should be removed from the calculation of PRC given that its reserves are “unavailable”}

16) AS Substitution: RTC will substitute higher value AS with lower offer for lower value AS in SCED only (substitutes ECRS for Non-Spin; RRS or RUS for ECRS and Non-Spin).

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

1. Additional concepts related to constraint formulaton (e.g., treatment 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) |  |