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| KP # (Paragraph #) | Key Principle Language |
| **Key Principle 1.1, Ancillary Service Demand Curves and Current Market Price Adders** | |
| KP1.1 (1) | The ORDC price adders and the associated process of determining those price adders in Real-Time are eliminated under Real-Time Co-optimization (RTC). Instead, the Real-Time market (RTM) optimization will use ASDCs as input and determine Market Clearing Prices for Capacity (MCPCs) for each of the individual AS products. |
| KP1.1 (2) | The existing process of having a pricing run to capture the effects of reliability deployments will continue, as will the existing reliability deployment triggers for executing that process. However, the pricing run will be modified to also co-optimize energy and AS. To account for the co-optimization in the pricing run and to preserve the existing market design of removing RUC and RMR capacity from the calculation of scarcity prices, the following modifications will be made to the inputs:   1. AS offers from Reliability Unit Commitment (RUC) instructed Resources, including RMR Resources, will be removed for the pricing run. 2. Energy Offers for RUC-instructed Resources, including RMR Resources, will be administratively set to $11,000/MWh for the pricing run. This EOC is still subject to mitigation for non-competitive constraints. |
| KP1.1 (3) | Real-Time AS Settlement will no longer include the Reliability Deployment Price Adder. Instead, the MCPCs for AS resulting from including the impacts of the pricing run will be used for Real-Time AS imbalance Settlement. |
| KP1.1 (4) | To reasonably reflect the current RTM pricing outcomes expected with the ORDC methodology changes being made starting in March, 2020, the following steps will be taken to develop a single aggregate ORDC for disaggregation into individual ASDCs:   1. For all Security-Constrained Economic Dispatch (SCED) where the sum of RTOLCAP and RTOFFCAP is less than 10,000MW, use the historical RTOLCAP and RTOFFCAP values to calculate the composite LOLP and composite price with composite price defined as:        1. To account for lower reserve level areas where there are no historical observations, create a single point using the following assumptions: 2. RTOFFCAP = 0, RTOLCAP = 2,000MW 3. Set System Lambda equal to the average of system lambda, with the historical values capped at $250/MWh, during SCED timestamps with less than or equal to 4,000MW of total reserves 4. Using the results of (a) and (b) above, use regression methods to fit a curve to the average reserve pricing outcomes for the various MW reserve levels. |
| KP1.1 (5) | ERCOT will design and implement parameters to represent the disaggregation of ASDCs so that potential future changes in values and distribution will not require system changes. The following steps will be taken to disaggregate the single aggregate ORDC into individual ASDCs:  a. Place Reg-Up requirement at the highest priced MWs on the aggregate ORDC;  b. Place RRS requirement at the highest priced open MWs on the aggregate ORDC;  c. Place ERCOT Contingency Reserve Service (ECRS) requirement at the highest priced open MWs on the aggregate ORDC;  d. Place Non-Spinning Reserve (Non-Spin) requirement at the highest priced open MWs on the aggregate ORDC; and  e. Fill remaining MWs on the aggregate ORDC priced at >= $0.01 as NSRS. |
| KP1.1 (6) | The Reliability Deployment Price Adder process will apply to both energy and AS, and the adder for each AS product will be the positive increase in MCPC between the dispatch and pricing run. |
| KP1.1 (7) | For Reg-Down, the ASDC will be a constant value equal to VOLL. |
| KP1.1 (8) | ERCOT will work with stakeholders prior to RTC go-live to develop a framework and reporting to periodically review RTC pricing outcomes relative to pricing outcomes that would have been realized through the ORDC for a reasonable period of time. |
| **Key Principle 1.2, System-Wide Offer Cap and Power Balance Penalty Price** | |
| KP1.2 (1) | For the period of the annual Resource Adequacy cycle where the PNM threshold has not been met, the following parameters will be in effect for the RTM:  a. SWOC will be equal to $2,000/MWh;  b. VOLL and the maximum Ancillary Service Demand Curve (ASDC) value will be equal to $9,000/MWh;  c. The energy price, exclusive of congestion costs, produced every execution of the RTM will be capped at $9,000/MWh; and  d. PBPP will be equal to $11,000.01/MWh. |
| KP1.2 (2) | After the PNM threshold has been met, a process will be used to adjust the parameters for the RTM to be:  a. SWOC will be equal to $2,000/MWh;  b. VOLL and the maximum ASDC value will be equal to $2,000/MWh;  c. The energy price, exclusive of congestion costs, produced every execution of the RTM will be capped at $2,000/MWh; and  d. PBPP will be equal to $4,000.01/MWh. |
| KP1.2 (3) | For the Day-Ahead Market (DAM), the SWOC will be equal to VOLL. |
| **Key Principle 1.3, Offering and Awarding Ancillary Services in Real-Time** | |
| KP1.3 (1) | QSEs will have ability in Real-Time to indicate whether a Resource is temporarily unable to provide AS due to operational constraints. |
| KP1.3 (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. |
| KP1.3 (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). |
| KP1.3 (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. |
| KP1.3 (5) | RTC will not change limitations on sub-categories of AS products (e.g., FRRS, FFR, and RRS and ECRS provided via UFR). |
| KP1.3 (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. |
| KP1.3 (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. |
| KP1.3 (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.  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. |
| KP1.3 (9) | Within RTC, ERCOT operators will have the ability to manually reduce 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 reduced AS amounts from the AS imbalance calculation. |
| KP1.3 (10) | RTC will utilize the AS Offer structure that will be in place with the implementation of Nodal Protocol Revision Request (NPRR) 863. |
| KP1.3 (11) | QSEs will have the ability to continuously update their AS Offers. SCED will use the most recently available AS Offer. |
| KP1.3 (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 telemetered HSL. For Load Resources, the proxy offer MW will be equal to the Resource’s telemetered 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. |
| KP1.3 (13) | Proxy AS Offers will not be created for Resources for use in the DAM. |
| KP1.3 (14) | A behavioral rule will be created that QSEs shall not submit confirmed trades for AS sub-types in excess of their DAM self-arrangement quantity (including 0 or null).  a. QSEs will be notified at 1430 in the Day-Ahead if they have an overage.  b. If the overage is not resolved by the end of the Adjustment Period, QSEs with any overage will be charged the RT MCPC for those quantities.  c. If ERCOT exceeds the AS sub-type limits system-wide in Real-Time, no awards will be prorated. |
| **Key Principle 1.4, Systems/Applications that Provide Input into the Real-Time Optimization Engine** | |
| KP1.4 (1) | Under RTC, for Resources that are being economically dispatched by ERCOT, the current practice of pre-reserving portions of their capacity to provide Ancillary Services (AS) through telemetry from the Resource’s QSE will be discontinued. AS awards will now be an output of RTC.  a. Because of this, RLC calculated Resource Limits of High Ancillary Service Limits (HASLs) and Low Ancillary Service Limits (LASLs) will be discontinued.  b. With the HASL and LASL calculations being discontinued, the method for calculating dispatch limits needs to be modified. High Sustained Limits (HSLs), Low Sustained Limits (LSLs), and telemetered ramp rates will be used directly to calculate High Dispatch Limits (HDLs) and Low Dispatch Limits (LDLs), per the formulas:  HDL=Min(HSL,TelemMW+NormalTelemeteredRampRateUp\*5)  LDL=Max(LSL,TelemMW-NormalTelemeteredRampRateDn\*5) |
| KP1.4 (2) | Under RTC, the following will occur:  a. HASL and LASL calculations will be discontinued;  b. AS will be a Resource specific award (and an output of RTC);  c. AS will be awarded only to Resources that are qualified to provide the service; and  d. Regulation instructions will be Generation Resource specific.  Furthermore, the following modifications to Real-Time telemetered information provided from/to QSEs via RLC will be necessary:  1. For Generation Resources, AS-related (i) responsibility and schedule telemetry, and (ii) Regulation Up/Down participation factor telemetry from QSEs will be discontinued;  2. New telemetry for QSEs to track (i) Resource-specific AS awards, and (ii) Generation Resource-specific Regulation Up/Down instructions from Load Frequency Control (LFC); |
| KP1.4 (3) | For each Resource, QSEs will continue to send Up and Down Normal Ramp Rates that represent the 5-minute ramping capability of the Resource. In addition, there will be new telemetry to be submitted by QSEs to inform ERCOT of the current physical capability of a qualified Resource to provide AS. These telemetry points will be calculated and updated by the QSE every 2 seconds and will be used as additional limits on AS awards below what could be awarded given the Resource’s other constraints such as HSL, HDL, LDL, and LSL. The table below describes the existing and new telemetry points required for each AS product or sub-product, the unit of measure for the telemetry point, and a comment describing what the telemetry point is and how it will be used.   |  |  |  | | --- | --- | --- | | Product or sub-product | Telemetry Unit | Comment | | Energy (up) | MW/minute | 5-minute blended Normal Up Ramp Rate that reflects the current ability of Resource to follow a Base Point instruction. Determines HDL. This is an existing telemetry point. | | Energy (down) | MW/minute | 5-minute blended Normal Down Ramp Rate that reflects the current ability of Resource to follow a Base Point instruction. Determines LDL. This is an existing telemetry point. | | Regulation Up | MW/minute | 5-minute blended ramp rate that reflects the current capability of the Resource to provide Regulation Up. In addition to HDL, limits amount of Regulation Up that SCED can award to the Resource. | | Regulation Down | MW/minute | 5-minute blended ramp rate that reflects the current capability of the Resource to provide Regulation Down. In addition to LDL, limits the amount of Regulation Down that SCED can award to the Resource. | | RRS-PFR | MW | Reflects the current capability to provide RRS from PFR via Governor response. In addition to available headroom and 20% of HSL, limits the amount of RRS-PFR that SCED can award to the Resource. | | RRS-FFR | MW | Reflected the current capability to provide Fast Frequency Response. In addition to HSL, limits the amount of RRS-FFR that SCED can award to the Resource. | | RRS-UFR | MW | Reflects the current capability to provide RRS via UFR. In addition to available headroom, limits the amount of RRS-UFR that SCED can award to the Resource. | | ECRS | MW/minute | 10-minute blended ramp rate that reflects the current capability of the Resource to provide ECRS. In addition to HSL, limits the amount of ECRS that SCED can award the Resource. This value will be the ten-minute output change capability of the Resource divided by ten (positive change for Resources injecting into the grid and negative change for Resources withdrawing from the grid). | | Non-Spin | MW/minute | 30-minute blended ramp rate that reflects the current capability of the Resource to provide Non-Spin. In addition to HSL, limits the amount of Non-Spin that SCED can award the Resource. This value will be the 30-minute output change capability of the Resource divided by 30 (positive change for Resources injecting into the grid and negative change for Resources withdrawing from the grid). | |
| KP1.4 (4) | Under RTC, the following changes will be made to Resource Statuses provided by QSEs for their Resources.  a. The following changes will be made for Resources that are not Load Resources:  1. A new status of ONSC will be created for Resources that are on-line operating as a synchronous condenser. This status will be for both Current Operating Plans (COP) and Real-Time telemetry. Resources with this status will be eligible to provide RRS and ECRS and will count towards Physical Responsive Capability (PRC).  2. A new status of ONHOLD will be created for Resources that are on-line but are temporarily not available for being awarded AS or economically dispatched by ERCOT. This status will only be used for Real-Time telemetry. Resources with this status will have their Base Point set equal to the telemetered MW output of the Resource, will not be eligible to provide AS, and will not count towards PRC.  3. All Resources Statuses that are specific to a particular AS product will be eliminated. These statuses are ONREG, ONOSREG, ONDSRREG, FRRUP, ONRR, ONECRS, ONFFRRRS, and OFFNS.  b. The following changes will be made for Load Resources:  1. A new status of ONL will be created for Resources that are On-Line and are available for economic dispatch and/or for providing AS. Economic dispatch is only applicable to Controllable Load Resources (CLRs) that are qualified to participate in Security-Constrained Economic Dispatch (SCED) and have a valid Energy Bid in Real-Time.  2. All Resources Statuses that are specific to a particular AS product or being a CLR will be eliminated. These statuses are ONRGL, FRRSUP, FRRSDN, ONCLR, ONRL, ONECL, and ONFRRRSL. |
| **Key Principle 1.5, Process for Deploying Ancillary Services** | |
| KP1.5 (1) | The AS manager application will be modified to obtain Resource-specific AS responsibility/award information as an output from RTC (i.e., it will no longer be driven by Real-Time telemetry and Current Operating Plan (COP) information provided by Qualified Scheduling Entities (QSEs)). |
| KP1.5 (2) | Under the current process, energy for immediate dispatch and Locational Marginal Prices (LMPs) from Security-Constrained Economic Dispatch (SCED) are binding; this process will remain in place with RTC. Thus, RTC awards for AS products, energy, dispatch, and their respective prices (e.g., LMPs, Market Clearing Prices for Capacity (MCPCs)) will be immediately binding as applicable to various AS products (e.g., Regulation Up Service (Reg-Up) and Regulation Down Service (Reg-Down)). |
| KP1.5 (3) | Regulations Service instructions from ERCOT will become Resource specific (i.e., no longer QSE portfolio level; participation factors will be removed). |
| KP1.5 (4) | Load Frequency Control (LFC) will be modified to address more frequent awards of Regulation Service to qualified Resources; upon the receipt of new Base Points and AS awards from RTC, LFC will reset Regulation Service instructions to zero. |
| KP1.5 (5) | Updated Desired Base Points (UDBP) will be replaced by Updated Desired Set Point (UDSP)—UDSP will be a single value that is the sum of two components: Base Ramp and Resource-specific Regulation Service instruction. Base Ramp will be a four minute ramp similar to UDBP, except that the starting point of the Base Ramp will be the expected output of the Resource using the previous Base Point and the last Resource-specific Regulation instruction from LFC before new Base Points were input to LFC (i.e., the expected output based on these two components). For Resources that are not providing Regulation Service, the Regulation instruction component will be zero. LFC will then determine the Resource-specific instruction and add it to the Base Ramp.  LFC will send UDSP every four seconds for all Resources receiving a Base Point from RTC and will continue to do so as new RTC results become available. The UDSP ramp may be temporarily halted for Resources that have Base Points directionally opposite a significant frequency deviation. |
| KP1.5 (6) | The calculated system level regulation requirement will be distributed as Regulation Service Instructions to each Resource proportionate to their Regulation Service awards. Issued Resource-specific Regulation Service instructions will respect Resource limits (i.e., HSL, LSL, and ramp rates) by considering UDSP and Resource-specific Regulation Service instructions. Remaining un-deployed system level regulation will be distributed to Resources with Regulation Service awards that have un-deployed Regulation Service award capacity. |
| KP1.5 (7) | Operational procedures for deploying Offline Non-spin and RRS from Load Resources remain the same |
| KP1.5 (8) | For manual deployment of Generation Resources carrying RRS with the Resource on Synchronous Condenser Fast Response Mode or carrying RRS as FFR capable Resources excluding NCLR, LFC will send energy deployment instructions. |
| KP1.5 (9) | The existing process for QSEs to update telemetered AS schedules following manual deployment for Generation Resources and Controllable Load Resources will be removed under RTC. |
| KP1.5 (10) | Under scarcity conditions, energy to be served is given priority and smaller amounts of each Ancillary Service will be procured. This will result in scarcity prices being set by the demand curves and reflected in energy prices and MCPCs. |
| KP1.5 (11) | The administrative price floor for Non-Spin will be replaced by prices determined from awarded offers and the ASDC for Non-Spin. |
| KP1.5 (12) | RTC will continue to have the ability for the Real-Time co-optimization (i.e., RTC) to be executed off-cycle, manually or automatically, between regularly scheduled 5-minute executions. |
| KP1.5 (13) | The processes and procedures during a SCED/RTC failure will remain the same: emergency base points and held prices (SPPs, Meter prices and MCPCs) through the 15 minute recovery period. |
| KP1.5 (14) | In Emergency Base Points, RTC systems will consider the AS awards from the most recent SCED execution. Non-AS awarded capacity will be utilized ahead of AS awarded capacity and, if necessary, Non-Spin capacity will be utilized before ECRS and ECRS will be utilized before Regulation Service and RRS capacity. |
| KP1.5 (15) | No new Settlement calculations will be needed to address the case where there is a SCED failure. |
| KP1.5 (16) | Under RTC Fast Responding Regulation Service (FRRS) will not be needed as a subset of Regulation Ancillary Service and will be removed. Energy Storage Resources (ESRs) will be required to qualify and provide the same Regulation Service as other Resources providing Regulation Service. |
| Key Principle 1.6, Ancillary Service Imbalance Settlement | |
| KP1.6 (1) | The new AS imbalance Settlement process will not create new sources of uplift or Make-Whole Charges/Payments for Load Serving Entities (LSEs). |
| KP1.6 (2) | AS imbalance calculations will be created for each AS product in the Real-Time Market (RTM). |
| KP1.6 (3) | 15-minute Settlement of non-zero net AS imbalance amounts will be charged/paid to Qualified Scheduling Entities (QSEs) on a Load Ratio Share (LRS) basis. Where the amount cleared in DAM plus corresponding AS trades is equal to the corresponding RTM award MW amount, there will be no LRS-based charge/payment. |
| KP1.6 (4) | Under RTC, a QSE’s RTM AS Obligation shall equal the RTM LRS multiplied by sum of all RTM AS awards (i.e., there will be no portfolio self-arrangement for the RTM). |
| KP1.6 (5) | Under RTC, the following revision will be made credit exposure calculations to account for the RTC AS activity:  a. Updates will be made to the Real-Time Liability Completed and Not Settled (RTLCNS) component of Estimated Aggregate Liability (EAL) calculation to include RTC AS activity.  b. Updates will be made to the Real-Time Liability Estimates (RTL) component of the EAL to include RTC AS activity (these components will flow into RTLCNS).  c. Updates will be made to the Minimum Current Exposure (MCE) component of Total Potential Exposure (TPE) calculation to include RTC AS activity. |
| **Key Principle 2, Suite of Ancillary Service Products** | |
| KP2 (1) | The set of AS products under RTC will be the products finalized with the approval NPRR863. |
| KP2 (2) | For all AS, the qualification process will determine for each Resource the maximum MW amount the Resource is qualified to provide. ERCOT will limit awards to no more than the qualified quantity. |
| KP2 (3) | Regulation Service  a. Continue with current qualification methodology. Existing Regulation Ancillary Service qualification tests can continue under RTC and ERCOT suggests currently qualified Resources qualification status to carry-over into RTC.  b. MW qualified to provide Regulation Service excluding Fast Responding Regulation Service (FRRS) will be limited to how much Resources can sustain for 15 minutes. |
| KP2 (4) | Responsive Reserve (RRS)  a. For a Generation Resource or Controllable Load Resource, continue with current qualification methodology and include the provision to sustain the qualified MW for 15 minutes.  b. For a Generation Resource operating in synchronous condenser fast-response mode, continue with current qualification methodology.  c. For a Load Resource controlled by high set UFR set at 59.7 Hz, continue with current qualification methodology.  d. For a Resource providing Fast Frequency Response (FFR) including under-frequency relay Controlled Load Resources, ERCOT deployment signal and high-speed site-level data to verify the 15-cycle response along with the sustained 15-minute output.  i. A Resource must be able to sustain for full 15 minutes its output, equal or greater than the amount requested for FFR qualification.  ii. A Resource must demonstrate its capability to provide full response in 15 cycles or faster when system frequency falls below 59.85 Hz.  iii. High-speed recorder capability must be demonstrated. |
| KP2 (5) | Non-Spinning Reserve (Non-Spin)  a. For Off-Line Non-Spin, continue with current qualification methodology.  b. All SCED-dispatchable Resources are qualified to provide On-Line Non-Spin based on their 30 minute blended ramp rate. |
| KP2 (6) | ERCOT Contingency Reserve Service (ECRS)  a. Off-Line ECRS can only be provided by Resources that have met the Quick Start Generation Resources (QSGR) qualification.  b. All SCED-dispatchable Resources are qualified to provide On-Line ECRS based on their 10-minute blended ramp rate.  c. For ECRS from a Load Resource other than a Controllable Load Resource, the same qualification process used today to test manual deployment of Load Resources for RRS, excluding requirements for under-frequency relay response will be used. |
| **Key Principle 3, Reliability Unit Commitment** | |
| KP3 (1) | RUC will continue to ensure adequate capacity for Real-Time to meet energy and AS needs, and resolve transmission constraints; since it is designed to distribute AS across all available Resources, it has the additional flexibility for resolving transmission constraints as well as AS needs and should result in fewer RUC commitments for congestion. |
| KP3 (2) | RUC will be built with the capability to use RUC Ancillary Service Demand Curves (ASDCs). RUC will attempt to solve for a Resource commitment that meets the Load forecast and AS Plan considering Resources’ COPs and using defined penalty curves. The values of these curves will be determined at a future date. |
| KP3 (3) | Modifications will be made to the existing set of data elements provided by Qualified Scheduling Entities (QSEs) in their COPs to accommodate changes to RUC optimization. |
| KP3 (4) | QSEs will have a mechanism in their COPs to indicate, for each hour, the physical ability/inability of a Resource to provide AS (i.e., the Resource Status). |
| KP3 (5) | The amount of AS that can be provided by a Resource will be constrained by its qualifications and capabilities. |
| KP3 (6) | Proxy AS Offers will be used in RUC in determining a co-optimized solution where AS Offers have not been submitted. |
| KP3 (7) | In addition to online qualified Resources, the RUC engine will consider a COP Resource Status of OFFQS (Off-Line but available for SCED deployment) for a Resource that is qualified for ERCOT Contingency Reserve Service (ECRS), as being able to provide ECRS. |
| KP3 (8) | In addition to online qualified Resources, the RUC engine will consider a COP Resource Status of OFF (Off-Line but available for commitment in the DAM and RUC) for a Resource that is qualified for Non-Spinning Reserve (Non-Spin), as being able to provide Non-Spin. |
| KP3 (9) | The current process under which ERCOT Operators review recommendations from the RUC optimization and make commitment instruction decisions will remain in place. This process includes:  a. ERCOT Operators will give Market Participants ample time to respond to postings of capacity shortages for future hours; and  b. If a generation commitment is recommended by RUC for a future hour, ERCOT Operators will delay any Dispatch Instruction until the next RUC process would not have sufficient lead time to commit the Resource for the same future hour thus giving QSEs a chance to self-commit. |
| KP3 (10) | Revenues from Real-Time AS awards will be used to offset the RUC Guarantee for the RUC Make-Whole Payment. |
| KP3 (11) | Revenues from Real-Time AS awards will be included as revenues in the RUC Clawback Charge. |
| KP3 (12) | The Capacity-Short Charge will be adjusted to allocate RUC Make-Whole Costs to QSEs that are short in either energy capacity or AS capacity.  a. QSEs with AS Supply Responsibility greater than their AS capability will be allocated a portion of RUC Make-Whole costs.  b. QSEs with an overall shortage in energy plus AS Supply Responsibility will be allocated a portion of the RUC Make-Whole costs.  c. AS capability for Capacity Short Charge Settlement purposes will be based on AS Offers validated against COP information. |
| KP3 (13) | The RUC engine will use the same proxy methodology for AS as Real-Time. |
| KP3 (14) | The RUC engine will use the same scaling for AS offers as energy offers. |
| KP3 (15) | RUC will use new information contained in the COP to determine how much capability for each AS product each Resource will be capable of providing. |
| KP3 (16) | The Energy Offer Floor for RUC-instructed Resources which have not opted out of RUC settlement will be $1,500/MWh for the dispatch run. |
| KP3 (17) | All RUC-instructed Resources will have their Energy Offer Curve administratively set to a value just below the Power Balance Penalty Price (i.e., $11,000/MWh) in the pricing run only. This EOC is still subject to mitigation for non-competitive constraints. |
| KP3 (18) | The AS Offer Floors for RUC-instructed Resources which have not opted out of RUC Settlement will be $1,500/MWh for the dispatch run. |
| KP3 (19) | AS Offers for RUC-instructed Resources which have not opted out of RUC Settlement will be removed for the pricing run. |
| KP3 (20) | RTC will not affect the ability for QSEs to opt out of RUC Settlement. |
| **Key Principle 4, The Supplemental Ancillary Service Market Process** | |
| KP4 (1) | This Real-Time Co-Optimization (RTC) principle proposes the elimination of the Supplemental Ancillary Service Market (SASM) process. |
| **Key Principle 5, Day-Ahead Market** | |
| KP5 (1) | ASDCs will be added to the DAM optimization, and will be used as an input affecting the AS quantity procured and the Market Clearing Price for Capacity (MCPC). |
| KP5 (2) | The same ASDCs that are used in Real-Time will be used in DAM.  a. In some cases, negative self-arranged quantities may necessitate shifting the DAM ASDC to the right, as they are treated by DAM as bids at the highest price on each corresponding ASDC. |
| KP5 (3) | The current DAM AS insufficiency process will be eliminated by removing:  a. The process of reopening submission window for more offers;  b. The AS penalty costs; and  c. The current pricing run used when AS Offers are insufficient to meet the AS Plan. |
| KP5 (4) | AS Obligation quantities posted by 06:00 in the Day-Ahead will become an advisory-only number based on the AS Plan.  a. They will be used to validate self-arranged AS transactions. This validation will include any AS subtype limitations, e.g., Responsive Reserve (RRS) being provided via Under Frequency Relay (UFR). |
| KP5 (5) | Minimum AS Obligation quantity will be 0.1 MW. |
| KP5 (6) | After DAM is published, updated AS Obligation quantities will be calculated and published based on the actual DAM AS requirement. These quantities may differ from the 06:00 posting, and are the quantities that will be used for DAM Settlement.  a. “DAM AS requirement” here means the sum of the DAM AS awards plus any self-arrangement.  b. In the event that a QSE’s self-arranged quantity exceeds the final AS Obligation, the remainder will be paid to the QSE at the DAM MCPC. Self-arranged AS transactions will not be allowed to be submitted or updated after DAM. |
| KP5 (7) | AS Virtual Offers  a. Allow one part, unlinked offers of AS that do not represent an offer from a physical Resource from Qualified Scheduling Entities (QSEs). The general purpose of adding this new transaction is convergence bidding, in contrast to conventional Resource-specific AS Offers.  b. If awarded, the QSE will be paid the DAM price for the capacity times the quantity awarded. The awarded QSE will pay the Real-Time price times the quantity awarded.  c. This proposal does not change the quantity of capacity purchased for each AS. ERCOT will attempt to procure the quantity from its AS Plan from Resource-specific offers as well as virtual offers against respective ASDCs.  d. Virtual offers can only be submitted for:  i. Conventional Regulation (not Fast Frequency Response Service);  ii. RRS – Primary Frequency Response type;  iii. ECRS – dispatchable; and  iv. Non-Spin.  e. The capability to self-arrange AS in excess of a QSE’s AS Obligation will no longer be needed and can be removed.  f. Virtual AS Offers will automatically expire at the close of the DAM.  g. The QSE will have the award included in the calculation of the QSE’s position regarding any RUC Capacity-Short Charge.  h. The credit calculation for Real-Time Liability Estimate (RTLE) will also need to be modified to include this capacity in a fashion similar to the DAM energy short calculations.  i. The DAM credit exposure calculations will be modified to validate the virtual AS Offers against the available credit limit, similar to how DAM Energy-Only Offers are treated (evaluating the potential DAM/RT price risk). This will take the form of the 90th percentile of any positive hourly difference between the RT MCPC and the DAM MCPC over the previous 30 days.  j. The Default Uplift Invoice Process will include virtual AS awards to the QSE when calculating the Maximum MWh Activity for the Counter-Party that represents the QSE. |
| **Key Principle 6, Market-Facing Reports** | |
| KP6 (1) | As necessary, existing market-facing reports and user interfaces will be removed or modified and new market-facing reports and user interfaces will be created to implement RTC and achieve the key principles developed by the RTCTF. |
| KP6 (2) | The list of reports and user interfaces contained in the appendix of this document will be used to guide the development of Protocol language for RTC. |
| **Key Principle 7, Performance Monitoring** | |
| KP7 (1) | Generation Resource Energy Deployment Performance (GREDP) and Controllable Load Resource Energy Deployment Performance (CLREDP) calculations will updated to account changes made to deployments instructions from ERCOT. The “ABP” and “ARI” components of the GREDP and CLREDP calculations will be replaced with an Average Set Point (ASP) component, where ASP is equal to the time-weighted average of the Updated Desired Set Point (UDSP), which is sum of a linearly ramped Base Point (Base Ramp) and Regulation Service instruction that the Resource should have produced during a five-minute clock interval. |
| KP7 (2) | Currently, ERCOT measures a QSE’s total telemetered Ancillary Service (AS) Responsibilities and total AS Responsibilities submitted in Current Operating Plans (COPs) against its total AS Obligation in order to identify any non-compliance with the Qualified Scheduling Entity (QSE) meeting its obligation. With RTC, the concept of an AS Obligation based on Day-Ahead Market (DAM) awards, AS self-arrangement, and AS trades is no longer relevant. As such, related compliance requirements and associated reporting will be removed. |
| KP7 (3) | With RTC, the updating on AS Schedules following a deployment instruction for the purpose of adjusting High Ancillary Service Limits (HASLs) is no longer relevant. As such, the compliance requirement and associated reporting will be removed. |
| KP7 (4) | In line with the changes for GREDP and CLREDP, the Aggregate Adjusted Base Point (AABP) calculation used in the Base Point Deviation (BPD) Settlement will replace the sum of the Average Base Point (AVGBP) and the Average Regulation Instruction (AVGREG) with the Average Set Point (ASP) component. |
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***Appendix: List of Reports and User Interfaces***

**New Reports/Interfaces**

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| 2-Day Ancillary Services Reports (RTM) |
| 48-Hour Highest Price AS Offer Selected (RTM) |
| 60-Day DAM Disclosure Reports - AS Offers (Not Associated with a Resource) |
| 60-Day SCED Disclosure Reports - Generation Resource Updates to Offer Curves for AS and potentially Energy Offers if later approved |
| 60-Day SCED Disclosure Reports - Load Resource Updates to Offer Curves for AS and potentially Energy Bids if later approved |
| 7-Day Event Trigger Posting - AS MCPC Greater than 50xFIP (RTM) |
| Aggregated Ancillary Service Offer Curve (SCED) |
| AS Obligation and Responsibility (RTM) |
| Daily RUC Hourly AS Capability |
| DAM Ancillary Service Demand Curves |
| Historical RTM Clearing Prices for Capacity |
| Hourly RUC Hourly AS Capability |
| RTD Indicative RTC MCPC |
| RTM Ancillary Service Demand Curves |
| RUC Ancillary Service Demand Curves |
| SCED Clearing Prices for Capacity |
| Website- RTM MCPCs display |
| Weekly RUC Hourly AS Capability |

**Deleted Reports/Interfaces**

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| 60-Day SASM Disclosure Reports - Gen AS Offer Awards |
| 60-Day SASM Disclosure Reports - Gen AS Offers |
| 60-Day SASM Disclosure Reports - Load AS Offer Awards |
| 60-Day SASM Disclosure Reports - Load AS Offers |
| Hourly RUC Ancillary Service Demand Curves |
| IMM Software Real-Time Co-Optimization Input Files |
| LOLP Distribution by Season and TOD Block |
| Monthly Summary of Ancillary Service Supply Responsibility Failure |
| Monthly Summary of Resource AS Supply Insufficiency at 1430 |
| Resource AS Supply Insufficiency at 1430 |
| SASM Aggregated Ancillary Service Offer Curve |
| SASM MCPC by Ancillary Service Type |
| Total Ancillary Service Procured in SASM |
| UI- Get SASM ID List |
| Weekly RUC Ancillary Service Demand Curves |

**Changed Reports/Interfaces with Notes on Changes**

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| --- | --- |
| 2-Day DAM and SCED Energy Curves Reports | SCED Energy Offers Report should be posted for each SCED interval |
| 2-Day Real Time Gen and Load Data Reports | HASL columns need to be removed from Gen summary report |
| 48-Hour Highest Price AS Offer Selected (DAM) | Remove SASM from market column population |
| 60-Day Current Operating Plan | COP information will change and report will need to change to contain new information. |
| 60-Day SCED Disclosure Reports - DSR Load data | Update to include SCED interval level data. |
| 60-Day SCED Disclosure Reports - Gen Resource data | Update to include SCED interval level data. HASL column needs to be removed. Include AS Offer information for each interval and update for changes in Resource telemetry |
| 60-Day SCED Disclosure Reports - HDL&LDL manual overrides | Update to include SCED interval level data. |
| 60-Day SCED Disclosure Reports - Load Resource data | Update to include SCED interval level data. HASL column needs to be removed. Include AS Offer information for each interval and update for changes in Resource telemetry |
| 60-Day SCED Disclosure Reports - QSE Self-Arranged AS | Update to include SCED interval level data. Change to self-provision concept |
| 60-Day SCED Disclosure Reports - SMNE Gen Resource (Settlement Metered Net Energy for Generation Resources) | Update to include SCED interval level data. |
| 7-Day Event Trigger Posting - AS MCPC Greater than 50xFIP (DAM) | Remove SASM from market column population |
| 7-Day Event Trigger Posting - LMP Exceeds 50xFIP (RTM) | Updated to include SCED interval level data, for the applicable intervals. |
| AS Obligation and Responsibility (DAM) | Responsibility will change to simply be DAM award |
| CLREDP Acceptable Performance Criteria and PRC Variables | Will need to be updated due to AS award changes |
| Complete Current Operating Plan Data | COP information will change and report will need to change to contain new information. |
| Controllable Load Resource Base Point Deviation Charge for Over-Consumption Variables | Will need to be updated due to AS award changes |
| Controllable Load Resource Base Point Deviation Charge for Under-Consumption Variables | Will need to be updated due to AS award changes |
| ERCOT Fundamentals Training Manual | This references AS awards in DAM being physically binding. More will need to be added about how AS works in RTM. |
| ERCOT Market Information List | Add new reports. Remove old reports. |
| ERCOT Summary Dispute Report | New settlement SUB TYPE needs to be added |
| Historical Real-Time ORDC and Reliability Deployment Price Adders and Reserves | Remove ORDC related data. Keep Reliability Deployment related data. |
| Historical Real-Time ORDC and Reliability Deployment Prices for 15-minute Settlement Interval | Remove ORDC related data. Keep Reliability Deployment related data. |
| Market Submission Validation Rules | Update to consider new RTC submission/validation rules |
| Monthly Generation Resource Energy Deployment Performance Report | Will need to be modified if GREDP metric is modified |
| Monthly Non-Spin CLR Performance Report | Need to change to reflect on how AS is awarded in RTM |
| Monthly Non-Spin Generation Performance Report | Need to change to reflect on how AS is awarded in RTM |
| QSE Ancillary Services Capacity Monitor | Will need to be updated to the concept of AS award vs. responsibility |
| Real-Time ORDC and Reliability Deployment Price Adders and Reserves by SCED Interval | Remove ORDC related data. Keep Reliability Deployment related data. |
| Real-Time ORDC and Reliability Deployment Prices for 15-minute Settlement Interval | Remove ORDC related data. Keep Reliability Deployment related data. |
| Responsive Reserve Performance QSE Summary Report for Non CLRs | Need to change to reflect on how AS is awarded and deployed in RTM |
| Responsive Reserve Performance Report for Generators and CLRs | Need to change to reflect on how AS is awarded and deployed in RTM |
| RTD Indicative ORDC and Reliability Deployment Price Adders and Reserves | Remove ORDC related data. Keep Reliability Deployment related data. |
| RTM Price Corrections | Update to include RTC MCPC |
| Short-Term System Adequacy Report | Construct likely the same but calculations will likely change as new COP statuses likely added and old COP statuses removed |
| System-Wide Offer Cap | Update to consider RTC SWCAPs and potentially new SWCAP for DAM |
| UI- Ancillary Service Obligations Notification | Remove SASM |
| UI- Ancillary Service Offer Awards | Remove SASM |
| UI- Ancillary Service Offers | changes to validation interface |
| UI- Ancillary Service Trades | Adjust to consider RTC trade rules |
| UI- AwardedAS | Remove SASM |
| UI- Confirmed and Unconfirmed Ancillary Service Trades | Adjust to consider RTC trade rules |
| UI- Confirmed Trades | Adjust to consider RTC trade rules |
| UI- Current Operating Plan (COP) Submissions/Retrievals | COP information will change and report will need to change to contain new information. |
| UI- Market MCPCs | Remove SASM |
| UI- Real-Time LMPs for Latest SCED Run Display | Remove ORDC related data |
| UI- RTD Indicative LMPs by Load Zones or Hubs Display | Remove ORDC related data |
| UI- Unconfirmed Ancillary Service Trades | Adjust to consider RTC trade rules |
| UI- Unconfirmed Trades | Adjust to consider RTC trade rules |
| Website- Capacity Available to SCED | HASL needs to be removed |
| Website- System Ancillary Service Capacity Monitor | Will need to be updated to the concept of AS award vs. responsibility |