KP 1.3

RTC Constraints

Working Document

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## Introduction

This document describes the proposed constraints used by RTC in the Real-Time optimization. This document will be revised based on feedback from stakeholders.

Status as of 6/21/2019:

Items not covered in this version

1. Synchronous Condenser participating in RRS (RRS-PFR) and ECRS
2. Storage Resources modeled as a combination of a Generation Resource and a Controllable Load Resource participating in FRRS, RRS-FFR and “blocky” ECR
3. Fast Load Resource participating in RRS-FFR

## Design Objective

In RTC, energy and Ancillary Service (AS) products are procured through a co-optimized clearing process that minimizes production costs. The results of the RTM (dispatch and prices) should respect the Resource constraints to assure that the energy dispatch and AS awards are feasible Resource opportunity is maximized.

To achieve this, it is important to account for the physical operational characteristics of the Resources, viz. Ramp Rates, Forbidden Zones, High/Low output limits, transient temporal constraints due to combined cycle configuration transition, etc.

ERCOT stakeholders, in the design of the current RTM (SCED), adopted the use of a combination of mathematical modeling of the physical operational characteristics and Real-Time Resource telemetry in the clearing engine to allow maximum flexibility.

The same approach is taken for the design of RTC where, a combination of additional Real-Time Resource telemetry and enhancements to the mathematical models in the clearing engine will be adopted.

## Resource Status:

The Resource statuses (COP and Telemetry) will need to be reviewed. The table below lists the current Resource statuses (COP and/or Telemetry) being used with suggested modifications for RTC implementation.

Table 1: Resource Status

|  |  |  |
| --- | --- | --- |
| Resource Type | Resource Status | Under RTC |
| Generation Resource | ON | Available for energy and AS awards |
| ONOS | Energy participation same as today. Today can carry all AS products. What should be the case with RTC?  Today, Resource with status of ONOS generally do not submit Inc/Dec EOC.  Under RTC, if awarded ECRS, Non-Spin, RTC will hardly ever convert this capacity to energy due to economics |
| ONDSR | Energy participation same as today. Today can carry all AS products. What should be the case with RTC?  There does not seem to be any Resource using this status  Status no longer needed? |
| ONOPTOUT | Considered to be same as ON |
| ONRUC | Considered to be same as ON (may have special treatment, e.g., AS offer floors) |
| OFFQS | Considered to be same as ON for energy, ECRS and NSPIN.  Cannot be awarded Regulation or RRS-PFR |
| OFF | Not available to for energy, Regulation, RRS-PFR, or ECRS awards. Available for NSPIN if qualified |
| ONREG | Status no longer needed |
| FRRSUP | Status no longer needed |
| ONOSREG | Status no longer needed |
| ONDSRREG | Status no longer needed |
| OFFNS | Status no longer needed |
| ONTEST | Energy participation same as today. Cannot be awarded AS |
| ONEMR | Considered to be same as ON, QSE may appropriately set LSL and HSL to reflect operating limits |
| ONRR | Hydro in Synchronous Condenser mode. Today, BP=telMW. Under RTC, setting BP=telMW, i.e.; RTC does not dispatch Resource for energy, allows for Resource tto be awarded RRS-PFR, however more discussion required if Resource wishes to participate in ECRS to determine how capacity awarded ECRS will be converted to energy if RTC cannot dispatch. |
| ONECRS | Hydro in Synchronous Condenser mode. See notes on ONRR. More discussion required on both energy and AS participation. How is ECRS awarded capacity converted to energy? |
| ONFFRRRS | Status no longer needed ? Replace with ON? |
| OUT | Not available for energy or AS awards |
| EMR | Not available for energy or AS awards |
| STARTUP | Energy participation same as today. BP=telMW+5\*NRRUp Cannot be awarded AS except for   1. ECRS,NSPIN for Resource Transitioning from OFFQS to ON 2. NSPIN for Resource Transitioning from OFF to ON in response to ERCOT XML Non-Spin Deployment Instruction |
| SHUTDOWN | Energy participation same as today. BP=telMW-5\*NRRDn Cannot be awarded AS |
| EMRSWGR | Not available for energy or AS awards |
|  |  |  |
| LR | ONRGL | Replace with ON |
| ONCLR | Replace with ON. Similar to GR with ON status |
| ONRL | Replace with ON. Not available for energy awards. Available for RRS and ECRS awards |
| ONECL | Replace with ON |
| ONFFRRRSL | Replace with ON |
| OUT | Not available for energy or AS |
| FRRSDN | Status no longer needed |
| FRRSUP | Status no longer needed |

**Feedback requested:**

1. **Please review table of Resource status and ERCOT comments and provide feedback**

## Telemetry Considerations

In this document new telemetry required for RTC are proposed. These new telemetry, in coordination with other existing telemetry and enhanced mathematical models will guide RTC in awarding energy and AS appropriately

**Existing Telemetry to manage physical operating conditions of Resources**

1. Resource status telemetry (STARTUP,SHUTDOWN), and
2. Resource Ramp Rate telemetry
3. Resource limits (HSL,LSL)
4. Lower/Raise Block Status (LBST, RBST)

**New Resource Specific Telemetry**

: Telemetry (MW value) to indicate maximum RegUp MW capability for *ith* Resource

: Telemetry (MW value) to indicate maximum RegDn MW capability for *ith* Resource

: Telemetry (MW value) to indicate maximum RRS-PFR MW capability for *ith* Resource

: Telemetry (MW value) to indicate maximum RRS-BLK MW capability **excluding** self-provided amount for *ith* UFR type Load Resource

: Telemetry (MW value) to indicate maximum RRS-FFR MW capability for *ith* “fast” Generation or Load Resource

: Telemetry (MW value) to indicate maximum ECRS MW capability for *ith* Resource

: Telemetry (MW value) to indicate maximum NSPIN MW capability for *ith* Resource

Additionally for Generation and controllable Load Resource:

: Blended Emergency Ramp Rate Up (value, when multiplied by 10 shows the 10 minute MW output change capability) of *ith* Resource. Used to check feasibility of ECRS awards

: Blended Normal Ramp Rate Up (value, when multiplied by 30 shows the 30 minute MW output change capability) of *ith* Resource. Used to check feasibility of Non-Spin awards

**Additional New Combined Cycle Specific Telemetry to accommodate frequency and non-frequency capacity**

: Proportion of the Base Point provided by the frequency responsive capacity of the *ith* Combined Cycle Generation Resource

: Minimum amount of the total Base Point provided by the frequency responsive capacity of the *ith* Combined Cycle Generation Resource

: Maximum amount of the total Base Point provided by the frequency responsive capacity of the *ith* Combined Cycle Generation Resource

**Additional New UFR Type Load Resource Specific Telemetry to accommodate self-provision of RRS and ECRS**

: Telemetry to indicate RRS-BLK MW amount self-provided by *ith* On-Line UFR type Load Resource

: Telemetry to indicate ECRS-BLK MW amount self-provided by *ith* On-Line UFR type Load Resource

**Feedback requested:**

**Is the flexibility of using telemetry to address operational constraints is adequate (e.g. awarding of Regulation, RRS-PFR considering only frequency responsive capacity, handling of forbidden zones, avoiding award of AS while Resource is transitioning through “dead zones”, etc.) adequate?**

Feedback from Floyd Trefny 07/03/2019 & 07/23/2019

1. For indicators such as these, ERCOT must provide a reasonability check to verify that the telemetry received from the QSE is less than the HSL minus the actual Mw telemetry. There can be many such reasonability rules that should be included in the RTC documentation.
2. Need to make sure that the sum of all reserves of all available up Ancillary Services for all Resources that participate in the calculation of PRC is greater than calculated PRC. Otherwise, RTC dispatch is invalid due to data errors
3. Consider the use of existing telemetry as input to RTC:
   1. Raise Block Status (RBST)
   2. Lower Block Status (LBST)

Discussion items: Based on phone conference - paraphrased by ERCOT

1. If RBST is set for longer than a few minutes, does it imply that this Resource is not available for upward AS and HDL is set to telemetered output in RTC till RBST is reset?
2. If LBST is set for longer than a few minutes, does it imply that this Resource is not available for RegDn AS and LDL is set to telemetered output in RTC till LBST is reset?
3. Is the use of RBST and LBST in RTC a better option than Resource status of ONOS?
4. Based on phone conference - paraphrased by ERCOT:
   1. Some of the proposed new telemetry needs to be reviewed to see if it is required. For instance, why would a QSE provide a Resource specific telemetry limiting awards for ECRS but the HDL for Resource indicates it can receive a Base Point higher than its current output level ?
   2. At some point in the RTC principle development, the list of proposed Resource statuses and proposed new telemetry need to be reviewed before finalizing (too many of them?)

Feedback from Randy Jones 07/18/2019

1. Consider a new Resource status ONTR: This status is used by Resource to indicate operational constraints like configuration transition, startup of boiler feed pump, etc. For this status ONTR, RTC will not consider this Resource for AS and its Base Point will be set to its telemetered output

## RTC Pricing Run

Intent, like today, is to capture system wide pricing impacts on energy and each AS type MCPC when “out-of-market” actions are taken

Note: Changes to current Pricing Run (locational impacts, others) will be analyzed and the intent of these changes will be incorporated into RTC.

* **Proposal for Pricing Run Under RTC:**
  + No Make Whole payment to Resources (Same as today)
  + Reliability Deployment Price Adder (RDPA) for Resource headroom does not exist anymore
  + Same categories of reliability deployments that initiate pricing run as today (6.5.7.3.1)
  + Change inputs to pricing run:
    - Relax HDL/LDL for certain On-Line Resources (6.5.7.3.1)
    - ONRUC/On-Line RMR Resource:
      * LSL,LDL set to zero (Refer to Protocols for combined cycle RUCed to different configuration)
      * **Remove AS Offers or high priced AS Offers**
    - ERS and UFR type Load Resource deployed due to ERCOT XML Instruction (RRS/ECRS)
      * **Remove AS offers or high priced AS Offers**
    - GTBD (same as today):
      * Add deployed MW (as per ERCOT XML Instruction) to GTBD(e.g. relax LSL of ONRUC to zero, modify HDL/LDL of certain Resources, etc.)
      * Modify GTBD related to “out of market actions” on DC Ties and Block Load Transfers
  + Rerun Step1 and Step2 (energy **and AS co-optimization**)
  + Final Pricing: energy and each AS type
    - Energy: If Pricing Run RTC Step2 Power Balance Shadow price (System Lambda) is greater than the Dispatch Run RTC Step 2 System Lambda then add the positive difference to the Dispatch Run RTC Step 2 System Lambda with check to ensure that the final System Lambda does not exceed VOLL

If the proposal to reduce System Lambda when System Lambda of Dispatch RTC Run Step 2 is greater than VOLL is adopted (KP1\_1 and KP1\_2 discussion), then the determination of the positive difference in System Lambda is performed after the reduction of Dispatch Run RTC Step 2 System Lambda

* + - For each AS type (RegUp, RegDn, RRS, ECRS, and Non-Spin), if the AS type MCPC from Pricing Run Step 2 is greater than the corresponding AS type MCPC from the Dispatch RTC Run Step 2 then add the positive difference to the Dispatch RTC Run Step 2 AS Type MCPC with check to ensure that the final AS type MCPC does not exceed that AS type maximum price on its AS Demand Curve (ASDCAS-type)

If the proposal to reduce AS MCPC when System Lambda of Dispatch RTC Run Step 2 is greater than VOLL is adopted (KP1\_1 and KP1\_2 discussion), then the determination of the positive difference in MCPC is performed after the reduction of Dispatch Run RTC Step 2 AS type MCPC

## Nomenclature

* Regulation Up Reserve Service (RegUp) has two (2) sub-types
* RegUp: Conventional RegUp, provided by On-Line Generation Resource, On-Line Controllable Load Resource
* FRRSUp: Fast Responding Regulation Up Service
* Regulation Down Reserve Service (RegUp) has two (2) sub-types
* RegDn: Conventional RegDn, provided by On-Line Generation Resource, On-Line Controllable Load Resource
* FRRSDn: Fast Responding Regulation Down Service
* Responsive Reserve Service (RRS) has three (3) sub-types
* Primary Frequency Response (RRS-PFR) from Generation Resource and Controllable Load Resource
* RRS from Load Resources (RRS-BLK) armed with high set Under Frequency Relay (UFR) - UFR setting at 59.7 Hz and must deploy within 30 cycles (0.5 seconds).
* Fast Frequency Response (RRS-FFR) from very fast responding Resources. Frequency setting at 59.85 Hz and must deploy within 15 cycles (0.25 seconds)
* ERCOT Contingency Reserve Service (ECRS) has two (2) sub-types
* ECRS: Conventional ECRS, i.e., RTC Dispatchable (On-Line or OFFQS Generation Resource, On-Line Controllable Load Resource)
* ECRS-BLK: Manually Dispatched (On-Line UFR type Load Resource)

: The number of On-Line Generation Resources

: The number of Generation Resources with status of OFFQS

: The number of On-Line Controllable Load Resources

: The number of On-Line “fast” Generation Resource part of Storage Resource

: The number of On-Line “fast” Controllable Load Resource part of Storage Resource

: The number of On-Line UFR type Load Resources

: The number of On-Line “fast” Load Resources that are qualified for RRS-FFR

: The number of Off-Line Generation Resources that are qualified for NSPIN

: Energy Base Point to *ith* Generation Resource (supply-generation)

: Energy Base Point to *ith* Controllable Load Resource (demand - consumption)

: Cleared MW segment of the Power Balance Penalty Curve

: RegUp MW capacity award to *ith* Resource

: FRRSUp MW capacity award to *ith* Resource

: RegDn MW capacity award to *ith* Resource

: FRRSDn MW capacity award to *ith* Resource

: RRS-PFR MW capacity award to *ith* Resource

: RRS-BLK MW capacity award to *ith* UFR type Load Resource

: RRS-FFR MW capacity award to *ith* “fast” Resource (Storage or Fast Load Resource)

: RTC dispatchable ECRS MW capacity award to *ith* Resource

: “Blocky” ECRS MW capacity award to *ith* Resource dispatched outside of RTC: NSPIN MW award to *ith* Resource

: Cleared RegUp MW segment of RegUp ASDC

: Cleared RegDn MW segment of RegDn ASDC

: Cleared RRS MW segment of RRS ASDC

: Cleared ECRS MW segment of ECRS ASDC

: Cleared NSPIN MW segment of NSPIN ASDC

**Resource Specific Telemetry Values input to RTC**

: Telemetered MW of *ith* Resource (supply side – generation, demand side - consumption)

: Low Sustained Limit of *ith* Generation Resource

: High Sustained Limit of *ith* Generation Resource

: Low Power Consumption Limit of *ith* Load Resource

: Maximum Power Consumption Limit of *ith* Load Resource

: Blended Normal Ramp Rate Up (value, when multiplied by 5 shows the 5 minute MW output change capability) of *ith* Resource

: Blended Emergency Ramp Rate Up (value, when multiplied by 5 shows the 5 minute MW output change capability using the emergency ramp rate) of *ith* Resource

: Blended Normal Ramp Rate Down (value, when multiplied by 5 shows the 5 minute MW output change capability) of *ith* Resource

**Additional New Generation and Controllable Load Resource Specific Telemetry to ensure feasibility of ECRS and Non-Spin awards**

: Blended Emergency Ramp Rate Up (value, when multiplied by 10 shows the 10 minute MW output change capability) of *ith* Resource. Used to check feasibility of ECRS awards

: Blended Normal Ramp Rate Up (value, when multiplied by 30 shows the 30 minute MW output change capability) of *ith* Resource. Used to check feasibility of Non-Spin awards

**Calculated Values input to RTC**

: Low Dispatch Limit of *ith* Resource

: High Dispatch Limit of *ith* Resource

**Other Inputs**

: Value between 0 and 1. Determines amount of ramp sharing between Base Point (energy) and RegUp. Value of 1 indicates no ramp sharing.

: Value between 0 and 1. Determines amount of ramp sharing between Base Point (energy) and RegDn. Value of 1 indicates no ramp sharing.

## RTC optimization Objective

Maximize bid based costs (energy bids and AS Demand Curves) minus offer based revenue (energy offers and AS offers)

## Power Balance Constraint

## System-Wide Regulation Up Procurement Constraint

1. FRRS-Up maximum procurement limit

## System-Wide Regulation Down Procurement Constraint

1. FRRS-Down maximum procurement limit:

## System-Wide RRS Procurement

1. RRS-PFRsys-min, RRS-BLK+RRS-FFR and FFR maximum procurement

NPRR 863 stipulates that:

1. Minimum amount of PFR shall be procured (1150 MW)
2. The Maximum amount of RRS and FFR from UFR Load Resources and fast resources is limited to 60% of the total RRS requirement
3. The maximum amount of FFR procured cannot exceed 420MW

ERCOT proposal for RTC to implement the rules for awarding the different sub-types of RRS mimics the current DAM implementation of the rules for RRS sub-type of RRS provided by UFR Load Resource

## System-Wide ECRS Procurement

1. Maximum procurement of ECRS-BLK from UFR Load Resource

NPRR 863 stipulates that:

1. The Maximum amount of 50% of the total ECRS requirement can be procured from UFR Load Resources

ERCOT proposal for RTC to implement the rules for awarding ECRS from UFR Load Resources is:

## System-Wide NSPIN Procurement

## On-Line Generation Resource

Generation Resources that are Combined Cycle Generation Resources, WGRs , PVGRs, and Storage Resources modeled as a combination of a Generation Resource and a Controllable Load Resource that participates in conventional Regulation, PFR, ECRS, and NSPIN ( Storage Resource participating in FRRS, and FFR are described in a later section)

1. Resource Status is one of (ON, ONOS, ONDSR, ONOPTOUT, ONRUC, ONEMR)
2. For each On-Line Generation Resource ():

LSL

LDL

HDL

HSL

TelemMW

1. Upward AS Offer constraints (RegUp, RRS-PFR, ECRS, On-Line NSPIN): Assume full utilization of available AS Offer structure

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AS Offer MW | RegUp $/MWh  (Conventional) | RRS-PFR $/MWh | ECRS $/MWh  (RTC Dispatchable) | On-Line NSPIN $/MWh  (RTC Dispatchable) |
| ASMW1 | Yes | Yes | Yes | Yes |
| ASMW2 | Yes | Yes | Yes | Yes |
| ASMW3 | Yes | Yes | Yes | Yes |
| ASMW4 | Yes | Yes | Yes | Yes |
| ASMW5 | Yes | Yes | Yes | Yes |

1. New telemetry to limit individual AS awards:
   1. : Telemetry (MW value) to indicate maximum RegUp MW capability.
2. : Telemetry (MW value) to indicate maximum RRS-PFR MW capability.
3. : Telemetry (MW value) to indicate maximum ECRS MW capability.
4. : Telemetry (MW value) to indicate maximum NSPIN MW capability.

**Feedback requested:**

1. **Is the provision of the additional new telemetry acceptable?**
2. **Are there other alternatives to inform ERCOT of reduced AS capability for use by RTC?**
3. Individual AS Offer MW constraints ():
4. Checks on allowable total RegUp Award for On-Line Generation Resource ():
5. Checks on allowable total RRS-PFR Award for On-Line Generation Resource ():
6. Checks on allowable total ECRS Award for On-Line Generation Resource ():
7. Checks on allowable total NSPIN Award for On-Line Generation Resource ():

**Feedback requested:**

1. **Is the proposed checks using the 10 minute emergency ramp rate and 30 minute normal ramp rate adequate checks to ensure feasibility of ECRS and Non-Spin awards?**
2. **Are there other alternatives?**
3. RegDn AS Offer constraints: Assume full utilization of available AS Offer structure

|  |  |
| --- | --- |
| RegDn  AS Offer MW | RegDn $/MWh  (Conventional) |
| ASMW1 | Yes |
| ASMW2 | Yes |
| ASMW3 | Yes |
| ASMW4 | Yes |
| ASMW5 | Yes |

1. New Resource telemetry to limit RegDn AS awards:
   1. : Telemetry (MW value) to indicate maximum RegDn MW capability.

**Feedback requested:**

1. **Is the provision of the additional new telemetry acceptable?**
2. **Are there other alternatives to inform ERCOT of reduced AS capability for use by RTC?**
3. Individual RegDn AS Offer MW constraints ():
4. Checks on allowable total RegDn Award for On-Line Generation Resource ():
5. LDL/LSL constraint: Ensures that the energy (Base Point) and Regulation Down awards are feasible with respect to the LDL and LSL of the Resource ():

LSL

LDL

HDL

HSL

1. HDL constraint: Ensures that the energy (Base Point) and Regulation Up awards are feasible with respect to the HDL of the Resource:

LSL

LDL

HDL

HSL

1. HSL constraint: Ensures that the energy (Base Point), Regulation Up, Responsive Reserve (PFR), ECRS and On-line NSPIN awards are feasible with respect to the High Sustained Limit (HSL) of the Resource:

LSL

LDL

HDL

HSL

1. Combined Cycle Generation Resource: Checks on ensuring awards for RegUp, RegDn and PFR are feasible.

Conditional Constraint: If the sum of RegUp and PFR award is greater than zero, then enforce additional constraint:

If () then enforce this constraint:

If () then enforce this constraint:

Where,

: Proportion of the Base Point provided by the frequency responsive capacity of the Combined Cycle Generation Resource

: Minimum amount of the total Base Point provided by the frequency responsive capacity of the Combined Cycle Generation Resource

: Maximum amount of the total Base Point provided by the frequency responsive capacity of the Combined Cycle Generation Resource

ST3 and/or duct burner

CT1

CT2

|  |  |  |  |
| --- | --- | --- | --- |
| CC component | Capacity | Frequency  Responsive? | MW output |
| CT1 | 100 | Yes | 80 |
| CT2 | 100 | Yes | 80 |
| ST3 no duct burner | 200 | No | 160 |
| ST3 with duct burner | 250 | No | 30 |

In this example for a 2x1 configuration, a sample value for new telemetry could be:

= 0.45

=150 MW

=200 MW

**Proposal is to have QSE provide these additional data inputs (,,) via telemetry**

**Feedback requested:**

1. **Review proposal. ERCOT staff available to walk through the concept in detail**
2. **Is the provision of the additional new telemetry acceptable?**
3. **Are there other alternatives to better model the constraints to consider the non-frequency responsive capacity of the combined cycle configuration in RTC?**

## QSGR Generation Resource with Resource Status of OFFQS

QSGR qualification requires a Generation Resource to be On-Line in 10 minutes and be capable of providing a certain minimum amount of energy as determined during qualification tests.

A QSGR telemetering a Resource Status of OFFQS will be treated by RTC as a On-Line Generation Resource with the exception that it is not eligible to receive Regulation or RRS-PFR awards

1. LSL=LDL=0; For each Generation Resource with Resource Status of OFFQS ():
2. Upward AS Offer constraints (ONLY ECRS and NSPIN): Assume full utilization of available AS Offer structure

|  |  |  |
| --- | --- | --- |
| AS Offer MW | ECRS $/MWh  (RTC Dispatchable) | On-Line NSPIN $/MWh  (RTC Dispatchable) |
| ASMW1 | Yes | Yes |
| ASMW2 | Yes | Yes |
| ASMW3 | Yes | Yes |
| ASMW4 | Yes | Yes |
| ASMW5 | Yes | Yes |

1. New Resource telemetry to limit individual AS awards:
2. : Telemetry (MW value) to indicate maximum ECRS MW capability.
3. : Telemetry (MW value) to indicate maximum NSPIN MW capability.

**Feedback requested:**

1. **Is the provision of the additional new telemetry acceptable?**
2. **Are there other alternatives to inform ERCOT of reduced AS capability for use by RTC?**
3. Individual AS Offer MW constraints ():
4. Checks on allowable total ECRS Award for OFFQS Generation Resource ():
5. Checks on allowable total NSPIN Award for OFFQS Generation Resource ():
6. LDL/LSL constraint: Ensures that the energy (Base Point) award is feasible with respect to the LDL and LSL of the Resource ():
7. HDL constraint: Ensures that the energy (Base Point) award is feasible with respect to the HDL of the Resource:
8. HSL constraint: Ensures that the energy (Base Point), ECRS and On-line NSPIN awards are feasible with respect to the High Sustained Limit (HSL) of the Resource:
9. RTC, for QSGR in OFFQS Resource Status:
   1. Will not award Regulation or RRS-PFR.
   2. Will consider On-Line Upward AS Offers (not Offline ECRS, Non-Spin AS offers)
10. If RTC awards non-zero energy award (Base Point > 0), then during transition from OFFQS to ON Resource Status, QSGR will continue to be eligible for ECRS and Non-Spin awards using the On-Line Upward AS Offers

Discussion Item:

ECRS is a 10 minute product. Currently, QSGRs have a 10 minute window to respond to non-zero Base Points. Should this 10 minute window apply to QSGRs that are given a Non-Zero Base Point that have been awarded ECRS?

## Off-Line Generation Resource Qualified to provide Non-Spin, with Resource Status of OFF

Can only be ONLY awarded NSPIN. Non-Spin deployment from Off-Line Generation Resource is done by XML. A Generation Resource deployed for Off-Line Non-Spin must be On-Line at LSL within 25 minutes of ERCOT XML Instruction and stay On-Line until ERCOT issues a XML Recall Instruction

1. Off-Line NSPIN AS Offer constraints (ONLY Off-Line NSPIN):

|  |  |
| --- | --- |
| AS Offer MW | Off-Line NSPIN $/MWh  (RTC Dispatchable) |
| ASMW1 | Yes |
| ASMW2 | Yes |
| ASMW3 | Yes |
| ASMW4 | Yes |
| ASMW5 | Yes |

1. New Resource telemetry to limit individual AS awards:
2. : Telemetry (MW value) to indicate maximum NSPIN MW capability.

**Feedback requested:**

1. **Is the provision of the additional new telemetry acceptable?**
2. **Are there other alternatives to inform ERCOT of reduced AS capability for use by RTC?**
3. Individual AS Offer MW constraints ():
4. Checks on allowable total NSPIN Award for On-Line Generation Resource ():
5. Upon ERCOT Instruction to deploy Off-Line Non-Spin:
6. Resource must be On-Line@LSL within 25 minutes of ERCOT XML instruction
7. Resource will be on On-Line status until ERCOT XML Recall
8. During STARTUP Resource Status, Resource is eligible to be awarded Non-Spin.
   * This eligibility lasts for 25 minutes from time of ERCOT instruction to deploy Non-Spin from Off-Line Generation Resource
   * During STARTUP, RTC will determine Non-Spin Award based on Non-Spin Offer Price from the Resource On-Line AS Offer. i.e. will NOT use Off-Line AS Offer

## UFR type Load Resource self-providing RRS and/or ECRS based on DAM awards, AS Trades

* UFR Load Resources are eligible to participate in RRS-BLK and ECRS-BLK AS markets
* UFR Load Resource can be awarded both RRS-BLK and ECRS-BLK for their curtailable load amount
  + Note that upon deployment, irrespective of whether the deployment is for RRS-BLK or ECRS-BLK, the full amount of curtailable load is deployed
* Two ways in which RRS-BLK are deployed and recalled:
  + RRS-BLK Automatic Self deployment: Low Frequency event causes UFR to trip
    - ERCOT systems does not get explicit information from QSE that UFR trip has occurred
    - ERCOT operations monitoring the grid usually detect UFR trips for large events, for smaller events, a UFR trip may go unnoticed. In such cases, QSE informs ERCOT operations that UFR trip has occured
    - UFR Load Resource remains deployed (curtail load) until ERCOT operations issues recall instruction (currently a phone call)
    - After ERCOT issued recall instruction (currently a phone call), UFR Load Resource has up to 3 hours to come back into service
  + RRS-BLK ERCOT operations directed deployment (not through RTC economic dispatch) :
    - ERCOT operations issues XML deployment instruction for RRS-BLK
    - UFR Load Resource remains deployed (curtail load) until ERCOT operations issues XML recall instruction
    - After ERCOT issued XML recall instruction, UFR Load Resource has up to 3 hours to come back into service
* ECRS-BLK deployment and recall:
  + UFR Load Resources with relay armed and providing ECRS-BLK can be deployed automatically on frequency or manually by ERCOT operations
  + ERCOT operations directed deployment (not through RTC economic dispatch) :
    - ERCOT operations issues XML deployment instruction for ECRS-BLK
    - UFR Load Resource responds by curtailing all available load
    - UFR Load Resource remains deployed until ERCOT operations issues XML recall instruction
    - After ERCOT issued XML recall instruction, UFR Load Resource has up to 3 hours to come back into service

Proposal is to allow self-provision at individual UFR Load Resource level of RRS-BLK and/or ECRS-BLK based on DAM awards and AS Trades for the QSE at the portfolio level.

* Impractical to arm and disarm UFR every 5 minutes and have UFR Load Resources participate actively in RTC
* Proposal is to allow self-provision of RRS-BLK and ECRS-BLK based on DAM RRS-BLK, ECRS-BLK awards, RRS-BLK, ECRS-BLK AS Trades and DAM Self-Arranged RRS\_BLK, ECRS\_BLK within a QSE

Self-provision MW quantities of RRS-BLK, ECRS-BLK is telemetered to ERCOT by QSE for each UFR Load Resource in its portfolio

Constraints:

1. For each On-Line UFR type Load Resource ():
2. New Resource telemetry indicating self-provided AS MW amounts
3. : Telemetry to indicate RRS-BLK MW amount self-provided by On-Line UFR type Load Resource
4. : Telemetry to indicate ECRS-BLK MW amount self-provided by On-Line UFR type Load Resource
5. Validation of self-provision of RRS-BLK and ECRS-BLK 🡨 **TBD**

**Proposal**

***Note that validation steps depend on validated AS Self-Arrangement and AS trades for RRS\_BLK and ECRS-BLK to ensure limits on these services have been checked before confirming these AS Self-Arrangement and AS Trades***

***ERCOT is working on designing a validation process for AS Self-Arrangement and AS Trades***

Validation of telemetered self-provision of RRS-BLK and ECRS-BLK at every RTC run

* + **Step 1** : At QSE portfolio level, check if sum of telemetered self provision of RRS is less than or equal to QSE’s RRS-BLK responsibility from DAM RRS-BLK awards and validated RRS-BLK AS Trades and Self-Arrangement within a QSE. Similar check for ECRS-BLK

If not, determine a step 1 validated self-provision amount (, ), (reduce the submitted telemetry values)

* + **Step 2** : For each UFR Load Resource, check if

If not, further revise to get step 2 validated self-provision amount ()

* + **Step 3** : System wide check.
    - If then,

prorate down all Step 2 validated RRS-BLK self-provision amounts to satisfy this limit and get the FINAL validated self-provision amount for RRS-BLK ()

* + - If then,

prorate down all Step 2 validated ECRS-BLK self-provision amounts to satisfy this limit and get the FINAL validated self-provision amount for ECRS-BLK ()

Validated self-provided RRS-BLK and ECRS-BLK are and .

**Feedback requested:**

1. **Is this proposal adequate?**
2. AS Offer constraints (RRS, ECRS): Assume full utilization of available AS Offer structure

|  |  |  |
| --- | --- | --- |
| AS Offer MW | RRS $/MWh | ECRS $/MWh  (RTC Dispatchable) |
| ASMW1 | Yes | Yes |
| ASMW2 | Yes | Yes |
| ASMW3 | Yes | Yes |
| ASMW4 | Yes | Yes |
| ASMW5 | Yes | Yes |

1. New telemetry to limit individual AS awards:
2. : Telemetry (MW value) to indicate maximum RRS MW capability **excluding** self-provided amount
3. : Telemetry (MW value) to indicate maximum ECRS MW capability **excluding** self-provided amount

**Feedback requested:**

1. **Is the provision of the additional new telemetry acceptable?**
2. **Are there other alternatives to inform ERCOT of reduced AS capability for use by RTC?**
3. Individual AS Offer MW constraints ():
4. Checks on allowable total RRS-BLK Award for On-Line UFR type Load Resource ():
5. Checks on allowable total ECRS-BLK Award for On-Line UFR type Load Resource ():
6. Checks on allowable total RRS-BLK and ECRS-BLK Award for On-Line UFR type Load Resource ():
7. Maximum total AS (RRS-BLK+ECRS-BLK) that can be provided from On-Line UFR type Load Resource is:

Summary of UFR Load Resource - **no deployment**

* Each RTC run will award UFR Load Resource RRS-BLK and ECRS-BLK equal to the sum of the final validated self-provision of RRS-BLK and ECRS-BLK, and potentially additional RRS-BLK, ECRS-BLK
* AS Imbalance Charge/Payment to QSE will use the RTC AS capacity awards for RRS-BLK and ECRS-BLK

Summary of UFR Load Resource – ERCOT XML Deployment (RRS-BLK or ECRS-BLK)

* Each RTC run will award UFR Load Resource RRS-BLK and ECRS-BLK equal to the sum of the final validated self-provision of RRS-BLK and ECRS-BLK, and potentially additional RRS-BLK, ECRS-BLK
* AS Imbalance Charge/Payment to QSE will use the RTC AS capacity awards for RRS-BLK and ECRS-BLK
* During Deployment period:
  + Dispatch Run RTC will output the UFR Load Resource AS awards (RRS-BL,ECRS-BLK) to be equal to the ERCOT XML Instruction amount.
    - These AS MW capacity awards are used in Settlements
  + Pricing Run is triggered during deployment period
* During Recall period:
  + Pricing Run is NOT triggered
  + Actual validated self-provision of RRS-BLK and ECR-BLK is used in RTC and Settlements
  + QSE may be subject to AS Imbalance Charge (Buy Back)– can be avoided by moving self-provision to another UFR Load Resource during Recall period

Summary of UFR Load Resource – Automatic Self Deployment Due To UFR Trip

* Each RTC run will award UFR Load Resource RRS-BLK and ECRS-BLK equal to the sum of the final validated self-provision of RRS-BLK and ECRS-BLK, and potentially additional RRS-BLK, ECRS-BLK
* AS Imbalance Charge/Payment to QSE will use the RTC AS capacity awards for RRS-BLK and ECRS-BLK
* During Deployment and Recall period:
  + Pricing Run is NOT triggered
  + Actual validated self-provision of RRS-BLK and ECR-BLK is used in RTC and Settlements
  + QSE may be subject to AS Imbalance Charge (Buy Back) – can be avoided by moving self-provision to another UFR Load Resource during Recall period

## On-Line Controllable Load Resource

1. For each On-Line Controllable Load Resource ():
2. Upward AS Offer constraints (RegUp, PFR, ECRS, On-Line NSPIN): Assume full utilization of available AS Offer structure

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AS Offer MW | RegUp $/MWh  (Conventional) | RRS (PFR) $/MWh | ECRS $/MWh  (RTC Dispatchable) | On-Line NSPIN $/MWh  (RTC Dispatchable) |
| ASMW1 | Yes | Yes | Yes | Yes |
| ASMW2 | Yes | Yes | Yes | Yes |
| ASMW3 | Yes | Yes | Yes | Yes |
| ASMW4 | Yes | Yes | Yes | Yes |
| ASMW5 | Yes | Yes | Yes | Yes |

1. New telemetry to limit individual AS awards:
   1. : Telemetry (MW value) to indicate maximum RegUp MW capability.
2. : Telemetry (MW value) to indicate maximum RRS-PFR MW capability.
3. : Telemetry (MW value) to indicate maximum ECRS MW capability.
4. : Telemetry (MW value) to indicate maximum NSPIN MW capability.

**Feedback requested:**

1. **Is the provision of the additional new telemetry acceptable?**
2. **Are there other alternatives to inform ERCOT of reduced AS capability for use by RTC?**
3. Individual AS Offer MW constraints ():
4. Checks on allowable total RegUp Award for On-Line Controllable Load Resource ():
5. Checks on allowable total RRS-PFR Award for On-Line Controllable Load Resource ():
6. Checks on allowable total ECRS Award for On-Line Controllable Load Resource ():
7. Checks on allowable total NSPIN Award for On-Line Controllable Load Resource ():
8. RegDn AS Offer constraints: Assume full utilization of available AS Offer structure

|  |  |
| --- | --- |
| RegDn  AS Offer MW | RegDn $/MWh  (Conventional) |
| ASMW1 | Yes |
| ASMW2 | Yes |
| ASMW3 | Yes |
| ASMW4 | Yes |
| ASMW5 | Yes |

1. New Resource telemetry to limit RegDn AS awards:
   1. : Telemetry (MW value) to indicate maximum RegDn MW capability.

**Feedback requested:**

1. **Is the provision of the additional new telemetry acceptable?**
2. **Are there other alternatives to inform ERCOT of reduced AS capability for use by RTC?**
3. Individual RegDn AS Offer MW constraints ():
4. Checks on allowable total RegDn Award for On-Line Controllable Load Resource ():
5. LDL/LPC constraint: Ensures that the energy (Base Point) and Regulation Up awards are feasible with respect to the LDL and LPC of the Controllable Load Resource ():
6. HDL constraint: Ensures that the energy (Base Point) and Regulation Down awards are feasible with respect to the HDL of the Controllable Load Resource ():
7. LPC constraint: Ensures that the energy (Base Point), Regulation Up, Responsive Reserve (PFR), ECRS and On-line NSPIN awards are feasible with respect to the Low Power Consumption Limit (LPC) of the Controllable Load Resource:

## Storage Resources modeled as a combination of Generation Resource and Controllable Load Resource participating in FRRS, FFR and “blocky” ECR

To be discussed later

## Fast Load Resources participating in FFR

To be discussed later