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| Key Topic Concept (KTC) Number | 6 | KTC Title | ESR Options to Maintain Desired Level of State of Charge and Single Model ESR Framework Description |
| Date Posted | November 6, 2019 |
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| Executive Summary | This KTC recommends an improved method for Energy Storage Resources (ESRs) to communicate to ERCOT their willingness or unwillingness to be dispatched by SCED. This KTC also provides information about the offer structure and general framework for a single model ESR. |
| Recommendation Description | This KTC recommends that updates to Energy Offer Curves (EOCs) by Limited Duration Resources (LDRs) may be submitted immediately prior to the start of the Operating Hour. As a second phase consideration, LDRs could be allowed to submit EOCs during the Operating Hour. |
| BESTF Discussion  | On 10/18/19, ERCOT staff presented a refresher on previous stakeholder discussion around the ability of Limited Duration Resources (LDRs) to have their Energy Offer Curves (EOCs) closer to Real-Time. Task force participants largely seemed in favor of a phased approach.On 11/4/19, the BESTF reached consensus on KTC 6 item 1. ERCOT staff presented information about the offer structure of a single model ESR (item 2 of this KTC document). |
| TAC Action Requested | BESTF plans to request at the 11/20/19 TAC meeting a vote to approve KTC 6 item 1.The TAC meeting in which there will be a request for TAC to approve KTC 6 item 2 is to be determined. |
| TAC Action Summary |   |

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| Proposed KTC Recommendation Language |

# *Key Topic/Concept recommendation Language for TAC Approval*

11/20/19 TAC Meeting:

1. ERCOT systems should be updated to capture whether or not a Resource is a LDR. This Resource attribute will be captured in ERCOT’s registration systems and passed to other downstream systems (e.g., the Energy Management System (EMS) and Market Management System (MMS)).
2. As an initial phase, the EOC submission window for LDRs should be expanded such that the window ends just prior to the beginning of the Operating Hour. ERCOT’s MMS should be updated to recognize that a Resource is an LDR and have validation to ensure the submission window is only expanded for LDRs.
3. As a second phase consideration, LDRs could be allowed to submit EOCs during the Operating Hour. Intra-Operating Hour EOCs would be a separate submittal type and would only allow updates with the MW quantity and price pairs. Again, ERCOT’s MMS should be updated to recognize that a Resource is an LDR and restrict the new submittal type to only LDRs.

# *Key Topic/Concept recommendation Language Previously APProved by tac*

None

# *Key Topic/Concept recommendation Language IN DISCUSSION AT BESTF*

1. Single Model ESR Characteristics

The single model ESR has the following characteristics:

1. Physically a single device with one electrical pathway to the modeled electrical network for both charging and discharging
2. Does not have temporal constraints (StartTime, MinUpTime, MinDownTime, etc.) and does not have transition times between charging and discharging
3. Does not have Startup, shutdown and transition costs
4. Can smoothly transition from charging to discharging and vice-versa and there is no deadband around 0 MW
5. Limited energy storage capability (<= 24 hours). This implies that an ESR cannot discharge continuously at its rated MW for 24 hours
6. Single Model ESR Market Rules
	1. Energy awards (DAM) / Base Points (RTC) will be a single number (in MW) that can be positive MW (discharge) or negative MW (charge)
	2. Ancillary Service Awards (DAM or RTC) will be positive MW
	3. In Phase 1 (EMS Upgrade/RTC go-live), State Of charge and State Of Charge Operational Limits (min, max) will not be used in the optimization engines of DAM, RUC, and Real-Time Market (RTC)
		1. SOC related telemetry will be used for:
			1. Calculation of contribution to PRC
			2. ERCOT Operator situational awareness displays
	4. QSEs have the responsibility for maintaining State Of Charge and reflecting energy capability to ERCOT via telemetry, COP, etc.
	5. For participation in energy, a single incremental energy price curve from charging (Bid-To-Buy) to discharging (Offer-To-Sell) that is monotonically non-decreasing from the negative MW (charging) to positive MW (discharging) range of the ESR
		1. StartUp, Minimum Energy costs are zero (note in DAM, RUC and RTC, there is no commitment cost, i.e. the optimization engine sees a Single Model ESR, as On-line Resource that justs needs to be dispatched)
	6. AS market participation (EMS Upgrade/RTC go-live):

If qualified, Single Model ESR can participate in:

* + 1. RegUp/RegDown (Conventional and/or Fast Responding Regulation Service)
		2. RRS-PFR and/or RRS-FFR
		3. ECRS-dispatchable
		4. Non-Spin
	1. Resource Status (EMS Upgrade/RTC go-live):
		1. ON
		2. ONOS
		3. OFF
		4. ONTEST
		5. ONEMR
		6. OUT
		7. EMR
		8. EMRSWGR
	2. Constraints in optimization engine for DAM, RUC and RTC
		1. Dispatch problem for on-line Single Model ESR (no commitment)
		2. Constraints are the same as on-line conventional Generation Resource with following additional considerations
			1. Limits (LSL, LDL and sometimes HDL,HSL) can be negative
			2. Energy Awards/Base points can be positive or negative values
			3. ESR can participate, if qualified in RRS-FFR and Fast Responding Regulation Service in addition to conventional Regulation Up/Down, RRS-PFR, ECRS-dispatchable and Non-Spin

# *Future Decision Points and Issues for Developing Key topic/Concept recommendation Language*

None.

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

Questions from RWE Renewables Americas:

* Does ERCOT want the single offer curve covering charging and discharging in both phases I and II?
* Confirm that there is no SoC control by ERCOT in Phase I
* Provide the Timeline for Phase I and II deployment
* Does the change in offer curve structure apply in the RT market as well?