A Review of ORDC Options

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ERCOT Supply Analysis Working Group

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# Introduction

The Supply Analysis Working Group (SAWG) was asked by the Wholesale Market Subcommittee (WMS) to review and consider whether there is a need for minor adjustments to ORDC per the 10-7-2015 memo[[1]](#footnote-1) filed by Commissioner Anderson, hereinafter referred to as *the memo*. The SAWG should deliver a preliminary outline of work product to December WMS meeting with a final work product no later than January WMS meeting**.**

This paper’s purpose is to be that work product and to inform discussion on the topic. Its contents are an aggregation of recommendations from ERCOT stakeholders and analysis by ERCOT Staff. This paper is not intended to address any threshold issues such as what an appropriate reserve margin is for the ERCOT region or how it should be attained.

This paper is the work of the SAWG which is intended to be agnostic of potential changes. Following this paper is an ERCOT Analysis of the options presented here, then position papers authored by ERCOT Stakeholders which provide viewpoints on what, if anything, should be changed in the ERCOT Market Design.

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# List of Observations regarding ORDC performance

Stakeholders do not generally agree what, if anything, needs to be addressed with the ORDC mechanism. This is a list of various stakeholder observations and it does not imply stakeholder consensus.

1. ORDC is performing as intended and designed. There was sufficient additional off-line generating capacity not counted in PRC available to the system during the 8/13/15 event, so it was appropriate for ORDC to recognize a low loss of load probability.
2. ORDC is not aligned with operations demonstrated by the 8/13/2015 event. The event is described both in ERCOT’s presentation[[2]](#footnote-3) to TAC and this comment from the memo, “I ask this question because at certain hours of certain days last summer the price adder resulting from the ORDC seemed to suggest LOLP of well under 1% even though ERCOT was considering making conservation appeals.”
3. Hockey stick curve[[3]](#footnote-4) makes optimization difficult and is driven by VOLL being identical to SWOC. Pricing outcomes during scarcity events are extremely volatile.
4. The value of X being lower than RRS and URS can lead to reserves being converted to energy at prices less than 25% of SWOC.
5. Because X=2,000 is lower than Ancillary Service reserve requirements, when ORDC reserves fall below 2,000 MW it’s too late to send signals to resources and consumers.
6. Current mechanism introduces the potential for lack of consistency and convergence in the Day Ahead Market outcomes compared to the Real-Time Market. Value differentiation of ancillary reserves is needed.

# Consensus Items

Stakeholders in SAWG did find consensus on two items which should not change:

1. Stakeholders do not recommend any more discretion in calling EEA than what is provided in NPRR708.
2. Stakeholders do not recommend increasing the “effective price cap” beyond the current $9,000 level.

# Stakeholder Proposals for Analysis

To address perceived shortcomings listed above, stakeholders suggested many different options listed below to be included in ERCOT’s analysis. This section serves as a summary for different options, none of which is a consensus view or an endorsement by any stakeholder group. Some of these options ultimately were not included the position papers authored by stakeholders, while some additional options were suggested.

1. There is no need to make any changes. Addresses item A from section II above.
2. Add ORDC to the DAM. The ORDC curve would be used as the demand curve for AS procurement and pricing instead of today’s inelastic procurement. Could be applied to all other options (1, 3-8). Addresses F
3. Apply dynamic Reserve Discount Factor (RDF) from PRC calculation instead of the static RDF in the ORDC Real Time Online Capacity (RTOLCAP). Addresses B
4. Set Real Time Offline Capacity (RTOFFCAP) = 0 at PRC =2500 to increase adder amounts. Addresses B
5. Upon deployment of NSRS by the ERCOT operator, require that all Quick Start Resources providing NSRS during that time to come physically online[[4]](#footnote-5).  Could be applied to all other options. Addresses B
6. Set minimum RRS procurement at 2,750; Set X each hour equal to the sum of RRS and URS procured; Set VOLL = $18,000; Retain “effective price cap” = SWOC ($9,000); Addresses B,C,D,E
7. Set minimum RRS procurement at 2,750; Set X each hour = sum of RRS and URS; Modify ORDC such that price adder plus system lambda is >= $4,500 when PRC is less than 2500MW and is at offer cap when PRC is less than 2300MW. Addresses B,C,D,E
8. Set X =2,300; Set VOLL = $12,000; Retain “effective price cap” = SWOC ($9,000); Addresses B,C,D,E
9. Set minimum RRS procurement at 2750; Set X =2,750; Set VOLL = $18,000; “effective price cap” = SWOC ($9,000); Addresses B,C,D,E
10. Set X=1708[[5]](#footnote-6); Set VOLL = $18,000; Retain “effective price cap” = SWOC ($9,000); Addresses C

 below

Table 1 Summary of proposals 6 though 10

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| # | Minimum RRS | Value of X (MCL) | VOLL | “Effective Price Cap”[[6]](#footnote-7) | Other | Addresses |
| 6 | 2,750 MW | Sum of RRS & URS[[7]](#footnote-8) | $18,000 | $9,000 |  | B,C,D,E |
| 7 | 2,750 MW | Sum of RRS & URS | $9,000 | N/A | PRC Based Adder Floor[[8]](#footnote-9) | B,C,D,E |
| 8 | 2,300 MW[[9]](#footnote-10) | 2,300 MW | $12,000 | $9,000 |  | B,C,D,E |
| 9 | 2,750 MW | 2,750 MW | $18,000 | $9,000 |  | B,C,D,E |
| 10 | 2,300 MW | 1,708 MW | $18,000 | $9,000 |  | C |

# ERCOT Analysis

ERCOT has provided back cast analysis based on the stakeholder proposals above in the following paper[[10]](#footnote-11).

## The Back Cast Tool

To aid in this analysis, ERCOT developed a tool[[11]](#footnote-12) reminiscent the 2011-12 back casts for the original ORDC discussion. The tool is flexible enough to handle different combinations of these changes including behavioral changes.

Understanding where back casts excel and where they have difficulty is important, especially when considering policy changes.

Pros:

1. Relatively easy to produce.
2. Familiar to analysists and decision makers, used for previous ORDC analysis.
3. Better suited to gauge relative differences in options.

Cons:

1. Magnitude of impact due to a modeled change can be misleading.
2. Behavioral changes from resources are difficult to model, and when those changes lead to additional commitment the model will generally overestimate the effect of ORDC changes. ERCOT has supplied some ability to modify behavior in the tool but currently it can only anticipate changes interval by interval so temporal considerations are ignored.

# Discussion of the Bullet Points from The Memo

In this sections, some rudimentary discussion and suggestions were captured surrounding each bullet point in the original memo.

## Level of X

From the memo: “The level of X used in the ORDC formula, which is 2,000 MW of operating reserves, selected to represent a level below which ERCOT operators cease relying on the market and begin to take out-of-market actions”

Discussion: X is also called the Minimum Contingency Level (MCL), and it is the level of ORDC Online Reserves which will trigger a price at VOLL (currently $9,000). It is important to remember that the Online Reserves is typically more than the Physical Responsive Capability (PRC) reserves, (see Chapter VII).

Alternatives:

1. X=2000 (Current level). The rationale for retaining X=2000 is:
	1. There is not clarity in what needs to be fixed or what goal is to be achieved by adjustment
2. X=Regup + RRS. The rationale is:
	1. Would continuously keep ERCOT in compliance with NERC BAL-003-1
	2. From a practical standpoint would ensure ERCOT could recover frequency from a loss of 2,750 MW
3. X= Regup + RRS with RRS floor of 2750. The rationale is:
	1. Provides appropriate prices signals during scarcity triggered by EEA
	2. Makes ORDC consistent with Demand curves in Real-Time Co-Optimization
4. X= 2000 with a multiplier of RT Load/average Load. The rationale is:
	1. Ties the X value to the level of unloaded capacity in the Market
5. X= Reduced value when used in combination with other changes.



Figure 3, X Options

 Conclusion: As you can see in the figure above, the higher X merely shifts the curve to the right.

##  Standard Deviation of the LOLP

From the memo: “The number of standard deviations used to formulate of the loss of load probability curve in the ORDC.”

Discussion: The LOLP is determined by analyzing historic events defined as the difference between the hour-ahead forecasted reserves with the reserves that were available in Real-Time during the Operating Hour[[12]](#footnote-13). There are two different ways a Standard Deviation could be added, either by creating a multiplier for the standard deviation (sigma) component, or by shifting the average (mu) by a multiple of the standard deviation.

### Multiplier for Sigma

Alternatives:

1. Use One Standard Deviation (SD) (Current practice). The rationale for retaining the current value is:
2. There is not clarity in what needs to be fixed or what goal is to be achieved by adjustment
3. Increase SD .The rationale is:
4. Shifts the slope of the curve to make it more gradual of a change between reserve levels.
5. A value higher than one SD may be appropriate to better capture the risk on some winter mornings where RUC has been necessary (Further analysis may be necessary).



Figure 4, Effect of increasing the Standard Deviation used in LOLP

Conclusion: As you can see in the figure above, adding standard deviations “flattens” the curve and extends the duration of a meaningful adder.

### Shifting Mu

Alternatives:

1. Use One Standard Deviation (SD) (Current practice). The rationale for retaining the current value is:
2. There is not clarity in what needs to be fixed or what goal is to be achieved by adjustment
3. Increase SD .The rationale is:
4. Shifts the slope of the curve to make it more gradual of a change between reserve levels.
5. A value higher than one SD may be appropriate to better capture the risk on some winter mornings where RUC has been necessary (Further analysis may be necessary).



Conclusion: As you can see in the figure above, adding standard deviations changes the shape of the curve and extends the duration of a meaningful adder.

## VOLL

From the memo: “The value of lost load (VOLL) used in the ORDC, which currently is $9,000 MWh (and whether $9,000 MWh should remain as the effective price cap even if the VOLL is increased)”

Discussion: A significant issue is the consideration of the “effective price cap”. Currently VOLL *is* the effective price cap, not the System Wide Offer Cap (SWOC), so if VOLL is greater than the SWOC the energy price could exceed SWOC even in intervals without congestion.

Alternatives:

1. VOLL = $9,000. Current value, as there is not clarity in what needs to be fixed or what goal is to be achieved by adjustment.
2. VOLL = $18,000, but the effective price cap remains at $9,000.
	1. Shifts the slope of the curve resulting in a more gradual change between reserve levels
	2. Places a higher value on real-time operating reserves during periods of increased system risk



Figure 5, VOLL at 9 & 18k, with and without 9k cap. Note, the 18k capped curve does go to 18k but the chart is truncated at 10k for ease of viewing.

Conclusion: In the figure above we see that an increase in VOLL would be a straight forward increase to the ORDC adder (RTORPA) but the cap question is an important one. It’s also important to note that the time the “effective price cap” issue makes a difference is when reserves are near the minimum contingency level.

## PRC vs Online Operating Reserves

From the memo: “Should operating reserves counted in ORDC become more closely correlated to PRC, and if so, how?”

Discussion: The PRC, which ERCOT uses to determine if it’s in an Energy Emergency Alert (EEA), is a more conservative value than the Operating Reserves calculation due to the requirement that PRC only count frequency responsive resource capacity. ERCOT presented an analysis at the 10-29-15 TAC[[13]](#footnote-14). ERCOT and stakeholders have identified a few options.

Possible solutions:

1. When Non-Spin Reserve Service (NSRS) is deployed, require all NSRS to be physically online which increases PRC so less likely EEA events, but also could decrease system lambda and the ORDC adder. Quick Start Generators (QSGRs) providing NSRS should also be required to be physically online at a particular PRC level which may be in economic order (after offline NSRS is deployed at 2500 MW)
	* Manual deployment is out of market action
	* Is deploying a reliability product procured to provide more capacity online when PRC drops below 2500?
	* Bringing on capacity could depress prices which could be partially mitigated using the Reliability Deployment Price Adder.
2. Increase Responsive Reserve Service (RRS) Procurement by putting a min RRS level above 2300 MW with a buffer
	* Market based solution
	* Would be procuring RRS more than what is needed per ERCOT’s reliability analysis for Frequency Response Obligation
3. Require all NSRS to be offline and to be brought online upon ERCOT deployment
	* Removes the ability for small fleet to provide NSRS
	* Reduces competition in NSRS market by reducing the supply stack
	* Will help converge ORDC to PRC if offline NSRS is required to be physically online when PRC=2300 MW
	* Aggravates price reversal issues
	* No additional service is provided if the behavior is otherwise the same
4. Allow operator to use more discretion in calling EEA[[14]](#footnote-15) – Modification to NPRR708
5. Increase ORDC parameters to create economic incentive for resources to be online.



Figure 6, Low PRC from ERCOT analysis presented to 10-29-15 TAC.

## Other inputs to LOLP

From the memo: “Are the current inputs used to calculate the loss of load probability (LOLP) for any given period a sufficiently reasonable approximation or should the method and inputs be reevaluated? I ask this question because at certain hours of certain days last summer the price adder resulting from the ORDC seemed to suggest LOLP of well under 1% even though ERCOT was considering making conservation appeals.”

Discussion: Alternatives to LOLP cannot be considered in a vacuum. Alternatives would necessitate a review of recommendations/options to the above and below questions.

* 1. Does the error distribution used for the LOLP calculation need to be re-examined?
	2. Is the error distribution capturing risk appropriately?
	3. Should the timing of conservation appeals be re-evaluated?

Recommendations: None.

# Other Suggestions

Stakeholders have suggested these other considerations which have not been evaluated in this effort.

1) Has the Non-Spin floor created a de-facto cap on energy prices? Should Non-Spin offer floors be increased?

2) LCAP/HCAP - Drop the HCAP as a pressure release (Should the pressure release valve remain or be applied to another value such as VOLL)?

# Record of Stakeholder Meetings

10-29-15 Technical Advisory Committee (TAC)

11-4-15 Wholesale Market Subcommittee (WMS)

11-11-15 Supply Analysis Working Group (SAWG)

11-13-15 Supply Analysis Working Group (SAWG)

11-19-15 Technical Advisory Committee (TAC)

12-2-15 Wholesale Market Subcommittee (WMS)

12-2-15 Supply Analysis Working Group (SAWG)

12-16-15 Supply Analysis Working Group (SAWG)

12-17-15 Technical Advisory Committee (TAC)

1-5-16 Supply Analysis Working Group (SAWG)

1-6-16 Wholesale Market Subcommittee (WMS)

1-28-16 Technical Advisory Committee (TAC)

1. http://interchange.puc.state.tx.us/WebApp/Interchange/Documents/40000\_667\_868214.PDF [↑](#footnote-ref-1)
2. “As we approach scarcity PRC will be around 2500 and ORDC will gradually approach PRC as prices increase causing QSGRs to come online, resources to put their duct firing online and SCED to move resources to the top making the remaining capacity within 20%HSL. However, since minimum RRS level is 2300MW there could be situations where PRC stays just above 2300MW for a long time and could drop below 2300 when we still have lot of quick starts physically offline but available to SCED.” <http://www.ercot.com/content/wcm/key_documents_lists/77254/14._08132015_Analysis_of_PRC_Vs_ORDC_Corrected.pptx> [↑](#footnote-ref-3)
3. Hockey Stick refers to the price being equal to $9,000 at reserves less than or equal to 2,000 MW while sharply decreasing to roughly $4,500 with the addition of one MW of additional reserves. [↑](#footnote-ref-4)
4. QMWG currently is discussing this concept and refinements to this proposal may be forthcoming through that effort. [↑](#footnote-ref-5)
5. Reduction from current level of 2,000 to keep ORDC changes revenue neutral. [↑](#footnote-ref-6)
6. “Effective Price Cap” is a suggestion to form the ORDC adder such that system lambda plus the adder does not exceed the system wide offer cap (SWOC). Today the “effective price cap” is equal to VOLL which happens to be the same as SWOC. [↑](#footnote-ref-7)
7. X would change hourly and be equal to sum of RRS and URS procured for that hour. [↑](#footnote-ref-8)
8. Floor RTORPA plus System Lambda at $4,500 when PRC is below 2,500 MW and at $9,000 when PRC is below 2,300 MW. [↑](#footnote-ref-9)
9. RRS minimum of 2,300 is today’s practice and this recommendation does not suggest a change. [↑](#footnote-ref-10)
10. Available directly at http://www.ercot.com/content/wcm/key\_documents\_lists/80837/ERCOT\_ORDC\_Options\_Analysis.pdf [↑](#footnote-ref-11)
11. The latest versions of the tool can be found at the 12/2/15 SAWG meeting page. http://www.ercot.com/calendar/2015/12/2/80827-SAWG [↑](#footnote-ref-12)
12. [**Methodology for Implementing Operating Reserve Demand Curve**](http://www.ercot.com/mktinfo/rtm/kd/Methodology%20for%20Implementing%20ORDC%20to%20Calculate%20Real-Time%20Res.zip)  [↑](#footnote-ref-13)
13. http://www.ercot.com/content/wcm/key\_documents\_lists/77254/14.\_08132015\_Analysis\_of\_PRC\_Vs\_ORDC.pptx [↑](#footnote-ref-14)
14. [↑](#footnote-ref-15)