



Control Number: 45572



Item Number: 24

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OPEN MEETING COVER SHEET

MEETING DATE: April 14, 2016
DATE DELIVERED: April 7, 2016
AGENDA ITEM NO.: 16
CAPTION: Project No. 45572 – Review of the
Parameters of the Operating Reserve
Demand Curve
ACTION REQUESTED: Discussion and possible action

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Public Utility Commission of Texas

Memorandum

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TO: Chairman Donna L. Nelson
Commissioner Kenneth W. Anderson, Jr.
Commissioner Brandy Marty Marquez

FROM: Mark Bryant, Competitive Markets Division
Julia Harvey, Competitive Markets Division *JH*
Jason Haas, Legal Division

DATE: April 7, 2016

RE: **Project No. 45572 – Review of the Parameters of the Operating Reserve Demand Curve – Agenda Item No. 16**

Background

At the October 8, 2015 Open Meeting, the Commission requested that ERCOT, Staff, and stakeholders evaluate the Operating Reserve Demand Curve (ORDC) in light of its performance since its June 2014 implementation.¹ Responsive to this request, on February 4, 2016, ERCOT filed a work product in this project containing stakeholder ORDC proposals and ERCOT's backcast analysis of certain proposals' impact on prices and Peaker Net Margin (PNM).² Staff then issued a request for reply comments addressing the proposals described in the filing. Staff now provides this memorandum to facilitate any further Commission consideration in this project.

This memorandum contains the following:

1. A high level summary of stakeholder comments;
2. ERCOT backcast analysis results;
3. Potential next steps (including a distillation of key concepts raised by stakeholders for possible further analysis); and
4. Attachments including a table, figure, and detailed summaries of stakeholder comments.

1. Comment Summary

A table and figure summarizing stakeholder recommendations can be found in Attachment A of this memorandum, and a detailed summary of comments can be found in Attachment B. At a high level, comments can be simplified and differentiated into two groups as follows:

¹ Open Meeting Tr. at 53:16-56:10. (Oct. 8, 2015).

² ERCOT's Submission Filing of Technical Advisory Committee (TAC) Work Project on Review of Operating Reserve Demand Curve (ORDC) Parameters (Feb. 6, 2016). The backcast analysis was included in this filing as ERCOT ORDC Options Analysis ("ERCOT Backcast Analysis").

- The ORDC is functioning as designed and modifications are not needed at this time. The ORDC has properly reflected scarcity of operating reserves, and low adders seen over the summer of 2015 were consistent with expectations given the high level of installed capacity and mild weather. Changes to the Value of Lost Load (VOLL) or the Value of X that produce prices reflecting a shortage of operating reserves during non-scarcity conditions introduce inefficiency in the form of (1) prices that deviate from the marginal cost of the marginal action the system operator must take to meet demand; (2) inefficient behavioral response, *i.e.*, potential over-commitment of generation and demand-side reductions of high-value uses of power; and (3) providing additional operational reliability beyond that needed to meet applicable standards. The ORDC should not be used to artificially inflate generator revenue. Rather, its design should correspond closely with underlying market fundamentals. Consistent with the principles outlined by Dr. Hogan, prices should only reach VOLL at a Value of X corresponding to imminent involuntary load shed.³
- The ORDC is dysfunctional and modifications are needed. The Value of X is set at a level too low to provide timely signals to generation and load to respond to degrading reliability. In order to properly value the reliability contributions of operating reserves, prices should reach VOLL at reserve levels significantly above the point at which ERCOT may shed firm load. Increasing the VOLL will eliminate the vertical portion of the ORDC, thereby avoiding any binary pricing outcomes that may occur as reserves approach and fall below the Value of X. The ORDC should also be adjusted to account for the effect of out-of-market actions. Certain commenters additionally suggest that the ORDC should be modified to achieve the Commission's resource adequacy objectives.⁴

2. ERCOT Backcast Results

At the request of stakeholders, ERCOT conducted a backcast analysis, estimating the impact of various ORDC recommendations on prices and PNM. ERCOT evaluated the stakeholder proposals using data from June 1, 2014 - October 31, 2015 and January 1, 2011 - December 31, 2011. Although a variety of proposals were evaluated, Staff summarizes analysis of only Option 6, which currently has the broadest support among parties advocating a change to the ORDC.

³ *Commission Proceeding to Ensure Resource Adequacy in Texas*, Project No. 40000, Supplemental Comments of IPR-GDF Suez Energy North America, Inc., attachment from William W. Hogan, "Electricity Scarcity Pricing Through Operating Reserves: An ERCOT Window of Opportunity" at 5-8 (Nov. 14, 2012).

⁴ No party submitted a specific proposal regarding the calculation of the Loss of Load Probability (LOLP).

Option 6 recommends a Value of X set to equal the sum of ERCOT's hourly Responsive Reserve Service (RRS) and Up Regulation Service (URS) requirements; a VOLL equal to \$18,000 (retaining an effective price cap at \$9,000/MWh); and a minimum RRS requirement of 2,750 MW. The Option 6 proposal implies a dynamic Value of X ranging from 2,946 to 3,524 MW given year 2016 assumptions. In this proposal, the Value of X would reach its highest levels during the winter and spring early morning hours, when ERCOT anticipates needing a larger quantity of reserves to respond to changing wind conditions.

The tables below depict the impact of Option 6 over the June 2014 - October 2015 time period in terms of additional PNM and average online price adder earned over the base case.⁵ The behavioral response dimension estimates outcomes assuming offline but available capacity will come online at certain price levels and for certain durations of these prices. Assuming a behavioral response when prices reach \$75/MWh for 2 or more hours, for example, implies that certain capacity will commit if that price materializes for that length of time. Additional online committed capacity will reduce prices, thus reducing the expected impact on PNM in comparison to an assumption of behavioral response at higher price levels, or no behavioral response at all. As described in ERCOT's March 11, 2016 filing, significant uncertainty exists surrounding the magnitude of potential behavioral response.⁶

Additional PNM (\$)⁷					
	Behavioral Response at \$75	Behavioral Response at \$75 for 2+ Hours	Behavioral Response at \$250	Behavioral Response at \$250 for 2+ Hours	No Behavioral Response
Base Case	\$5,254.46	\$6,457.22	\$7,089.44	\$7,881.62	\$8,818.39
Option 6	\$89,522.41	\$120,568.95	\$154,169.90	\$194,370.91	\$265,834.38

Time- and Energy-Weighted Average Online Price Adder (\$/MWh)⁸					
	Behavioral Response at \$75	Behavioral Response at \$75 for 2+ Hours	Behavioral Response at \$250	Behavioral Response at \$250 for 2+ Hours	No Behavioral Response
Base Case	\$0.66	\$0.78	\$0.85	\$0.94	\$1.05
Option 6	\$10.71	\$13.47	\$16.81	\$20.50	\$28.08

⁵ The base case indicates the online price adder and PNM produced by current ORDC design over this timeframe. The base case and Option 6 estimates do not include any additional PNM associated with system lambda during this period (approximately \$42,000, assuming no behavioral response).

⁶ ERCOT's Response to the Public Utility Commission of Texas Staff's Request for Comments at 4 (March 11, 2016) ("ERCOT Reply Comments").

⁷ ERCOT Backcast Analysis at 35.

⁸ *Id.* at 33.

3. Possible Next Steps

1. **Allow ERCOT to gather more data.** Because the ORDC has been in production for less than two years, the Commission could defer action and allow ERCOT to gather additional relevant data regarding its performance and effectiveness over time.
2. **Order ERCOT to Perform Additional Analysis.** The Commission could request that ERCOT conduct additional analysis, such as quantifying the expected equilibrium reserve margin for each proposal, undertaking additional study to determine a more accurate VOLL, analyzing the inputs to the LOLP calculation, or running additional backcasts. Cost estimates for such analyses have not yet been studied.
3. **Hold a workshop.** The Commission could convene a workshop to review stakeholder positions or other related issues. Such a workshop could be presided over by the Commissioners or by Staff.

Stakeholder Concepts for Potential Additional Study or Comment

In the event the Commission seeks further analysis or comment, Staff offers the following summary of salient concepts and objectives regarding possible ORDC modifications set forth by the commenting parties.

- **Approximating real-time co-optimization:** Real-time co-optimization allows simultaneous clearing of energy and ancillary service markets at the least cost. The ORDC has been described as a proxy for real-time co-optimization, or an interim measure implemented in the near-term prior to the eventual institution of co-optimization.

Staff has been presented with different percentage levels estimating how close the ORDC comes to achieving the efficiencies of co-optimization. The ORDC has improved the valuation of operating reserves during brief periods of shortage by mimicking the effects of the reserve demand curves that would exist in real-time co-optimization. However, according to the Independent Market Monitor (IMM), the ORDC cannot capture the substantial additional benefits provided by the efficient coordination of energy and reserves that occurs in real-time co-optimization.⁹ In the current market design, capacity reserved for ancillary services is withheld from the real-time energy market, even when this capacity could be more economically dispatched as energy. In contrast, a co-optimized market provides access to the entire offered resource capacity, allowing substitution of energy and ancillary services based

⁹ Potomac Economics, Comments on the ORDC at 5 (March 11, 2016).

on system need at the least cost. Because the ORDC does not correct this aspect of the current market, it may be unable to replicate the broader benefits provided by real-time co-optimization.¹⁰

- **Improving operational reliability:** Scarcity pricing that reflects the underlying value of reserves as the loss of load probability increases supports operational reliability by providing incentives for resources to be available when needed. As noted by Commissioner Anderson, since its inception the ORDC has had a positive impact on operational reliability by incenting the correct behavior of generation and load.¹¹ In the current design, the Value of X was increased from a level at which load shed would credibly occur to 2,000 MW in part to account for the value of interventions the system operator may take to preserve reliability and avoid involuntary curtailment. Further increasing the Value of X or VOLL to produce scarcity price signals at higher reserve levels would likely provide additional operational reliability. However, as observed by ERCOT staff, this additional reliability would exceed that required by applicable standards and “will come at a cost in the form of possible higher prices and market efficiency impairments.”¹²
- **Effect on long-term supply adequacy:** While the ORDC was implemented to improve scarcity pricing in the near term by appropriately valuing the demand for operating reserves, the price signals provided by the ORDC may influence future investment decisions in new capacity. Adjusting the parameters of the ORDC could reduce the probability that ERCOT’s equilibrium reserve margin will fall within the low end of the range of possible outcomes. Several stakeholders have emphasized this potential use of the ORDC in their comments (see Attachment B). Although significant uncertainty exists around forward projections, evaluating the equilibrium reserve margin associated with stakeholder proposals could provide the Commission with insight into how potential ORDC modifications might impact long-term supply adequacy.

Staff appreciates the opportunity to provide this update to the Commission, and looks forward to further discussion at the April 14, 2016 Open Meeting. Please contact Julia Harvey at 6-7371 or Jason Haas at 6-7295 with additional questions.

¹⁰ Project No. 41837 was initiated to evaluate the institution real-time co-optimization in ERCOT. This project is currently on hold pending the ERCOT stakeholder determination regarding Future Ancillary Services.

¹¹ *Commission Proceeding to Ensure Resource Adequacy in Texas*, Project No. 40000, Memo from Commissioner Anderson at 1 (Oct. 7, 2015).

¹² ERCOT Reply Comments at 4 (March 11, 2016).

Attachment A
Table Summarizing Stakeholder Recommendations

Party	Value of X (MW)	VOLL (\$/MWh)
<i>ORDC is functioning as designed; modifications are not needed</i>		
ERCOT Steel Mills; Denton Municipal Electric; Direct Energy; Brazos Electric Power Cooperative, Inc.; Rayburn County Electric Cooperative, Inc.; Austin Energy; CPS Energy; Texas Industrial Energy Consumers; Independent Market Monitor; Steering Committee of Cities Served by Oncor; Office of Public Utility Counsel; Retail Electric Provider Group ¹³	2,000 (no change)	\$9,000 (no change)
<i>ORDC is dysfunctional; modifications are needed</i>		
Koch Energy Services; Luminant Energy Company LLC; Panda Power Funds; Coalition ¹⁴	Sum of RRS + URS (varying hourly from 2,946 to 3,524 MW in 2016)	\$18,000 (effective price cap at \$9,000)
Calpine Corporation; LS Power Group	Sum of RRS + URS	-
GDF Suez Energy North America	2,750 or higher	\$18,000 (effective price cap at \$9,000)
Tenaska, Inc.	3,150	-
NRG	2,500 in summer months; 2,300 in other months	\$18,000 (effective price cap at \$9,000)
Shell Energy North America	Between 2,700 and 3,000	Above \$9,000 (effective price cap at \$9,000)

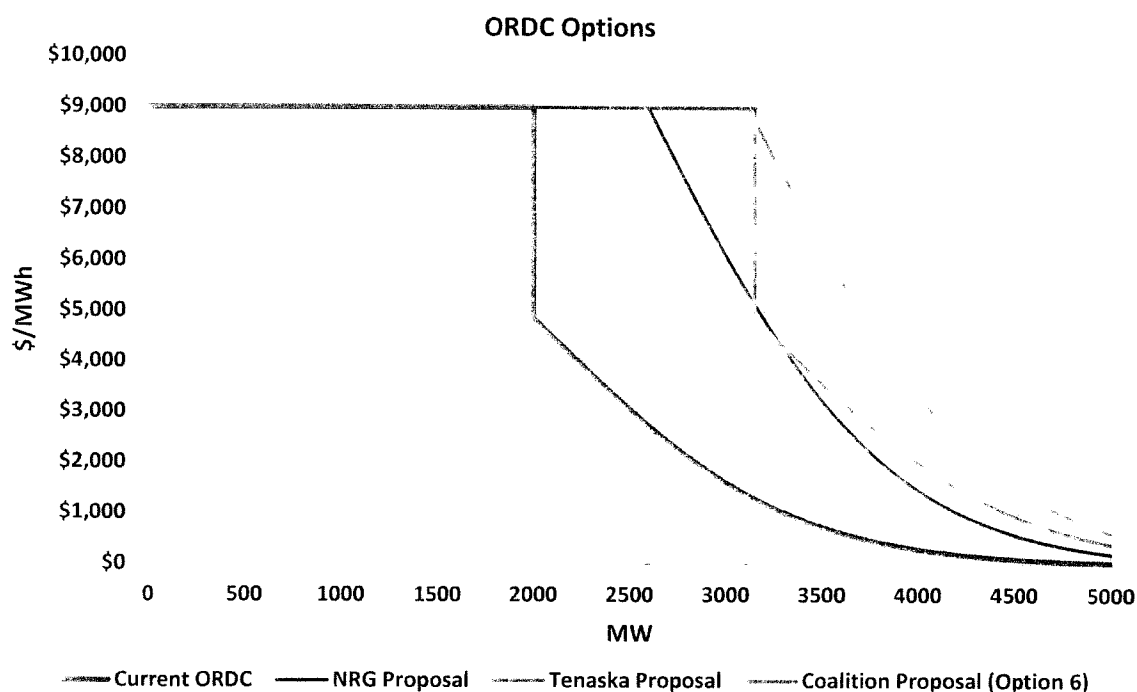
¹³ The Retail Electric Provider Group is composed of Direct Energy, Just Energy, Source Power & Gas, and Nobel Energy Solutions LLC.

¹⁴ The Coalition is composed of Apex CAES, LLC, Calpine Corporation, First Solar Inc., GDF Suez Energy Marketing North America Inc., Lower Colorado River Authority, Luminant Energy Company LLC, SunEdison Inc., SunPower Corporation, and Talen Energy.

Attachment A

Figure Summarizing Stakeholder Recommendations

The following figure depicts certain stakeholder proposals regarding potential ORDC modifications alongside the current ORDC design for online reserves. In creating this figure, Staff assumed August 2016 Ancillary Service requirements for Hour Ending 17 and a System Lambda of \$0. Because the shape of the ORDC will vary throughout the year, this figure provides an example to indicate the magnitude of the impact of various proposals.



Attachment B

Summary of Comments

A. The ORDC is operating as intended and designed. No adjustments are needed.

The ERCOT Steel Mills, Denton Municipal Electric, Brazos Electric Coop and Rayburn County Electric Coop, CPS Energy, Texas Industrial Energy Consumers, and Direct Energy each filed position papers as part of the February 4, 2016 ERCOT filing arguing that the ORDC is operating as intended and designed, and recommended that no changes to the ORDC be undertaken at this time. In response to Staff's request for reply comment, Potomac Economics, ERCOT staff, the Office of Public Utility Counsel, the Steering Committee of Cities Served by Oncor, Austin Energy and a group of Retail Electric Providers filed comments supporting the same position. Texas Industrial Electric Consumers supplemented its February 4 comments.

According to Potomac Economics, the **Independent Market Monitor** ("IMM") for the ERCOT region, whether the current configuration of the ORDC will provide sufficient incentives for efficient investment in the resources needed to ensure resource adequacy is yet to be determined. Because the ORDC will produce significant price impacts only when supply is scarce and when weather-dependent loads rise higher than normal, the ORDC has thus far had little impact on prices, as neither of these conditions have occurred since the ORDC was implemented. Addressing outcomes on August 13, 2015, the IMM shows that the ERCOT grid operated reliably as PRC approached 2,300 MW, and that prices, including the ORDC price adder, appropriately reflected system conditions. The IMM argues that there is no economic rationale for setting prices to VOLL when all responsive and regulating services are still available for conversion into energy and the probability of load shed is low. Finally, while there may be some support in academic research for increasing the VOLL, such an increase would be inconsistent with the current effective price cap. Ultimately, the IMM advises against modifying ORDC parameters at this time.

ERCOT staff states that the current market design, including the ORDC, has served to promote efficient market outcomes and reliable grid operations, and that none of the proposed changes are necessary from a reliability perspective. According to ERCOT staff, while the proposed ORDC changes would provide additional system reliability, this would come at a cost in form of higher prices and market efficiency impairment. ERCOT recommends that the ORDC not be implemented in the day-ahead market ("DAM") absent real-time co-optimization. ERCOT staff additionally provides an update on their solution to address outcomes such as those seen on August 13, 2015, where PRC declined to near Energy Emergency Alert ("EEA") levels while significant capacity was available but undeployed. This solution involves reducing the Reserve Discount Factor and correspondingly adjusting the amount of RRS procured.

According to **CPS Energy**, neither the IMM nor ERCOT staff have identified any evidence that the ORDC is broken or needs to be adjusted to fix a specific problem. In CPS' view, the issues that occurred on August 13, 2015, are symptomatic of inefficiencies outside of the ORDC mechanism, rather than issues with ORDC itself. These issues may be addressed by changes in procedures for bringing non-spinning reserves online. CPS also opposes changes to the amount of reserves procured by ERCOT to address perceived market issues. According to CPS, the amount of reserve services procured should solely be based on reliability needs.

The **ERCOT Steel Mills** note that no capacity shortage existed on August 13th, 2015. Although Physically Responsive Capacity ("PRC") had dropped below 2,500 MW, an ample

amount of Quick Start capacity was available to meet system demand, and an amount sufficient to avoid declaration of an EEA did in fact come on line without any need for out-of-market action by ERCOT. The Steel Mills suggest that a review of the relationship between the reserves considered in the ORDC calculation and the reserves contained in the PRC measure, and that adjustments to ERCOT procedures for activating Quick Start units may be in order, but that no changes to the ORDC calculation itself are needed.

Texas Industrial Energy Consumers (“TIEC”) characterizes the changes proposed by some stakeholders to the ORDC parameters as “unjustified and overreaching given observed market performance.” TIEC refers to the most recent CDR report as evidence that the current scarcity pricing mechanism is adequately incenting generation investment. According to TIEC, proposals to increase the VOLL or X parameters are not based on any sound economic principles, but are simply designed to produce an increase in revenue to generators. TIEC sees no reason for concern for the lack of convergence of PRC and the ORDC reserves on August 13, 2015. In the view of TIEC, the divergence between PRC and ORDC reserves was primarily due to very high offers for certain quick-start units. TIEC suggests that stakeholders may wish to consider removing offline quick-start units from SCED or requiring physical commitment of these units when non-spinning reserves are deployed.

In supplemental comments filed on March 11, 2016, TIEC observes that, since the ORDC was implemented, ERCOT has seen several thousand megawatts of new generation development, and that ERCOT currently has capacity far in excess of the level needed to ensure reliable operations, and that this surplus will continue at least through 2025. TIEC’s analysis of the behavior of the ERCOT market on August 13, 2015 contends that ORDC pricing correctly reflected the presence of sufficient reserves in the market, despite the drop in PRC. According to TIEC, a number of resources providing non-spinning reserve service were not brought online even though energy prices were relatively high because the offers for these resources were in excess of \$1,500 per MWh, well above the energy price at the time. TIEC views the proposals to increase the Value of X and to increase the VOLL in the ORDC calculation as unjustified revenue increases without support in sound market principles or current market conditions. TIEC calculates that the changes proposed by the generators could result in an increase in revenue of at least \$3.8 billion or more in extreme weather years or if market behavioral response is considered. TIEC recommends that no changes to the ORDC be made at this time.

Brazos Electric Coop and Rayburn County Coop expressed concern that insufficient analysis has been performed to justify a change to the ORDC mechanism. According to the coops, no reliability issue has been presented that would indicate a need for changes, and the only analysis that has been performed addresses only the amount of additional revenue for generation produced under various scenarios. The changes that have been proposed would result in significant increases in costs to load serving entities (“LSEs”) without any demonstrated positive impact on system reliability. The coops also oppose the inclusion of ORDC in the DAM. The coops believe that inclusion of ORDC in DAM, without real-time co-optimization, could result in uneconomic “must-run” of generation and a suppression of participation in the DAM.

Denton Municipal Electric points to the robust reserve margins projected ten years into the future by ERCOT’s Capacity, Demand, and Reserves (“CDR”) report in support of its position that the ORDC mechanism is functioning as intended.

Direct Energy takes the position that the ORDC is functioning as intended and that changes are not needed at this time. Direct Energy refers to reports by the IMM that indicate that the ORDC is appropriately valuing reserves and that implementation of ORDC has resulted in an increase in capacity available in real time, as further evidenced by the adequate reserves shown in the CDR. Direct Energy opposes any changes that would result in an increase in energy prices without a clear demonstration that the changes are needed for reliability purposes. If the Commission were to determine that changes are needed, Direct Energy believes that at least 12 months should elapse between such a Commission determination and the implementation of any changes, to allow market participants time to incorporate changes into future contracts.

OPUC refers to an analysis presented by ERCOT staff to the ERCOT Board, concluding that the ORDC is working as designed and providing accurate scarcity pricing. OPUC also highlights the reserve levels shown in the most recent SARA and CDR reports to support its position that no changes to the ORDC are needed. OPUC expressed concern about potential costs to residential and small business customers if the ORDC parameters were changed.

The Steering Committee of Cities Served by Oncor ("**Oncor Cities**") points to the more than adequate reserve margins projected in the CDR report as evidence that the ORDC is working as intended. Oncor Cities believes that ample generation capacity has correctly led to relatively low ORDC revenue. The Oncor Cities recommends that any proposed changes to the ORDC should be rejected.

Austin Energy ("AE"), like other stakeholders, cites the CDR report as evidence that the ORDC is working as intended. The August 13 event indicates that the ORDC is working properly, as it correctly recognized that the large amount of quick start capacity available implied a low loss of load probability. AE argues that increasing the Value of X would result in inefficiencies in the ERCOT market because the system wide offer cap of \$9,000 would be reached before there is any true scarcity in the market. AE rejects the proposal to determine the loss of load probability by using a two standard deviation sampling of historic data, as this would overestimate the likelihood of a loss of load event and increase, without good cause, the frequency of ORDC events. According to AE, no evidence exists that the VOLL should be increased above the current \$9,000 value, and there is some evidence that this value is too high. AE recommends that a study be undertaken to determine more accurate the cost of load loss to retail customers. Finally, AE argues that any increase in the amount of RRS purchased should be based only upon a reliability need. AE recommends that the Commission make no changes to the ORDC.

A group of Retail Electric Providers ("**REP Group**"), including Direct Energy, Just Energy, Source Power & Gas, and Noble Americas Energy Solutions, review ERCOT's backcast analysis of the cost effects to the market of some of the proposed changes to the ORDC mechanism. The REP Group states that ERCOT analysis indicates prices would increase by between \$1.66 to \$28.08 per MWh, and notes that every \$1 per MWh increase in price imposes some \$350 million in additional cost on the market on an annual basis. The REP Group also shows that with different assumptions regarding the behavioral response of generators to market prices, the cost effect could be much higher. While the REP Group does not believe that any changes to the ORDC are warranted, the group requests that, if changes are made, that implementation be delayed to no sooner than the summer of 2017, to allow REPs an opportunity to adjust product offerings to account for the resulting increase in costs. **Ambit Energy** concurs that any changes should be delayed until next summer.

B. The value of the Minimum Contingency Level (X) should be adjusted, the minimum Responsive Reserve Service ("RRS") requirement should be increased, and the Value of Lost Load ("VOLL") should be increased.

As part of the February 4, 2016 ERCOT filing, Calpine, LS Power Group, NRG, Shell Energy, and a group of commenters including Apex CAES, Calpine, First Solar, GDF Suez, LCRA, Luminant, SunEdison, Sun Power, and Talen Energy ("the Coalition") each filed position papers that, with some variation, recommended increasing the Value of X and the value of VOLL in the ORDC calculation, and increasing the minimum RRS requirement. In response to Staff's request for reply comment, Panda Power Funds, Tenaska, and Koch Energy Services filed comments supporting similar positions, and Calpine, Luminant, GDF Suez, and NRG filed comments supplementing their position papers.

Calpine recommends that the Value of X be set dynamically to equal the sum of Responsive Reserve Service ("RRS") and Up Regulation Service ("URS") requirements, and that the minimum RRS requirement be set to 2,750 MW. In advocating the increase in the Value of X, Calpine reasons that the current value of 2,000 MW is too low to send a timely signal to load and generation to take action, because ERCOT will have begun taking out-of-market action at a PRC level of 2,500 MW and will have declared an EEA at 2,300 MW. Calpine also argues that the current ORDC mechanism does not properly reflect ERCOT's willingness to pay for all reserves. Calpine observes that, if real-time co-optimization were in effect, the demand for the total requirement for RRS and URS would form the basis for the demand curve, and therefore should form the basis for the formulation of the ORDC mechanism. Calpine finally recommends that the minimum RRS requirement should be set to 2,750 MW, in order to ensure that ORDC price adders result in a price at the SWOC when ERCOT begins to take out-of-market action at 2,500 MW of PRC, and to ensure that ERCOT is able to meet its NERC reliability obligations.

In supplemental comments filed on March 11, 2016, Calpine reiterated its position, and responded to the position papers of the Steel Mills, TIEC and CPS Energy. In response to the Steel Mills' contention that the lack of correlation between PRC and ORDC reserves does not indicate a deficiency, Calpine reviews the impact of ERCOT's actions on August 13, 2015 to bring non-spinning reserves online. According to Calpine, this deployment depressed energy prices and prevented the creation of a significant ORDC price adder at just the point where ERCOT would otherwise have had to declare an EEA 1 event. In Calpine's view, these events indicate that the Commission must take steps to properly value reserves so that meaningful adders accompany any ERCOT out-of-market actions. Responding to TIEC's arguments regarding the Value of X, Calpine states that the ORDC was not intended as a resource adequacy mechanism, but rather as a means to value operating reserves. Consequently, the current level of reserve margins is not relevant to the Value of X.

LS Power Group also supports increasing the Value of X to equal the sum of RRS and URS requirements, and setting a minimum RRS requirement of 2,750. According to LS Power, the adoption of these changes will reflect the new NERC BAL-003-01 requirements and will make the ORDC consistent with real time co-optimization. LS Power also recommends that ORDC parameters be reviewed on an annual basis, to ensure that it continues to provide the correct incentives for reliability in the ERCOT region.

Apex CAES, Calpine, First Solar, GDF Suez, LCRA, Luminant, SunEdison, Sun Power, and Talen Energy (“the Coalition”) recommends that the RRS requirement be set in 2,750 MW in all hours; that the Value of X be set to equal the sum of RRS and RUS requirements; that the value of VOLL be set to \$18,000 while maintaining the effective price cap of \$9,000; and that the ORDC be added to the DAM. The Coalition argues that increase the RRS requirement would enable SCED to dispatch more of the available reserves before ERCOT approaches the PRC level that would necessitate an EEA. The Coalition also believes that the increase in the RRS requirement is needed to account for capacity additions to the South Texas and Comanche Peak nuclear generators (the two largest generators in the ERCOT fleet) and to account for the increasing role of wind generation in the ERCOT region. According to the Coalition, the minimum contingency level should be set to the sum of RRS and URS requirements in order to accurately reflect the value of these reserves, enabling scarcity pricing formation while ERCOT protects these reserves. The Coalition’s proposal to increase the VOLL parameter to \$18,000 is designed to prevent the sharp escalation in the ORDC adder that occurs as the level of operating reserves approaches the Minimum Contingency Level. Finally, the Coalition recommends that the ORDC should be added to the DAM in order to promote convergence between the DAM and the real-time market. In supplemental comments, **Luminant** presents further analysis in support of the Coalition’s proposals, showing that, under the current ORDC, the ORDC value for RRS is slightly above \$2,000, or only 25% of the system-wide offer cap. By contrast, the coalition’s proposal would ensure that when reliability reserves are deployed, prices would have risen to the SWOC.

NRG proposes that the Value of X be set to 2,500 MW in the summer months and to 2,300 MW at all other times; that the VOLL be set to \$18,000, while maintaining the effective price cap at \$9,000; that the minimum RRS requirement be set to an amount higher than the EEA Level 1 threshold of 2,300 MW; and that the changes should be implemented on June 1st, 2017. In support of increasing the Value of X, NRG cites the out-of-market actions taken by ERCOT as EEA Level 1 is declared at 2,300 MW of PRC, as well as the influence of 4CP-driven demand response, both of which have the effect of suppressing prices at times of scarcity. NRG does not recommend that X be permitted to fluctuate from hour to hour, as suggested by the Coalition, but be established as a static value, varying only between summer months and other months. NRG recommends delaying implementation of any changes until the summer of 2017, to allow market participants time to recognize the changes in contracts for that period.

In supplemental comments filed on March 11, 2016, NRG argues that recent development of new generation capacity does not prove that ORDC is working properly, since most of this new generation was planned well before ORDC was implemented, and is more likely the result of high energy prices in 2011. NRG observes that energy efficiency programs and the 4CP pricing mechanism have acted to reduce demand and therefore reduce prices during peak demand periods, and must be balanced by a mechanism such as ORDC to ensure resource adequacy in the energy-only market. Finally, NRG believes that implementation of ORDC in the DAM would be inconsistent with the purpose of that market, which currently is a hedging mechanism and a means for ERCOT to obtain ancillary services. Implementation of ORDC in the DAM would change the nature of the market and the behavior of market participants and should be carefully studied before undertaken.

Shell Energy North America (“SENA”) recommends increasing the Value of X to a level between 2,700 MW and 3,000 MW; increasing the value of VOLL to a level above the SWOC; and accommodating participation of price-responsive distributed resources in SCED dispatch. SENA believes that increasing the Value of X to a level above the PRC reserve level at which

ERCOT begins to take out-of-market reliability actions (2,500 MW) would introduce more frequent scarcity events and more accurately reflect the value of reserves. SENA believes that increasing the level of VOLL above the SWOC would accelerate the onset of scarcity and potentially smooth price formation. SENA strongly believes, however, that the effective price cap should be maintained at the current \$9,000.

Panda Power Funds ("Panda"), in comments filed on March 14, 2016, opines that revisions to the ORDC may not be sufficient to provide incentives for the construction of resources to support long-term resource adequacy, and argues that the Commission should move toward implementation of real time co-optimization of ancillary services and energy. According to Panda, the unpredictable nature of the price signals generated by the ORDC do not provide the consistent revenue streams that are needed to enable investment in new generation. Panda also believes that the current CDR is misleading and should be corrected to provide accurate information to those contemplating investing in ERCOT. If the ORDC parameters are to be adjusted, Panda supports setting the Value of X to the sum of RRS and URS, increasing the minimum RRS procurement to a level higher than 2,300 MW, and adjusting the shape of the ORDC curve by, for example, using more than one standard deviation in the incorporation of mu into the curve.

Tenaska, in comments filed on March 11, 2016, proposes an increase in the Value of X to 3,150 MW. Tenaska believes that, at the current level of X, reserve margins may become unadvisedly low before the market is able to signal distress. Setting the Value of X at the higher level of 3,150 will cause the market to exhibit scarcity pricing more frequently and will provide market participants with time to add capacity before reserves decline below the target level.

Koch Energy Services ("KES"), in comments filed on March 11, 2016, recommends first that the PUC and ERCOT act to bring PRC and ORDC reserves into closer alignment. If the Commission is to make changes to the current ORDC parameters, then KES recommends that the Value of X be set to the sum of RRS and URS procurements, that the value of VOLL be set to \$18,000, and that any reserves deployed by ERCOT for reliability purposes be deducted from the reserves included in the ORDC calculations.

C. ERCOT Staff Estimates of Implementation Times

In comments filed on March 11, 2016, ERCOT staff provided preliminary estimates of the time needed to implement some of the proposals contained in the stakeholder white paper.

ERCOT estimates that the proposal to modify the value of X to a different static value and/or to modify the value of VOLL would require as few as three months for implementation and would incur negligible implementation cost.

Implementation of a dynamic value of X (for example, to be equal to the sum of RRS and URS) and implementation of ORDC in the DAM are estimated to require at least six and 24 months, respectively. ERCOT has not developed a cost estimate for these proposals, but expects that implementing a dynamic value for X would cost less than implementing the ORDC in the DAM.