PROJECT NO. 40000

COMMISSION PROCEEDING TO ENSURE RESOURCE ADEQUACY IN TEXAS	**§**	**PUBLIC UTILITY COMMISSION OF TEXAS**

ERCOT'S SUPPLEMENTAL ANALYSIS OF ISSUES IN ORDC B+ WHITE PAPER

COMES NOW, Electric Reliability Council of Texas, Inc. (ERCOT) and submits the attached supplemental analysis (Attachment A) of the proposal to improve real-time scarcity pricing through implementation of an Operating Reserve Demand Curve (ORDC), as discussed in the white paper filed in this project on March 22, 2013 (the proposal hereinafter referred to as "ORDC B+").[1]

As requested by the Commission, ERCOT continues to analyze ORDC B+, and provides this supplemental information to inform stakeholder comments on ORDC B+ that are due in this project on May 31, 2103.[2] In addition to the analysis in Attachment A, ERCOT plans to file an implementation impact analysis (including estimated costs and schedule for implementation), well before the due date for stakeholder comments.

ERCOT staff prepared the analysis in Attachment A in response to meetings and discussions with stakeholders regarding the ORDC B+ white paper. The Attachment A analysis is entitled: "*ORDC B+: Additional Data with Contingency Level at 2300 MW and Seasonal Curves*." The analysis is responsive to requests for additional data on the impact of ORDC B+ if the minimum contingency level (the value of "*x*" in the ORDC B+ formula) utilized in prior back casts is set at 2300 megawatts (MW). In the previous analyses submitted, ERCOT conducted a back cast OF 2011-2012 conditions using minimum contingency levels of 1375 MW and 1750 MW. Attachment A replicates the analysis included in the original ORDC B+ white paper, adding data for a 2300 MW minimum contingency to tables depicting the results when the other

[1] ERCOT's Response to the Commission's Request for Additional Analysis of the "Interim Solution B" Scarcity Pricing Proposal Discussed at the January 24, 2013 Workshop in Project No. 40000) (March 22, 2013) Interchange Item 392).

[2] Memo from Chairman Nelson, Project No. 40000 (March 27, 2013) (Interchange Item 396).

minimum contingency values were used. Specifically, the tables in Attachment A replicate the analysis in the following ORDC B+ white paper tables:

- Table 1 & 6: Energy-weighted average energy price adder
- Table 2 & 8: Estimated additional Peaker Net Margin (PNM)
- Table 3 & 9: Estimated additional PNM by only increasing SWCAP (included for reference; does not include new analysis)
- Table 4 & 12: Net Ancillary Services (AS) imbalance settlement charge to Resources
- Table 5 & 13: Change in net (energy + AS) charge to resources
- Table 7: Energy-weighted average offline reserve price
- Table 10 & 11: Net AS imbalance settlement charge to Resources

Attachment A also includes additional information regarding the calculation of online and offline reserve prices using Loss of Load Probability (LOLP) curves, and a depiction of those curves based on seasonal conditions.

ERCOT staff is available to respond to questions about this supplemental analysis, as requested by the Commission.

Respectfully submitted,

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Additional Data with Contingency Level at 2300MW and Seasonal Curves

Energy-weighted Average Price Adder P_S ($/MWh) for Different VOLLs and Minimum Contingency Levels (X)

Addition to Tables 1 and 6 of the B+ back cast whitepaper

VOLL	Energy-weighted average price increase with X at 1375 MW ($/MWh)			Energy-weighted average price increase with X at 1750 MW ($/MWh)			Energy-weighted average price increase with X at 2300 MW ($/MWh)		
	2011	2012	2011 & 2012 combined	2011	2012	2011 & 2012 combined	2011	2012	2011 & 2012 combined
$5000/MWh	7.00	1.08	4.08	12.03	2.40	7.28	33.74	7.36	20.71
$7000/MWh	11.27	1.56	6.48	19.06	3.45	11.35	52.08	10.55	31.57
$9000/MWh	15.54	2.05	8.87	26.08	4.50	15.42	70.42	13.75	42.43

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Additional PNM ($/MW) for 2011 & 2012 for Different VOLLs and Minimum Contingency Levels (X)

The numbers in these Tables are in addition to the realized PNM in 2011 & 2012, $125,001 & $33,952 respectively

Addition to Tables 2 and 8 of the B+ back cast whitepaper

VOLL	Total Additional PNM under Interim Solution B+ with X at 1375 MW ($/MW)		Total Additional PNM under Interim Solution B+ with X at 1750 MW ($/MW)		Total Additional PNM under Interim Solution B+ with X at 2300 MW ($/MW)	
	2011	2012	2011	2012	2011	2012
$5000/MWh	38,544	7,740	67,892	17,267	192,728	53,194
$7000/MWh	62,141	11,189	107,327	24,809	296,489	76,367
$9000/MWh	85,773	14,643	146,795	32,362	400,361	99,568

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Additional PNM ($/MW) for 2011 & 2012 for Different VOLLs and Minimum Contingency Levels (X)

Estimated additional PNM ($/MW) for 2011 and 2012 by only increasing the SWCAP

Tables 3 and 9 of the B+ back cast whitepaper

SWCAP	Total Additional PNM if SWCAP Increased to VOLL ($/MW)	
	2011	2012
$5000/MWh	57,631	2,877
$7000/MWh	114,168	5,883
$9000/MWh	170,706	8,889

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Net AS imbalance Settlement ($) charge to Resources for Different VOLLs and Minimum Contingency Levels (X)

Addition to Tables 4 and 12 of the B+ back cast whitepaper

VOLL	Net AS Imbalance Settlement for All Reserves with X at 1375MW ($)			Net AS Imbalance Settlement for All Reserves with X at 1750MW ($)			Net AS Imbalance Settlement for All Reserves with X at 2300MW ($)		
	2011	2011 w/o Feb & Aug	2012	2011	2011 w/o Feb & Aug	2012	2011	2011 w/o Feb & Aug	2012
$5000/MWh	60,247,604	2,945,245	1,757,030	88,156,738	1,938,250	1,554,245	213,180,468	214,798	-1,493,361
$7000/MWh	104,970,127	4,380,067	2,902,841	153,256,516	3,123,633	2,905,054	356,890,176	1,593,544	107,521
$9000/MWh	149,692,650	5,814,890	4,048,651	218,356,295	4,309,015	4,255,863	500,599,884	2,972,290	1,708,404

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Change in Net (Energy + AS) Charge to Resources for Different VOLLs and Minimum Contingency Levels (X)

Addition to Tables 5 and 13 of the B+ back cast whitepaper

VOLL	Change in Net (Energy + AS) Charge to Resources with X at 1375			Change in Net (Energy + AS) Charge to Resources with X at 1750			Change in Net (Energy + AS) Charge to Resources with X at 2300		
	2011	2011 w/o Feb & Aug	2012	2011	2011 w/o Feb & Aug	2012	2011	2011 w/o Feb & Aug	2012
$5000/MWh	-2,263,748,410	-499,032,094	-349,087,357	-3,908,542,492	-1,046,569,996	-777,553,251	-10,991,156,078	-3,218,687,706	-2,385,857,627
$7000/MWh	-3,637,412,917	-710,986,103	-504,279,661	-6,175,394,742	-1,487,477,702	-1,115,981,451	-16,938,967,566	-4,575,783,884	-3,421,258,501
$9000/MWh	-5,011,077,423	-922,940,111	-659,471,967	-8,442,246,992	-1,928,385,410	-1,454,409,650	-22,886,779,054	-5,932,880,063	-4,456,659,375

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Energy-weighted Average Offline Reserve Price P_{NS} ($/MWh) for Different VOLLs and Minimum Contingency Levels (X)

Addition to Table 7 of the B+ back cast whitepaper

VOLL	Energy-weighted average P_{NS} with X at 1375 MW ($/MWh)			Energy-weighted average P_{NS} with X at 1750 MW ($/MWh)			Energy-weighted average P_{NS} with X at 2300 MW ($/MWh)		
	2011	2012	2011 & 2012 combined	2011	2012	2011 & 2012 combined	2011	2012	2011 & 2012 combined
$5000/MWh	3.84	0.48	2.18	6.08	0.92	3.53	15.46	2.31	8.96
$7000/MWh	6.15	0.69	3.45	9.63	1.33	5.53	24.05	3.33	13.82
$9000/MWh	8.46	0.91	4.73	13.18	1.73	7.53	32.64	4.36	18.67

Net AS imbalance Settlement ($) Charge to Resources for Different VOLLs and Minimum Contingency Levels (X) at 2300MW

New Table corresponding with Tables 10 and 11 of the B+ back cast whitepaper

VOLL	Net AS Imbalance Settlement for Online Reserves ($)			Net AS Imbalance Settlement for Offline Reserves ($)		
	2011	2011 w/o Feb & Aug	2012	2011	2011 w/o Feb & Aug	2012
$5000/MWh	216,349,966	2,661,596	987,977	-3,169,498	-2,446,797	-2,481,338
$7000/MWh	361,401,658	5,047,957	3,608,942	-4,511,482	-3,454,413	-3,501,421
$9000/MWh	506,453,350	7,434,319	6,229,908	-5,853,466	-4,462,029	-4,521,503

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Calculating Online and Offline Reserve Prices using LOLP Curves $\pi_S(R_S)$ and $\pi_{NS}(R_{SNS})$

- **Reserves are divided into two categories which are (R_S) and (R_{SNS})**
- **$\pi_S(R_S)$ is a function of the Real-Time reserves that should be available in the first 30 minutes of the hour and is intended to capture the LOLP for that level of reserves.**
- **$\pi_{NS}(R_{SNS})$ is a function of all the Real-Time reserves that can be expected to be available within the hour and is intended to capture the LOLP for that level of reserves based on events that happen in an hour.**
- **The π_S & π_S are generated from a linear piecewise function that slopes the change between breakpoints that correspond to Ancillary Service requirements**
- **The IMM has observed that the use of the piecewise linear representation of the LOLP curve significantly overstates the actual LOLP values between the breakpoints and has recommended the use of a continuous LOLP function.**

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Online and Offline Reserve Prices P_S and P_{NS}

- **P_S is the price for real-time, online reserves and the price adder for real-time energy**
- **P_{NS} is the price for real-time, offline reserves**
- **P_S and P_{NS} are functions of the LOLP at various levels of Real-Time reserves, In this proposal, P_S and P_{NS} are determined as follows:**

$$P_S = v * 0.5 * \pi_S(R_S) + P_{NS}$$
$$P_{NS} = v * (1 - 0.5) * \pi_{NS}(R_{\mathrm{SNS}})$$
$$v = VOLL - Marginal\ Offer$$

- **Online spinning reserves are available for both the first 30 minutes and the last 30 minutes of the hour. Therefore, there is a higher payment associated with this type of reserve.**
- **Offline spinning reserves are only available during the last 30 minutes of the hour and is therefore valued less.**

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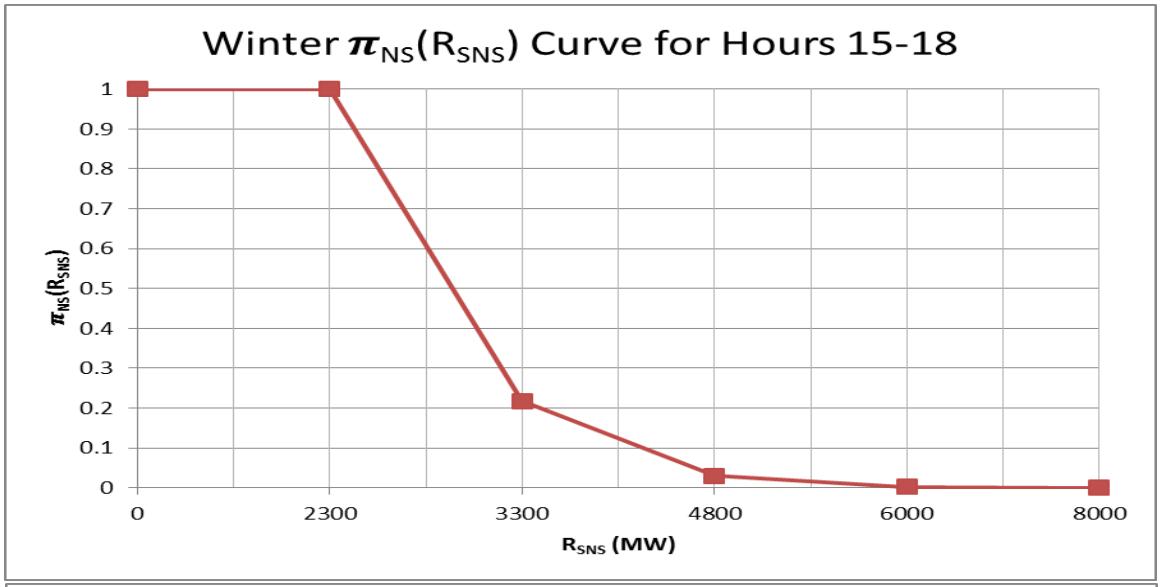
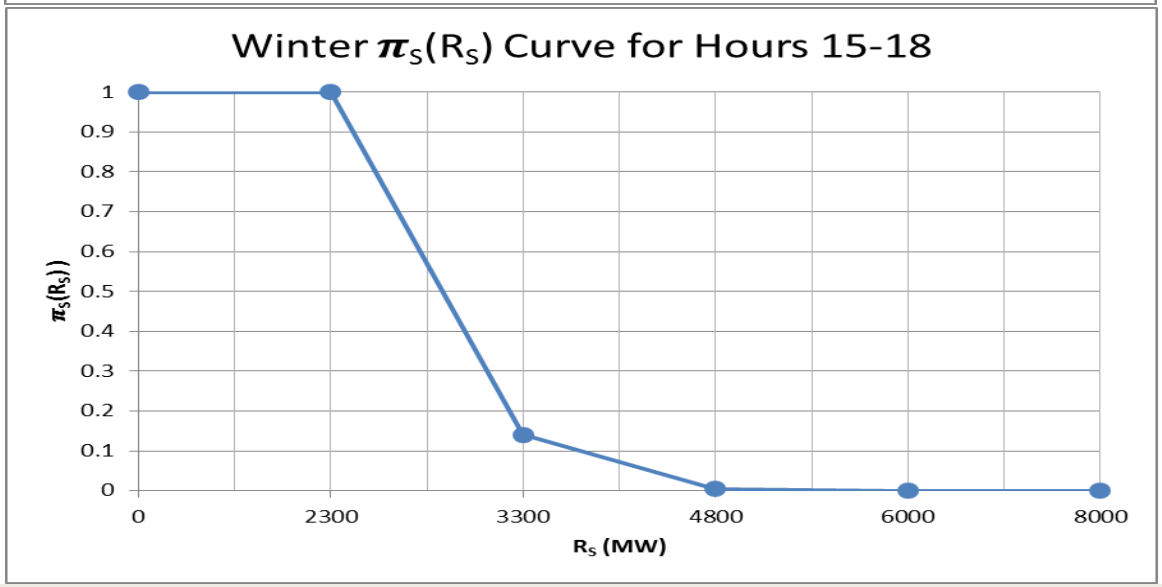
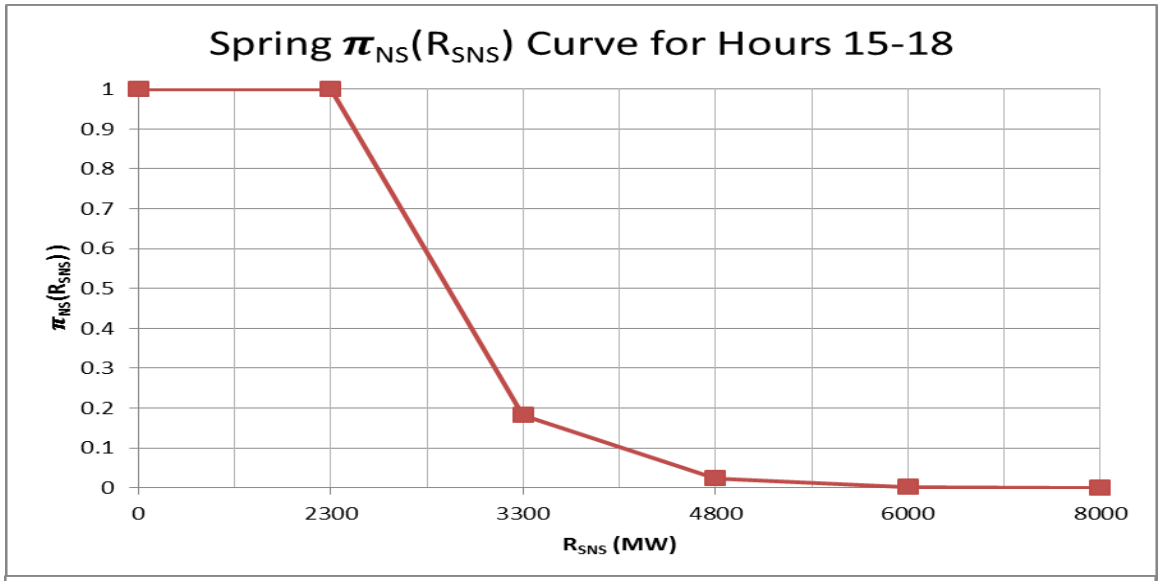
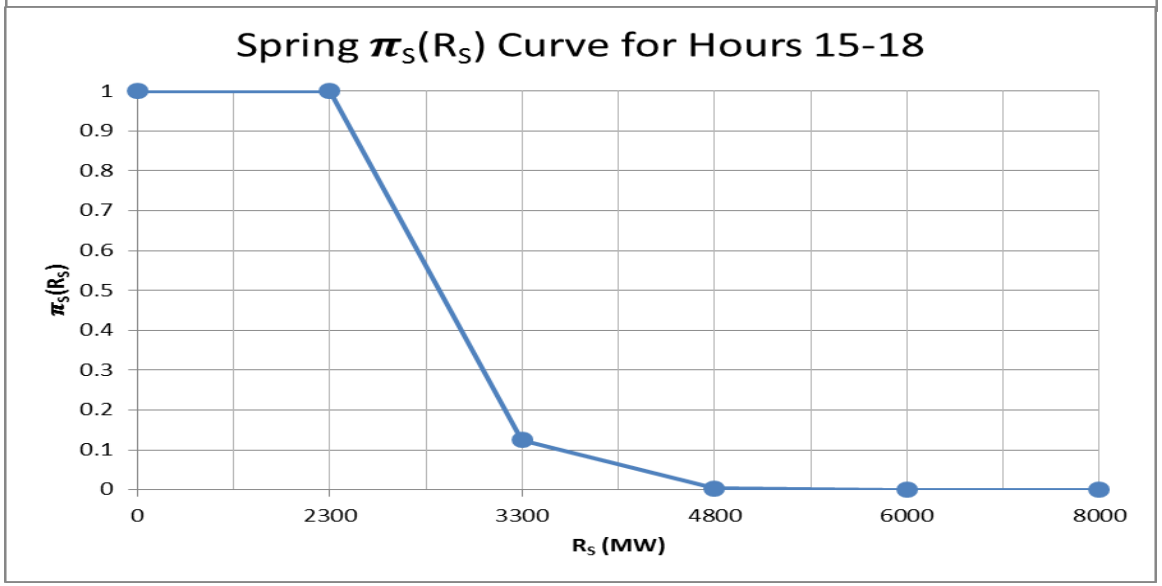
Winter LOLP curves for Hour 15-18



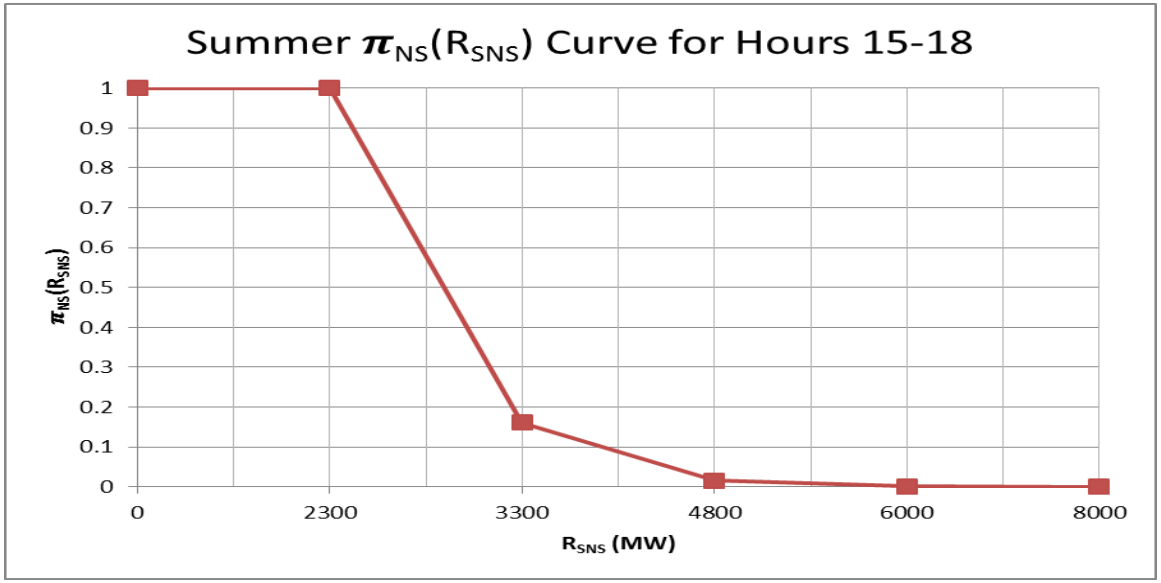


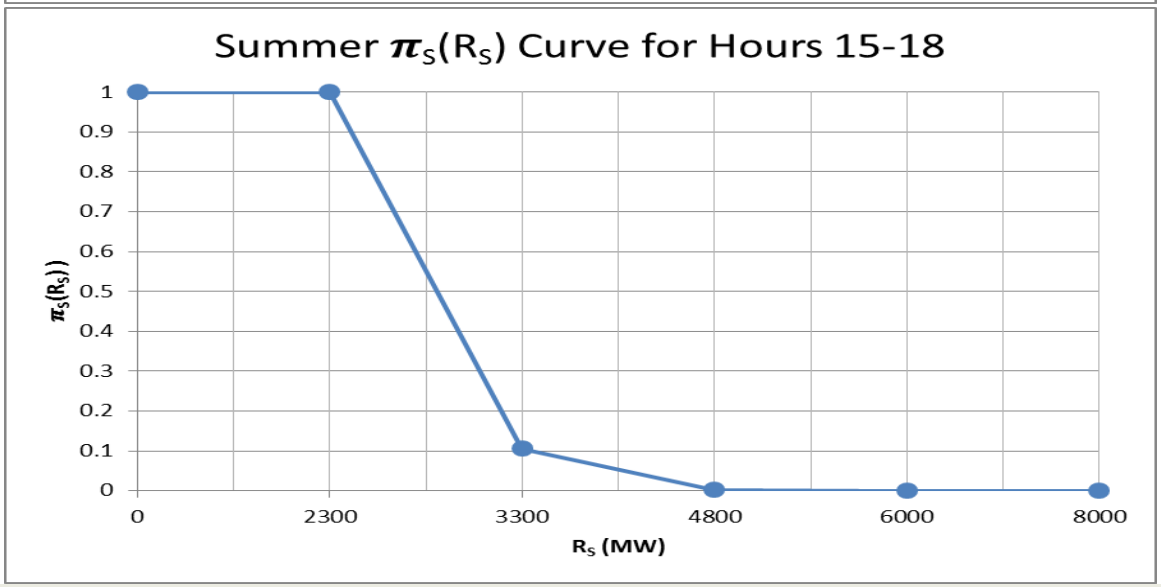
Spring LOLP curves for Hours 15-18





Summer LOLP curves for Hours 15-18





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Fall LOLP curves for Hours 15-18