

**ERCOT ORDC Options Analysis**

January 5, 2015

SAWG

Market Analysis, ERCOT

## Table of Contents

List of Figures .....	2
List of Tables .....	3
Introduction .....	4
Options.....	5
Section 1: June 1, 2014 – October 31, 2015 Backcast .....	7
Real-Time On-Line Price Adder .....	7
Additional Peaker Net Margin .....	13
Real-Time On-Line Price Adder Histogram .....	15
Probability of Falling Below Minimum Contingency Level on August 13, 2015 .....	19
Section 2: January 1, 2011 – December 31, 2011 Backcast.....	20
Real-Time On-Line Price Adder .....	20
Additional Peaker Net Margin .....	26
Real-Time On-Line Price Adder Histogram .....	28
Probability of Falling Below Minimum Contingency Level on August 3, 2011 .....	31
Section 3: Sensitivity Analysis .....	32
Section 4: Add Demand Curves to DAM – Snapshot from August 13, 2015 Online ORDC Curve as an Example (Option 2) .....	39
Example for options 0,1,3,4.....	40
Section 5: $X = URS + RRS$ – A look at the 2016 AS Methodology Values (Options 6 & 7).....	41
Without RRS Floor.....	41
With RRS Floor of 2,750 MW .....	43



## List of Figures

Figure 1. Energy and Time Weighted Average RTORPA of All Hours (6/1/2014 – 10/31/2015) .....	7
Figure 2. Time Weighted Average RTORPA of All Hours (6/1/2014 – 10/31/2015) .....	7
Figure 3. ONPEAK Energy and Time Weighted Average RTORPA (6/1/2014 – 10/31/2015) .....	8
Figure 4. ONPEAK Time Weighted Average RTORPA (6/1/2014 – 10/31/2015) .....	8
Figure 5. OFFPEAK Energy and Time Weighted Average RTORPA (6/1/2014 – 10/31/2015) .....	9
Figure 6. OFFPEAK Time Weighted Average RTORPA (6/1/2014 – 10/31/2015) .....	9
Figure 7. Energy and Time Weighted Average RTORPA of All Hours by Month (6/1/2014 – 10/31/2015) .....	11
Figure 8. Time Weighted Average RTORPA of All Hours by Month (6/1/2014 – 10/31/2015) .....	12
Figure 9. Sum of Estimated Additional PNM with ORDC (6/1/2014 – 10/31/2015).....	13
Figure 10. Sum of Estimated Additional PNM with ORDC by Month (6/1/2014 – 10/31/2015).....	14
Figure 11. Number of Hours where RTORPA > Threshold (6/1/2014 – 10/31/2015).....	15
Figure 12. Max PBMCL on August 13, 2015 .....	19
Figure 13. Energy and Time Weighted Average RTORPA of All Hours (2011) .....	20
Figure 14. Time Weighted Average RTORPA of All Hours (2011) .....	20
Figure 15. ONPEAK Energy and Time Weighted Average RTORPA (2011).....	21
Figure 16. ONPEAK Time Weighted Average RTORPA (2011).....	21
Figure 17. OFFPEAK Energy and Time Weighted Average RTORPA (2011) .....	22
Figure 18. OFFPEAK Time Weighted Average RTORPA (2011) .....	22
Figure 19. Energy and Time Weighted Average RTORPA of All Hours by Month (2011).....	24
Figure 20. Time Weighted Average RTORPA of All Hours by Month (2011) .....	25
Figure 21. Sum of Estimated Additional PNM with ORDC (2011).....	26
Figure 22. Sum of Estimated Additional PNM with ORDC by Month (2011) .....	27
Figure 23. Number of Hours where RTORPA > Threshold (2011).....	28
Figure 24. Max PBMCL on August 3, 2011 .....	31
Figure 25. Energy and Time Weighted RTORPA Sensitivity to Market Behavior (6/1/2014 – 10/31/2015) .....	33
Figure 26. Time Weighted RTORPA Sensitivity to Market Behavior (6/1/2014 – 10/31/2015) .....	34
Figure 27. Additional Peaker Net Margin from ORDC Sensitivity to Market Behavior (6/1/2014 – 10/31/2015).....	35
Figure 28. Energy and Time Weighted RTORPA Sensitivity to Market Behavior (2011) .....	36
Figure 29. Time Weighted RTORPA Sensitivity to Market Behavior (2011) .....	37
Figure 30. Additional Peaker Net Margin from ORDC Sensitivity to Market Behavior (2011) .....	38
Figure 31. August 13, 2015 HE17 Online ORDC Curve (VOLL * LOLPs) Overlaid with AS Requirements....	39
Figure 32. Heat map of URS + RRS without RRS floor from 2016 AS Methodology .....	41
Figure 33. Heat map of URS + RRS with RRS floored at 2750 MW from 2016 AS Methodology.....	43



## List of Tables

Table 1. Proposed options .....	5
Table 2. Averages of RTORPA (6/1/2014 – 10/31/2015) .....	10
Table 3. Energy and Time Weighted Average RTORPA of All Hours by Month (6/1/2014 – 10/31/2015) .....	11
Table 4. Time Weighted Average RTORPA of All Hours by Month (6/1/2014 – 10/31/2015) .....	12
Table 5. Sum of Estimated Additional PNM with ORDC (6/1/2014 – 10/31/2015) .....	13
Table 6. Sum of Estimated Additional PNM with ORDC by Month (6/1/2014 – 10/31/2015) .....	14
Table 7. Number of Hours where RTORPA > Threshold (6/1/2014 – 10/31/2015) .....	15
Table 8. Number of Hours where RTORPA > \$100/MWh by Month (6/1/2014 – 10/31/2015) .....	16
Table 9. Number of Hours where RTORPA > \$500/MWh by Month (6/1/2014 – 10/31/2015) .....	16
Table 10. Number of Hours where RTORPA > \$1,000/MWh by Month (6/1/2014 – 10/31/2015) .....	17
Table 11. Number of Hours where RTORPA > \$3,000/MWh by Month (6/1/2014 – 10/31/2015) .....	17
Table 12. Number of Hours where RTORPA > \$5,000/MWh by Month (6/1/2014 – 10/31/2015) .....	18
Table 13. Number of Hours where RTORPA > \$7,000/MWh by Month (6/1/2014 – 10/31/2015) .....	18
Table 14. Max PBMCL on August 13, 2015 .....	19
Table 15. Averages of RTORPA (2011) .....	23
Table 16. Energy and Time Weighted Average RTORPA of All Hours by Month (2011) .....	24
Table 17. Time Weighted Average RTORPA of All Hours by Month (2011) .....	25
Table 18. Sum of Estimated Additional PNM with ORDC (2011) .....	26
Table 19. Sum of Estimated Additional PNM with ORDC by Month (6/1/2014 – 10/31/2015) .....	27
Table 20. Number of Hours where RTORPA > Threshold (2011) .....	28
Table 21. Number of Hours where RTORPA > \$100/MWh by Month (2011) .....	29
Table 22. Number of Hours where RTORPA > \$500/MWh by Month (2011) .....	29
Table 23. Number of Hours where RTORPA > \$1,000/MWh by Month (2011) .....	29
Table 24. Number of Hours where RTORPA > \$3,000/MWh by Month (2011) .....	30
Table 25. Number of Hours where RTORPA > \$5,000/MWh by Month (2011) .....	30
Table 26. Number of Hours where RTORPA > \$7,000/MWh by Month (2011) .....	30
Table 27. Max PBMCL on August 3, 2011 .....	31
Table 28. Energy and Time Weighted RTORPA Sensitivity to Market Behavior (6/1/2014 – 10/31/2015) .....	33
Table 29. Time Weighted RTORPA Sensitivity to Market Behavior (6/1/2014 – 10/31/2015) .....	34
Table 30. Additional Peaker Net Margin from ORDC Sensitivity to Market Behavior (6/1/2014 – 10/31/2015) .....	35
Table 31. Energy and Time Weighted RTORPA Sensitivity to Market Behavior (2011) .....	36
Table 32. Time Weighted RTORPA Sensitivity to Market Behavior (2011) .....	37
Table 33. Additional Peaker Net Margin from ORDC Sensitivity to Market Behavior (2011) .....	38
Table 34. Penalty Price of AS Demand Curve for last MW of AS Requirement in DAM using August 13, 2015 HE17 Online ORDC Curve as an Example .....	40
Table 35. URS + RRS without RRS floor from 2016 AS Methodology .....	42
Table 36. URS + RRS with RRS floored at 2750 MW from 2016 AS Methodology .....	44
Table 37. Individual URS and RRS tables from 2016 AS Methodology Requirements .....	45



## Introduction

Options for changing the Operation Reserve Demand Curve (ORDC) parameters were proposed at the November 13, 2015<sup>1</sup> and December 2, 2015<sup>2</sup> Supply Analysis Working Group (SAWG). ERCOT was asked to analyze the options and present the following results:

1. Additional Peaker Net Margin (PNM) contributed by ORDC
2. Real-time On-line Price Adder (RTORPA)
3. Number of hours histogram where RTORPA was greater than \$100/MWh, \$500/MWh, and \$1,000/MWh

Following the December 16, 2015 SAWG meeting, clarification was needed on the weighting method used for calculating RTORPA. As a result, two weighting methods will be presented:

1. Energy and Time-weighted RTORPA (originally presented on December 16, 2015)
2. Time-weighted RTORPA

Energy is weighted by generation to be dispatched (GTBD) and time is weighted by each SCED interval length. Calculations using on-peak hours include hour ending 0700-2200 CPT weekdays and exclude NERC defined holidays. Off-peak hours include all other hours.

ERCOT was asked to analyze the following dates with actual FIPs:

1. June 1, 2014 – October 31, 2015
2. January 1, 2011 – December 31, 2011

Market behavior changes after ORDC implementation, changes in the System-Wide Offer Cap (SWOC), and changes in price floors will significantly affect the validity of 2011 backcast results. Additionally, it is recommended to use the backcast only to compare options since changes in market behavior can affect both periods

**How does the market behavior price response mechanism work?** Using the proposed options, the new RTORPA is calculated for each option. If System Lambda plus the new RTORPA is greater than the price response value (i.e. \$75), then offline and available capacity with cold start time greater than 30 minutes is added to the Real-Time On-Line Capacity (RTOLCAP) until either offline and available capacity is exhausted or System Lambda + RTORPA reaches the price response value.

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<sup>1</sup> <http://www.ercot.com/calendar/2015/11/13/78245-SAWG>

<sup>2</sup> <http://www.ercot.com/calendar/2015/12/2/80827-SAWG>



## Options

Current ORDC implementation values are in **red**.

See ORDC Options Whitepaper from 12-16-15 for more details<sup>3</sup>.

Option	Minimum RRS	Value of X (MCL)	VOLL	Effective Price Cap	Price Response	Other
0	2,300 MW	2,000 MW	\$9,000	\$9,000	None	
1	2,300 MW	2,000 MW	\$9,000	\$9,000	\$75	
2	See Section 4					
3	2,300 MW	2,000 MW	\$9,000	\$9,000	\$75	Discount Factor = 0.98 (0.99)
4	2,300 MW	2,000 MW	\$9,000	\$9,000	\$75	RTOFFCAP = 0 when PRC < 2500 (2300)
5	Same results as base case					
6	2,750 MW	Sum of RRS & URS	\$18,000	\$9,000	\$75	
7	2,750 MW	Sum of RRS & URS	\$9,000	\$9,000	\$75	RTORPA+System Lambda = \$4,500 when PRC < 2,500 MW (None) RTORPA+System Lambda = \$9,000 when PRC < 2,300 MW (None)
8	2,300 MW	2,300 MW	\$12,000	\$9,000	\$75	
9	2,750 MW	2,750 MW	\$18,000	\$9,000	\$75	
10	2,300 MW	1,708 MW	\$18,000	\$9,000	\$75	

Table 1. Proposed options

### Option 0 – Base Case No Response

- X = 2000
- VOLL = \$9,000
- SWOC = \$9,000
- RDF = 0.99
- PRC Threshold to set RTOFFCAP to 0 = 2300

### Option 1 – Base Case

- Option 0 with price response at \$75/MWh

### Option 2

- Convert ORDC into Ancillary Services Demand Curves in the DAM

<sup>3</sup> <http://www.ercot.com/calendar/2015/12/2/80827-SAWG>



**Option 3 – RDF=0.98**

- Price response at \$75/MWh
- RDF = 0.98

**Option 4 – RTOFFCAP=0 PRC<2500**

- Price response at \$75/MWh
- PRC Threshold to set RTOFFCAP to 0 = 2500

**Option 5**

Upon deployment of NSRS by the ERCOT operator, require all Quick Start Resources providing NSRS to come physically online. **Note:** *This would not change RTOLCAP if implemented but would increase PRC.*

**Option 6 – X=RRS+URS VOLL=18000**

- Price response at \$75/MWh
- X = RRS + URS
- Min. RRS = 2750
- VOLL = \$18,000

**Option 7 – X=RRS+URS Price Floor**

- Price response at \$75/MWh
- X = RRS + URS
- Min. RRS = 2750
- Floor Price to \$4,500 when PRC<2500 and Price to \$9,000 when PRC<2300

**Option 8 – X=2300 VOLL=12000**

- Price response at \$75/MWh
- X = 2300
- VOLL = \$12,000

**Option 9 – X=2750 VOLL=18000**

- Price response at \$75/MWh
- X = 2750
- VOLL = \$18,000

**Option 10 – X=1708 VOLL=18000**

- Price response at \$75/MWh
- X = 1708
- VOLL = \$18,000



## Section 1: June 1, 2014 – October 31, 2015 Backcast

### Real-Time On-Line Price Adder

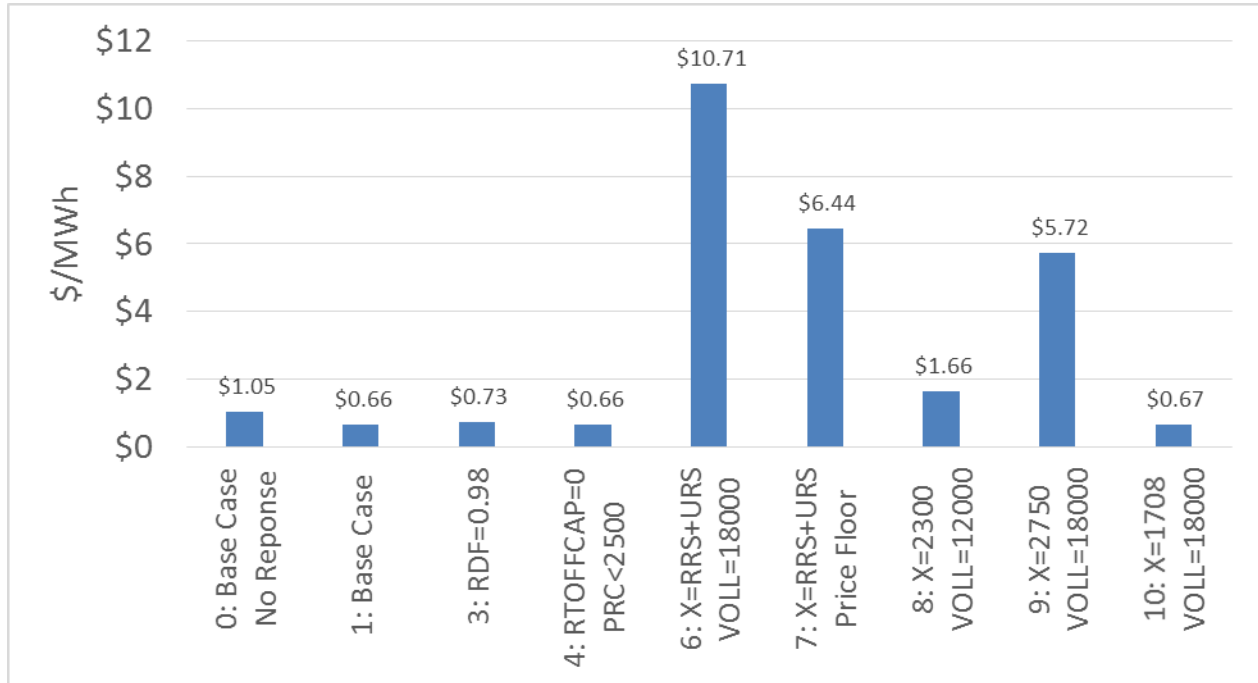


Figure 1. Energy and Time Weighted Average RTORPA of All Hours (6/1/2014 – 10/31/2015)

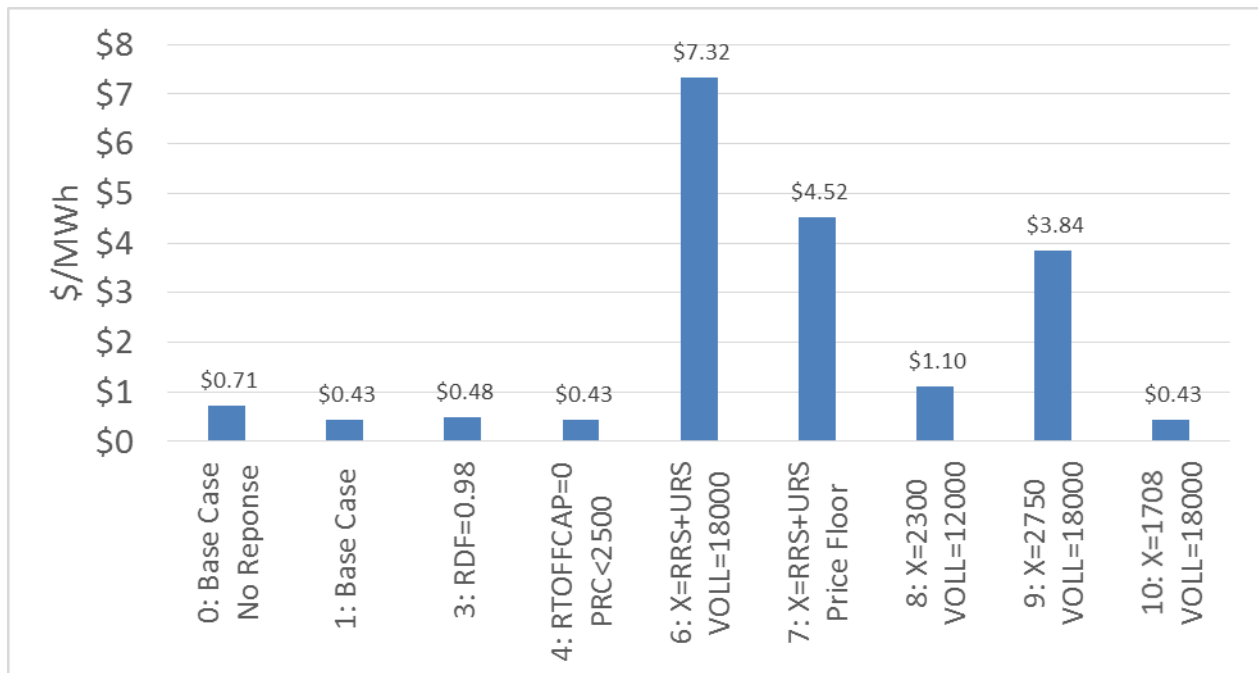


Figure 2. Time Weighted Average RTORPA of All Hours (6/1/2014 – 10/31/2015)





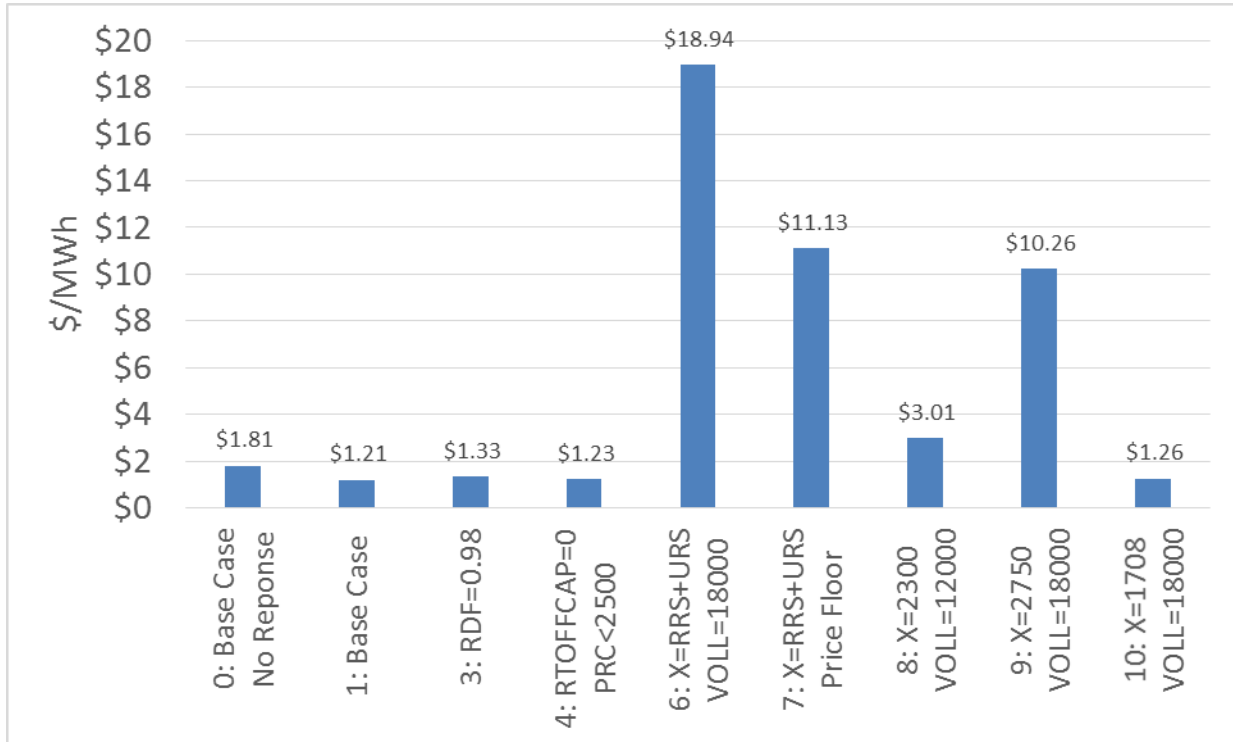


Figure 3. ONPEAK Energy and Time Weighted Average RTORPA (6/1/2014 – 10/31/2015)

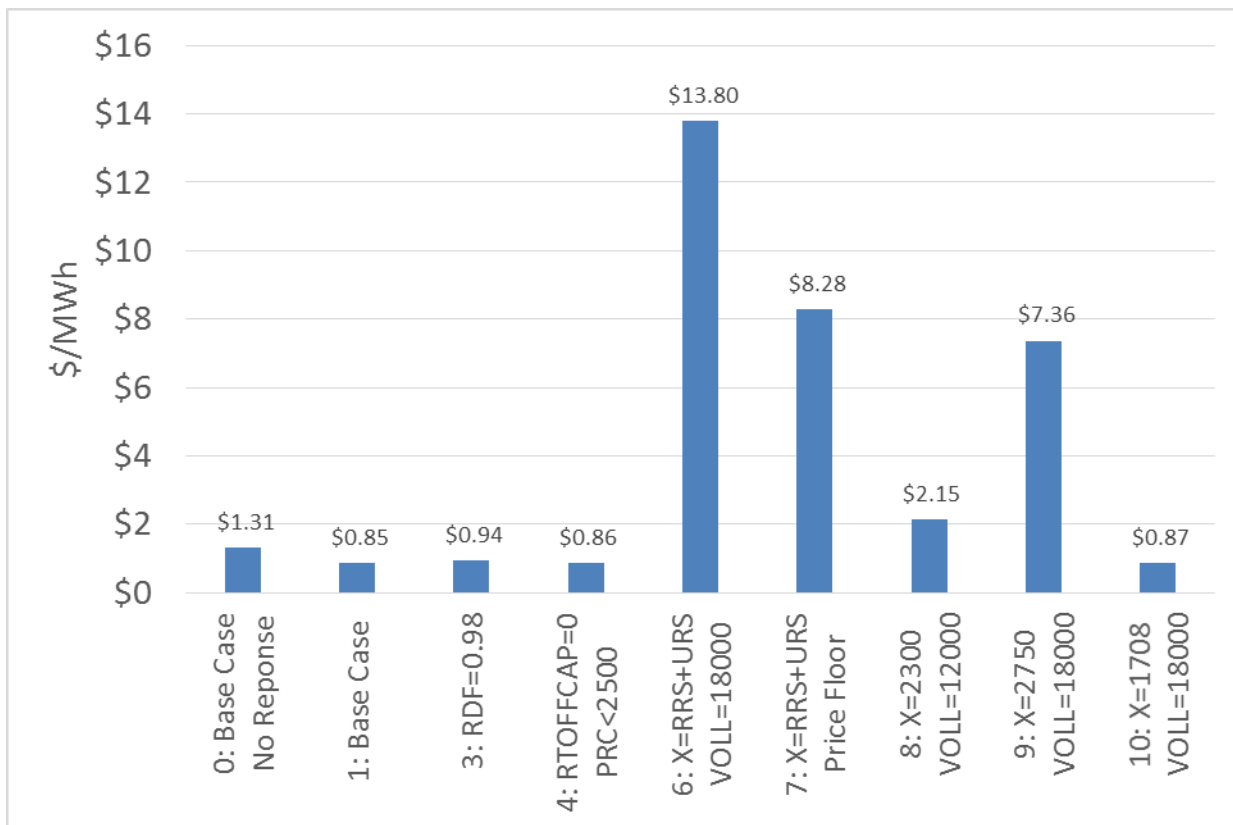


Figure 4. ONPEAK Time Weighted Average RTORPA (6/1/2014 – 10/31/2015)



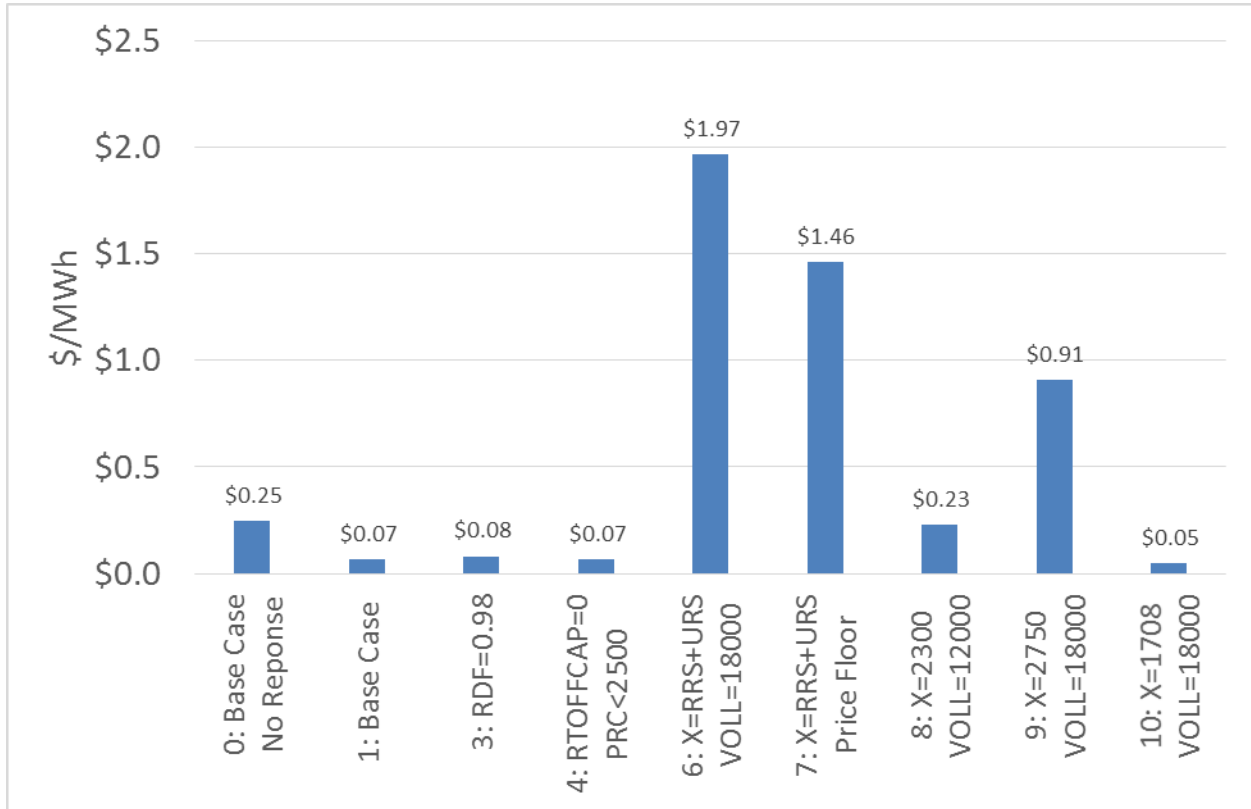


Figure 5. OFFPEAK Energy and Time Weighted Average RTORPA (6/1/2014 – 10/31/2015)

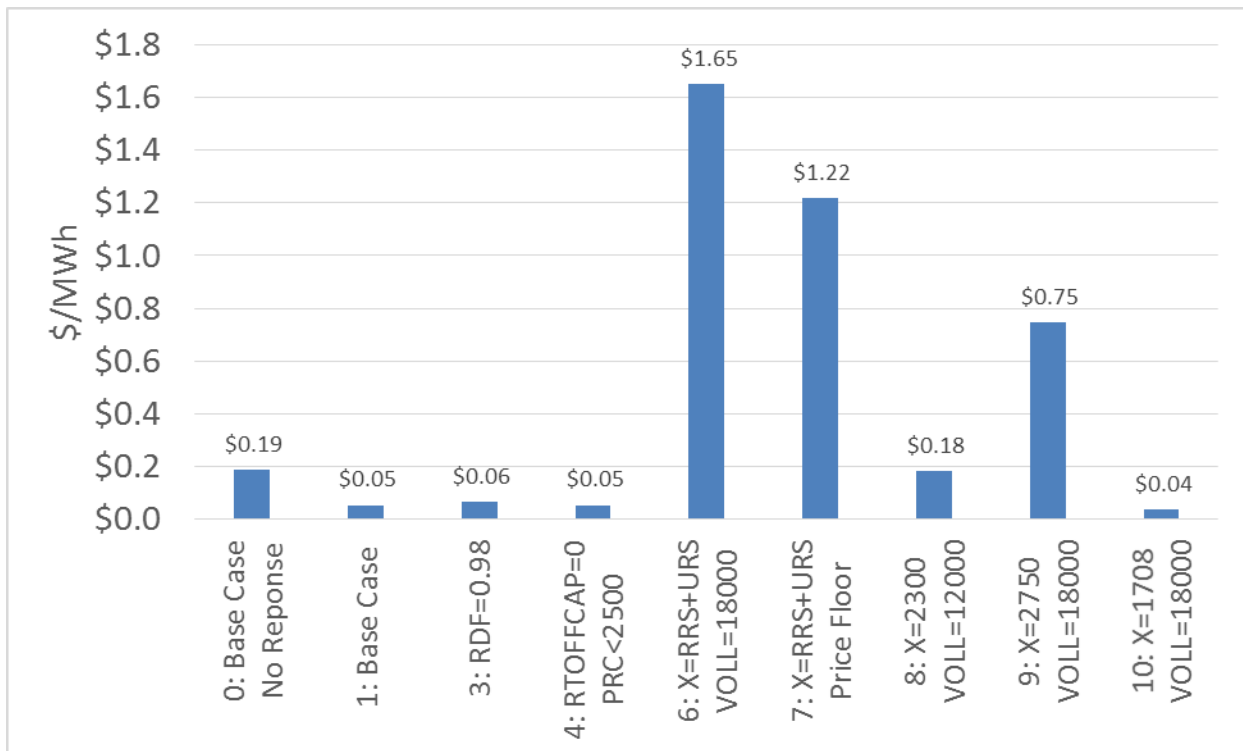


Figure 6. OFFPEAK Time Weighted Average RTORPA (6/1/2014 – 10/31/2015)



Option	Energy and Time Weighted Average RTORPA(\$/MWh)	Time Weighted Average RTORPA(\$/MWh)	ONPEAK Energy and Time Weighted Average RTORPA(\$/MWh)	ONPEAK Time Weighted Average RTORPA(\$/MWh)	OFFPEAK Energy and Time Weighted Average RTORPA(\$/MWh)	OFFPEAK Time Weighted Average RTORPA(\$/MWh)
0: Base Case No Reponse	\$ 1.05	\$ 0.71	\$ 1.81	\$ 1.31	\$ 0.25	\$ 0.19
1: Base Case	\$ 0.66	\$ 0.43	\$ 1.21	\$ 0.85	\$ 0.07	\$ 0.05
3: RDF=0.98	\$ 0.73	\$ 0.48	\$ 1.33	\$ 0.94	\$ 0.08	\$ 0.06
4: RTOFFCAP=0 PRC<2500	\$ 0.66	\$ 0.43	\$ 1.23	\$ 0.86	\$ 0.07	\$ 0.05
6: X=RRS+URS VOLL=18000	\$ 10.71	\$ 7.32	\$ 18.94	\$ 13.80	\$ 1.97	\$ 1.65
7: X=RRS+URS Price Floor	\$ 6.44	\$ 4.52	\$ 11.13	\$ 8.28	\$ 1.46	\$ 1.22
8: X=2300 VOLL=12000	\$ 1.66	\$ 1.10	\$ 3.01	\$ 2.15	\$ 0.23	\$ 0.18
9: X=2750 VOLL=18000	\$ 5.72	\$ 3.84	\$ 10.26	\$ 7.36	\$ 0.91	\$ 0.75
10: X=1708 VOLL=18000	\$ 0.67	\$ 0.43	\$ 1.26	\$ 0.87	\$ 0.05	\$ 0.04

**Table 2. Averages of RTORPA (6/1/2014 – 10/31/2015)**



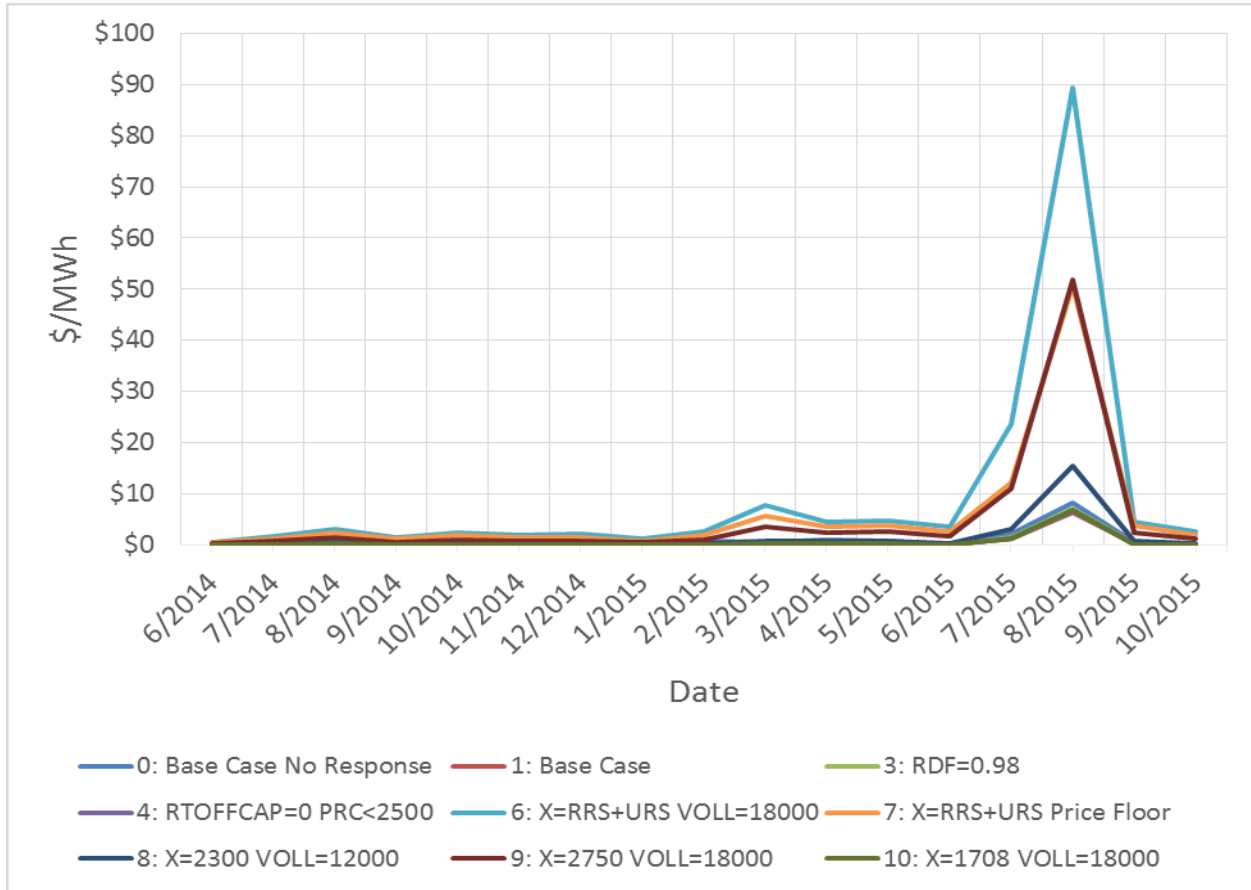


Figure 7. Energy and Time Weighted Average RTORPA of All Hours by Month (6/1/2014 – 10/31/2015)

Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
6/2014	\$ 0.03	\$ 0.01	\$ 0.02	\$ 0.01	\$ 0.56	\$ 0.40	\$ 0.05	\$ 0.24	\$ 0.01
7/2014	\$ 0.13	\$ 0.05	\$ 0.06	\$ 0.05	\$ 1.77	\$ 1.26	\$ 0.19	\$ 0.73	\$ 0.03
8/2014	\$ 0.80	\$ 0.27	\$ 0.29	\$ 0.27	\$ 3.11	\$ 2.34	\$ 0.55	\$ 1.50	\$ 0.23
9/2014	\$ 0.13	\$ 0.04	\$ 0.04	\$ 0.04	\$ 1.56	\$ 1.12	\$ 0.13	\$ 0.58	\$ 0.02
10/2014	\$ 0.35	\$ 0.06	\$ 0.07	\$ 0.06	\$ 2.43	\$ 1.84	\$ 0.22	\$ 0.96	\$ 0.03
11/2014	\$ 0.15	\$ 0.03	\$ 0.04	\$ 0.03	\$ 1.97	\$ 1.44	\$ 0.13	\$ 0.73	\$ 0.02
12/2014	\$ 0.11	\$ 0.09	\$ 0.10	\$ 0.09	\$ 2.20	\$ 1.51	\$ 0.23	\$ 0.82	\$ 0.07
1/2015	\$ 0.10	\$ 0.05	\$ 0.06	\$ 0.05	\$ 1.10	\$ 0.77	\$ 0.13	\$ 0.42	\$ 0.04
2/2015	\$ 0.66	\$ 0.08	\$ 0.09	\$ 0.08	\$ 2.62	\$ 1.89	\$ 0.24	\$ 1.08	\$ 0.06
3/2015	\$ 0.49	\$ 0.24	\$ 0.29	\$ 0.24	\$ 7.68	\$ 5.75	\$ 0.82	\$ 3.48	\$ 0.17
4/2015	\$ 0.96	\$ 0.32	\$ 0.37	\$ 0.32	\$ 4.51	\$ 3.47	\$ 0.86	\$ 2.41	\$ 0.25
5/2015	\$ 0.79	\$ 0.24	\$ 0.28	\$ 0.24	\$ 4.83	\$ 3.78	\$ 0.77	\$ 2.60	\$ 0.18
6/2015	\$ 0.14	\$ 0.10	\$ 0.12	\$ 0.10	\$ 3.56	\$ 2.54	\$ 0.34	\$ 1.62	\$ 0.06
7/2015	\$ 2.12	\$ 1.23	\$ 1.36	\$ 1.23	\$ 23.65	\$ 12.08	\$ 3.04	\$ 11.12	\$ 1.27
8/2015	\$ 8.32	\$ 6.39	\$ 6.97	\$ 6.50	\$ 89.28	\$ 50.70	\$ 15.54	\$ 51.73	\$ 6.89
9/2015	\$ 0.43	\$ 0.23	\$ 0.27	\$ 0.23	\$ 4.49	\$ 3.68	\$ 0.75	\$ 2.48	\$ 0.15
10/2015	\$ 0.05	\$ 0.04	\$ 0.05	\$ 0.04	\$ 2.61	\$ 1.96	\$ 0.18	\$ 1.12	\$ 0.02

Table 3. Energy and Time Weighted Average RTORPA of All Hours by Month (6/1/2014 – 10/31/2015)



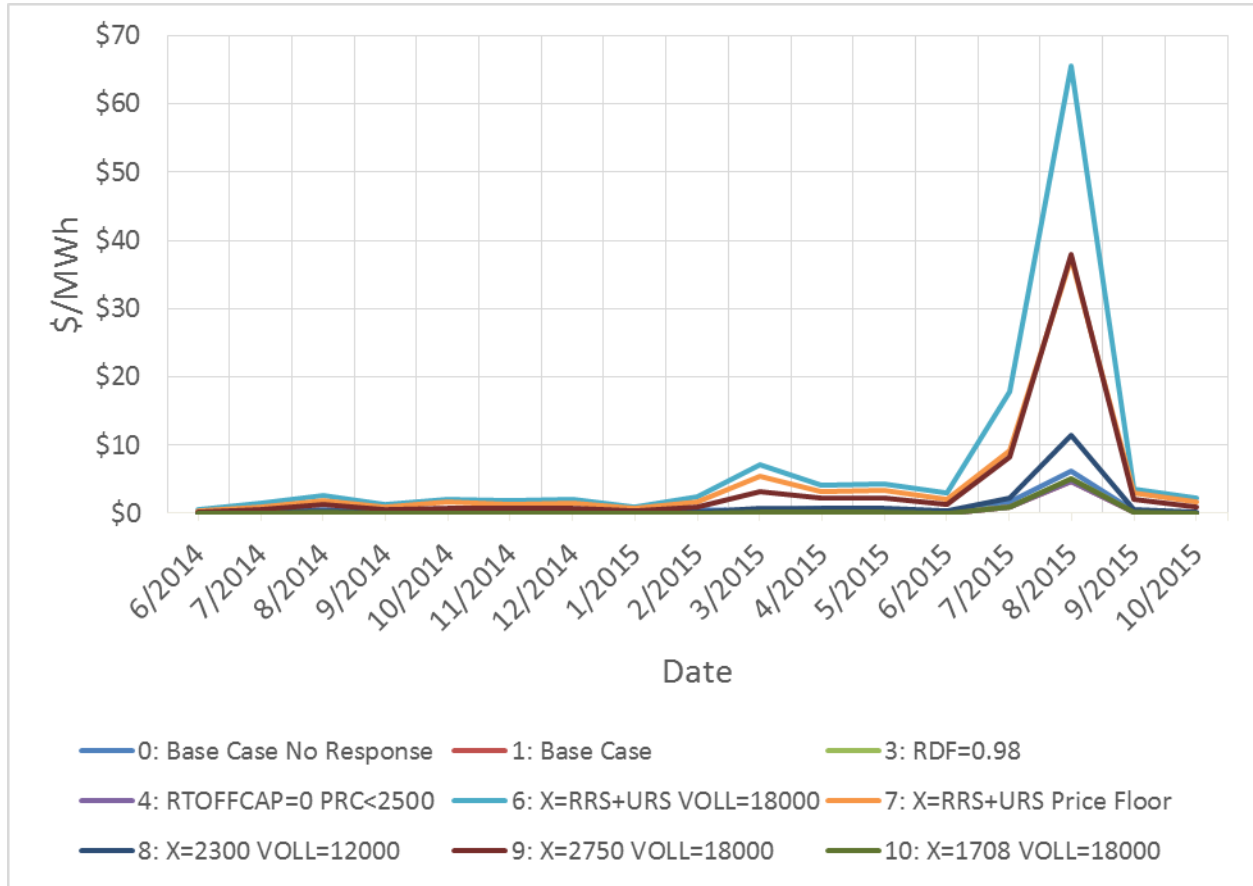


Figure 8. Time Weighted Average RTORPA of All Hours by Month (6/1/2014 – 10/31/2015)

Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
6/2014	\$ 0.02	\$ 0.01	\$ 0.01	\$ 0.01	\$ 0.46	\$ 0.33	\$ 0.04	\$ 0.19	\$ 0.01
7/2014	\$ 0.10	\$ 0.04	\$ 0.05	\$ 0.04	\$ 1.46	\$ 1.02	\$ 0.15	\$ 0.59	\$ 0.03
8/2014	\$ 0.64	\$ 0.21	\$ 0.24	\$ 0.21	\$ 2.58	\$ 1.93	\$ 0.45	\$ 1.22	\$ 0.18
9/2014	\$ 0.11	\$ 0.03	\$ 0.04	\$ 0.03	\$ 1.27	\$ 0.91	\$ 0.10	\$ 0.48	\$ 0.02
10/2014	\$ 0.29	\$ 0.05	\$ 0.06	\$ 0.05	\$ 2.15	\$ 1.62	\$ 0.19	\$ 0.84	\$ 0.03
11/2014	\$ 0.13	\$ 0.03	\$ 0.03	\$ 0.03	\$ 1.86	\$ 1.36	\$ 0.12	\$ 0.69	\$ 0.02
12/2014	\$ 0.11	\$ 0.08	\$ 0.09	\$ 0.08	\$ 2.08	\$ 1.42	\$ 0.22	\$ 0.77	\$ 0.06
1/2015	\$ 0.08	\$ 0.04	\$ 0.05	\$ 0.04	\$ 0.95	\$ 0.66	\$ 0.10	\$ 0.35	\$ 0.03
2/2015	\$ 0.52	\$ 0.07	\$ 0.08	\$ 0.07	\$ 2.38	\$ 1.71	\$ 0.22	\$ 0.98	\$ 0.05
3/2015	\$ 0.43	\$ 0.22	\$ 0.26	\$ 0.22	\$ 7.18	\$ 5.35	\$ 0.74	\$ 3.22	\$ 0.15
4/2015	\$ 0.81	\$ 0.28	\$ 0.33	\$ 0.28	\$ 4.19	\$ 3.21	\$ 0.77	\$ 2.20	\$ 0.22
5/2015	\$ 0.62	\$ 0.21	\$ 0.24	\$ 0.21	\$ 4.28	\$ 3.34	\$ 0.67	\$ 2.27	\$ 0.15
6/2015	\$ 0.11	\$ 0.08	\$ 0.09	\$ 0.08	\$ 2.91	\$ 2.07	\$ 0.27	\$ 1.31	\$ 0.05
7/2015	\$ 1.59	\$ 0.92	\$ 1.01	\$ 0.92	\$ 17.81	\$ 9.11	\$ 2.28	\$ 8.35	\$ 0.95
8/2015	\$ 6.11	\$ 4.69	\$ 5.12	\$ 4.77	\$ 65.65	\$ 37.34	\$ 11.42	\$ 38.03	\$ 5.06
9/2015	\$ 0.34	\$ 0.19	\$ 0.22	\$ 0.19	\$ 3.61	\$ 2.95	\$ 0.60	\$ 1.98	\$ 0.12
10/2015	\$ 0.04	\$ 0.03	\$ 0.04	\$ 0.03	\$ 2.26	\$ 1.70	\$ 0.16	\$ 0.96	\$ 0.02

Table 4. Time Weighted Average RTORPA of All Hours by Month (6/1/2014 – 10/31/2015)



### Additional Peaker Net Margin

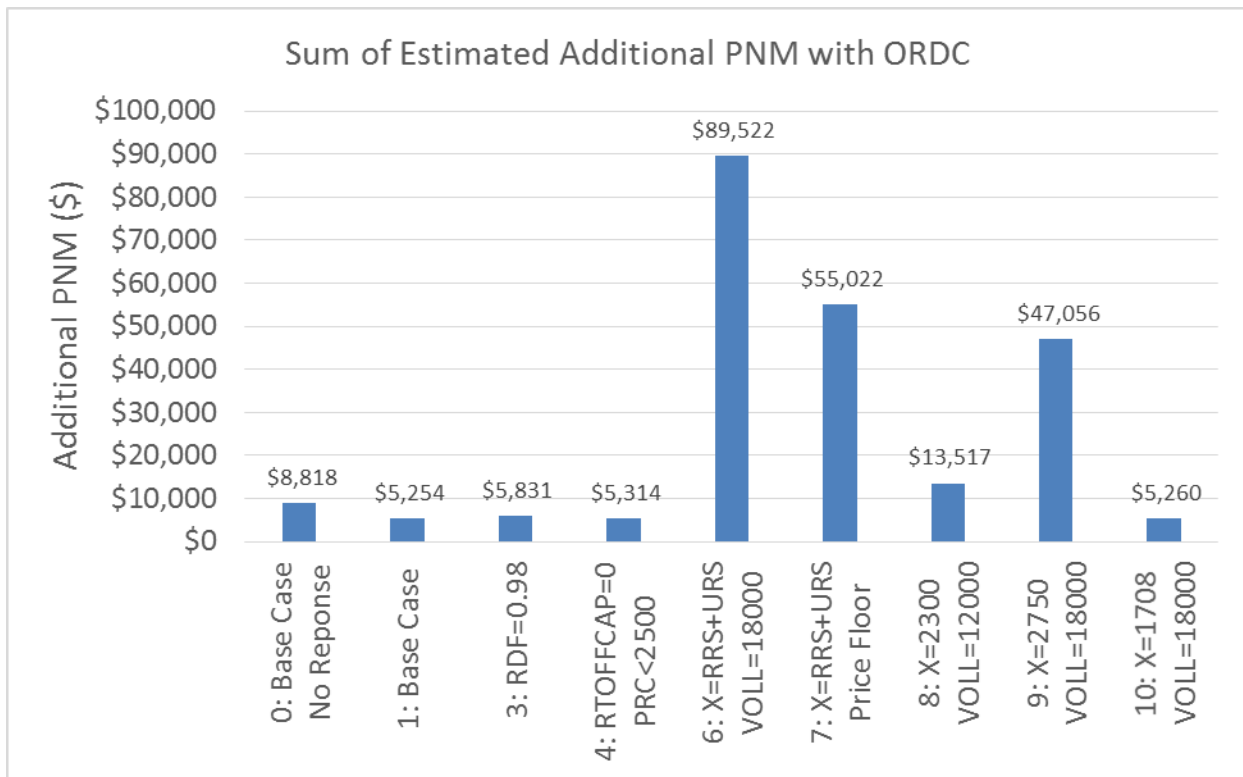


Figure 9. Sum of Estimated Additional PNM with ORDC (6/1/2014 – 10/31/2015)

Option	Sum of Estimated PNM without ORDC	Sum of Estimated Additional PNM with ORDC
0: Base Case No Reponse	\$ 42,731	\$ 8,818
1: Base Case		\$ 5,254
3: RDF=0.98		\$ 5,831
4: RTOFFCAP=0 PRC<2500		\$ 5,314
6: X=RRS+URS VOLL=18000		\$ 89,522
7: X=RRS+URS Price Floor		\$ 55,022
8: X=2300 VOLL=12000		\$ 13,517
9: X=2750 VOLL=18000		\$ 47,056
10: X=1708 VOLL=18000		\$ 5,260

Table 5. Sum of Estimated Additional PNM with ORDC (6/1/2014 – 10/31/2015)



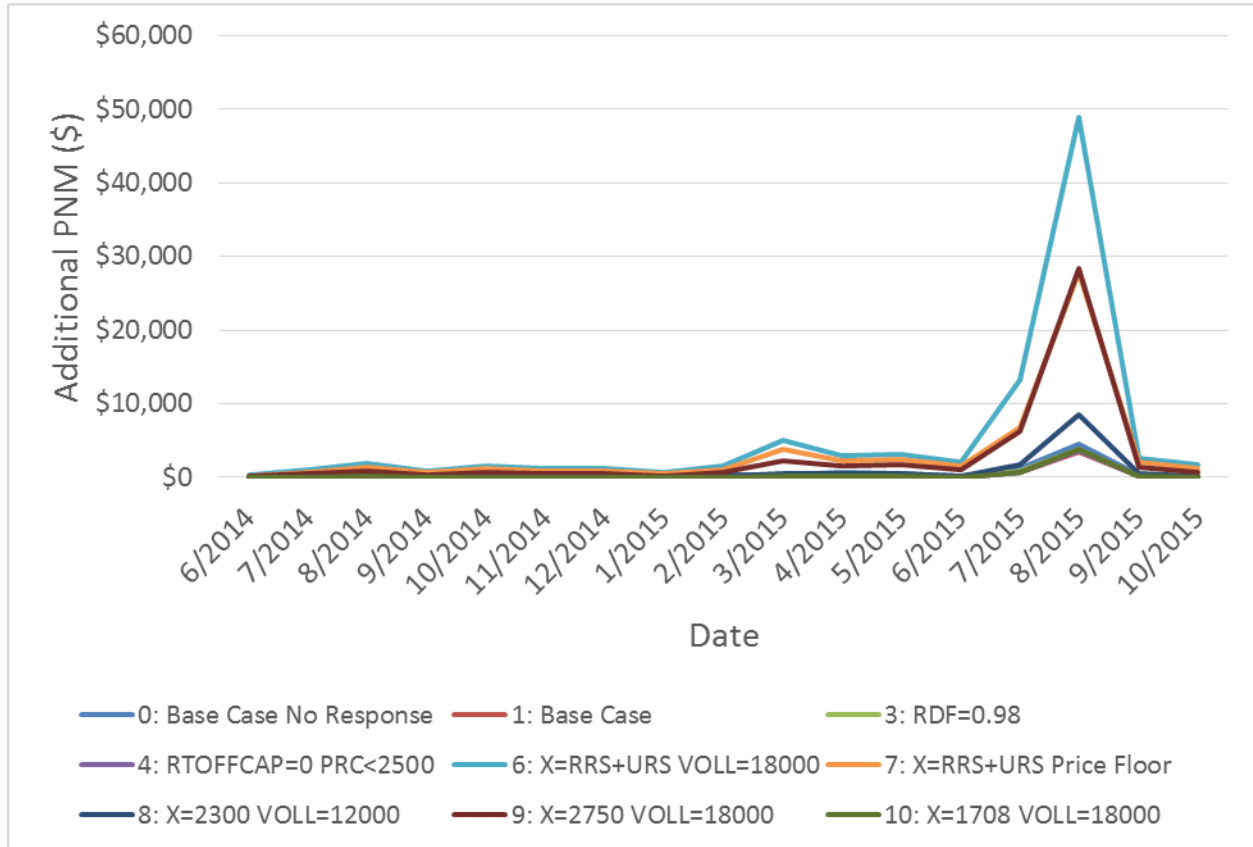


Figure 10. Sum of Estimated Additional PNM with ORDC by Month (6/1/2014 – 10/31/2015)

Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
6/2014	\$ 14.86	\$ 7.36	\$ 8.87	\$ 7.36	\$ 305.97	\$ 217.27	\$ 28.17	\$ 128.83	\$ 4.92
7/2014	\$ 69.75	\$ 29.28	\$ 35.52	\$ 29.28	\$ 998.82	\$ 699.81	\$ 104.33	\$ 413.44	\$ 19.27
8/2014	\$ 473.71	\$ 157.52	\$ 173.72	\$ 157.52	\$ 1,846.57	\$ 1,389.05	\$ 326.54	\$ 888.93	\$ 134.37
9/2014	\$ 76.13	\$ 21.34	\$ 25.48	\$ 21.34	\$ 900.39	\$ 644.86	\$ 73.87	\$ 340.78	\$ 14.10
10/2014	\$ 214.86	\$ 35.78	\$ 43.58	\$ 35.78	\$ 1,521.75	\$ 1,153.09	\$ 135.47	\$ 596.89	\$ 21.31
11/2014	\$ 86.20	\$ 16.54	\$ 20.20	\$ 16.54	\$ 1,164.19	\$ 851.87	\$ 70.18	\$ 431.18	\$ 9.99
12/2014	\$ 62.67	\$ 44.84	\$ 51.88	\$ 44.84	\$ 1,201.24	\$ 798.00	\$ 118.62	\$ 419.45	\$ 35.59
1/2015	\$ 54.00	\$ 26.86	\$ 30.57	\$ 26.86	\$ 628.04	\$ 430.34	\$ 66.16	\$ 226.74	\$ 22.28
2/2015	\$ 343.78	\$ 39.23	\$ 46.26	\$ 39.23	\$ 1,520.89	\$ 1,081.91	\$ 132.59	\$ 617.93	\$ 28.84
3/2015	\$ 300.44	\$ 143.71	\$ 172.28	\$ 143.71	\$ 5,084.24	\$ 3,767.30	\$ 505.38	\$ 2,259.15	\$ 99.12
4/2015	\$ 583.11	\$ 202.09	\$ 231.79	\$ 202.09	\$ 2,909.51	\$ 2,232.03	\$ 547.75	\$ 1,545.47	\$ 156.83
5/2015	\$ 454.13	\$ 145.29	\$ 171.83	\$ 145.29	\$ 3,060.30	\$ 2,382.47	\$ 477.50	\$ 1,630.15	\$ 107.49
6/2015	\$ 77.00	\$ 54.52	\$ 65.97	\$ 54.52	\$ 2,055.34	\$ 1,462.64	\$ 193.75	\$ 930.77	\$ 33.67
7/2015	\$ 1,186.30	\$ 682.24	\$ 754.96	\$ 682.24	\$ 13,244.37	\$ 6,772.57	\$ 1,693.03	\$ 6,209.98	\$ 708.81
8/2015	\$ 4,543.84	\$ 3,489.59	\$ 3,809.42	\$ 3,549.14	\$ 48,845.74	\$ 27,783.47	\$ 8,498.72	\$ 28,290.83	\$ 3,761.93
9/2015	\$ 245.87	\$ 134.43	\$ 158.34	\$ 134.43	\$ 2,578.62	\$ 2,111.61	\$ 431.38	\$ 1,417.91	\$ 88.85
10/2015	\$ 31.73	\$ 23.84	\$ 30.00	\$ 23.84	\$ 1,656.42	\$ 1,243.23	\$ 113.70	\$ 707.79	\$ 12.55

Table 6. Sum of Estimated Additional PNM with ORDC by Month (6/1/2014 – 10/31/2015)



### Real-Time On-Line Price Adder Histogram

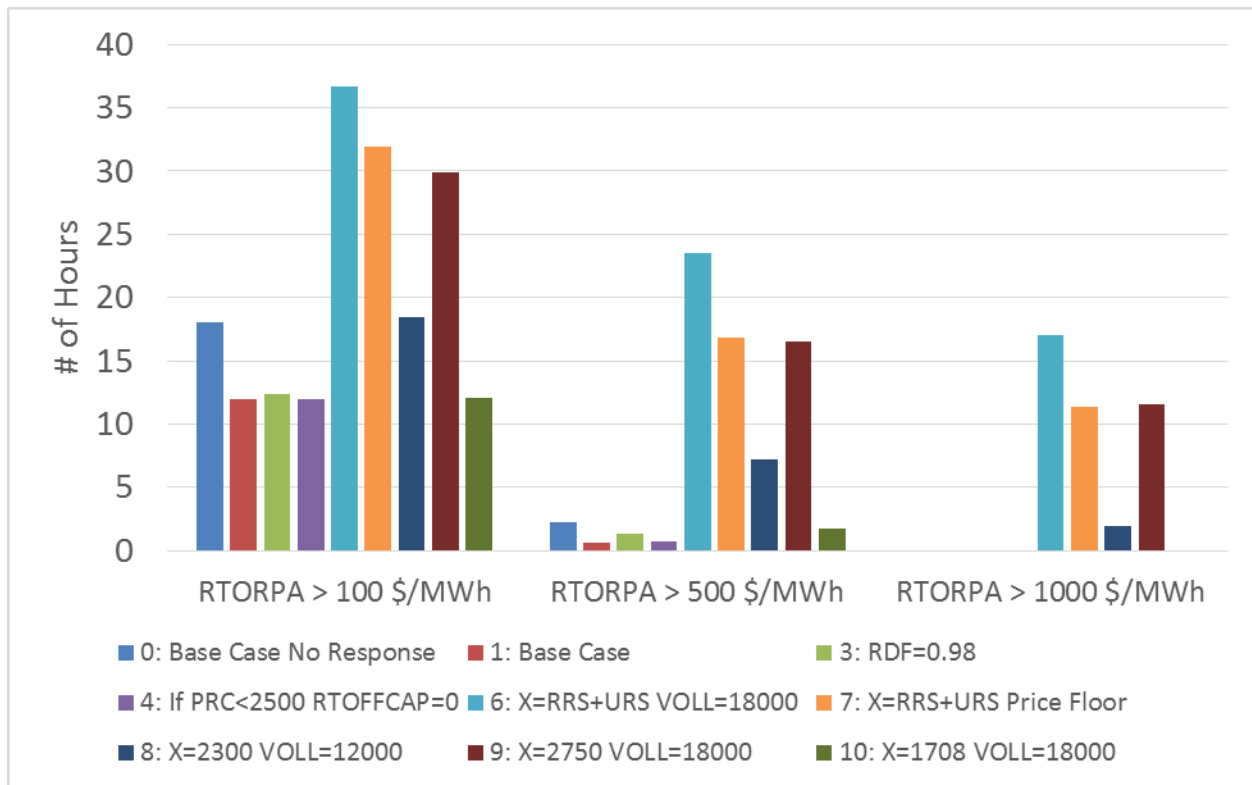


Figure 11. Number of Hours where RTORPA > Threshold (6/1/2014 – 10/31/2015)

Option	# of Hours RTORPA > 100 \$/MWh	# of Hours RTORPA > 500 \$/MWh	# of Hours RTORPA > 1000 \$/MWh
0: Base Case No Reponse	18.05	2.25	0.00
1: Base Case	12.00	0.58	0.00
3: RDF=0.98	12.34	1.33	0.00
4: RTOFFCAP=0 PRC<2500	12.00	0.75	0.00
6: X=RRS+URS VOLL=18000	36.67	23.54	17.00
7: X=RRS+URS Price Floor	31.96	16.84	11.33
8: X=2300 VOLL=12000	18.42	7.17	2.00
9: X=2750 VOLL=18000	29.88	16.51	11.58
10: X=1708 VOLL=18000	12.09	1.75	0.00

Table 7. Number of Hours where RTORPA > Threshold (6/1/2014 – 10/31/2015)





Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
6/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/2014	0.42	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00
9/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2014	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/2015	1.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/2015	1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/2015	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2015	3.04	2.17	2.25	2.17	12.75	10.29	3.75	9.12	2.25
8/2015	10.84	9.84	10.09	9.84	23.84	21.68	14.67	20.76	9.84
9/2015	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Table 8. Number of Hours where RTORPA > \$100/MWh by Month (6/1/2014 – 10/31/2015)**

Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
6/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2015	0.00	0.00	0.00	0.00	6.29	3.75	0.83	3.34	0.00
8/2015	2.25	0.58	1.33	0.75	17.25	13.09	6.33	13.17	1.75
9/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Table 9. Number of Hours where RTORPA > \$500/MWh by Month (6/1/2014 – 10/31/2015)**



Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
6/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2015	0.00	0.00	0.00	0.00	3.83	2.00	0.00	2.08	0.00
8/2015	0.00	0.00	0.00	0.00	13.17	9.33	2.00	9.50	0.00
9/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Table 10. Number of Hours where RTORPA > \$1,000/MWh by Month (6/1/2014 – 10/31/2015)**

Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
6/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2015	0.00	0.00	0.00	0.00	0.92	0.00	0.00	0.00	0.00
8/2015	0.00	0.00	0.00	0.00	6.50	1.75	0.00	2.25	0.00
9/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Table 11. Number of Hours where RTORPA > \$3,000/MWh by Month (6/1/2014 – 10/31/2015)**



Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
6/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/2015	0.00	0.00	0.00	0.00	1.42	0.00	0.00	0.00	0.00
9/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Table 12. Number of Hours where RTORPA > \$5,000/MWh by Month (6/1/2014 – 10/31/2015)**

Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
6/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/2015	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00
9/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Table 13. Number of Hours where RTORPA > \$7,000/MWh by Month (6/1/2014 – 10/31/2015)**



### Probability of Falling Below Minimum Contingency Level on August 13, 2015

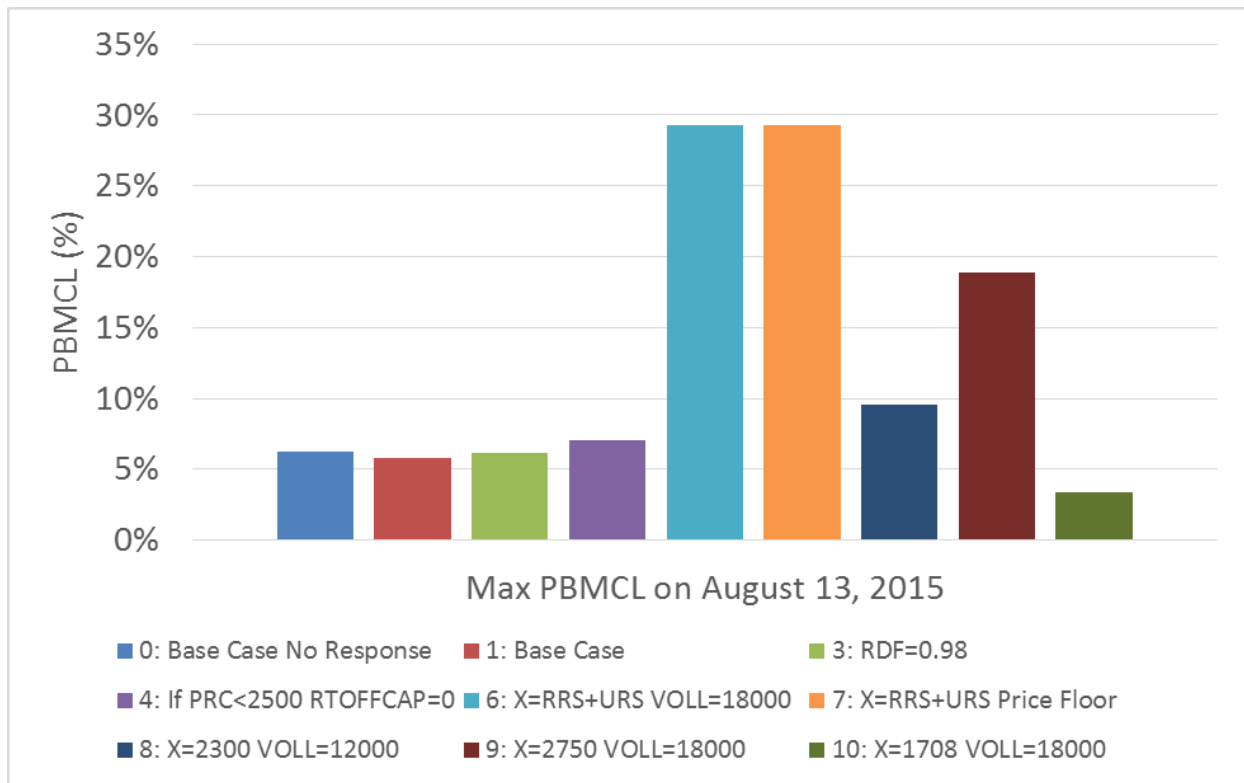


Figure 12. Max PBMCL on August 13, 2015

Option	Max PBMCL on August 13, 2015 by SCED Interval
0: Base Case	6.2%
1: Base Case Price Response	5.8%
3: RDF=0.98	6.2%
4: RTOFFCAP=0 PRC<2500	7.0%
6: X=RRS+URS VOLL=18000	29.3%
7: X=RRS+URS Price Floor	29.3%
8: X=2300 VOLL=12000	9.6%
9: X=2750 VOLL=18000	18.8%
10: X=1708 VOLL=18000	3.4%

Table 14. Max PBMCL on August 13, 2015



## Section 2: January 1, 2011 – December 31, 2011 Backcast

### Real-Time On-Line Price Adder

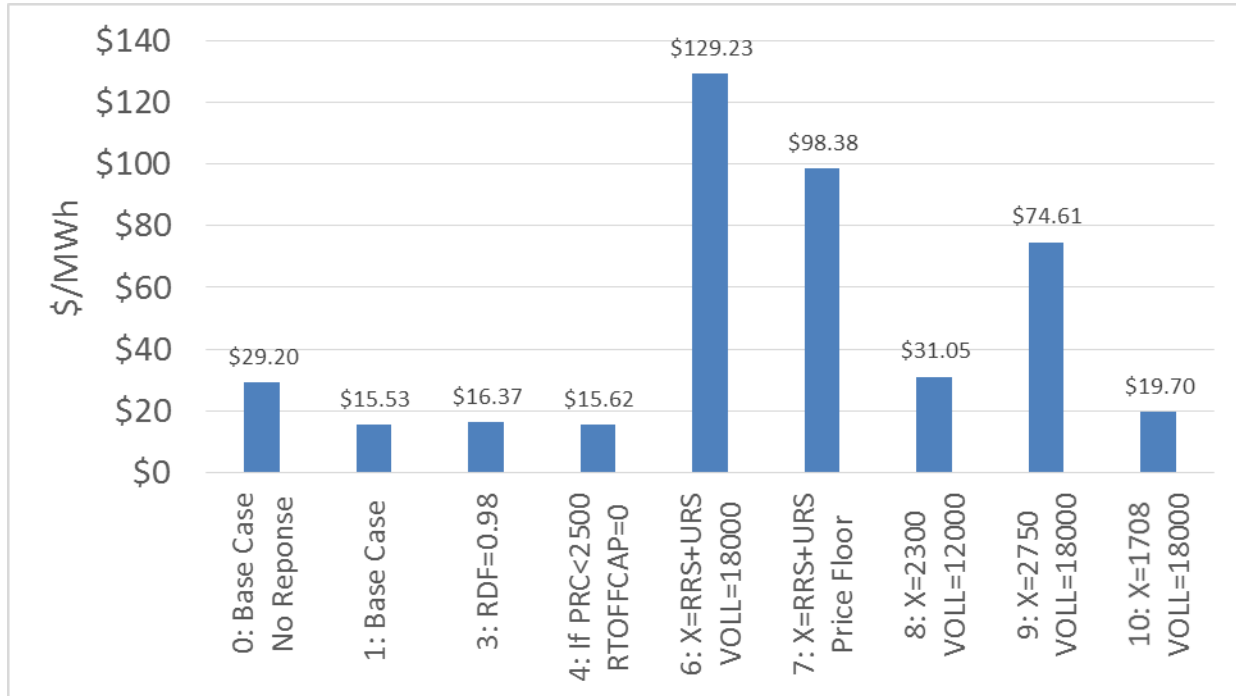


Figure 13. Energy and Time Weighted Average RTORPA of All Hours (2011)

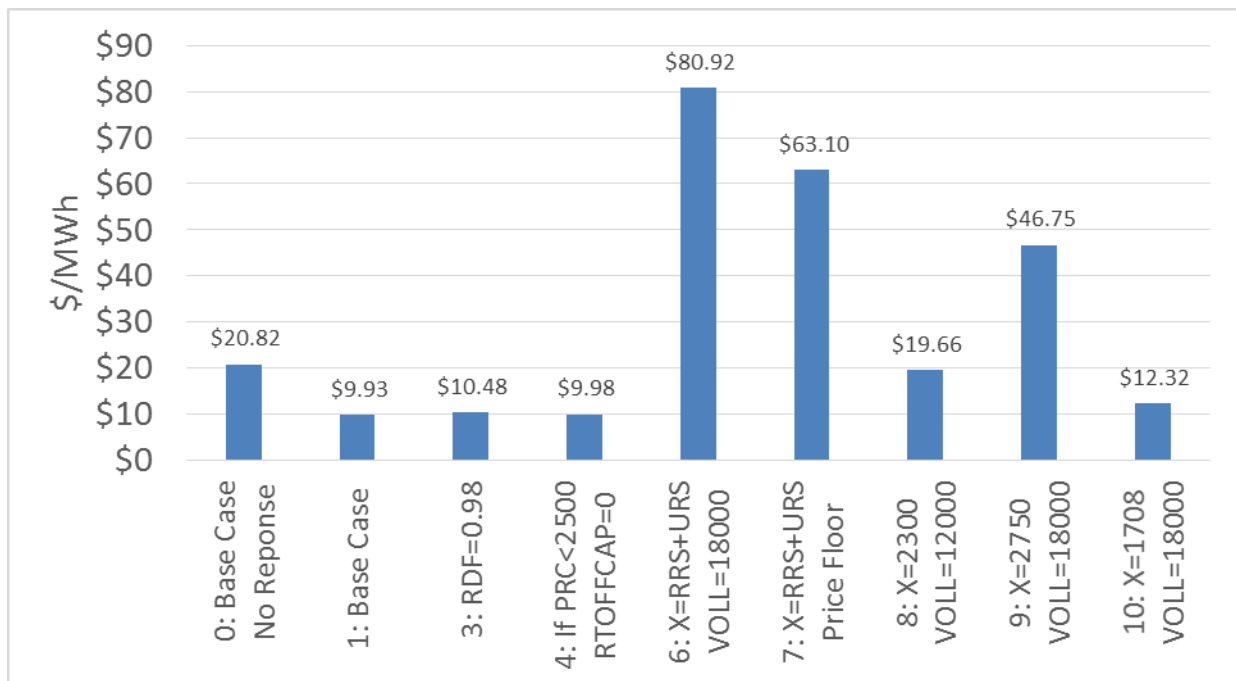


Figure 14. Time Weighted Average RTORPA of All Hours (2011)



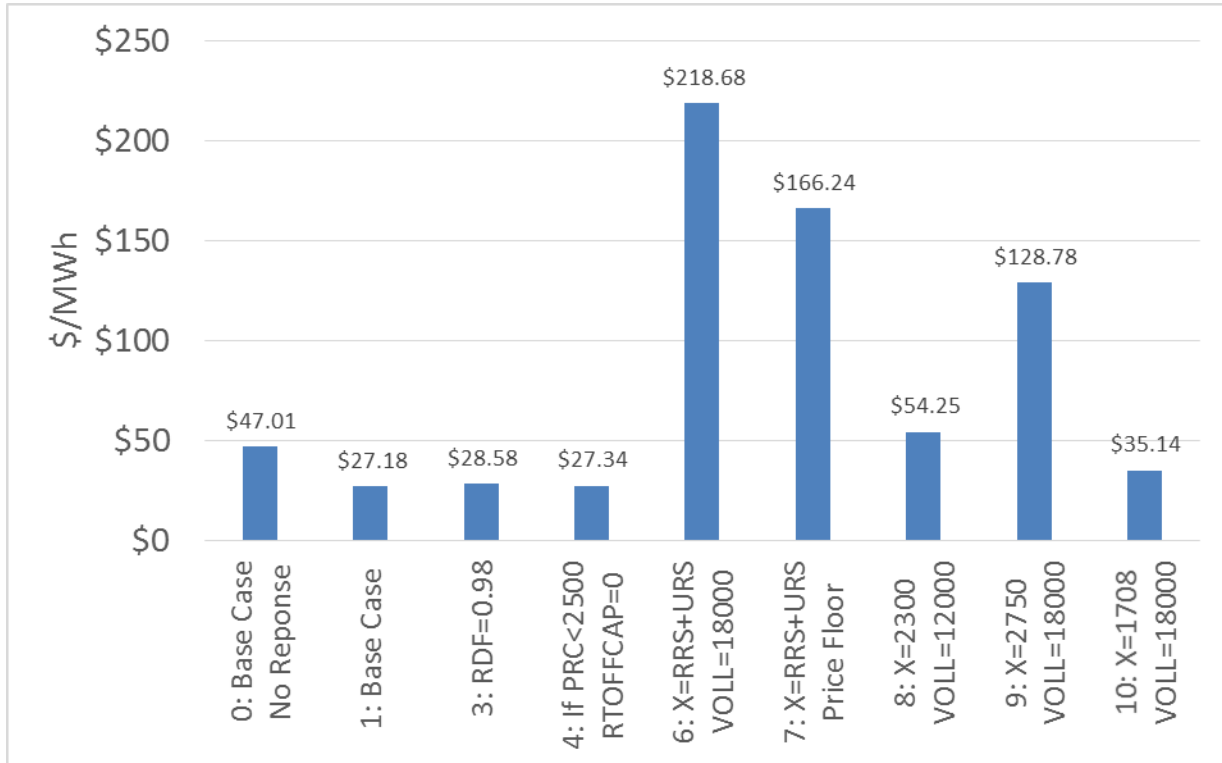


Figure 15. ONPEAK Energy and Time Weighted Average RTORPA (2011)



Figure 16. ONPEAK Time Weighted Average RTORPA (2011)



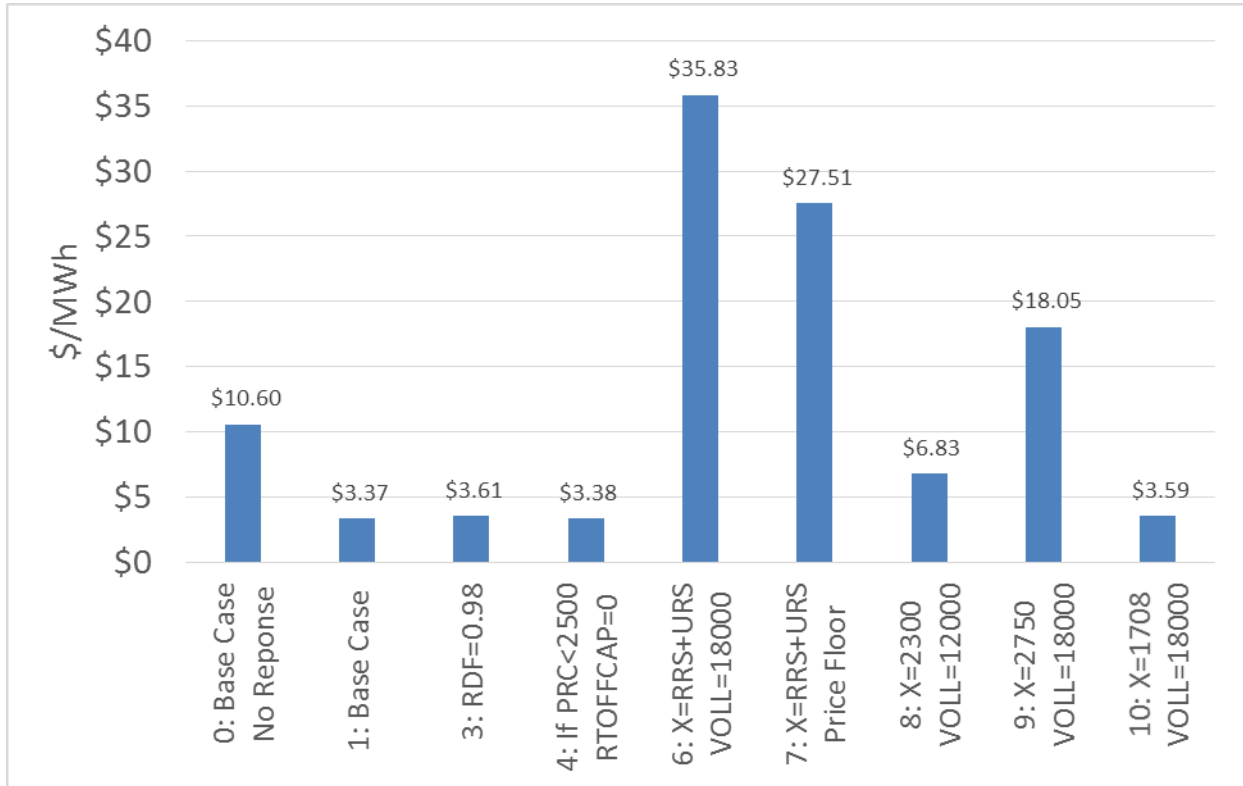


Figure 17. OFFPEAK Energy and Time Weighted Average RTORPA (2011)

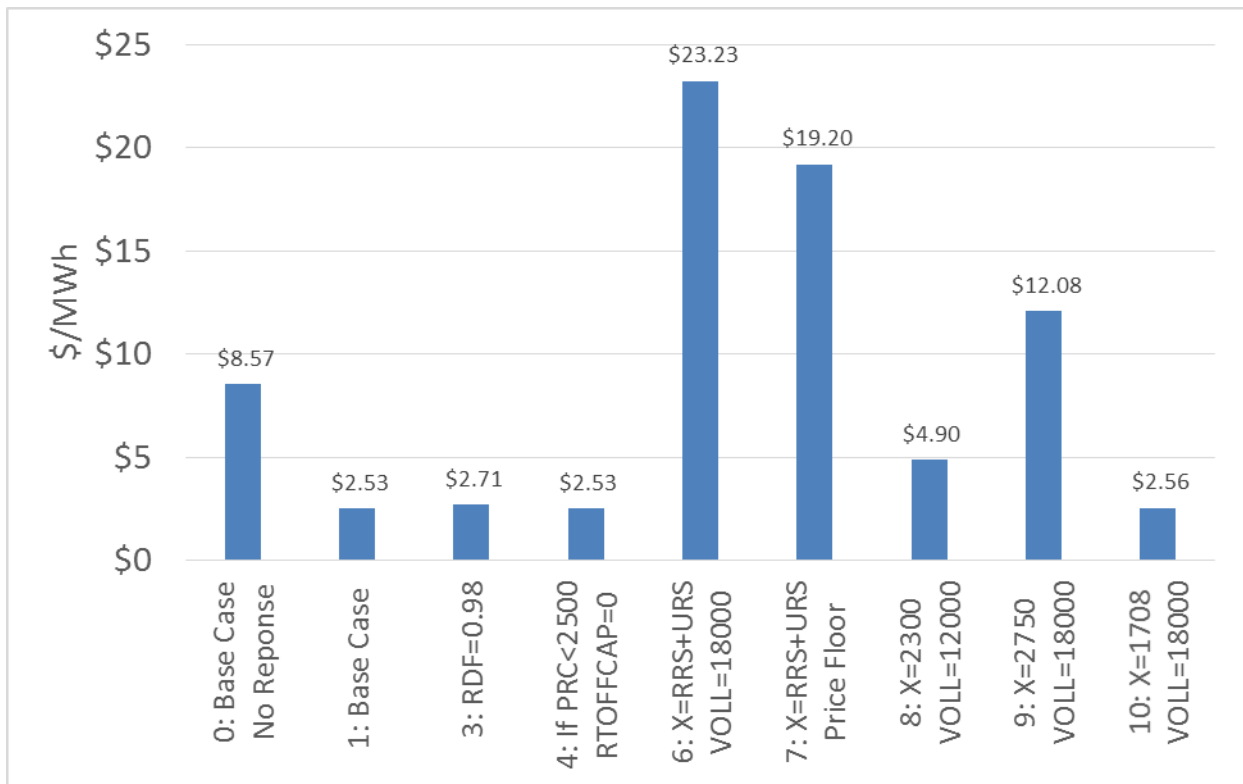


Figure 18. OFFPEAK Time Weighted Average RTORPA (2011)



Option	Energy and Time Weighted Average RTORPA(\$/MWh)	Time Weighted Average RTORPA(\$/MWh)	ONPEAK Energy and Time Weighted Average RTORPA(\$/MWh)	ONPEAK Time Weighted Average RTORPA(\$/MWh)	OFFPEAK Energy and Time Weighted Average RTORPA(\$/MWh)	OFFPEAK Time Weighted Average RTORPA(\$/MWh)
0: Base Case No Reponse	\$ 29.20	\$ 20.82	\$ 47.01	\$ 34.86	\$ 10.60	\$ 8.57
1: Base Case	\$ 15.53	\$ 9.93	\$ 27.18	\$ 18.43	\$ 3.37	\$ 2.53
3: RDF=0.98	\$ 16.37	\$ 10.48	\$ 28.58	\$ 19.40	\$ 3.61	\$ 2.71
4: If PRC<2500 RTOFFCAP=0	\$ 15.62	\$ 9.98	\$ 27.34	\$ 18.53	\$ 3.38	\$ 2.53
6: X=RRS+URS VOLL=18000	\$ 129.23	\$ 80.92	\$ 218.68	\$ 147.12	\$ 35.83	\$ 23.23
7: X=RRS+URS Price Floor	\$ 98.38	\$ 63.10	\$ 166.24	\$ 113.48	\$ 27.51	\$ 19.20
8: X=2300 VOLL=12000	\$ 31.05	\$ 19.66	\$ 54.25	\$ 36.58	\$ 6.83	\$ 4.90
9: X=2750 VOLL=18000	\$ 74.61	\$ 46.75	\$ 128.78	\$ 86.53	\$ 18.05	\$ 12.08
10: X=1708 VOLL=18000	\$ 19.70	\$ 12.32	\$ 35.14	\$ 23.51	\$ 3.59	\$ 2.56

**Table 15. Averages of RTORPA (2011)**





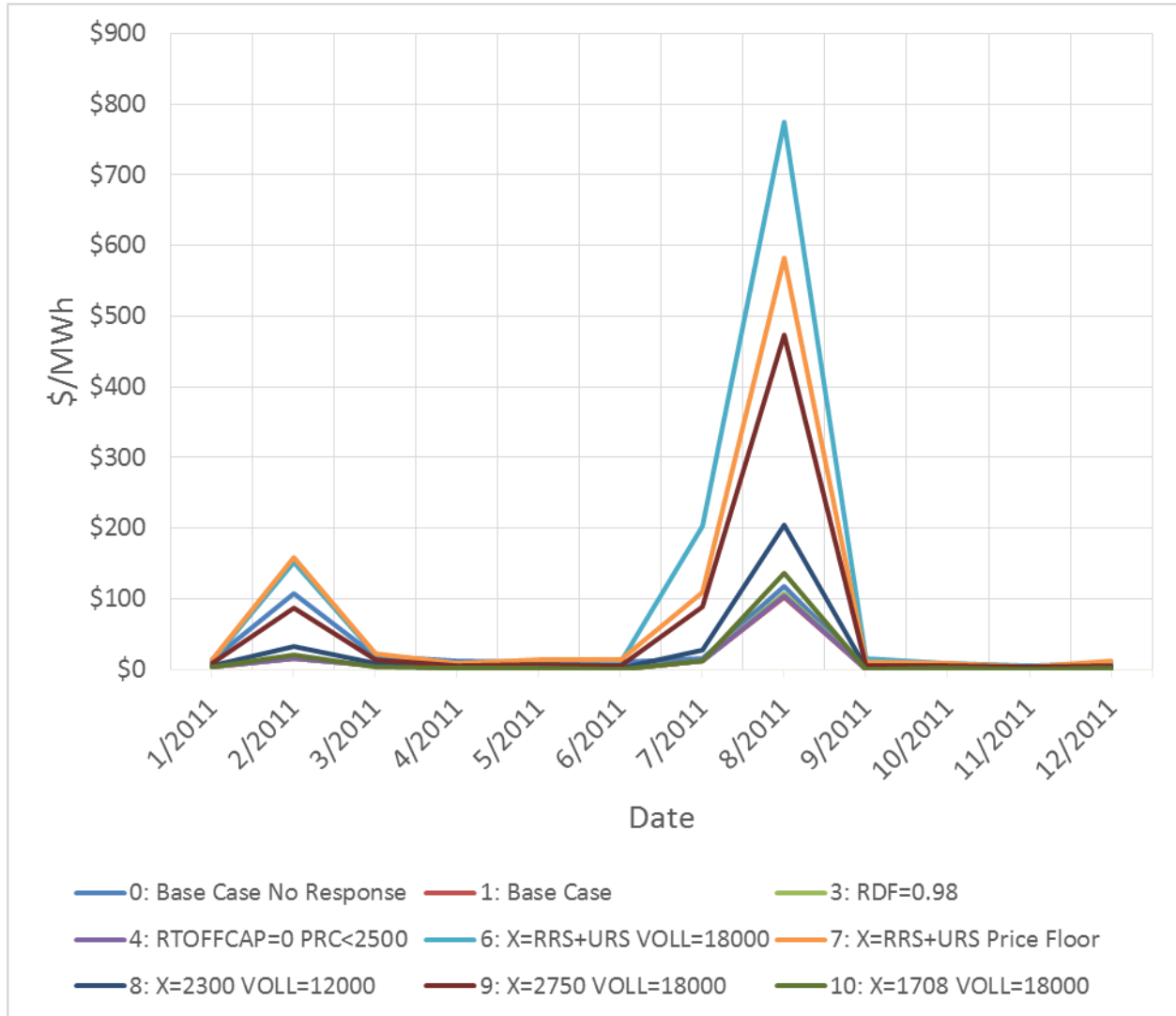


Figure 19. Energy and Time Weighted Average RTORPA of All Hours by Month (2011)

Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
1/2011	\$ 14.73	\$ 3.80	\$ 4.02	\$ 3.80	\$ 12.92	\$ 13.81	\$ 5.81	\$ 9.29	\$ 3.42
2/2011	\$ 106.89	\$ 15.44	\$ 16.36	\$ 15.47	\$ 151.26	\$ 159.34	\$ 32.30	\$ 87.95	\$ 21.04
3/2011	\$ 18.41	\$ 5.03	\$ 5.38	\$ 5.03	\$ 20.47	\$ 23.07	\$ 8.40	\$ 14.25	\$ 4.43
4/2011	\$ 11.58	\$ 1.52	\$ 1.62	\$ 1.52	\$ 9.15	\$ 8.92	\$ 2.58	\$ 5.13	\$ 1.34
5/2011	\$ 10.69	\$ 2.45	\$ 2.60	\$ 2.45	\$ 10.61	\$ 14.16	\$ 3.80	\$ 6.67	\$ 2.19
6/2011	\$ 10.36	\$ 0.86	\$ 0.93	\$ 0.86	\$ 11.27	\$ 14.64	\$ 1.68	\$ 4.82	\$ 0.76
7/2011	\$ 15.00	\$ 11.62	\$ 12.54	\$ 11.63	\$ 202.80	\$ 109.32	\$ 27.59	\$ 89.50	\$ 12.74
8/2011	\$ 118.42	\$ 103.01	\$ 107.98	\$ 103.71	\$ 773.97	\$ 582.84	\$ 204.89	\$ 473.62	\$ 136.40
9/2011	\$ 2.81	\$ 0.74	\$ 0.82	\$ 0.74	\$ 15.04	\$ 10.05	\$ 1.67	\$ 5.23	\$ 0.63
10/2011	\$ 5.54	\$ 1.75	\$ 1.87	\$ 1.75	\$ 9.48	\$ 8.96	\$ 2.87	\$ 5.53	\$ 1.52
11/2011	\$ 5.13	\$ 1.12	\$ 1.19	\$ 1.12	\$ 5.62	\$ 4.54	\$ 1.76	\$ 3.27	\$ 0.98
12/2011	\$ 4.27	\$ 1.58	\$ 1.72	\$ 1.60	\$ 9.08	\$ 12.16	\$ 2.88	\$ 5.63	\$ 1.44

Table 16. Energy and Time Weighted Average RTORPA of All Hours by Month (2011)



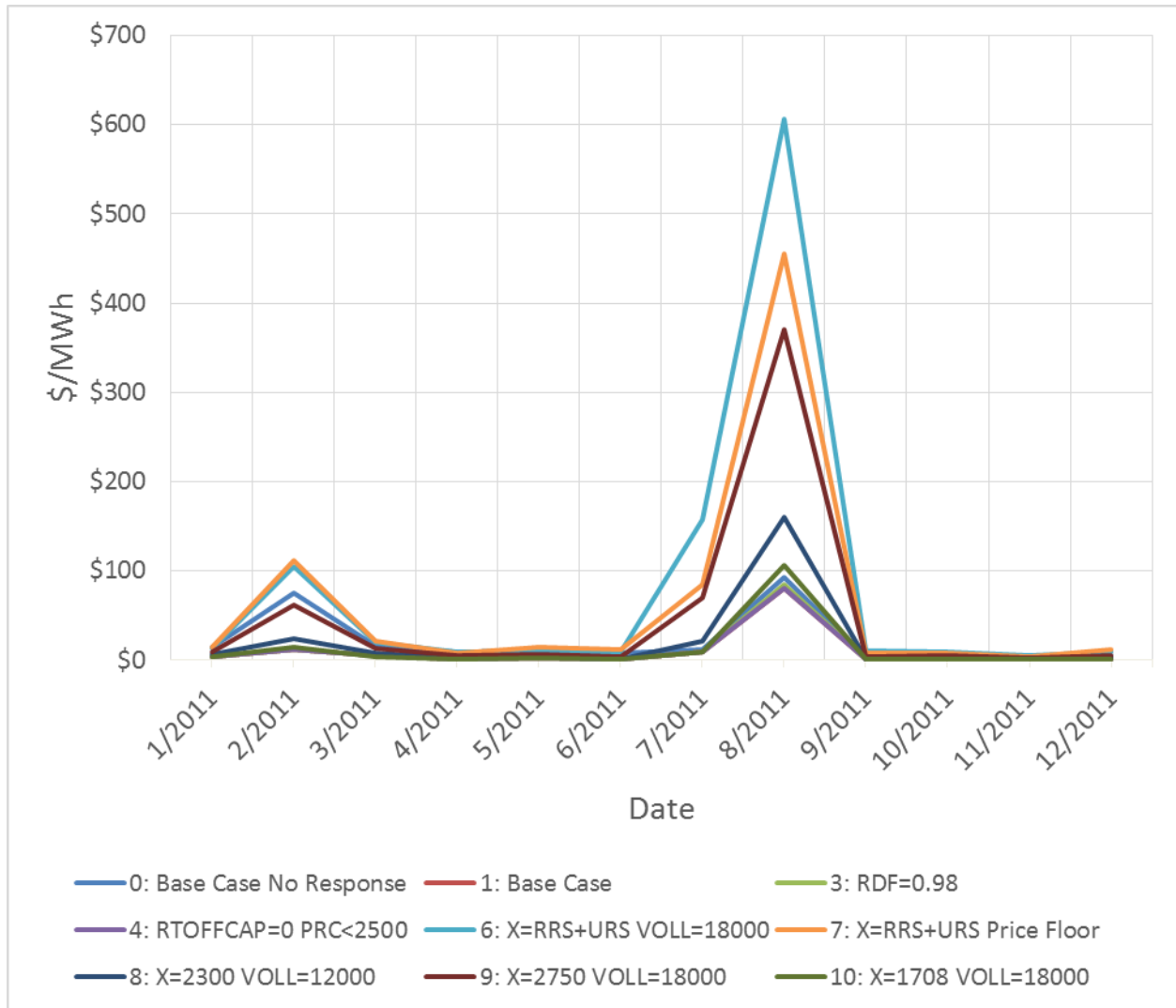


Figure 20. Time Weighted Average RTORPA of All Hours by Month (2011)

Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
1/2011	\$ 15.07	\$ 3.90	\$ 4.12	\$ 3.90	\$ 13.08	\$ 14.46	\$ 5.94	\$ 9.45	\$ 3.50
2/2011	\$ 74.94	\$ 11.45	\$ 12.14	\$ 11.47	\$ 104.95	\$ 111.32	\$ 23.41	\$ 61.90	\$ 15.13
3/2011	\$ 16.20	\$ 4.74	\$ 5.08	\$ 4.74	\$ 20.01	\$ 21.60	\$ 8.03	\$ 13.85	\$ 4.16
4/2011	\$ 9.40	\$ 1.35	\$ 1.44	\$ 1.35	\$ 8.78	\$ 8.36	\$ 2.36	\$ 4.86	\$ 1.18
5/2011	\$ 10.11	\$ 2.27	\$ 2.41	\$ 2.27	\$ 10.58	\$ 14.97	\$ 3.58	\$ 6.50	\$ 2.01
6/2011	\$ 8.11	\$ 0.77	\$ 0.84	\$ 0.77	\$ 9.56	\$ 11.89	\$ 1.50	\$ 4.15	\$ 0.68
7/2011	\$ 11.62	\$ 8.98	\$ 9.69	\$ 8.98	\$ 157.34	\$ 84.91	\$ 21.34	\$ 69.25	\$ 9.83
8/2011	\$ 92.35	\$ 80.19	\$ 84.07	\$ 80.74	\$ 606.41	\$ 455.65	\$ 159.69	\$ 369.78	\$ 106.11
9/2011	\$ 2.02	\$ 0.55	\$ 0.61	\$ 0.55	\$ 10.90	\$ 7.69	\$ 1.25	\$ 3.88	\$ 0.47
10/2011	\$ 4.55	\$ 1.47	\$ 1.58	\$ 1.47	\$ 8.64	\$ 8.18	\$ 2.49	\$ 4.96	\$ 1.27
11/2011	\$ 4.58	\$ 0.99	\$ 1.06	\$ 0.99	\$ 5.18	\$ 4.18	\$ 1.58	\$ 3.00	\$ 0.88
12/2011	\$ 4.17	\$ 1.52	\$ 1.65	\$ 1.53	\$ 8.66	\$ 11.58	\$ 2.74	\$ 5.37	\$ 1.38

Table 17. Time Weighted Average RTORPA of All Hours by Month (2011)



### Additional Peaker Net Margin

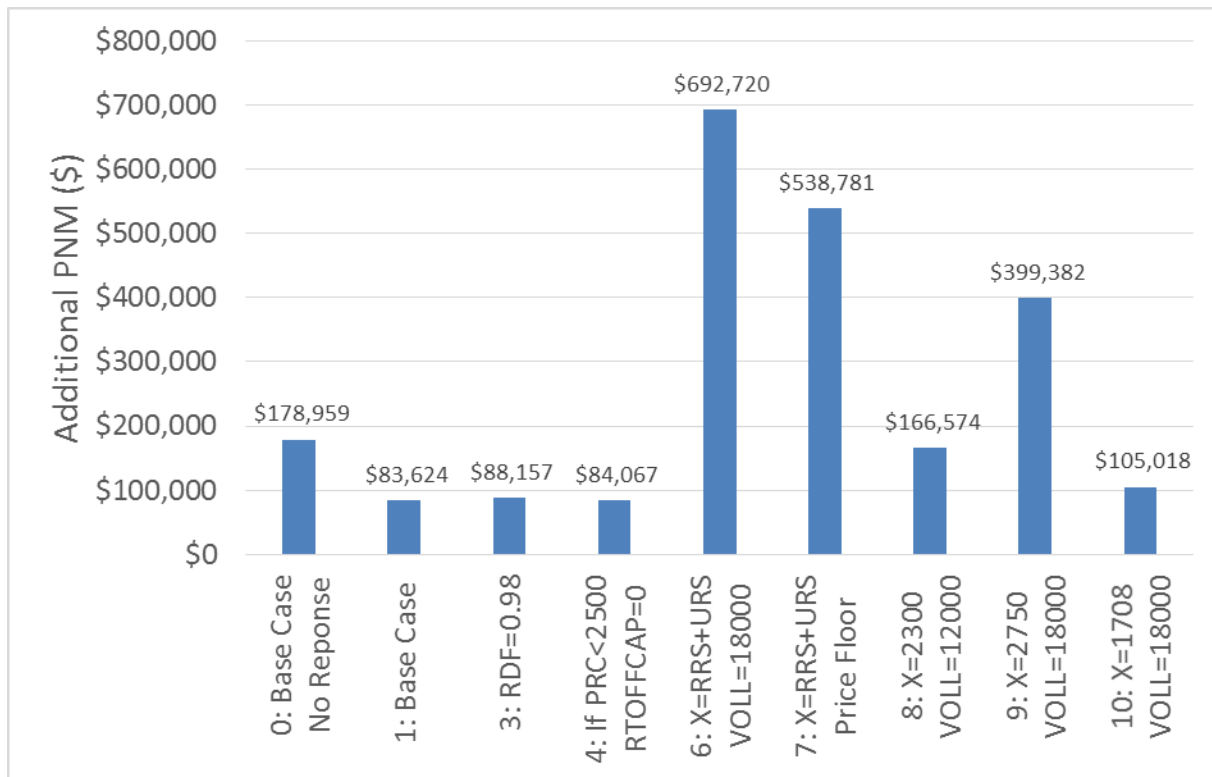


Figure 21. Sum of Estimated Additional PNM with ORDC (2011)

Option	Sum of Estimated PNM without ORDC	Sum of Estimated Additional PNM with ORDC
0: Base Case No Reponse	\$ 130,794	\$ 178,959
1: Base Case		\$ 83,624
3: RDF=0.98		\$ 88,157
4: If PRC<2500 RTOFFCAP=0		\$ 84,067
6: X=RRS+URS VOLL=18000		\$ 692,720
7: X=RRS+URS Price Floor		\$ 538,781
8: X=2300 VOLL=12000		\$ 166,574
9: X=2750 VOLL=18000		\$ 399,382
10: X=1708 VOLL=18000		\$ 105,018

Table 18. Sum of Estimated Additional PNM with ORDC (2011)



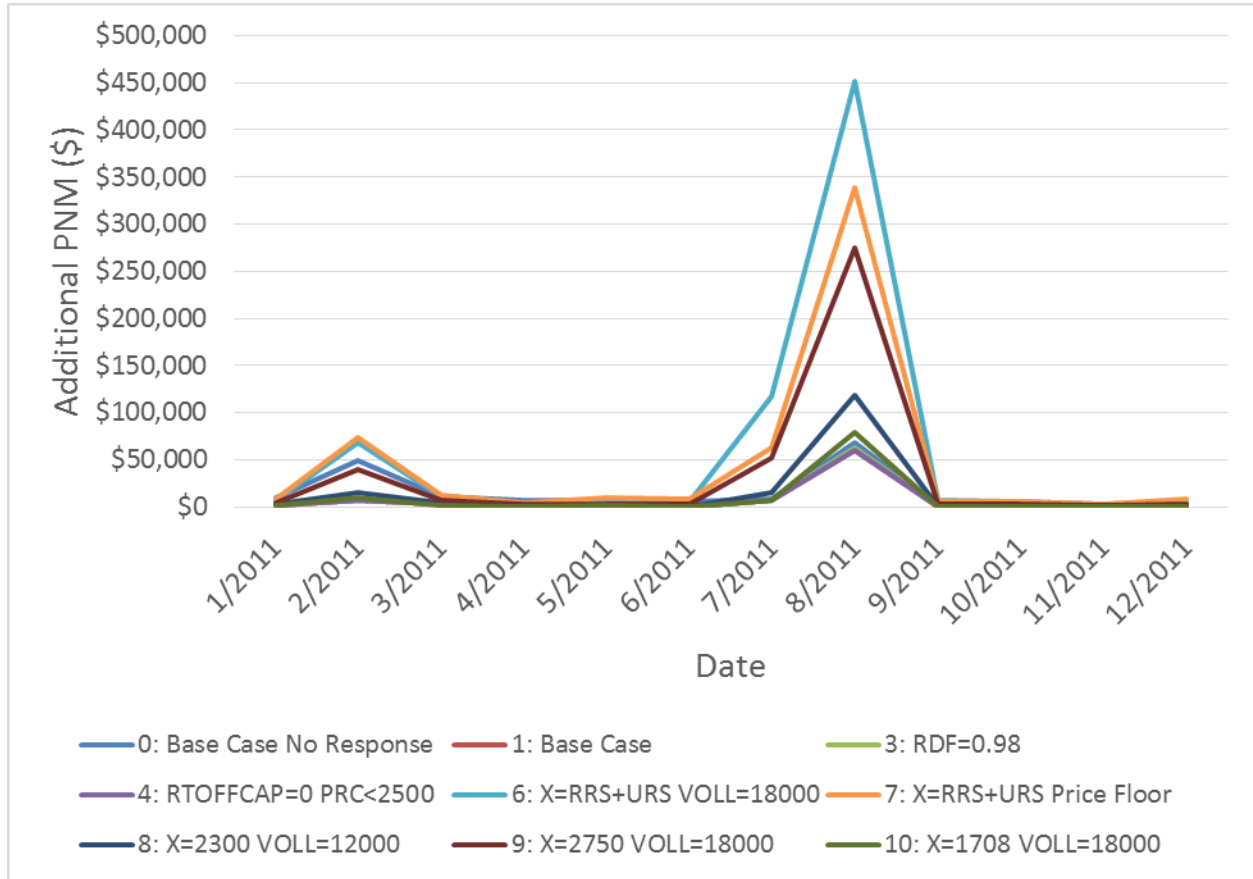


Figure 22. Sum of Estimated Additional PNM with ORDC by Month (2011)

Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
1/2011	\$ 10,334.23	\$ 2,018.66	\$ 2,132.70	\$ 2,018.66	\$ 6,823.95	\$ 8,201.16	\$ 3,110.08	\$ 4,984.70	\$ 1,830.92
2/2011	\$ 49,866.65	\$ 7,203.44	\$ 7,636.47	\$ 7,218.87	\$ 68,705.12	\$ 73,194.77	\$ 14,978.57	\$ 40,319.24	\$ 9,736.46
3/2011	\$ 10,994.73	\$ 2,471.20	\$ 2,643.77	\$ 2,471.20	\$ 10,778.66	\$ 12,369.94	\$ 4,250.63	\$ 7,390.88	\$ 2,202.16
4/2011	\$ 6,570.79	\$ 770.88	\$ 820.20	\$ 770.88	\$ 4,579.64	\$ 4,579.08	\$ 1,292.48	\$ 2,600.00	\$ 692.53
5/2011	\$ 7,224.06	\$ 1,388.16	\$ 1,463.92	\$ 1,388.16	\$ 5,923.15	\$ 9,437.61	\$ 2,105.57	\$ 3,703.47	\$ 1,255.33
6/2011	\$ 5,726.66	\$ 441.76	\$ 483.95	\$ 444.43	\$ 6,060.62	\$ 7,881.91	\$ 882.65	\$ 2,571.50	\$ 393.93
7/2011	\$ 8,620.56	\$ 6,654.00	\$ 7,181.38	\$ 6,656.98	\$ 116,650.84	\$ 62,867.71	\$ 15,820.41	\$ 51,369.10	\$ 7,289.52
8/2011	\$ 68,702.32	\$ 59,659.33	\$ 62,546.14	\$ 60,067.85	\$ 451,069.39	\$ 338,934.95	\$ 118,802.12	\$ 275,088.91	\$ 78,944.56
9/2011	\$ 1,445.17	\$ 391.63	\$ 434.07	\$ 391.90	\$ 7,660.98	\$ 5,391.39	\$ 882.19	\$ 2,733.68	\$ 334.21
10/2011	\$ 3,311.26	\$ 1,017.66	\$ 1,085.72	\$ 1,019.47	\$ 5,642.16	\$ 5,424.93	\$ 1,679.68	\$ 3,276.30	\$ 887.02
11/2011	\$ 3,254.25	\$ 673.95	\$ 713.15	\$ 673.95	\$ 3,204.54	\$ 2,587.50	\$ 1,041.62	\$ 1,898.72	\$ 601.41
12/2011	\$ 2,908.63	\$ 933.25	\$ 1,015.63	\$ 944.30	\$ 5,620.91	\$ 7,909.86	\$ 1,727.83	\$ 3,445.61	\$ 850.16

Table 19. Sum of Estimated Additional PNM with ORDC by Month (6/1/2014 – 10/31/2015)



### Real-Time On-Line Price Adder Histogram

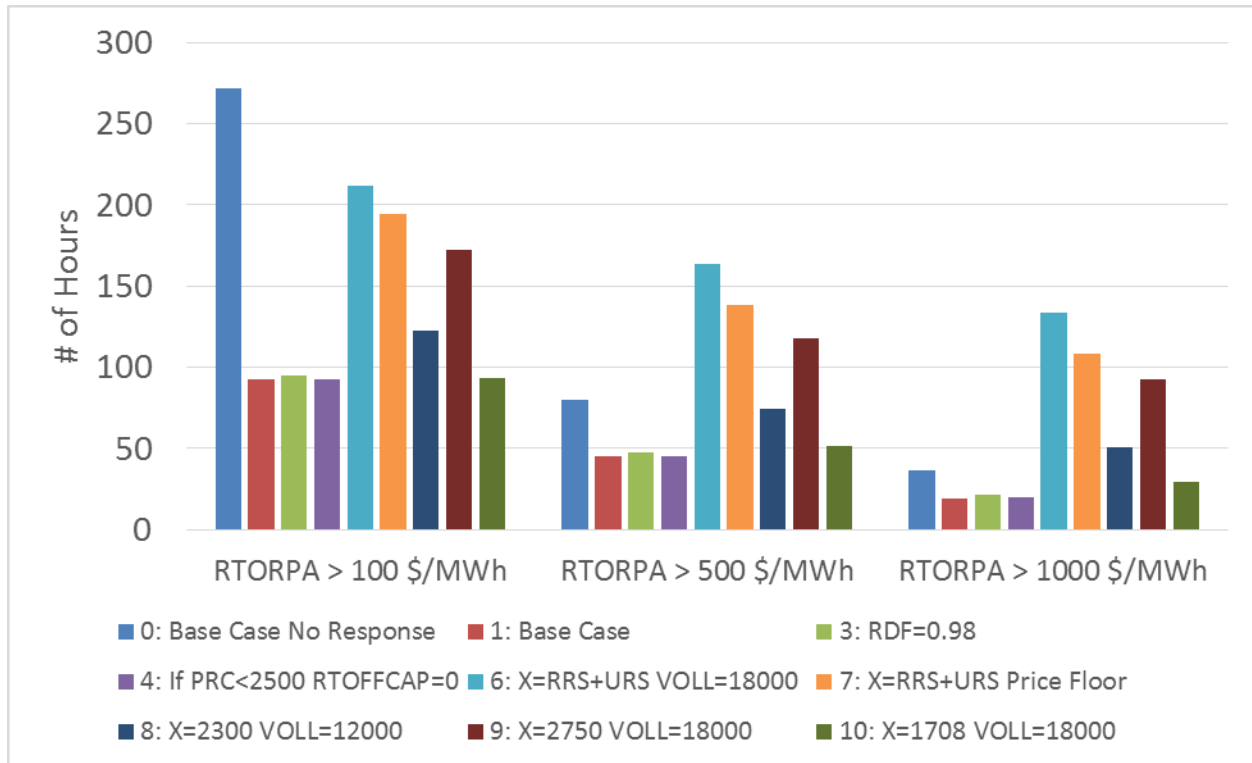


Figure 23. Number of Hours where RTORPA > Threshold (2011)

Option	# of Hours RTORPA > 100 \$/MWh	# of Hours RTORPA > 500 \$/MWh	# of Hours RTORPA > 1000 \$/MWh
0: Base Case No Reponse	271.66	79.72	36.67
1: Base Case	92.73	45.19	19.61
3: RDF=0.98	95.31	47.30	21.36
4: If PRC<2500 RTOFFCAP=0	92.90	45.53	20.27
6: X=RRS+URS VOLL=18000	211.58	163.52	133.28
7: X=RRS+URS Price Floor	194.65	138.21	108.57
8: X=2300 VOLL=12000	122.74	74.17	50.53
9: X=2750 VOLL=18000	172.46	117.57	92.37
10: X=1708 VOLL=18000	93.35	51.41	29.52

Table 20. Number of Hours where RTORPA > Threshold (2011)



Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
1/2011	31.47	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00
2/2011	32.66	10.72	11.13	10.80	24.17	22.34	15.85	21.23	11.44
3/2011	28.90	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00
4/2011	13.60	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00
5/2011	19.49	0.00	0.00	0.00	0.00	1.01	0.00	0.00	0.00
6/2011	9.41	0.00	0.00	0.00	6.55	6.03	0.00	4.25	0.00
7/2011	21.84	15.67	16.17	15.67	53.02	46.28	24.16	40.48	15.25
8/2011	80.68	66.34	68.01	66.43	122.60	113.58	81.66	104.01	66.66
9/2011	3.83	0.00	0.00	0.00	5.25	3.41	1.08	2.50	0.00
10/2011	11.27	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00
11/2011	11.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/2011	6.66	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00

Table 21. Number of Hours where RTORPA > \$100/MWh by Month (2011)

Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
1/2011	3.18	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00
2/2011	11.07	4.79	4.91	4.79	19.42	16.65	7.97	14.84	6.09
3/2011	4.64	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00
4/2011	4.17	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00
5/2011	2.29	0.00	0.00	0.00	0.00	1.01	0.00	0.00	0.00
6/2011	4.02	0.00	0.00	0.00	2.49	1.47	0.00	0.00	0.00
7/2011	4.75	3.25	4.33	3.25	37.97	27.18	11.09	23.08	4.92
8/2011	43.90	37.15	38.07	37.49	100.98	87.50	55.12	78.82	40.40
9/2011	0.08	0.00	0.00	0.00	2.66	2.41	0.00	0.83	0.00
10/2011	0.08	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00
11/2011	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/2011	1.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00

Table 22. Number of Hours where RTORPA > \$500/MWh by Month (2011)

Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
1/2011	0.08	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00
2/2011	8.61	0.90	1.40	0.90	16.27	12.74	5.22	10.45	3.36
3/2011	0.50	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00
4/2011	1.36	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00
5/2011	0.48	0.00	0.00	0.00	0.00	1.01	0.00	0.00	0.00
6/2011	1.48	0.00	0.00	0.00	0.00	1.47	0.00	0.00	0.00
7/2011	0.00	0.00	0.00	0.00	27.26	18.08	5.25	15.50	0.33
8/2011	23.90	18.70	19.95	19.37	87.50	72.35	40.06	66.34	25.82
9/2011	0.00	0.00	0.00	0.00	2.25	0.91	0.00	0.08	0.00
10/2011	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00
11/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/2011	0.25	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00

Table 23. Number of Hours where RTORPA > \$1,000/MWh by Month (2011)



Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
1/2011	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00
2/2011	6.50	0.00	0.00	0.00	8.87	8.78	0.00	4.93	0.00
3/2011	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00
4/2011	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00
5/2011	0.08	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00
6/2011	0.00	0.00	0.00	0.00	0.00	0.75	0.00	0.00	0.00
7/2011	0.00	0.00	0.00	0.00	13.42	4.83	0.00	5.50	0.00
8/2011	2.00	2.00	2.17	2.00	62.18	42.40	8.15	40.31	6.18
9/2011	0.00	0.00	0.00	0.00	0.08	0.17	0.00	0.00	0.00
10/2011	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00
11/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/2011	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00

Table 24. Number of Hours where RTORPA > \$3,000/MWh by Month (2011)

Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
1/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/2011	5.40	0.00	0.00	0.00	5.56	8.05	0.00	1.17	0.00
3/2011	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00
4/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/2011	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00
6/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2011	0.00	0.00	0.00	0.00	7.75	1.83	0.00	0.08	0.00
8/2011	2.00	2.00	2.17	2.00	46.41	32.99	4.50	22.98	1.34
9/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/2011	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00

Table 25. Number of Hours where RTORPA > \$5,000/MWh by Month (2011)

Month	0: Base Case No Response	1: Base Case	3: RDF=0.98	4: RTOFFCAP=0 PRC<2500	6: X=RRS+URS VOLL=18000	7: X=RRS+URS Price Floor	8: X=2300 VOLL=12000	9: X=2750 VOLL=18000	10: X=1708 VOLL=18000
1/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/2011	0.29	0.00	0.00	0.00	0.58	2.56	0.00	0.00	0.00
3/2011	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00
4/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/2011	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00
6/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/2011	0.00	0.00	0.00	0.00	3.74	0.41	0.00	0.00	0.00
8/2011	0.00	0.00	0.00	0.00	19.37	11.95	0.08	2.17	0.00
9/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/2011	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00

Table 26. Number of Hours where RTORPA > \$7,000/MWh by Month (2011)



### Probability of Falling Below Minimum Contingency Level on August 3, 2011

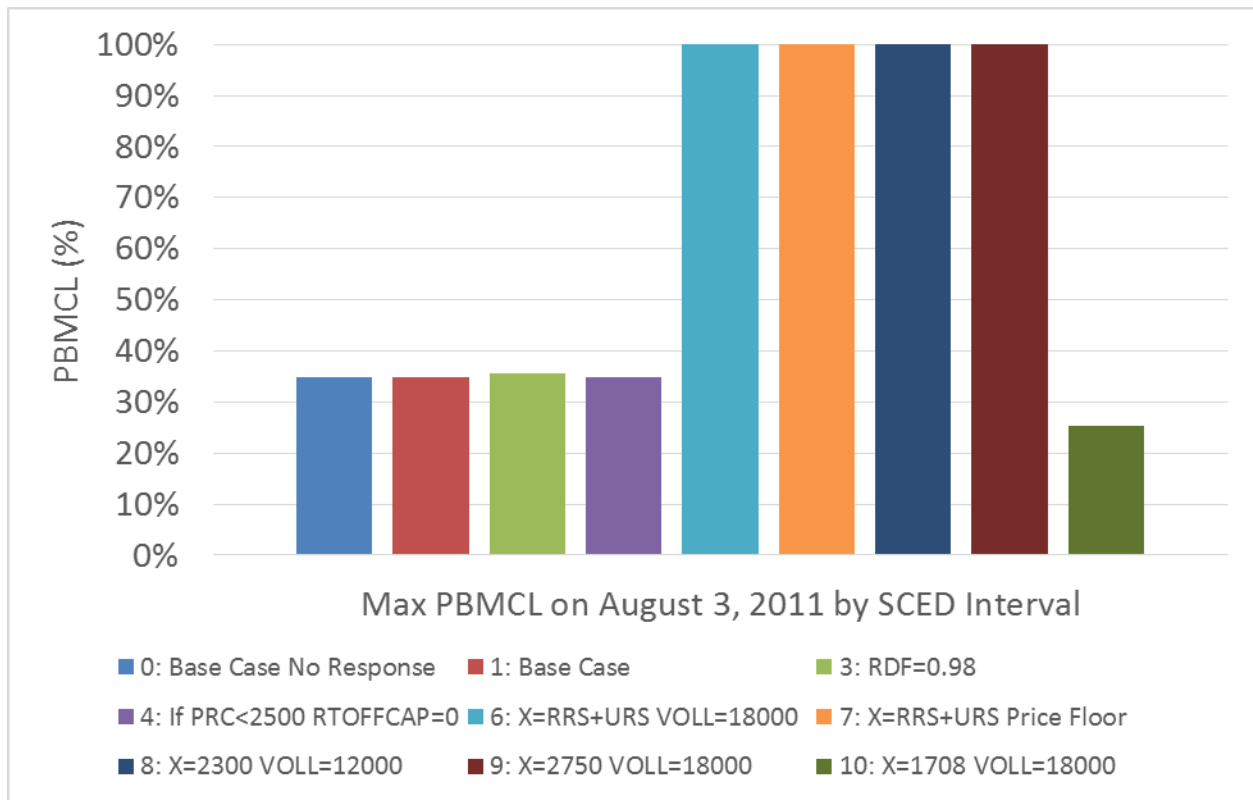


Figure 24. Max PBMCL on August 3, 2011

Option	Max PBMCL on August 3, 2011 by SCED Interval
0: Base Case No Reponse	34.8%
1: Base Case	34.8%
3: RDF=0.98	35.6%
4: If PRC<2500 RTOFFCAP=0	34.8%
6: X=RRS+URS VOLL=18000	100.0%
7: X=RRS+URS Price Floor	100.0%
8: X=2300 VOLL=12000	100.0%
9: X=2750 VOLL=18000	100.0%
10: X=1708 VOLL=18000	25.4%

Table 27. Max PBMCL on August 3, 2011





## Section 3: Sensitivity Analysis

Offline and available resources had varying levels of startup time and startup cost. Assuming that all those resources will be online any time prices were greater than a particular level might lead to over commitment.

Hence, a sensitivity analysis was done to show a range of outcomes:

1. Price response any time prices were greater than \$75/MWh
2. Price response when prices go above \$75/MWh for 2 hours
3. Price response any time prices were greater than \$250/MWh
4. Price response when prices go above \$250/MWh for 2 hours
5. No price response

Two hours were estimated based on average start times, start costs, and time needed to recover average start costs.



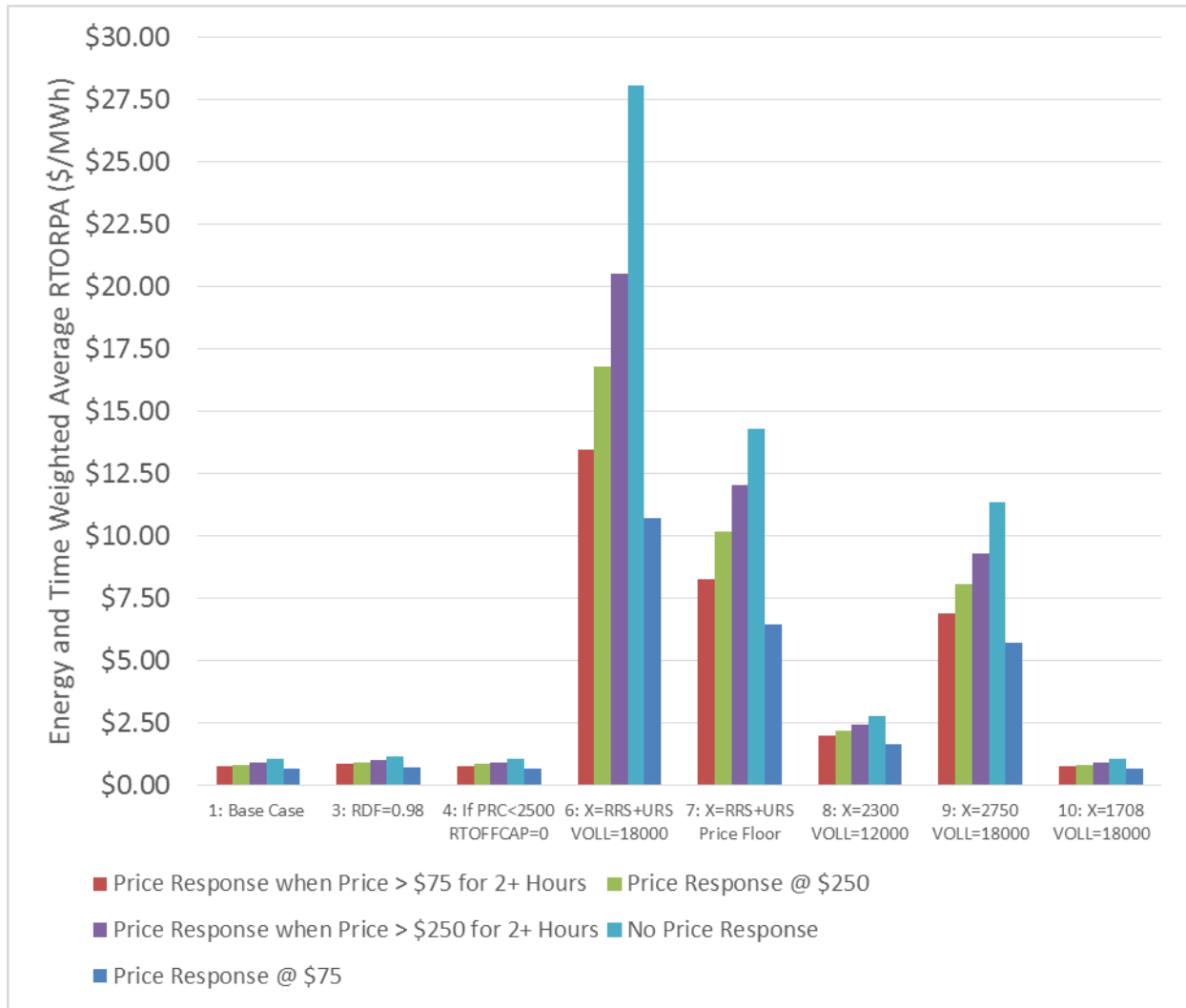


Figure 25. Energy and Time Weighted RTORPA Sensitivity to Market Behavior (6/1/2014 – 10/31/2015)

Option	Price Response @ \$75	Price Response when Price > \$75 for 2+ Hours	Price Response @ \$250	Price Response when Price > \$250 for 2+ Hours	No Price Response
1: Base Case	\$0.66	\$0.78	\$0.85	\$0.94	\$1.05
3: RDF=0.98	\$0.73	\$0.86	\$0.94	\$1.04	\$1.17
4: If PRC<2500 RTOFFCAP=0	\$0.66	\$0.79	\$0.86	\$0.95	\$1.06
6: X=RRS+URS VOLL=18000	\$10.71	\$13.47	\$16.81	\$20.50	\$28.08
7: X=RRS+URS Price Floor	\$6.44	\$8.26	\$10.20	\$12.07	\$14.33
8: X=2300 VOLL=12000	\$1.66	\$2.02	\$2.22	\$2.43	\$2.81
9: X=2750 VOLL=18000	\$5.72	\$6.90	\$8.08	\$9.29	\$11.37
10: X=1708 VOLL=18000	\$0.67	\$0.77	\$0.84	\$0.93	\$1.07

Table 28. Energy and Time Weighted RTORPA Sensitivity to Market Behavior (6/1/2014 – 10/31/2015)



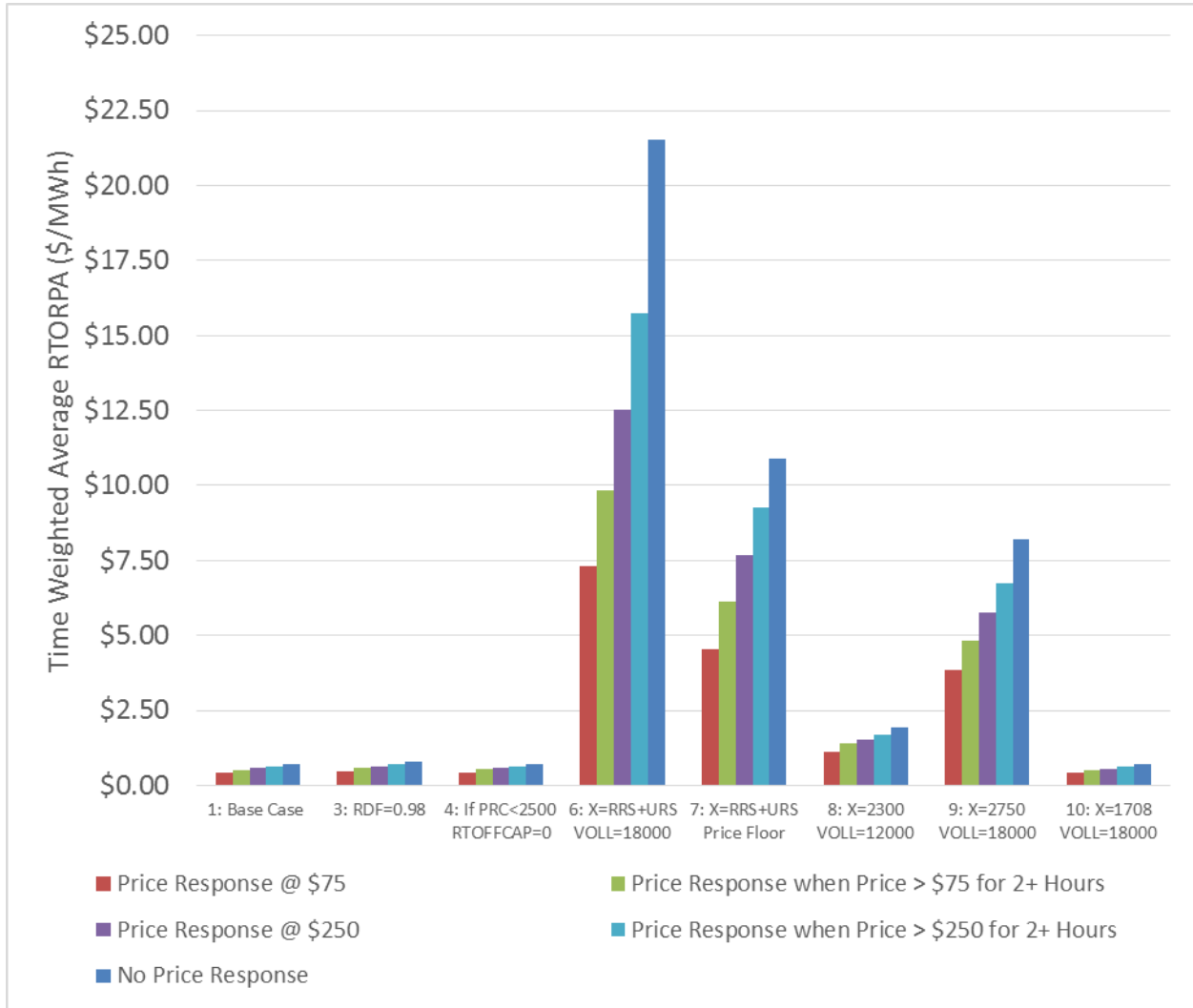


Figure 26. Time Weighted RTORPA Sensitivity to Market Behavior (6/1/2014 – 10/31/2015)

Option	Price Response @ \$75	Price Response when Price > \$75 for 2+ Hours	Price Response @ \$250	Price Response when Price > \$250 for 2+ Hours	No Price Response
1: Base Case	\$0.43	\$0.52	\$0.58	\$0.64	\$0.71
3: RDF=0.98	\$0.48	\$0.58	\$0.64	\$0.71	\$0.80
4: If PRC<2500 RTOFFCAP=0	\$0.43	\$0.53	\$0.58	\$0.64	\$0.72
6: X=RRS+URS VOLL=18000	\$7.32	\$9.82	\$12.52	\$15.76	\$21.51
7: X=RRS+URS Price Floor	\$4.52	\$6.12	\$7.69	\$9.27	\$10.91
8: X=2300 VOLL=12000	\$1.10	\$1.39	\$1.54	\$1.70	\$1.95
9: X=2750 VOLL=18000	\$3.84	\$4.83	\$5.77	\$6.73	\$8.20
10: X=1708 VOLL=18000	\$0.43	\$0.51	\$0.55	\$0.62	\$0.71

Table 29. Time Weighted RTORPA Sensitivity to Market Behavior (6/1/2014 – 10/31/2015)



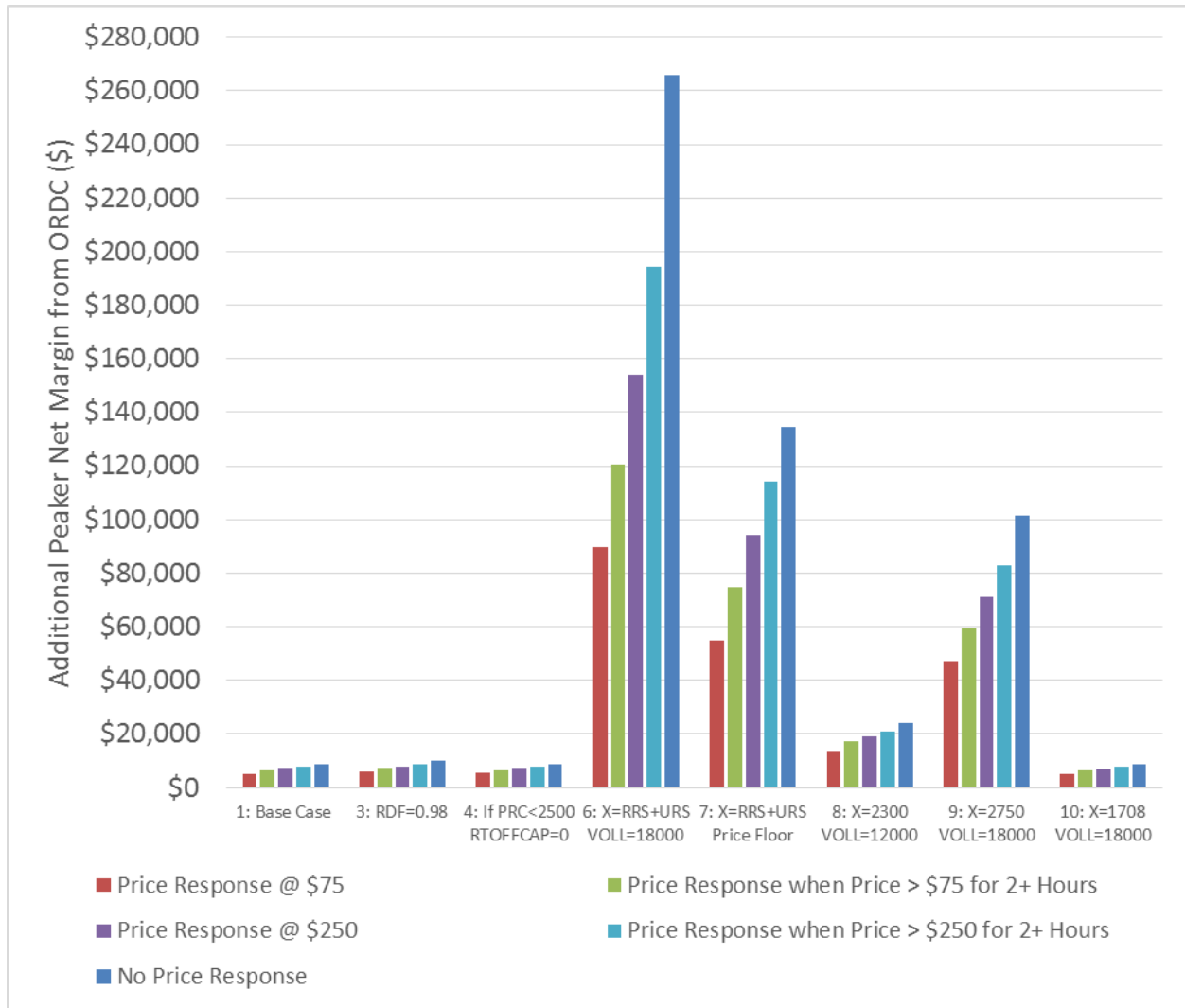


Figure 27. Additional Peaker Net Margin from ORDC Sensitivity to Market Behavior (6/1/2014 – 10/31/2015)

Option	Price Response @ \$75	Price Response when Price > \$75 for 2+ Hours	Price Response @ \$250	Price Response when Price > \$250 for 2+ Hours	No Price Response
1: Base Case	\$5,254.46	\$6,457.22	\$7,089.44	\$7,881.62	\$8,818.39
3: RDF=0.98	\$5,830.66	\$7,088.94	\$7,902.24	\$8,786.55	\$9,810.15
4: If PRC<2500 RTOFFCAP=0	\$5,314.01	\$6,516.77	\$7,148.99	\$7,941.17	\$8,880.98
6: X=RRS+URS VOLL=18000	\$89,522.41	\$120,568.95	\$154,169.90	\$194,370.91	\$265,834.38
7: X=RRS+URS Price Floor	\$55,021.54	\$74,886.36	\$94,421.96	\$114,050.91	\$134,481.47
8: X=2300 VOLL=12000	\$13,517.15	\$17,054.73	\$18,960.95	\$20,997.12	\$24,072.53
9: X=2750 VOLL=18000	\$47,056.24	\$59,453.59	\$71,126.50	\$83,079.55	\$101,310.73
10: X=1708 VOLL=18000	\$5,259.91	\$6,243.16	\$6,828.77	\$7,666.11	\$8,752.54

Table 30. Additional Peaker Net Margin from ORDC Sensitivity to Market Behavior (6/1/2014 – 10/31/2015)





Figure 28. Energy and Time Weighted RTORPA Sensitivity to Market Behavior (2011)

Option	Price Response @ \$75	Price Response when Price > \$75 for 2+ Hours	Price Response @ \$250	Price Response when Price > \$250 for 2+ Hours	No Price Response
1: Base Case	\$15.53	\$17.06	\$18.74	\$20.44	\$29.20
3: RDF=0.98	\$16.37	\$18.03	\$19.82	\$21.63	\$30.73
4: If PRC<2500 RTOFFCAP=0	\$15.62	\$17.26	\$18.83	\$20.67	\$29.50
6: X=RRS+URS VOLL=18000	\$129.23	\$140.24	\$152.56	\$171.55	\$318.40
7: X=RRS+URS Price Floor	\$98.38	\$105.00	\$116.63	\$128.59	\$196.23
8: X=2300 VOLL=12000	\$31.05	\$34.13	\$37.34	\$41.89	\$57.84
9: X=2750 VOLL=18000	\$74.61	\$80.34	\$87.97	\$99.23	\$154.39
10: X=1708 VOLL=18000	\$19.70	\$21.60	\$22.73	\$24.78	\$34.86

Table 31. Energy and Time Weighted RTORPA Sensitivity to Market Behavior (2011)





Figure 29. Time Weighted RTORPA Sensitivity to Market Behavior (2011)

Option	Price Response @ \$75	Price Response when Price > \$75 for 2+ Hours	Price Response @ \$250	Price Response when Price > \$250 for 2+ Hours	No Price Response
1: Base Case	\$9.93	\$11.50	\$12.91	\$14.55	\$20.82
3: RDF=0.98	\$10.48	\$12.19	\$13.70	\$15.47	\$21.98
4: If PRC<2500 RTOFFCAP=0	\$9.98	\$11.69	\$12.96	\$14.75	\$21.09
6: X=RRS+URS VOLL=18000	\$80.92	\$92.20	\$103.98	\$123.48	\$256.98
7: X=RRS+URS Price Floor	\$63.10	\$69.89	\$81.08	\$93.46	\$151.79
8: X=2300 VOLL=12000	\$19.66	\$22.90	\$25.68	\$30.24	\$42.13
9: X=2750 VOLL=18000	\$46.75	\$52.75	\$59.89	\$71.55	\$118.12
10: X=1708 VOLL=18000	\$12.32	\$14.27	\$15.12	\$17.12	\$24.30

Table 32. Time Weighted RTORPA Sensitivity to Market Behavior (2011)





Figure 30. Additional Peaker Net Margin from ORDC Sensitivity to Market Behavior (2011)

Option	Price Response @ \$75	Price Response when Price > \$75 for 2+ Hours	Price Response @ \$250	Price Response when Price > \$250 for 2+ Hours	No Price Response
1: Base Case	\$83,623.92	\$97,350.80	\$109,674.28	\$124,043.89	\$178,959.31
3: RDF=0.98	\$88,157.10	\$103,104.27	\$116,363.82	\$131,866.99	\$188,855.42
4: If PRC<2500 RTOFFCAP=0	\$84,066.63	\$99,010.41	\$110,134.02	\$125,865.82	\$181,385.05
6: X=RRS+URS VOLL=18000	\$692,719.97	\$791,496.48	\$894,689.13	\$1,065,525.65	\$2,234,961.82
7: X=RRS+URS Price Floor	\$538,780.82	\$598,214.40	\$696,304.42	\$804,706.81	\$1,315,720.45
8: X=2300 VOLL=12000	\$166,573.81	\$195,036.08	\$219,345.77	\$259,280.09	\$363,466.42
9: X=2750 VOLL=18000	\$399,382.10	\$451,969.63	\$514,522.44	\$616,612.57	\$1,024,588.17
10: X=1708 VOLL=18000	\$105,018.20	\$122,115.42	\$129,587.81	\$147,093.73	\$209,985.04

Table 33. Additional Peaker Net Margin from ORDC Sensitivity to Market Behavior (2011)



## Section 4: Add Demand Curves to DAM – Snapshot from August 13, 2015 Online ORDC Curve as an Example (Option 2)

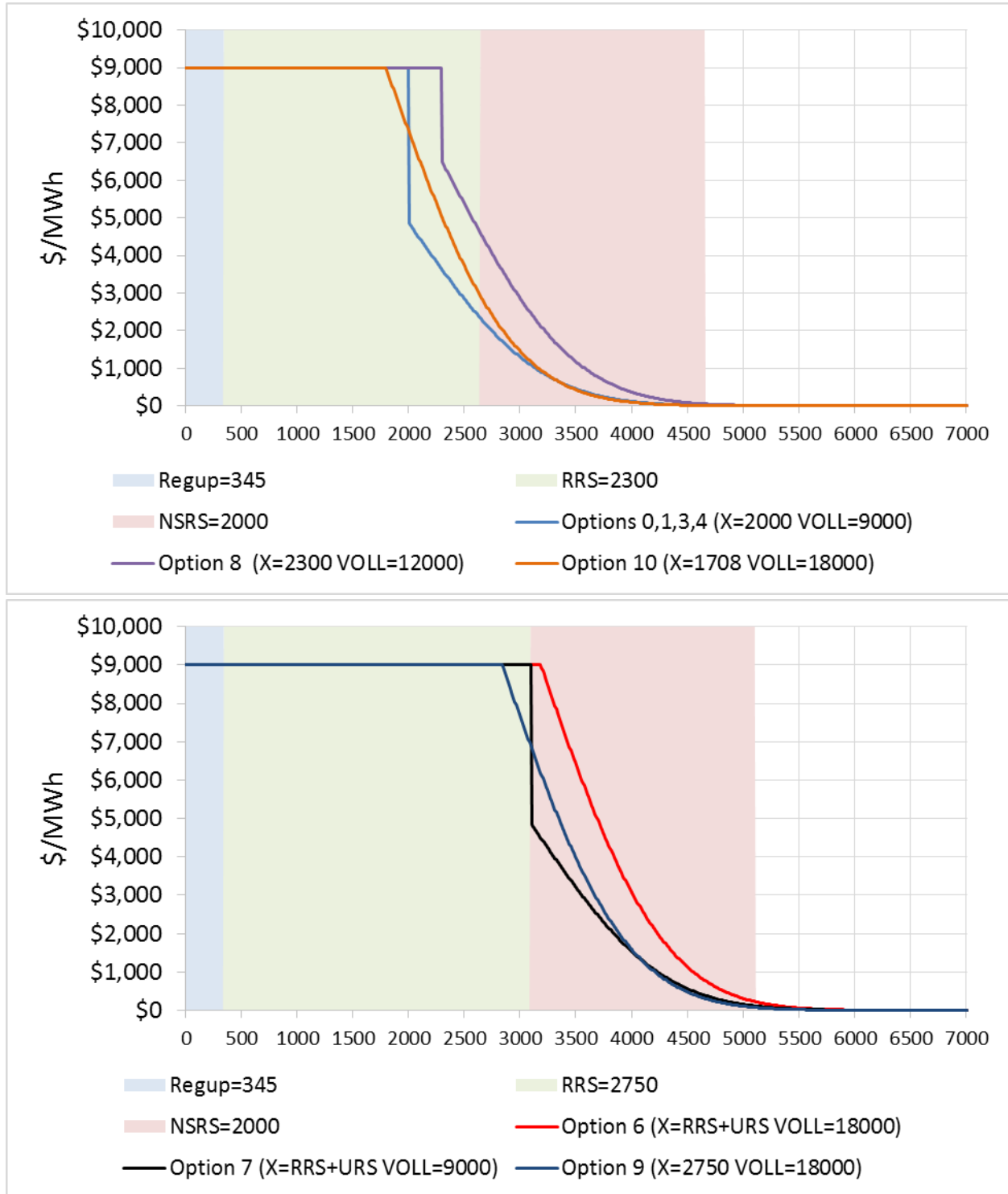


Figure 31. August 13, 2015 HE17 Online ORDC Curve (VOLL \* LOLPs) Overlaid with AS Requirements





Penalty Price of AS Demand Curve for last MW of AS requirement in DAM using August 13, 2015 HE17 Online ORDC Curve as an example								
Ancillary Service Type	Total AS (Last MW)	Options 0,1,3,4 X=2000 VOLL=9000	Option 6 X=RRS+URS VOLL=18000	Option 7 X=RRS+URS VOLL=9000	Option 8 X=2300 VOLL=12000	Option 9 X=2750 VOLL=18000	Option 10 X=1708 VOLL=18000	
URS	345	\$9,000	\$9,000	\$9,000	\$9,000	\$9,000	\$9,000	
RRS=2300	RRS	2645	\$2,318	N/A	N/A	\$4,577	N/A	\$2,898
	NSRS	4645	\$13	N/A	N/A	\$51	N/A	\$8
RRS=2750	RRS	3095	N/A	\$9,000	\$4,857	N/A	\$6,866	N/A
	NSRS	5095	N/A	\$234	\$117	N/A	\$77	N/A

Table 34. Penalty Price of AS Demand Curve for last MW of AS Requirement in DAM using August 13, 2015 HE17 Online ORDC Curve as an Example

### Example for options 0,1,3,4

Last MW of URS = 345 MW where price would be \$9,000/MWh on the curve

Last MW of RRS = 345 + 2300 = 2645 MW where price would be \$2,319/MWh on the curve

Last MW of NSRS = 345 + 2300 + 2000 = 4645 MW where price would be \$13/MWh on the curve



## Section 5: X = URS + RRS – A look at the 2016 AS Methodology Values (Options 6 & 7)

### Without RRS Floor

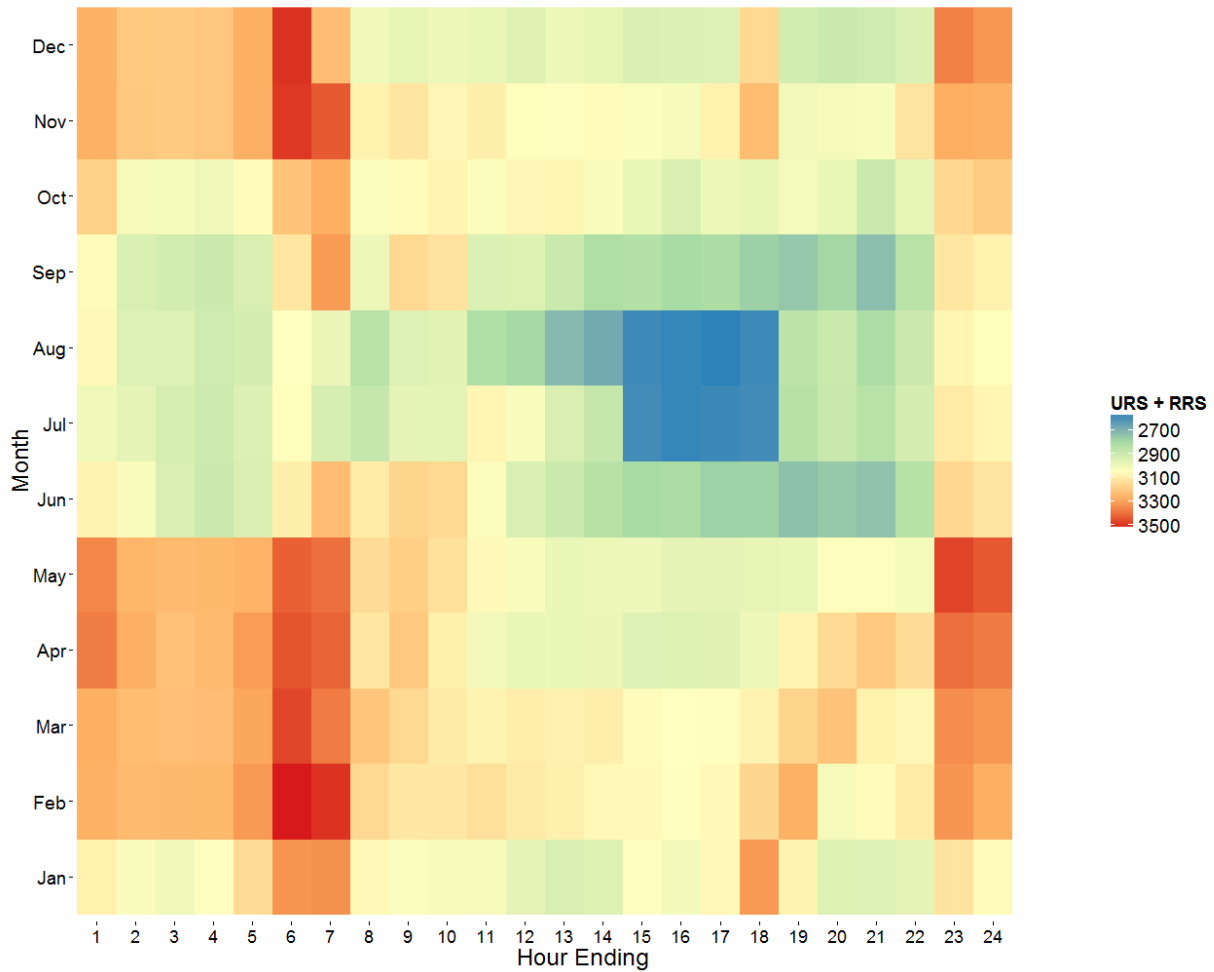


Figure 32. Heat map of URS + RRS without RRS floor from 2016 AS Methodology



URS+RRS without 2750 MW RRS Floor												2016
HE	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3088	3273	3282	3380	3361	3079	3008	3067	3056	3183	3272	3268
2	3030	3245	3239	3277	3261	3031	2972	2954	2940	3018	3208	3204
3	3008	3252	3234	3228	3250	2941	2932	2952	2921	3020	3198	3199
4	3042	3253	3241	3247	3253	2898	2907	2909	2903	3004	3211	3211
5	3149	3326	3297	3319	3267	2939	2947	2927	2938	3059	3277	3281
6	3332	3524	3474	3452	3433	3092	3053	3047	3118	3221	3494	3500
7	3343	3501	3382	3429	3404	3242	2931	2990	3322	3282	3443	3242
8	3062	3157	3216	3117	3150	3108	2882	2846	2997	3038	3088	3002
9	3034	3111	3159	3203	3188	3173	2974	2954	3162	3054	3124	2977
10	3022	3115	3102	3091	3135	3158	2970	2964	3131	3078	3073	2998
11	3018	3137	3079	3010	3061	3038	3072	2823	2945	3036	3093	2986
12	2974	3104	3096	2986	3032	2942	3027	2799	2950	3074	3053	2955
13	2941	3089	3083	2992	2988	2901	2940	2717	2896	3071	3039	2996
14	2949	3066	3095	2990	2994	2843	2884	2676	2823	3029	3058	2977
15	3043	3061	3056	2954	2997	2804	2596	2589	2833	2991	3036	2943
16	3011	3046	3047	2950	2974	2807	2580	2580	2805	2938	3022	2944
17	3066	3062	3049	2955	2975	2780	2587	2570	2815	2994	3086	2953
18	3323	3168	3079	2997	2977	2781	2594	2590	2776	2983	3240	3162
19	3080	3271	3172	3077	2987	2738	2843	2864	2754	3012	3010	2922
20	2949	3018	3223	3153	3051	2757	2890	2894	2795	2991	3019	2892
21	2953	3057	3086	3203	3051	2742	2846	2818	2730	2896	3025	2910
22	2972	3108	3070	3147	3021	2840	2926	2898	2847	2979	3125	2946
23	3128	3334	3351	3407	3479	3163	3108	3072	3118	3163	3284	3376
24	3058	3282	3329	3384	3446	3121	3072	3053	3086	3195	3274	3330

Table 35. URS + RRS without RRS floor from 2016 AS Methodology



### With RRS Floor of 2,750 MW

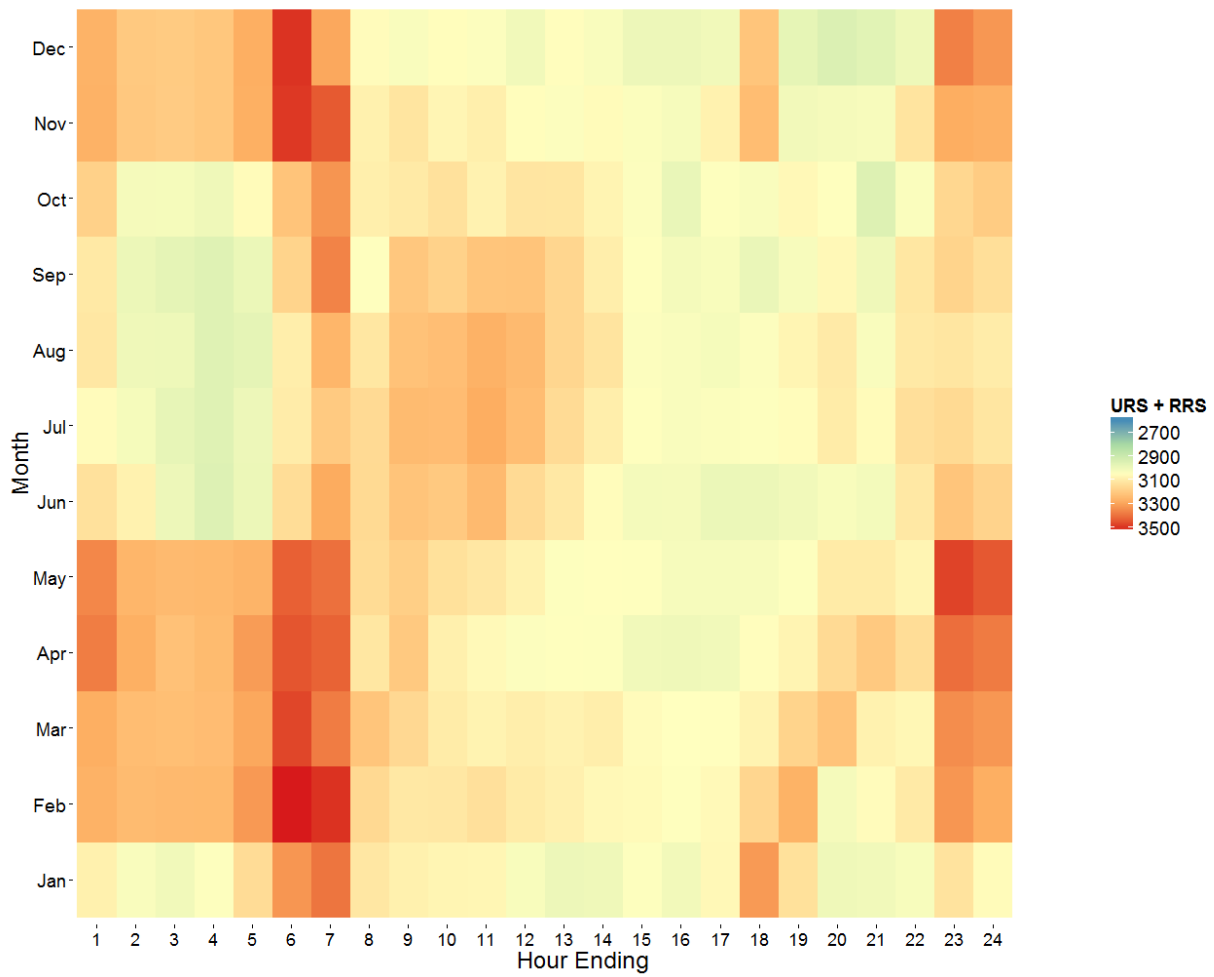


Figure 33. Heat map of URS + RRS with RRS floored at 2750 MW from 2016 AS Methodology



URS+RRS with 2750 MW RRS Floor												2016
HE	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3088	3273	3282	3380	3361	3133	3056	3115	3110	3183	3272	3268
2	3030	3245	3239	3277	3261	3085	3020	3002	2994	3018	3208	3204
3	3008	3252	3234	3228	3250	2995	2980	3000	2975	3020	3198	3199
4	3042	3253	3241	3247	3253	2952	2955	2957	2957	3004	3211	3211
5	3149	3326	3297	3319	3267	2993	2995	2975	2992	3059	3277	3281
6	3332	3524	3474	3452	3433	3146	3101	3095	3172	3221	3494	3500
7	3343	3501	3382	3429	3404	3290	3202	3261	3370	3336	3443	3296
8	3062	3157	3216	3117	3150	3156	3153	3117	3045	3092	3088	3056
9	3034	3111	3159	3203	3188	3221	3245	3225	3210	3108	3124	3031
10	3022	3115	3102	3091	3135	3206	3241	3235	3179	3132	3073	3052
11	3018	3137	3079	3064	3115	3250	3284	3273	3216	3084	3093	3040
12	2974	3104	3096	3040	3086	3154	3239	3249	3221	3122	3053	3009
13	2941	3089	3083	3046	3042	3113	3152	3167	3167	3119	3039	3050
14	2949	3066	3095	3044	3048	3055	3096	3126	3094	3077	3058	3031
15	3043	3061	3056	3008	3045	3016	3046	3039	3045	3039	3036	2997
16	3011	3046	3047	3004	3022	3019	3030	3030	3017	2986	3022	2998
17	3066	3062	3049	3009	3023	2992	3037	3020	3027	3042	3086	3007
18	3323	3168	3079	3051	3025	2993	3044	3040	2988	3031	3240	3216
19	3080	3271	3172	3077	3041	3009	3055	3076	3025	3066	3010	2976
20	2949	3018	3223	3153	3105	3028	3102	3106	3066	3045	3019	2946
21	2953	3057	3086	3203	3105	3013	3058	3030	3001	2950	3025	2964
22	2972	3108	3070	3147	3075	3111	3138	3110	3118	3033	3125	3000
23	3128	3334	3351	3407	3479	3217	3156	3120	3172	3163	3284	3376
24	3058	3282	3329	3384	3446	3175	3120	3101	3140	3195	3274	3330

Table 36. URS + RRS with RRS floored at 2750 MW from 2016 AS Methodology



URS Requirements												2016
HE	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	280	273	282	380	361	383	306	365	360	375	272	268
2	222	245	239	277	261	335	270	252	244	210	208	204
3	200	252	234	228	250	245	230	250	225	212	198	199
4	234	253	241	247	253	202	205	207	207	196	211	211
5	341	326	297	319	267	243	245	225	242	251	277	281
6	524	524	474	452	433	396	351	345	422	413	494	500
7	647	693	574	621	596	540	452	511	620	586	635	546
8	366	349	408	309	342	406	403	367	295	342	280	306
9	338	303	351	395	380	471	495	475	460	358	316	281
10	326	307	294	283	327	456	491	485	429	382	265	302
11	322	329	271	314	365	500	534	523	466	334	285	290
12	278	296	288	290	336	404	489	499	471	372	245	259
13	245	281	275	296	292	363	402	417	417	369	231	300
14	253	258	287	294	298	305	346	376	344	327	250	281
15	235	253	248	258	295	266	296	289	295	289	228	247
16	203	238	239	254	272	269	280	280	267	236	214	248
17	258	254	241	259	273	242	287	270	277	292	278	257
18	515	360	271	301	275	243	294	290	238	281	432	466
19	384	463	364	269	291	259	305	326	275	316	202	226
20	253	210	415	345	355	278	352	356	316	295	211	196
21	257	249	278	395	355	263	308	280	251	200	217	214
22	276	300	262	339	325	361	388	360	368	283	317	250
23	320	334	351	407	479	467	406	370	422	355	284	376
24	250	282	329	384	446	425	370	351	390	387	274	330
RRS Requirements												2016
HE	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2808	3000	3000	3000	3000	2696	2702	2702	2696	2808	3000	3000
2	2808	3000	3000	3000	3000	2696	2702	2702	2696	2808	3000	3000
3	2808	3000	3000	3000	3000	2696	2702	2702	2696	2808	3000	3000
4	2808	3000	3000	3000	3000	2696	2702	2702	2696	2808	3000	3000
5	2808	3000	3000	3000	3000	2696	2702	2702	2696	2808	3000	3000
6	2808	3000	3000	3000	3000	2696	2702	2702	2696	2808	3000	3000
7	2696	2808	2808	2808	2808	2702	2479	2479	2702	2696	2808	2696
8	2696	2808	2808	2808	2808	2702	2479	2479	2702	2696	2808	2696
9	2696	2808	2808	2808	2808	2702	2479	2479	2702	2696	2808	2696
10	2696	2808	2808	2808	2808	2702	2479	2479	2702	2696	2808	2696
11	2696	2808	2808	2696	2696	2538	2538	2300	2479	2702	2808	2696
12	2696	2808	2808	2696	2696	2538	2538	2300	2479	2702	2808	2696
13	2696	2808	2808	2696	2696	2538	2538	2300	2479	2702	2808	2696
14	2696	2808	2808	2696	2696	2538	2538	2300	2479	2702	2808	2696
15	2808	2808	2808	2696	2702	2538	2300	2300	2538	2702	2808	2696
16	2808	2808	2808	2696	2702	2538	2300	2300	2538	2702	2808	2696
17	2808	2808	2808	2696	2702	2538	2300	2300	2538	2702	2808	2696
18	2808	2808	2808	2696	2702	2538	2300	2300	2538	2702	2808	2696
19	2696	2808	2808	2808	2696	2479	2538	2538	2479	2696	2808	2696
20	2696	2808	2808	2808	2696	2479	2538	2538	2479	2696	2808	2696
21	2696	2808	2808	2808	2696	2479	2538	2538	2479	2696	2808	2696
22	2696	2808	2808	2808	2696	2479	2538	2538	2479	2696	2808	2696
23	2808	3000	3000	3000	3000	2696	2702	2702	2696	2808	3000	3000
24	2808	3000	3000	3000	3000	2696	2702	2702	2696	2808	3000	3000

Table 37. Individual URS and RRS tables from 2016 AS Methodology Requirements

