



Item 5: Independent Market Monitor (IMM) Report

Beth Garza
IMM Report

Board of Directors Meeting

ERCOT Public
December 13, 2016

A walk back through 2016

- February: Summary of 2015
- April: Negative Prices
- June: ORDC impacts on price
- August: Key mid-year metrics
- October: RMR

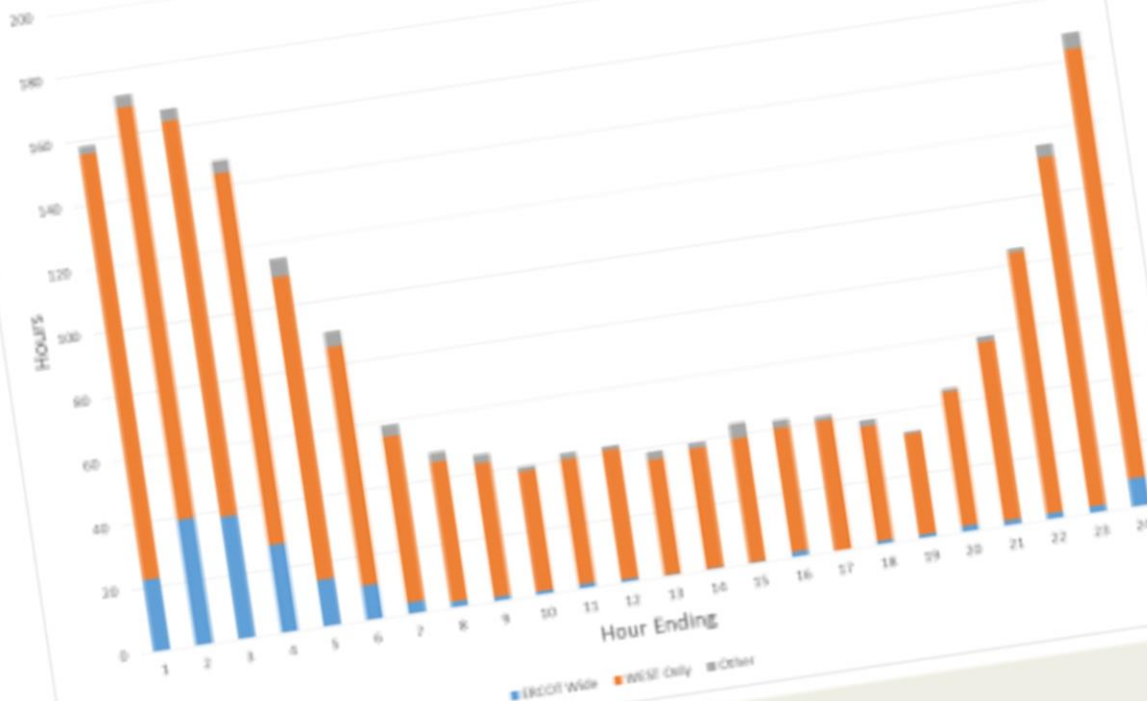


Updates through October

	2015	2016
Real Time Prices		
Jan - Oct	28.14	24.77
Annual	26.77	
Natural Gas		
Jan – Oct	2.69	2.34
Annual	2.57	

Negative Prices by Hour Ending

Negative Prices by Type and Hour



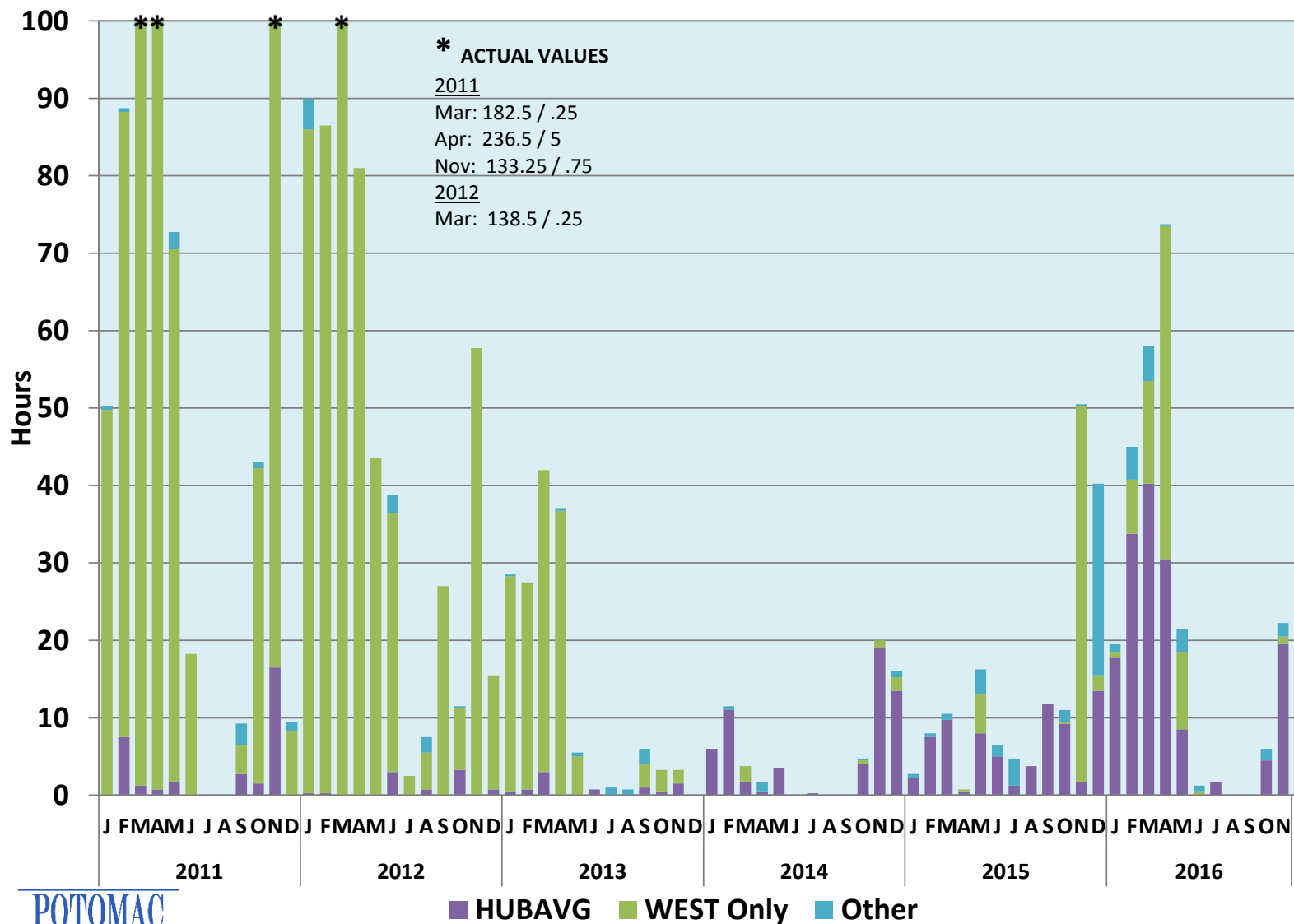
Tab X
ERCOT Public

Negative Price Events in ERCOT



Tab X
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Negative Prices by Location



ORDC expectations and limitations

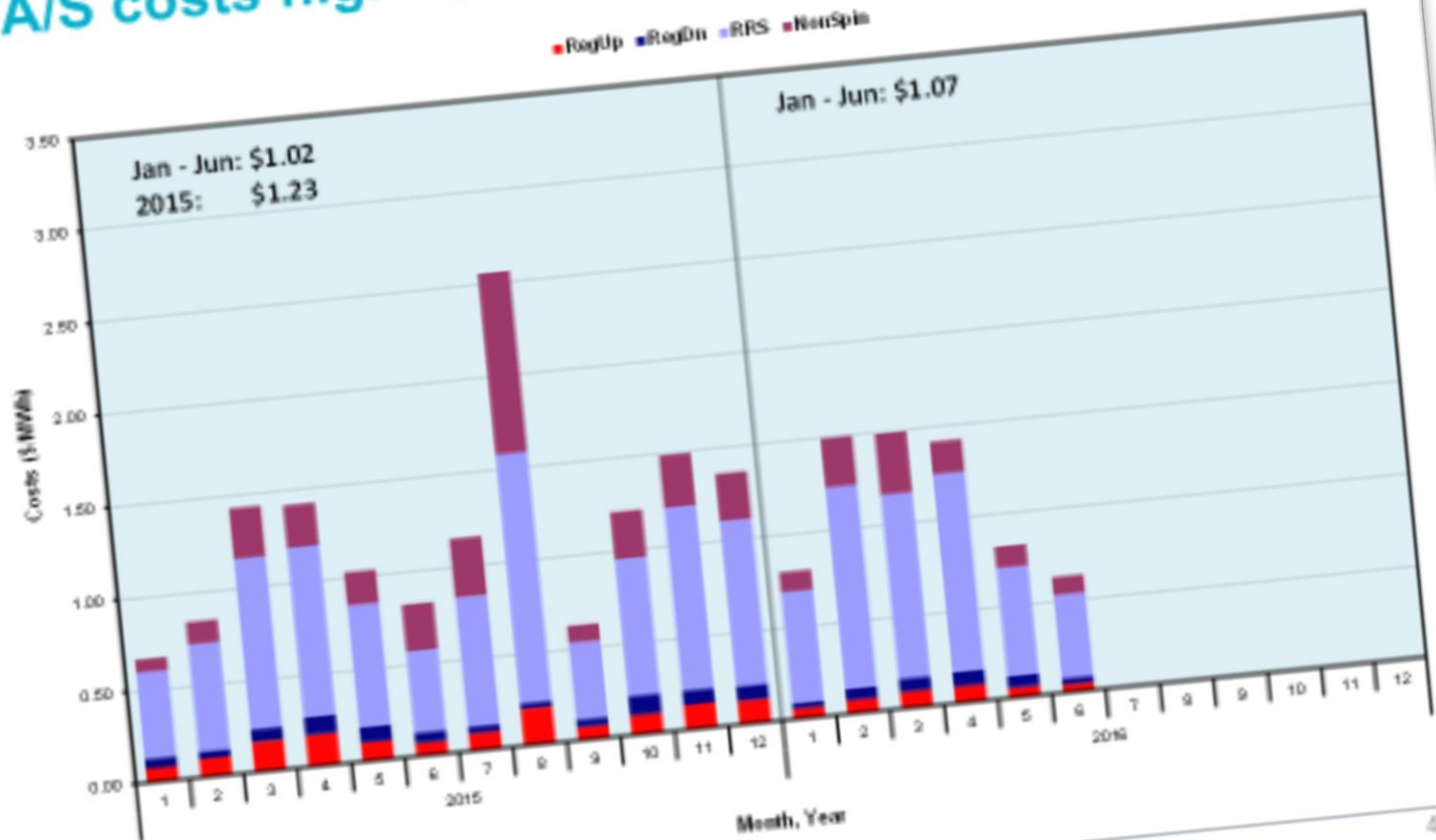
- The modest ORDC values to date are expected given surplus planning reserves and resulting sufficient operating reserves.
- ORDC values should be modest in most years as frequent shortages are only expected under unusually high load conditions or low supply availability.
- Regardless of the ORDC parameters selected, current market design does not allow for the graceful conversion of most operating reserves into energy.
- Co-optimization would ensure efficient shortage pricing and improve the utilization of ERCOT's resources.

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August

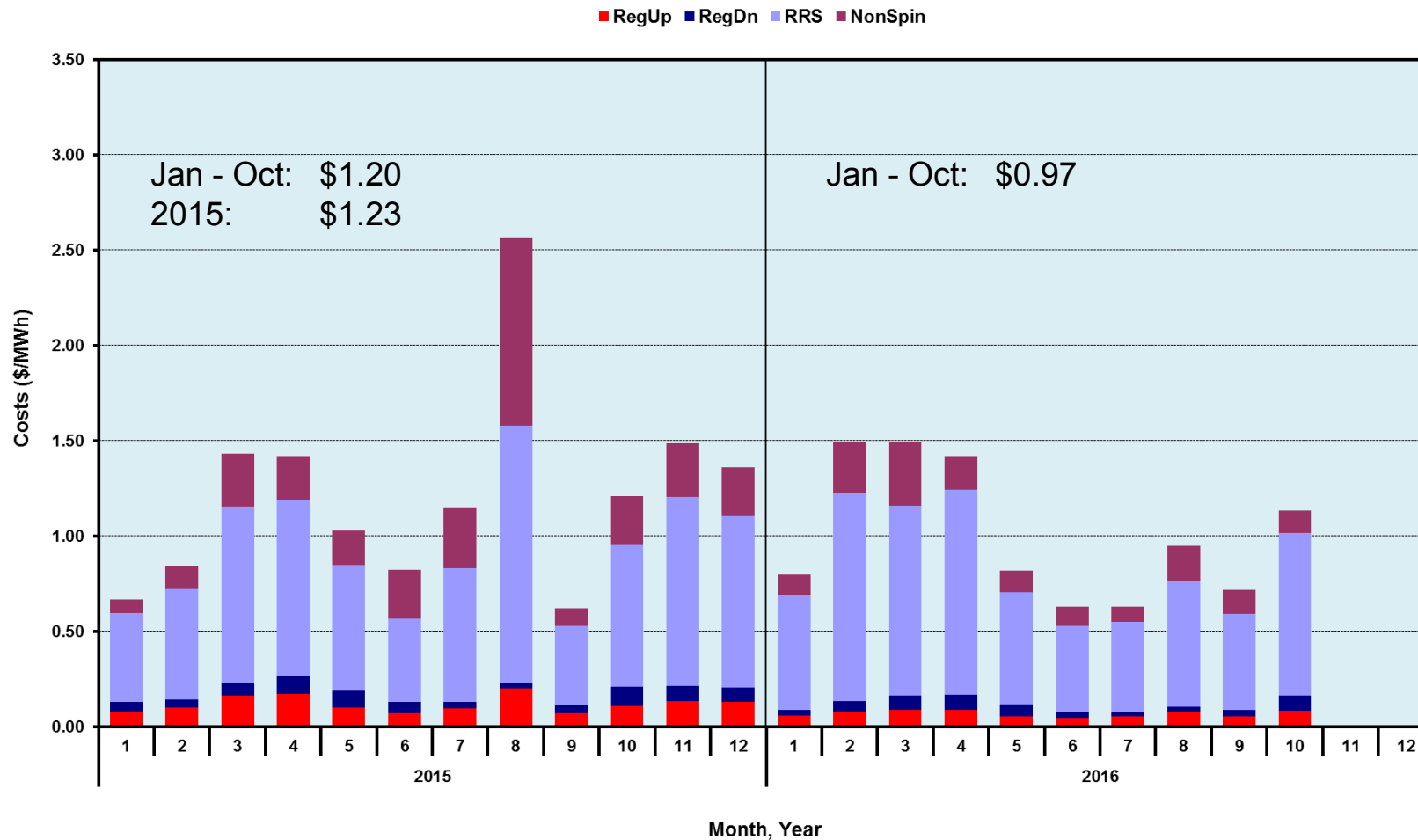
A/S costs higher, even with lower quantities



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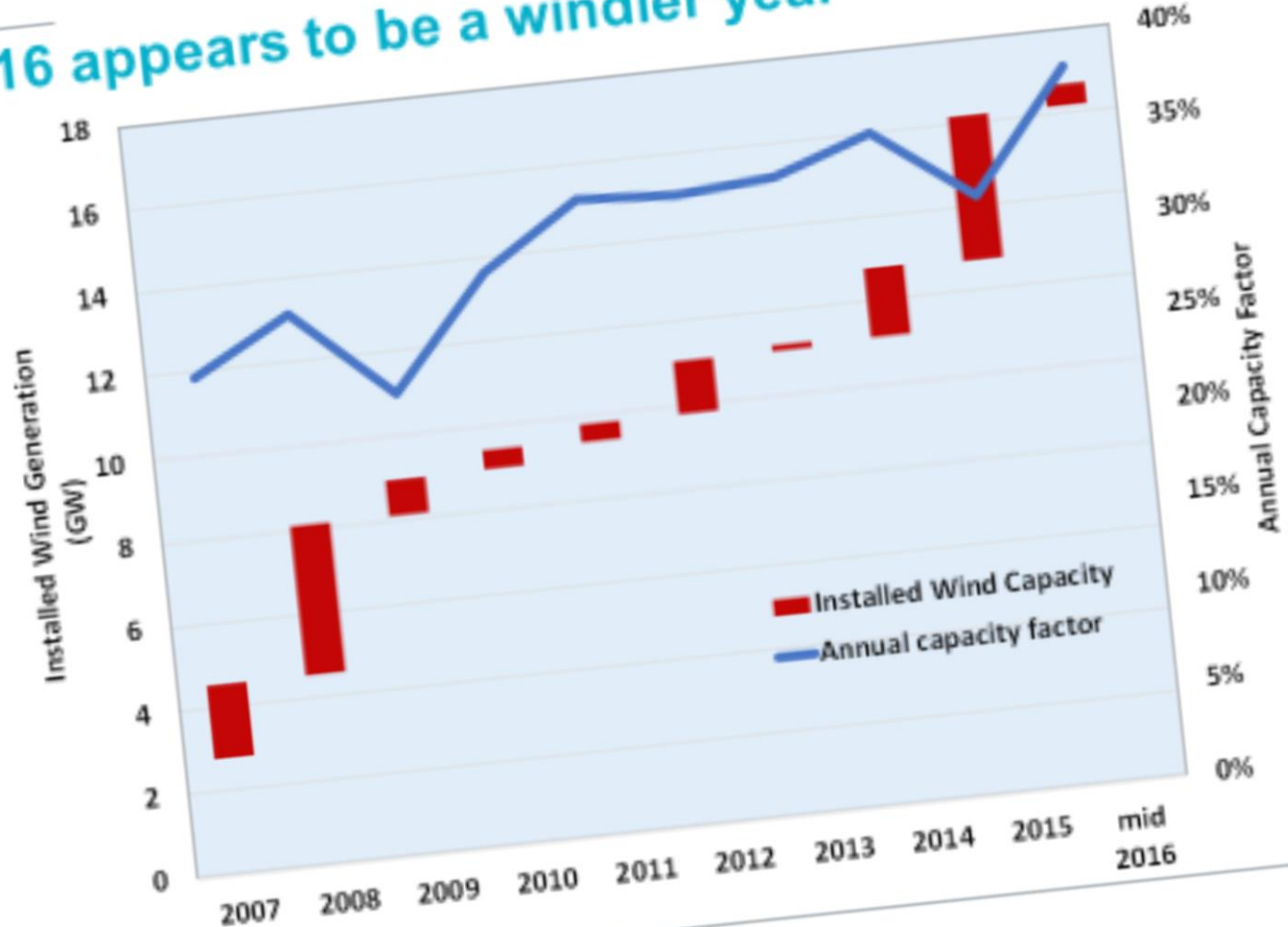
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Cost of Ancillary Services



August

2016 appears to be a windier year



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Potential drivers of higher wind capacity factors

- Improved wind turbine technology
- Access to higher wind locations in the Panhandle
- Less curtailment
- Higher average wind speeds

October – RMR

Issues / Improvements Needed

- **Probabilistic reliability assessment**
 - RMR costs balanced against benefits
 - Benefits = reduced probability of curtailing firm load, valued at \$9000 per MWh.
- **All RMR contracts to ERCOT Board for approval**
- **Ensure adequate review of potential RMR unit budgets and control over actual expenditures**

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To the Public Utility Commission of Texas

ERCOT Wholesale Electricity Market Monthly Report

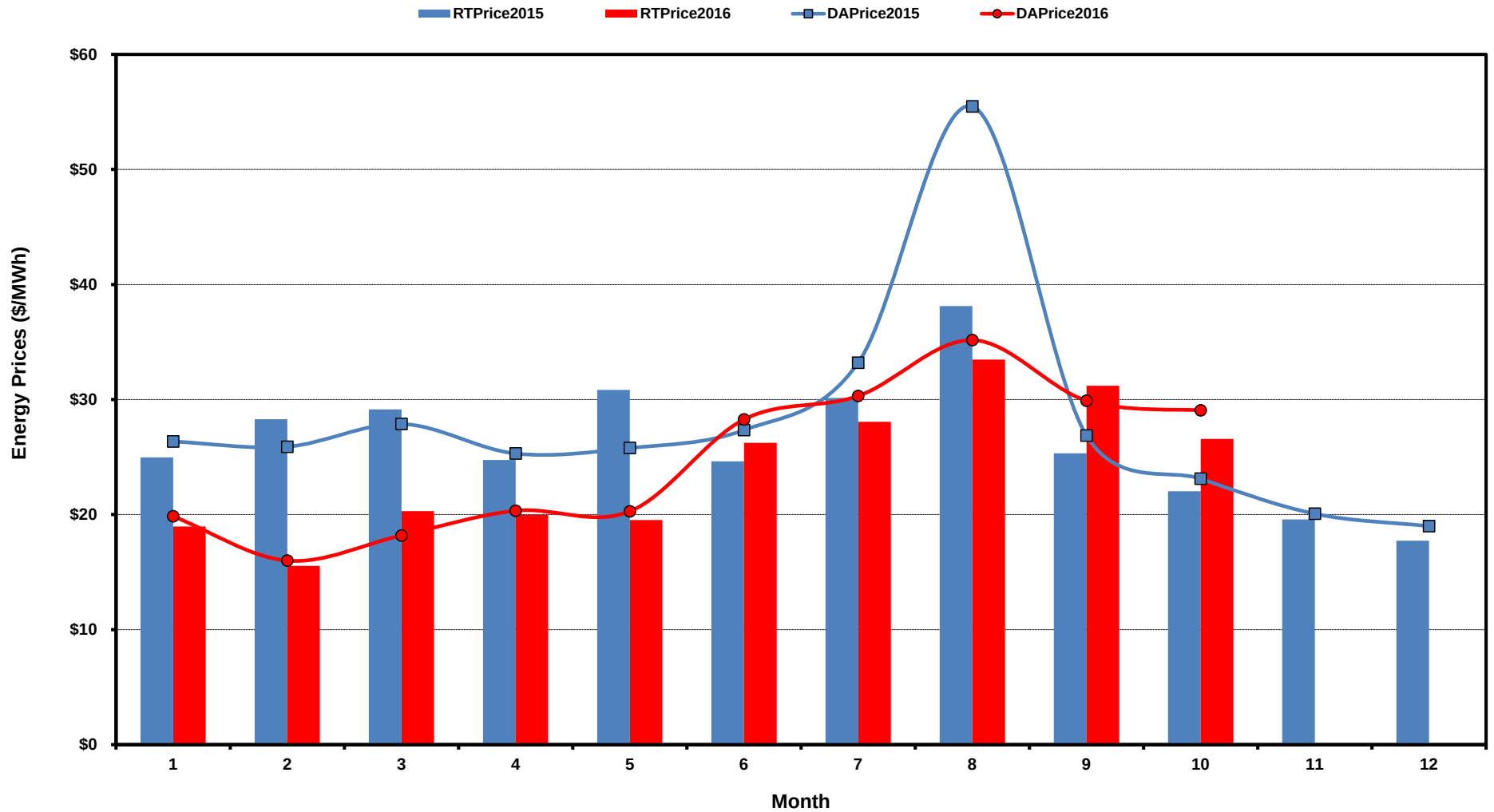
Monday, November 14, 2016

Potomac Economics, Ltd.
Independent Market Monitor

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ERCOT-wide Average Energy Prices DA vs RT

(avg. DA & RT SPPs weighted by Real Time Settlement Loads)



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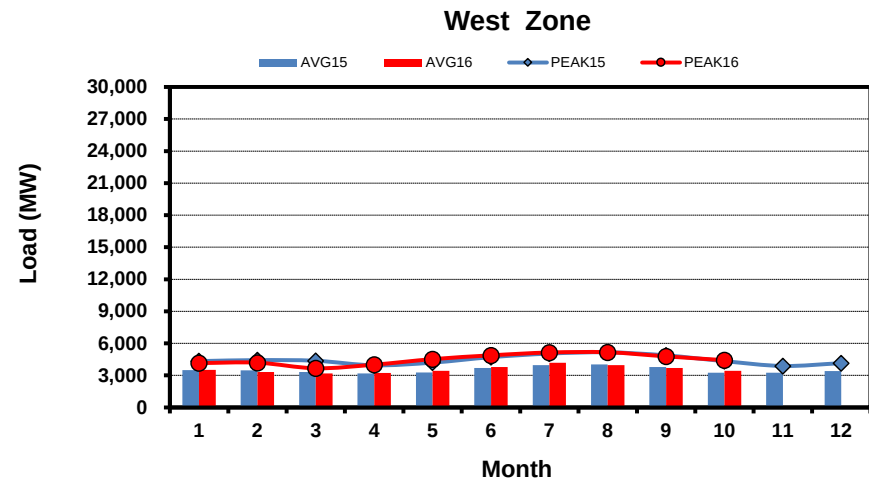
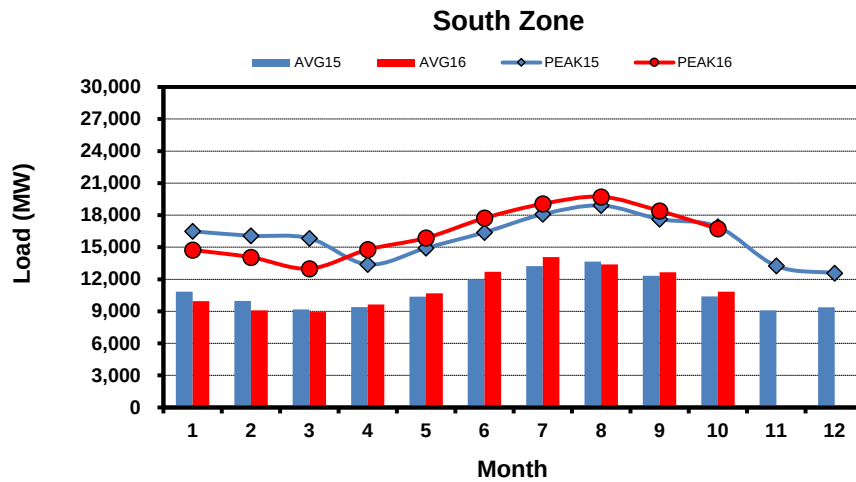
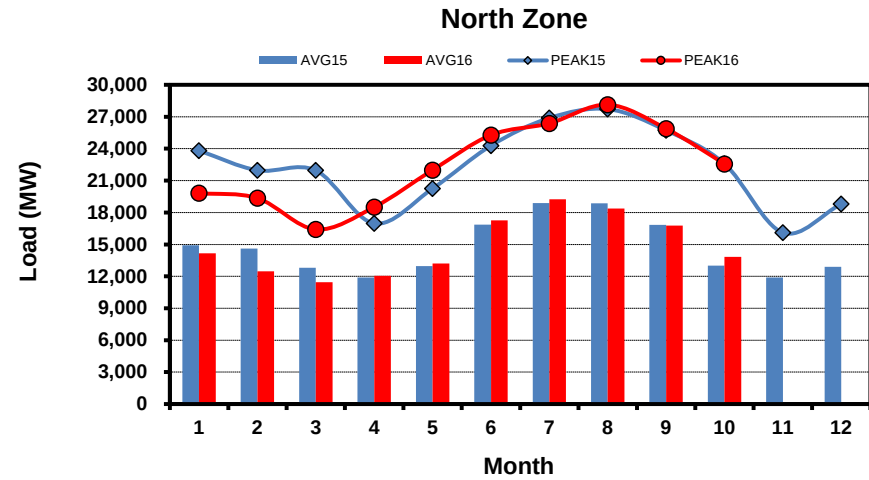
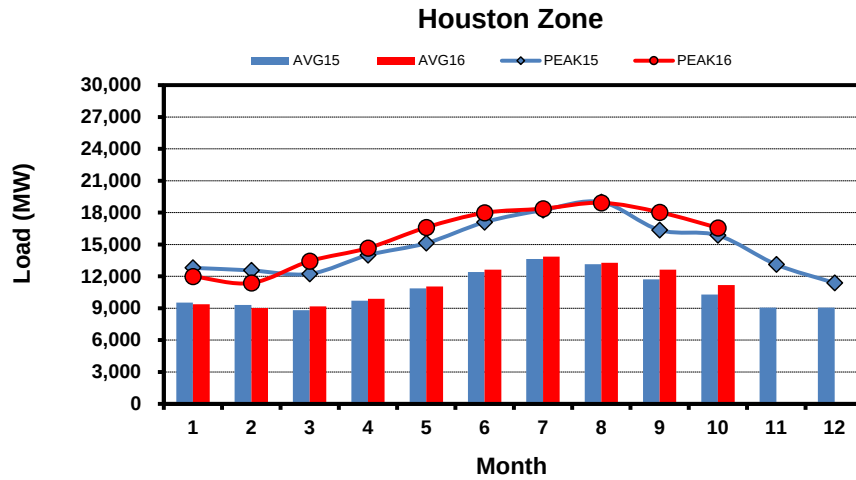
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Load Zone Load Statistics

(Nodal load zone made comparable to zonal sytem Load Zone definitions*)



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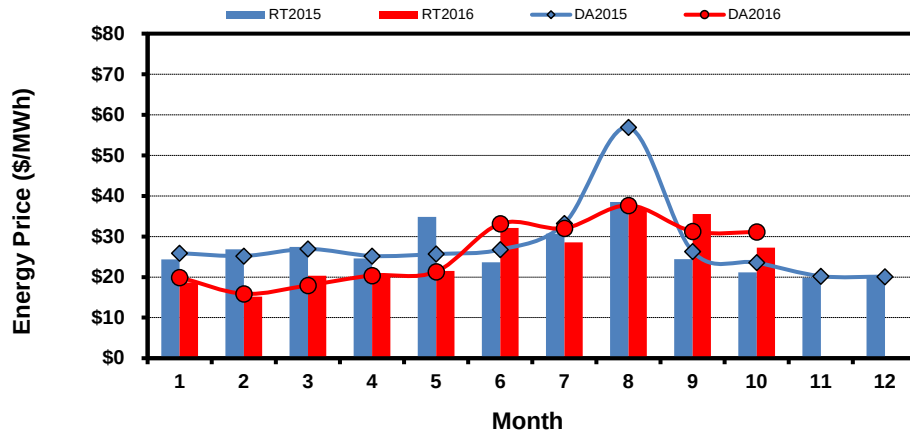
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Note: * Zonal load zone definition vs. Nodal comparable load zone definition: LZ_Houston=LZ_Houston; LZ_West=LZ_West; LZ_North=(LZ_North,LZ_RAYBN); LZ_South=(LZ_South,LZ_CPS,LZ_AEN,LZ_LCRA)

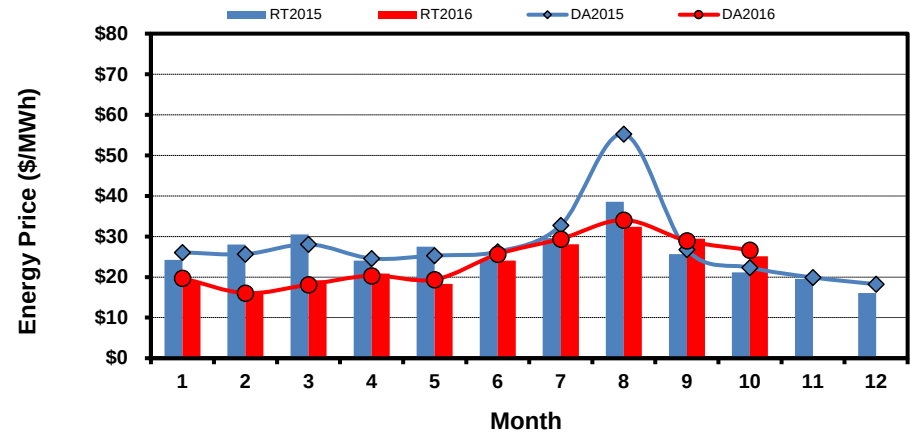
Load Zone Monthly Average Energy Price DA vs RT

(avg. DA & RT SPPs weighted by Real Time Settlement Loads)
(Nodal load zone made comparable to zonal sytem Load Zone definitions*)

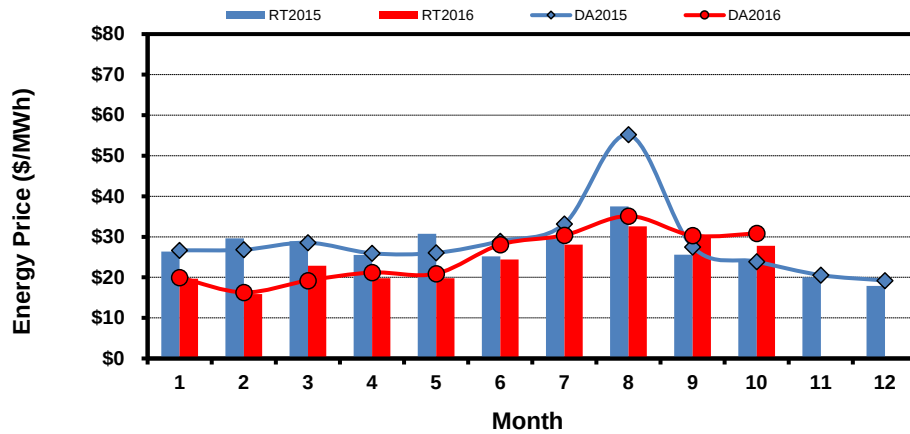
Houston Zone



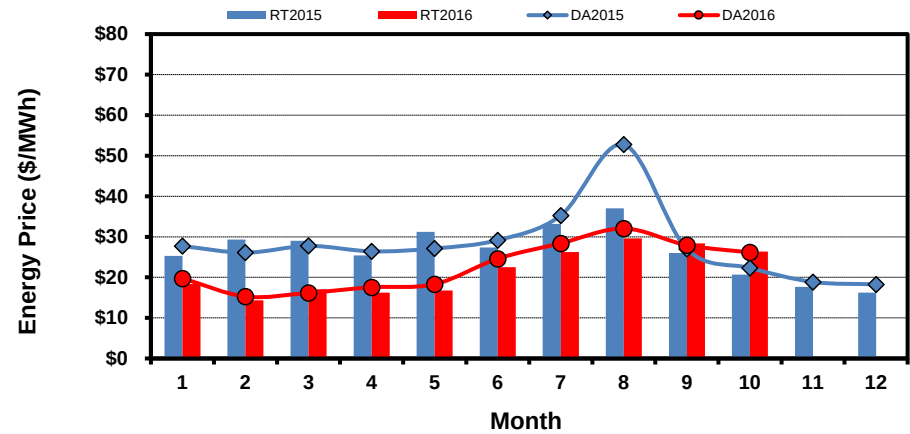
North Zone



South Zone



West Zone



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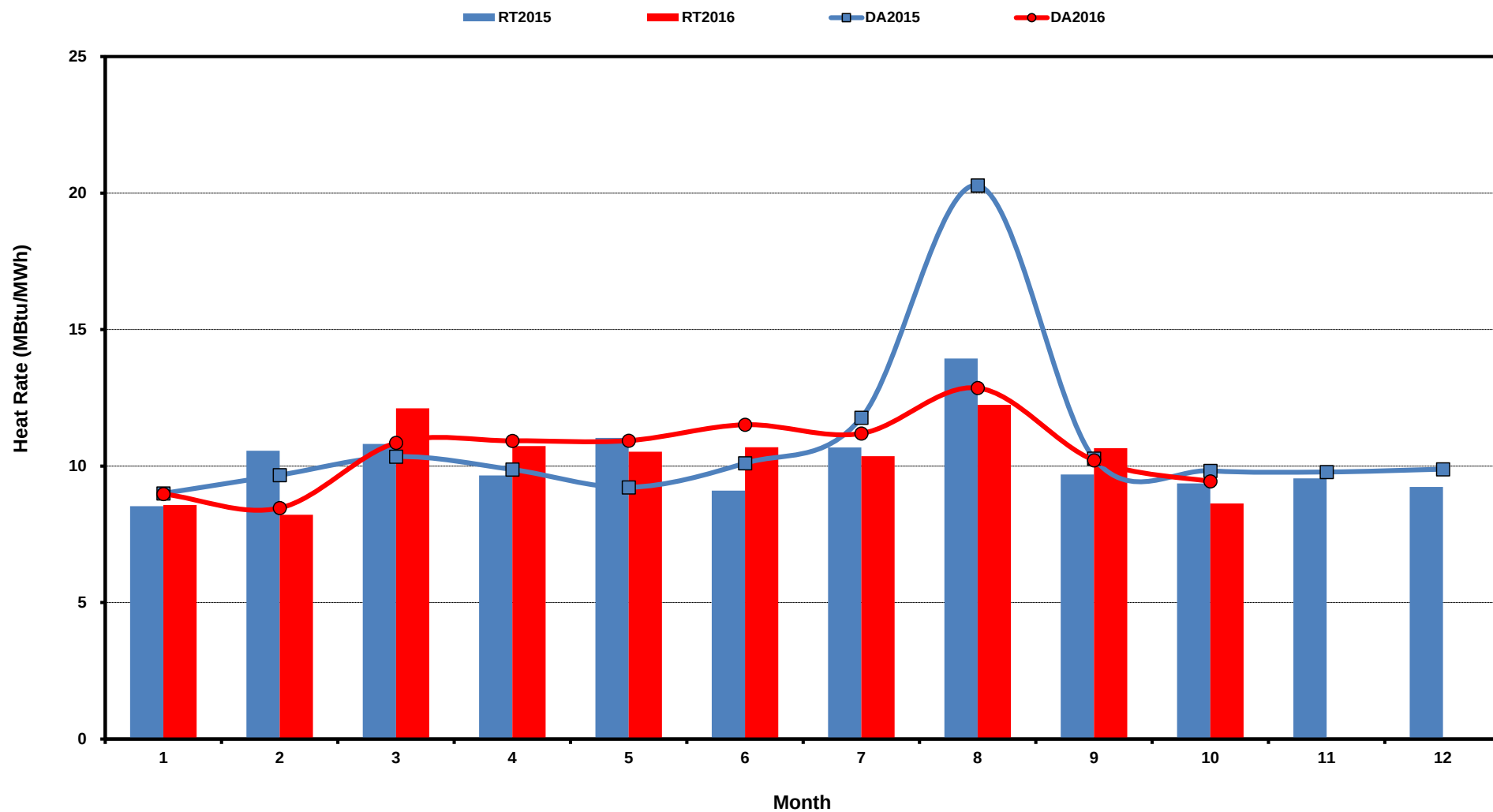
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Note: * Zonal load zone definition vs. Nodal comparable load zone definition: LZ_Houston=LZ_Houston; LZ_West=LZ_West; LZ_North=(LZ_North,LZ_RAYBN); LZ_South=(LZ_South,LZ_CPS,LZ_AEN,LZ_LCRA)

ERCOT-wide Monthly Implied Heat Rate DA vs RT

(avg. heat rates weighted by Real Time Settlement Loads)



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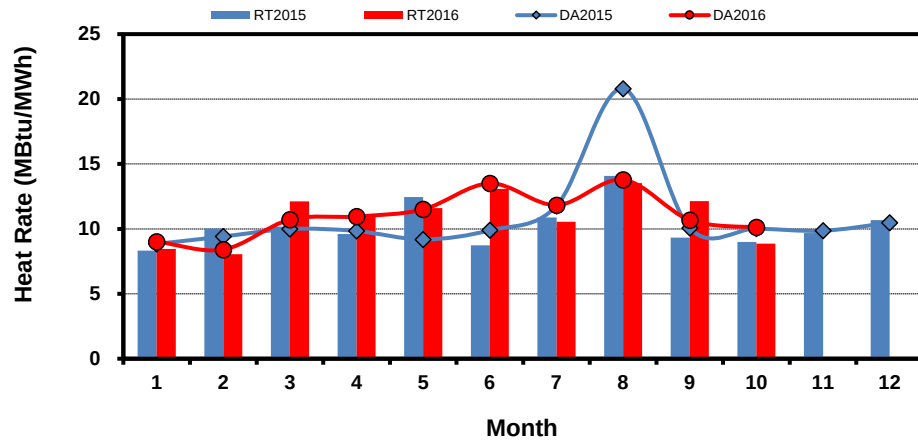
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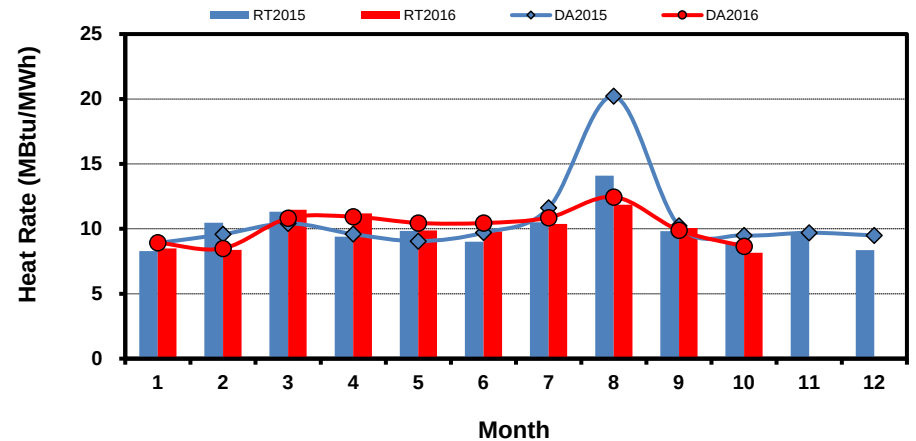
Load Zone Monthly Implied Heat Rate DA vs RT

(avg. heat rates weighted by Real Time Settlement Loads)
(Nodal load zone made comparable to zonal sytem Load Zone definitions*)

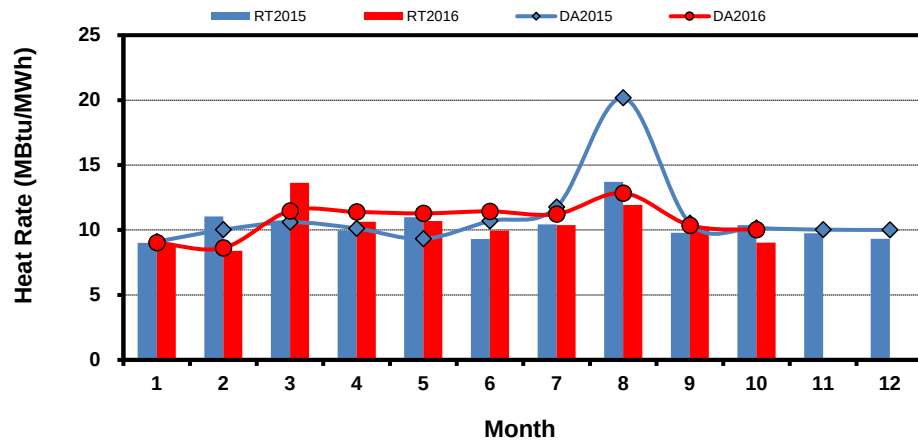
Houston Zone



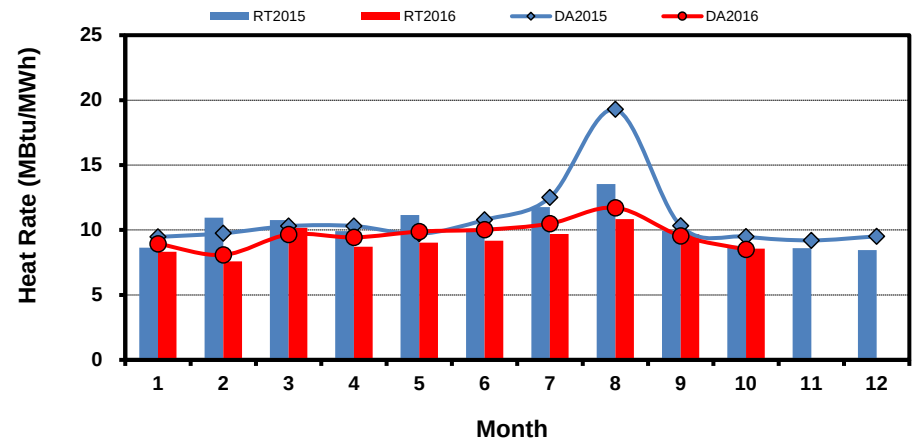
North Zone



South Zone



West Zone



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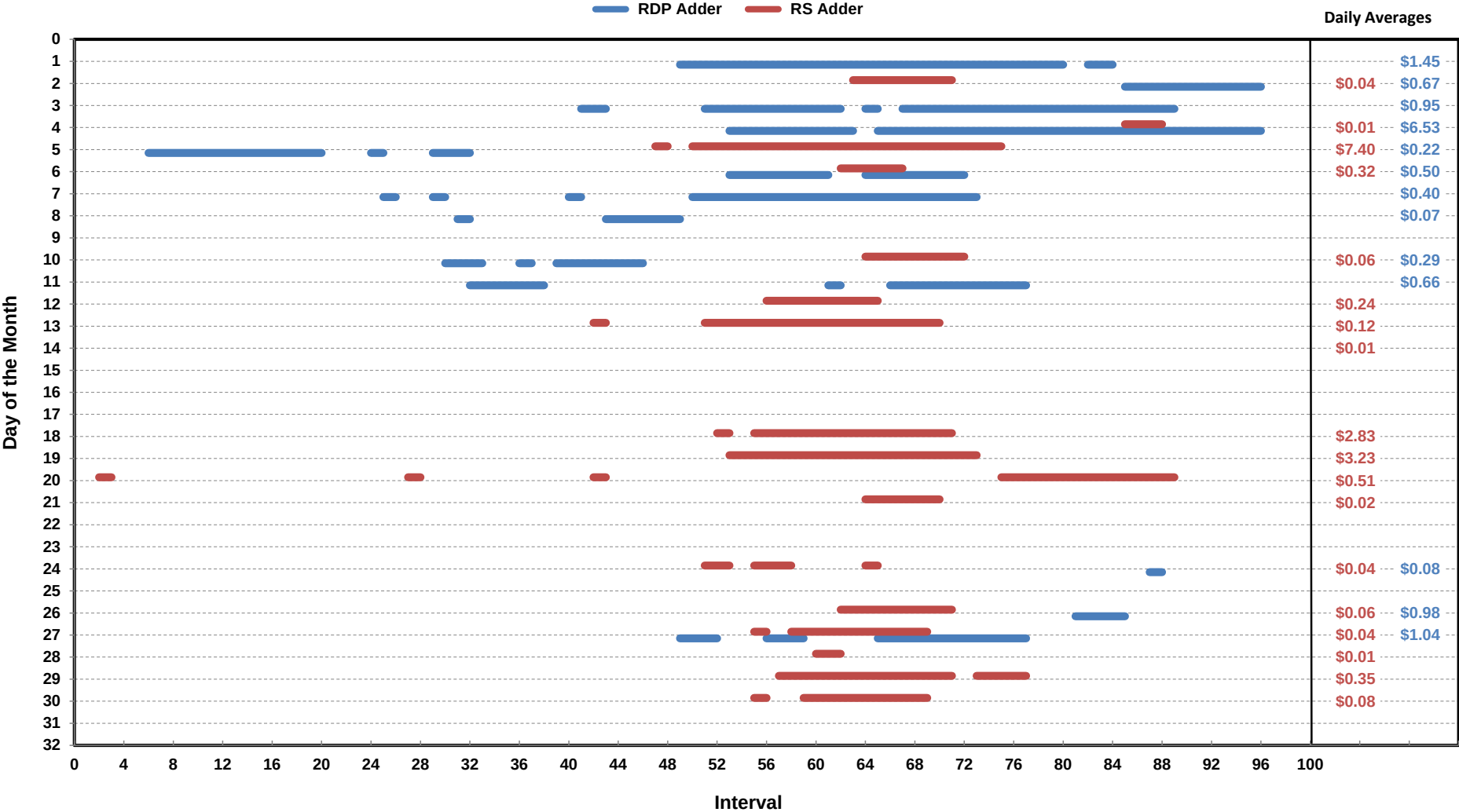
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Note: * Zonal load zone definition vs. Nodal comparable load zone definition: LZ_Houston=LZ_Houston; LZ_West=LZ_West; LZ_North=(LZ_North,LZ_RAYBN); LZ_South=(LZ_South,LZ_CPS,LZ_AEN,LZ_LCRA)

Daily ORDC Adders Average Values and Interval Duration
Oct-2016



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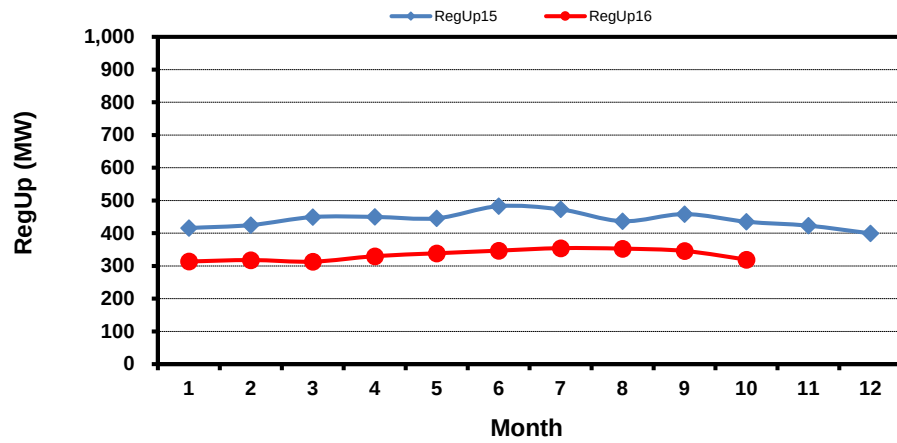
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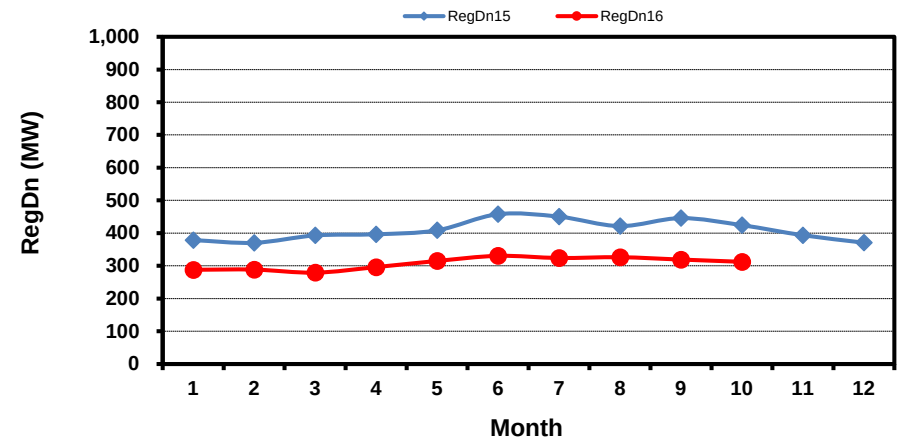
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Monthly Average of Ancillary Services Required MW

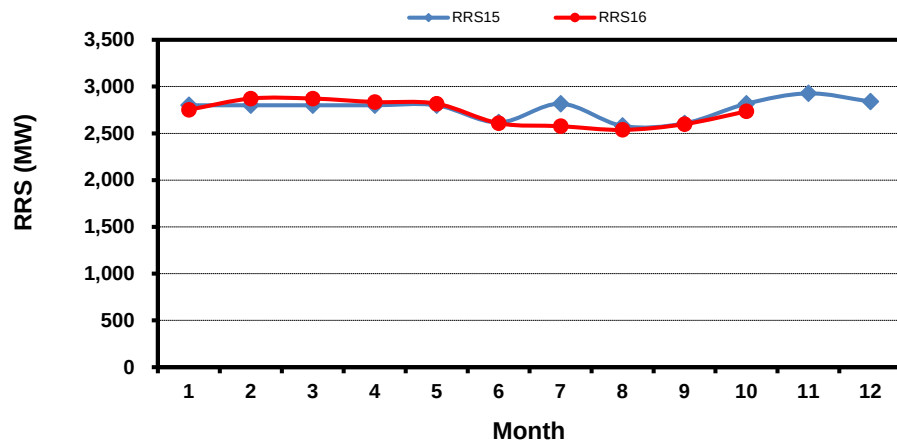
Regulation Up



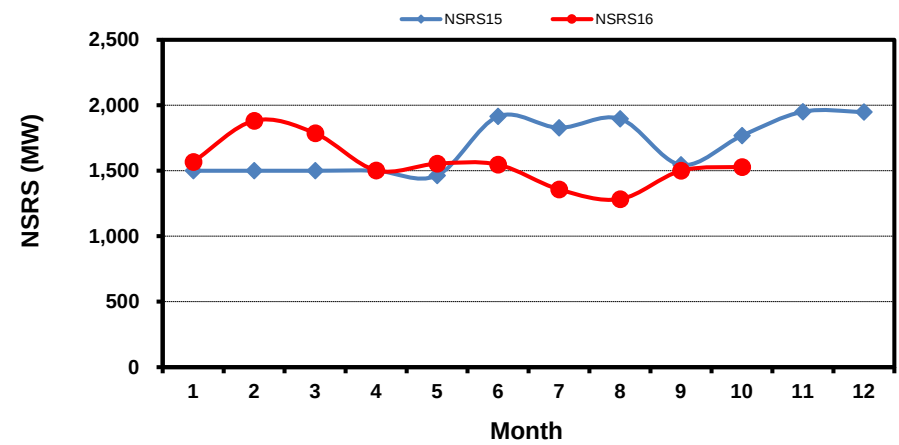
Regulation Down



Responsive Reserve



Non-Spin Reserve



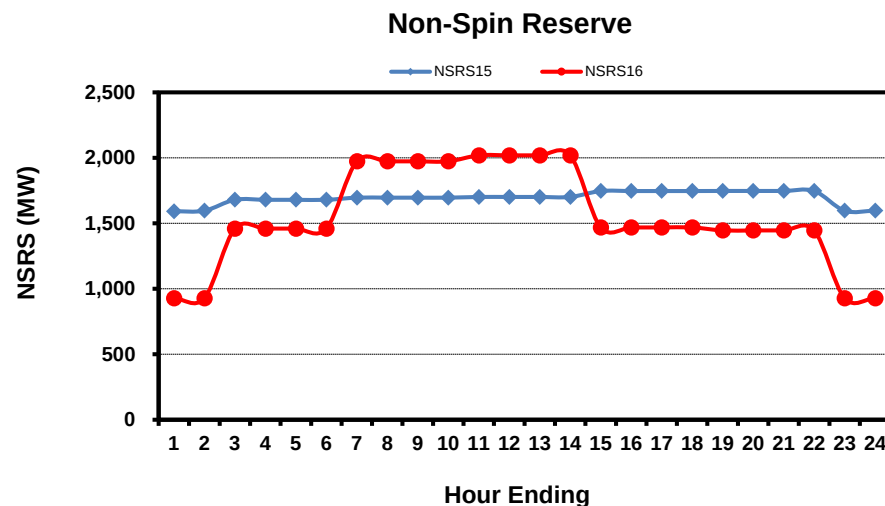
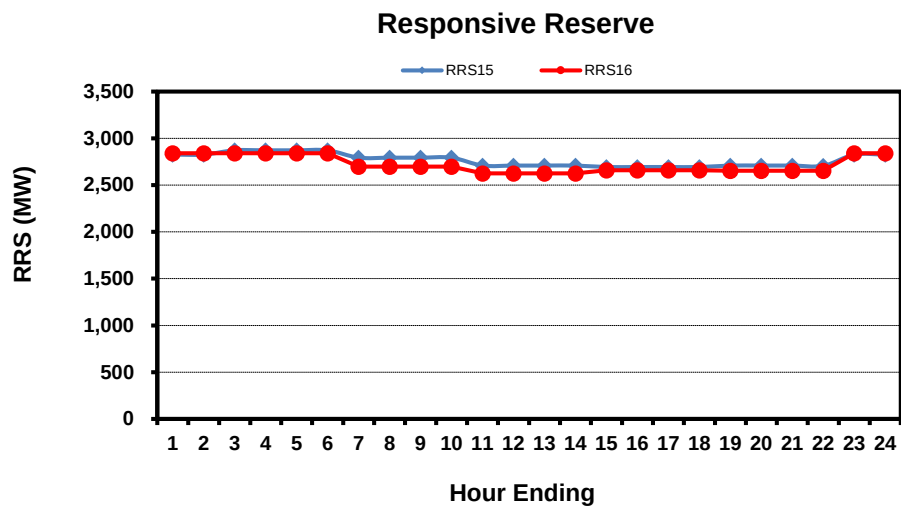
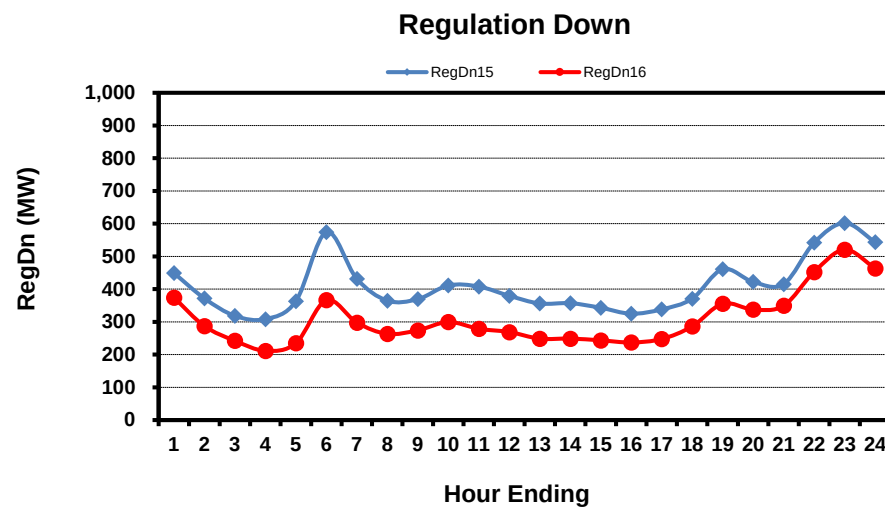
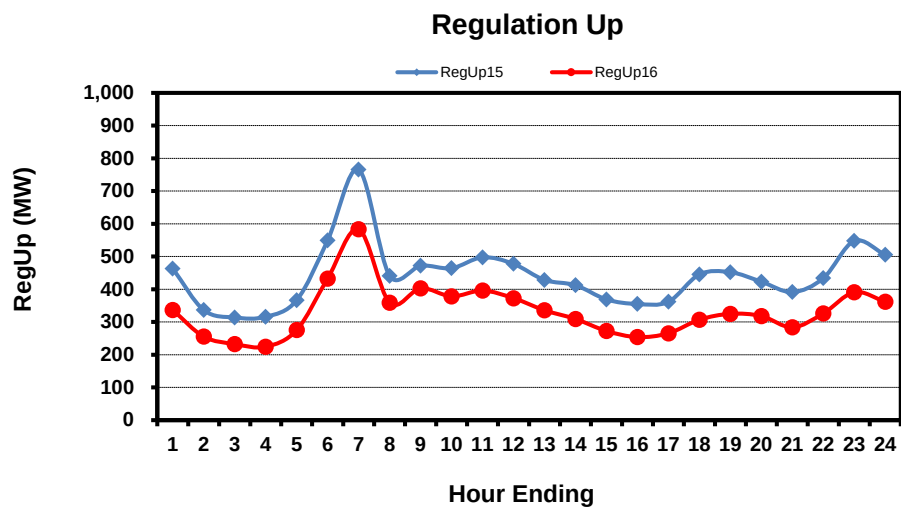
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Hourly Average of Ancillary Services Required MW



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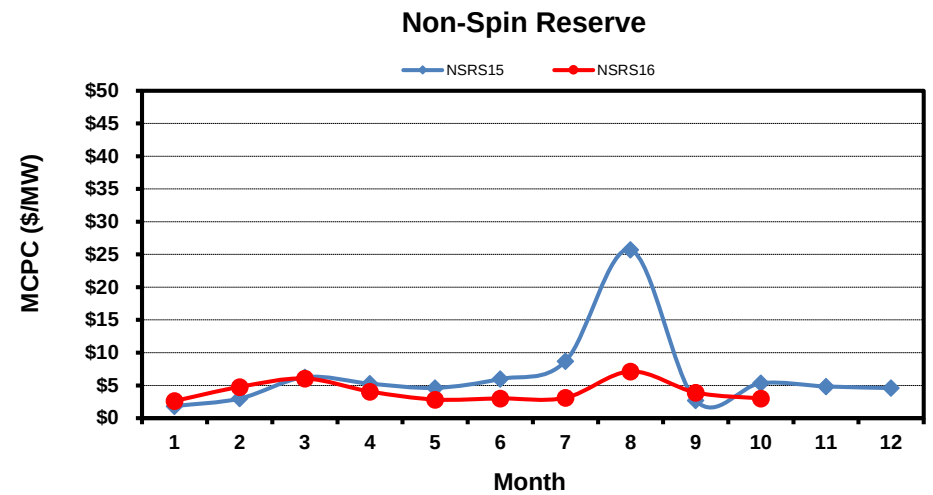
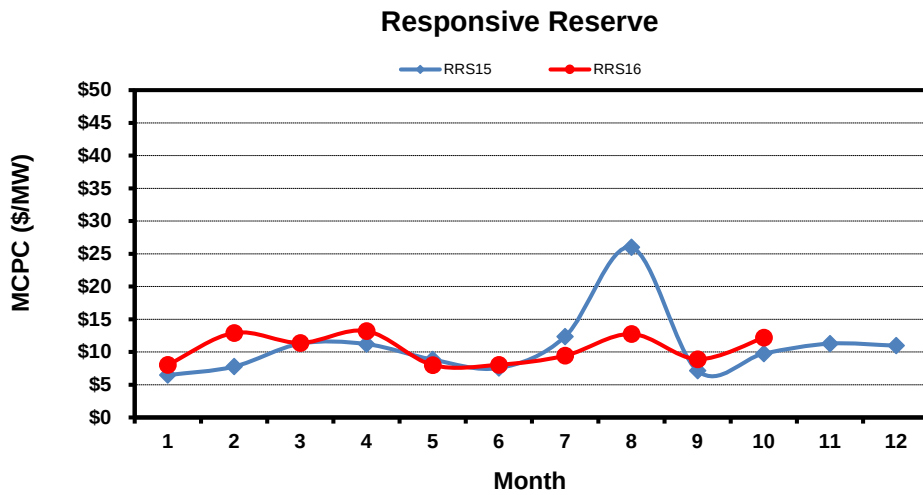
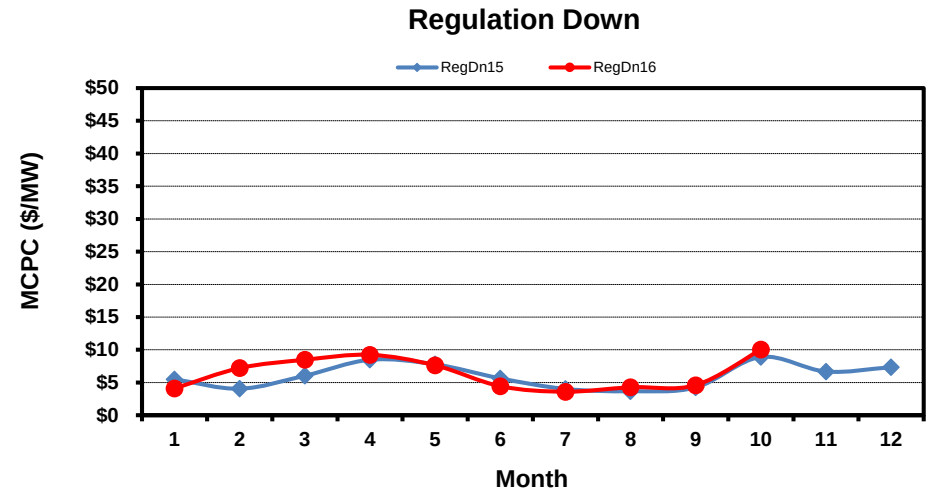
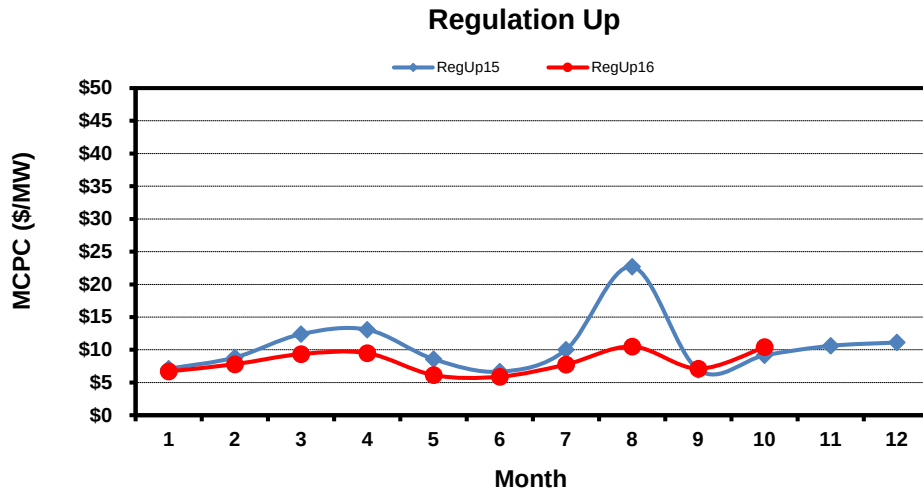
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Monthly Average Ancillary Services Price

(weighted by A/S Quantities Required)



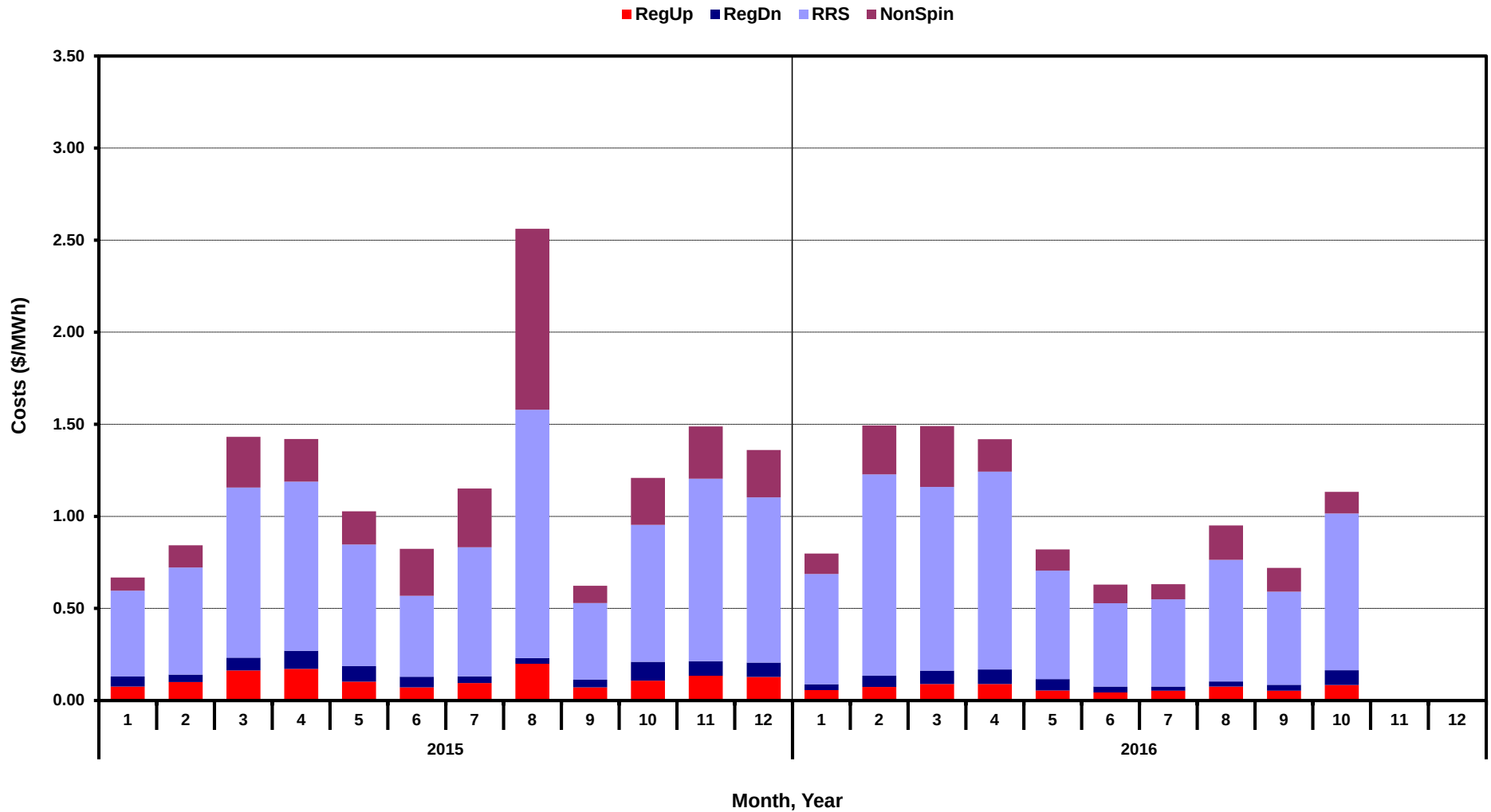
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Monthly Average A/S Cost per MWh Load



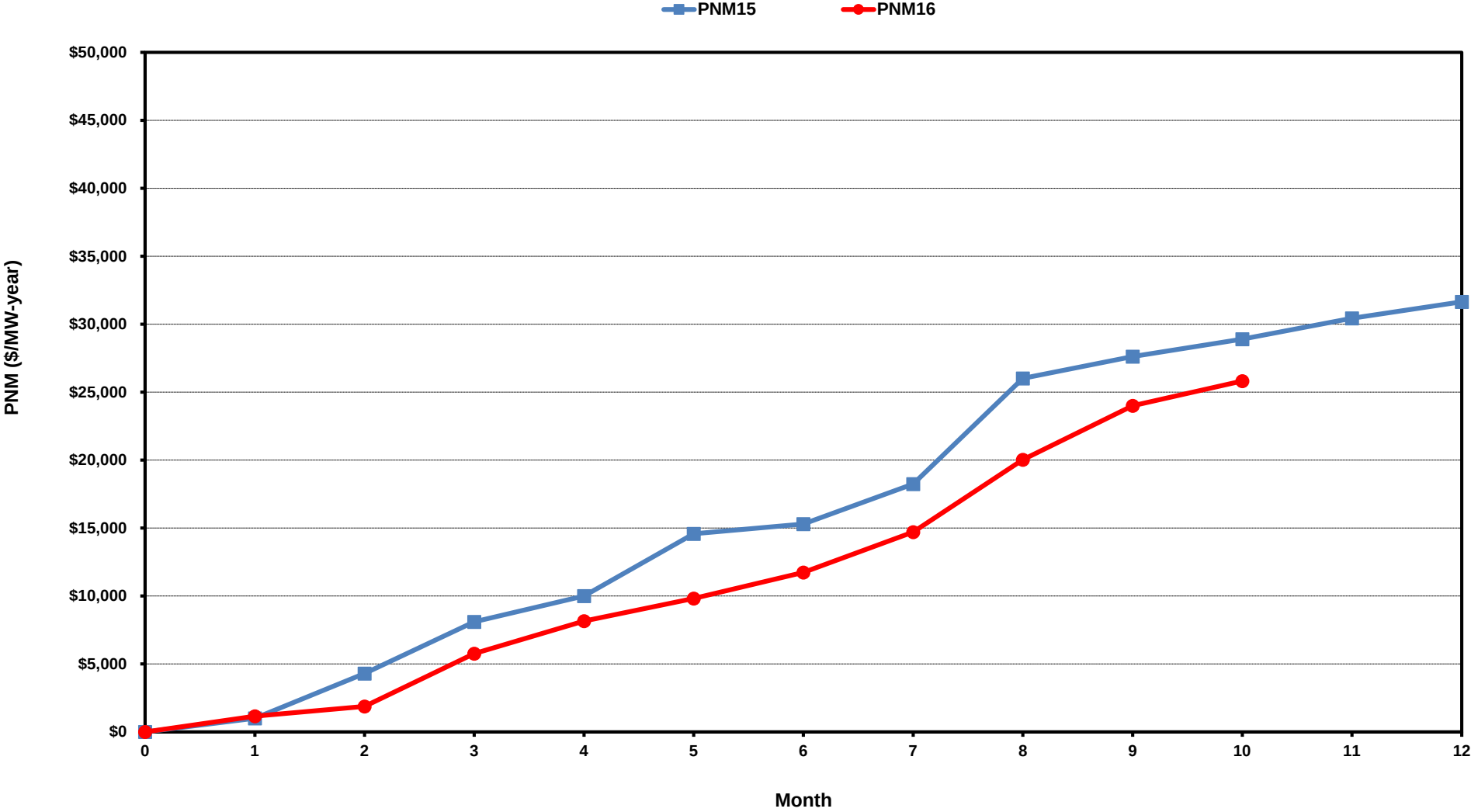
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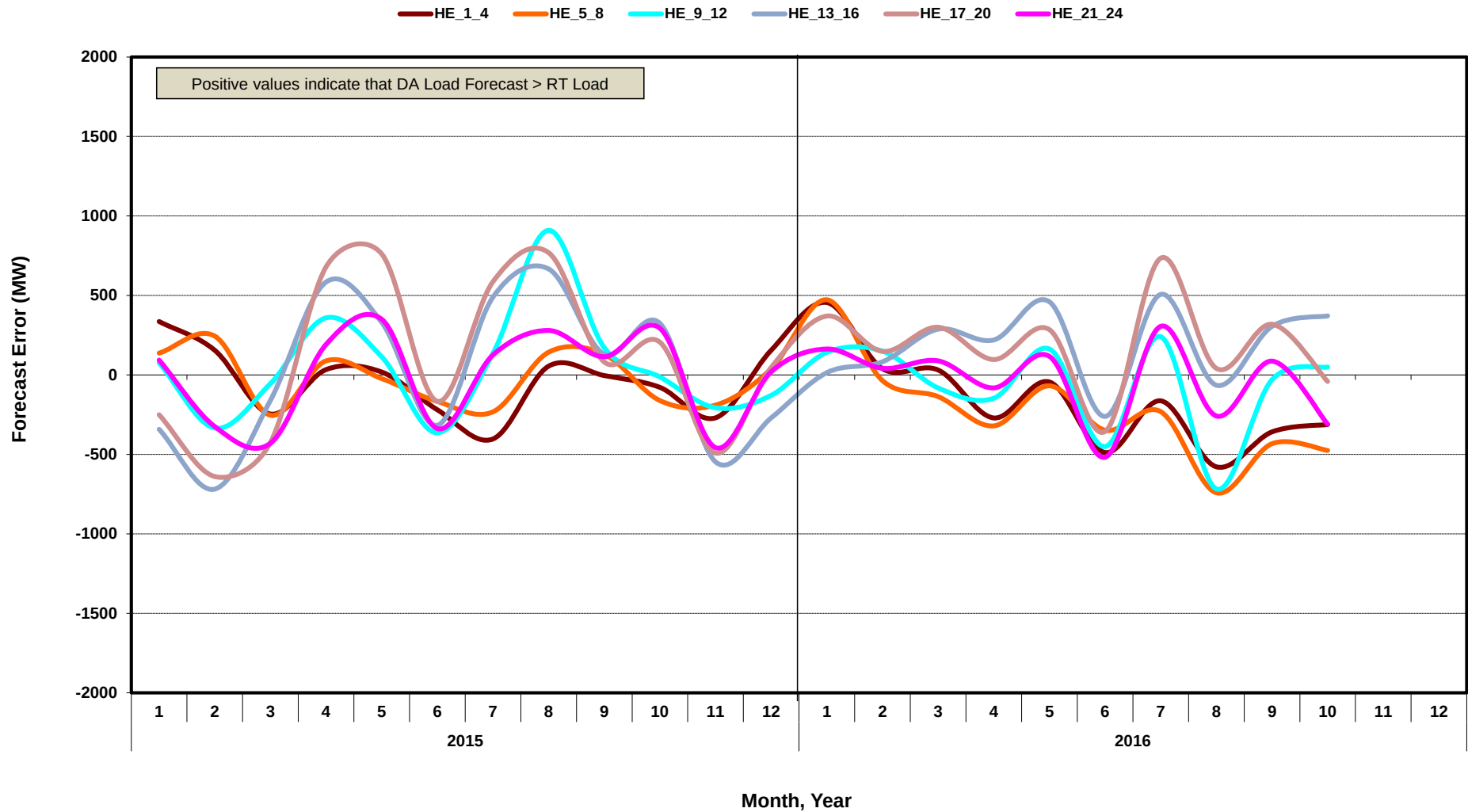
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ERCOT-wide Cumulative Peaker Net Margin



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DA vs. RT Load Forecast Error by Hour Ending



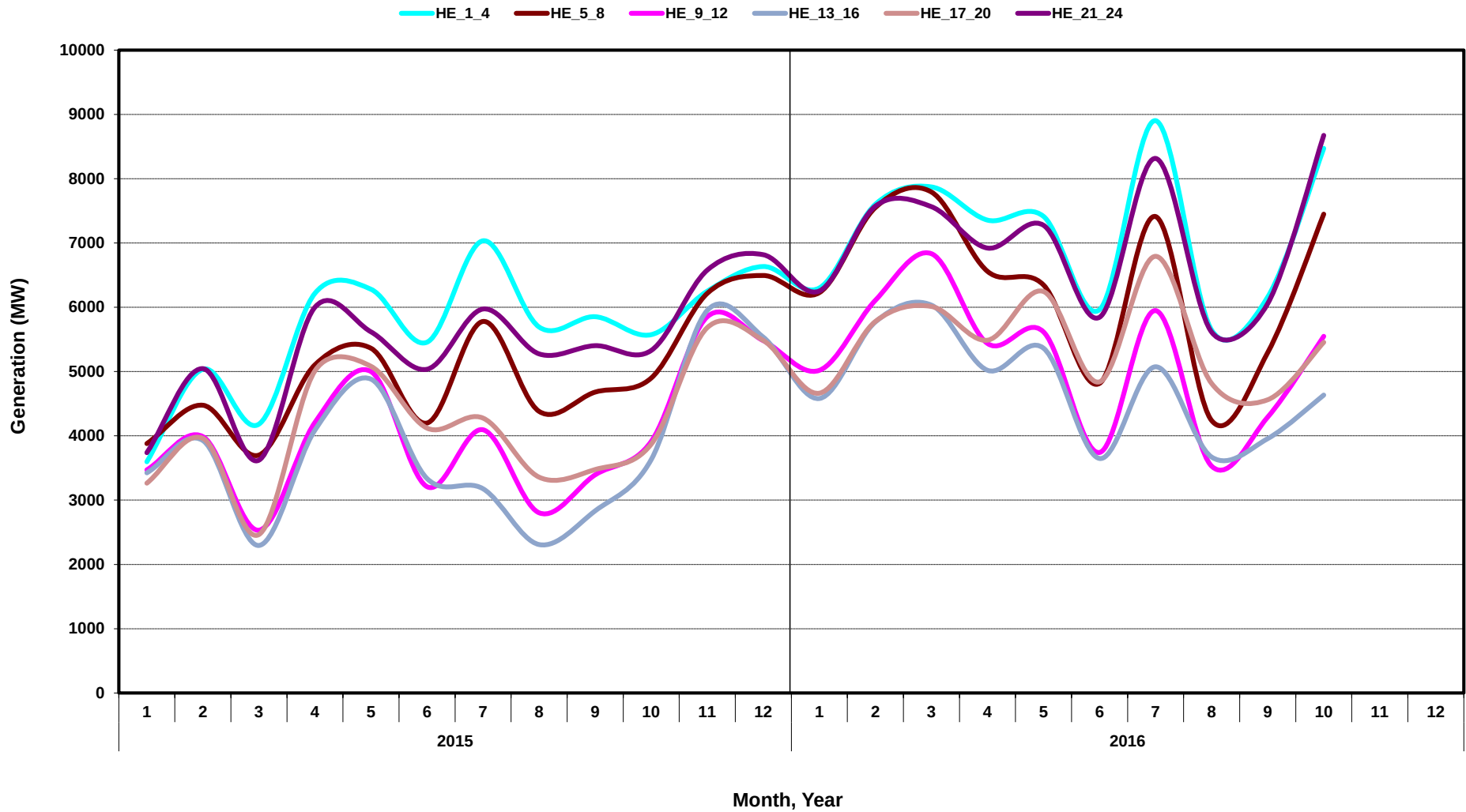
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Monthly Average of Wind Generation by Hour Ending



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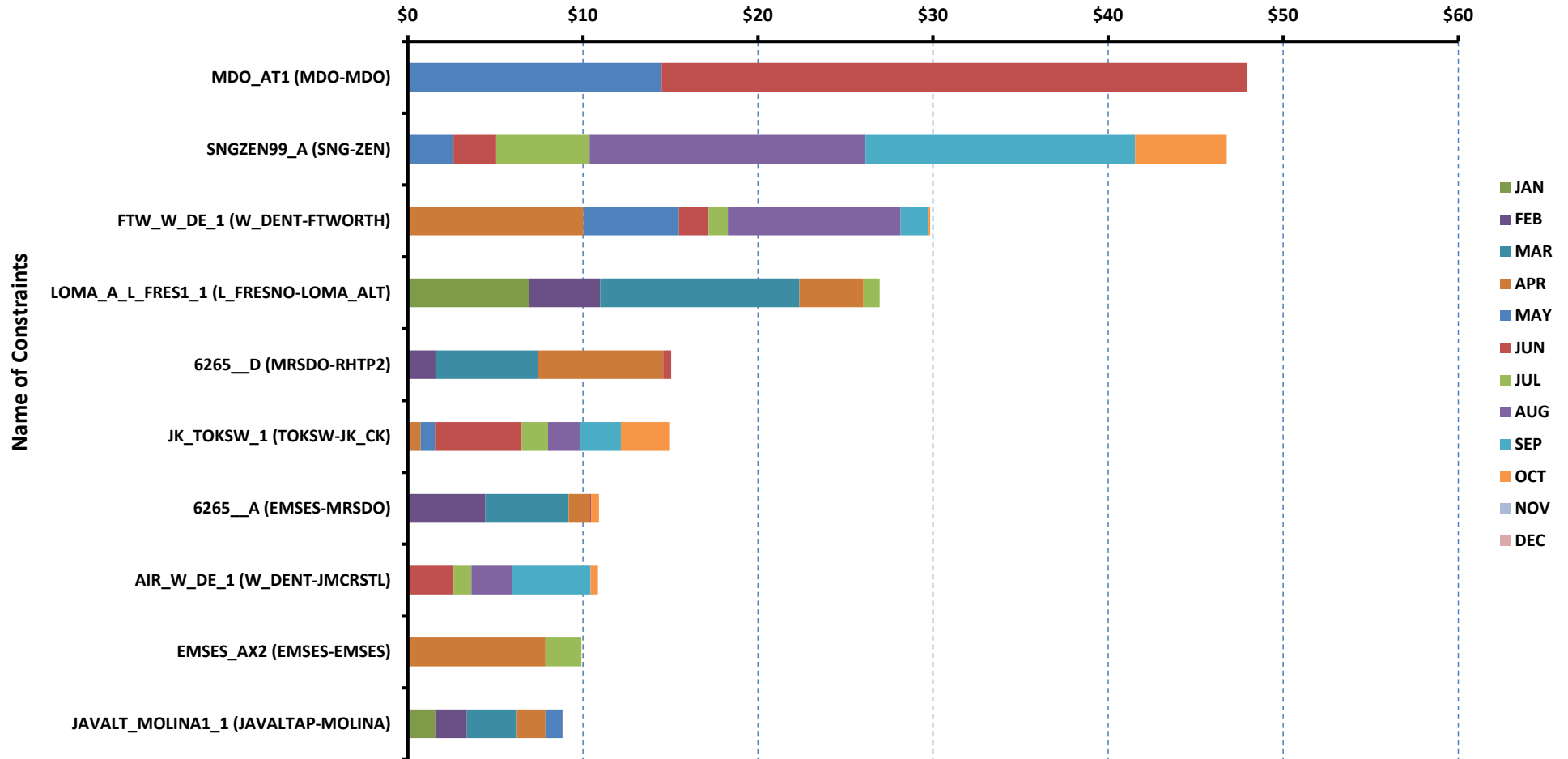
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RT Congestion Constraint Rankings - 1

Top 10 Constraints by Total Congestion Rent

Congestion Rent in \$ million



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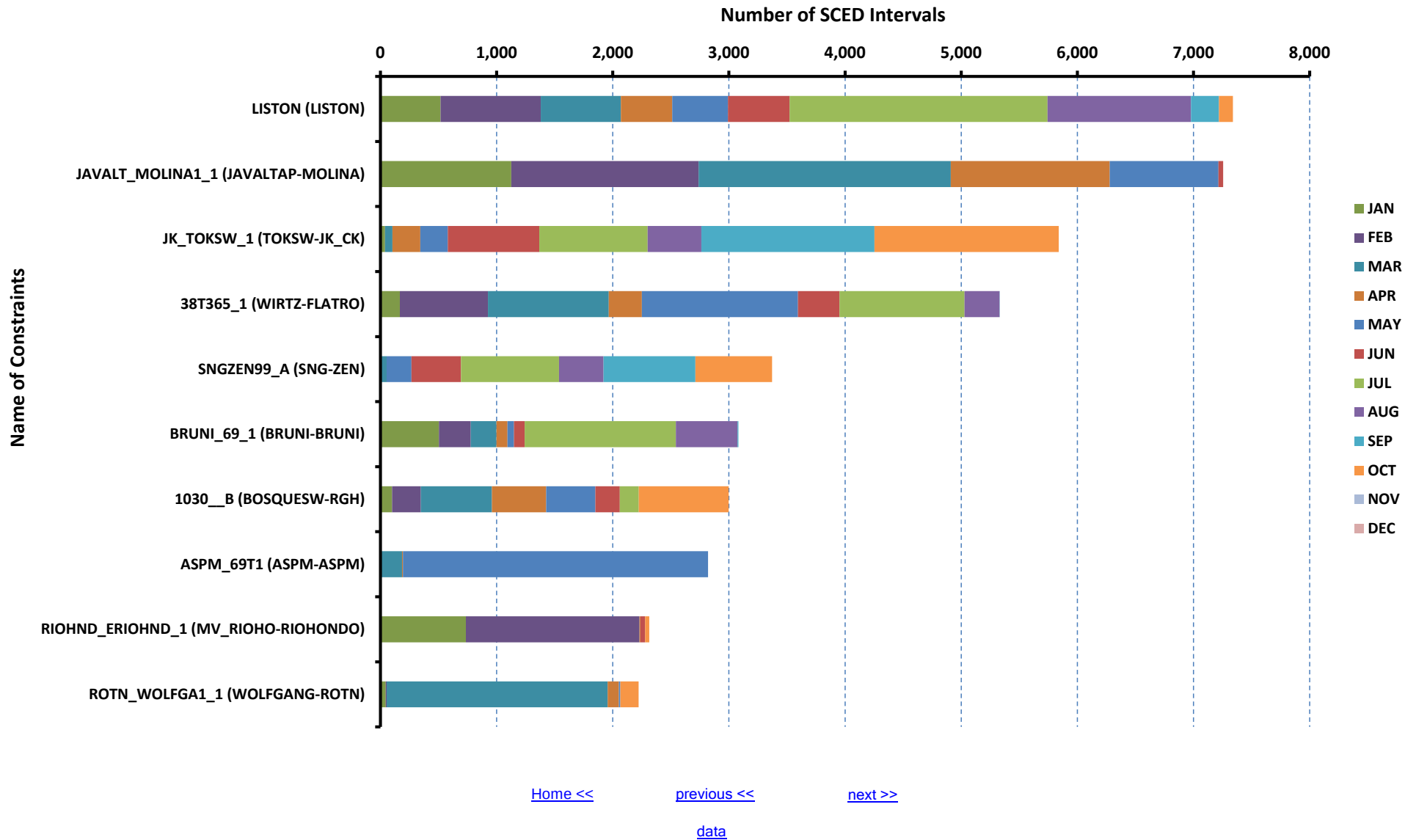
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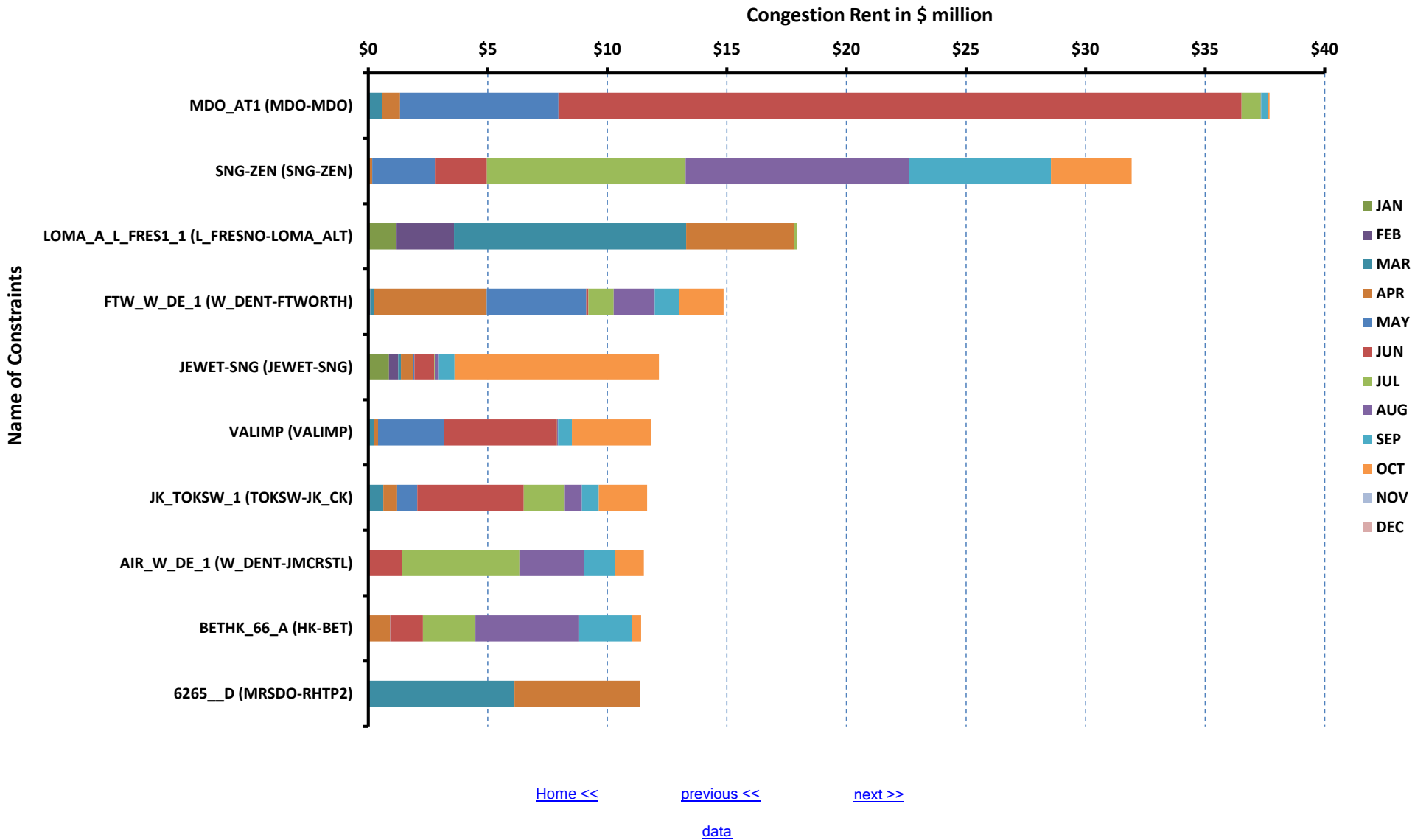
RT Congestion Constraint Rankings - 2

Top 10 Constraints by Binding Frequency



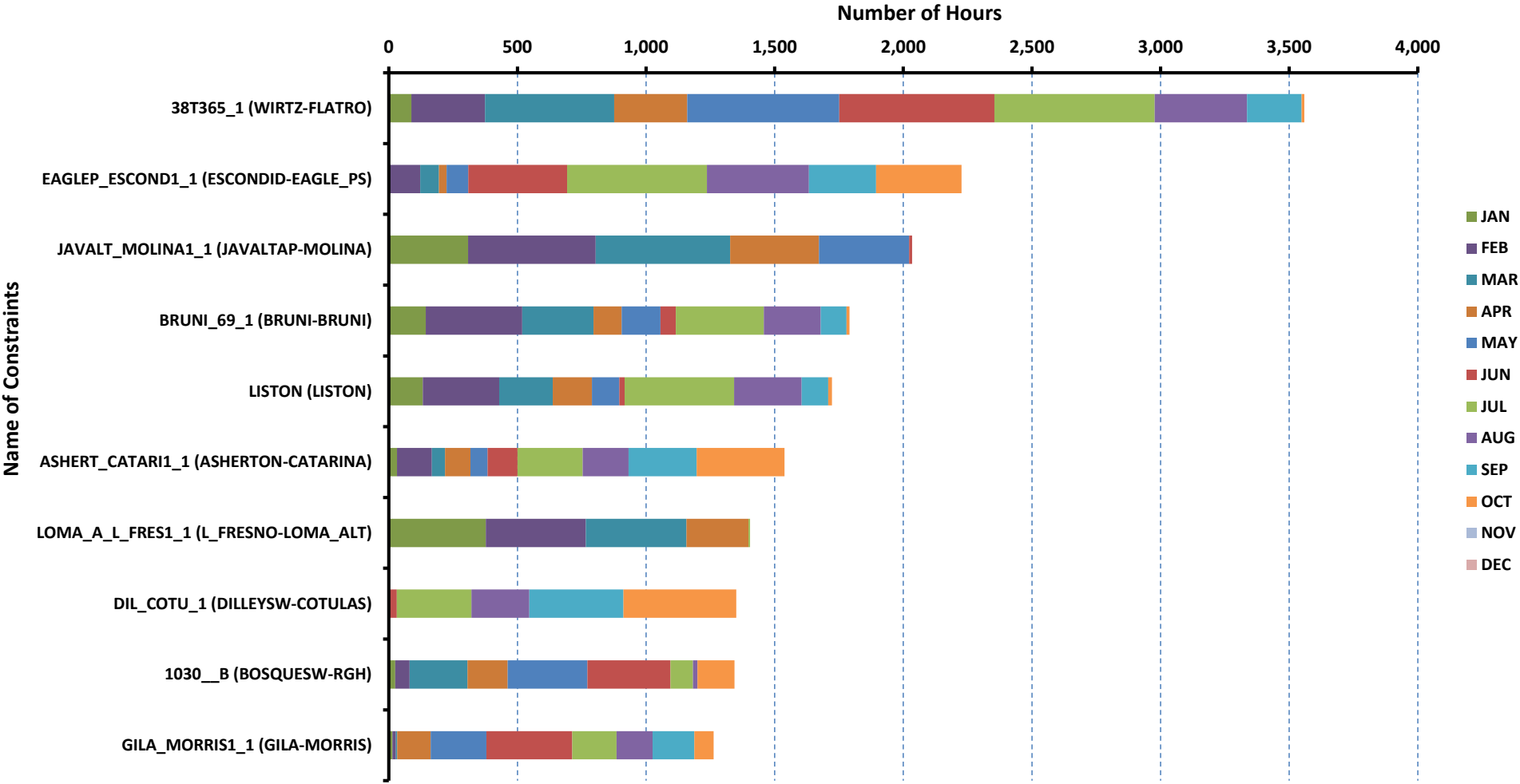
DA Congestion Constraint Rankings - 1

Top 10 Constraints by Total Congestion Rent



DA Congestion Constraint Rankings - 2

Top 10 Constraints by Binding Frequency



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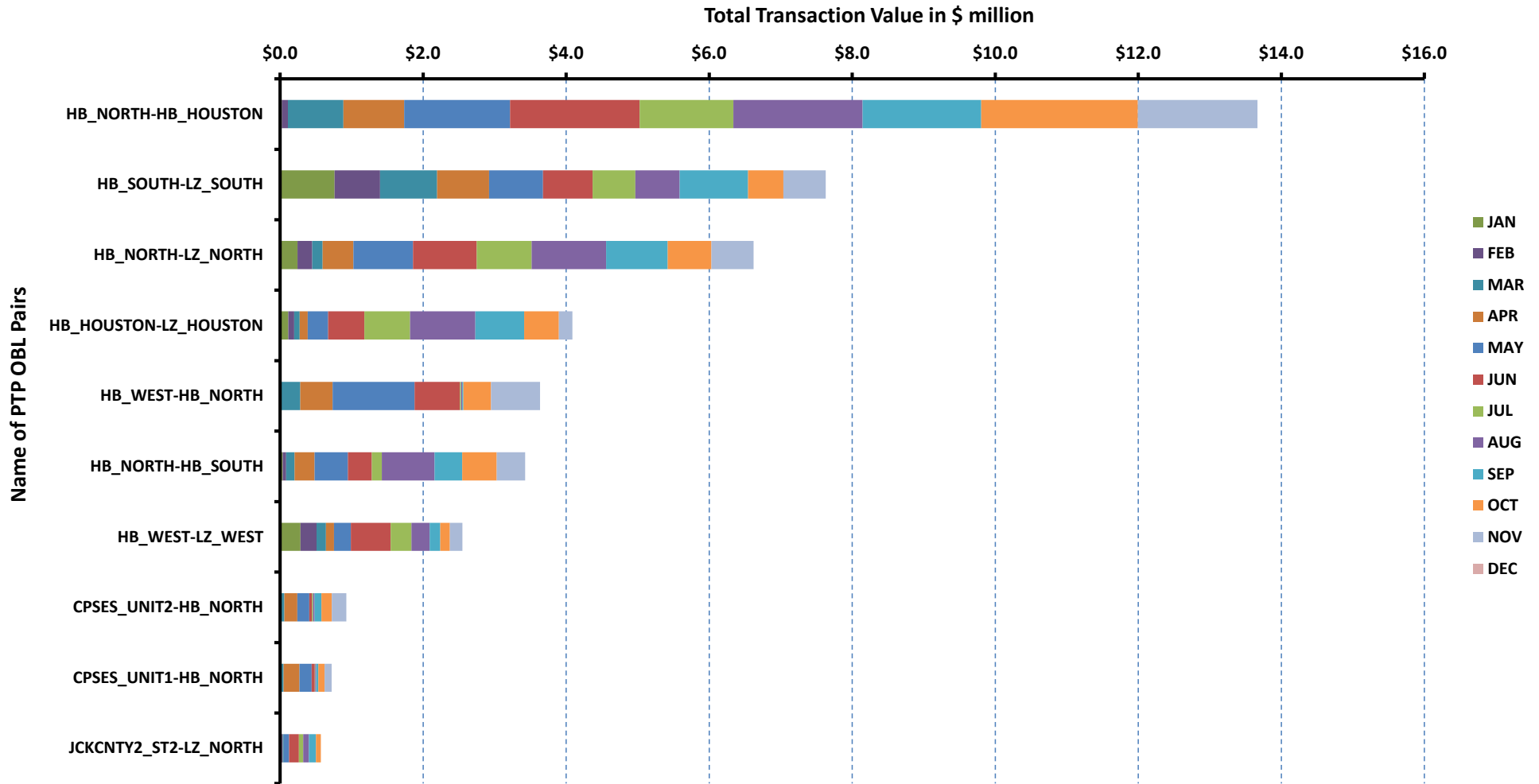
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Top 10 CRR Pairs Ranked by Monthly Auction Values - 1

Top 10 PTP Obligations by Total Transaction Value



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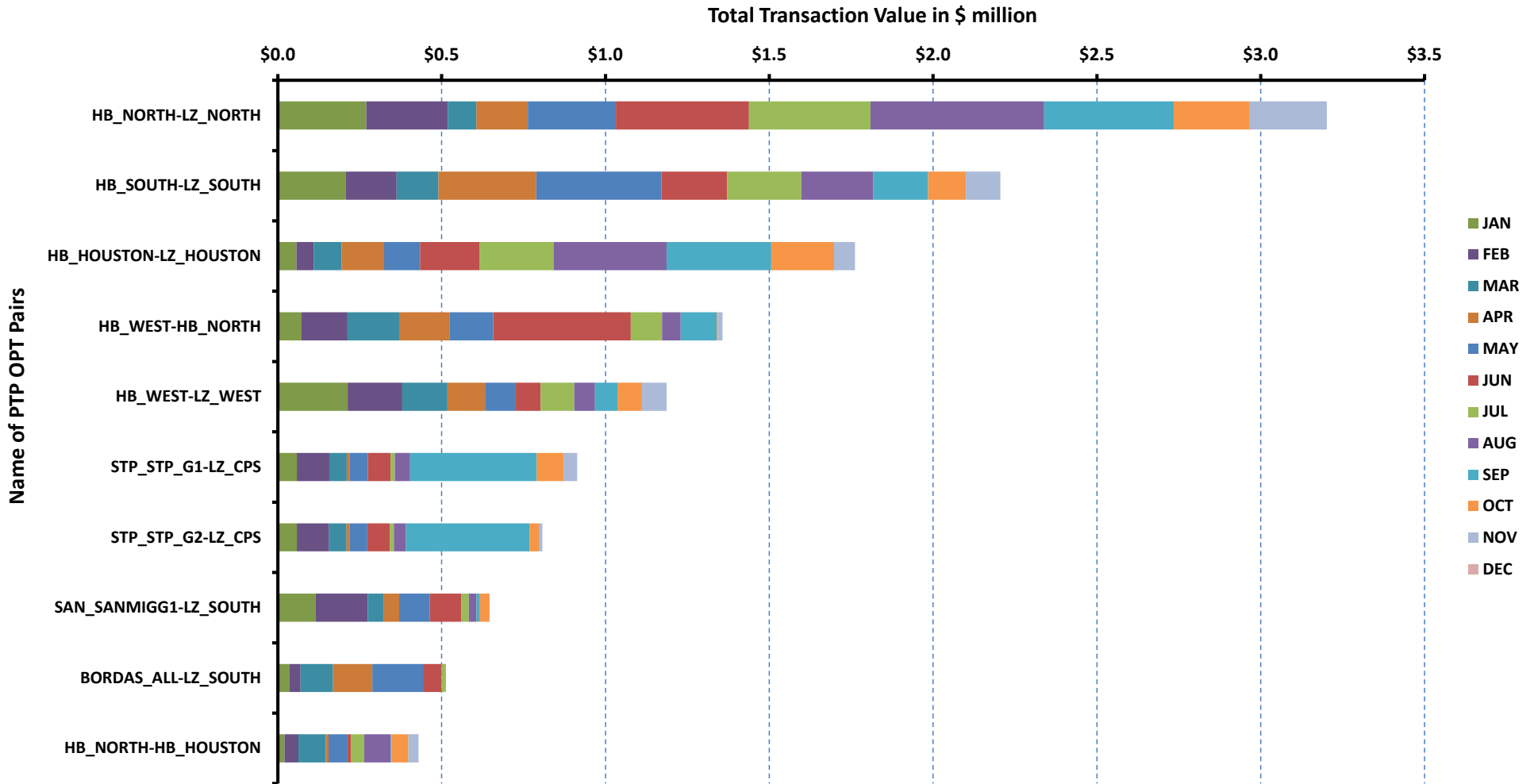
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Top 10 CRR Pairs Ranked by Monthly Auction Values - 2

Top 10 PTP Options by Total Transaction Value



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ERCOT-wide Avg. Energy Price - DA vs. RT			
year	month	dam_spp	rtm_spp
2015	1	\$ 26.35	\$ 24.97
	2	\$ 25.90	\$ 28.28
	3	\$ 27.88	\$ 29.14
	4	\$ 25.30	\$ 24.74
	5	\$ 25.78	\$ 30.84
	6	\$ 27.35	\$ 24.63
	7	\$ 33.20	\$ 30.14
	8	\$ 55.48	\$ 38.12
	9	\$ 26.87	\$ 25.33
	10	\$ 23.11	\$ 22.02
	11	\$ 20.07	\$ 19.58
	12	\$ 18.99	\$ 17.74
2016	1	\$ 19.85	\$ 18.96
	2	\$ 16.00	\$ 15.54
	3	\$ 18.18	\$ 20.30
	4	\$ 20.34	\$ 19.98
	5	\$ 20.28	\$ 19.52
	6	\$ 28.27	\$ 26.23
	7	\$ 30.31	\$ 28.06
	8	\$ 35.17	\$ 33.47
	9	\$ 29.90	\$ 31.20
	10	\$ 29.06	\$ 26.57
	11	\$ -	\$ -
	12	\$ -	\$ -

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Load Zone Load Statistics									
year	month	loadPEAK_Houston	loadPEAK_North	loadPEAK_South	loadPEAK_West	loadAVG_Houston	loadAVG_North	loadAVG_South	loadAVG_West
2015	1	12,803	23,814	16,491	4,339	9,538	14,918	10,830	3,496
	2	12,561	21,965	16,070	4,433	9,308	14,612	9,980	3,477
	3	12,235	21,950	15,837	4,372	8,827	12,810	9,182	3,318
	4	14,001	16,971	13,386	3,944	9,708	11,901	9,397	3,177
	5	15,128	20,253	14,926	4,199	10,879	12,956	10,381	3,265
	6	17,100	24,285	16,392	4,708	12,402	16,870	11,974	3,702
	7	18,236	26,878	18,084	5,043	13,643	18,882	13,232	3,958
	8	18,994	27,717	18,902	5,164	13,139	18,853	13,665	4,029
	9	16,361	25,718	17,631	4,876	11,726	16,837	12,322	3,782
	10	15,857	22,580	16,908	4,335	10,302	13,015	10,387	3,250
	11	13,116	16,108	13,252	3,884	9,076	11,891	9,089	3,255
	12	11,380	18,800	12,571	4,146	9,059	12,889	9,377	3,412
2016	1	11,996	19,817	14,745	4,154	9,367	14,160	9,958	3,525
	2	11,378	19,345	14,062	4,194	9,027	12,473	9,085	3,318
	3	13,434	16,410	12,996	3,667	9,184	11,447	8,934	3,177
	4	14,666	18,506	14,780	4,007	9,890	12,058	9,634	3,239
	5	16,611	21,991	15,871	4,524	11,046	13,210	10,679	3,424
	6	17,978	25,277	17,726	4,880	12,627	17,253	12,697	3,794
	7	18,373	26,378	19,056	5,145	13,869	19,237	14,083	4,190
	8	18,924	28,130	19,719	5,166	13,284	18,384	13,382	3,973
	9	18,037	25,884	18,396	4,781	12,643	16,764	12,657	3,697
	10	16,565	22,569	16,728	4,428	11,193	13,830	10,831	3,425
	11	-	-	-	-	-	-	-	-
	12	-	-	-	-	-	-	-	-

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Load Zone Monthly Average Energy Price - DA vs. RT									
year	month	avgRTMp_Houston	avgRTMp_North	avgRTMp_South	avgRTMp_West	avgDAMp_Houston	avgDAMp_North	avgDAMp_South	avgDAMp_West
2015	1	\$ 24.37	\$ 24.24	\$ 26.39	\$ 25.32	\$ 25.89	\$ 26.09	\$ 26.67	\$ 27.72
	2	\$ 26.86	\$ 28.03	\$ 29.60	\$ 29.35	\$ 25.21	\$ 25.66	\$ 26.83	\$ 26.10
	3	\$ 27.42	\$ 30.50	\$ 28.93	\$ 29.01	\$ 26.93	\$ 28.08	\$ 28.55	\$ 27.76
	4	\$ 24.59	\$ 24.08	\$ 25.53	\$ 25.39	\$ 25.21	\$ 24.58	\$ 25.94	\$ 26.41
	5	\$ 34.82	\$ 27.49	\$ 30.72	\$ 31.20	\$ 25.68	\$ 25.30	\$ 26.05	\$ 27.14
	6	\$ 23.61	\$ 24.36	\$ 25.20	\$ 27.36	\$ 26.76	\$ 26.26	\$ 28.92	\$ 29.18
	7	\$ 30.68	\$ 29.60	\$ 29.44	\$ 33.16	\$ 33.21	\$ 32.75	\$ 33.20	\$ 35.27
	8	\$ 38.50	\$ 38.54	\$ 37.49	\$ 37.05	\$ 56.90	\$ 55.28	\$ 55.18	\$ 52.76
	9	\$ 24.39	\$ 25.66	\$ 25.57	\$ 25.98	\$ 26.30	\$ 26.75	\$ 27.52	\$ 27.00
	10	\$ 21.14	\$ 21.16	\$ 24.41	\$ 20.69	\$ 23.57	\$ 22.33	\$ 23.89	\$ 22.31
	11	\$ 19.86	\$ 19.57	\$ 20.01	\$ 17.64	\$ 20.22	\$ 19.89	\$ 20.57	\$ 18.87
	12	\$ 20.50	\$ 16.07	\$ 17.91	\$ 16.24	\$ 20.10	\$ 18.23	\$ 19.22	\$ 18.27
2016	1	\$ 18.68	\$ 18.77	\$ 19.69	\$ 18.39	\$ 19.93	\$ 19.74	\$ 19.95	\$ 19.76
	2	\$ 15.20	\$ 15.84	\$ 15.89	\$ 14.35	\$ 15.89	\$ 16.05	\$ 16.30	\$ 15.28
	3	\$ 20.31	\$ 19.22	\$ 22.84	\$ 17.04	\$ 17.95	\$ 18.12	\$ 19.22	\$ 16.18
	4	\$ 20.32	\$ 20.84	\$ 19.79	\$ 16.22	\$ 20.39	\$ 20.35	\$ 21.20	\$ 17.56
	5	\$ 21.52	\$ 18.32	\$ 19.82	\$ 16.75	\$ 21.33	\$ 19.38	\$ 20.92	\$ 18.32
	6	\$ 32.12	\$ 24.08	\$ 24.42	\$ 22.54	\$ 33.15	\$ 25.64	\$ 28.08	\$ 24.61
	7	\$ 28.55	\$ 28.07	\$ 28.10	\$ 26.26	\$ 32.03	\$ 29.41	\$ 30.40	\$ 28.41
	8	\$ 36.96	\$ 32.41	\$ 32.61	\$ 29.63	\$ 37.68	\$ 34.06	\$ 35.13	\$ 32.04
	9	\$ 35.55	\$ 29.44	\$ 30.02	\$ 28.36	\$ 31.27	\$ 28.96	\$ 30.34	\$ 27.95
	10	\$ 27.27	\$ 25.11	\$ 27.77	\$ 26.37	\$ 31.15	\$ 26.67	\$ 30.87	\$ 26.18
	11	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
	12	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

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ERCOT-wide Monthly Implied Heat Rate - DA vs. RT						
year	month	gasprice	rtm_spp	HR_rtm	dam_spp	HR_dam
2015	1	\$ 2.93	\$ 24.97	8.53	\$ 26.35	9.00
	2	\$ 2.68	\$ 28.28	10.56	\$ 25.90	9.67
	3	\$ 2.69	\$ 29.14	10.81	\$ 27.88	10.35
	4	\$ 2.56	\$ 24.74	9.66	\$ 25.30	9.87
	5	\$ 2.80	\$ 30.84	11.03	\$ 25.78	9.22
	6	\$ 2.71	\$ 24.63	9.10	\$ 27.35	10.11
	7	\$ 2.82	\$ 30.14	10.69	\$ 33.20	11.77
	8	\$ 2.74	\$ 38.12	13.94	\$ 55.48	20.28
	9	\$ 2.61	\$ 25.33	9.69	\$ 26.87	10.28
	10	\$ 2.35	\$ 22.02	9.36	\$ 23.11	9.83
	11	\$ 2.05	\$ 19.58	9.55	\$ 20.07	9.78
	12	\$ 1.92	\$ 17.74	9.23	\$ 18.99	9.89
2016	1	\$ 2.21	\$ 18.96	8.58	\$ 19.85	8.98
	2	\$ 1.89	\$ 15.54	8.22	\$ 16.00	8.46
	3	\$ 1.68	\$ 20.30	12.12	\$ 18.18	10.85
	4	\$ 1.86	\$ 19.98	10.73	\$ 20.34	10.92
	5	\$ 1.85	\$ 19.52	10.52	\$ 20.28	10.93
	6	\$ 2.46	\$ 26.23	10.69	\$ 28.27	11.51
	7	\$ 2.71	\$ 28.06	10.36	\$ 30.31	11.19
	8	\$ 2.73	\$ 33.47	12.24	\$ 35.17	12.86
	9	\$ 2.93	\$ 31.20	10.66	\$ 29.90	10.21
	10	\$ 3.08	\$ 26.57	8.63	\$ 29.06	9.44
	11	\$ -	\$ -	-	\$ -	-
	12	\$ -	\$ -	-	\$ -	-

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Load Zone Monthly Implied Heat Rate - DA vs. RT									
year	month	HRdam_Houston	HRdam_South	HRdam_North	HRdam_West	HRrtm_Houston	HRrtm_South	HRrtm_North	HRrtm_West
2015	1	8.84	9.11	8.91	9.47	8.32	9.01	8.28	8.65
	2	9.41	10.02	9.58	9.75	10.03	11.05	10.47	10.96
	3	9.99	10.60	10.42	10.30	10.18	10.73	11.32	10.77
	4	9.84	10.12	9.59	10.31	9.60	9.96	9.40	9.91
	5	9.19	9.32	9.05	9.70	12.45	10.99	9.83	11.16
	6	9.89	10.69	9.70	10.78	8.73	9.31	9.00	10.11
	7	11.78	11.77	11.61	12.51	10.88	10.44	10.50	11.76
	8	20.80	20.17	20.21	19.29	14.08	13.70	14.09	13.55
	9	10.06	10.53	10.23	10.33	9.33	9.78	9.82	9.94
	10	10.02	10.16	9.50	9.49	8.99	10.38	8.99	8.80
	11	9.86	10.03	9.70	9.20	9.68	9.75	9.54	8.60
	12	10.47	10.01	9.49	9.51	10.67	9.32	8.36	8.46
2016	1	9.02	9.02	8.93	8.94	8.45	8.91	8.49	8.32
	2	8.41	8.62	8.49	8.08	8.04	8.41	8.38	7.59
	3	10.71	11.47	10.81	9.65	12.12	13.63	11.47	10.17
	4	10.95	11.39	10.93	9.43	10.92	10.63	11.20	8.71
	5	11.50	11.28	10.45	9.88	11.60	10.68	9.88	9.03
	6	13.50	11.44	10.44	10.02	13.08	9.95	9.81	9.18
	7	11.83	11.23	10.86	10.49	10.55	10.38	10.37	9.70
	8	13.78	12.84	12.45	11.72	13.52	11.92	11.85	10.84
	9	10.68	10.36	9.89	9.55	12.14	10.25	10.05	9.68
	10	10.12	10.02	8.66	8.50	8.86	9.02	8.15	8.56
	11	-	-	-	-	-	-	-	-
	12	-	-	-	-	-	-	-	-

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Daily ORDC Adders Average Values and Interval Duration								
YEAR	MONTH	DAY	PRICE_RS	PRICE_RDP	RS_CNT	RDP_CNT	RS_POS	RDP_POS
2016	10	1	\$ -	\$ 1.45	0	35	80	90
2016	10	2	\$ 0.04	\$ 0.67	9	12	80	90
2016	10	3	\$ -	\$ 0.95	0	41	80	90
2016	10	4	\$ 0.01	\$ 6.53	5	43	80	90
2016	10	5	\$ 7.40	\$ 0.22	29	22	80	90
2016	10	6	\$ 0.32	\$ 0.50	6	19	80	90
2016	10	7	\$ -	\$ 0.40	0	31	80	90
2016	10	8	\$ -	\$ 0.07	0	10	80	90
2016	10	9	\$ -	\$ -	0	0	80	90
2016	10	10	\$ 0.06	\$ 0.29	9	16	80	90
2016	10	11	\$ -	\$ 0.66	0	23	80	90
2016	10	12	\$ 0.24	\$ -	10	0	80	90
2016	10	13	\$ 0.12	\$ -	25	0	80	90
2016	10	14	\$ 0.01	\$ -	1	0	80	90
2016	10	15	\$ -	\$ -	0	0	80	90
2016	10	16	\$ -	\$ -	0	0	80	90
2016	10	17	\$ -	\$ -	0	0	80	90
2016	10	18	\$ 2.83	\$ -	19	0	80	90
2016	10	19	\$ 3.23	\$ -	21	0	80	90
2016	10	20	\$ 0.51	\$ -	21	0	80	90
2016	10	21	\$ 0.02	\$ -	7	0	80	90
2016	10	22	\$ -	\$ -	0	0	80	90
2016	10	23	\$ -	\$ -	0	0	80	90
2016	10	24	\$ 0.04	\$ 0.08	10	2	80	90
2016	10	25	\$ -	\$ -	0	0	80	90
2016	10	26	\$ 0.06	\$ 0.98	10	5	80	90
2016	10	27	\$ 0.04	\$ 1.04	14	23	80	90
2016	10	28	\$ 0.01	\$ -	6	0	80	90
2016	10	29	\$ 0.35	\$ -	20	0	80	90
2016	10	30	\$ 0.08	\$ -	13	0	80	90
2016	10	31	\$ -	\$ -	0	0	80	90

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Monthly Average of Ancillary Services Required MW					
year	month	ASMW_REGDN	ASMW_NSPIN	ASMW_RRS	ASMW_REGUP
2015	1	379	1,500	2,800	416
	2	370	1,500	2,800	425
	3	393	1,500	2,800	449
	4	396	1,500	2,800	450
	5	409	1,464	2,800	446
	6	458	1,915	2,616	483
	7	450	1,828	2,817	473
	8	422	1,897	2,579	437
	9	446	1,545	2,607	458
	10	424	1,768	2,817	435
	11	394	1,951	2,927	423
	12	371	1,949	2,840	400
2016	1	288	1,568	2,752	314
	2	289	1,882	2,872	318
	3	279	1,787	2,872	313
	4	296	1,503	2,835	330
	5	315	1,554	2,817	339
	6	331	1,547	2,608	347
	7	324	1,358	2,577	354
	8	326	1,283	2,537	353
	9	319	1,500	2,598	346
	10	312	1,529	2,735	319
	11	-	-	-	-
	12	-	-	-	-

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Hourly Average of Ancillary Services Required MW					
year	DELIVERY_HOUR	ASMW_REGDN	ASMW_NSPIN	ASMW_RRS	ASMW_REGUP
2015	1	449	1,592	2,826	463
	2	372	1,596	2,826	336
	3	318	1,680	2,872	314
	4	308	1,680	2,872	316
	5	363	1,680	2,872	367
	6	574	1,680	2,872	549
	7	432	1,696	2,793	766
	8	365	1,696	2,793	441
	9	369	1,696	2,793	472
	10	411	1,696	2,793	464
	11	408	1,701	2,709	498
	12	380	1,701	2,709	478
	13	356	1,701	2,709	428
	14	357	1,701	2,709	412
	15	343	1,746	2,693	369
	16	325	1,746	2,693	355
	17	338	1,746	2,693	362
	18	371	1,746	2,693	445
	19	461	1,747	2,709	452
	20	422	1,747	2,709	423
	21	415	1,747	2,709	391
	22	542	1,747	2,706	434
	23	602	1,596	2,826	547
	24	544	1,596	2,826	505
2016	1	375	928	2,841	337
	2	287	928	2,841	255
	3	242	1,460	2,840	232
	4	212	1,460	2,841	224
	5	235	1,460	2,841	275
	6	366	1,460	2,841	433
	7	298	1,973	2,698	583
	8	263	1,973	2,698	359
	9	274	1,973	2,698	403
	10	300	1,973	2,698	378
	11	279	2,019	2,625	396
	12	269	2,019	2,625	373
	13	249	2,019	2,625	336
	14	249	2,019	2,625	309
	15	244	1,468	2,660	273
	16	237	1,468	2,660	254
	17	248	1,468	2,660	265
	18	286	1,468	2,660	307
	19	356	1,446	2,654	325
	20	338	1,446	2,654	318
	21	349	1,446	2,654	284
	22	453	1,446	2,654	326
	23	521	928	2,841	391
	24	464	928	2,841	362

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Monthly Average Ancillary Services Price					
year	month	MCPC_REGDN	MCPC_NSPIN	MCPC_RRS	MCPC_REGUP
2015	1	\$ 5.49	\$ 1.84	\$ 6.47	\$ 7.10
	2	\$ 4.05	\$ 3.00	\$ 7.77	\$ 8.83
	3	\$ 6.04	\$ 6.26	\$ 11.27	\$ 12.39
	4	\$ 8.47	\$ 5.27	\$ 11.21	\$ 13.08
	5	\$ 7.78	\$ 4.63	\$ 8.84	\$ 8.58
	6	\$ 5.63	\$ 5.98	\$ 7.56	\$ 6.65
	7	\$ 4.01	\$ 8.69	\$ 12.37	\$ 10.00
	8	\$ 3.67	\$ 25.73	\$ 25.98	\$ 22.70
	9	\$ 4.25	\$ 2.70	\$ 7.13	\$ 6.93
	10	\$ 8.90	\$ 5.34	\$ 9.76	\$ 9.15
	11	\$ 6.67	\$ 4.84	\$ 11.28	\$ 10.60
	12	\$ 7.33	\$ 4.59	\$ 10.97	\$ 11.12
2016	1	\$ 4.10	\$ 2.62	\$ 8.05	\$ 6.69
	2	\$ 7.21	\$ 4.77	\$ 12.91	\$ 7.80
	3	\$ 8.47	\$ 6.06	\$ 11.39	\$ 9.34
	4	\$ 9.23	\$ 4.07	\$ 13.20	\$ 9.48
	5	\$ 7.63	\$ 2.84	\$ 8.01	\$ 6.14
	6	\$ 4.43	\$ 3.02	\$ 8.05	\$ 5.89
	7	\$ 3.59	\$ 3.11	\$ 9.44	\$ 7.75
	8	\$ 4.27	\$ 7.13	\$ 12.75	\$ 10.49
	9	\$ 4.59	\$ 3.91	\$ 8.91	\$ 7.12
	10	\$ 10.06	\$ 3.02	\$ 12.21	\$ 10.42
	11	\$ -	\$ -	\$ -	\$ -
	12	\$ -	\$ -	\$ -	\$ -

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Monthly Average A/S Cost per MWh Load					
year	month	AScost_REGDN	AScost_NSPIN	AScost_RRS	AScost_REGUP
2015	1	\$ 0.05	\$ 0.07	\$ 0.47	\$ 0.08
	2	\$ 0.04	\$ 0.12	\$ 0.58	\$ 0.10
	3	\$ 0.07	\$ 0.28	\$ 0.92	\$ 0.16
	4	\$ 0.10	\$ 0.23	\$ 0.92	\$ 0.17
	5	\$ 0.08	\$ 0.18	\$ 0.66	\$ 0.10
	6	\$ 0.06	\$ 0.25	\$ 0.44	\$ 0.07
	7	\$ 0.04	\$ 0.32	\$ 0.70	\$ 0.10
	8	\$ 0.03	\$ 0.98	\$ 1.35	\$ 0.20
	9	\$ 0.04	\$ 0.09	\$ 0.42	\$ 0.07
	10	\$ 0.10	\$ 0.26	\$ 0.74	\$ 0.11
	11	\$ 0.08	\$ 0.28	\$ 0.99	\$ 0.13
	12	\$ 0.08	\$ 0.26	\$ 0.90	\$ 0.13
2016	1	\$ 0.03	\$ 0.11	\$ 0.60	\$ 0.06
	2	\$ 0.06	\$ 0.26	\$ 1.09	\$ 0.07
	3	\$ 0.07	\$ 0.33	\$ 1.00	\$ 0.09
	4	\$ 0.08	\$ 0.18	\$ 1.07	\$ 0.09
	5	\$ 0.06	\$ 0.12	\$ 0.59	\$ 0.05
	6	\$ 0.03	\$ 0.10	\$ 0.45	\$ 0.04
	7	\$ 0.02	\$ 0.08	\$ 0.47	\$ 0.05
	8	\$ 0.03	\$ 0.19	\$ 0.66	\$ 0.08
	9	\$ 0.03	\$ 0.13	\$ 0.51	\$ 0.05
	10	\$ 0.08	\$ 0.12	\$ 0.85	\$ 0.08
	11	\$ -	\$ -	\$ -	\$ -
	12	\$ -	\$ -	\$ -	\$ -

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ERCOT-wide Cumulative PNM			
year	month	pnm	pnm_accum
2015	0	\$ -	\$ -
	1	\$ 1,009.59	\$ 1,009.59
	2	\$ 3,289.14	\$ 4,298.73
	3	\$ 3,800.40	\$ 8,099.13
	4	\$ 1,900.94	\$ 10,000.07
	5	\$ 4,578.64	\$ 14,578.71
	6	\$ 720.30	\$ 15,299.01
	7	\$ 2,945.67	\$ 18,244.68
	8	\$ 7,767.43	\$ 26,012.11
	9	\$ 1,612.54	\$ 27,624.65
	10	\$ 1,283.56	\$ 28,908.21
	11	\$ 1,529.59	\$ 30,437.80
	12	\$ 1,209.77	\$ 31,647.57
2016	0	\$ -	\$ -
	1	\$ 1,160.69	\$ 1,160.69
	2	\$ 720.57	\$ 1,881.26
	3	\$ 3,883.41	\$ 5,764.67
	4	\$ 2,389.99	\$ 8,154.66
	5	\$ 1,661.50	\$ 9,816.16
	6	\$ 1,922.76	\$ 11,738.92
	7	\$ 2,969.44	\$ 14,708.36
	8	\$ 5,321.18	\$ 20,029.54
	9	\$ 3,967.65	\$ 23,997.19
	10	\$ 1,824.61	\$ 25,821.80
	11	\$ -	\$ -
	12	\$ -	\$ -

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DA vs. RT Load Forecast Error by Hour Ending							
year	month	HE_1_4	HE_13_16	HE_17_20	HE_21_24	HE_5_8	HE_9_12
2015	1	336	(342)	(251)	93	137	75
	2	155	(718)	(639)	(325)	244	(334)
	3	(246)	(160)	(425)	(430)	(253)	(54)
	4	34	585	680	192	88	359
	5	18	330	761	350	(23)	114
	6	(219)	(317)	(166)	(338)	(167)	(364)
	7	(403)	490	587	126	(232)	136
	8	55	667	769	280	143	910
	9	(4)	130	81	114	129	171
	10	(78)	324	206	294	(161)	(13)
	11	(270)	(547)	(492)	(457)	(190)	(207)
	12	156	(270)	47	20	38	(128)
2016	1	455	14	371	163	473	142
	2	39	83	148	42	(36)	150
	3	31	288	300	89	(136)	(82)
	4	(271)	220	97	(82)	(320)	(147)
	5	(44)	460	285	117	(69)	163
	6	(488)	(261)	(356)	(518)	(348)	(451)
	7	(163)	507	735	306	(231)	240
	8	(578)	(65)	41	(258)	(741)	(717)
	9	(358)	305	319	87	(433)	(30)
	10	(312)	371	(41)	(310)	(475)	50
	11	-	-	-	-	-	-
	12	-	-	-	-	-	-

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Monthly Average of Wind Generation by Hour Ending							
year	month	HE_1_4	HE_13_16	HE_17_20	HE_21_24	HE_5_8	HE_9_12
2015	1	3,597	3,424	3,264	3,738	3,879	3,471
	2	5,036	3,927	3,961	5,045	4,476	3,988
	3	4,182	2,295	2,465	3,622	3,701	2,532
	4	6,218	4,090	5,011	6,002	5,105	4,209
	5	6,280	4,882	5,081	5,617	5,362	5,000
	6	5,457	3,335	4,120	5,036	4,199	3,209
	7	7,034	3,176	4,275	5,973	5,779	4,094
	8	5,692	2,309	3,357	5,275	4,380	2,803
	9	5,853	2,834	3,476	5,403	4,681	3,394
	10	5,574	3,631	3,871	5,329	4,899	3,913
	11	6,250	5,952	5,683	6,578	6,216	5,852
	12	6,634	5,535	5,484	6,817	6,494	5,481
2016	1	6,300	4,581	4,663	6,253	6,228	5,019
	2	7,602	5,772	5,779	7,573	7,552	6,109
	3	7,872	6,033	6,013	7,565	7,793	6,833
	4	7,356	5,020	5,488	6,921	6,559	5,437
	5	7,414	5,363	6,245	7,275	6,347	5,617
	6	5,963	3,648	4,840	5,845	4,816	3,741
	7	8,903	5,074	6,793	8,315	7,411	5,948
	8	5,644	3,670	4,814	5,613	4,238	3,529
	9	6,159	3,957	4,561	6,057	5,295	4,291
	10	8,472	4,634	5,455	8,674	7,449	5,548
	11	-	-	-	-	-	-
	12	-	-	-	-	-	-

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RT Congestion Constraint Rankings - Top 10 Constraints by Binding Frequency and Top 10 Constraints by Total Congestion Rent																	
category	year	item	rankvar	rank	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
FREQ_EXIST	2016	LISTON (LISTON)	7,339	1	518	862	690	442	479	532	2,220	1,235	241	120	-	-	
FREQ_EXIST	2016	JAVALT_MOLINA1_1 (JAVALTAP-MOLINA)	7,255	2	1,127	1,613	2,170	1,369	935	41	-	-	-	-	-	-	
FREQ_EXIST	2016	JK_TOKSW_1 (TOKSW-JK_CK)	5,840	3	39	-	65	239	236	789	932	463	1,490	1,587	-	-	
FREQ_EXIST	2016	38T365_1 (WIRTZ-FLATRO)	5,332	4	167	759	1,039	286	1,344	357	1,076	302	2	-	-	-	
FREQ_EXIST	2016	SNGZEN99_A (SNG-ZEN)	3,372	5	-	-	54	-	212	427	844	383	791	661	-	-	
FREQ_EXIST	2016	BRUNI_69_1 (BRUNI-BRUNI)	3,082	6	503	274	221	95	57	91	1,302	531	8	-	-	-	
FREQ_EXIST	2016	1030_B (BOSQUESW-RGH)	2,998	7	100	248	612	467	424	209	164	-	-	774	-	-	
FREQ_EXIST	2016	ASPM_69T1 (ASPM-ASPM)	2,821	8	-	-	186	8	2,627	-	-	-	-	-	-	-	
FREQ_EXIST	2016	RIOHND_ERIOHND_1 (MV RIOHO-RIOHONDO)	2,314	9	736	1,495	-	7	-	40	-	-	-	36	-	-	
FREQ_EXIST	2016	ROTN_WOLFGA1_1 (WOLFGANG-ROTN)	2,222	10	46	7	1,904	96	12	-	-	-	-	157	-	-	
TOP10_RENT	2016	MDO_AT1 (MDO-MDO)	\$ 47.86	1	\$ -	\$ -	\$ -	\$ -	\$ 14.49	\$ 33.47	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
TOP10_RENT	2016	SNGZEN99_A (SNG-ZEN)	\$ 46.77	2	\$ -	\$ -	\$ 0.06	\$ -	\$ 2.54	\$ 2.44	\$ 5.33	\$ 15.76	\$ 15.40	\$ 5.23	\$ -	\$ -	
TOP10_RENT	2016	FTW_W_DE_1 (W_DENT-FTWORTH)	\$ 29.84	3	\$ -	\$ -	\$ -	\$ 10.03	\$ 5.46	\$ 1.70	\$ 1.09	\$ 9.87	\$ 1.59	\$ 0.10	\$ -	\$ -	
TOP10_RENT	2016	LOMA_A_L_FRES1_1 (L_FRESNO-LOMA_ALT)	\$ 26.95	4	\$ 6.90	\$ 4.08	\$ 11.39	\$ 3.65	\$ -	\$ -	\$ 0.92	\$ -	\$ -	\$ -	\$ -	\$ -	
TOP10_RENT	2016	6265_D (MRSDO-RHTP2)	\$ 15.05	5	\$ -	\$ 1.58	\$ 5.86	\$ 7.14	\$ -	\$ 0.46	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
TOP10_RENT	2016	JK_TOKSW_1 (TOKSW-JK_CK)	\$ 14.97	6	\$ 0.06	\$ -	\$ 0.05	\$ 0.63	\$ 0.82	\$ 4.96	\$ 1.50	\$ 1.80	\$ 2.36	\$ 2.80	\$ -	\$ -	
TOP10_RENT	2016	6265_A (EMSES-MRSDO)	\$ 10.92	7	\$ 0.00	\$ 4.43	\$ 4.75	\$ 1.24	\$ -	\$ 0.07	\$ -	\$ -	\$ -	\$ 0.43	\$ -	\$ -	
TOP10_RENT	2016	AIR_W_DE_1 (W_DENT-JMCRSTL)	\$ 10.85	8	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 2.61	\$ 1.03	\$ 2.31	\$ 4.49	\$ 0.42	\$ -	\$ -	
TOP10_RENT	2016	EMSES_AX2 (EMSES-EMSES)	\$ 9.91	9	\$ -	\$ -	\$ -	\$ 7.86	\$ -	\$ -	\$ 2.05	\$ -	\$ -	\$ -	\$ -	\$ -	
TOP10_RENT	2016	JAVALT_MOLINA1_1 (JAVALTAP-MOLINA)	\$ 8.87	10	\$ 1.57	\$ 1.81	\$ 2.86	\$ 1.63	\$ 0.97	\$ 0.04	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	

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DA Congestion Constraint Rankings - Top 10 Constraints by Binding Frequency and Top 10 Constraints by Total Congestion Rent																	
category	year	item	rankvar	rank	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
FREQ_EXIST	2016	38T365_1 (WIRTZ-FLATRO)	3,559	1	88	286	502	284	591	603	623	359	212	11	-	-	
FREQ_EXIST	2016	EAGLEP_ESCOND1_1 (ESCONDID-EAGLE PS)	2,226	2	-	122	73	30	84	384	544	396	261	332	-	-	
FREQ_EXIST	2016	JAVALT_MOLINA1_1 (JAVALTAP-MOLINA)	2,034	3	308	496	523	345	351	11	-	-	-	-	-	-	
FREQ_EXIST	2016	BRUNI_69_1 (BRUNI-BRUNI)	1,791	4	144	375	277	109	151	80	342	221	100	12	-	-	
FREQ_EXIST	2016	LISTON (LISTON)	1,723	5	132	297	208	153	106	21	425	263	103	15	-	-	
FREQ_EXIST	2016	ASHERT_CATARI1_1 (ASHERTON-CATARINA)	1,538	6	32	135	52	98	67	116	254	178	265	341	-	-	
FREQ_EXIST	2016	LOMA_A_L_FRES1_1 (L_FRESNO-LOMA_ALT)	1,404	7	377	389	391	241	-	-	6	-	-	-	-	-	
FREQ_EXIST	2016	DIL_COTU_1 (DILLEYSW-COTULAS)	1,351	8	-	-	3	1	-	27	290	225	366	439	-	-	
FREQ_EXIST	2016	1030_B (BOSQUESW-RGH)	1,344	9	25	56	225	156	310	323	87	18	-	144	-	-	
FREQ_EXIST	2016	GILA_MORRIS1_1 (GILA-MORRIS)	1,263	10	14	13	6	130	216	334	172	140	163	75	-	-	
TOP10_RENT	2016	MDO_AT1 (MDO-MDO)	\$ 37.70	1	\$ 0.00	\$ -	\$ 0.58	\$ 0.75	\$ 6.62	\$ 28.57	\$ 0.81	\$ 0.01	\$ 0.28	\$ 0.07	\$ -	\$ -	
TOP10_RENT	2016	SNG-ZEN (SNG-ZEN)	\$ 31.92	2	\$ -	\$ 0.01	\$ 0.02	\$ 0.14	\$ 2.62	\$ 2.18	\$ 8.31	\$ 9.36	\$ 5.92	\$ 3.37	\$ -	\$ -	
TOP10_RENT	2016	LOMA_A_L_FRES1_1 (L_FRESNO-LOMA_ALT)	\$ 17.94	3	\$ 1.18	\$ 2.40	\$ 9.71	\$ 4.53	\$ -	\$ -	\$ 0.11	\$ -	\$ -	\$ -	\$ -	\$ -	
TOP10_RENT	2016	FTW_W_DE_1 (W_DENT-FTWORTH)	\$ 14.86	4	\$ -	\$ 0.08	\$ 0.15	\$ 4.72	\$ 4.16	\$ 0.10	\$ 1.06	\$ 1.72	\$ 1.00	\$ 1.88	\$ -	\$ -	
TOP10_RENT	2016	JEWET-SNG (JEWET-SNG)	\$ 12.16	5	\$ 0.86	\$ 0.39	\$ 0.11	\$ 0.51	\$ 0.05	\$ 0.82	\$ 0.02	\$ 0.18	\$ 0.65	\$ 8.55	\$ -	\$ -	
TOP10_RENT	2016	VALIMP (VALIMP)	\$ 11.83	6	\$ -	\$ 0.04	\$ 0.20	\$ 0.16	\$ 2.78	\$ 4.71	\$ 0.01	\$ 0.04	\$ 0.58	\$ 3.31	\$ -	\$ -	
TOP10_RENT	2016	JK_TOKSW_1 (TOKSW-JK_CK)	\$ 11.66	7	\$ 0.05	\$ -	\$ 0.58	\$ 0.58	\$ 0.84	\$ 4.45	\$ 1.69	\$ 0.74	\$ 0.71	\$ 2.02	\$ -	\$ -	
TOP10_RENT	2016	AIR_W_DE_1 (W_DENT-JMCRSTL)	\$ 11.52	8	\$ -	\$ -	\$ -	\$ -	\$ 0.01	\$ 1.41	\$ 4.91	\$ 2.70	\$ 1.30	\$ 1.21	\$ -	\$ -	
TOP10_RENT	2016	BETHK_66_A (HK-BET)	\$ 11.41	9	\$ -	\$ 0.00	\$ 0.00	\$ 0.91	\$ 0.01	\$ 1.36	\$ 2.20	\$ 4.31	\$ 2.24	\$ 0.39	\$ -	\$ -	
TOP10_RENT	2016	6265_D (MRSDO-RHTP2)	\$ 11.38	10	\$ -	\$ 0.02	\$ 6.10	\$ 5.25	\$ -	\$ 0.02	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	

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Top 10 CRR Pairs Ranked by Monthly Auction Values - Top 10 PTP Obligations by Total Transaction Values and Top 10 PTP Options by Total Transaction Values																	
ft	option	year	pair	total value	rank	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
N		2016	HB NORTH-HB HOUSTON	\$ 13.67	1	\$ 0.02	\$ 0.08	\$ 0.78	\$ 0.85	\$ 1.48	\$ 1.81	\$ 1.31	\$ 1.81	\$ 1.66	\$ 2.19	\$ 1.67	\$ -
N		2016	HB SOUTH-LZ SOUTH	\$ 7.63	2	\$ 0.76	\$ 0.64	\$ 0.80	\$ 0.72	\$ 0.76	\$ 0.69	\$ 0.60	\$ 0.62	\$ 0.96	\$ 0.49	\$ 0.59	\$ -
N		2016	HB NORTH-LZ NORTH	\$ 6.62	3	\$ 0.24	\$ 0.21	\$ 0.15	\$ 0.43	\$ 0.83	\$ 0.89	\$ 0.77	\$ 1.04	\$ 0.86	\$ 0.61	\$ 0.59	\$ -
N		2016	HB HOUSTON-LZ HOUSTON	\$ 4.09	4	\$ 0.12	\$ 0.08	\$ 0.08	\$ 0.11	\$ 0.28	\$ 0.51	\$ 0.64	\$ 0.91	\$ 0.68	\$ 0.49	\$ 0.19	\$ -
N		2016	HB WEST-HB NORTH	\$ 3.64	5	\$ 0.01	\$ 0.00	\$ 0.27	\$ 0.45	\$ 1.15	\$ 0.63	\$ 0.02	\$ 0.02	\$ 0.02	\$ 0.39	\$ 0.69	\$ -
N		2016	HB NORTH-HB SOUTH	\$ 3.43	6	\$ 0.03	\$ 0.05	\$ 0.12	\$ 0.28	\$ 0.47	\$ 0.33	\$ 0.14	\$ 0.74	\$ 0.39	\$ 0.48	\$ 0.40	\$ -
N		2016	HB WEST-LZ WEST	\$ 2.55	7	\$ 0.29	\$ 0.23	\$ 0.13	\$ 0.11	\$ 0.24	\$ 0.56	\$ 0.29	\$ 0.25	\$ 0.15	\$ 0.13	\$ 0.17	\$ -
N		2016	CPSES UNIT2-HB NORTH	\$ 0.93	8	\$ 0.01	\$ 0.01	\$ 0.04	\$ 0.18	\$ 0.17	\$ 0.04	\$ 0.01	\$ 0.02	\$ 0.10	\$ 0.14	\$ 0.20	\$ -
N		2016	CPSES UNIT1-HB NORTH	\$ 0.72	9	\$ 0.01	\$ 0.01	\$ 0.03	\$ 0.22	\$ 0.17	\$ 0.05	\$ 0.00	\$ 0.01	\$ 0.03	\$ 0.09	\$ 0.10	\$ -
N		2016	JCKCNTY2_ST2-LZ NORTH	\$ 0.57	10	\$ 0.02	\$ 0.02	\$ 0.01	\$ -	\$ 0.07	\$ 0.14	\$ 0.06	\$ 0.08	\$ 0.10	\$ 0.07	\$ -	\$ -
Y		2016	HB NORTH-LZ NORTH	\$ 3.20	1	\$ 0.27	\$ 0.25	\$ 0.09	\$ 0.16	\$ 0.27	\$ 0.41	\$ 0.37	\$ 0.53	\$ 0.40	\$ 0.23	\$ 0.24	\$ -
Y		2016	HB SOUTH-LZ SOUTH	\$ 2.20	2	\$ 0.21	\$ 0.15	\$ 0.13	\$ 0.30	\$ 0.38	\$ 0.20	\$ 0.23	\$ 0.22	\$ 0.17	\$ 0.12	\$ 0.10	\$ -
Y		2016	HB HOUSTON-LZ HOUSTON	\$ 1.76	3	\$ 0.06	\$ 0.05	\$ 0.09	\$ 0.13	\$ 0.11	\$ 0.18	\$ 0.23	\$ 0.35	\$ 0.32	\$ 0.19	\$ 0.06	\$ -
Y		2016	HB WEST-HB NORTH	\$ 1.36	4	\$ 0.07	\$ 0.14	\$ 0.16	\$ 0.16	\$ 0.13	\$ 0.42	\$ 0.10	\$ 0.06	\$ 0.11	\$ 0.00	\$ 0.01	\$ -
Y		2016	HB WEST-LZ WEST	\$ 1.19	5	\$ 0.21	\$ 0.17	\$ 0.14	\$ 0.11	\$ 0.09	\$ 0.08	\$ 0.10	\$ 0.06	\$ 0.07	\$ 0.07	\$ 0.07	\$ -
Y		2016	STP STP G1-LZ CPS	\$ 0.91	6	\$ 0.06	\$ 0.10	\$ 0.05	\$ 0.01	\$ 0.05	\$ 0.07	\$ 0.01	\$ 0.05	\$ 0.39	\$ 0.08	\$ 0.04	\$ -
Y		2016	STP STP G2-LZ CPS	\$ 0.81	7	\$ 0.06	\$ 0.10	\$ 0.05	\$ 0.01	\$ 0.05	\$ 0.07	\$ 0.01	\$ 0.04	\$ 0.38	\$ 0.03	\$ 0.01	\$ -
Y		2016	SAN SANMIGG1-LZ SOUTH	\$ 0.65	8	\$ 0.11	\$ 0.16	\$ 0.05	\$ 0.05	\$ 0.09	\$ 0.10	\$ 0.02	\$ 0.02	\$ 0.01	\$ 0.03	\$ 0.00	\$ -
Y		2016	BORDAS ALL-LZ SOUTH	\$ 0.51	9	\$ 0.04	\$ 0.03	\$ 0.10	\$ 0.12	\$ 0.15	\$ 0.06	\$ 0.01	\$ -	\$ -	\$ -	\$ -	\$ -
Y		2016	HB NORTH-HB HOUSTON	\$ 0.43	10	\$ 0.02	\$ 0.04	\$ 0.08	\$ 0.01	\$ 0.06	\$ 0.01	\$ 0.04	\$ 0.08	\$ 0.00	\$ 0.05	\$ 0.03	\$ -

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