Item 6: Independent Market Monitor (IMM) Report

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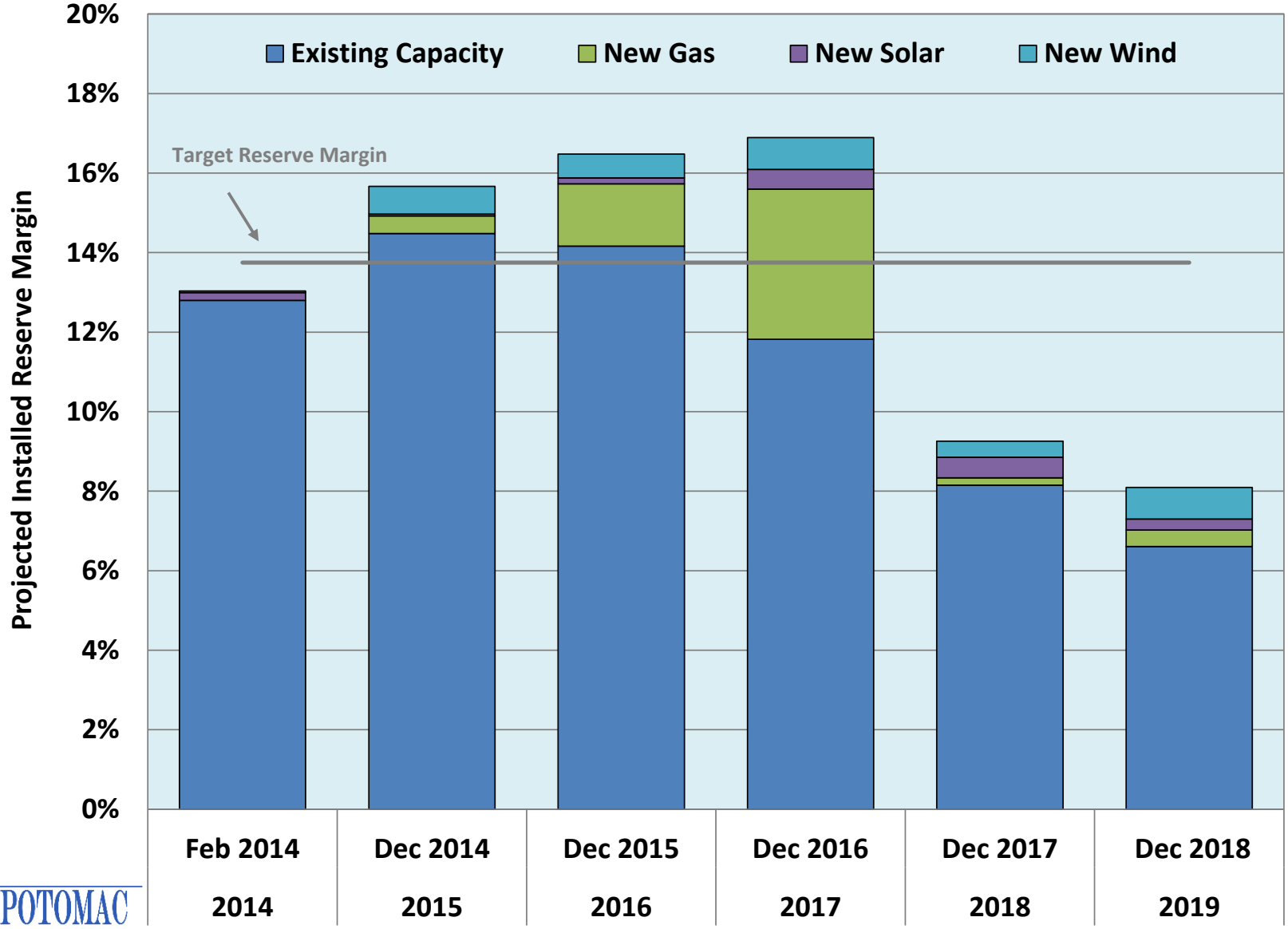
Board of Directors Meeting

ERCOT Public
October 8, 2019

Pre-summer thoughts

- High expectations for scarcity conditions during summer 2018 were largely unfulfilled
- Would similar high expectations for summer 2019 come to fruition?
- Would generation availability in 2019 be at the high levels experienced in 2018?

History of summer reserve margin expectations



POTOMAC ECONOMICS

August forward prices

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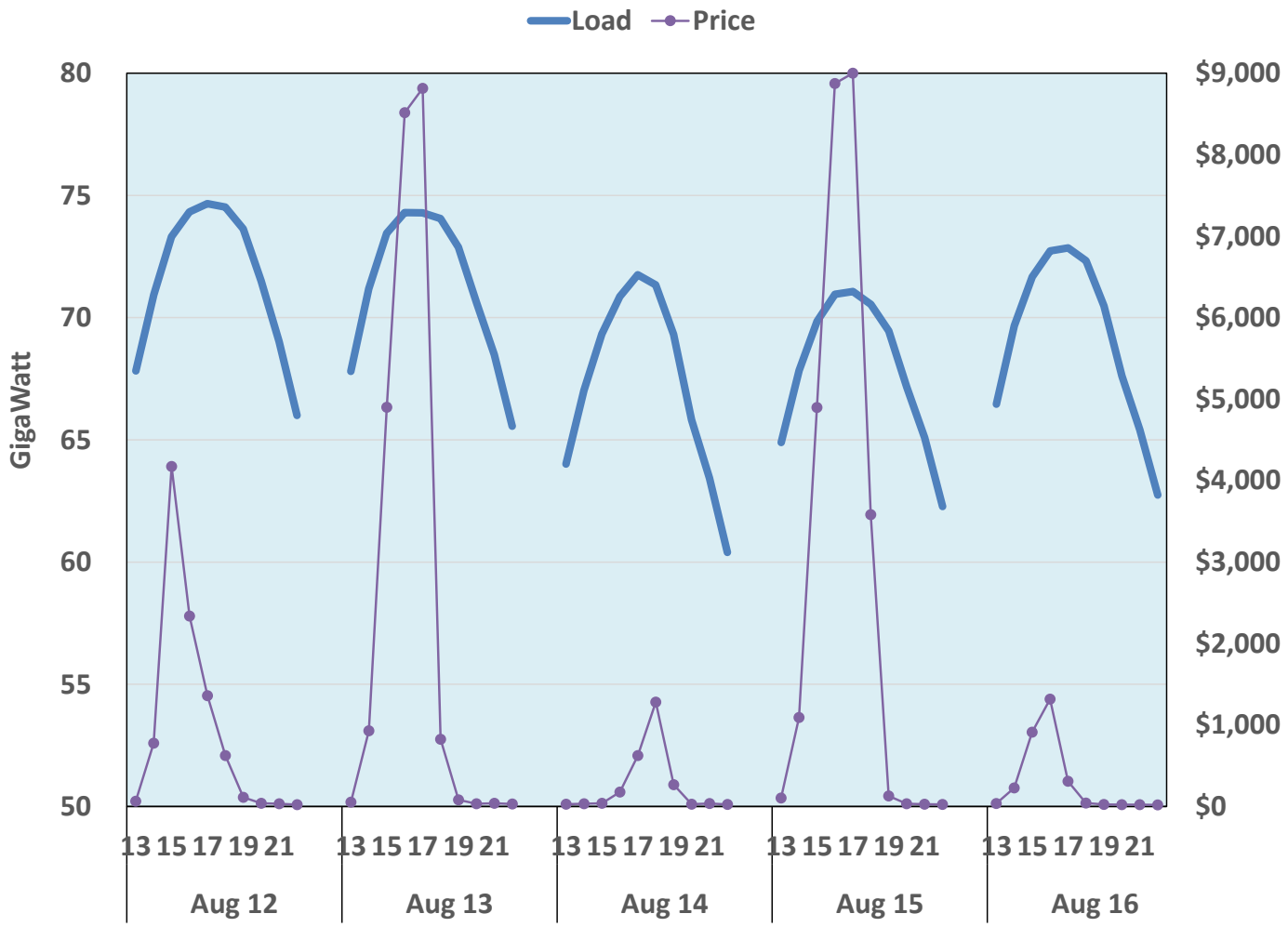
Summary of events August 12-16, 2019

- A new record peak demand was set on Monday, August 12
  - RT prices (HB_BUSAVG) reached $6500 for one 15-minute period, and averaged ~$1000 for the afternoon
- ERCOT declared Emergency conditions (EEA-1) on Tuesday and Thursday, August 13 and 15
  - Tuesday: RT prices reached $9000 for six periods and averaged ~$2500 for the afternoon
  - Thursday: RT prices reached $9000 for seven periods and averaged ~ $2900 for the afternoon
- Emergency Response Service (ERS) was deployed as part of the EEA conditions

After-event questions

- Were pricing outcomes reflective of system conditions?
- Did the ORDC and RDP price adders contribute appropriately to real-time prices?
- Did the various mechanisms ERCOT used to ensure demand/supply balance work as intended?
  - ERS
  - RRS deployments
- Did market participants effectively manage their price exposure?
- What does the future hold? Will enough new generation be built in ERCOT to meet forecasted increased demand?

EEA conditions were not on the highest load days



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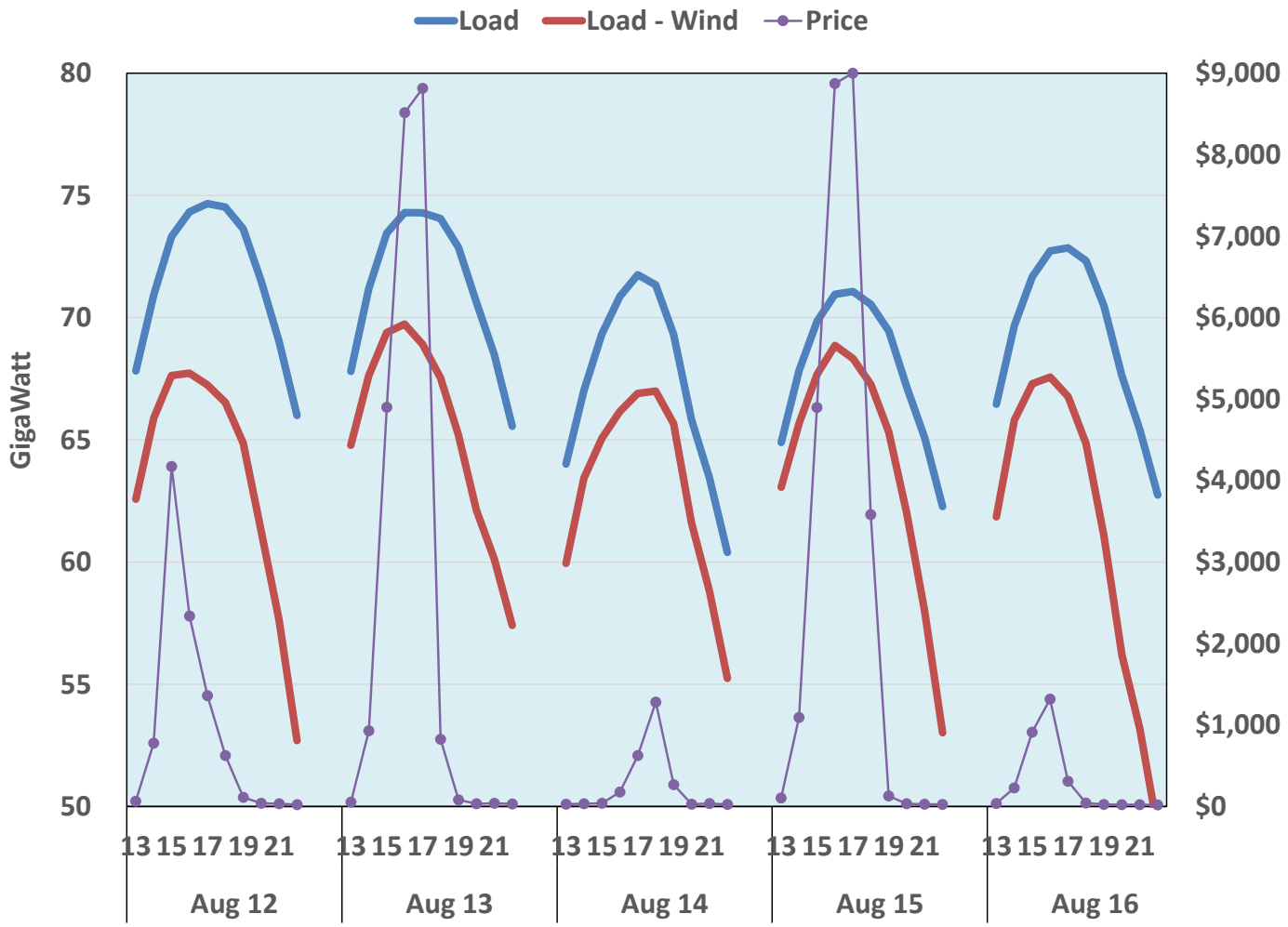
Net Load (Load – Wind) is a better predictor of high prices



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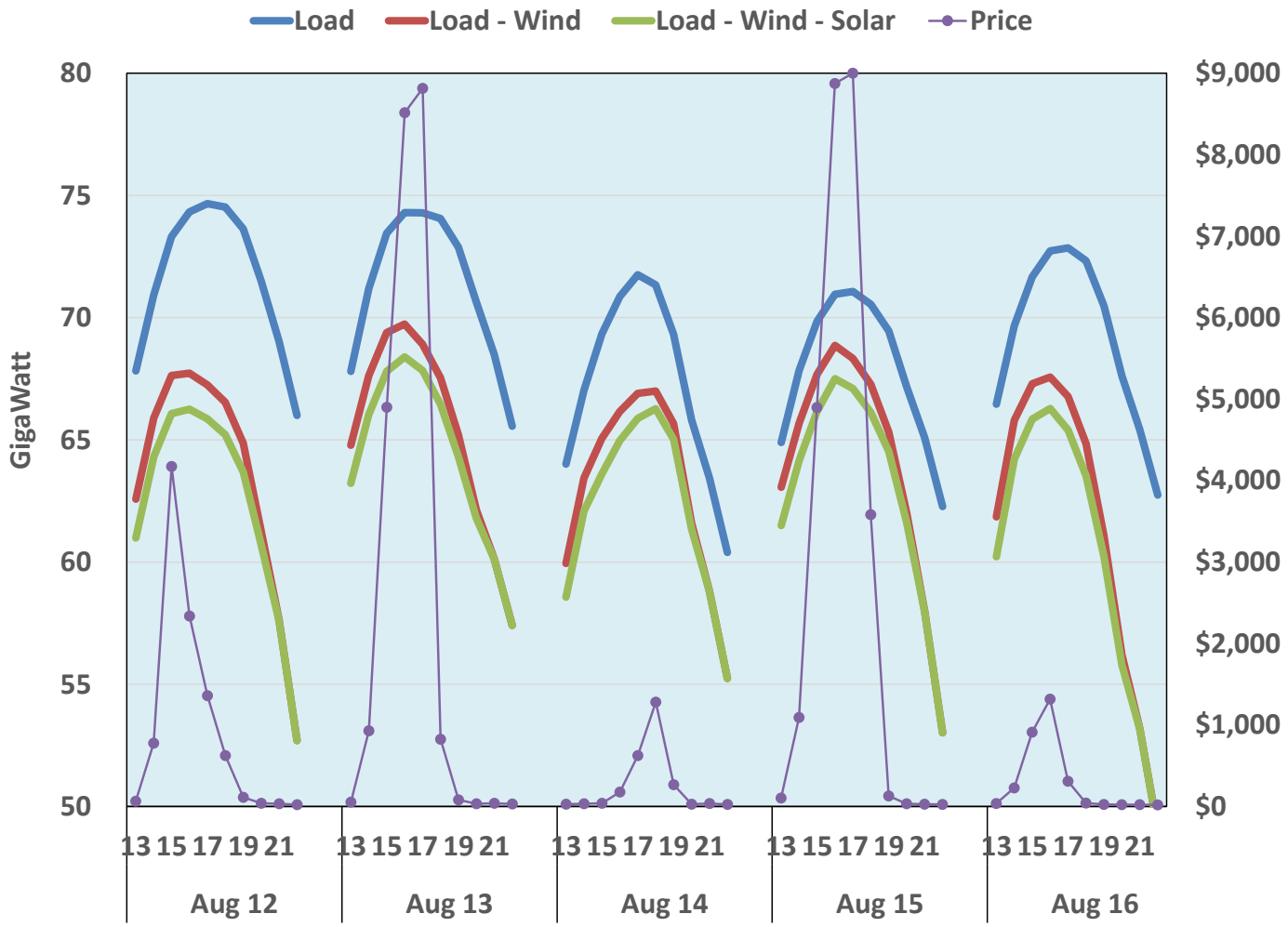
Highest prices are no longer associated with highest loads



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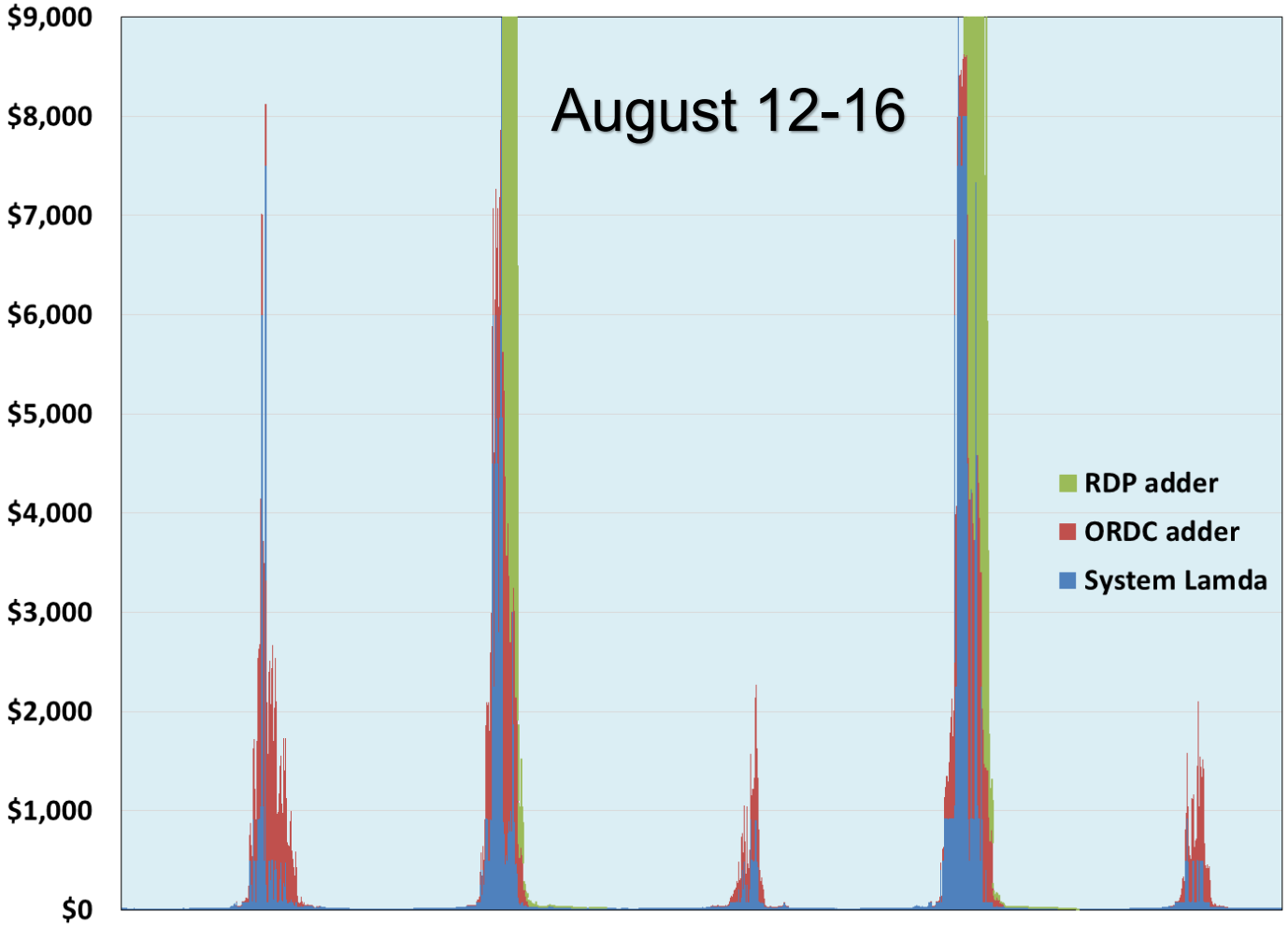
Three components of real-time prices



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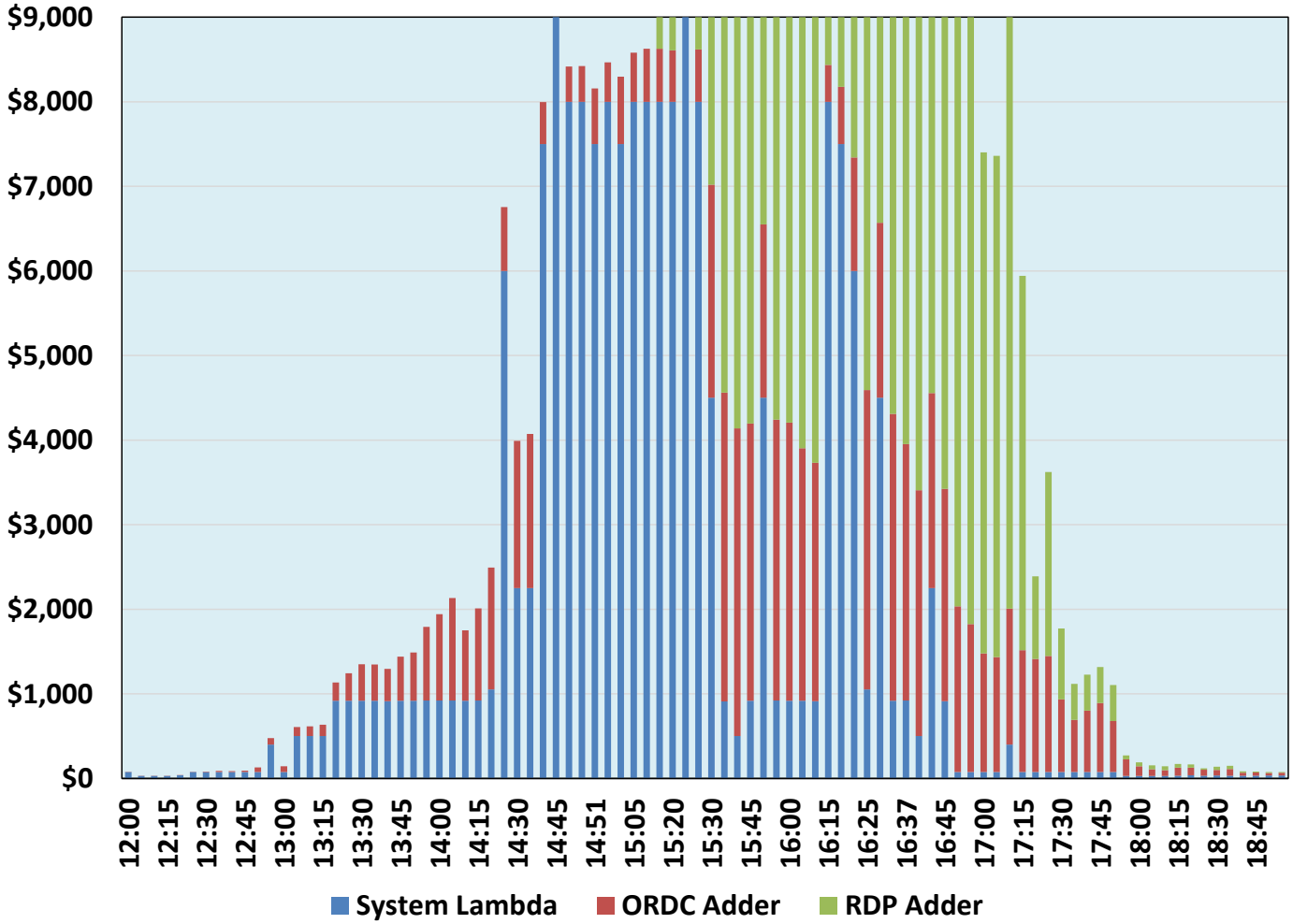
August 15 real-time prices



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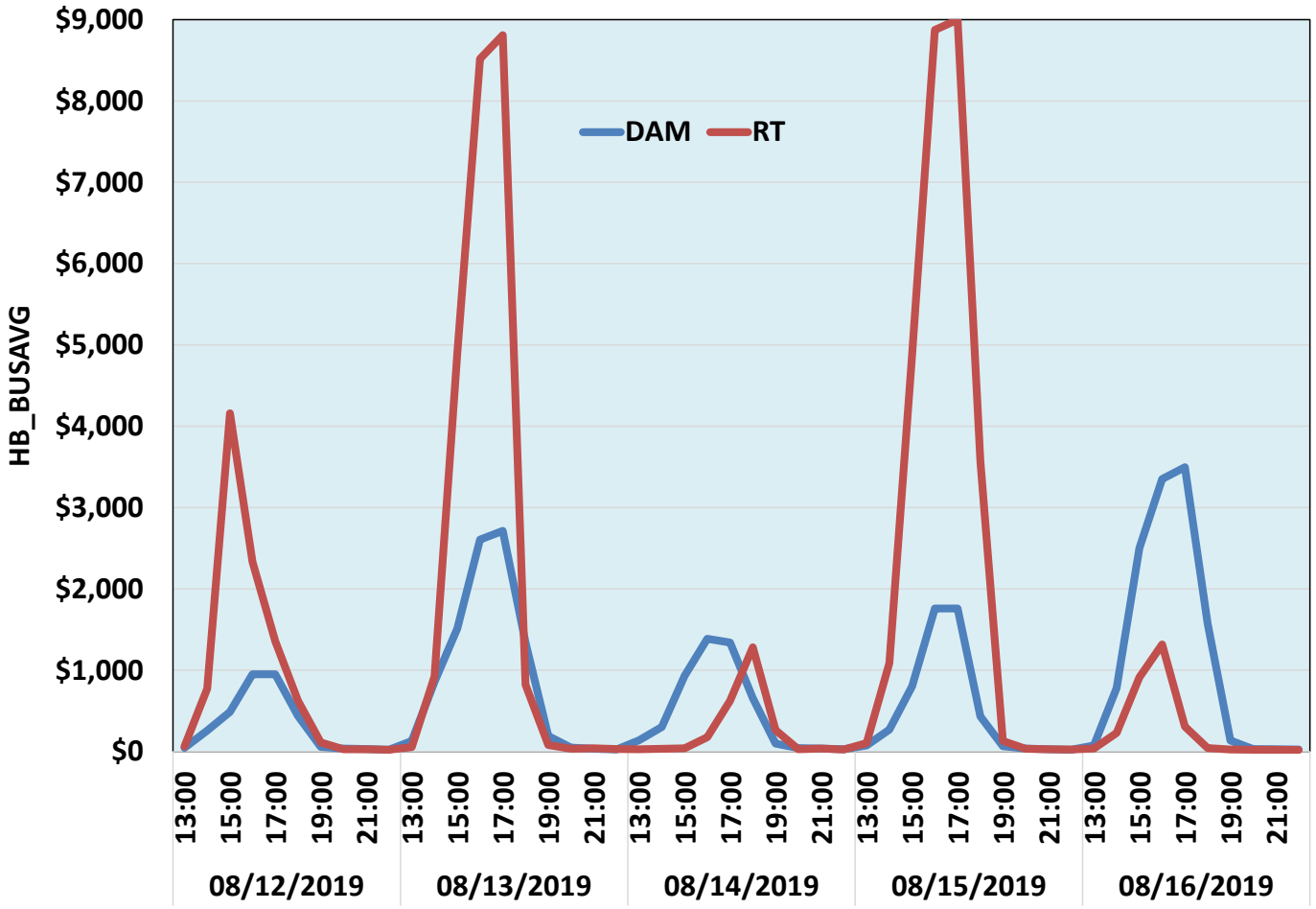
Day Ahead vs Real-Time Prices



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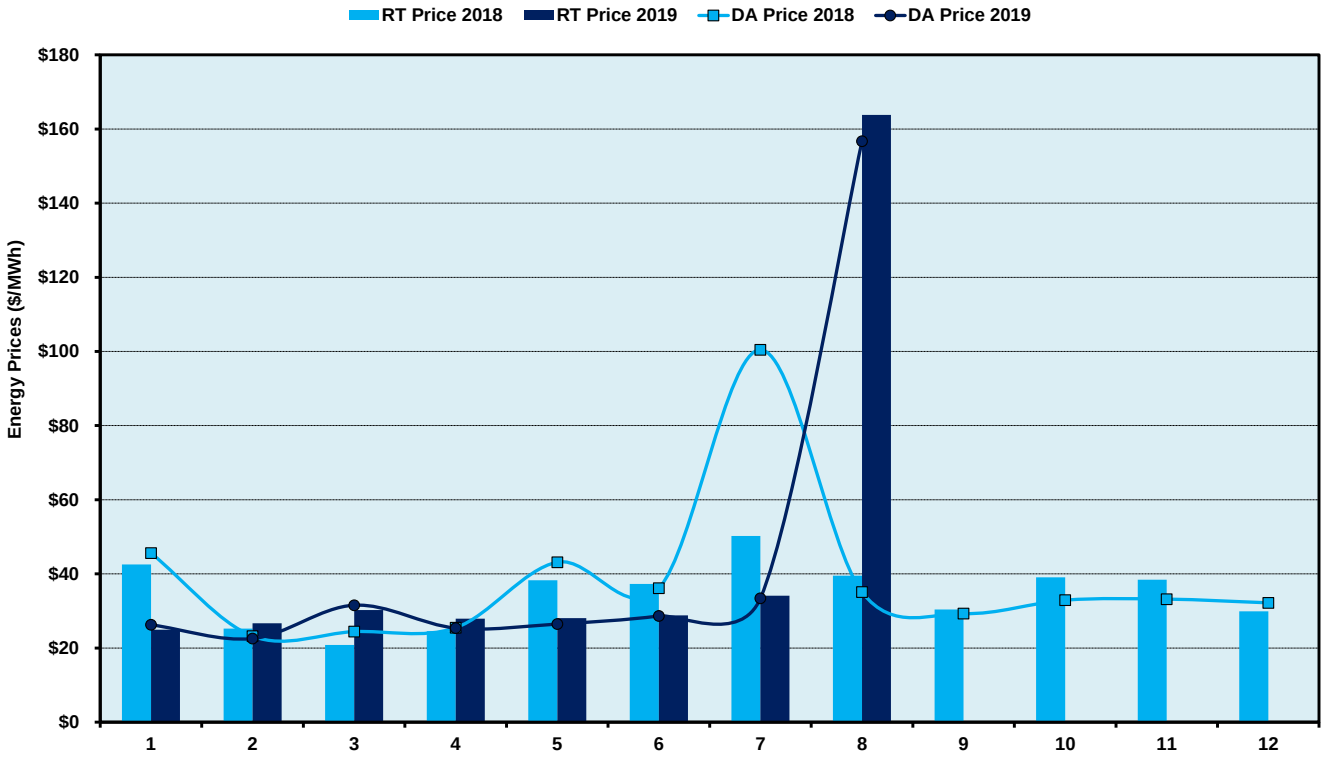
Higher energy prices due to scarcity

Real Time Prices
8M18: $36.2/MWh
2018: $35.6/MWh

8M19: $50.7/MWh
~ 40% increase

Natural Gas Prices
~15% lower so far in 2019



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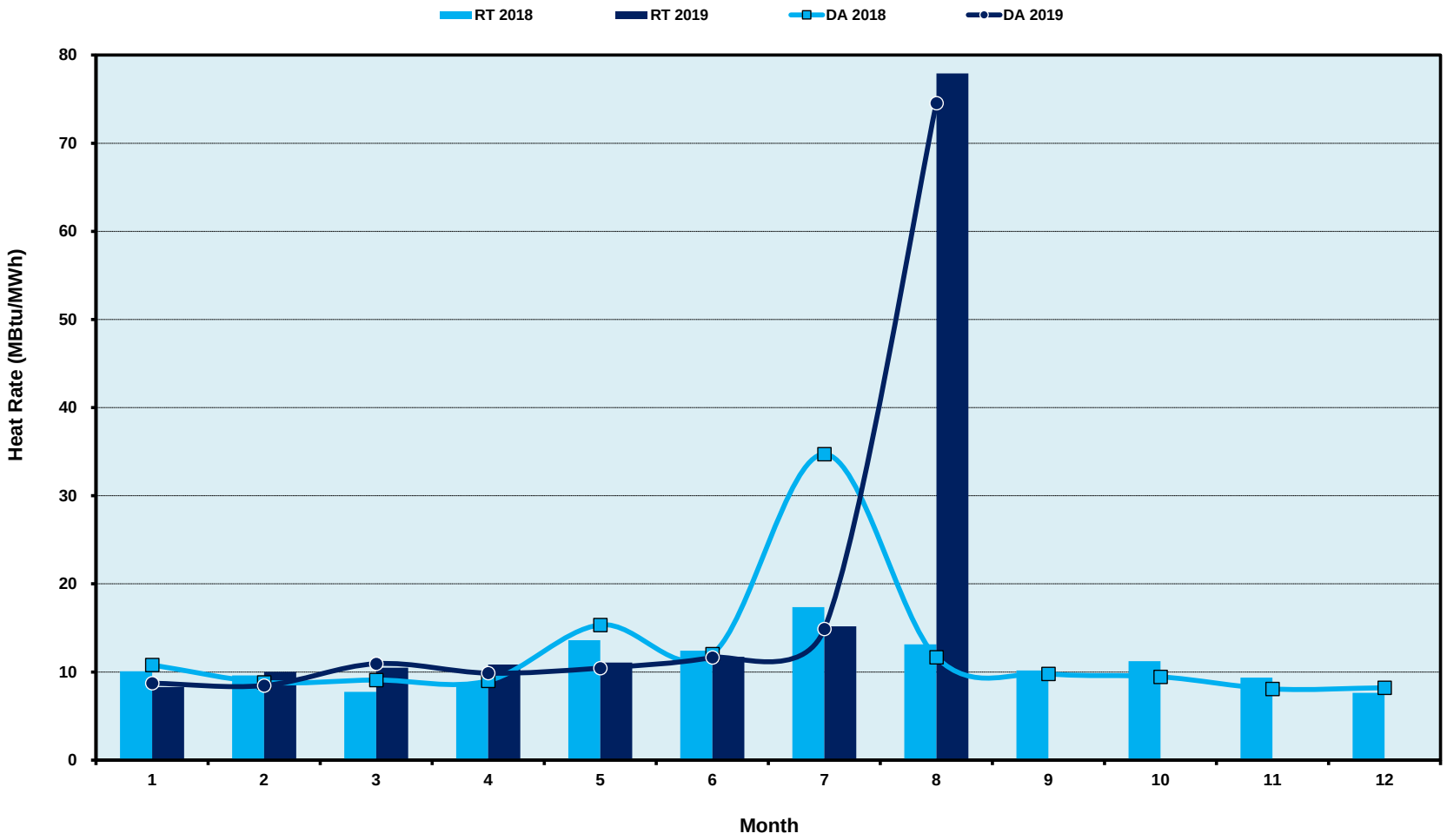
Lower 2019 gas prices results in much higher implied heat rates



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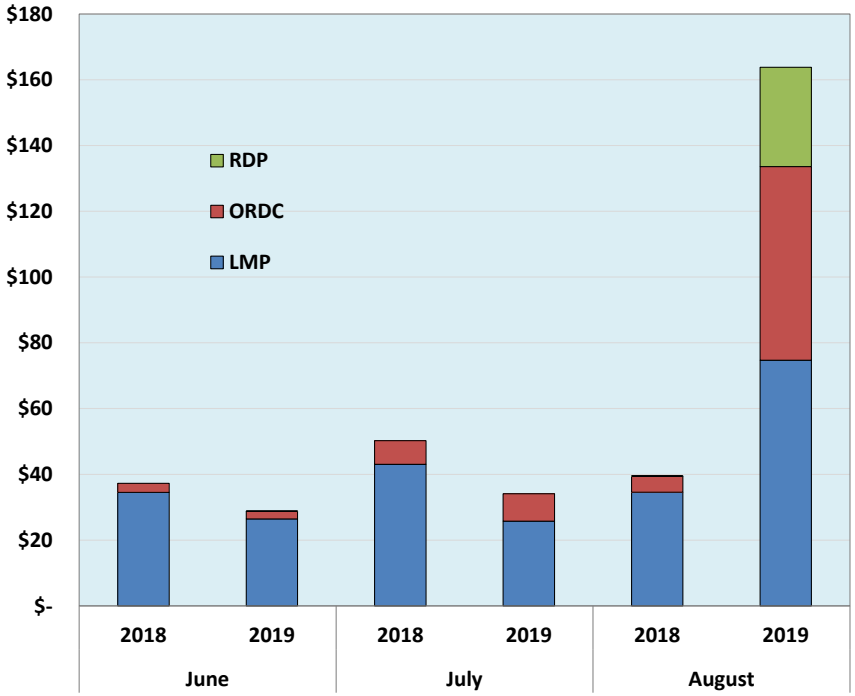
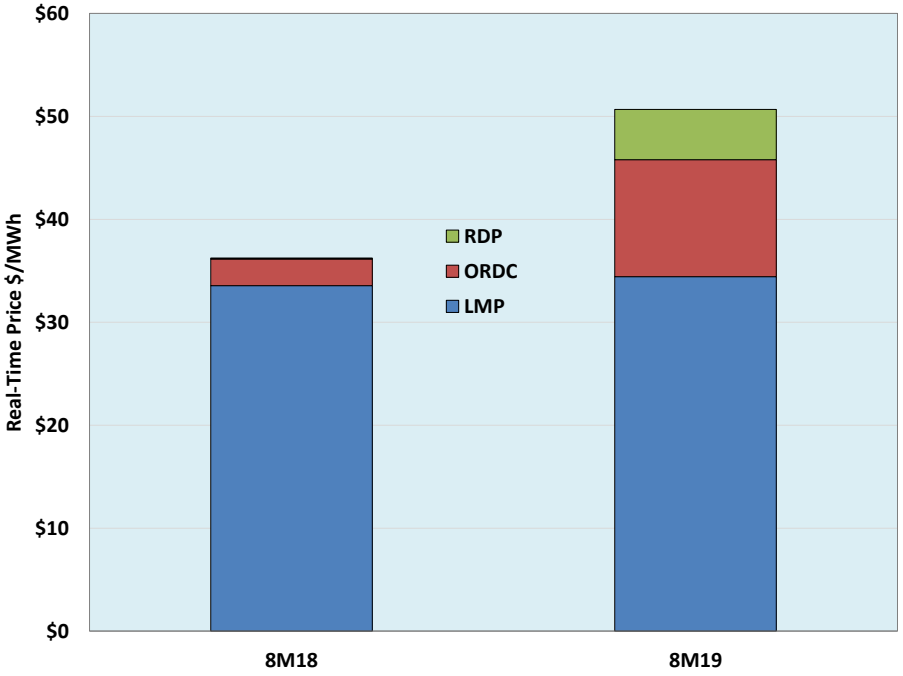
Larger adders contribute to higher 2019 prices





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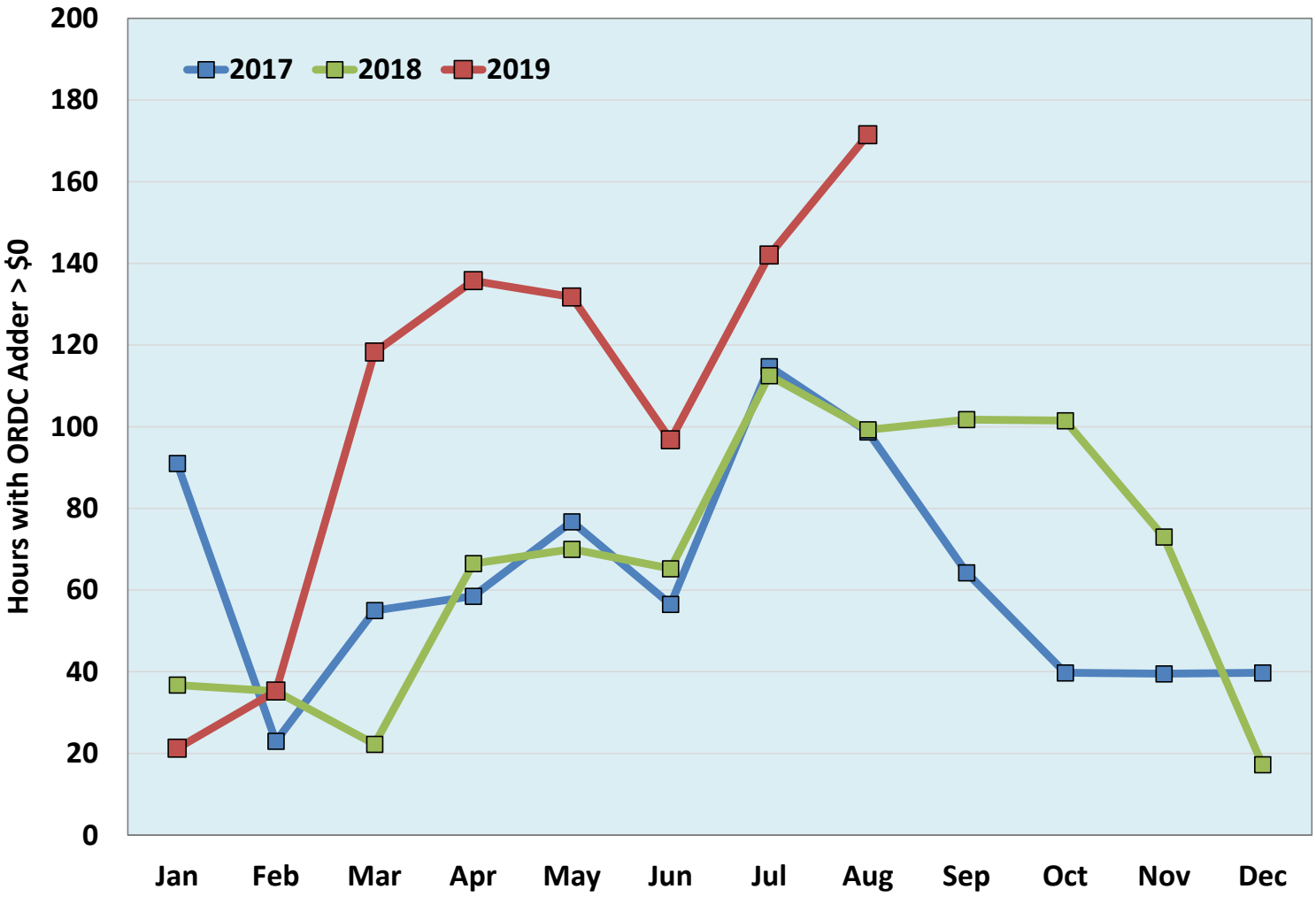
ORDC Adder is a more frequent contributor to price



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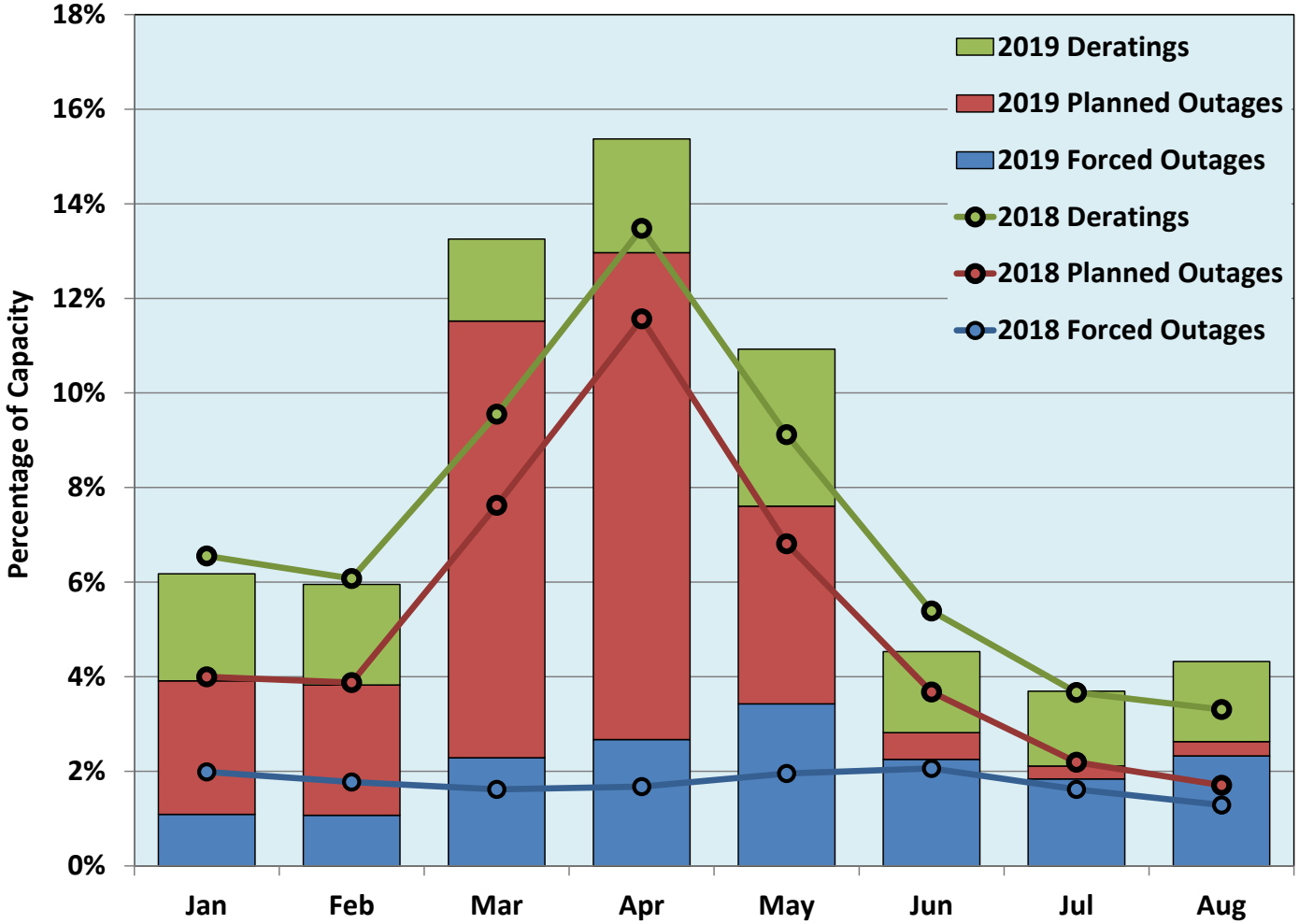
Low generator outage rates during summer months, but not as low as 2018



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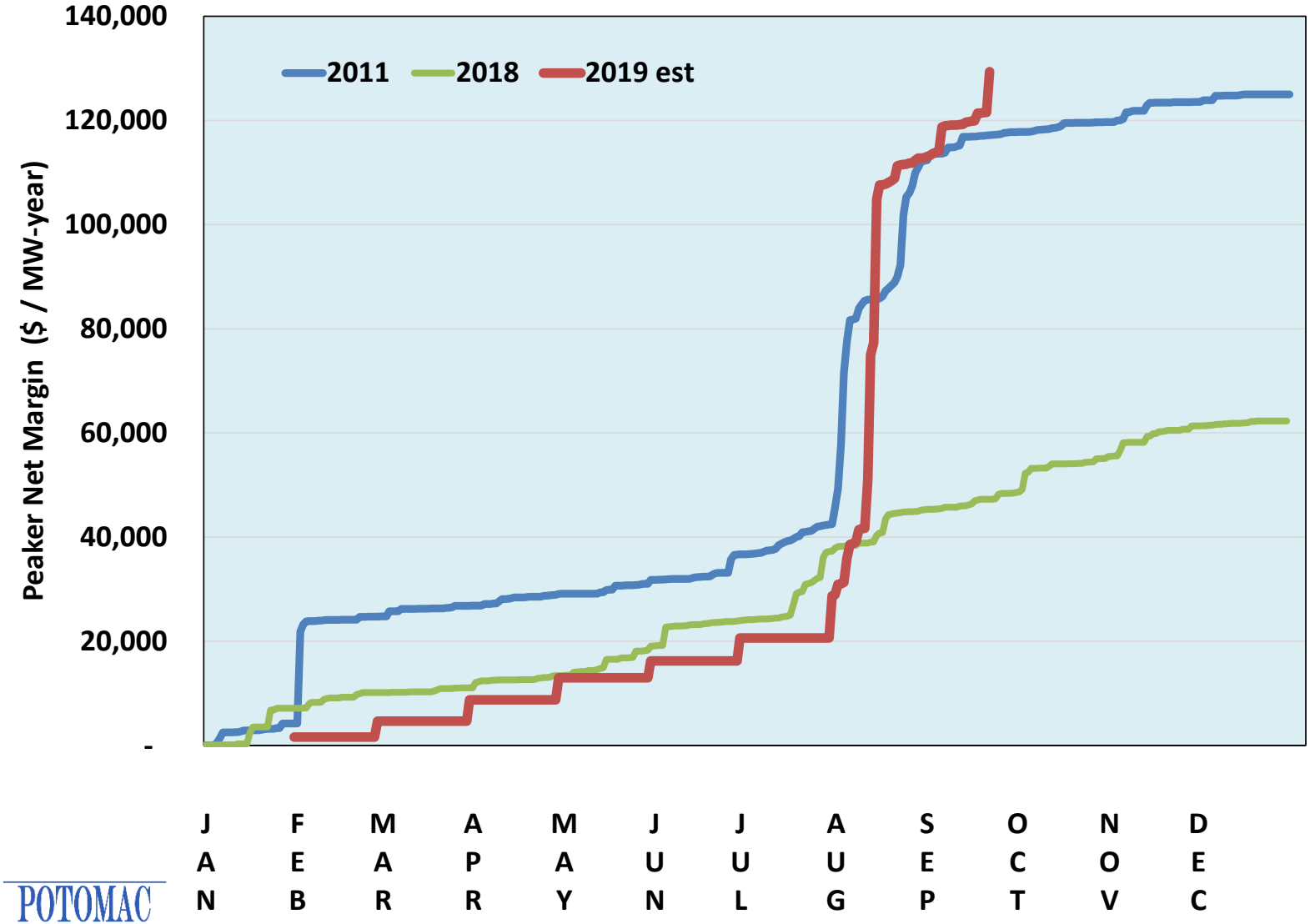
Peaker net margin in 2019 is the highest ever



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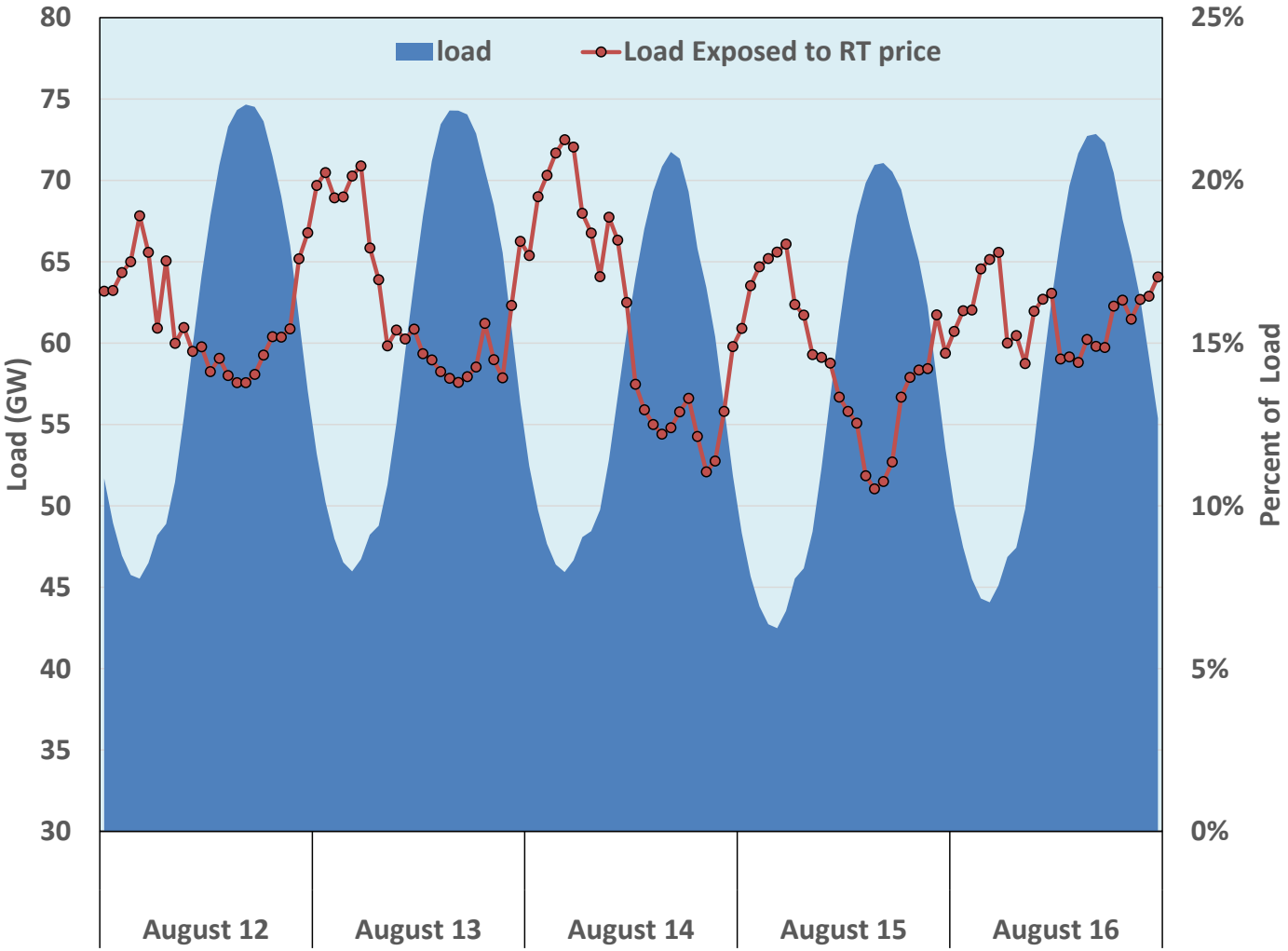
Load exposure to RT prices

Does not include purchases made in markets not administered by ERCOT



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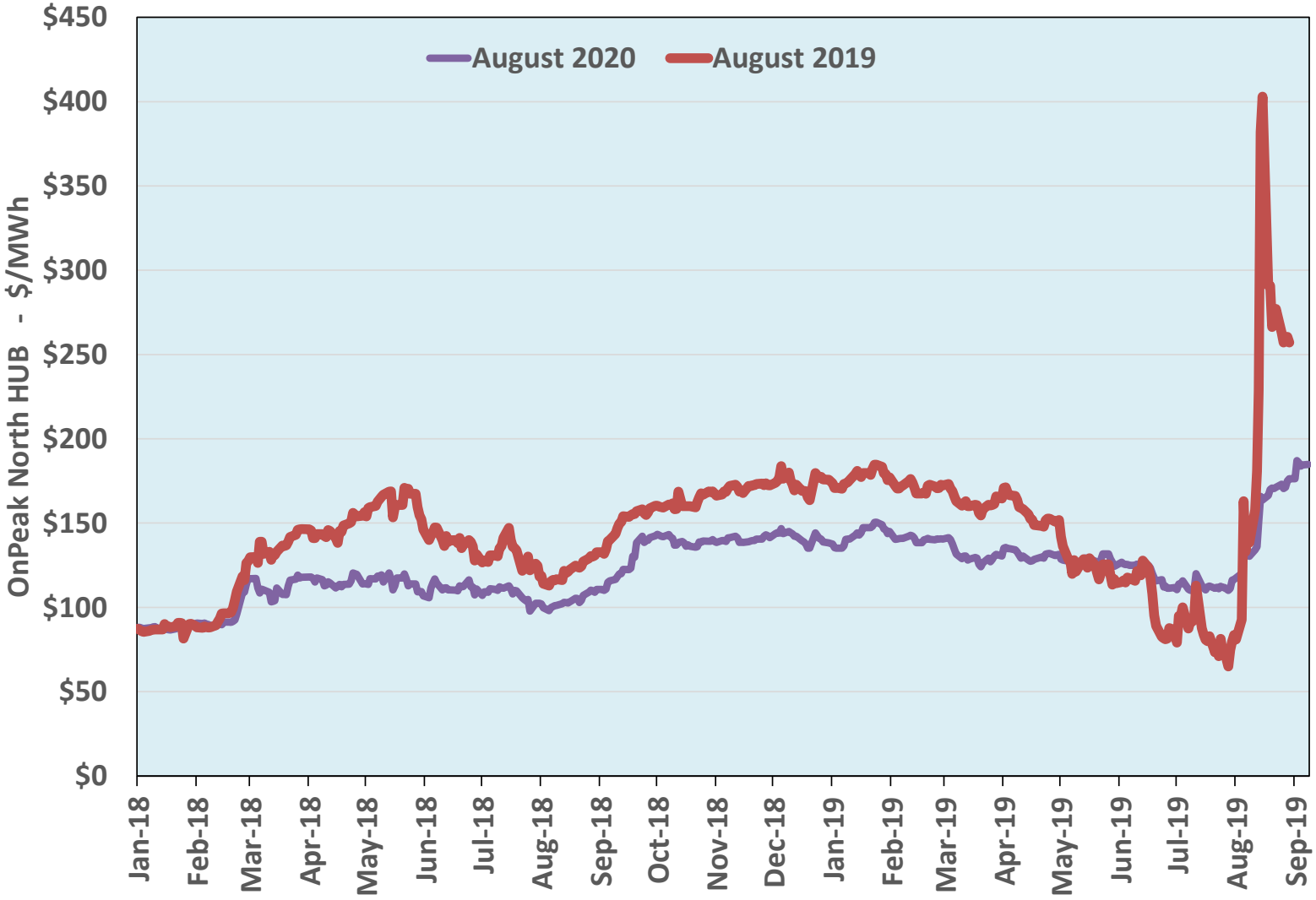
Looking Ahead to Summer 2020



POTOMAC ECONOMICS

To the Public Utility Commission of Texas

ERCOT Wholesale Electricity Market Monthly Report

Monday, September 9, 2019

Potomac Economics, Ltd.
Independent Market Monitor

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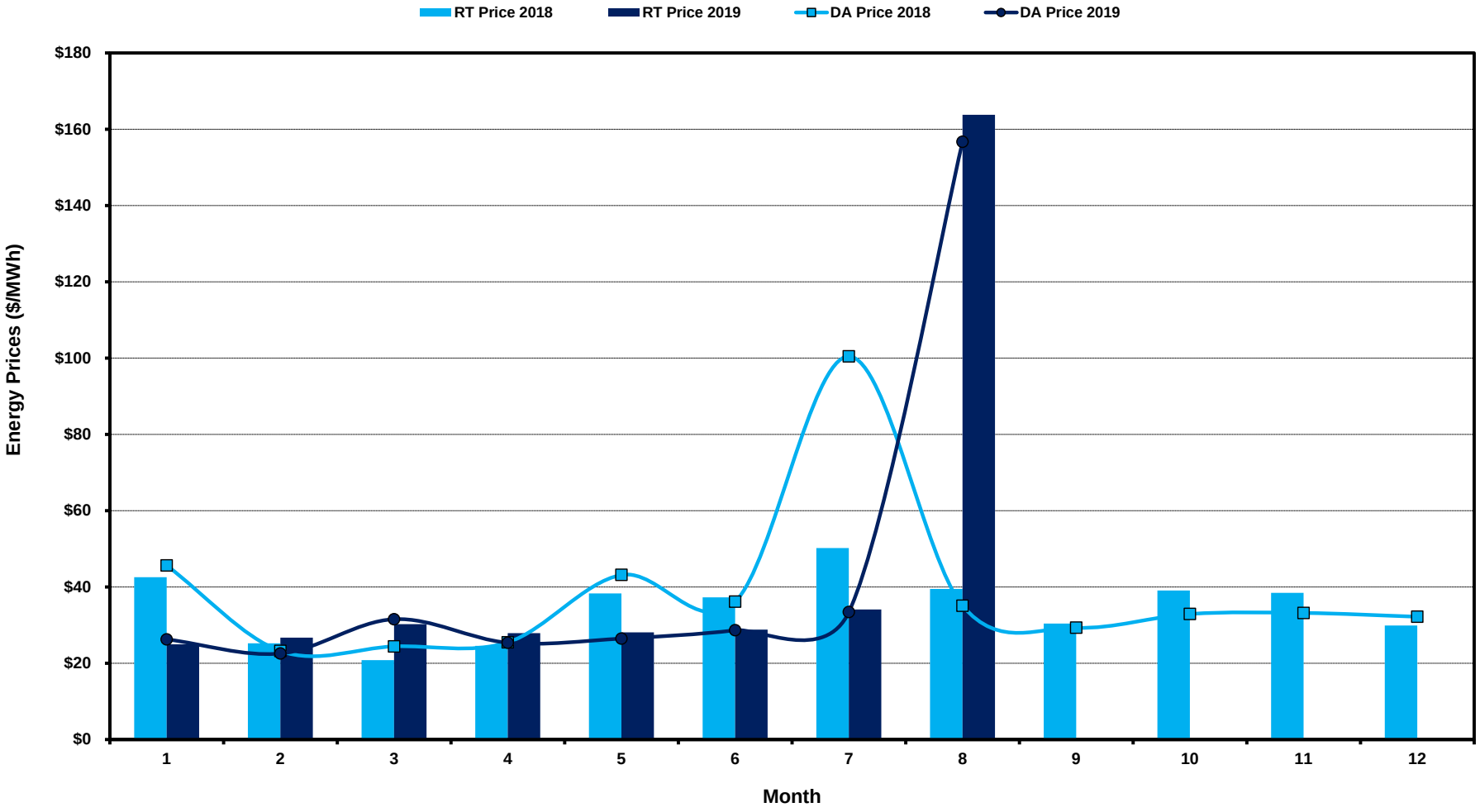
ERCOT-wide Average Energy Prices DA vs RT

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



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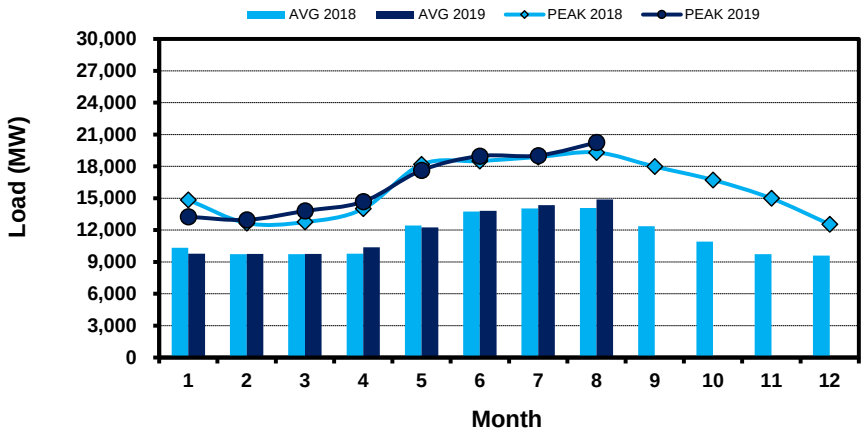
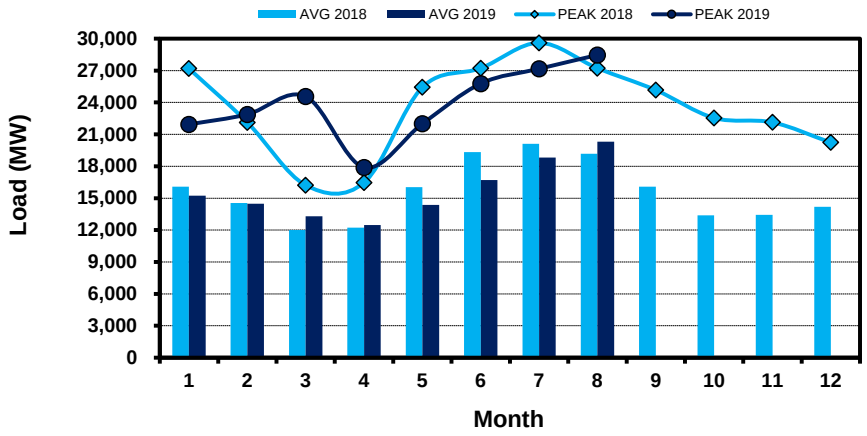
Load Zone Load Statistics

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

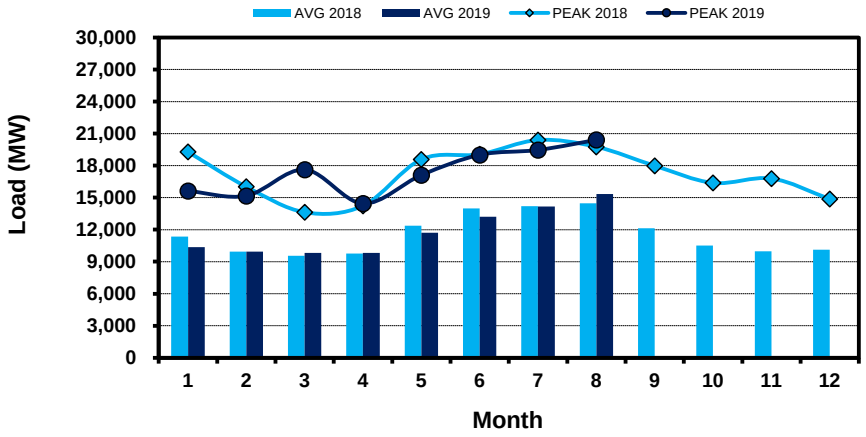
Houston Zone



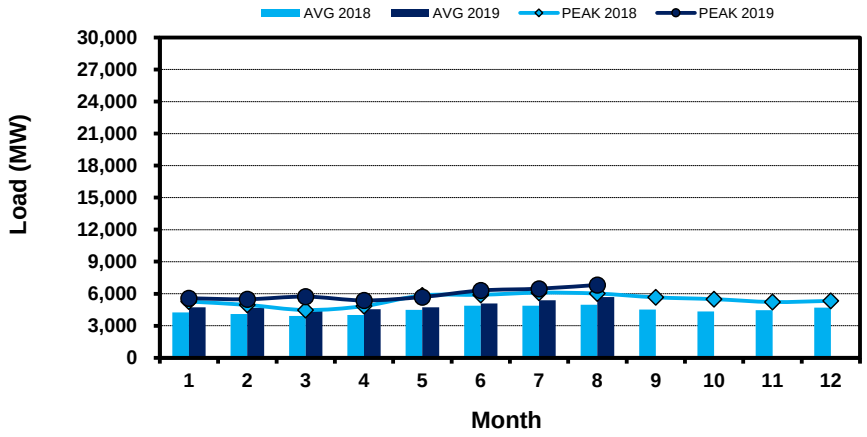
North Zone



South Zone



West Zone



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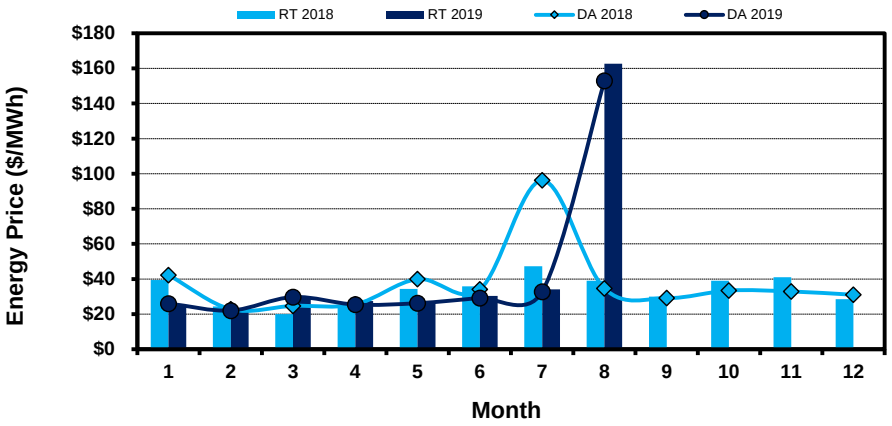
data

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



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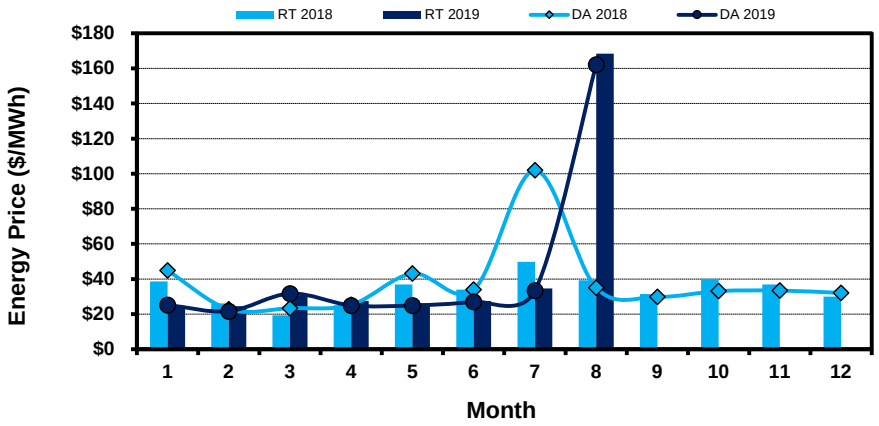
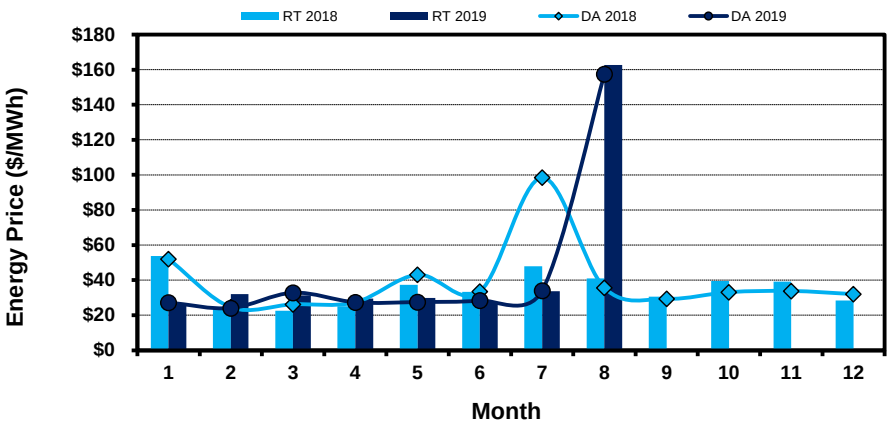
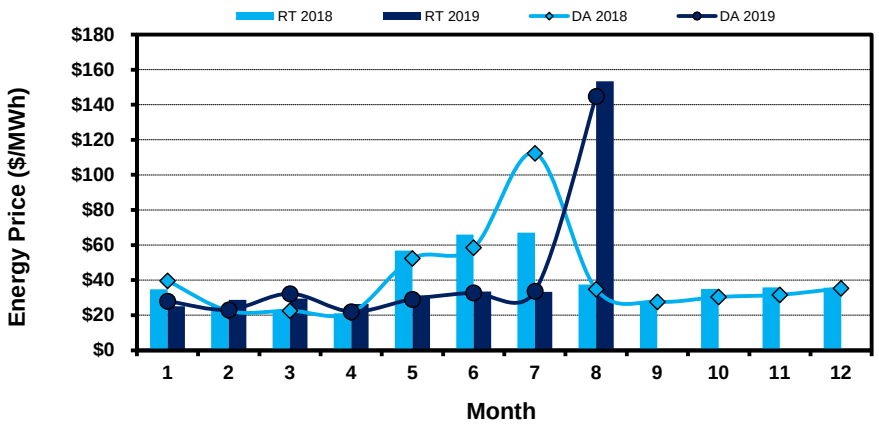


South Zone



West Zone



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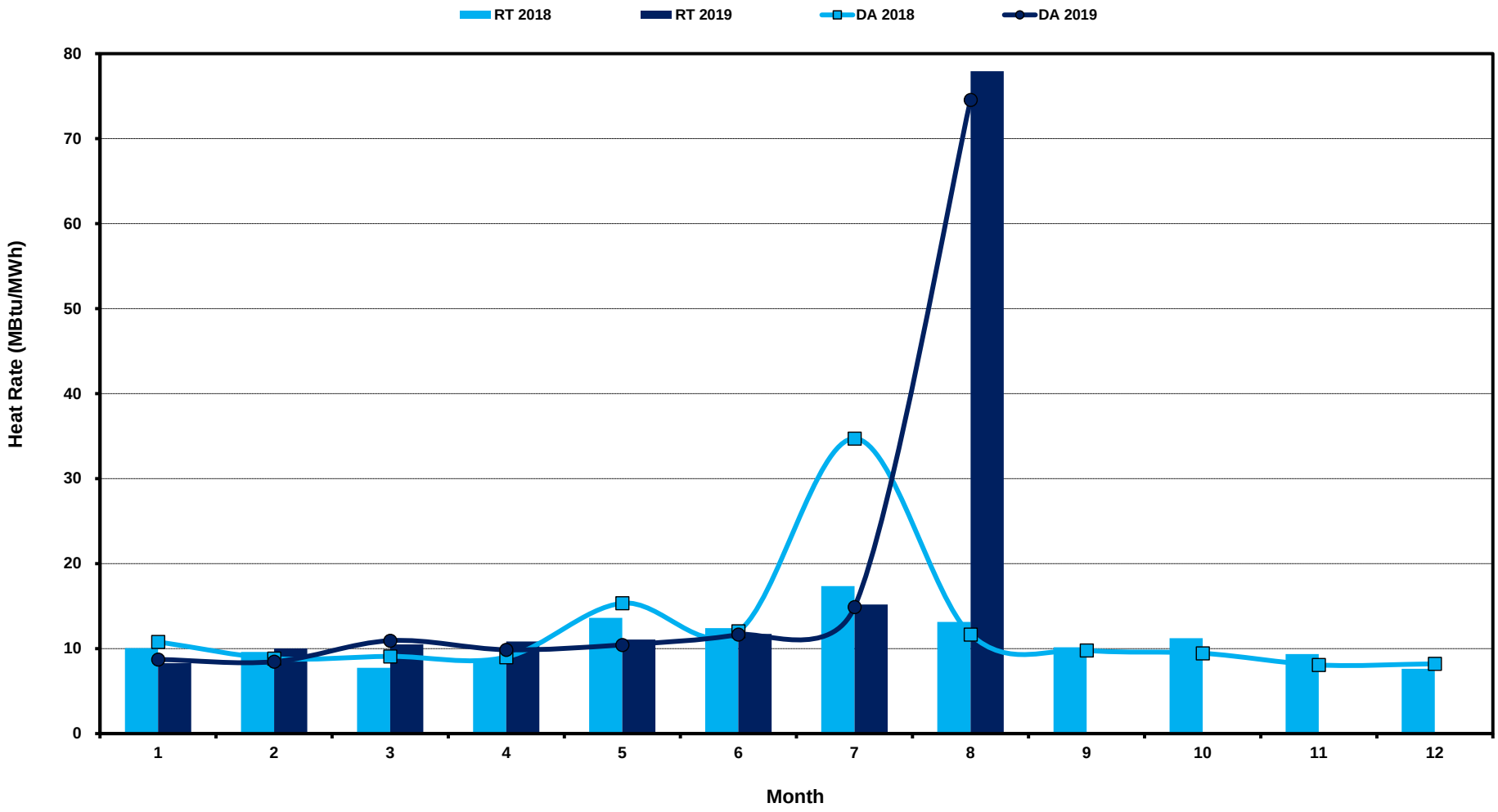
ERCOT-wide Monthly Implied Heat Rate DA vs RT

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



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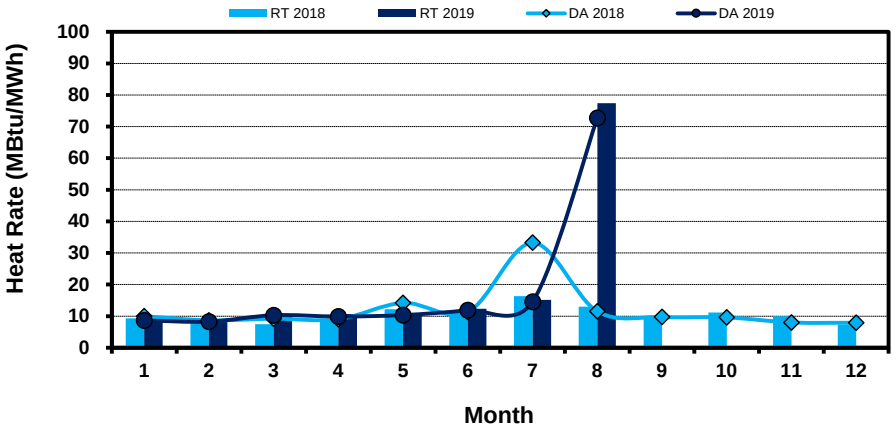
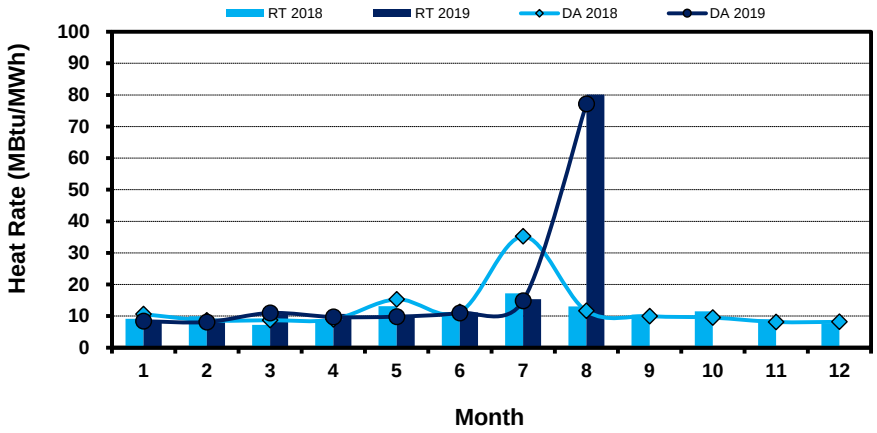
Load Zone Monthly Implied Heat Rate DA vs RT

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

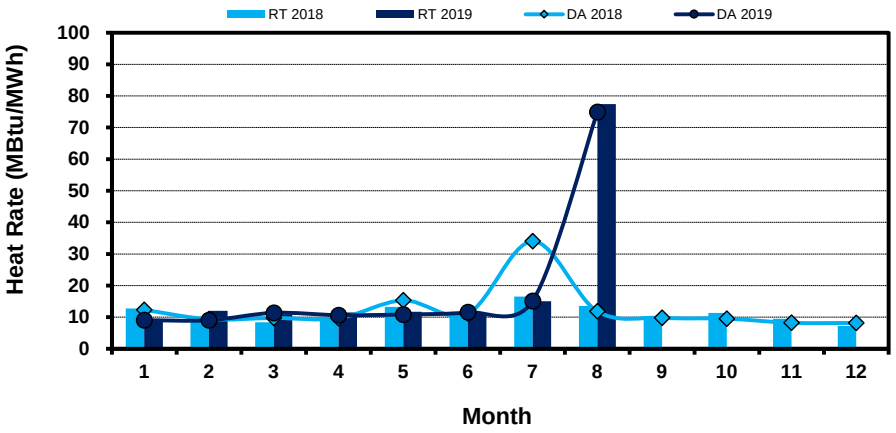
Houston Zone



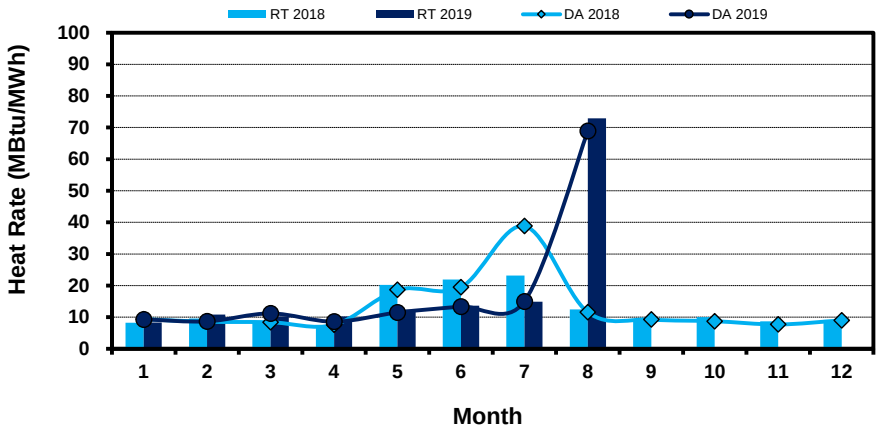
North Zone



South Zone



West Zone



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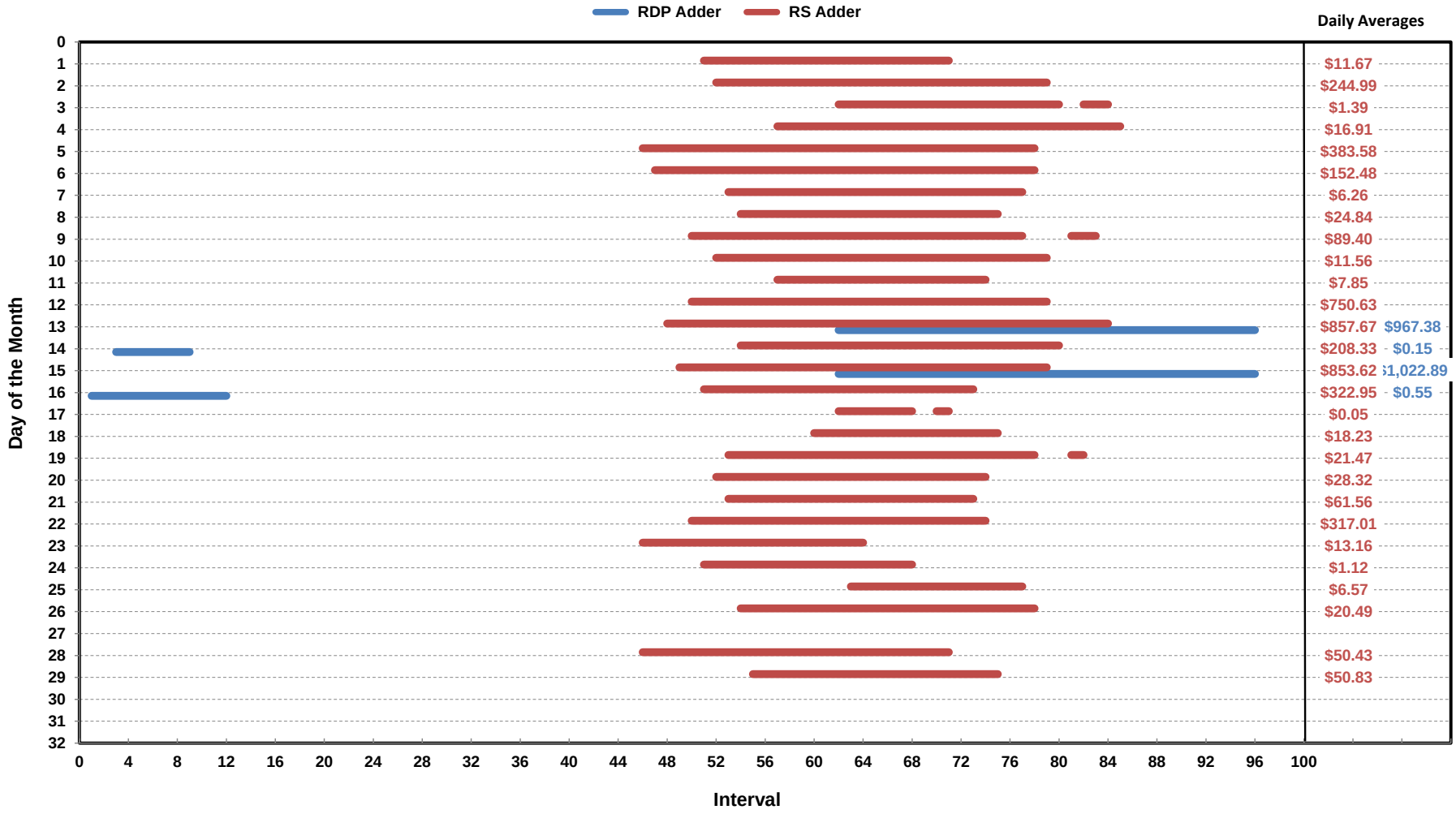
Daily ORDC Adders Average Values and Interval Duration

Aug-2019



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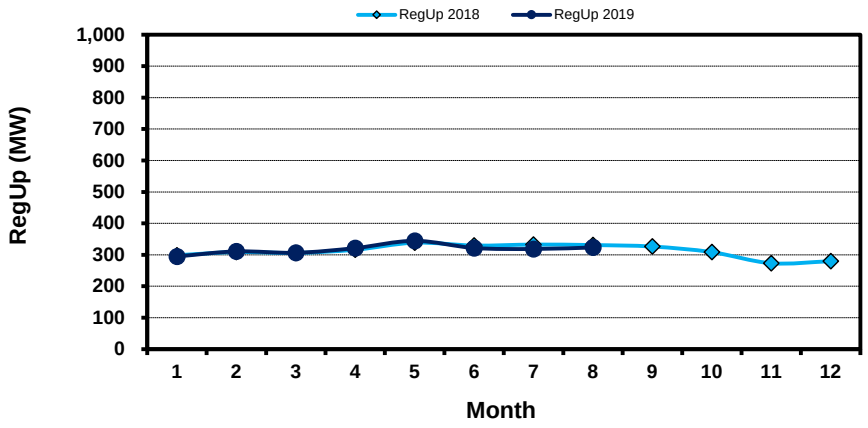
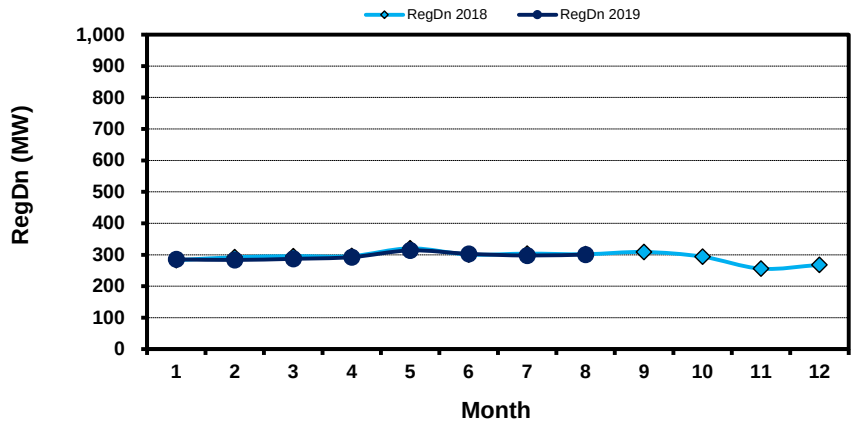
Monthly Average of Ancillary Services Required MW

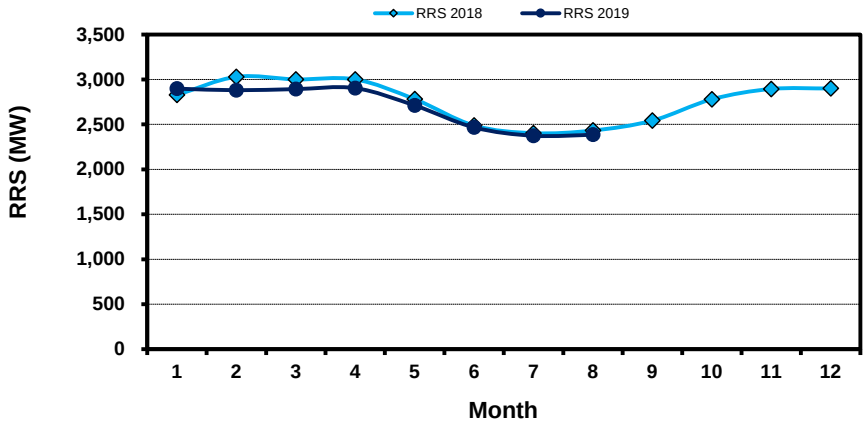
Regulation Up



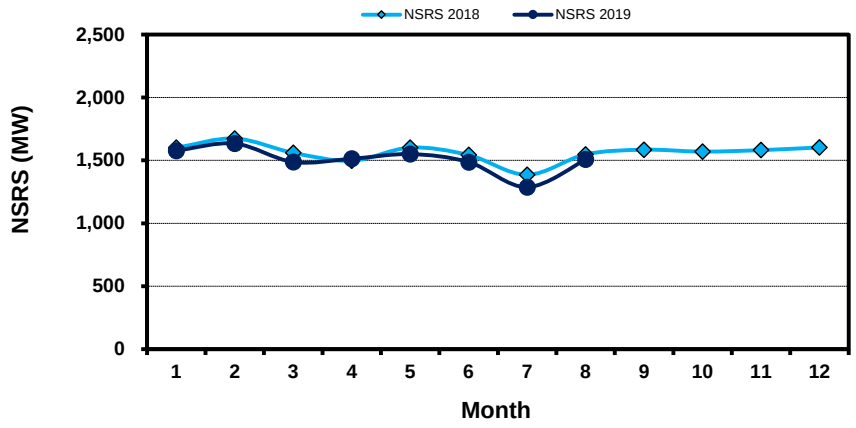
Regulation Down



Responsive Reserve



Non-Spin Reserve



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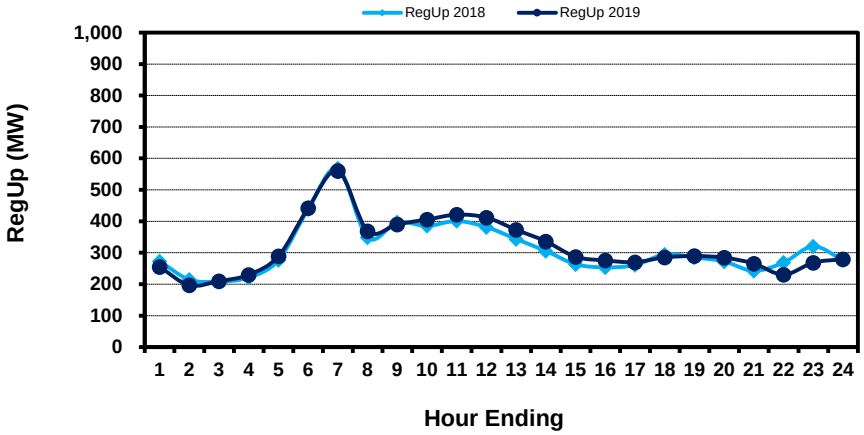
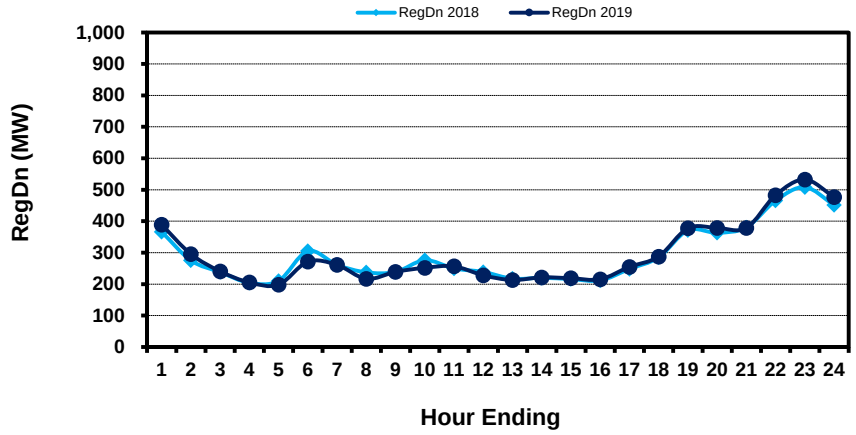
Hourly Average of Ancillary Services Required MW

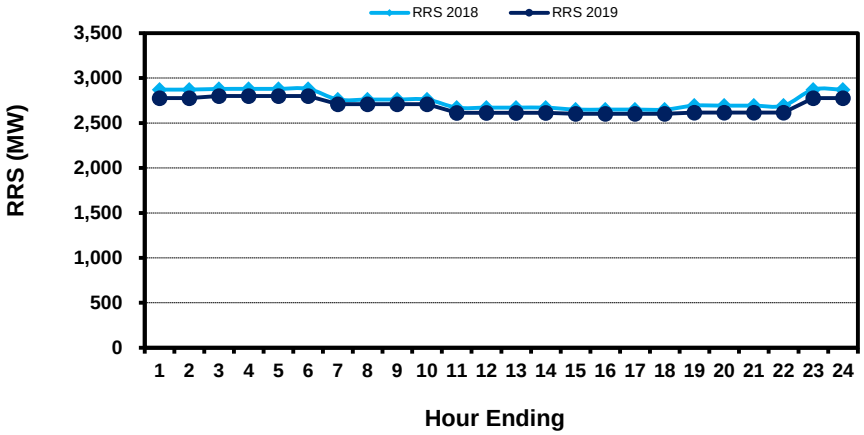
Regulation Up



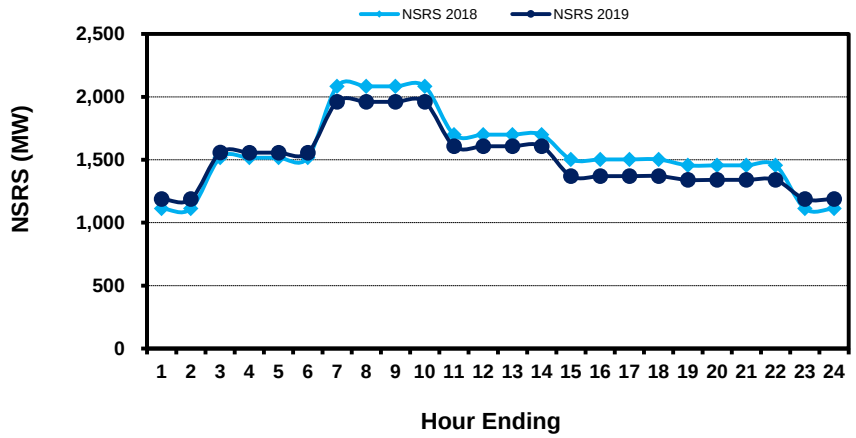
Regulation Down



Responsive Reserve



Non-Spin Reserve



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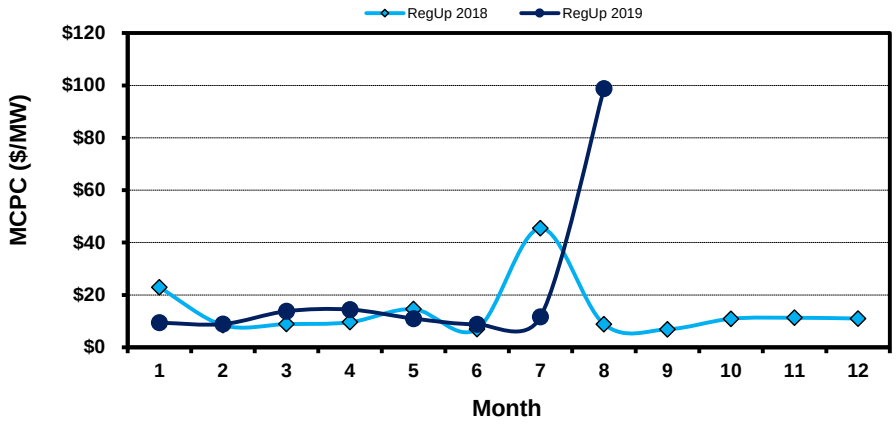
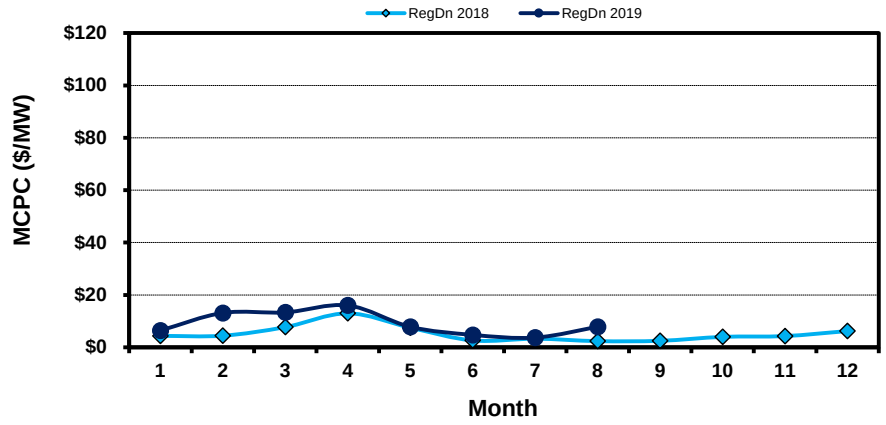
Monthly Average Ancillary Services Price

(weighted by A/S Quantities Required)

Regulation Up



Regulation Down



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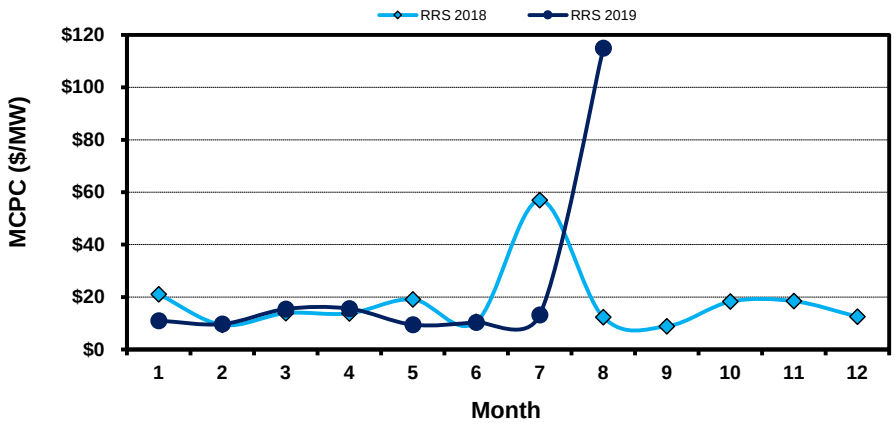
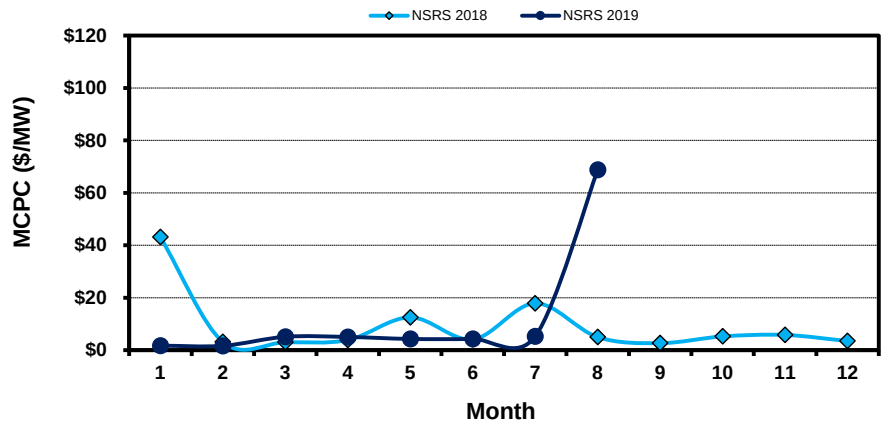


Non-Spin Reserve



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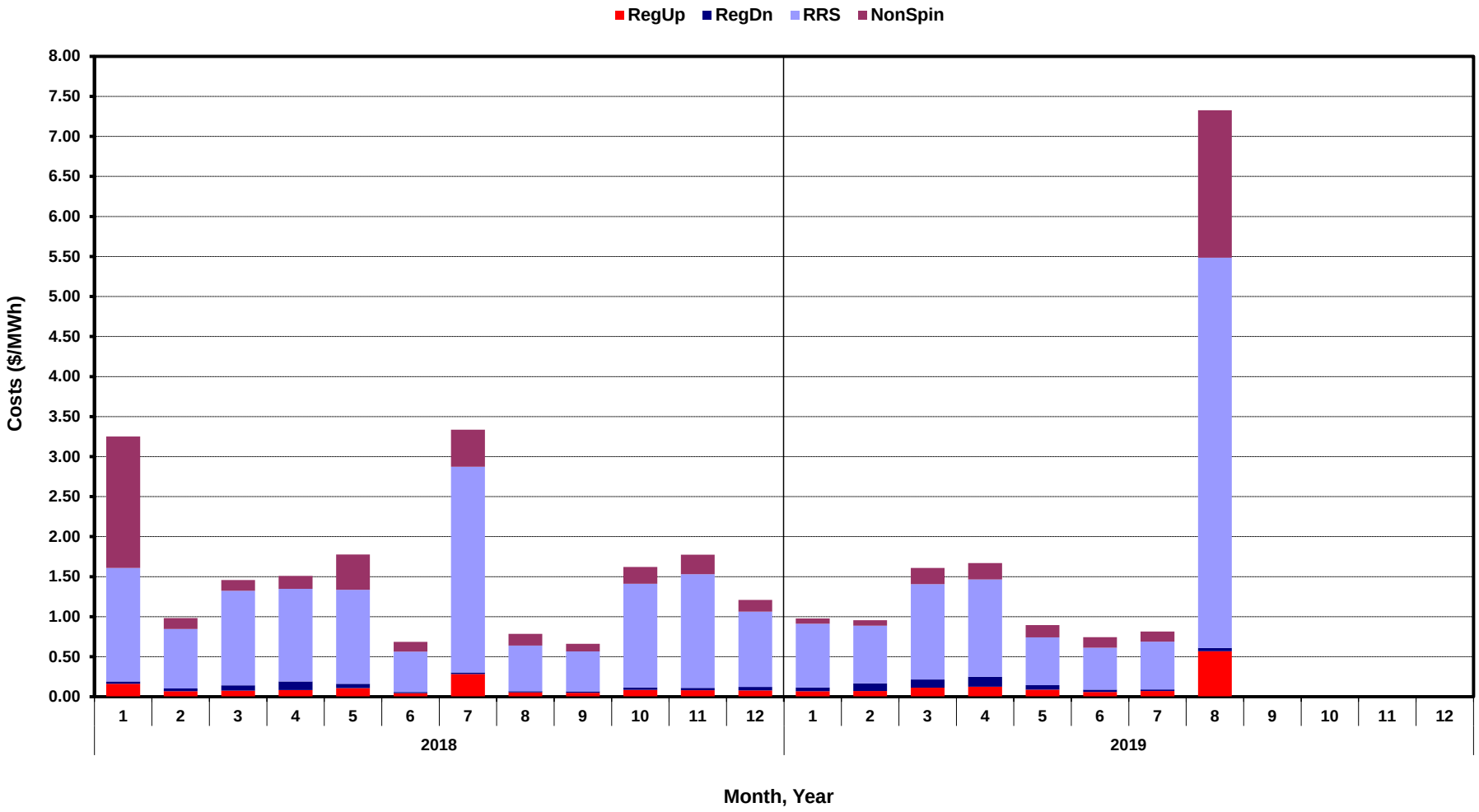
data

Monthly Average A/S Cost per MWh Load



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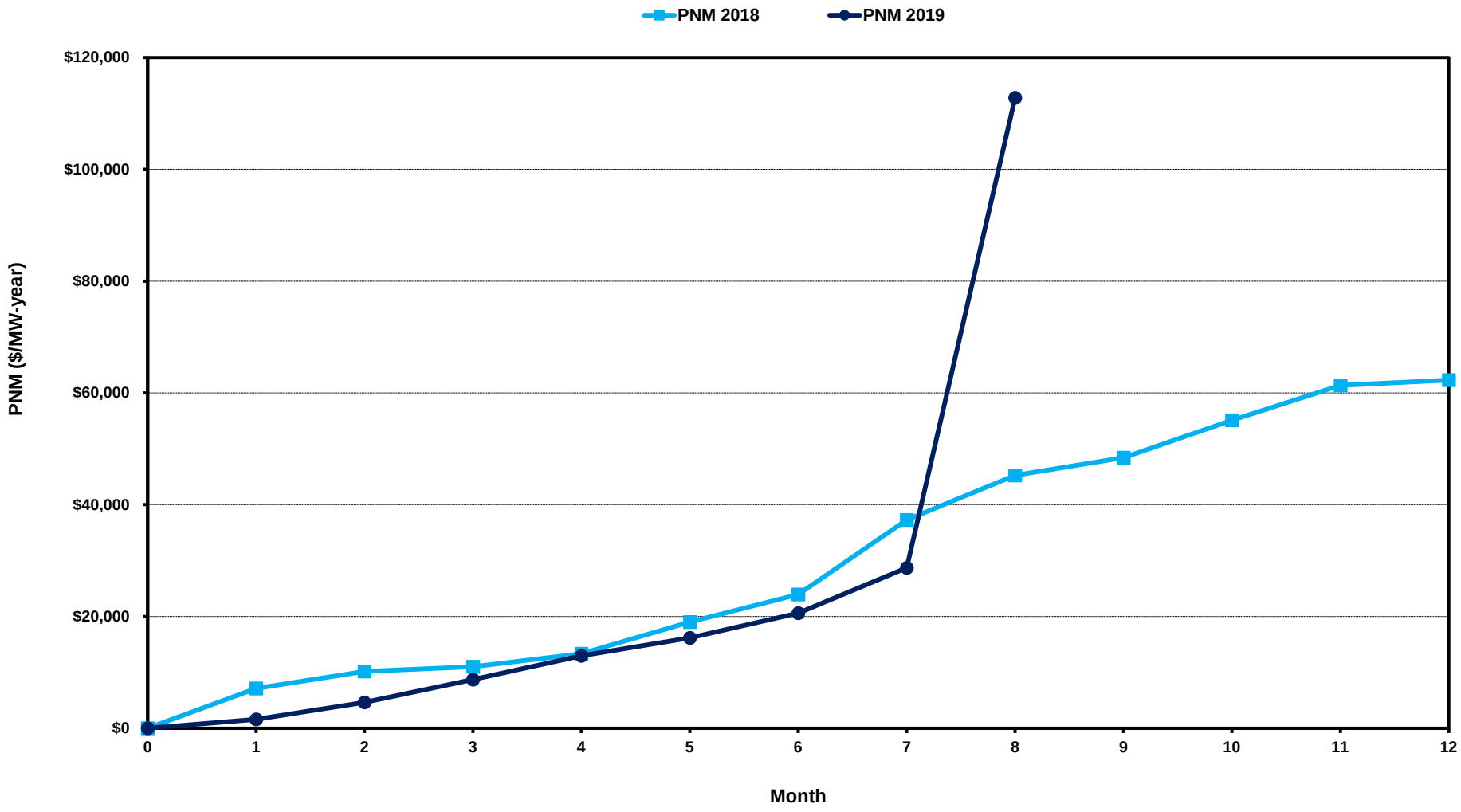
data

ERCOT-wide Cumulative Peaker Net Margin



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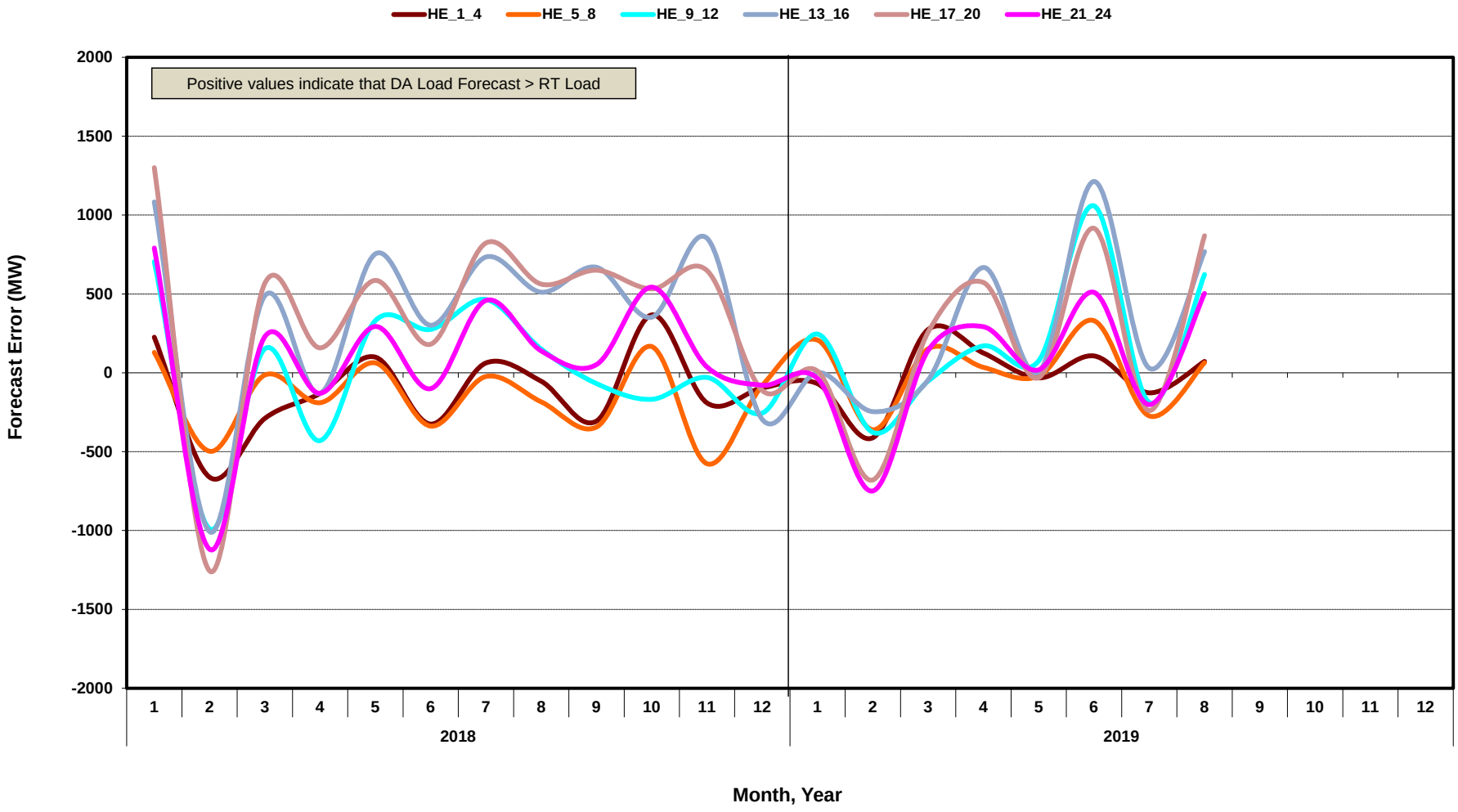
DA vs. RT Load Forecast Error by Hour Ending



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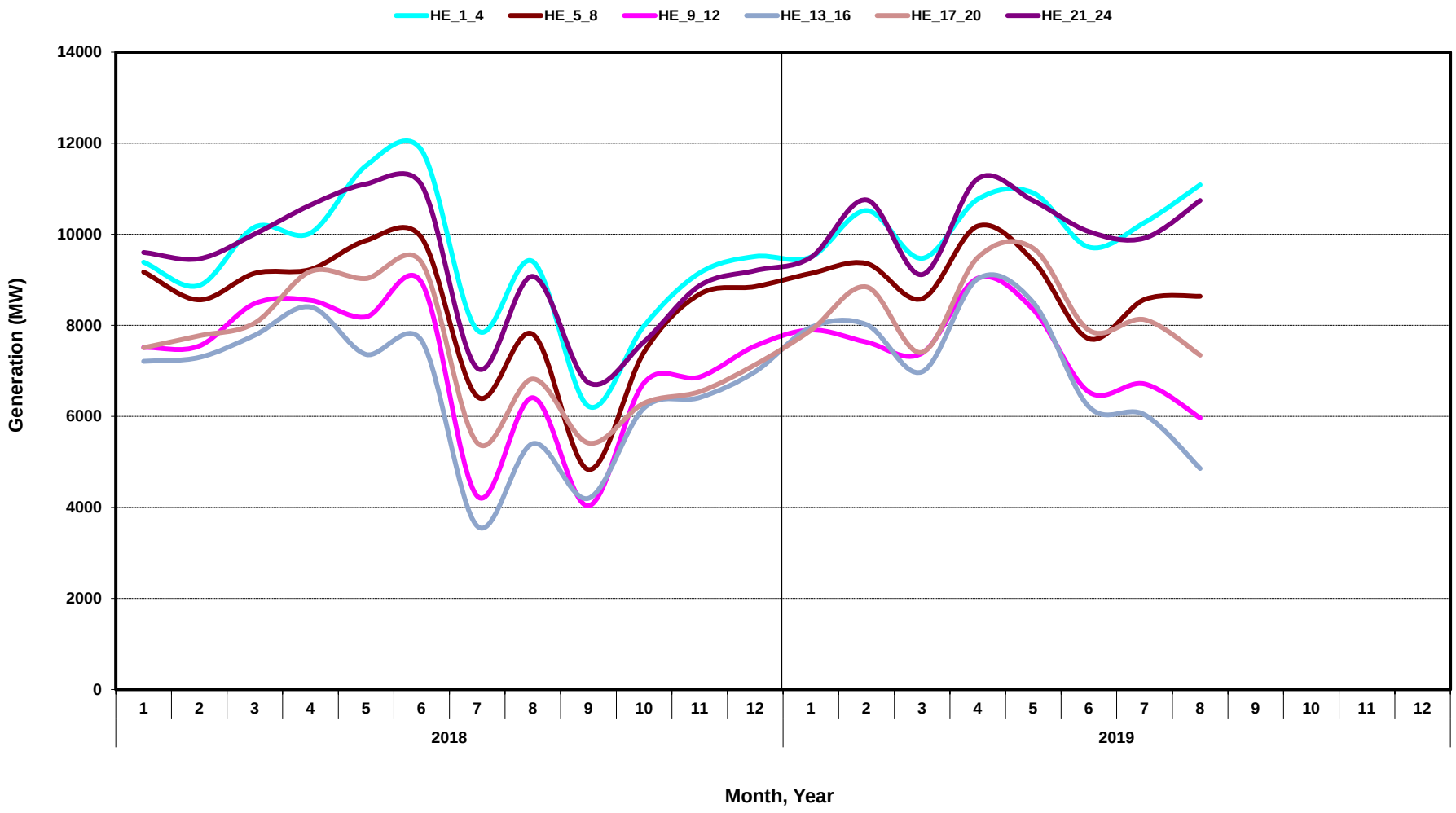
Monthly Average of Wind Generation by Hour Ending



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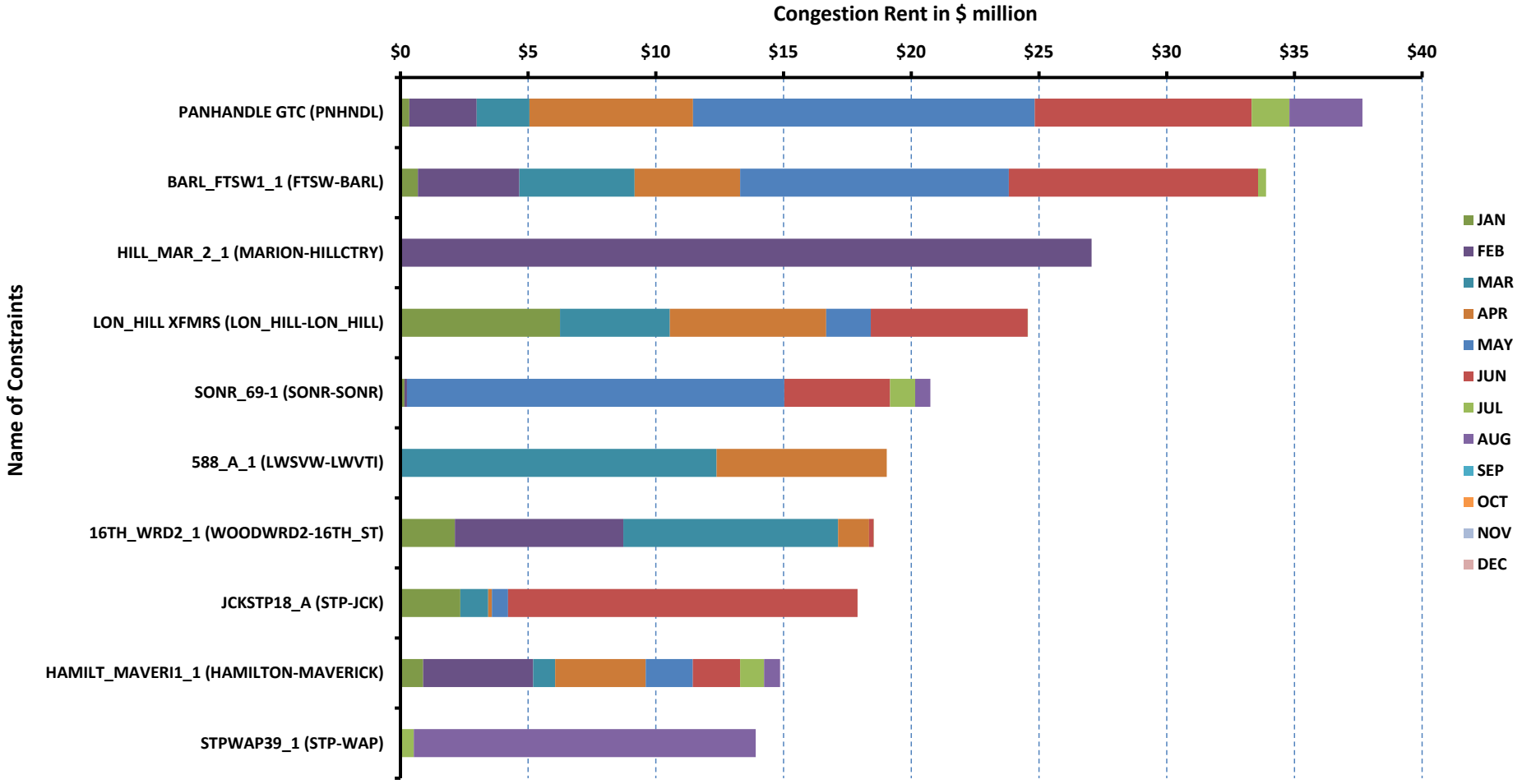
RT Congestion Constraint Rankings - 1

Top 10 Constraints by Total Congestion Value - 2019



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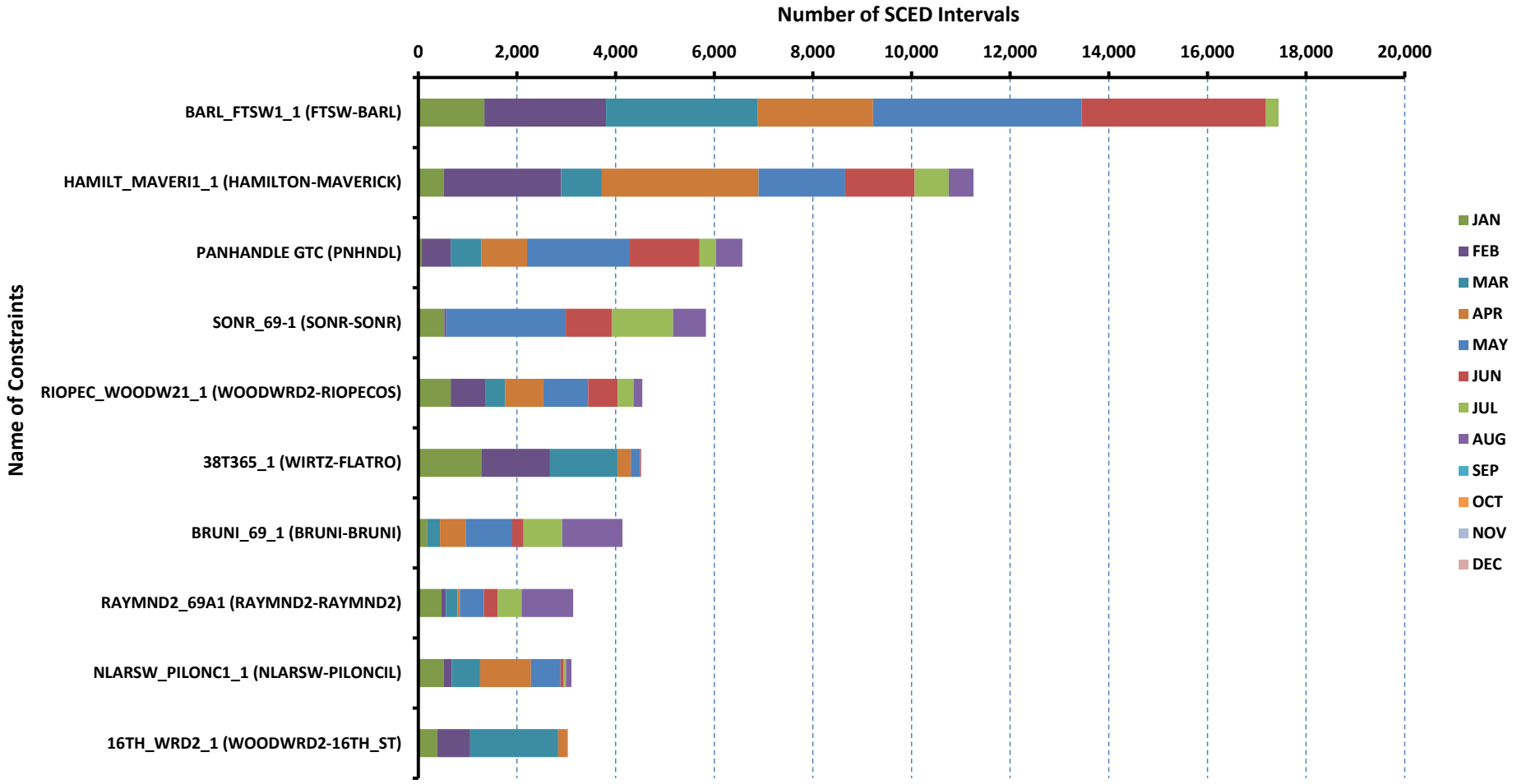
RT Congestion Constraint Rankings - 2

Top 10 Constraints by Binding Frequency - 2019



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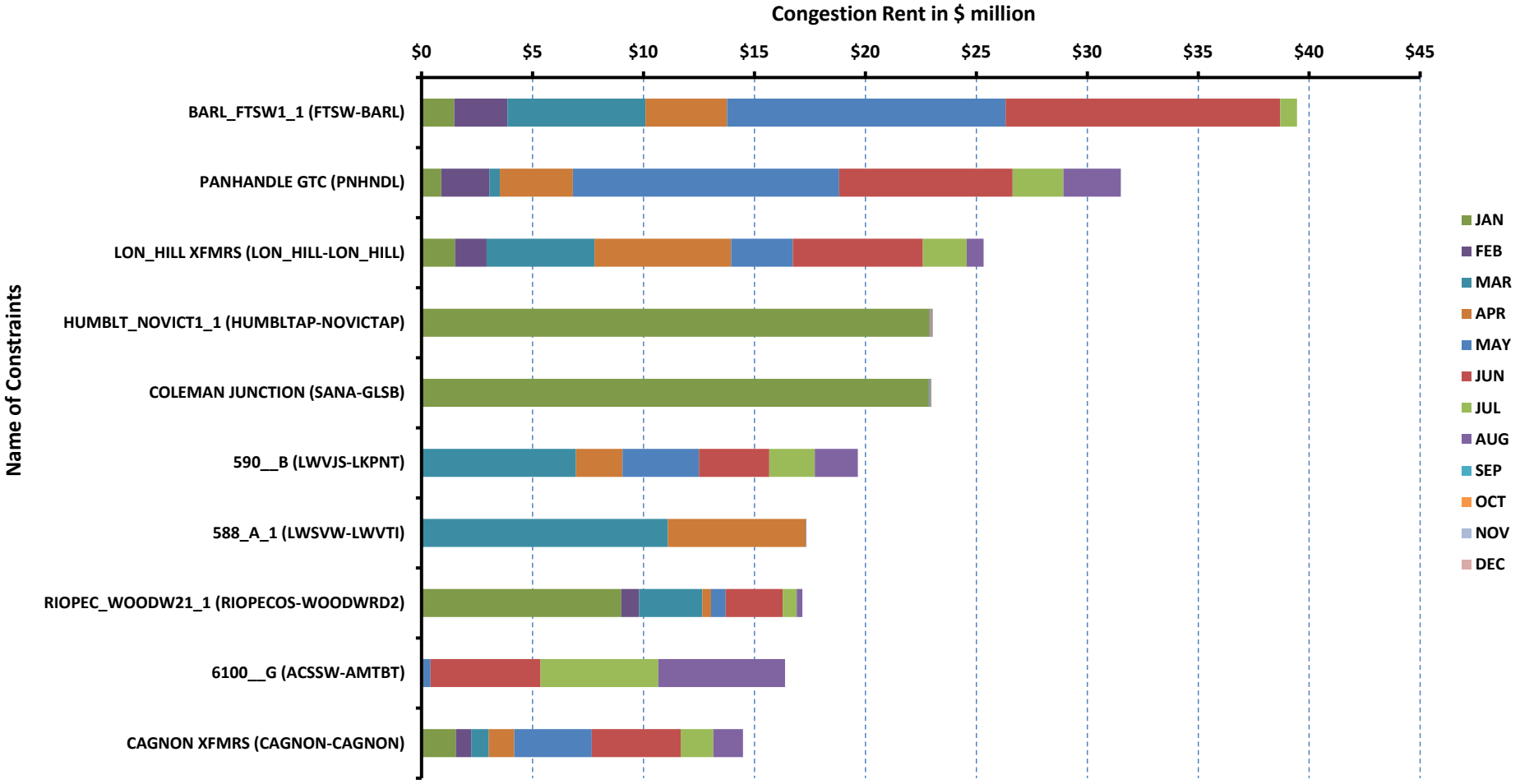
DA Congestion Constraint Rankings - 1

Top 10 Constraints by Total Congestion Value - 2019



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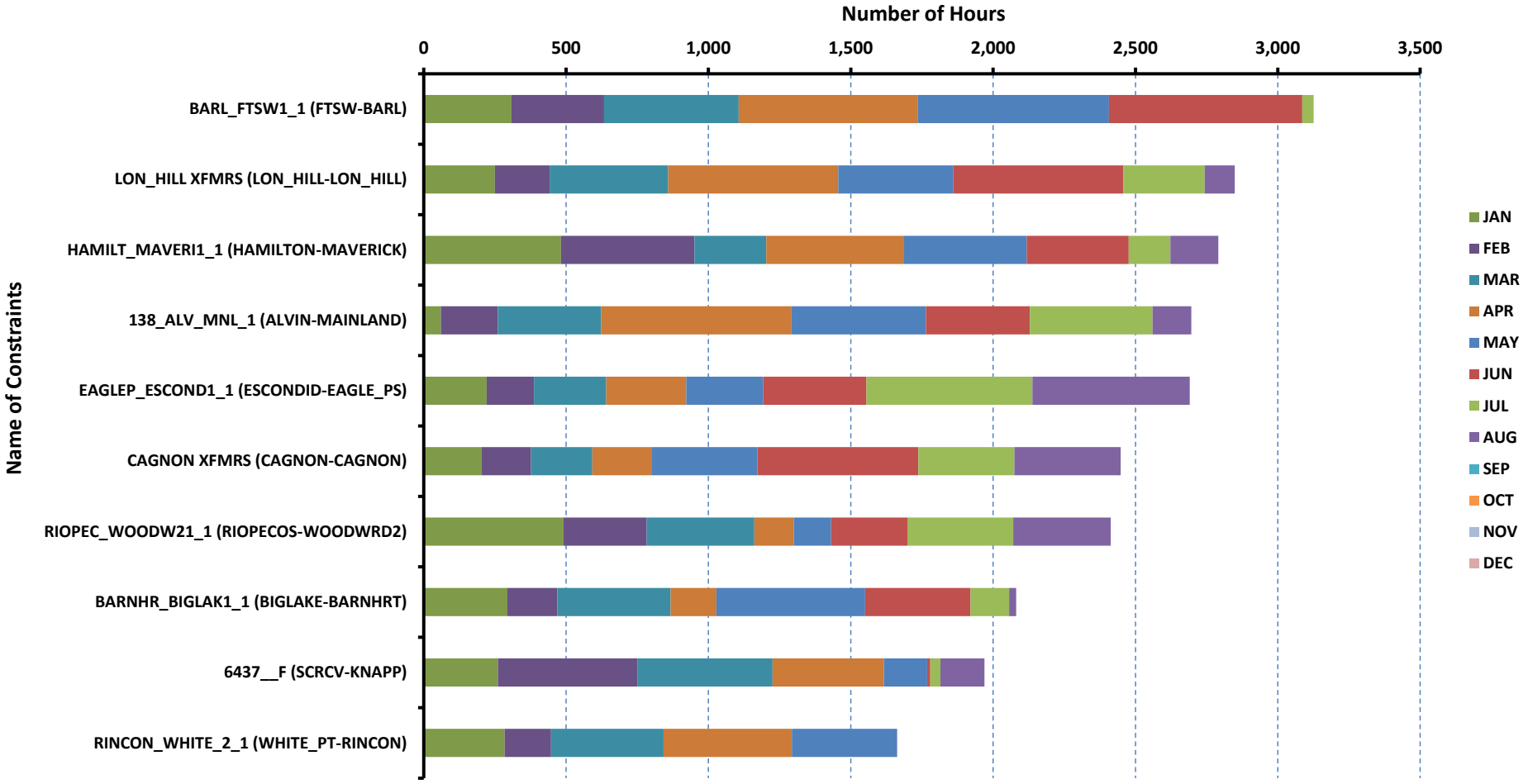
DA Congestion Constraint Rankings - 2

Top 10 Constraints by Binding Frequency - 2019



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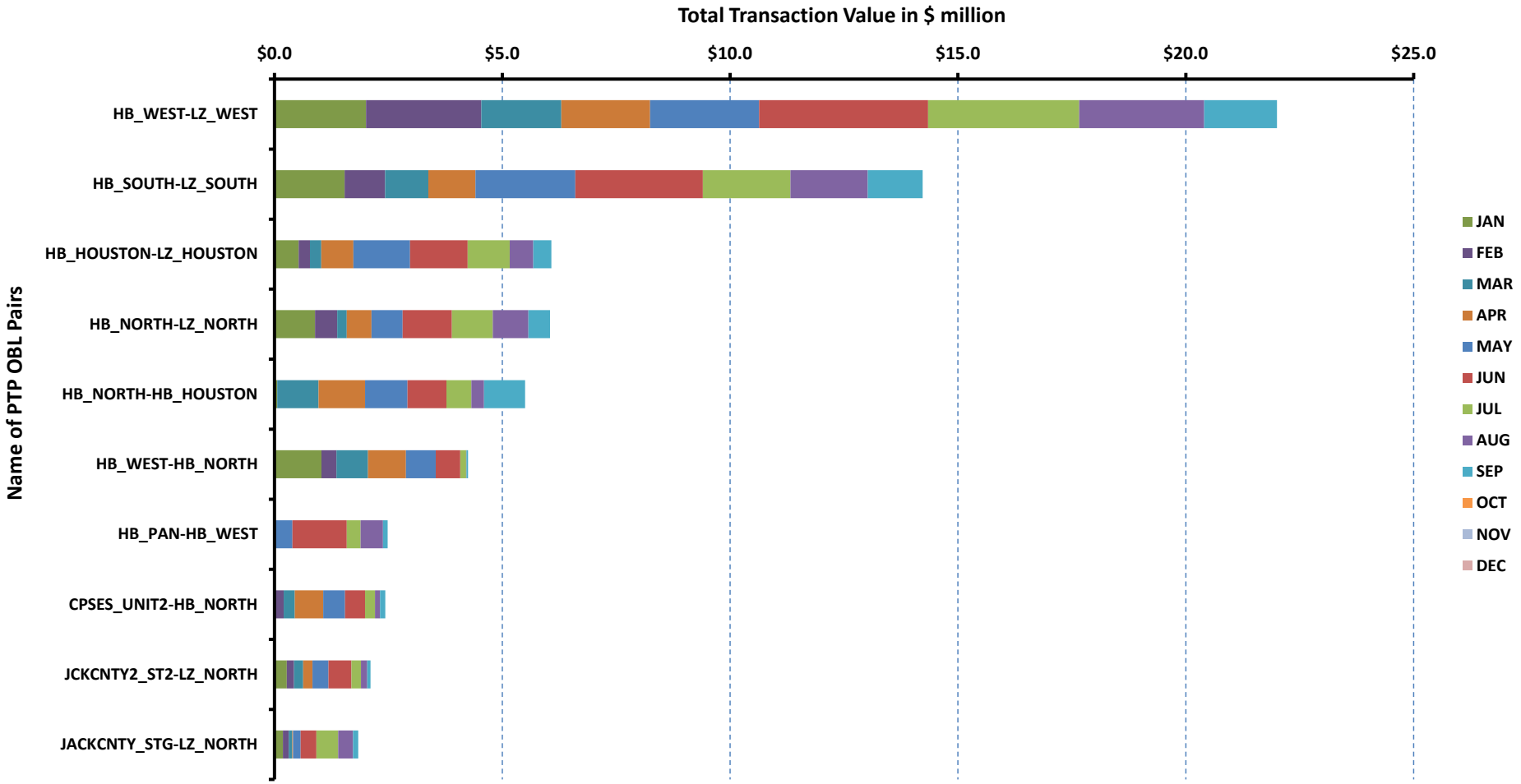
Top 10 CRR Pairs Ranked by Monthly Auction Values - 1

Top 10 PTP Obligations by Total Transaction Value - 2019



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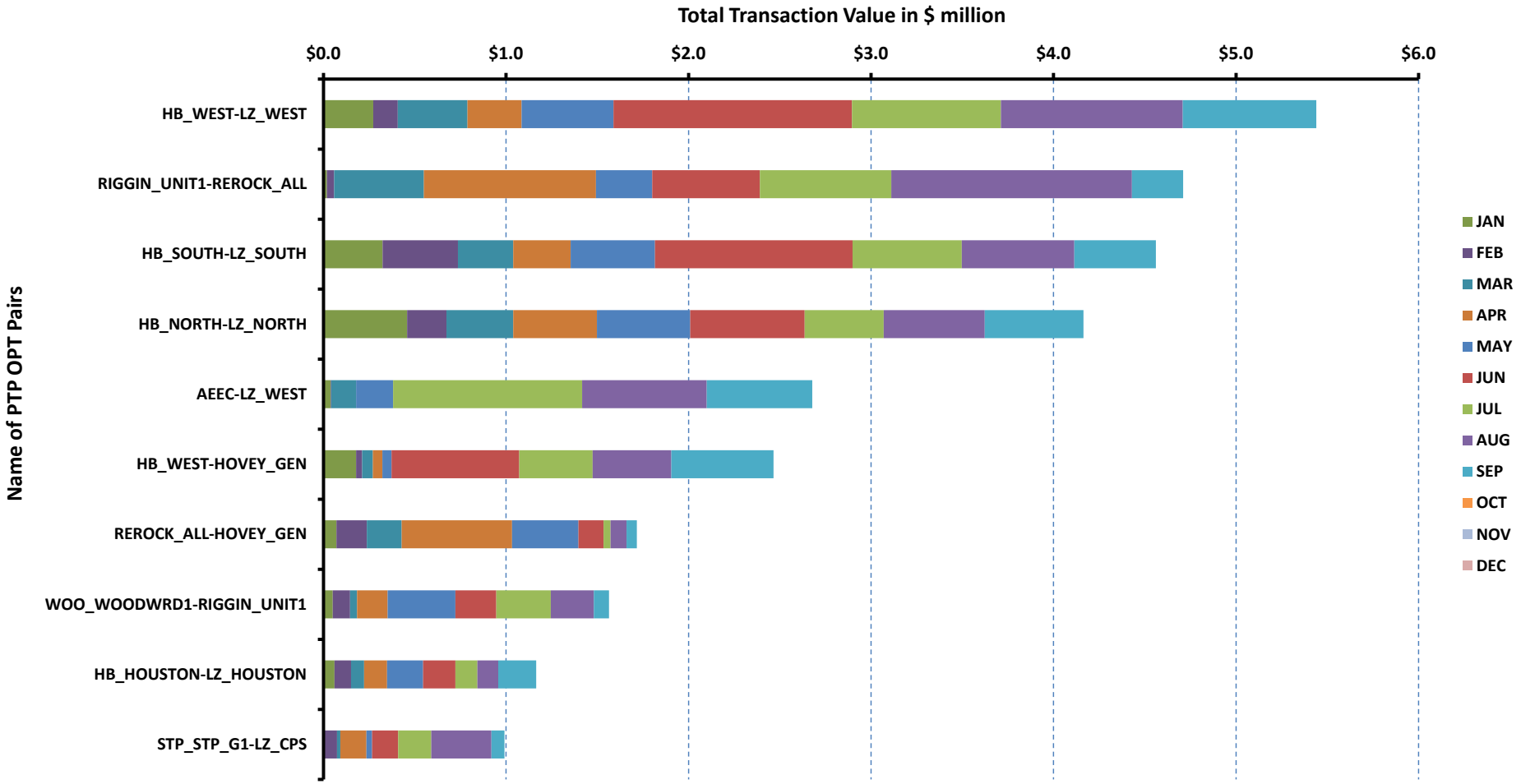
data

Top 10 CRR Pairs Ranked by Monthly Auction Values - 2

Top 10 PTP Options by Total Transaction Value - 2019



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data

ERCOT-wide Avg. Energy Price - DA vs. RT			
year	month	dam_spp	rtm_spp
2018	1	$ 45.63	$ 42.56
	2	$ 23.21	$ 25.24
	3	$ 24.42	$ 20.80
	4	$ 25.49	$ 24.54
	5	$ 43.15	$ 38.28
	6	$ 36.15	$ 37.29
	7	$ 100.46	$ 50.22
	8	$ 35.08	$ 39.51
	9	$ 29.31	$ 30.40
	10	$ 32.92	$ 39.09
	11	$ 33.19	$ 38.44
	12	$ 32.19	$ 29.90
2019	1	$ 26.27	$ 24.96
	2	$ 22.55	$ 26.69
	3	$ 31.55	$ 30.25
	4	$ 25.38	$ 27.90
	5	$ 26.47	$ 28.07
	6	$ 28.65	$ 28.82
	7	$ 33.43	$ 34.09
	8	$ 156.70	$ 163.79
	9	$ -	$ -
	10	$ -	$ -
	11	$ -	$ -
	12	$ -	$ -

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chart

Load Zone Load Statistics									
year	month	loadPEAK_Houston	loadPEAK_North	loadPEAK_South	loadPEAK_West	loadAVG_Houston	loadAVG_North	loadAVG_South	loadAVG_West
2018	1	14,841	27,183	19,284	5,270	10,346	16,082	11,354	4,263
	2	12,660	22,124	16,019	4,952	9,740	14,553	9,933	4,101
	3	12,755	16,224	13,632	4,474	9,738	12,000	9,549	3,934
	4	14,008	16,467	14,236	4,842	9,773	12,219	9,759	4,009
	5	18,179	25,425	18,585	5,840	12,436	16,042	12,382	4,477
	6	18,501	27,219	19,059	5,898	13,746	19,328	13,975	4,872
	7	18,885	29,606	20,395	6,101	14,046	20,118	14,207	4,890
	8	19,311	27,221	19,761	6,017	14,083	19,181	14,463	4,965
	9	17,980	25,161	17,984	5,661	12,364	16,072	12,140	4,532
	10	16,718	22,540	16,381	5,492	10,919	13,391	10,514	4,336
	11	14,989	22,127	16,793	5,224	9,739	13,438	9,986	4,462
	12	12,545	20,233	14,873	5,332	9,601	14,187	10,136	4,685
2019	1	13,254	21,938	15,626	5,577	9,787	15,227	10,361	4,720
	2	12,967	22,880	15,171	5,483	9,754	14,467	9,950	4,662
	3	13,805	24,563	17,622	5,730	9,761	13,293	9,836	4,554
	4	14,685	17,893	14,451	5,371	10,374	12,469	9,822	4,555
	5	17,630	21,996	17,110	5,694	12,250	14,367	11,706	4,741
	6	18,971	25,775	19,006	6,303	13,823	16,703	13,220	5,098
	7	19,018	27,165	19,462	6,472	14,358	18,820	14,170	5,391
	8	20,254	28,460	20,411	6,825	14,892	20,319	15,340	5,701
	9	-	-	-	-	-	-	-	-
	10	-	-	-	-	-	-	-	-
	11	-	-	-	-	-	-	-	-
	12	-	-	-	-	-	-	-	-

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chart

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
2018	1	$ 39.47	$ 38.65	$ 53.81	$ 34.86	$ 42.24	$ 44.85	$ 52.06	$ 39.65
	2	$ 24.34	$ 26.14	$ 24.82	$ 25.22	$ 22.81	$ 22.74	$ 24.57	$ 22.50
	3	$ 19.97	$ 19.38	$ 22.64	$ 22.79	$ 24.70	$ 23.37	$ 26.22	$ 22.58
	4	$ 24.84	$ 25.06	$ 25.02	$ 21.02	$ 25.55	$ 25.28	$ 27.35	$ 21.42
	5	$ 34.38	$ 36.88	$ 37.31	$ 56.83	$ 39.95	$ 43.08	$ 43.09	$ 52.45
	6	$ 35.79	$ 33.97	$ 33.39	$ 65.89	$ 34.05	$ 33.91	$ 33.53	$ 58.47
	7	$ 47.28	$ 49.79	$ 47.92	$ 67.06	$ 96.21	$ 101.92	$ 98.48	$ 112.38
	8	$ 39.07	$ 39.32	$ 40.89	$ 37.46	$ 34.63	$ 35.04	$ 35.67	$ 34.80
	9	$ 29.92	$ 31.42	$ 30.61	$ 27.56	$ 29.11	$ 29.87	$ 29.36	$ 27.71
	10	$ 38.98	$ 40.11	$ 39.61	$ 34.97	$ 33.45	$ 33.12	$ 33.15	$ 30.40
	11	$ 40.99	$ 36.95	$ 39.15	$ 35.80	$ 32.91	$ 33.42	$ 33.83	$ 31.67
	12	$ 28.56	$ 29.93	$ 28.42	$ 35.76	$ 31.02	$ 32.07	$ 32.04	$ 35.32
2019	1	$ 24.67	$ 24.09	$ 26.47	$ 25.06	$ 26.05	$ 25.20	$ 27.25	$ 28.00
	2	$ 23.30	$ 24.58	$ 32.09	$ 28.80	$ 22.05	$ 21.64	$ 24.07	$ 23.14
	3	$ 29.20	$ 30.43	$ 31.39	$ 29.53	$ 29.73	$ 31.70	$ 32.83	$ 32.28
	4	$ 27.42	$ 27.57	$ 29.52	$ 26.42	$ 25.42	$ 24.98	$ 27.36	$ 22.09
	5	$ 27.41	$ 26.16	$ 29.80	$ 31.34	$ 26.23	$ 24.93	$ 27.53	$ 29.12
	6	$ 30.40	$ 27.46	$ 27.07	$ 33.55	$ 29.22	$ 27.10	$ 28.39	$ 32.84
	7	$ 34.09	$ 34.56	$ 33.74	$ 33.39	$ 32.77	$ 33.40	$ 34.02	$ 33.71
	8	$ 162.69	$ 168.38	$ 162.68	$ 153.31	$ 152.95	$ 162.17	$ 157.50	$ 144.88
	9	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	10	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	11	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	12	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

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chart

ERCOT-wide Monthly Implied Heat Rate - DA vs. RT						
year	month	gasprice	rtm_spp	HR_rtm	dam_spp	HR_dam
2018	1	$ 4.23	$ 42.56	10.07	$ 45.63	10.79
	2	$ 2.63	$ 25.24	9.61	$ 23.21	8.83
	3	$ 2.69	$ 20.80	7.74	$ 24.42	9.09
	4	$ 2.83	$ 24.54	8.67	$ 25.49	9.00
	5	$ 2.81	$ 38.28	13.61	$ 43.15	15.34
	6	$ 3.00	$ 37.29	12.42	$ 36.15	12.03
	7	$ 2.89	$ 50.22	17.35	$ 100.46	34.71
	8	$ 3.01	$ 39.51	13.14	$ 35.08	11.67
	9	$ 2.99	$ 30.40	10.16	$ 29.31	9.79
	10	$ 3.48	$ 39.09	11.22	$ 32.92	9.45
	11	$ 4.11	$ 38.44	9.35	$ 33.19	8.07
	12	$ 3.92	$ 29.90	7.62	$ 32.19	8.21
2019	1	$ 3.01	$ 24.96	8.29	$ 26.27	8.73
	2	$ 2.67	$ 26.69	10.01	$ 22.55	8.46
	3	$ 2.88	$ 30.25	10.49	$ 31.55	10.94
	4	$ 2.57	$ 27.90	10.85	$ 25.38	9.87
	5	$ 2.54	$ 28.07	11.07	$ 26.47	10.44
	6	$ 2.46	$ 28.82	11.72	$ 28.65	11.65
	7	$ 2.25	$ 34.09	15.18	$ 33.43	14.89
	8	$ 2.10	$ 163.79	77.92	$ 156.70	74.55
	9	$ -	$ -	-	$ -	-
	10	$ -	$ -	-	$ -	-
	11	$ -	$ -	-	$ -	-
	12	$ -	$ -	-	$ -	-

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chart

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
2018	1	9.99	12.31	10.61	9.38	9.34	12.73	9.14	8.25
	2	8.68	9.35	8.65	8.56	9.26	9.44	9.95	9.60
	3	9.19	9.76	8.70	8.40	7.43	8.42	7.21	8.48
	4	9.02	9.66	8.93	7.57	8.77	8.84	8.85	7.42
	5	14.20	15.32	15.32	18.65	12.22	13.27	13.11	20.20
	6	11.34	11.16	11.29	19.47	11.92	11.12	11.31	21.94
	7	33.25	34.03	35.22	38.83	16.34	16.56	17.20	23.17
	8	11.52	11.86	11.66	11.57	13.00	13.60	13.08	12.46
	9	9.73	9.81	9.98	9.26	10.00	10.23	10.50	9.21
	10	9.60	9.52	9.51	8.73	11.19	11.37	11.52	10.04
	11	8.01	8.23	8.13	7.70	9.97	9.52	8.99	8.71
	12	7.91	8.17	8.18	9.00	7.28	7.25	7.63	9.12
2019	1	8.65	9.05	8.37	9.30	8.19	8.79	8.00	8.32
	2	8.27	9.03	8.12	8.68	8.74	12.04	9.22	10.80
	3	10.31	11.38	10.99	11.19	10.12	10.88	10.55	10.24
	4	9.88	10.64	9.71	8.59	10.66	11.48	10.72	10.27
	5	10.35	10.86	9.83	11.49	10.81	11.75	10.32	12.36
	6	11.88	11.55	11.02	13.36	12.36	11.01	11.17	13.64
	7	14.59	15.15	14.87	15.01	15.18	15.02	15.39	14.87
	8	72.77	74.93	77.15	68.93	77.40	77.40	80.11	72.94
	9	-	-	-	-	-	-	-	-
	10	-	-	-	-	-	-	-	-
	11	-	-	-	-	-	-	-	-
	12	-	-	-	-	-	-	-	-

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chart

Daily ORDC Adders Average Values and Interval Duration								
YEAR	MONTH	DAY	PRICE_RS	PRICE_RDP	RS_CNT	RDP_CNT	RS_POS	RDP_POS
2019	8	1	$ 11.67	$ -	21	0	80	90
2019	8	2	$ 244.99	$ -	28	0	80	90
2019	8	3	$ 1.39	$ -	22	0	80	90
2019	8	4	$ 16.91	$ -	29	0	80	90
2019	8	5	$ 383.58	$ -	33	0	80	90
2019	8	6	$ 152.48	$ -	32	0	80	90
2019	8	7	$ 6.26	$ -	25	0	80	90
2019	8	8	$ 24.84	$ -	22	0	80	90
2019	8	9	$ 89.40	$ -	31	0	80	90
2019	8	10	$ 11.56	$ -	28	0	80	90
2019	8	11	$ 7.85	$ -	18	0	80	90
2019	8	12	$ 750.63	$ -	30	0	80	90
2019	8	13	$ 857.67	$ 967.38	37	35	80	90
2019	8	14	$ 208.33	$ 0.15	28	8	80	90
2019	8	15	$ 853.62	$ 1,022.89	31	35	80	90
2019	8	16	$ 322.95	$ 0.55	23	12	80	90
2019	8	17	$ 0.05	$ -	9	0	80	90
2019	8	18	$ 18.23	$ -	16	0	80	90
2019	8	19	$ 21.47	$ -	28	0	80	90
2019	8	20	$ 28.32	$ -	23	0	80	90
2019	8	21	$ 61.56	$ -	21	0	80	90
2019	8	22	$ 317.01	$ -	25	0	80	90
2019	8	23	$ 13.16	$ -	19	0	80	90
2019	8	24	$ 1.12	$ -	18	0	80	90
2019	8	25	$ 6.57	$ -	15	0	80	90
2019	8	26	$ 20.49	$ -	25	0	80	90
2019	8	27	$ -	$ -	0	0	80	90
2019	8	28	$ 50.43	$ -	26	0	80	90
2019	8	29	$ 50.83	$ -	23	0	80	90
2019	8	30	$ -	$ -	0	0	80	90
2019	8	31	$ -	$ -	0	0	80	90

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chart

Monthly Average of Ancillary Services Required MW					
year	month	ASMW_REGDN	ASMW_NSPIN	ASMW_RRS	ASMW_REGUP
2018	1	283	1,601	2,829	299
	2	292	1,674	3,030	309
	3	296	1,560	3,001	306
	4	296	1,497	3,001	316
	5	320	1,601	2,782	339
	6	301	1,543	2,488	330
	7	304	1,386	2,403	333
	8	302	1,548	2,433	331
	9	309	1,585	2,543	326
	10	294	1,570	2,780	309
	11	256	1,582	2,895	273
	12	268	1,603	2,900	280
2019	1	285	1,578	2,898	295
	2	283	1,634	2,881	311
	3	287	1,487	2,893	306
	4	292	1,513	2,904	321
	5	314	1,550	2,712	345
	6	303	1,486	2,467	322
	7	298	1,287	2,374	319
	8	300	1,507	2,386	323
	9	-	-	-	-
	10	-	-	-	-
	11	-	-	-	-
	12	-	-	-	-

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chart

Hourly Average of Ancillary Services Required MW					
year	DELIVERY_HOUR	ASMW_REGDN	ASMW_NSPIN	ASMW_RRS	ASMW_REGUP
2018	1	366	1,112	2,872	273
	2	275	1,112	2,872	215
	3	238	1,516	2,880	208
	4	204	1,516	2,880	221
	5	210	1,516	2,880	276
	6	305	1,516	2,880	439
	7	261	2,083	2,761	568
	8	237	2,083	2,761	348
	9	239	2,083	2,761	397
	10	276	2,083	2,761	385
	11	250	1,700	2,672	401
	12	239	1,700	2,672	382
	13	217	1,700	2,672	344
	14	220	1,700	2,672	306
	15	216	1,503	2,650	263
	16	212	1,503	2,650	254
	17	248	1,503	2,650	261
	18	285	1,503	2,650	295
	19	371	1,456	2,694	285
	20	363	1,456	2,694	272
	21	380	1,456	2,694	242
	22	465	1,456	2,694	269
	23	508	1,112	2,872	320
	24	451	1,112	2,872	276
2019	1	389	1,188	2,778	255
	2	296	1,188	2,778	197
	3	241	1,557	2,800	210
	4	205	1,557	2,801	230
	5	198	1,557	2,801	289
	6	271	1,557	2,801	442
	7	261	1,960	2,710	561
	8	217	1,960	2,710	369
	9	239	1,960	2,710	390
	10	252	1,960	2,710	405
	11	257	1,607	2,613	421
	12	228	1,607	2,613	412
	13	213	1,607	2,613	373
	14	221	1,607	2,613	336
	15	219	1,370	2,603	287
	16	215	1,370	2,603	276
	17	255	1,370	2,603	270
	18	288	1,370	2,603	285
	19	378	1,340	2,617	290
	20	379	1,340	2,617	284
	21	378	1,340	2,617	266
	22	483	1,340	2,617	230
	23	532	1,188	2,778	268
	24	477	1,188	2,778	280

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chart

Monthly Average Ancillary Services Price					
year	month	MCPC_REGDN	MCPC_NSPIN	MCPC_RRS	MCPC_REGUP
2018	1	$ 4.36	$ 43.10	$ 21.06	$ 22.87
	2	$ 4.45	$ 3.14	$ 9.40	$ 8.48
	3	$ 7.71	$ 3.01	$ 13.87	$ 8.86
	4	$ 12.98	$ 3.86	$ 13.76	$ 9.59
	5	$ 7.51	$ 12.51	$ 19.12	$ 14.58
	6	$ 2.62	$ 4.10	$ 10.51	$ 6.98
	7	$ 3.28	$ 17.86	$ 56.96	$ 45.45
	8	$ 2.37	$ 4.98	$ 12.34	$ 8.85
	9	$ 2.49	$ 2.67	$ 8.86	$ 6.90
	10	$ 3.99	$ 5.24	$ 18.25	$ 10.91
	11	$ 4.30	$ 5.80	$ 18.44	$ 11.28
	12	$ 6.21	$ 3.48	$ 12.53	$ 11.00
2019	1	$ 6.43	$ 1.71	$ 11.01	$ 9.40
	2	$ 13.14	$ 1.66	$ 9.70	$ 8.88
	3	$ 13.34	$ 5.10	$ 15.43	$ 13.77
	4	$ 16.00	$ 5.03	$ 15.59	$ 14.42
	5	$ 7.83	$ 4.27	$ 9.47	$ 11.00
	6	$ 4.76	$ 4.30	$ 10.39	$ 8.82
	7	$ 3.71	$ 5.25	$ 13.23	$ 11.65
	8	$ 7.87	$ 68.75	$ 114.97	$ 98.80
	9	$ -	$ -	$ -	$ -
	10	$ -	$ -	$ -	$ -
	11	$ -	$ -	$ -	$ -
	12	$ -	$ -	$ -	$ -

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chart

Monthly Average A/S Cost per MWh Load					
year	month	AScost_REGDN	AScost_NSPIN	AScost_RRS	AScost_REGUP
2018	1	$ 0.03	$ 1.64	$ 1.42	$ 0.16
	2	$ 0.03	$ 0.14	$ 0.74	$ 0.07
	3	$ 0.06	$ 0.13	$ 1.18	$ 0.08
	4	$ 0.11	$ 0.16	$ 1.16	$ 0.08
	5	$ 0.05	$ 0.44	$ 1.17	$ 0.11
	6	$ 0.02	$ 0.12	$ 0.50	$ 0.04
	7	$ 0.02	$ 0.46	$ 2.57	$ 0.28
	8	$ 0.01	$ 0.15	$ 0.57	$ 0.06
	9	$ 0.02	$ 0.09	$ 0.50	$ 0.05
	10	$ 0.03	$ 0.21	$ 1.30	$ 0.09
	11	$ 0.03	$ 0.24	$ 1.42	$ 0.08
	12	$ 0.04	$ 0.14	$ 0.94	$ 0.08
2019	1	$ 0.05	$ 0.07	$ 0.80	$ 0.07
	2	$ 0.10	$ 0.07	$ 0.72	$ 0.07
	3	$ 0.10	$ 0.20	$ 1.19	$ 0.11
	4	$ 0.13	$ 0.20	$ 1.22	$ 0.12
	5	$ 0.06	$ 0.15	$ 0.60	$ 0.09
	6	$ 0.03	$ 0.13	$ 0.52	$ 0.06
	7	$ 0.02	$ 0.13	$ 0.60	$ 0.07
	8	$ 0.04	$ 1.84	$ 4.88	$ 0.57
	9	$ -	$ -	$ -	$ -
	10	$ -	$ -	$ -	$ -
	11	$ -	$ -	$ -	$ -
	12	$ -	$ -	$ -	$ -

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chart

ERCOT-wide Cumulative PNM			
year	month	pnm	pnm_accum
2018	0	$ -	$ -
	1	$ 7,139.99	$ 7,139.99
	2	$ 3,011.86	$ 10,151.85
	3	$ 870.03	$ 11,021.88
	4	$ 2,333.76	$ 13,355.64
	5	$ 5,671.10	$ 19,026.74
	6	$ 4,930.69	$ 23,957.43
	7	$ 13,313.16	$ 37,270.59
	8	$ 7,965.15	$ 45,235.74
	9	$ 3,181.93	$ 48,417.67
	10	$ 6,676.58	$ 55,094.25
	11	$ 6,257.98	$ 61,352.23
	12	$ 941.00	$ 62,293.23
2019	0	$ -	$ -
	1	$ 1,594.61	$ 1,594.61
	2	$ 3,042.70	$ 4,637.31
	3	$ 4,087.75	$ 8,725.06
	4	$ 4,232.61	$ 12,957.67
	5	$ 3,234.19	$ 16,191.86
	6	$ 4,409.46	$ 20,601.32
	7	$ 8,110.34	$ 28,711.66
	8	$ 84,095.03	$ 112,806.69
	9	$ -	$ -
	10	$ -	$ -
	11	$ -	$ -
	12	$ -	$ -

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chart

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
2018	1	226	1,083	1,300	791	129	705
	2	(662)	(1,007)	(1,256)	(1,119)	(497)	(990)
	3	(289)	489	568	229	(14)	152
	4	(131)	(131)	158	(130)	(190)	(430)
	5	99	754	586	294	63	331
	6	(325)	302	181	(100)	(338)	275
	7	62	734	823	459	(23)	465
	8	(54)	511	562	138	(184)	150
	9	(306)	669	650	52	(344)	(68)
	10	367	352	532	543	166	(168)
	11	(191)	853	648	37	(577)	(30)
	12	(96)	(296)	(112)	(79)	(80)	(255)
2019	1	(69)	2	10	(37)	207	245
	2	(412)	(246)	(679)	(749)	(361)	(378)
	3	275	(45)	258	142	152	(52)
	4	125	668	573	292	35	171
	5	(32)	5	(31)	19	(21)	76
	6	107	1,213	916	510	330	1,059
	7	(127)	29	(239)	(201)	(273)	(188)
	8	72	768	869	503	64	623
	9	-	-	-	-	-	-
	10	-	-	-	-	-	-
	11	-	-	-	-	-	-
	12	-	-	-	-	-	-

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chart

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
2018	1	9,387	7,209	7,508	9,601	9,171	7,514
	2	8,876	7,295	7,771	9,462	8,559	7,545
	3	10,159	7,784	8,052	10,006	9,143	8,480
	4	10,025	8,403	9,183	10,641	9,227	8,549
	5	11,505	7,360	9,027	11,105	9,862	8,186
	6	11,843	7,661	9,377	11,080	9,922	8,937
	7	7,895	3,590	5,418	7,058	6,434	4,248
	8	9,401	5,402	6,821	9,075	7,803	6,410
	9	6,222	4,201	5,415	6,741	4,833	4,036
	10	7,988	6,184	6,290	7,640	7,413	6,738
	11	9,151	6,413	6,543	8,872	8,685	6,866
	12	9,512	6,983	7,137	9,202	8,850	7,547
2019	1	9,500	7,954	7,892	9,491	9,141	7,897
	2	10,520	8,015	8,843	10,755	9,358	7,631
	3	9,471	6,980	7,408	9,114	8,585	7,389
	4	10,770	9,020	9,488	11,220	10,180	9,034
	5	10,907	8,497	9,689	10,736	9,414	8,343
	6	9,717	6,210	7,891	10,058	7,706	6,535
	7	10,258	6,036	8,124	9,915	8,568	6,712
	8	11,086	4,854	7,343	10,742	8,638	5,965
	9	-	-	-	-	-	-
	10	-	-	-	-	-	-
	11	-	-	-	-	-	-
	12	-	-	-	-	-	-

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chart

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	2019	BARL_FTSW1_1 (FTSW-BARL)	17,441	1	1,340	2,467	3,067	2,346	4,230	3,737	254	-	-	-	-	-
FREQ_EXIST	2019	HAMILT_MAVERI1_1 (HAMILTON-MAVERICK)	11,258	2	520	2,373	827	3,178	1,756	1,410	691	503	-	-	-	-
FREQ_EXIST	2019	PANHANDLE GTC (PNHNDL)	6,571	3	61	594	623	928	2,083	1,411	338	533	-	-	-	-
FREQ_EXIST	2019	SONR_69-1 (SONR-SONR)	5,832	4	528	37	-	-	2,423	941	1,235	668	-	-	-	-
FREQ_EXIST	2019	RIOPEC_WOODW21_1 (WOODWRD2-RIOPECOS)	4,540	5	658	698	401	779	908	598	322	176	-	-	-	-
FREQ_EXIST	2019	38T365_1 (WIRTZ-FLATRO)	4,517	6	1,277	1,393	1,371	267	191	18	-	-	-	-	-	-
FREQ_EXIST	2019	BRUNI_69_1 (BRUNI-BRUNI)	4,139	7	173	5	261	523	941	231	781	1,224	-	-	-	-
FREQ_EXIST	2019	RAYMND2_69A1 (RAYMND2-RAYMND2)	3,140	8	471	86	236	51	483	280	487	1,046	-	-	-	-
FREQ_EXIST	2019	NLARSW_PILONC1_1 (NLARSW-PILONCIL)	3,103	9	511	171	569	1,031	601	55	54	111	-	-	-	-
FREQ_EXIST	2019	16TH_WRD2_1 (WOODWRD2-16TH_ST)	3,031	10	386	666	1,783	184	-	9	3	-	-	-	-	-
TOP10_RENT	2019	PANHANDLE GTC (PNHNDL)	$ 37.66	1	$ 0.35	$ 2.64	$ 2.06	$ 6.40	$ 13.38	$ 8.49	$ 1.48	$ 2.86	$ -	$ -	$ -	$ -
TOP10_RENT	2019	BARL_FTSW1_1 (FTSW-BARL)	$ 33.89	2	$ 0.68	$ 3.97	$ 4.52	$ 4.13	$ 10.52	$ 9.76	$ 0.32	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	HILL_MAR_2_1 (MARION-HILLCTRY)	$ 27.06	3	$ -	$ 27.06	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	LON_HILL XFMRS (LON_HILL-LON_HILL)	$ 24.57	4	$ 6.25	$ 0.00	$ 4.29	$ 6.12	$ 1.75	$ 6.15	$ 0.01	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	SONR_69-1 (SONR-SONR)	$ 20.75	5	$ 0.15	$ 0.10	$ -	$ -	$ 14.77	$ 4.14	$ 0.98	$ 0.60	$ -	$ -	$ -	$ -
TOP10_RENT	2019	588_A_1 (LWSVW-LWVTI)	$ 19.04	6	$ -	$ -	$ 12.37	$ 6.67	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	16TH_WRD2_1 (WOODWRD2-16TH_ST)	$ 18.54	7	$ 2.13	$ 6.59	$ 8.41	$ 1.21	$ -	$ 0.18	$ 0.00	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	JCKSTP18_A (STP-JCK)	$ 17.89	8	$ 2.34	$ -	$ 1.10	$ 0.14	$ 0.63	$ 13.68	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	HAMILT_MAVERI1_1 (HAMILTON-MAVERICK)	$ 14.86	9	$ 0.89	$ 4.31	$ 0.86	$ 3.55	$ 1.85	$ 1.85	$ 0.94	$ 0.62	$ -	$ -	$ -	$ -
TOP10_RENT	2019	STPWAP39_1 (STP-WAP)	$ 13.91	10	$ -	$ -	$ -	$ -	$ 0.00	$ -	$ 0.52	$ 13.39	$ -	$ -	$ -	$ -

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chart 1 chart 2

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	2019	BARL_FTSW1_1 (FTSW-BARL)	3,126	1	308	325	473	630	671	679	40	-	-	-	-	-
FREQ_EXIST	2019	LON_HILL XFMRS (LON_HILL-LON_HILL)	2,849	2	250	192	417	597	404	597	286	106	-	-	-	-
FREQ_EXIST	2019	HAMILT_MAVERI1_1 (HAMILTON-MAVERICK)	2,791	3	482	469	252	484	431	358	147	168	-	-	-	-
FREQ_EXIST	2019	138_ALV_MNL_1 (ALVIN-MAINLAND)	2,696	4	60	200	363	669	472	365	431	136	-	-	-	-
FREQ_EXIST	2019	EAGLEP_ESCOND1_1 (ESCONDID-EAGLE_PS)	2,691	5	221	166	254	281	270	363	583	553	-	-	-	-
FREQ_EXIST	2019	CAGNON XFMRS (CAGNON-CAGNON)	2,448	6	202	175	215	210	370	565	338	373	-	-	-	-
FREQ_EXIST	2019	RIOPEC_WOODW21_1 (RIOPECOS-WOODWRD2)	2,413	7	491	292	378	139	131	268	372	342	-	-	-	-
FREQ_EXIST	2019	BARNHR_BIGLAK1_1 (BIGLAKE-BARNHRT)	2,081	8	294	175	398	161	522	371	135	25	-	-	-	-
FREQ_EXIST	2019	6437__F (SCRCV-KNAPP)	1,970	9	261	489	475	391	152	11	36	155	-	-	-	-
FREQ_EXIST	2019	RINCON_WHITE_2_1 (WHITE_PT-RINCON)	1,663	10	284	163	395	451	369	-	-	1	-	-	-	-
TOP10_RENT	2019	BARL_FTSW1_1 (FTSW-BARL)	$ 39.45	1	$ 1.48	$ 2.39	$ 6.22	$ 3.68	$ 12.55	$ 12.38	$ 0.75	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	PANHANDLE GTC (PNHNDL)	$ 31.51	2	$ 0.89	$ 2.17	$ 0.47	$ 3.29	$ 12.00	$ 7.82	$ 2.29	$ 2.59	$ -	$ -	$ -	$ -
TOP10_RENT	2019	LON_HILL XFMRS (LON_HILL-LON_HILL)	$ 25.33	3	$ 1.51	$ 1.42	$ 4.86	$ 6.15	$ 2.78	$ 5.86	$ 1.98	$ 0.77	$ -	$ -	$ -	$ -
TOP10_RENT	2019	HUMBLT_NOVICT1_1 (HUMBLTAP-NOVICTAP)	$ 23.04	4	$ 22.89	$ 0.01	$ 0.02	$ 0.03	$ 0.04	$ 0.02	$ 0.01	$ 0.01	$ -	$ -	$ -	$ -
TOP10_RENT	2019	COLEMAN JUNCTION (SANA-GLSB)	$ 22.96	5	$ 22.86	$ 0.02	$ 0.05	$ 0.02	$ 0.01	$ 0.00	$ 0.00	$ 0.00	$ -	$ -	$ -	$ -
TOP10_RENT	2019	590__B (LWVJS-LKPNT)	$ 19.66	6	$ -	$ -	$ 6.96	$ 2.10	$ 3.44	$ 3.17	$ 2.06	$ 1.93	$ -	$ -	$ -	$ -
TOP10_RENT	2019	588_A_1 (LWSVW-LWVTI)	$ 17.35	7	$ -	$ -	$ 11.10	$ 6.22	$ 0.02	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	RIOPEC_WOODW21_1 (RIOPECOS-WOODWRD2)	$ 17.16	8	$ 9.00	$ 0.80	$ 2.85	$ 0.40	$ 0.66	$ 2.57	$ 0.63	$ 0.26	$ -	$ -	$ -	$ -
TOP10_RENT	2019	6100__G (ACSSW-AMTBT)	$ 16.38	9	$ -	$ -	$ 0.02	$ 0.06	$ 0.33	$ 4.96	$ 5.31	$ 5.71	$ -	$ -	$ -	$ -
TOP10_RENT	2019	CAGNON XFMRS (CAGNON-CAGNON)	$ 14.49	10	$ 1.55	$ 0.69	$ 0.79	$ 1.15	$ 3.49	$ 4.01	$ 1.48	$ 1.33	$ -	$ -	$ -	$ -

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chart 1 chart 2

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																
ftr_option	year	pair	total_value	rank	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
N	2019	HB_WEST-LZ_WEST	$ 22.00	1	$ 2.01	$ 2.53	$ 1.75	$ 1.95	$ 2.39	$ 3.71	$ 3.32	$ 2.74	$ 1.60	$ -	$ -	$ -
N	2019	HB_SOUTH-LZ_SOUTH	$ 14.22	2	$ 1.54	$ 0.89	$ 0.95	$ 1.03	$ 2.19	$ 2.80	$ 1.92	$ 1.70	$ 1.20	$ -	$ -	$ -
N	2019	HB_HOUSTON-LZ_HOUSTON	$ 6.07	3	$ 0.53	$ 0.25	$ 0.25	$ 0.70	$ 1.24	$ 1.27	$ 0.92	$ 0.52	$ 0.39	$ -	$ -	$ -
N	2019	HB_NORTH-LZ_NORTH	$ 6.05	4	$ 0.89	$ 0.49	$ 0.21	$ 0.54	$ 0.69	$ 1.08	$ 0.90	$ 0.78	$ 0.47	$ -	$ -	$ -
N	2019	HB_NORTH-HB_HOUSTON	$ 5.50	5	$ 0.06	$ 0.00	$ 0.91	$ 1.02	$ 0.93	$ 0.86	$ 0.55	$ 0.28	$ 0.90	$ -	$ -	$ -
N	2019	HB_WEST-HB_NORTH	$ 4.25	6	$ 1.03	$ 0.33	$ 0.69	$ 0.83	$ 0.66	$ 0.54	$ 0.13	$ 0.01	$ 0.04	$ -	$ -	$ -
N	2019	HB_PAN-HB_WEST	$ 2.48	7	$ -	$ -	$ -	$ -	$ 0.39	$ 1.19	$ 0.30	$ 0.49	$ 0.10	$ -	$ -	$ -
N	2019	CPSES_UNIT2-HB_NORTH	$ 2.43	8	$ -	$ 0.20	$ 0.24	$ 0.62	$ 0.48	$ 0.44	$ 0.22	$ 0.11	$ 0.12	$ -	$ -	$ -
N	2019	JCKCNTY2_ST2-LZ_NORTH	$ 2.11	9	$ 0.27	$ 0.15	$ 0.20	$ 0.20	$ 0.35	$ 0.50	$ 0.21	$ 0.14	$ 0.07	$ -	$ -	$ -
N	2019	JACKCNTY_STG-LZ_NORTH	$ 1.84	10	$ 0.19	$ 0.13	$ 0.08	$ 0.01	$ 0.17	$ 0.35	$ 0.48	$ 0.32	$ 0.12	$ -	$ -	$ -
Y	2019	HB_WEST-LZ_WEST	$ 5.44	1	$ 0.27	$ 0.13	$ 0.38	$ 0.30	$ 0.50	$ 1.31	$ 0.82	$ 1.00	$ 0.73	$ -	$ -	$ -
Y	2019	RIGGIN_UNIT1-REROCK_ALL	$ 4.71	2	$ 0.02	$ 0.04	$ 0.49	$ 0.94	$ 0.31	$ 0.59	$ 0.72	$ 1.32	$ 0.28	$ -	$ -	$ -
Y	2019	HB_SOUTH-LZ_SOUTH	$ 4.56	3	$ 0.32	$ 0.41	$ 0.30	$ 0.31	$ 0.46	$ 1.08	$ 0.60	$ 0.62	$ 0.45	$ -	$ -	$ -
Y	2019	HB_NORTH-LZ_NORTH	$ 4.16	4	$ 0.46	$ 0.22	$ 0.37	$ 0.46	$ 0.51	$ 0.63	$ 0.43	$ 0.55	$ 0.54	$ -	$ -	$ -
Y	2019	AEEC-LZ_WEST	$ 2.68	5	$ 0.04	$ 0.00	$ 0.14	$ -	$ 0.20	$ -	$ 1.03	$ 0.68	$ 0.58	$ -	$ -	$ -
Y	2019	HB_WEST-HOVEY_GEN	$ 2.47	6	$ 0.18	$ 0.03	$ 0.06	$ 0.05	$ 0.05	$ 0.70	$ 0.40	$ 0.43	$ 0.56	$ -	$ -	$ -
Y	2019	REROCK_ALL-HOVEY_GEN	$ 1.72	7	$ 0.07	$ 0.17	$ 0.19	$ 0.60	$ 0.36	$ 0.14	$ 0.04	$ 0.09	$ 0.06	$ -	$ -	$ -
Y	2019	WOO_WOODWRD1-RIGGIN_UNIT1	$ 1.56	8	$ 0.05	$ 0.10	$ 0.04	$ 0.17	$ 0.37	$ 0.22	$ 0.30	$ 0.24	$ 0.08	$ -	$ -	$ -
Y	2019	HB_HOUSTON-LZ_HOUSTON	$ 1.16	9	$ 0.06	$ 0.09	$ 0.07	$ 0.13	$ 0.20	$ 0.18	$ 0.12	$ 0.11	$ 0.21	$ -	$ -	$ -
Y	2019	STP_STP_G1-LZ_CPS	$ 0.99	10	$ -	$ 0.07	$ 0.02	$ 0.14	$ 0.03	$ 0.14	$ 0.18	$ 0.33	$ 0.07	$ -	$ -	$ -

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