Item 6: Independent Market Monitor (IMM) Report

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Board of Directors Meeting

ERCOT Public
June 11, 2019

Today's topic

- Preliminary results and recommendations from the 2018 State of the Market report

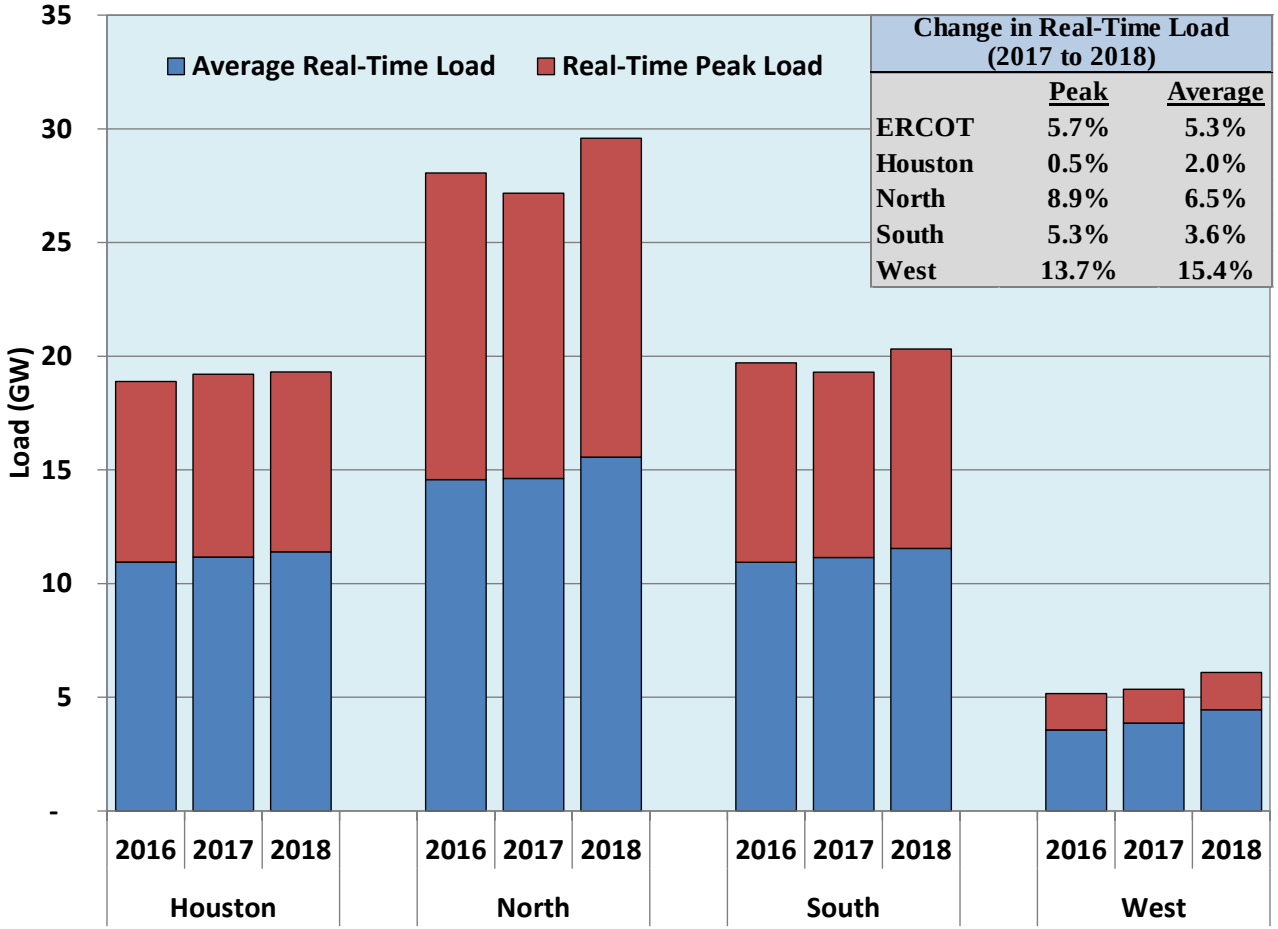
2018 Thumbnail

- Higher prices: $35.63/MWh ⬆ 26%
  - Higher natural gas prices: $3.22/MMBtu ⬆ 8%
  - Increased system shortages: ~17 hours >$1000
- Record peak, continued energy growth
  - Peak demand: 73,473MW ⬆ 3.3% previous
  - Average demand: ⬆ 5.3% (2,200 MW per hour)
- Small contributions from Reserve and Reliability Adders: $1.97 & $0.08 per MWh
- Increased congestion costs ⬆ 30%

POTOMAC ECONOMICS

Annual Load by Zone

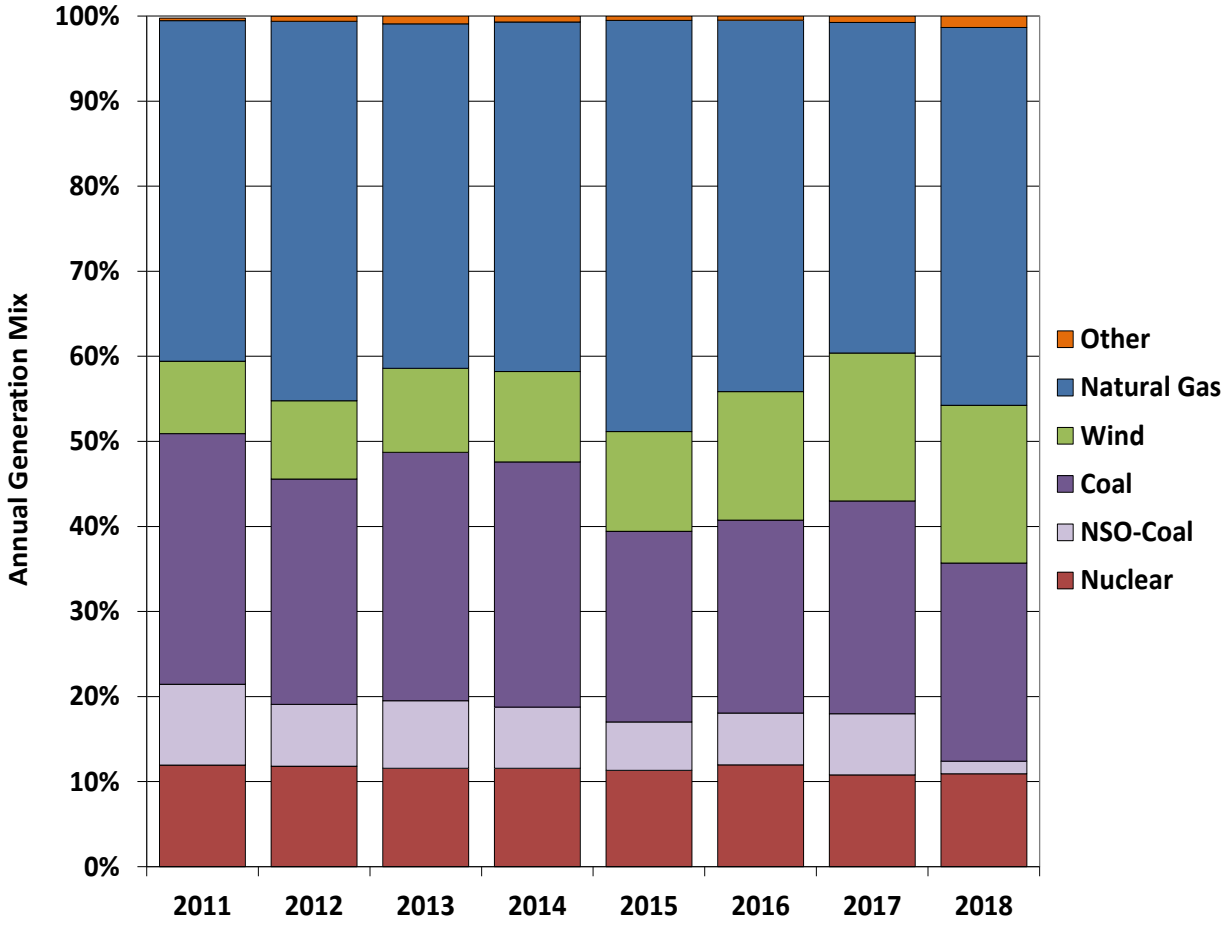
Load is growing in all zones



Change in Real-Time Load (2017 to 2018)	Peak	Average
ERCOT	5.7%	5.3%
Houston	0.5%	2.0%
North	8.9%	6.5%
South	5.3%	3.6%
West	13.7%	15.4%

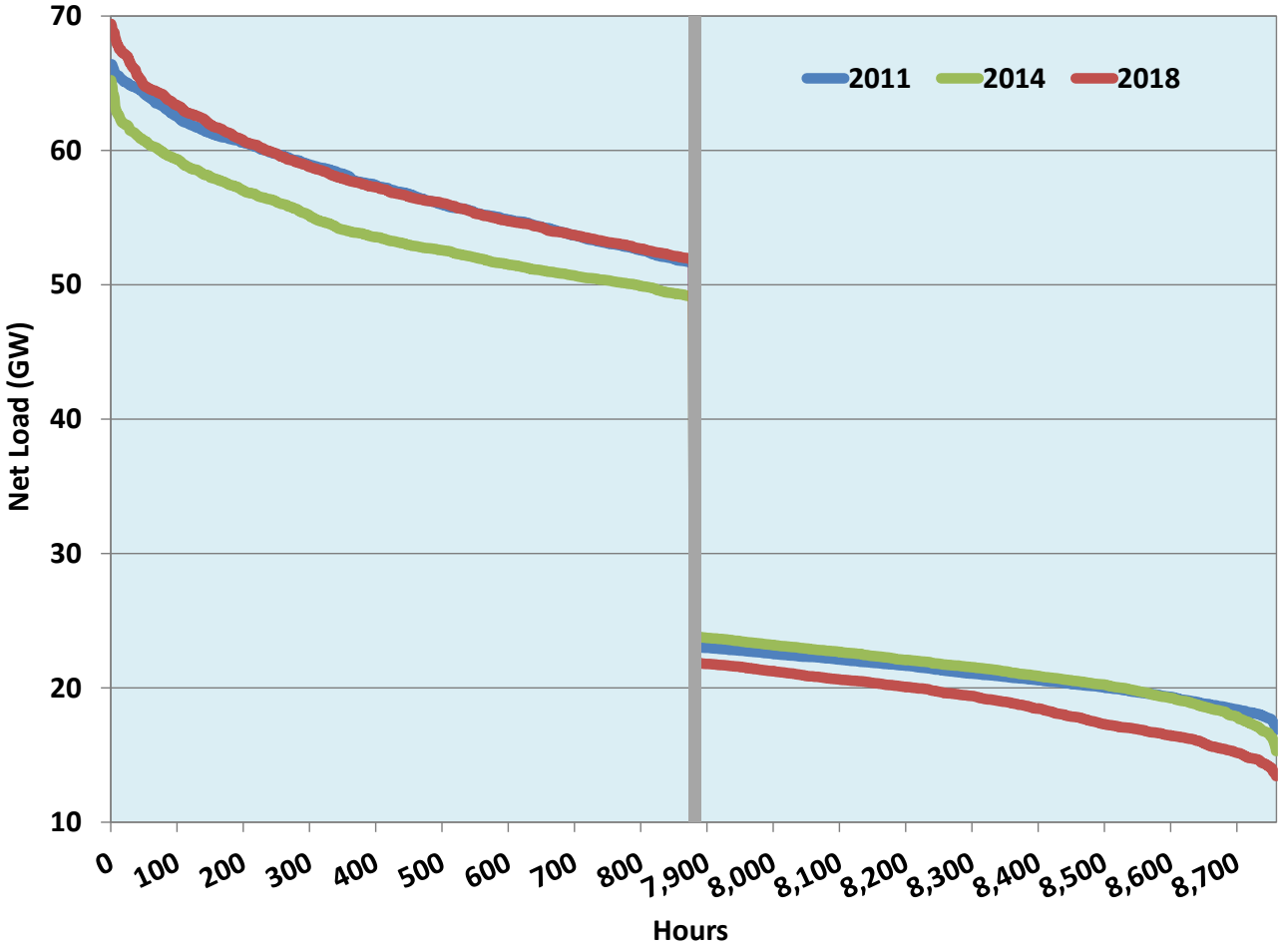
Annual Generation Mix

Other: 1%
Gas: 44%
Wind: 19%
Coal: 25%
Nuclear: 11%



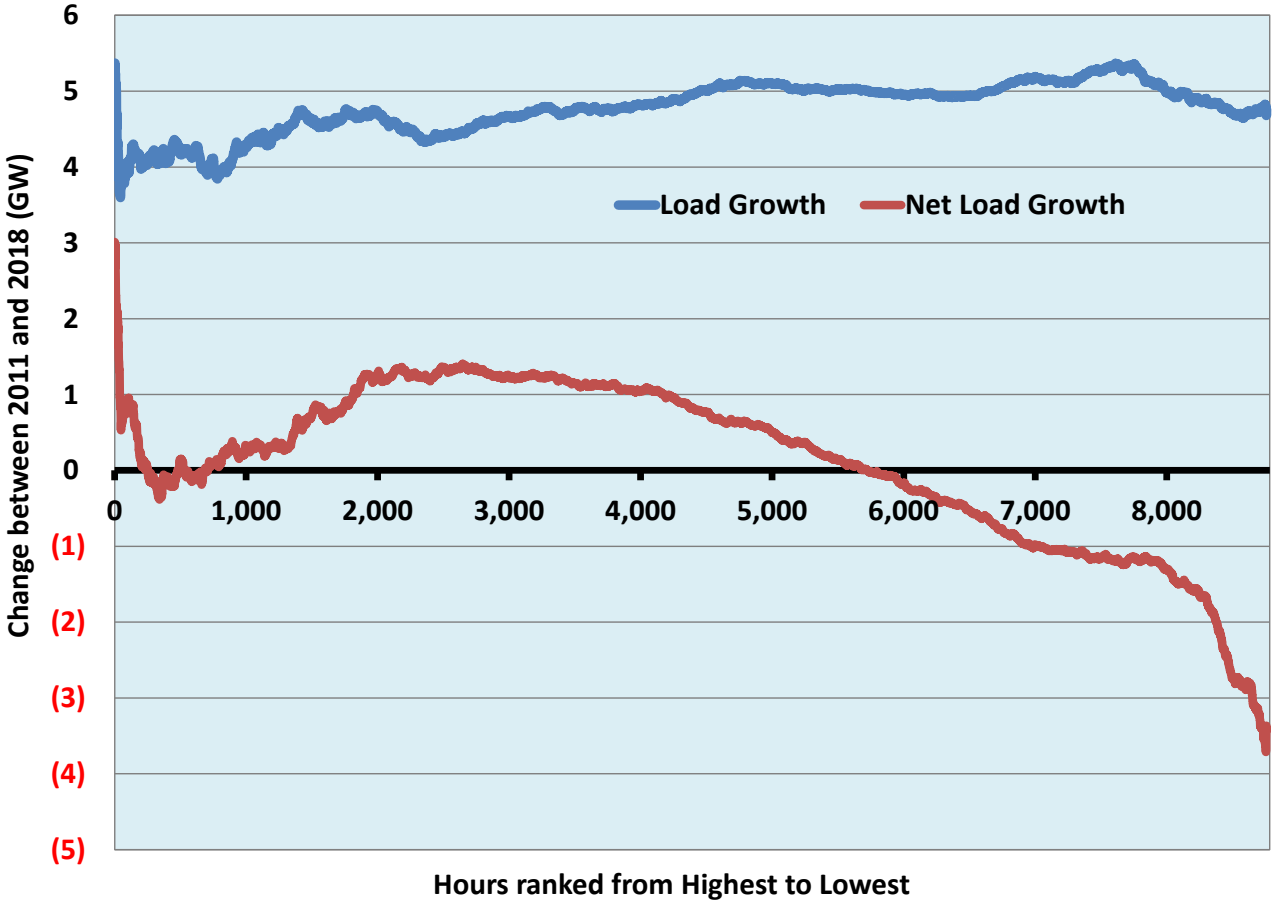
Top and Bottom Deciles (Hours) of Net Load

- Net Load = customer demand minus wind generation
- Highest net loads in 2018 were the same as in 2011
- Lowest net loads in 2018 were much lower



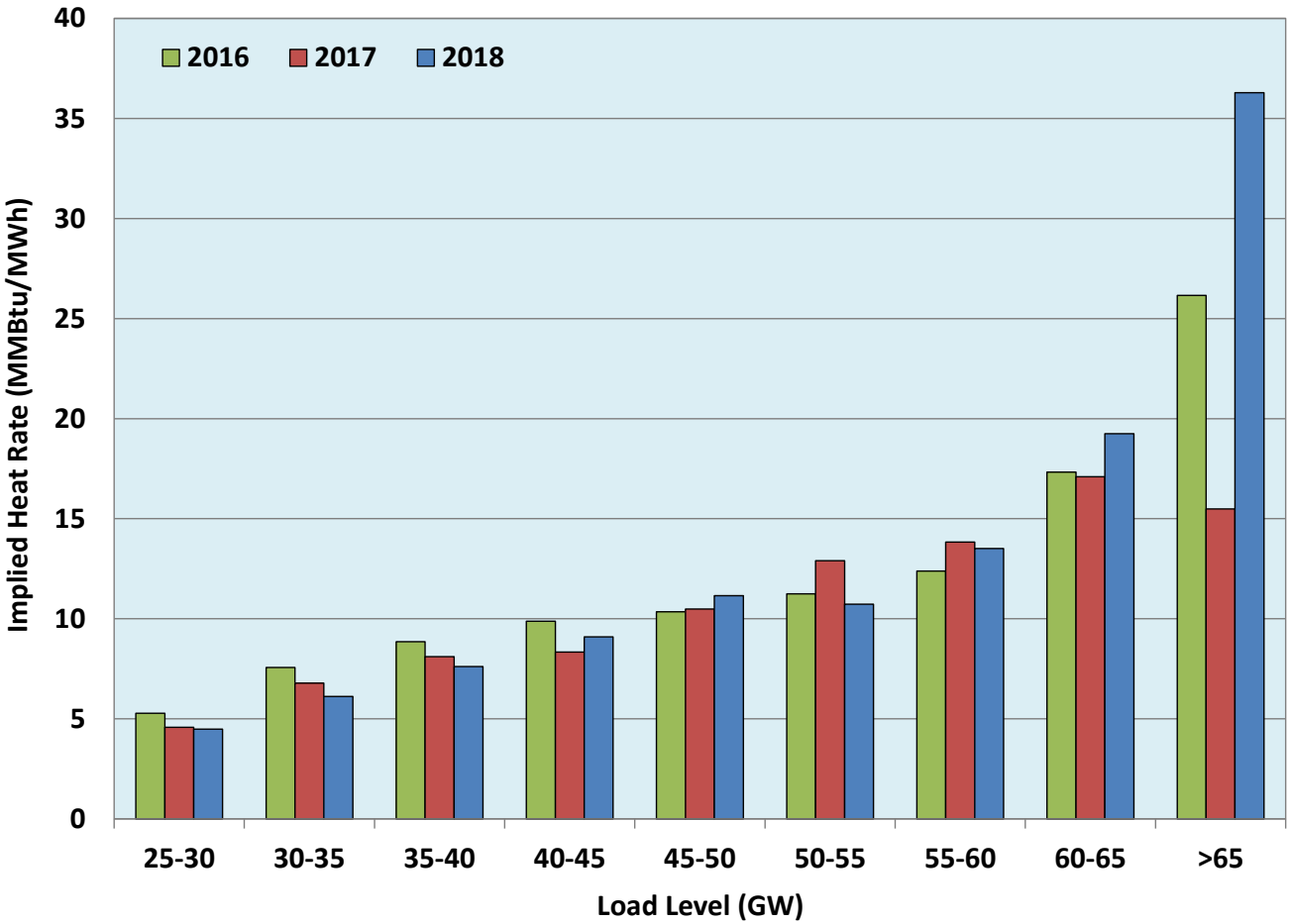
Load vs Net Load Growth 2011 - 2018

- Load growth is pretty consistent across high and low load hours
- Net load growth has resulted in higher highs and lower lows



Implied Heat Rate and Load Relationship

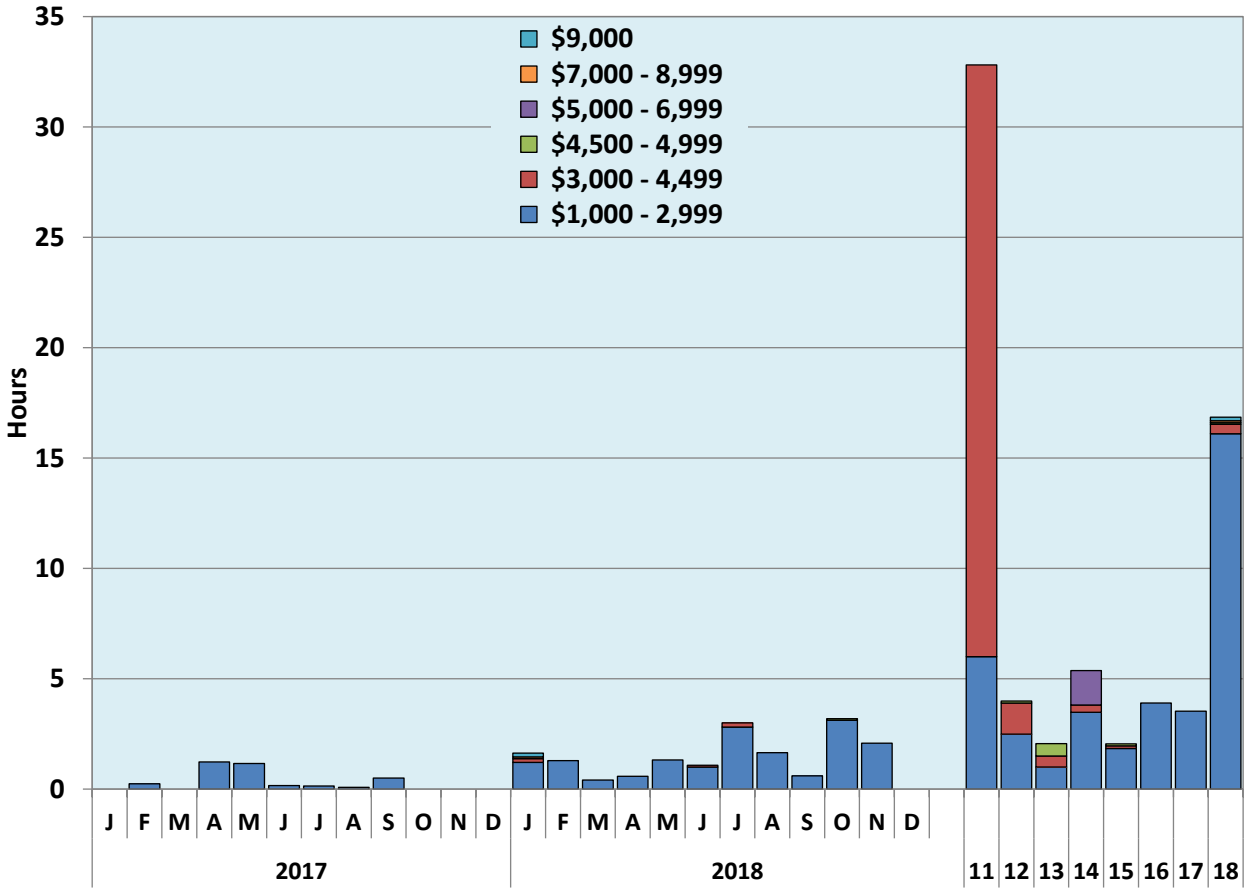
- Heat rate for load <40GW has been steadily dropping
- Load <40GW occurs ~ 47% of the year
- 40-45 GW occurs ~ 20%



POTOMAC ECONOMICS

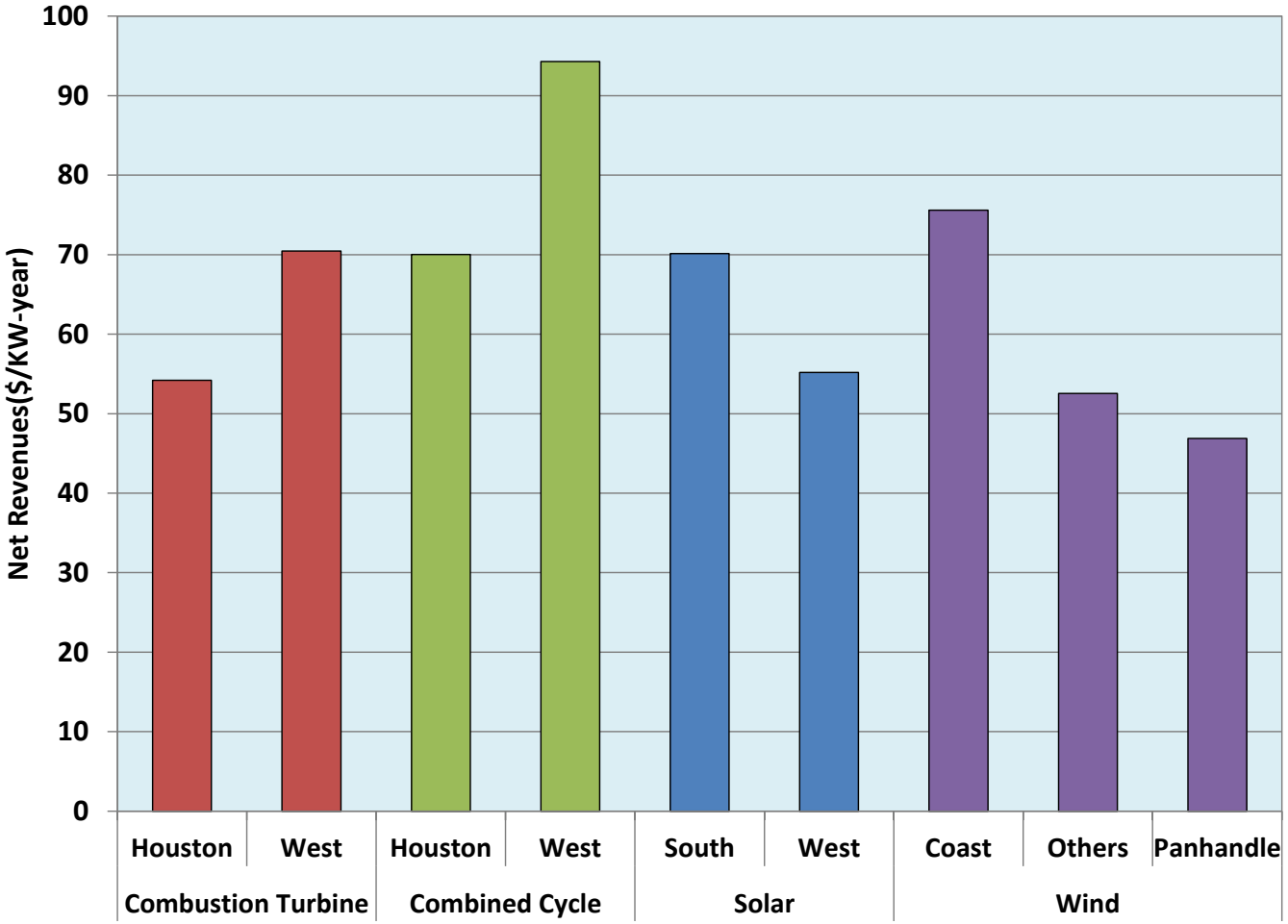
Duration of High Prices

- More, but infrequent high prices in 2018



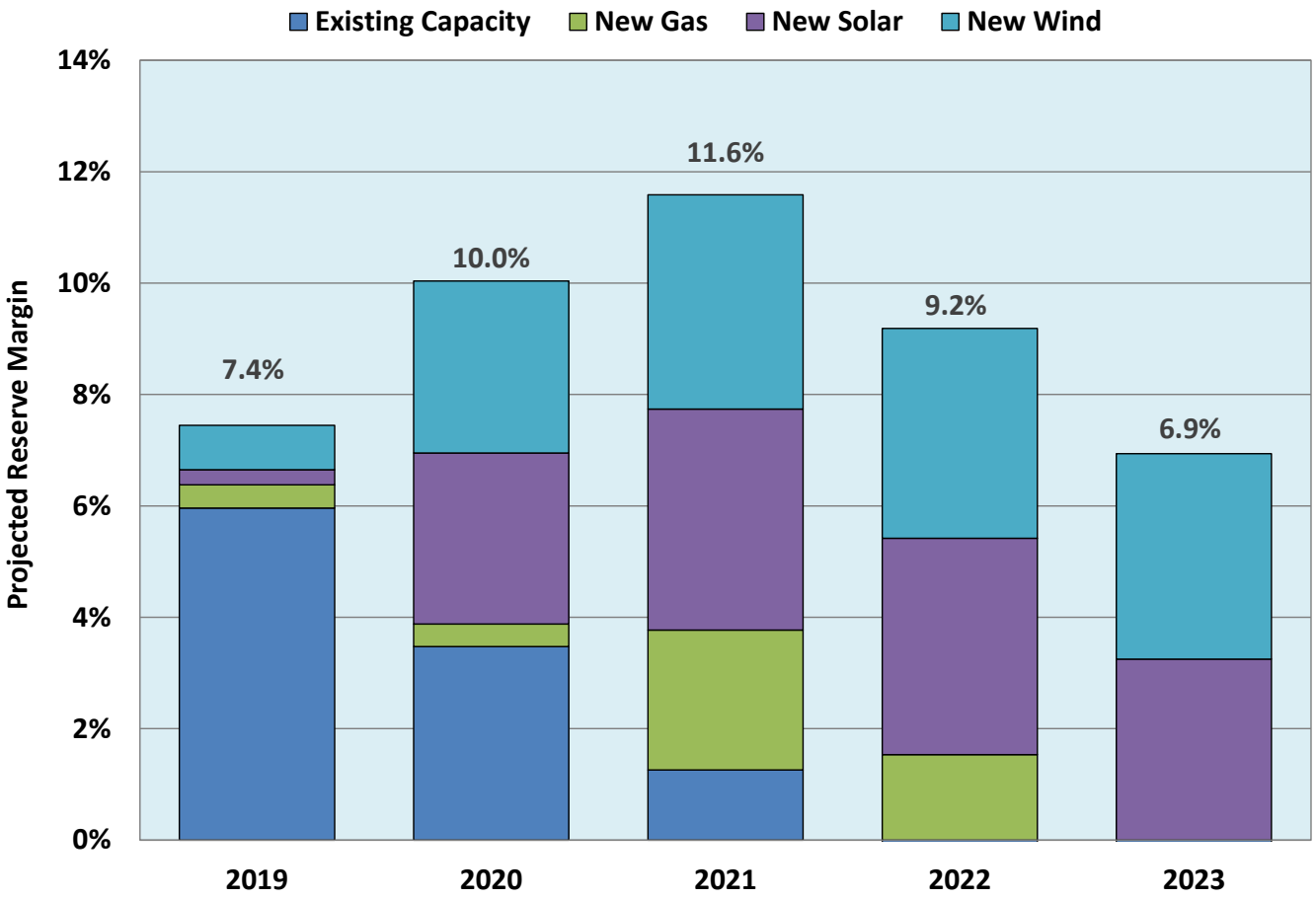
Energy Net Revenues

- West Zone using Waha gas price
- Revenues based on generation nodes



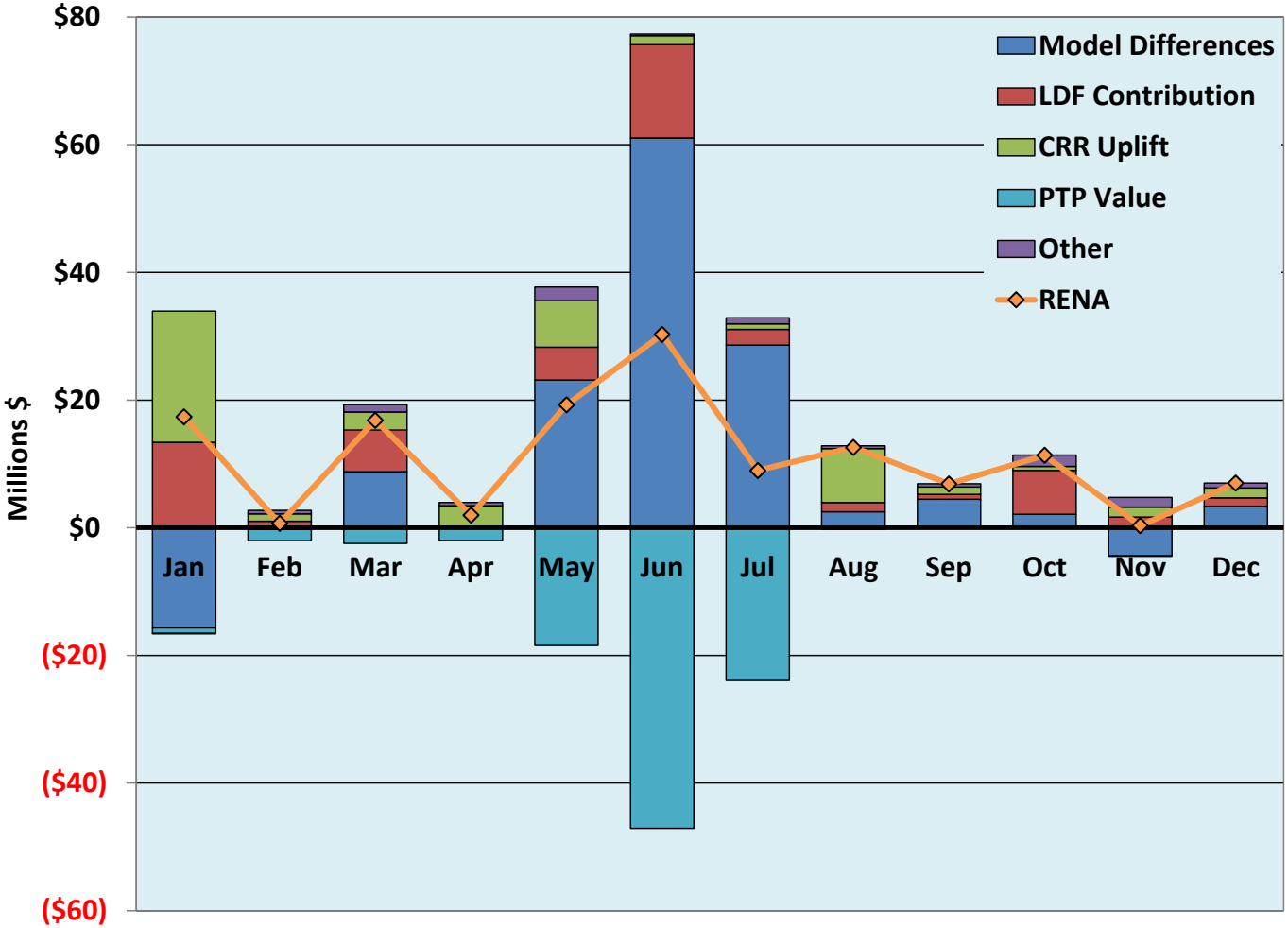
Projected Planning Reserve Margins

- Does not reflect Summer SARA capacity
- Existing generation will not be sufficient to serve expected peak demand in 2022.



Source: ERCOT Capacity, Demand and Reserves Report, December 2018 with Gibbons Creek capacity removed

RENA Analysis



- RENA increased 40% to $134M ($0.35/MWh)
- Model Diff: $114M
- LDF Diff: $55M
- CRR Uplift (PTP Obl linked to Options): $51M
- PTP Option Clearing: ($97M)

New Recommendations to Enhance Market Efficiency

1. Evaluate and improve the Reliability Deployment Price Adder
2. Explore options to consider commitment costs for RUC-committed units
3. Eliminate the OPTOUT option for RUC-committed Resources
4. Review PTP obligations linked to options
5. Evaluate and Improve Load Distribution Factors (LDFs) used in the Congestion Revenue Right (CRR) and Day-Ahead Market clearing activities
6. Evaluate Transmission Demand Curves

Previously Recommended Enhancements

7. Evaluate the need for a local reserve product.
8. Price future ancillary services based on the shadow price of procuring the service
9. Price congestion at all locations that affect a transmission constraint.
10. Modify the real-time market software to better commit load and generation resources that can be online within 30 minutes.
11. Evaluate policies and programs that create incentives for loads to reduce consumption for reasons unrelated to real-time energy prices, including: (a) the Emergency Response Service (ERS) program and (b) the allocation of transmission costs
12. Reserve the inclusion of marginal losses in ERCOT locational marginal prices for post-implementation of real-time co-optimization in ERCOT.

To the Public Utility Commission of Texas

ERCOT Wholesale Electricity Market Monthly Report

Friday, May 10, 2019

Potomac Economics, Ltd.
Independent Market Monitor

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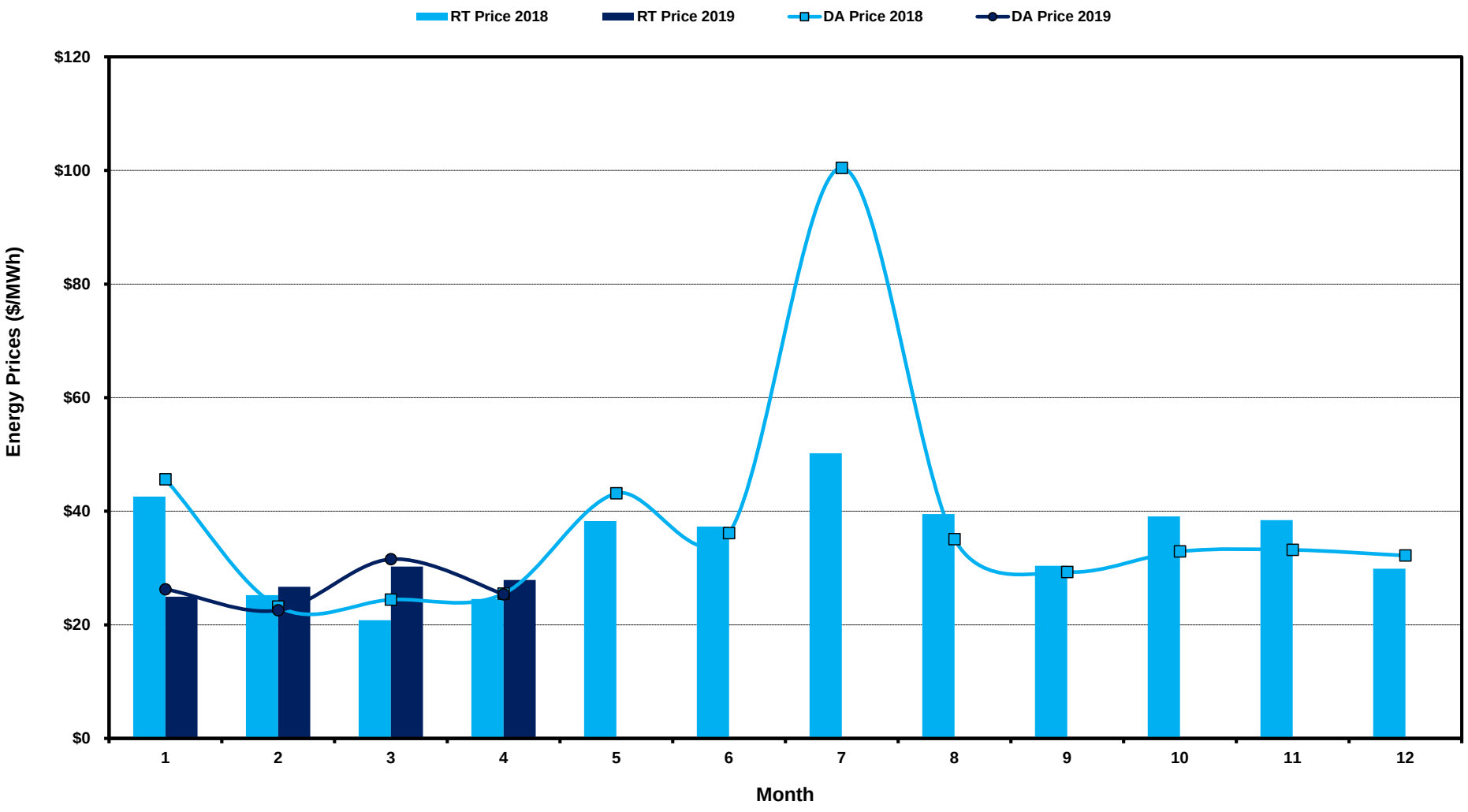
ERCOT-wide Average Energy Prices DA vs RT

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



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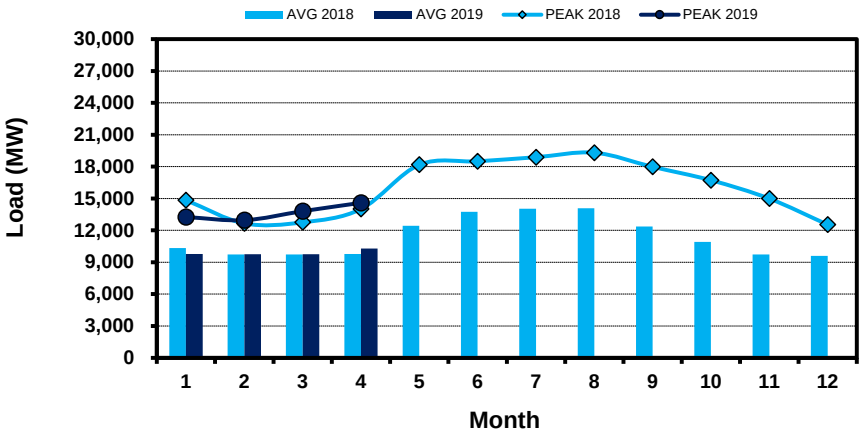
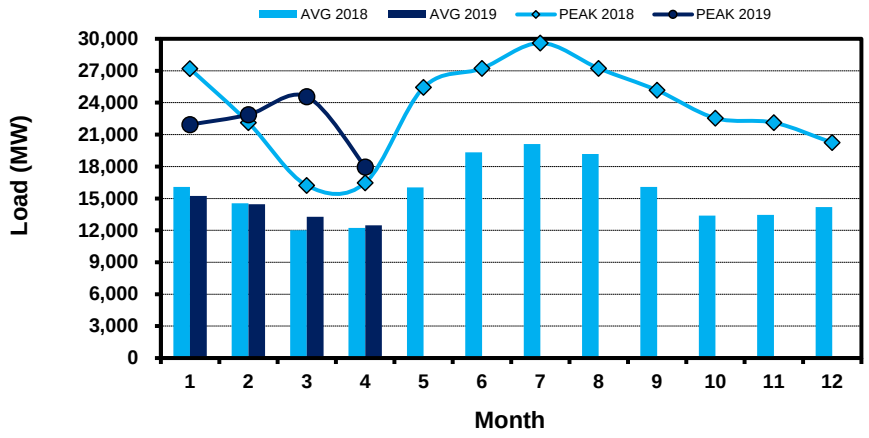
Load Zone Load Statistics

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

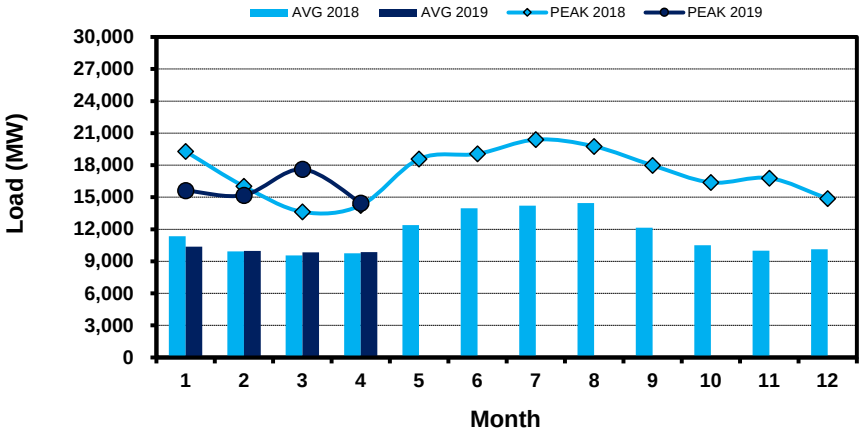
Houston Zone



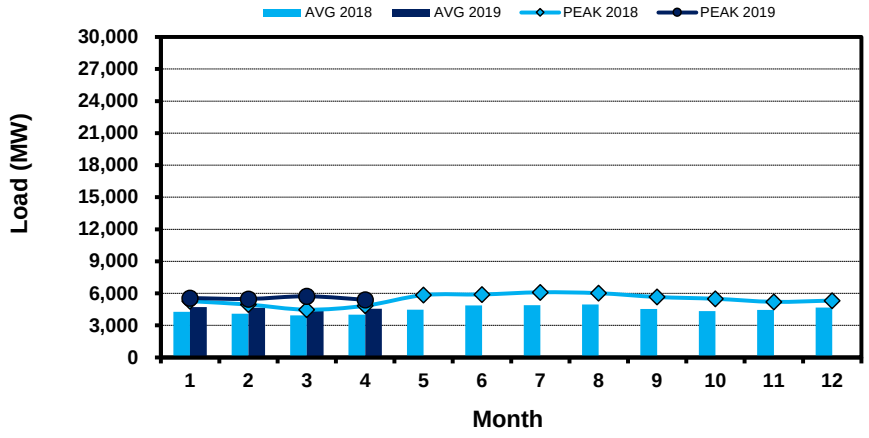
North Zone



South Zone



West Zone



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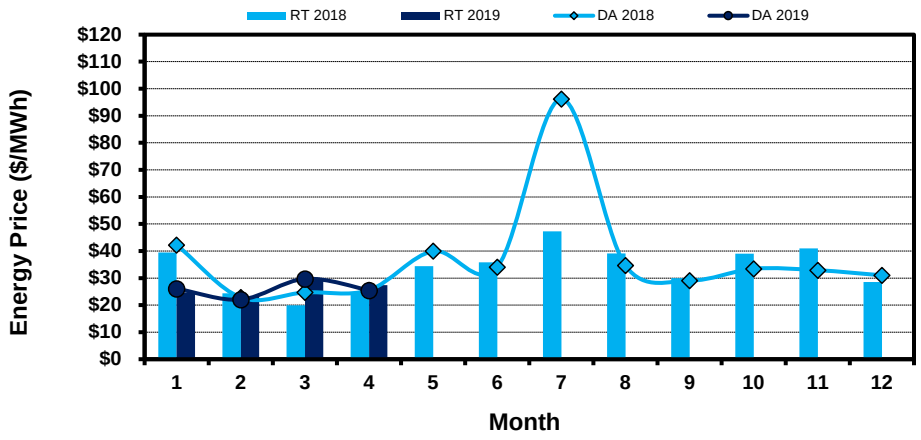
Note: * Zonal load zone definition vs. Nodal comparable load zone definition: LZ_Houston=LZ_Houston; LZ_West=LZ_West; LZ_North=(LZ_North,LZ_RAYBN); LZ_South=(LZ_South,LZ_CPS,LZ_AEN,LZ_LCRA)

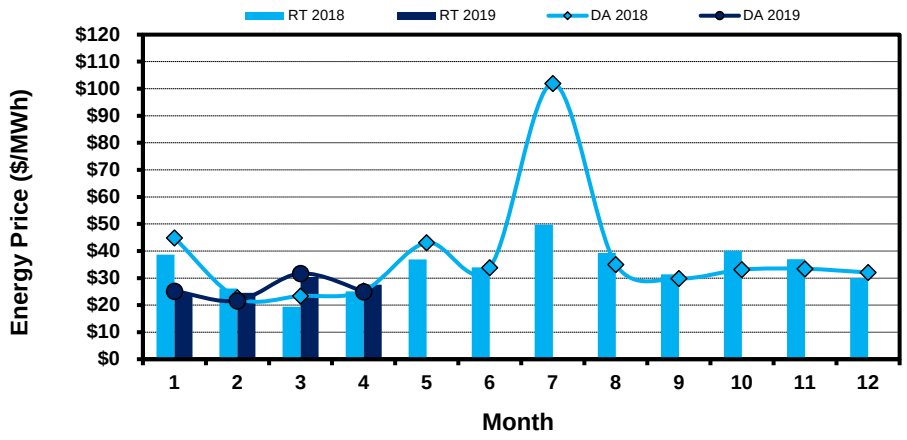
Load Zone Monthly Average Energy Price DA vs RT

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

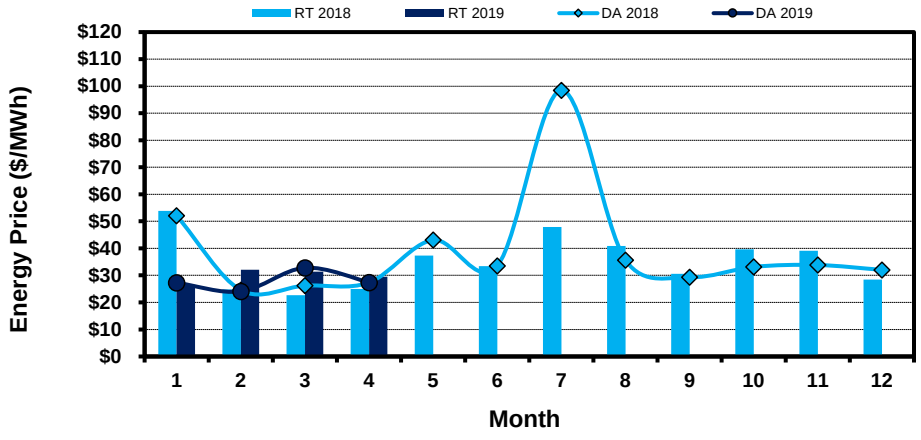
Houston Zone



North Zone



South Zone



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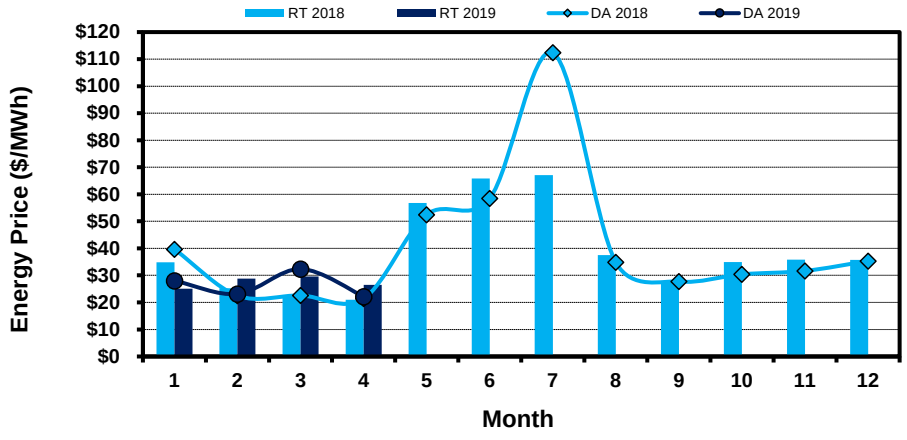

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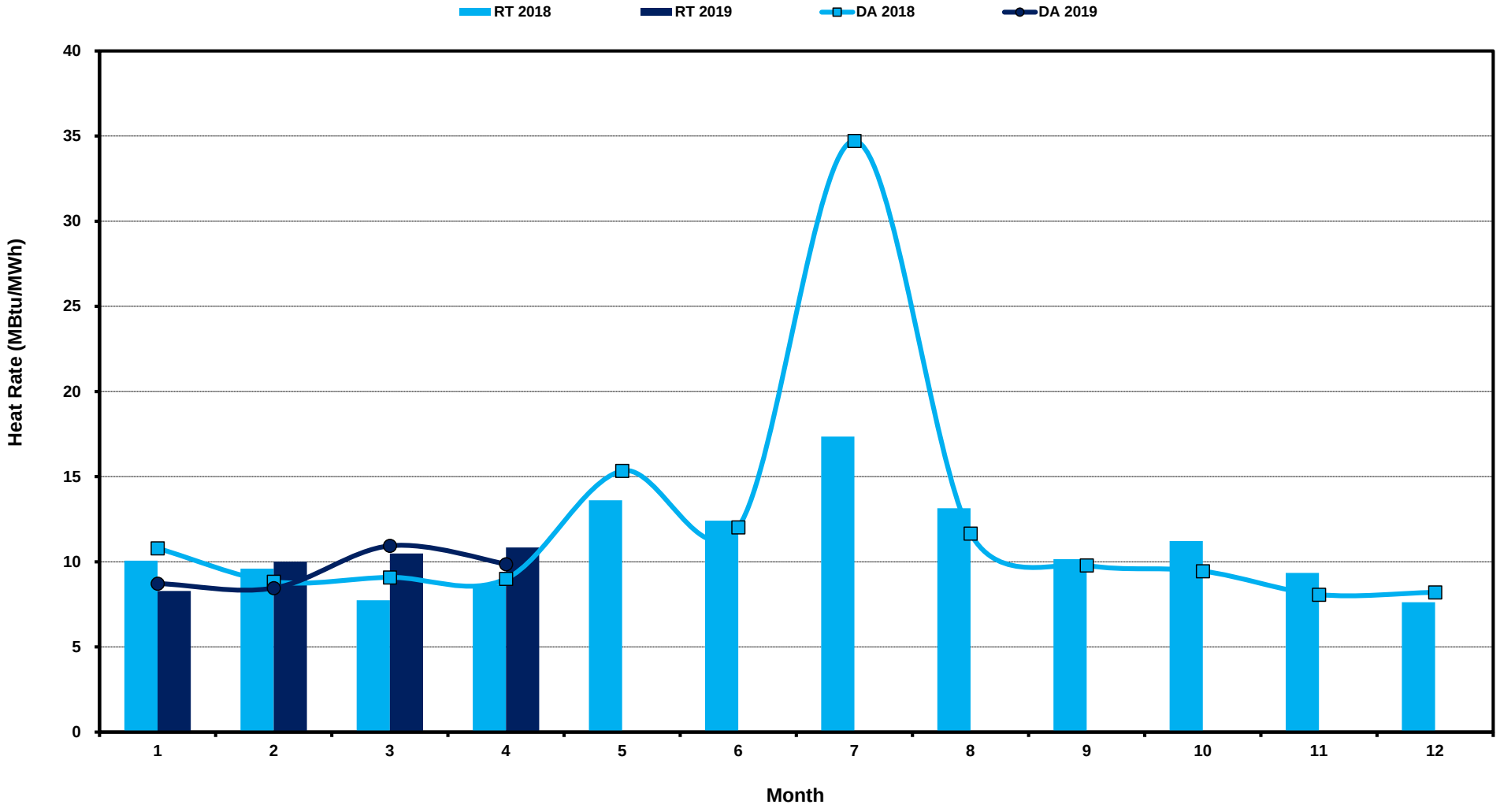
ERCOT-wide Monthly Implied Heat Rate DA vs RT

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



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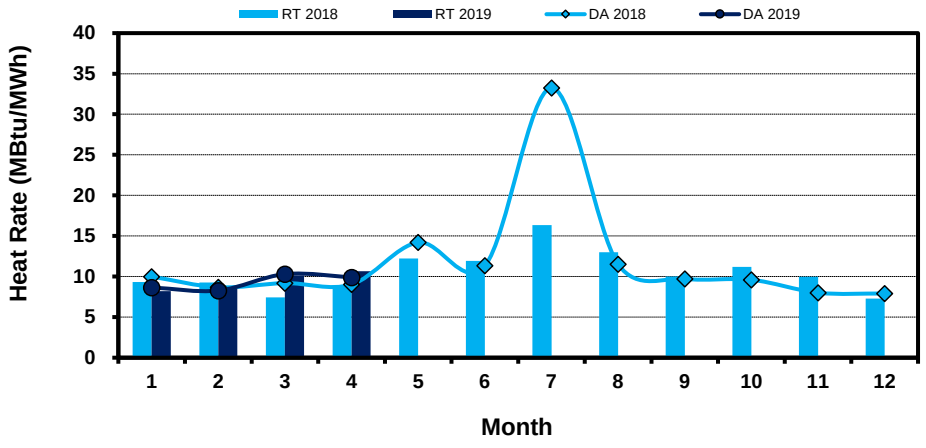

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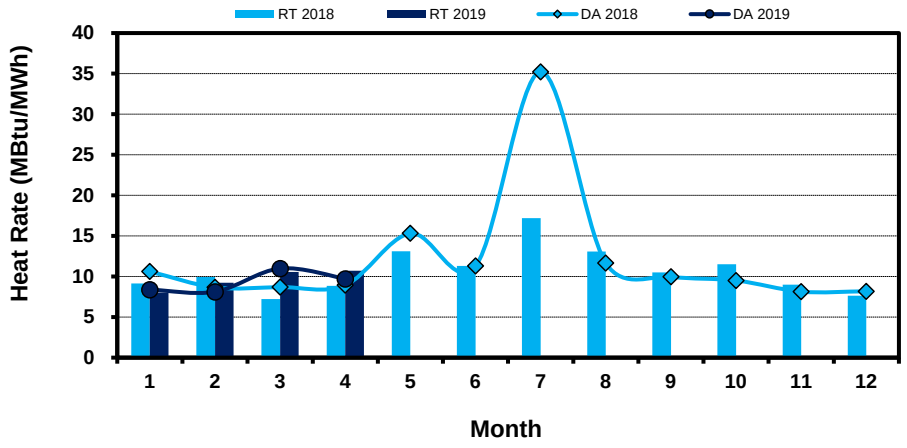

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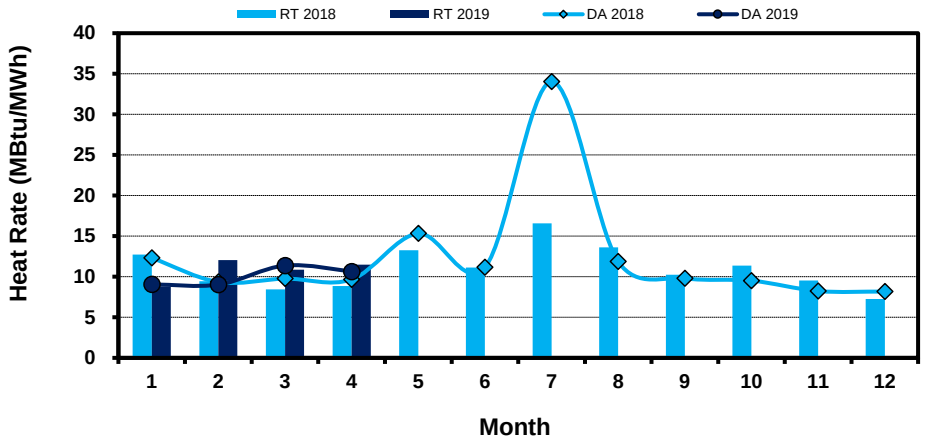
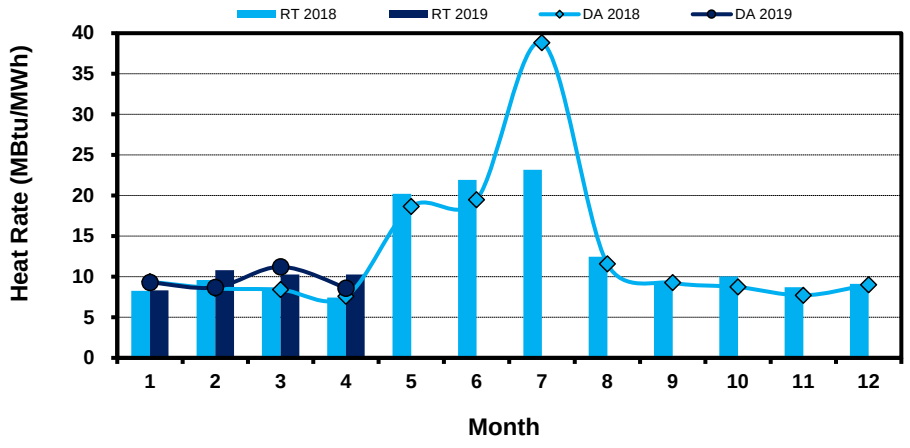


West Zone



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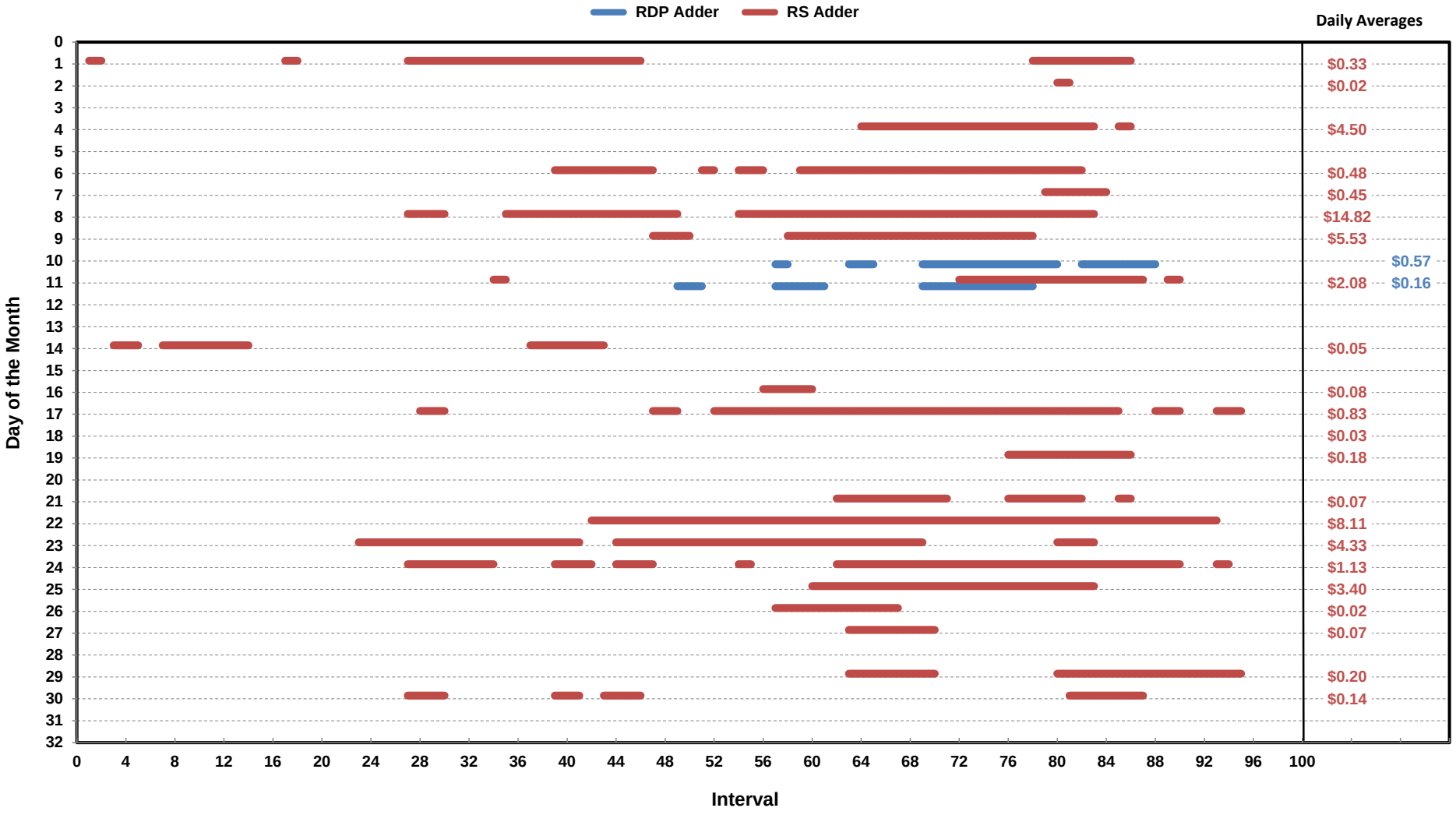
Daily ORDC Adders Average Values and Interval Duration

Apr-2019



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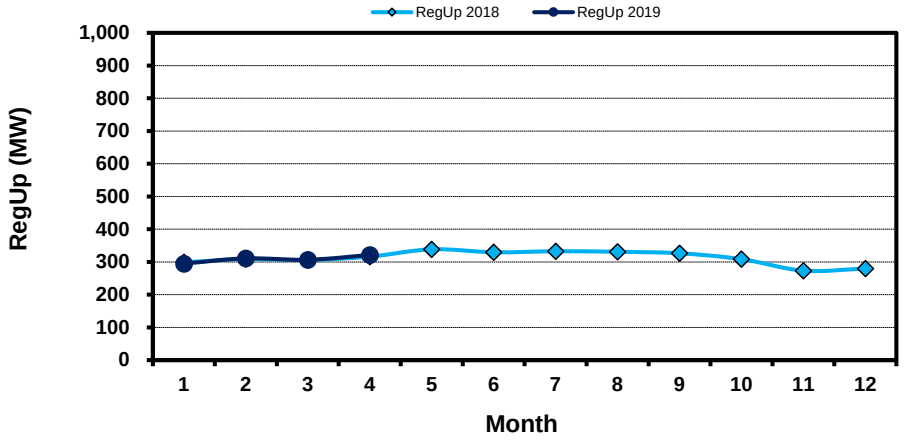
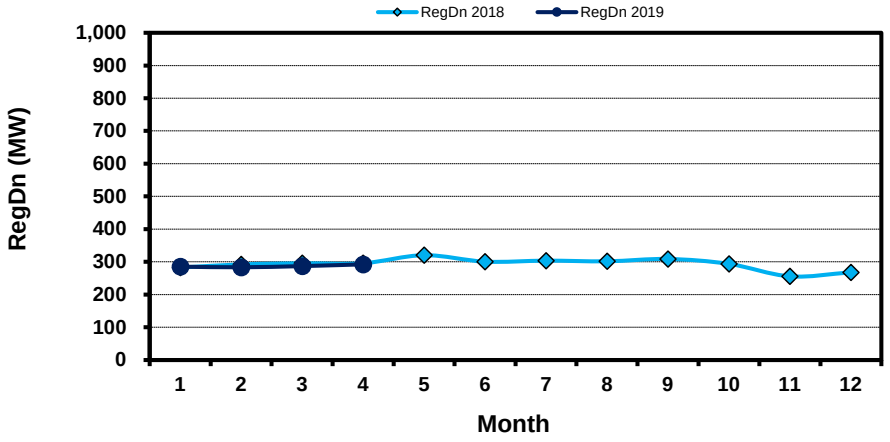
Monthly Average of Ancillary Services Required MW

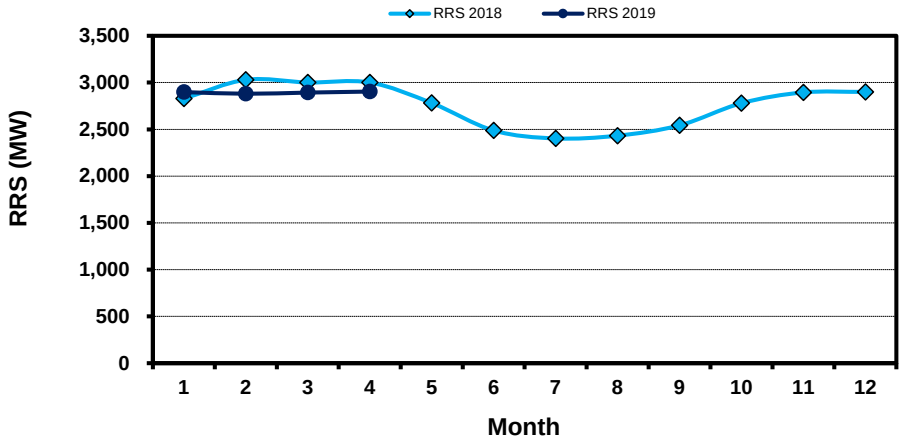
Regulation Up



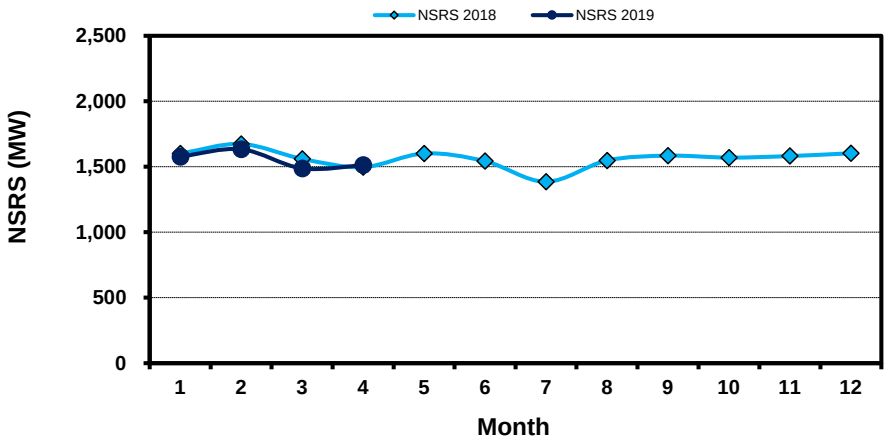
Regulation Down



Responsive Reserve



Non-Spin Reserve



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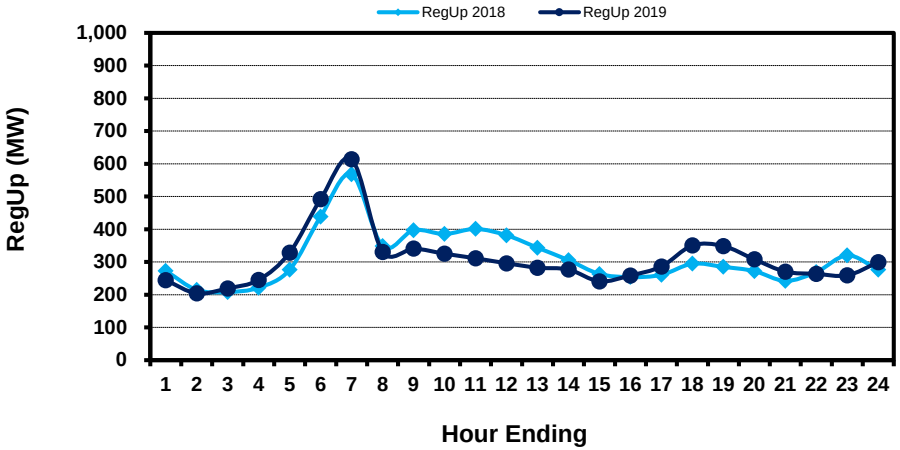
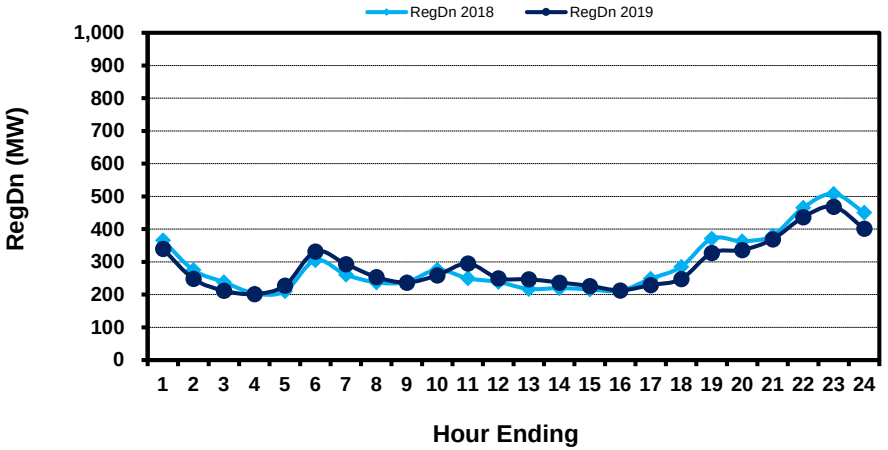
Hourly Average of Ancillary Services Required MW

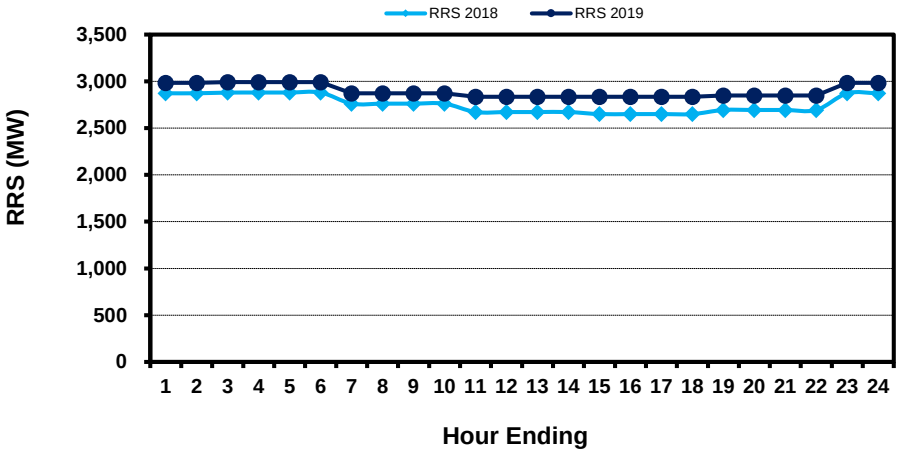
Regulation Up



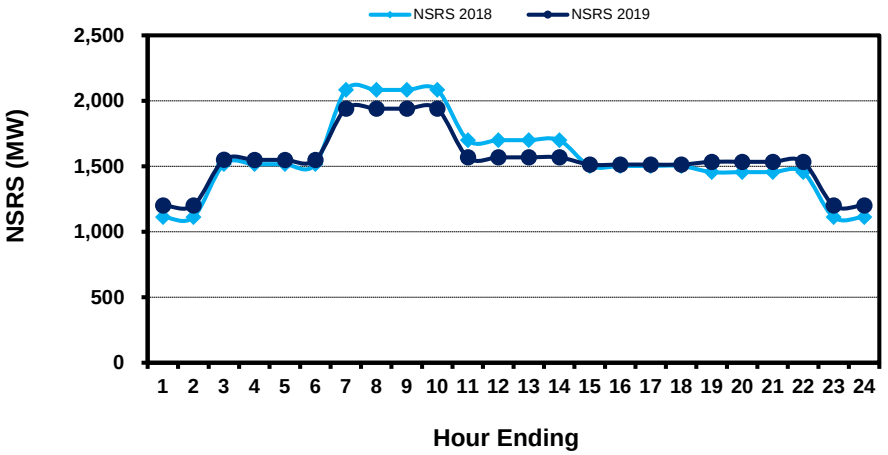
Regulation Down



Responsive Reserve



Non-Spin Reserve



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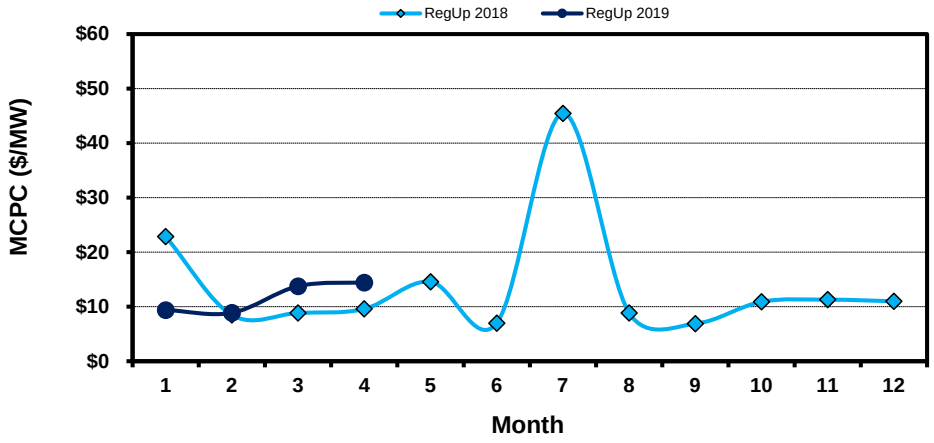
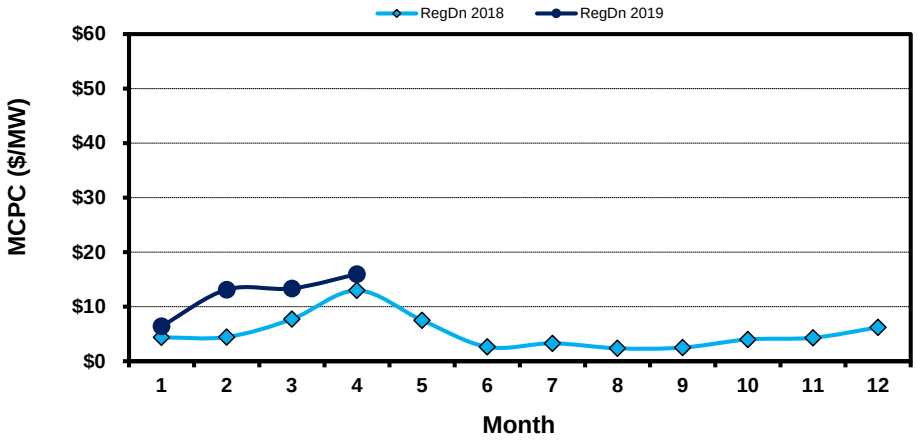
Monthly Average Ancillary Services Price

(weighted by A/S Quantities Required)

Regulation Up



Regulation Down



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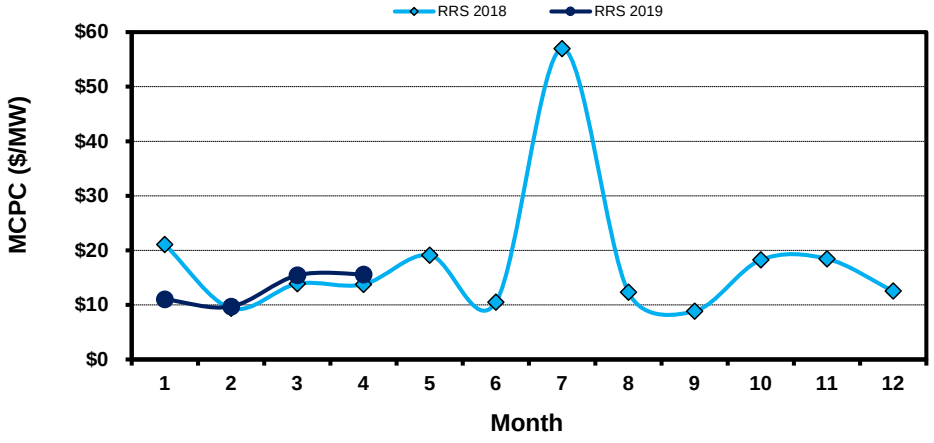
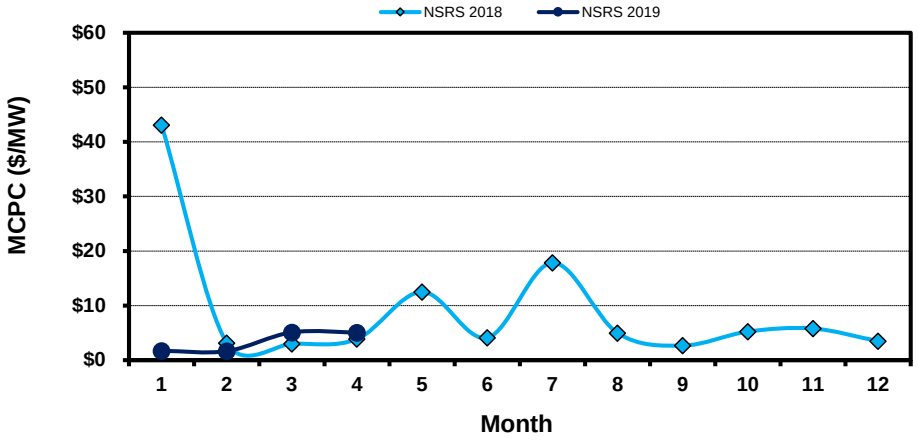


Non-Spin Reserve



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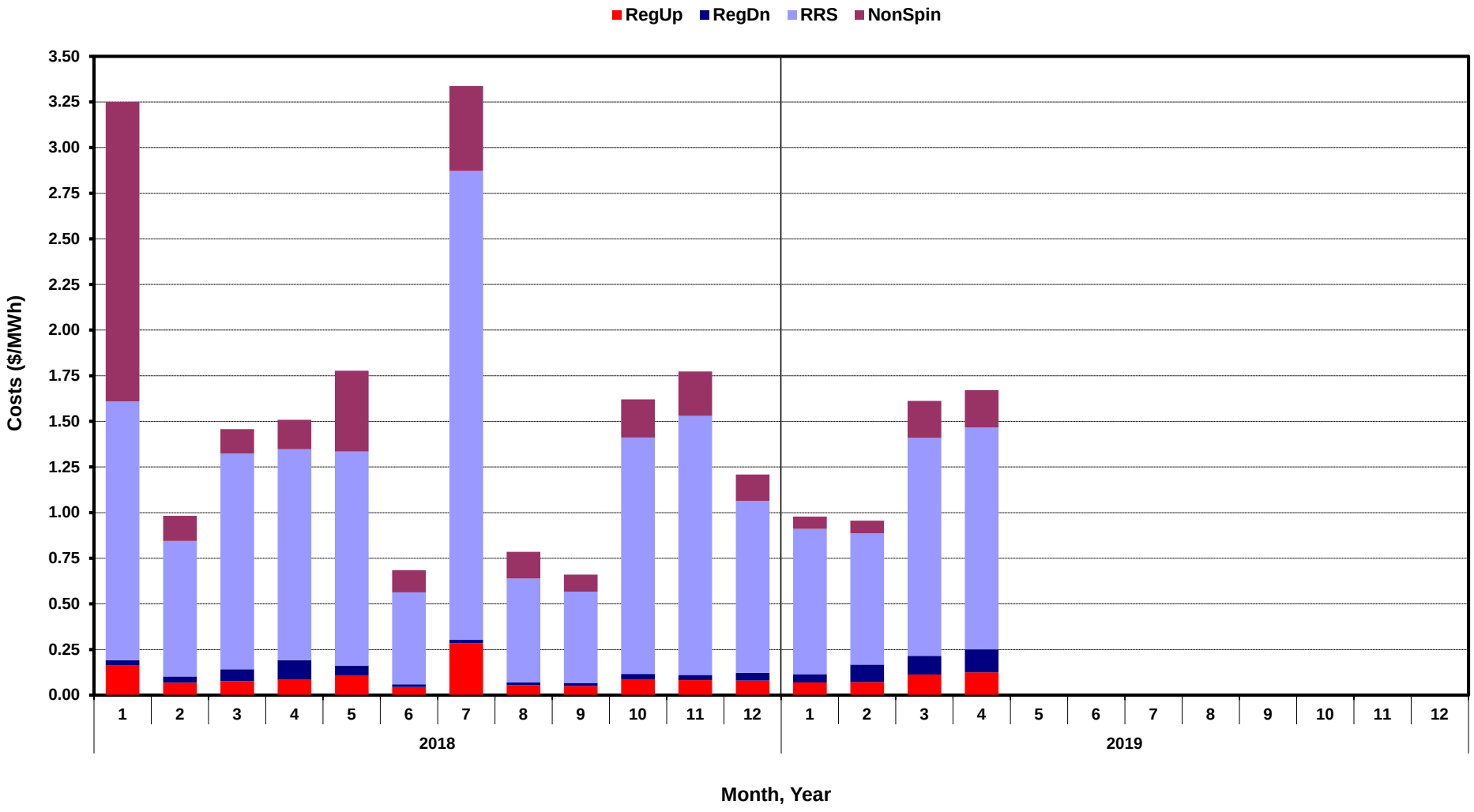
Monthly Average A/S Cost per MWh Load



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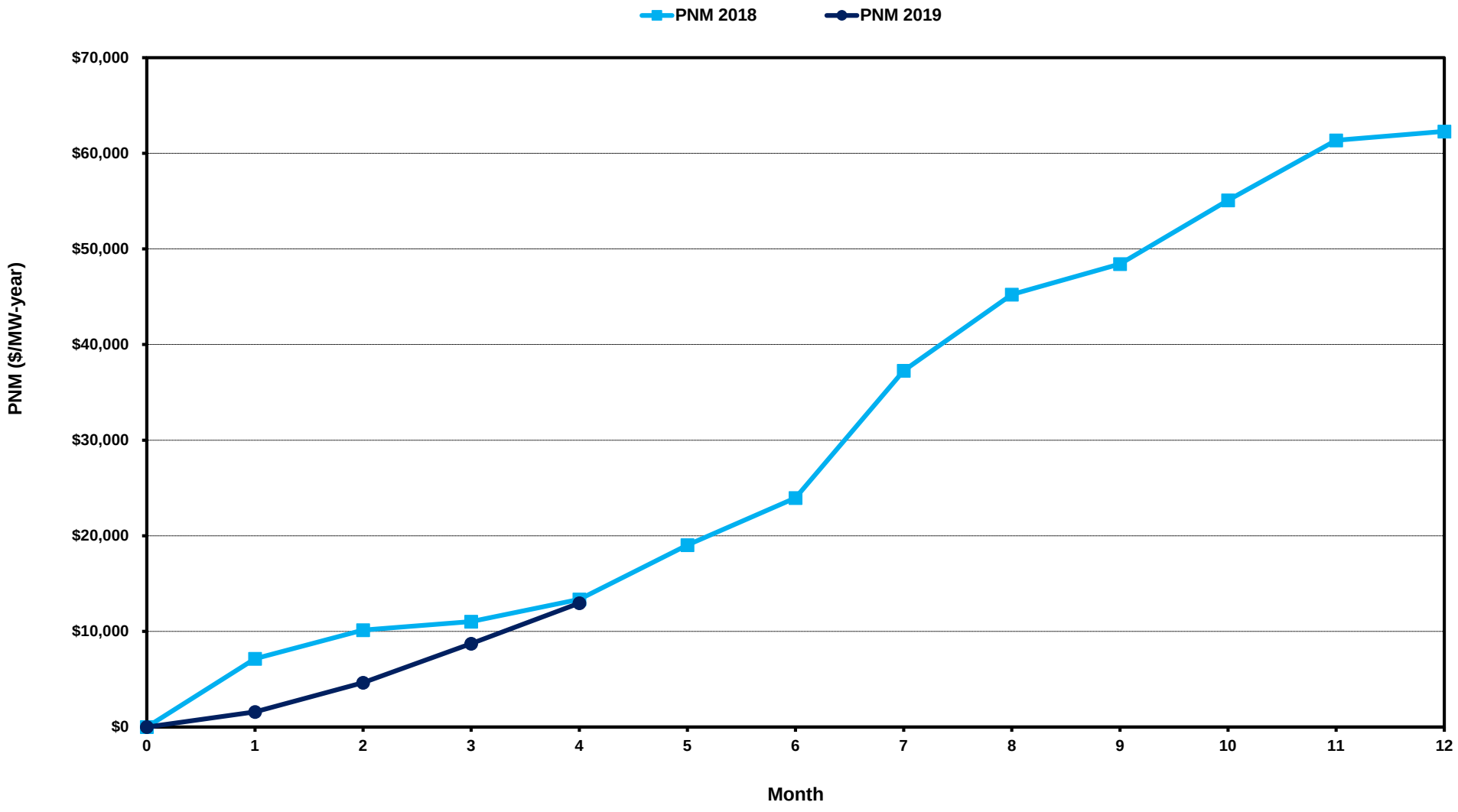
ERCOT-wide Cumulative Peaker Net Margin



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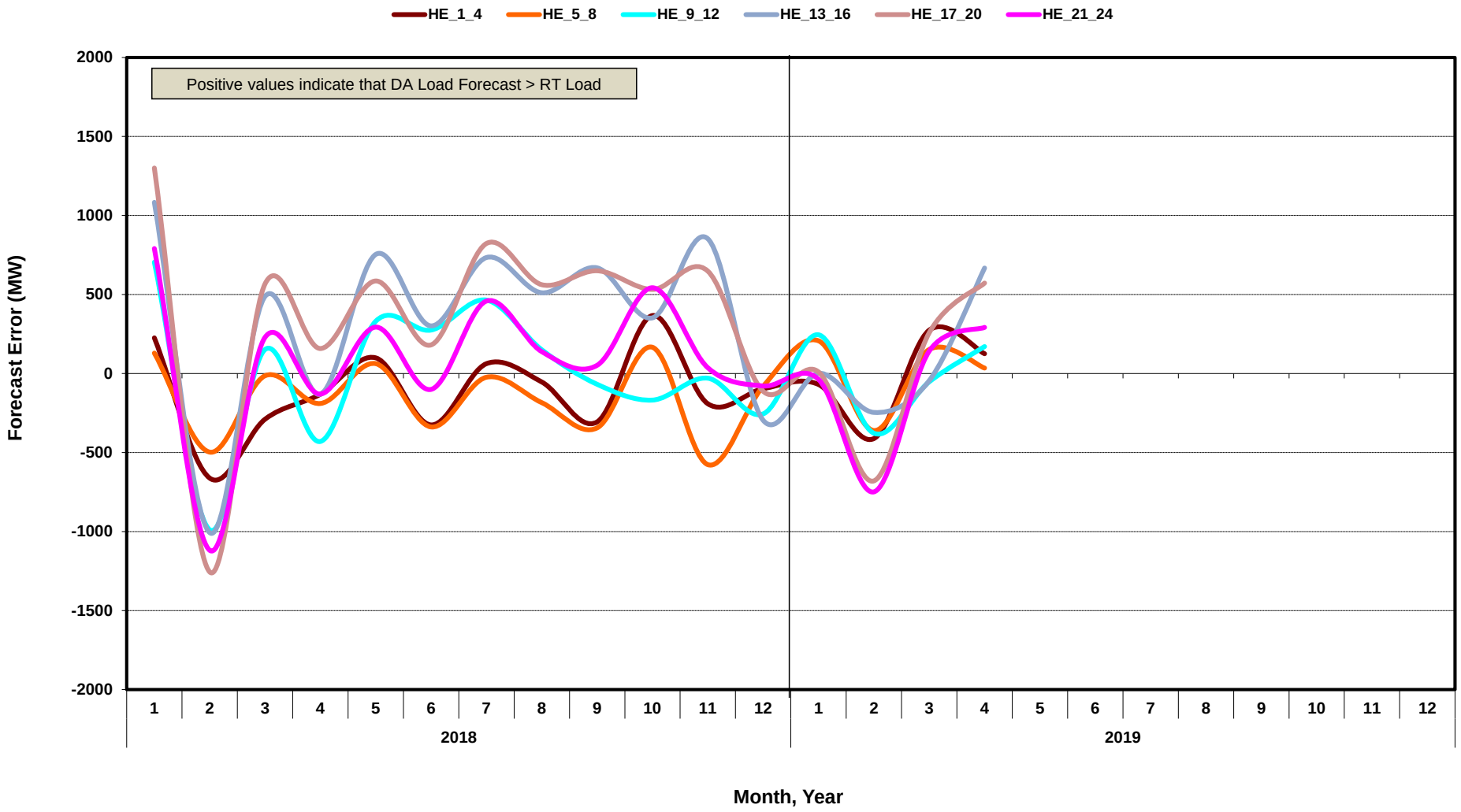
DA vs. RT Load Forecast Error by Hour Ending



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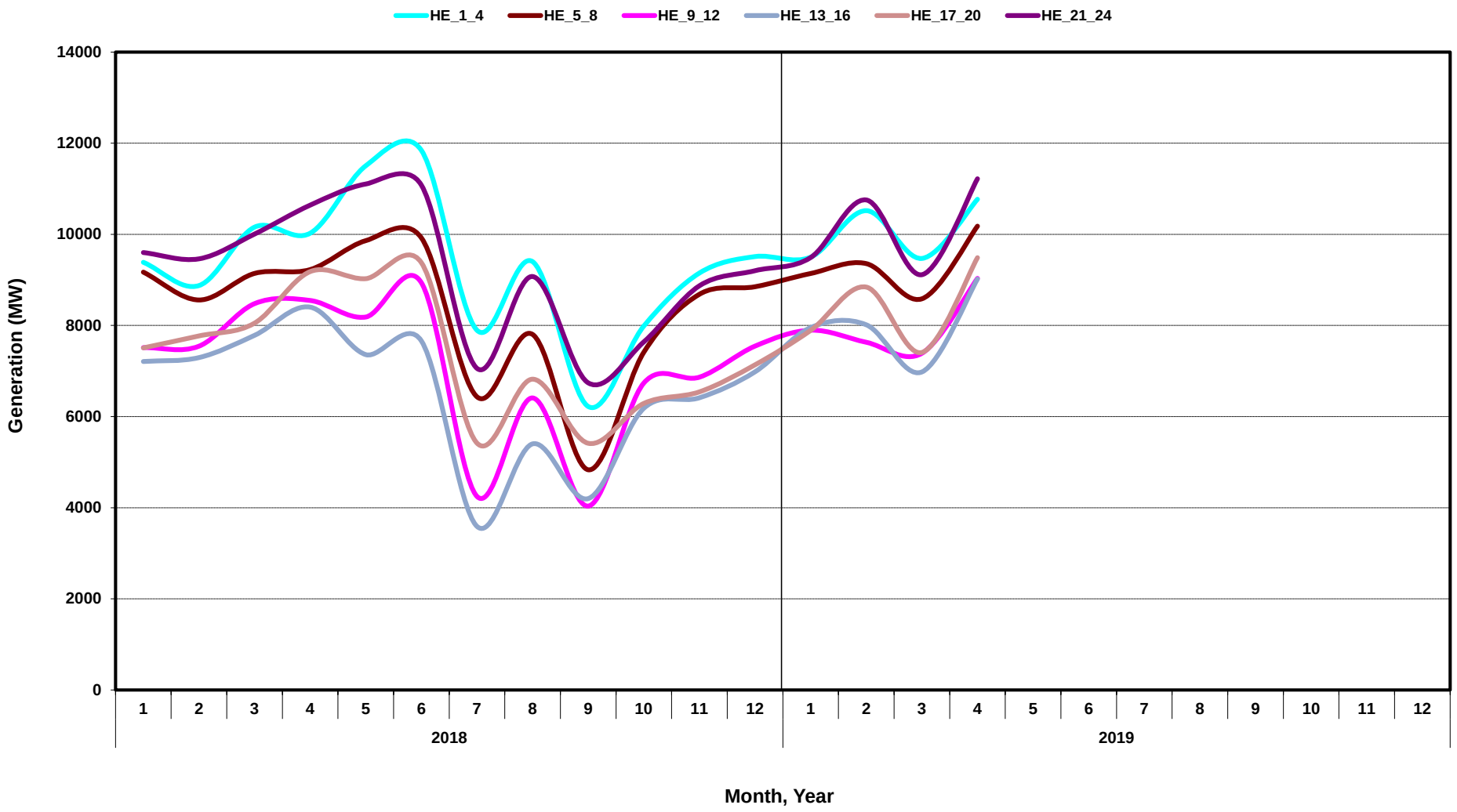
Monthly Average of Wind Generation by Hour Ending



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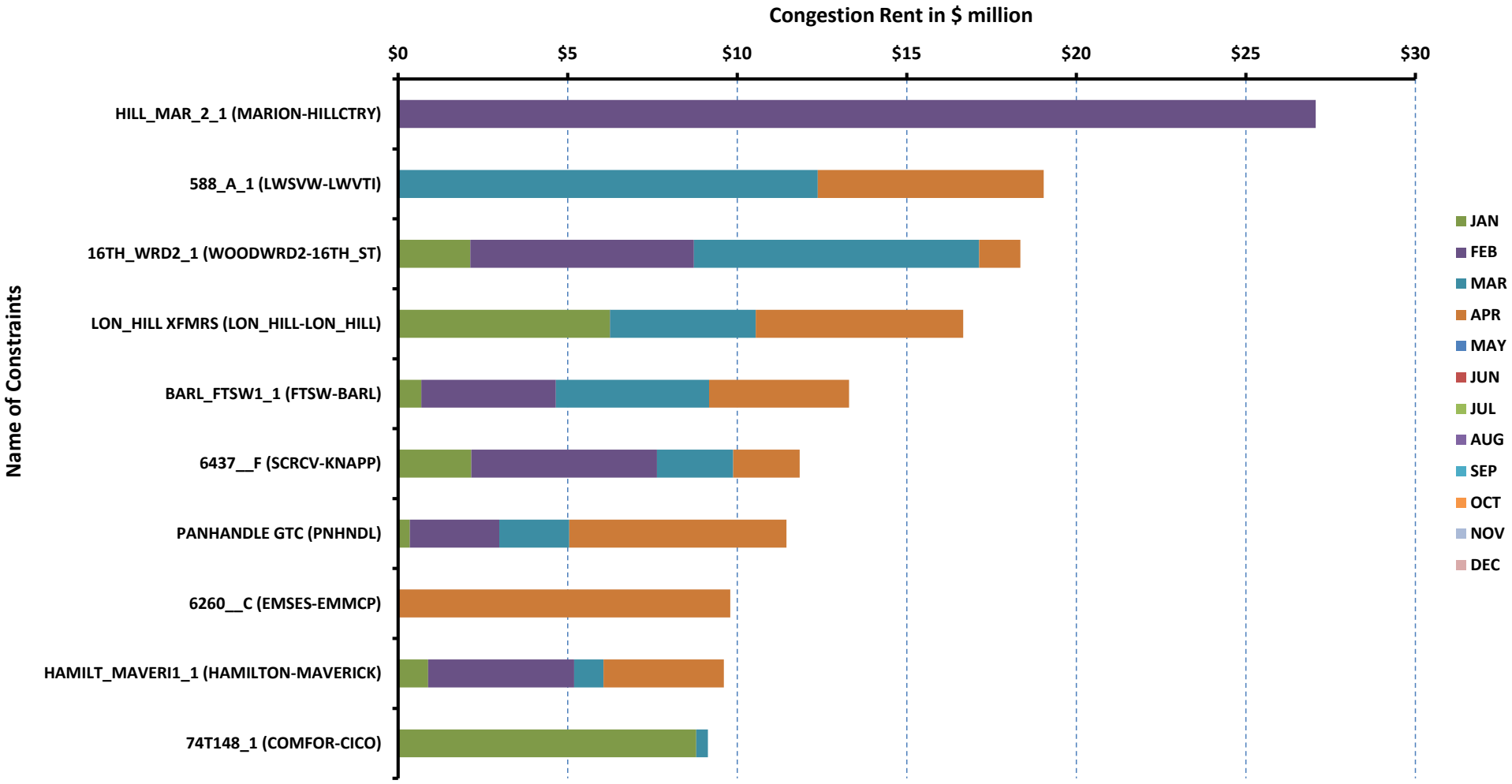
RT Congestion Constraint Rankings - 1

Top 10 Constraints by Total Congestion Value - 2019



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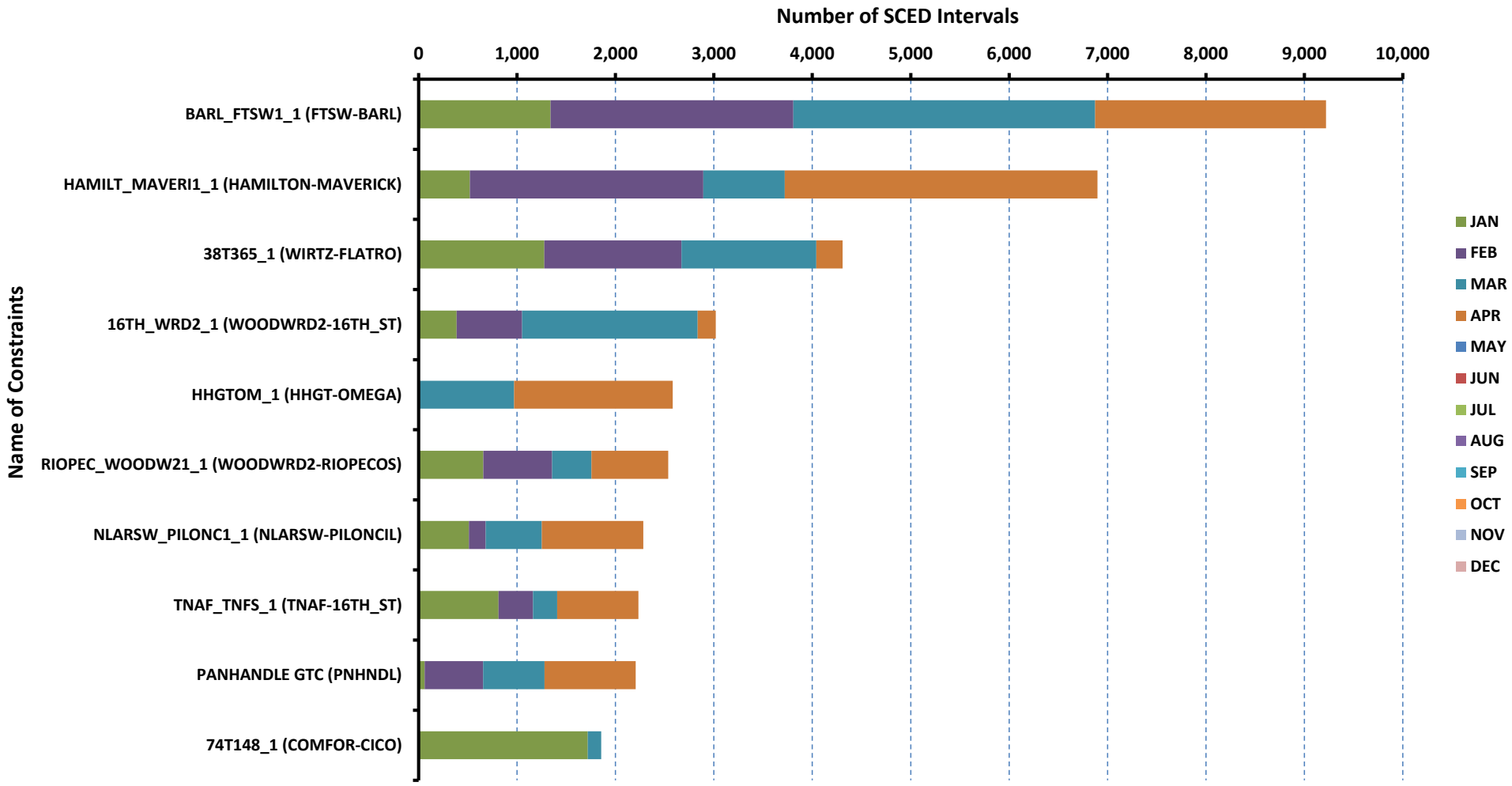
RT Congestion Constraint Rankings - 2

Top 10 Constraints by Binding Frequency - 2019



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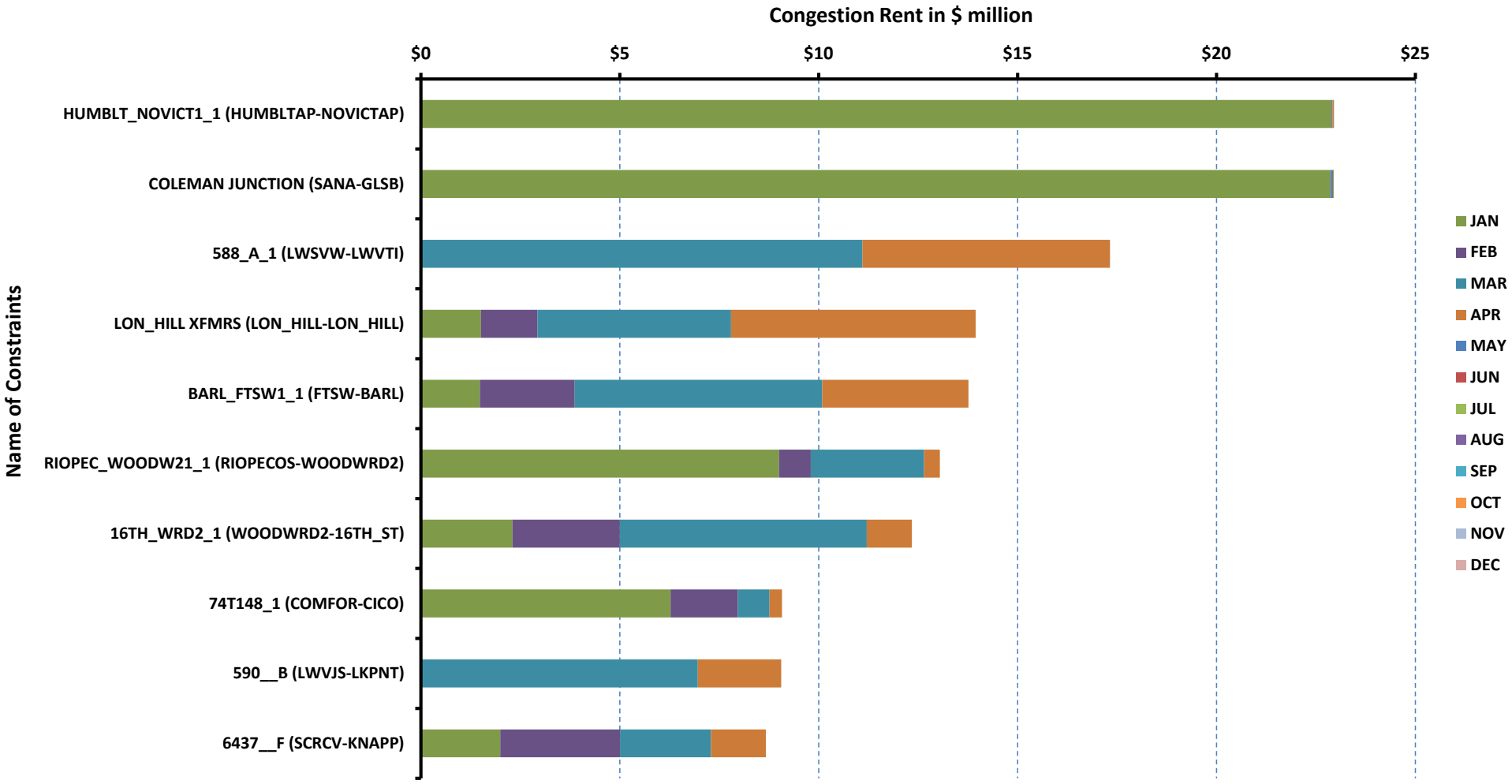
DA Congestion Constraint Rankings - 1

Top 10 Constraints by Total Congestion Value - 2019



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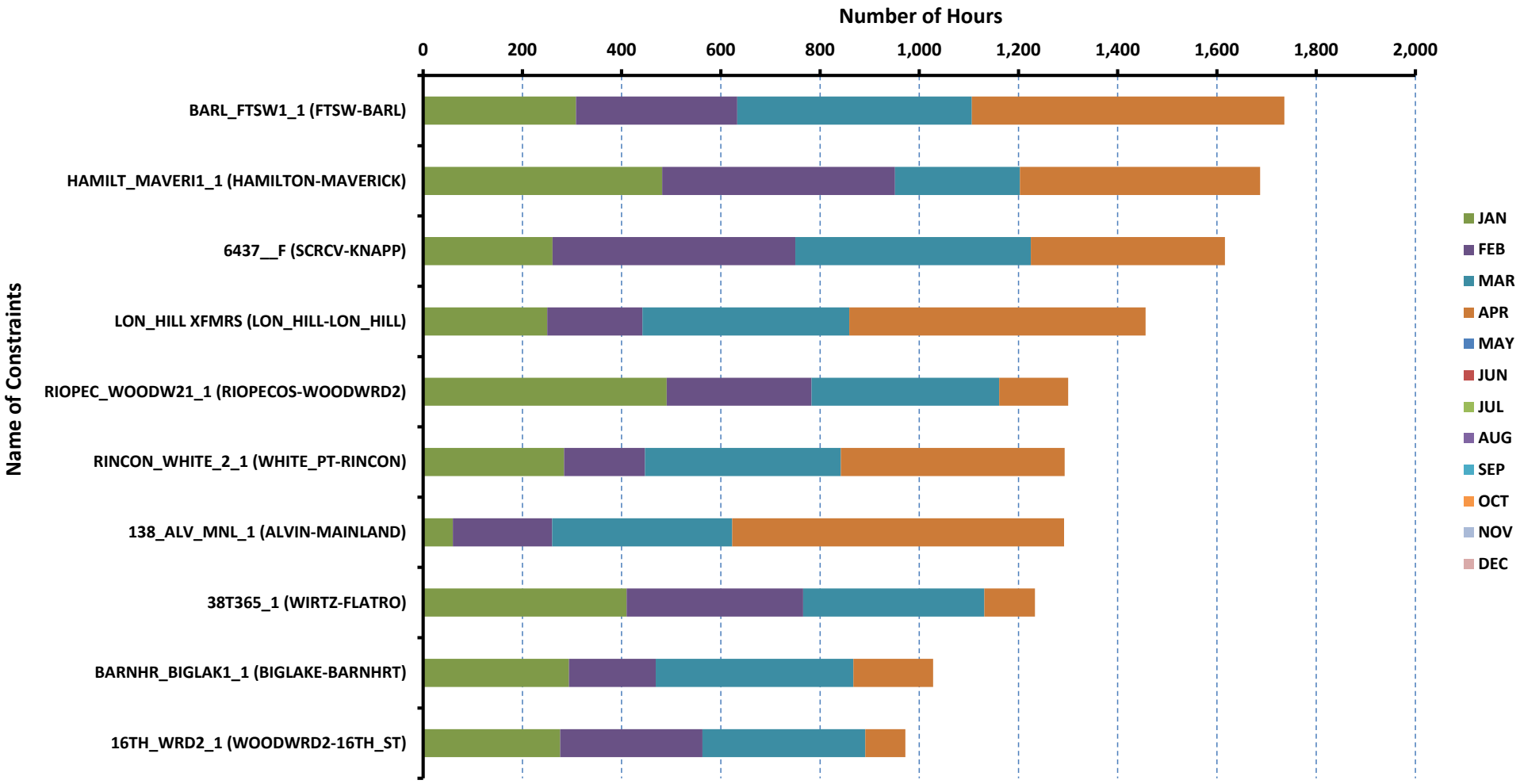
DA Congestion Constraint Rankings - 2

Top 10 Constraints by Binding Frequency - 2019



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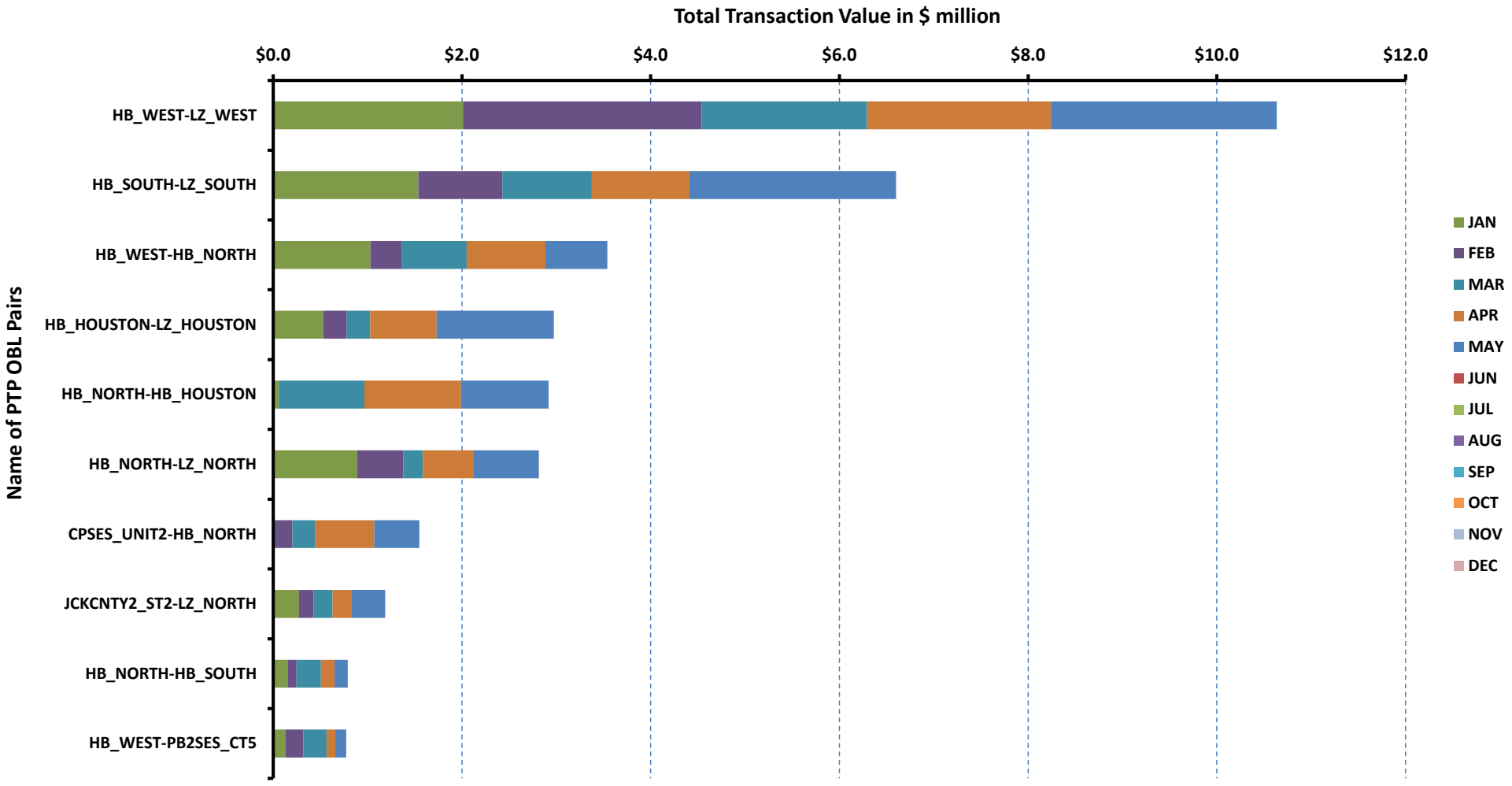
Top 10 CRR Pairs Ranked by Monthly Auction Values - 1

Top 10 PTP Obligations by Total Transaction Value - 2019



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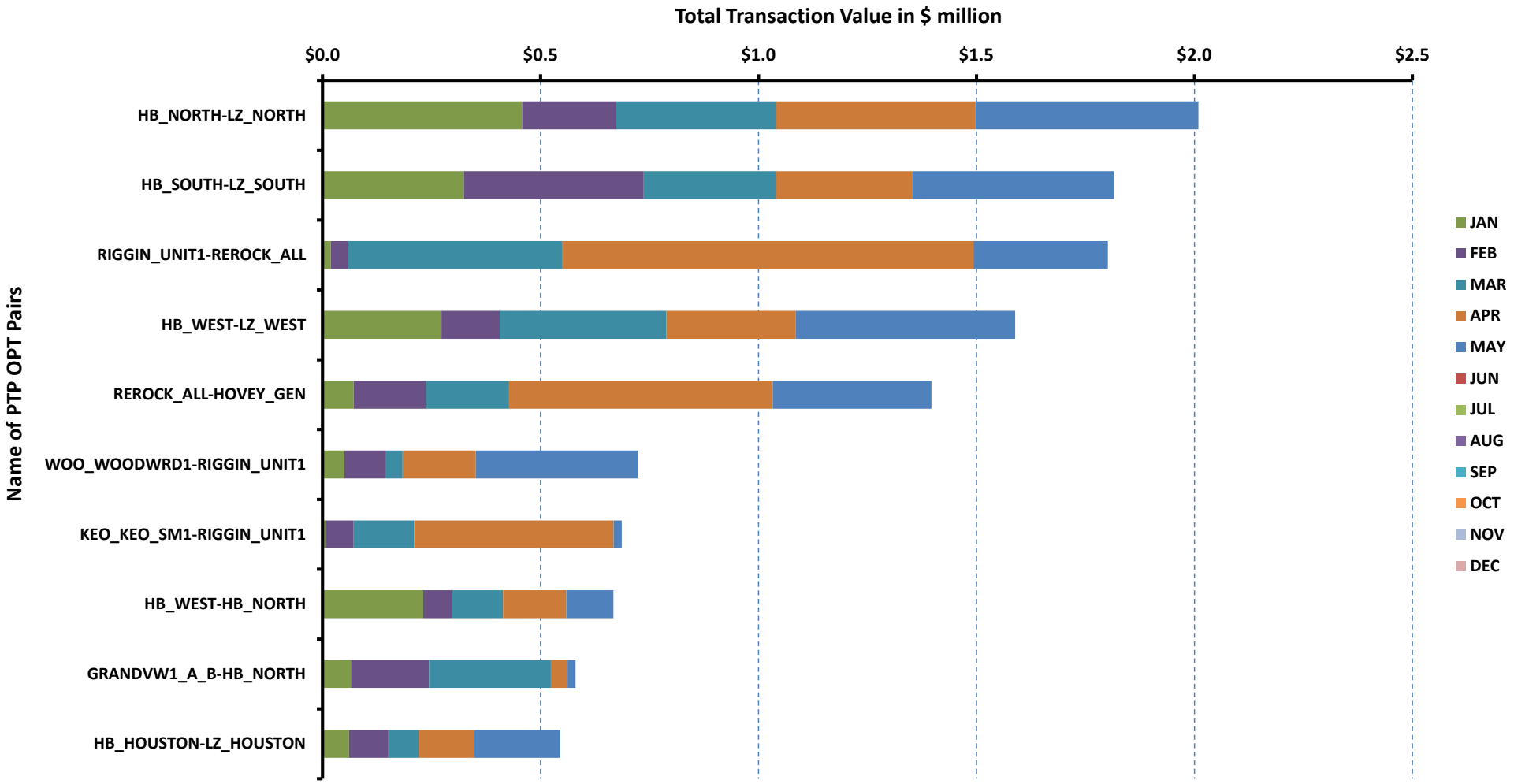
Top 10 CRR Pairs Ranked by Monthly Auction Values - 2

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	$ 31.56	$ 30.25
	4	$ 25.38	$ 27.90
	5	$ -	$ -
	6	$ -	$ -
	7	$ -	$ -
	8	$ -	$ -
	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	22,122	16,789	5,208	9,739	13,444	9,987	4,455
	12	12,540	20,244	14,871	5,325	9,601	14,196	10,136	4,677
2019	1	13,256	21,937	15,623	5,564	9,784	15,231	10,366	4,713
	2	12,957	22,873	15,196	5,480	9,746	14,466	9,964	4,658
	3	13,808	24,569	17,618	5,728	9,765	13,278	9,835	4,521
	4	14,592	17,956	14,457	5,397	10,292	12,477	9,871	4,564
	5	-	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-	-
	7	-	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-	-
	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	$ 40.98	$ 36.95	$ 39.15	$ 35.80	$ 32.90	$ 33.43	$ 33.83	$ 31.66
	12	$ 28.56	$ 29.93	$ 28.42	$ 35.75	$ 31.02	$ 32.07	$ 32.04	$ 35.31
2019	1	$ 24.67	$ 24.09	$ 26.47	$ 25.06	$ 26.05	$ 25.21	$ 27.25	$ 28.00
	2	$ 23.30	$ 24.58	$ 32.08	$ 28.80	$ 22.05	$ 21.64	$ 24.07	$ 23.14
	3	$ 29.19	$ 30.43	$ 31.38	$ 29.60	$ 29.72	$ 31.70	$ 32.82	$ 32.37
	4	$ 27.41	$ 27.55	$ 29.52	$ 26.46	$ 25.43	$ 24.97	$ 27.36	$ 22.11
	5	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	6	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	7	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
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	11	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
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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	$ 31.56	10.94
	4	$ 2.57	$ 27.90	10.85	$ 25.38	9.87
	5	$ -	$ -	-	$ -	-
	6	$ -	$ -	-	$ -	-
	7	$ -	$ -	-	$ -	-
	8	$ -	$ -	-	$ -	-
	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	10.81
	3	10.30	11.38	10.99	11.22	10.12	10.88	10.55	10.26
	4	9.89	10.64	9.71	8.60	10.66	11.48	10.71	10.29
	5	-	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-	-
	7	-	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-	-
	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	4	1	$ 0.33	$ -	33	0	80	90
2019	4	2	$ 0.02	$ -	4	0	80	90
2019	4	3	$ -	$ -	0	0	80	90
2019	4	4	$ 4.50	$ -	22	0	80	90
2019	4	5	$ -	$ -	0	0	80	90
2019	4	6	$ 0.48	$ -	38	0	80	90
2019	4	7	$ 0.45	$ -	6	0	80	90
2019	4	8	$ 14.82	$ -	51	0	80	90
2019	4	9	$ 5.53	$ -	25	0	80	90
2019	4	10	$ -	$ 0.57	0	24	80	90
2019	4	11	$ 2.08	$ 0.16	21	19	80	90
2019	4	12	$ -	$ -	0	0	80	90
2019	4	13	$ -	$ -	0	0	80	90
2019	4	14	$ 0.05	$ -	19	0	80	90
2019	4	15	$ -	$ -	0	0	80	90
2019	4	16	$ 0.08	$ -	5	0	80	90
2019	4	17	$ 0.83	$ -	46	0	80	90
2019	4	18	$ 0.03	$ -	1	0	80	90
2019	4	19	$ 0.18	$ -	11	0	80	90
2019	4	20	$ -	$ -	0	0	80	90
2019	4	21	$ 0.07	$ -	20	0	80	90
2019	4	22	$ 8.11	$ -	52	0	80	90
2019	4	23	$ 4.33	$ -	50	0	80	90
2019	4	24	$ 1.13	$ -	49	0	80	90
2019	4	25	$ 3.40	$ -	25	0	80	90
2019	4	26	$ 0.02	$ -	12	0	80	90
2019	4	27	$ 0.07	$ -	8	0	80	90
2019	4	28	$ -	$ -	0	0	80	90
2019	4	29	$ 0.20	$ -	25	0	80	90
2019	4	30	$ 0.14	$ -	20	0	80	90
0	0	0	$ -	$ -	0	0	0	0

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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	-	-	-	-
	6	-	-	-	-
	7	-	-	-	-
	8	-	-	-	-
	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	340	1,202	2,984	244
	2	248	1,202	2,984	204
	3	212	1,549	2,992	219
	4	202	1,549	2,992	245
	5	228	1,549	2,992	329
	6	332	1,549	2,992	492
	7	293	1,940	2,872	614
	8	254	1,940	2,872	331
	9	237	1,940	2,872	341
	10	259	1,940	2,872	325
	11	295	1,568	2,835	311
	12	250	1,568	2,835	296
	13	247	1,568	2,835	283
	14	237	1,568	2,835	277
	15	227	1,513	2,835	241
	16	213	1,513	2,835	259
	17	229	1,513	2,835	286
	18	248	1,513	2,835	350
	19	327	1,534	2,848	349
	20	336	1,534	2,848	308
	21	369	1,534	2,848	270
	22	436	1,534	2,848	264
	23	469	1,202	2,984	259
	24	401	1,202	2,984	300

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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	$ -	$ -	$ -	$ -
	6	$ -	$ -	$ -	$ -
	7	$ -	$ -	$ -	$ -
	8	$ -	$ -	$ -	$ -
	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	$ -	$ -	$ -	$ -
	6	$ -	$ -	$ -	$ -
	7	$ -	$ -	$ -	$ -
	8	$ -	$ -	$ -	$ -
	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	$ -	$ -
	6	$ -	$ -
	7	$ -	$ -
	8	$ -	$ -
	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	-	-	-	-	-	-
	6	-	-	-	-	-	-
	7	-	-	-	-	-	-
	8	-	-	-	-	-	-
	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	-	-	-	-	-	-
	6	-	-	-	-	-	-
	7	-	-	-	-	-	-
	8	-	-	-	-	-	-
	9	-	-	-	-	-	-
	10	-	-	-	-	-	-
	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	2019	BARL_FTSW1_1 (FTSW-BARL)	9,220	1	1,340	2,467	3,067	2,346	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	HAMILT_MAVERI1_1 (HAMILTON-MAVERICK)	6,898	2	520	2,373	827	3,178	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	38T365_1 (WIRTZ-FLATRO)	4,308	3	1,277	1,393	1,371	267	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	16TH_WRD2_1 (WOODWRD2-16TH_ST)	3,019	4	386	666	1,783	184	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	HHGTOM_1 (HHGT-OMEGA)	2,581	5	-	-	970	1,611	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	RIOPEC_WOODW21_1 (WOODWRD2-RIOPECOS)	2,536	6	658	698	401	779	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	NLARSW_PILONC1_1 (NLARSW-PILONCIL)	2,282	7	511	171	569	1,031	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	TNAF_TNFS_1 (TNAF-16TH_ST)	2,234	8	811	352	244	827	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	PANHANDLE GTC (PNHNDL)	2,206	9	61	594	623	928	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	74T148_1 (COMFOR-CICO)	1,856	10	1,718	-	138	-	-	-	-	-	-	-	-	-
TOP10_RENT	2019	HILL_MAR_2_1 (MARION-HILLCTRY)	$ 27.06	1	$ -	$ 27.06	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	588_A_1 (LWSVW-LWVTI)	$ 19.04	2	$ -	$ -	$ 12.37	$ 6.67	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	16TH_WRD2_1 (WOODWRD2-16TH_ST)	$ 18.35	3	$ 2.13	$ 6.59	$ 8.41	$ 1.21	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	LON_HILL XFMRS (LON_HILL-LON_HILL)	$ 16.67	4	$ 6.25	$ 0.00	$ 4.29	$ 6.12	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	BARL_FTSW1_1 (FTSW-BARL)	$ 13.30	5	$ 0.68	$ 3.97	$ 4.52	$ 4.13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	6437__F (SCRCV-KNAPP)	$ 11.84	6	$ 2.16	$ 5.48	$ 2.25	$ 1.96	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	PANHANDLE GTC (PNHNDL)	$ 11.45	7	$ 0.35	$ 2.64	$ 2.06	$ 6.40	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	6260__C (EMSES-EMMCP)	$ 9.80	8	$ -	$ -	$ -	$ 9.80	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	HAMILT_MAVERI1_1 (HAMILTON-MAVERICK)	$ 9.60	9	$ 0.89	$ 4.31	$ 0.86	$ 3.55	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	74T148_1 (COMFOR-CICO)	$ 9.13	10	$ 8.79	$ -	$ 0.34	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

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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)	1,736	1	308	325	473	630	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	HAMILT_MAVERI1_1 (HAMILTON-MAVERICK)	1,687	2	482	469	252	484	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	6437__F (SCRCV-KNAPP)	1,616	3	261	489	475	391	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	LON_HILL XFMRS (LON_HILL-LON_HILL)	1,456	4	250	192	417	597	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	RIOPEC_WOODW21_1 (RIOPECOS-WOODWRD2)	1,300	5	491	292	378	139	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	RINCON_WHITE_2_1 (WHITE_PT-RINCON)	1,293	6	284	163	395	451	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	138_ALV_MNL_1 (ALVIN-MAINLAND)	1,292	7	60	200	363	669	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	38T365_1 (WIRTZ-FLATRO)	1,233	8	410	356	365	102	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	BARNHR_BIGLAK1_1 (BIGLAKE-BARNHRT)	1,028	9	294	175	398	161	-	-	-	-	-	-	-	-
FREQ_EXIST	2019	16TH_WRD2_1 (WOODWRD2-16TH_ST)	972	10	276	287	328	81	-	-	-	-	-	-	-	-
TOP10_RENT	2019	HUMBLT_NOVICT1_1 (HUMBLTAP-NOVICTAP)	$ 22.96	1	$ 22.89	$ 0.01	$ 0.02	$ 0.03	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	COLEMAN JUNCTION (SANA-GLSB)	$ 22.95	2	$ 22.86	$ 0.02	$ 0.05	$ 0.02	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	588_A_1 (LWSVW-LWVTI)	$ 17.33	3	$ -	$ -	$ 11.10	$ 6.22	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	LON_HILL XFMRS (LON_HILL-LON_HILL)	$ 13.95	4	$ 1.51	$ 1.42	$ 4.86	$ 6.15	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	BARL_FTSW1_1 (FTSW-BARL)	$ 13.76	5	$ 1.48	$ 2.39	$ 6.22	$ 3.68	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	RIOPEC_WOODW21_1 (RIOPECOS-WOODWRD2)	$ 13.05	6	$ 9.00	$ 0.80	$ 2.85	$ 0.40	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	16TH_WRD2_1 (WOODWRD2-16TH_ST)	$ 12.34	7	$ 2.30	$ 2.70	$ 6.20	$ 1.14	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	74T148_1 (COMFOR-CICO)	$ 9.08	8	$ 6.28	$ 1.69	$ 0.80	$ 0.31	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	590__B (LWVJS-LKPNT)	$ 9.06	9	$ -	$ -	$ 6.96	$ 2.10	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2019	6437__F (SCRCV-KNAPP)	$ 8.67	10	$ 1.99	$ 3.01	$ 2.29	$ 1.38	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

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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	$ 10.63	1	$ 2.01	$ 2.53	$ 1.75	$ 1.95	$ 2.39	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	2019	HB_SOUTH-LZ_SOUTH	$ 6.60	2	$ 1.54	$ 0.89	$ 0.95	$ 1.03	$ 2.19	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	2019	HB_WEST-HB_NORTH	$ 3.54	3	$ 1.03	$ 0.33	$ 0.69	$ 0.83	$ 0.66	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	2019	HB_HOUSTON-LZ_HOUSTON	$ 2.97	4	$ 0.53	$ 0.25	$ 0.25	$ 0.70	$ 1.24	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	2019	HB_NORTH-HB_HOUSTON	$ 2.92	5	$ 0.06	$ 0.00	$ 0.91	$ 1.02	$ 0.93	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	2019	HB_NORTH-LZ_NORTH	$ 2.81	6	$ 0.89	$ 0.49	$ 0.21	$ 0.54	$ 0.69	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	2019	CPSES_UNIT2-HB_NORTH	$ 1.55	7	$ -	$ 0.20	$ 0.24	$ 0.62	$ 0.48	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	2019	JCKCNTY2_ST2-LZ_NORTH	$ 1.19	8	$ 0.27	$ 0.15	$ 0.20	$ 0.20	$ 0.35	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	2019	HB_NORTH-HB_SOUTH	$ 0.79	9	$ 0.15	$ 0.10	$ 0.26	$ 0.14	$ 0.14	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N	2019	HB_WEST-PB2SES_CT5	$ 0.77	10	$ 0.13	$ 0.19	$ 0.25	$ 0.09	$ 0.11	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	2019	HB_NORTH-LZ_NORTH	$ 2.01	1	$ 0.46	$ 0.22	$ 0.37	$ 0.46	$ 0.51	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	2019	HB_SOUTH-LZ_SOUTH	$ 1.82	2	$ 0.32	$ 0.41	$ 0.30	$ 0.31	$ 0.46	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	2019	RIGGIN_UNIT1-REROCK_ALL	$ 1.80	3	$ 0.02	$ 0.04	$ 0.49	$ 0.94	$ 0.31	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	2019	HB_WEST-LZ_WEST	$ 1.59	4	$ 0.27	$ 0.13	$ 0.38	$ 0.30	$ 0.50	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	2019	REROCK_ALL-HOVEY_GEN	$ 1.40	5	$ 0.07	$ 0.17	$ 0.19	$ 0.60	$ 0.36	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	2019	WOO_WOODWRD1-RIGGIN_UNIT1	$ 0.72	6	$ 0.05	$ 0.10	$ 0.04	$ 0.17	$ 0.37	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	2019	KEO_KEO_SM1-RIGGIN_UNIT1	$ 0.69	7	$ 0.01	$ 0.06	$ 0.14	$ 0.46	$ 0.02	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	2019	HB_WEST-HB_NORTH	$ 0.67	8	$ 0.23	$ 0.07	$ 0.12	$ 0.15	$ 0.11	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	2019	GRANDVW1_A_B-HB_NORTH	$ 0.58	9	$ 0.07	$ 0.18	$ 0.28	$ 0.04	$ 0.02	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Y	2019	HB_HOUSTON-LZ_HOUSTON	$ 0.55	10	$ 0.06	$ 0.09	$ 0.07	$ 0.13	$ 0.20	$ -	$ -	$ -	$ -	$ -	$ -	$ -

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