Item 7: Independent Market Monitor (IMM) Report

Beth Garza
IMM Report

Board of Directors Meeting

ERCOT Public
October 11, 2016

Greens Bayou 5

- 371 MW unit
- Built in 1973, operating for 43 years
- Located in Houston
- Operated infrequently 2013 - 2015
  - Annual capacity factor < 3%
  - Summer (June-Sep) capacity factor ~ 6%

GBY5 Historical Operation

Greens Bayou 5 – RMR unit

- Suspension of Operations Notification received March 29, 2016
  - Indefinite suspension beginning June 27, 2016
- Final Determination issued May 28, 2016
  - "…summer peak case showed reliability violations in the study area indicating that Greens Bayou Unit 5 is required to meet the system reliability."
  - Thermal overload of Singleton to Zenith lines

Greens Bayou 5 – RMR unit costs

- Initial budget submittal: $66M for 24 months
- Contract term: June 1, 2016 – June 30, 2018 (25 months)
- Contracted budget: $58.1M for 25 months ($3,185 per hour)
  - Possibility of up to 10% incentive for meeting availability targets brings the total up to $63.9M.
- Costs will be trued up based on verified actuals

Cumulative Costs of GBY5 RMR

Cost / Value of the RMR contract

- $63.9 M spread over total ERCOT energy forecast June 2016 – June 2018 (744 TWH) is $0.086 per MWh.

However,

- If the reason for the RMR unit is improved reliability, how much avoided curtailment has been (will be) paid for?

How much avoided curtailment?

- Assume 400 MW of load curtailment in Houston would provide the same constraint unloading benefit as GBY5
- The cost of load curtailment is $9000 per MWh
- $63.9 Million / (400 MW * $9000/MWh) =
  17.8 hours

History of firm load curtailments

- October 8, 2014 – Rio Grande Valley
  - 200 MW for 2 hours
- January 6, 2014 – system wide ERS
  - 600 MW for 1 hour
- August 4, 2011 – system wide EILS
  - 400 MW for 3 hours
- February 3, 2011 – Rio Grande Valley
  - 300 MW for 1 ½ hours
- February 2, 2011 – system wide
  - 1500 MW for 7 ½ hours

All quantities and durations are IMM approximations

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**

To the Public Utility Commission of Texas

ERCOT Wholesale Electricity Market Monthly Report

Tuesday, September 13, 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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Load Zone Load Statistics

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

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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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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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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

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West Zone

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Daily ORDC Adders Average Values and Interval Duration

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Monthly Average of Ancillary Services Required MW

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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

Responsive Reserve

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 Rent

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RT Congestion Constraint Rankings - 2

Top 10 Constraints by Binding Frequency

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DA Congestion Constraint Rankings - 1

Top 10 Constraints by Total Congestion Rent

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DA Congestion Constraint Rankings - 2

Top 10 Constraints by Binding Frequency

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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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Top 10 CRR Pairs Ranked by Monthly Auction Values - 2

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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	$ -	$ -
	10	$ -	$ -
	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	13,432	16,409	12,996	3,670	9,183	11,447	8,934	3,178
	4	14,669	18,504	14,782	4,006	9,890	12,058	9,635	3,238
	5	16,611	21,994	15,869	4,524	11,047	13,207	10,678	3,425
	6	17,978	25,277	17,726	4,880	12,627	17,253	12,697	3,794
	7	18,373	26,368	19,065	5,145	13,895	19,230	14,090	4,158
	8	18,871	28,186	19,702	5,086	13,287	18,409	13,351	3,960
	9	-	-	-	-	-	-	-	-
	10	-	-	-	-	-	-	-	-
	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	$ 20.30	$ 19.22	$ 22.84	$ 17.04	$ 17.95	$ 18.12	$ 19.22	$ 16.18
	4	$ 20.33	$ 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	$ 26.22	$ 32.03	$ 29.41	$ 30.40	$ 28.39
	8	$ 36.99	$ 32.40	$ 32.58	$ 29.60	$ 37.70	$ 34.04	$ 35.13	$ 32.03
	9	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	10	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	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	10.93
	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	$ -	$ -	-	$ -	-
	10	$ -	$ -	-	$ -	-
	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	10.54	10.38	10.37	9.69
	8	13.79	12.84	12.45	11.71	13.52	11.91	11.85	10.82
	9	-	-	-	-	-	-	-	-
	10	-	-	-	-	-	-	-	-
	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	8	1	$ 0.01	$ -	7	0	80	90
2016	8	2	$ 16.66	$ 29.53	27	8	80	90
2016	8	3	$ 16.79	$ -	29	0	80	90
2016	8	4	$ 0.43	$ 0.70	18	44	80	90
2016	8	5	$ 1.29	$ 0.24	19	10	80	90
2016	8	6	$ 0.77	$ -	25	0	80	90
2016	8	7	$ 0.26	$ -	14	0	80	90
2016	8	8	$ 0.01	$ 1.40	2	12	80	90
2016	8	9	$ 0.04	$ 0.47	10	33	80	90
2016	8	10	$ 0.14	$ 8.04	23	24	80	90
2016	8	11	$ 2.40	$ 0.71	19	9	80	90
2016	8	12	$ 0.01	$ -	3	0	80	90
2016	8	13	$ -	$ -	0	0	80	90
2016	8	14	$ -	$ -	0	0	80	90
2016	8	15	$ -	$ -	0	0	80	90
2016	8	16	$ 0.05	$ -	2	0	80	90
2016	8	17	$ 0.78	$ -	19	0	80	90
2016	8	18	$ 0.02	$ -	4	0	80	90
2016	8	19	$ -	$ -	0	0	80	90
2016	8	20	$ -	$ 0.47	0	29	80	90
2016	8	21	$ -	$ -	0	0	80	90
2016	8	22	$ -	$ -	0	0	80	90
2016	8	23	$ 0.08	$ -	7	0	80	90
2016	8	24	$ 0.33	$ 0.75	15	22	80	90
2016	8	25	$ 3.47	$ -	22	0	80	90
2016	8	26	$ 0.39	$ -	26	0	80	90
2016	8	27	$ 4.14	$ -	24	0	80	90
2016	8	28	$ 0.04	$ -	6	0	80	90
2016	8	29	$ -	$ -	0	0	80	90
2016	8	30	$ 0.01	$ -	1	0	80	90
2016	8	31	$ 0.08	$ -	9	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	-	-	-	-
	10	-	-	-	-
	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	377	914	2,863	329
	2	291	914	2,863	262
	3	242	1,440	2,862	236
	4	211	1,441	2,863	230
	5	241	1,441	2,863	283
	6	367	1,441	2,863	437
	7	308	2,010	2,697	578
	8	263	2,010	2,697	369
	9	281	2,010	2,697	402
	10	293	2,010	2,697	372
	11	277	2,026	2,634	395
	12	263	2,026	2,634	361
	13	242	2,026	2,634	322
	14	247	2,026	2,634	303
	15	245	1,492	2,669	268
	16	238	1,492	2,669	254
	17	236	1,492	2,669	261
	18	280	1,492	2,669	319
	19	347	1,463	2,670	332
	20	337	1,463	2,670	321
	21	329	1,463	2,670	298
	22	445	1,463	2,670	326
	23	519	914	2,863	392
	24	467	914	2,863	355

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chart

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	$ -	$ -	$ -	$ -
	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
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	$ -	$ -	$ -	$ -
	10	$ -	$ -	$ -	$ -
	11	$ -	$ -	$ -	$ -
	12	$ -	$ -	$ -	$ -

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chart

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	$ 3,800.54	$ 8,099.27
	4	$ 1,900.94	$ 10,000.21
	5	$ 4,578.64	$ 14,578.85
	6	$ 738.37	$ 15,317.22
	7	$ 2,945.67	$ 18,262.89
	8	$ 7,767.43	$ 26,030.32
	9	$ 1,612.54	$ 27,642.86
	10	$ 1,283.56	$ 28,926.42
	11	$ 1,529.59	$ 30,456.01
	12	$ 1,209.77	$ 31,665.78
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	$ 3,402.97	$ 15,141.89
	8	$ 5,321.18	$ 20,463.07
	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
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	-	-	-	-	-	-
	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
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	-	-	-	-	-	-
	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	2016	JAVALT_MOLINA1_1 (JAVALTAP-MOLINA)	7,255	1	1,127	1,613	2,170	1,369	935	41	-	-	-	-	-	-
FREQ_EXIST	2016	LISTON (LISTON)	6,978	2	518	862	690	442	479	532	2,220	1,235	-	-	-	-
FREQ_EXIST	2016	38T365_1 (WIRTZ-FLATRO)	5,330	3	167	759	1,039	286	1,344	357	1,076	302	-	-	-	-
FREQ_EXIST	2016	BRUNI_69_1 (BRUNI-BRUNI)	3,074	4	503	274	221	95	57	91	1,302	531	-	-	-	-
FREQ_EXIST	2016	ASPM_69T1 (ASPM-ASPM)	2,821	5	-	-	186	8	2,627	-	-	-	-	-	-	-
FREQ_EXIST	2016	JK_TOKSW_1 (TOKSW-JK_CK)	2,763	6	39	-	65	239	236	789	932	463	-	-	-	-
FREQ_EXIST	2016	RIOHND_ERIOHND_1 (MV_RIOHO-RIOHONDO)	2,278	7	736	1,495	-	7	-	40	-	-	-	-	-	-
FREQ_EXIST	2016	1030__B (BOSQUESW-RGH)	2,224	8	100	248	612	467	424	209	164	-	-	-	-	-
FREQ_EXIST	2016	ROTN_WOLFGA1_1 (WOLFGANG-ROTN)	2,065	9	46	7	1,904	96	12	-	-	-	-	-	-	-
FREQ_EXIST	2016	SNG-ZEN (SNG-ZEN)	2,007	10	-	-	54	-	212	427	844	470	-	-	-	-
TOP10_RENT	2016	MDO_AT1 (MDO-MDO)	$ 47.96	1	$ -	$ -	$ -	$ -	$ 14.49	$ 33.47	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2016	FTW_W_DE_1 (W_DENT-FTWORTH)	$ 28.15	2	$ -	$ -	$ -	$ 10.03	$ 5.46	$ 1.70	$ 1.09	$ 9.87	$ -	$ -	$ -	$ -
TOP10_RENT	2016	LOMA_A_L_FRES1_1 (L_FRESNO-LOMA_ALT)	$ 26.95	3	$ 6.90	$ 4.08	$ 11.39	$ 3.65	$ -	$ -	$ 0.92	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2016	SNG-ZEN (SNG-ZEN)	$ 26.35	4	$ -	$ -	$ 0.06	$ -	$ 2.54	$ 2.44	$ 5.33	$ 15.97	$ -	$ -	$ -	$ -
TOP10_RENT	2016	6265__D (MRSDO-RHTP2)	$ 15.05	5	$ -	$ 1.58	$ 5.86	$ 7.14	$ -	$ 0.46	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2016	6265__A (EMSES-MRSDO)	$ 10.48	6	$ 0.00	$ 4.43	$ 4.75	$ 1.24	$ -	$ 0.07	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2016	EMSES_AX2 (EMSES-EMSES)	$ 9.91	7	$ -	$ -	$ -	$ 7.86	$ -	$ -	$ 2.05	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2016	JK_TOKSW_1 (TOKSW-JK_CK)	$ 9.81	8	$ 0.06	$ -	$ 0.05	$ 0.63	$ 0.82	$ 4.96	$ 1.50	$ 1.80	$ -	$ -	$ -	$ -
TOP10_RENT	2016	JAVALT_MOLINA1_1 (JAVALTAP-MOLINA)	$ 8.87	9	$ 1.57	$ 1.81	$ 2.86	$ 1.63	$ 0.97	$ 0.04	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2016	PNHNDL (PNHNDL)	$ 8.11	10	$ 0.01	$ 0.31	$ 4.26	$ 0.01	$ 3.29	$ 0.05	$ 0.17	$ 0.00	$ -	$ -	$ -	$ -

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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	2016	38T365_1 (WIRTZ-FLATRO)	3,336	1	88	286	502	284	591	603	623	359	-	-	-	-
FREQ_EXIST	2016	JAVALT_MOLINA1_1 (JAVALTAP-MOLINA)	2,034	2	308	496	523	345	351	11	-	-	-	-	-	-
FREQ_EXIST	2016	BRUNI_69_1 (BRUNI-BRUNI)	1,679	3	144	375	277	109	151	60	342	221	-	-	-	-
FREQ_EXIST	2016	EAGLEP_ESCOND1_1 (ESCONDID-EAGLE_PS)	1,633	4	-	122	73	30	84	384	544	396	-	-	-	-
FREQ_EXIST	2016	LISTON (LISTON)	1,605	5	132	297	208	153	106	21	425	263	-	-	-	-
FREQ_EXIST	2016	LOMA_A_L_FRES1_1 (L_FRESNO-LOMA_ALT)	1,404	6	377	389	391	241	-	-	6	-	-	-	-	-
FREQ_EXIST	2016	1030__B (BOSQUESW-RGH)	1,200	7	25	56	225	156	310	323	87	18	-	-	-	-
FREQ_EXIST	2016	670__B (BRNSW-CMPBW)	1,134	8	198	185	174	119	180	28	241	9	-	-	-	-
FREQ_EXIST	2016	FORTMA_MASN1_1 (FORTMA-MASN)	1,095	9	22	130	145	59	275	302	117	45	-	-	-	-
FREQ_EXIST	2016	GILA_MORRIS1_1 (GILA-MORRIS)	1,025	10	14	13	6	130	216	334	172	140	-	-	-	-
TOP10_RENT	2016	MDO_AT1 (MDO-MDO)	$ 37.35	1	$ 0.00	$ -	$ 0.58	$ 0.75	$ 6.62	$ 28.57	$ 0.81	$ 0.01	$ -	$ -	$ -	$ -
TOP10_RENT	2016	SNG-ZEN (SNG-ZEN)	$ 22.63	2	$ -	$ 0.01	$ 0.02	$ 0.14	$ 2.62	$ 2.18	$ 8.31	$ 9.36	$ -	$ -	$ -	$ -
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)	$ 11.98	4	$ -	$ 0.08	$ 0.15	$ 4.72	$ 4.16	$ 0.10	$ 1.06	$ 1.72	$ -	$ -	$ -	$ -
TOP10_RENT	2016	6265__D (MRSDO-RHTP2)	$ 11.38	5	$ -	$ 0.02	$ 6.10	$ 5.25	$ -	$ 0.02	$ -	$ -	$ -	$ -	$ -	$ -
TOP10_RENT	2016	AIR_W_DE_1 (W_DENT-JMCRSTL)	$ 9.01	6	$ -	$ -	$ -	$ -	$ 0.01	$ 1.41	$ 4.91	$ 2.70	$ -	$ -	$ -	$ -
TOP10_RENT	2016	JK_TOKSW_1 (TOKSW-JK_CK)	$ 8.93	7	$ 0.05	$ -	$ 0.58	$ 0.58	$ 0.84	$ 4.45	$ 1.69	$ 0.74	$ -	$ -	$ -	$ -
TOP10_RENT	2016	BETHK_66_A (HK-BET)	$ 8.79	8	$ -	$ 0.00	$ 0.00	$ 0.91	$ 0.01	$ 1.36	$ 2.20	$ 4.31	$ -	$ -	$ -	$ -
TOP10_RENT	2016	VALIMP (VALIMP)	$ 7.94	9	$ -	$ 0.04	$ 0.20	$ 0.16	$ 2.78	$ 4.71	$ 0.01	$ 0.04	$ -	$ -	$ -	$ -
TOP10_RENT	2016	FAYETT_6AT2 (FAYETT-FAYETT)	$ 7.29	10	$ 0.00	$ 0.02	$ -	$ 0.04	$ 0.00	$ 0.20	$ 7.03	$ 0.00	$ -	$ -	$ -	$ -

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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	2016	HB_NORTH-HB_HOUSTON	$ 9.80	1	$ 0.02	$ 0.08	$ 0.78	$ 0.85	$ 1.48	$ 1.81	$ 1.31	$ 1.81	$ 1.66	$ -	$ -	$ -
N	2016	HB_SOUTH-LZ_SOUTH	$ 6.54	2	$ 0.76	$ 0.64	$ 0.80	$ 0.72	$ 0.76	$ 0.69	$ 0.60	$ 0.62	$ 0.96	$ -	$ -	$ -
N	2016	HB_NORTH-LZ_NORTH	$ 5.42	3	$ 0.24	$ 0.21	$ 0.15	$ 0.43	$ 0.83	$ 0.89	$ 0.77	$ 1.04	$ 0.86	$ -	$ -	$ -
N	2016	HB_HOUSTON-LZ_HOUSTON	$ 3.41	4	$ 0.12	$ 0.08	$ 0.08	$ 0.11	$ 0.28	$ 0.51	$ 0.64	$ 0.91	$ 0.68	$ -	$ -	$ -
N	2016	HB_WEST-HB_NORTH	$ 2.56	5	$ 0.01	$ 0.00	$ 0.27	$ 0.45	$ 1.15	$ 0.63	$ 0.02	$ 0.02	$ 0.02	$ -	$ -	$ -
N	2016	HB_NORTH-HB_SOUTH	$ 2.55	6	$ 0.03	$ 0.05	$ 0.12	$ 0.28	$ 0.47	$ 0.33	$ 0.14	$ 0.74	$ 0.39	$ -	$ -	$ -
N	2016	HB_WEST-LZ_WEST	$ 2.24	7	$ 0.29	$ 0.23	$ 0.13	$ 0.11	$ 0.24	$ 0.56	$ 0.29	$ 0.25	$ 0.15	$ -	$ -	$ -
N	2016	CPSES_UNIT2-HB_NORTH	$ 0.58	8	$ 0.01	$ 0.01	$ 0.04	$ 0.18	$ 0.17	$ 0.04	$ 0.01	$ 0.02	$ 0.10	$ -	$ -	$ -
N	2016	CPSES_UNIT1-HB_NORTH	$ 0.53	9	$ 0.01	$ 0.01	$ 0.03	$ 0.22	$ 0.17	$ 0.05	$ 0.00	$ 0.01	$ 0.03	$ -	$ -	$ -
N	2016	JCKCNTY2_ST2-LZ_NORTH	$ 0.50	10	$ 0.02	$ 0.02	$ 0.01	$ -	$ 0.07	$ 0.14	$ 0.06	$ 0.08	$ 0.10	$ -	$ -	$ -
Y	2016	HB_NORTH-LZ_NORTH	$ 2.73	1	$ 0.27	$ 0.25	$ 0.09	$ 0.16	$ 0.27	$ 0.41	$ 0.37	$ 0.53	$ 0.40	$ -	$ -	$ -
Y	2016	HB_SOUTH-LZ_SOUTH	$ 1.98	2	$ 0.21	$ 0.15	$ 0.13	$ 0.30	$ 0.38	$ 0.20	$ 0.23	$ 0.22	$ 0.17	$ -	$ -	$ -
Y	2016	HB_HOUSTON-LZ_HOUSTON	$ 1.51	3	$ 0.06	$ 0.05	$ 0.09	$ 0.13	$ 0.11	$ 0.18	$ 0.23	$ 0.35	$ 0.32	$ -	$ -	$ -
Y	2016	HB_WEST-HB_NORTH	$ 1.34	4	$ 0.07	$ 0.14	$ 0.16	$ 0.16	$ 0.13	$ 0.42	$ 0.10	$ 0.06	$ 0.11	$ -	$ -	$ -
Y	2016	HB_WEST-LZ_WEST	$ 1.04	5	$ 0.21	$ 0.17	$ 0.14	$ 0.11	$ 0.09	$ 0.08	$ 0.10	$ 0.06	$ 0.07	$ -	$ -	$ -
Y	2016	STP_STP_G1-LZ_CPS	$ 0.79	6	$ 0.06	$ 0.10	$ 0.05	$ 0.01	$ 0.05	$ 0.07	$ 0.01	$ 0.05	$ 0.39	$ -	$ -	$ -
Y	2016	STP_STP_G2-LZ_CPS	$ 0.77	7	$ 0.06	$ 0.10	$ 0.05	$ 0.01	$ 0.05	$ 0.07	$ 0.01	$ 0.04	$ 0.38	$ -	$ -	$ -
Y	2016	SAN_SANMIGG1-LZ_SOUTH	$ 0.62	8	$ 0.11	$ 0.16	$ 0.05	$ 0.05	$ 0.09	$ 0.10	$ 0.02	$ 0.02	$ 0.01	$ -	$ -	$ -
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	LV5_UNIT1-HB_NORTH	$ 0.37	10	$ -	$ -	$ 0.04	$ 0.13	$ 0.17	$ 0.03	$ -	$ -	$ -	$ -	$ -	$ -

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