

June 2016 ERCOT Monthly Operations Report

Reliability and Operations Subcommittee Meeting

August 4th, 2016

Table of Contents

[1. Report Highlights 1](#_Toc456361931)

[2. Frequency Control 2](#_Toc456361932)

[2.1. Frequency Events 2](#_Toc456361933)

[2.2. Responsive Reserve Events 3](#_Toc456361934)

[2.3. Load Resource Events 3](#_Toc456361935)

[3. Reliability Unit Commitment 3](#_Toc456361936)

[4. Wind Generation as a Percent of Load 5](#_Toc456361937)

[5. Congestion Analysis 5](#_Toc456361938)

[5.1. Notable Constraints for June 5](#_Toc456361939)

[5.2. Generic Transmission Constraint Congestion 8](#_Toc456361940)

[5.3. Manual Overrides for June 8](#_Toc456361941)

[5.4. Congestion Costs for Calendar Year 2016 8](#_Toc456361942)

[6. System Events 9](#_Toc456361943)

[6.1. ERCOT Peak Load 9](#_Toc456361944)

[6.2. Load Shed Events 9](#_Toc456361945)

[6.3. Stability Events 9](#_Toc456361946)

[6.4. Notable PMU Events 9](#_Toc456361947)

[6.5. TRE/DOE Reportable Events 9](#_Toc456361948)

[6.6. New/Updated Constraint Management Plans 9](#_Toc456361949)

[6.7. New/Modified/Removed SPS 9](#_Toc456361950)

[6.8. New Procedures/Forms/Operating Bulletins 9](#_Toc456361951)

[7. Emergency Conditions 10](#_Toc456361952)

[7.1. OCNs 10](#_Toc456361953)

[7.2. Advisories 10](#_Toc456361954)

[7.3. Watches 10](#_Toc456361955)

[7.4. Emergency Notices 10](#_Toc456361956)

[8. Application Performance 10](#_Toc456361957)

[8.1. TSAT/VSAT Performance Issues 10](#_Toc456361958)

[8.2. Communication Issues 10](#_Toc456361959)

[8.3. Market System Issues 10](#_Toc456361960)

[Appendix A: Real-Time Constraints 11](#_Toc456361961)

# Report Highlights

* The unofficial ERCOT peak for June was 65,184 MW.
* There were three frequency events in June. PMU data indicates the ERCOT system transitioned well in each case.
* There were three instances where Responsive Reserves were deployed, all of which were the result of frequency events.
* There were twenty-six RUC commitments in June.
* The level of reportable SCED congestion increased in June. This congestion was due primarily to planned outages and area load/gen patterns. There were thirty-four instances over 25 days on the Generic Transmission Constraints (GTCs) in June. There were five days of activity on the Zorillo – Ajo GTC, eight days on the Panhandle GTC, and twenty-one days on the Liston GTC in June. There was no activity on the remaining GTCs during the Month.
* There were no significant system events for the month of June.
* There were no application issues to report for June.

# Frequency Control

## Frequency Events

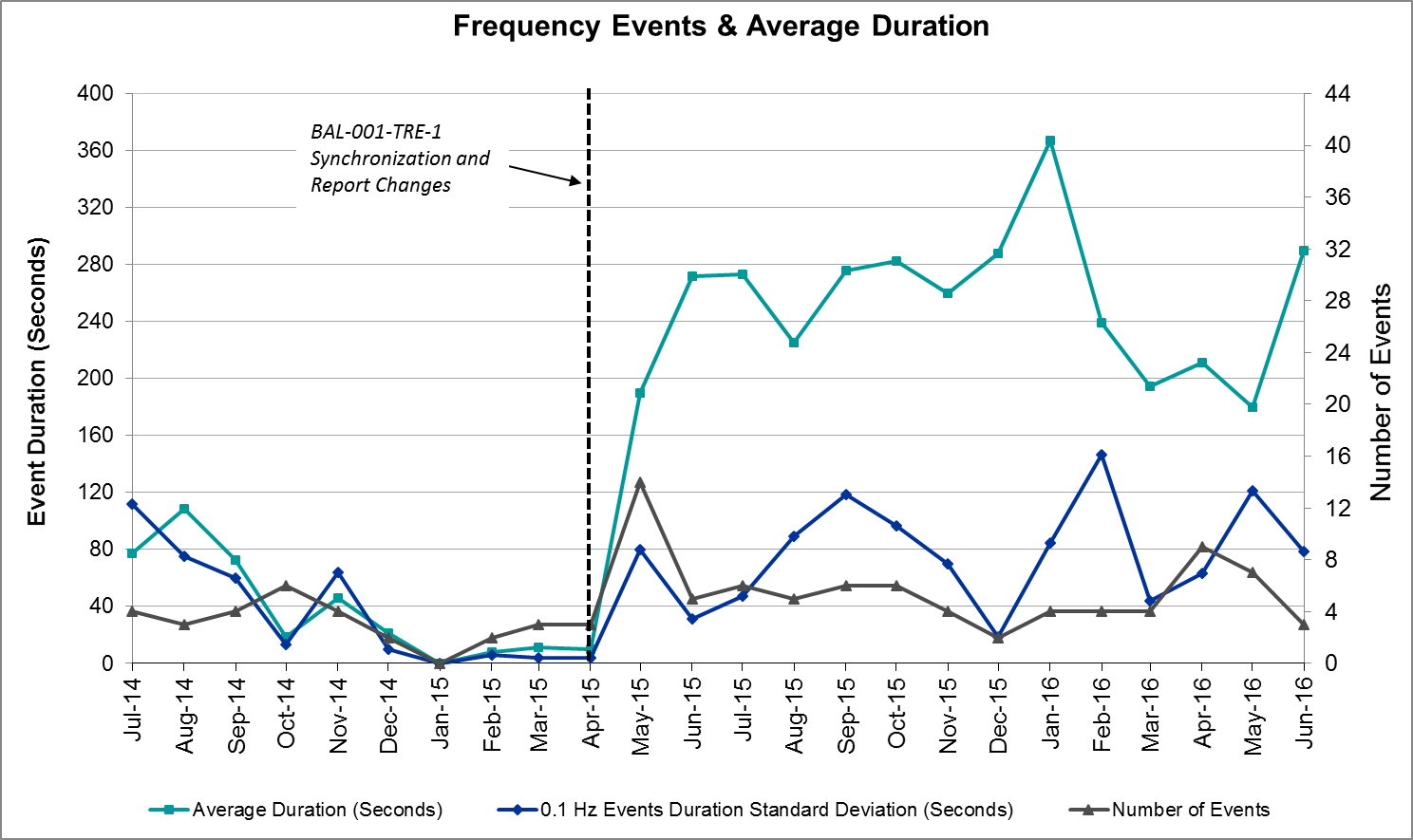
The ERCOT Interconnection experienced seven frequency events in June, all of which resulted from Resource trips. The average event duration was approximately 0:03:00.

When analyzing frequency events, ERCOT evaluates PMU data according to industry standards. Events with an oscillating frequency of less than 1 Hz are considered to be inter-area, while higher frequencies indicate local events. Industry standards specify that damping ratio for inter-area oscillations should be 3.0% or greater. All events listed below indicate the ERCOT system met these standards and transitioned well after each disturbance.

Reported frequency events will include both frequency events where frequency was outside the range of 60±0.1 Hz as well as those determined to be Frequency Measurable Events (FME) as defined by BAL-001-TRE-1. Delta Frequency is defined as the difference between the pre-perturbation and post-perturbation frequency. The Duration of Event is defined as the time it takes for the frequency to recover to lesser/greater of the frequency at the time of the frequency event (t(0) or “A-point”) for low/high-frequency events, respectively. Further details on FMEs can be found in the MIS posted BAL-001-TRE-1 PDCWG Unit Performance reports. A summary of the frequency events is provided below:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Date and Time** | | **Delta Frequency** | **Max/Min Frequency** | **Duration of Event** | **PMU Data** | | **Load** | **Wind** | | **Inertia** | | **Comments** | |
| **(Hz)** | **(Hz)** | **Oscillation Mode (Hz)** | **Damping Ratio** | **(MW)** | **%** | | **(GW-s)** | |
| 6/6/2016 16:21 | | 0.064 | | 59.90 | 0:05:32 | 0.65 | 7% | 36,327 | | 29% | | 221,026 | | Unit Trip of 517 MW |
| 6/19/2016 18:14 | | 0.082 | | 59.88 | 0:05:39 | 0.76 | 15% | 53,972 | | 1% | | 309,402 | | Unit Trip of 669 MW |
| 0.63 | 12% |
| 6/24/2016 14:44 | | 0.049 | | 59.88 | 0:03:19 | 0.64 | 10% | 56,582 | | 9% | | 320,633 | | Unit Trip of 484 MW |

(Note: frequency events highlighted in blue have been identified as FMEs per BAL-001-TRE-1 and the Performance Disturbance Compliance Working group.)



## Responsive Reserve Events

There were seven events where Responsive Reserve MWs were released to SCED in June. The events highlighted in blue were related to frequency events reported in Section 2.1 above.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date and Time Released to SCED** | **Date and Time Recalled** | **Duration of Event** | **Maximum MWs Released** | **Comments** |
|
| 6/6/2016 16:21:50 | 6/6/2016 16:26:02 | 0:04:12 | 500.03 |  |
| 6/19/2016 18:14:40 | 6/19/2016 18:19:00 | 0:04:20 | 459.95 |  |
| 6/24/2016 14:44:48 | 6/24/2016 14:48:32 | 0:03:44 | 396.94 |  |

## Load Resource Events

None.

# Reliability Unit Commitment

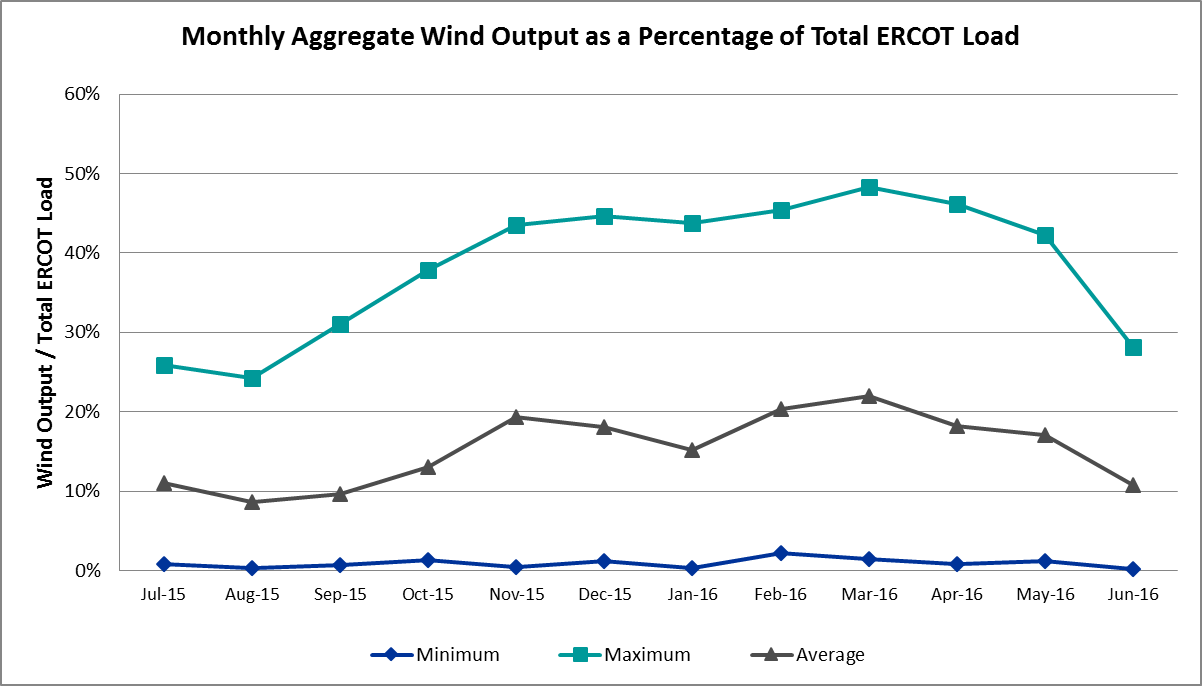
ERCOT reports on Reliability Unit Commitments (RUC) on a monthly basis. Commitments are reported grouped by operating day and weather zone. The total number of hours committed is the sum of the hours for all the units in the specified region. Additional information on RUC commitments can be found on the MIS secure site at Grid 🡪 Generation 🡪 Reliability Unit Commitment.

There were no DRUC commitments in June.

There were 26 HRUC commitments in June.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **HRUC Commitments** | | | | | |
| **Resource Location** | **# of Resources** | **Operating Day** | **Total # of Hours Committed** | **Total MWhs** | **Reason for Commitment** |
| Coastal | 8 | 6/1/2016 | 22 | 8296 | Local Congestion |
| Coastal | 1 | 6/3/2016 | 1 | 11 | Local Congestion |
| South Central | 1 | 6/3/2016 | 2 | 50 | Local Congestion |
| Coastal | 1 | 6/6/2016 | 6 | 3216 | Local Congestion |
| Coastal | 2 | 6/7/2016 | 15 | 8217 | Houston Import, Local Congestion |
| Southern | 2 | 6/7/2016 | 15 | 735 | Valley Import |
| Coastal | 1 | 6/8/2016 | 5 | 3745 | Local Congestion |
| Coastal | 3 | 6/9/2016 | 23 | 14907 | Local Congestion |
| Southern | 1 | 6/9/2016 | 8 | 2640 | Local Congestion |
| Coastal | 1 | 6/10/2016 | 14 | 10486 | Local Congestion |
| Coastal | 1 | 6/11/2016 | 4 | 676 | Local Congestion |
| Coastal | 1 | 6/13/2016 | 5 | 3745 | Local Congestion |
| Coastal | 5 | 6/14/2016 | 41 | 23244 | North to Houston |
| Coastal | 2 | 6/15/2016 | 24 | 17904 | Local Congestion |
| Coastal | 2 | 6/16/2016 | 26 | 17396 | Local Congestion |
| Coastal | 1 | 6/17/2016 | 2 | 492 | Local Congestion |
| Southern | 2 | 6/21/2016 | 3 | 698 | Local Congestion, Valley Import |
| Coastal | 1 | 6/21/2016 | 4 | 676 | Local Congestion |
| North Central | 9 | 6/22/2016 | 49 | 8014 | Local Congestion |
| North Central | 2 | 6/23/2016 | 7 | 427 | Local Congestion |
| Southern | 1 | 6/23/2016 | 8 | 2640 | Local Congestion |
| Coastal | 1 | 6/24/2016 | 8 | 4288 | Local Congestion |
| Coastal | 1 | 6/25/2016 | 3 | 1608 | Local Congestion |
| North Central | 1 | 6/28/2016 | 5 | 2615 | Local Congestion |
| South Central | 1 | 6/28/2016 | 5 | 630 | Local Congestion |
| Coastal | 2 | 6/29/2016 | 8 | 1352 | Local Congestion |

# Wind Generation as a Percent of Load



# Congestion Analysis

The number of congestion events experienced by the ERCOT system decreased in June. There were thirty-four instances of activity on the Generic Transmission Constraints (GTCs) in June.

## Notable Constraints for June

Nodal protocol section 3.20 specifies that ERCOT shall identify transmission constraints that are active or binding three or more times within a calendar month. As part of this process, ERCOT reports congestion that meets this criterion to ROS. In addition ERCOT also highlights notable constraints that have an estimated congestion rent exceeding $1,000,000 for a calendar month. These constraints are detailed in the table below. Rows highlighted in blue indicate the congestion was affected by one or more outages. For a list of all constraints activated in SCED for the month of June, please see Appendix A at the end of this report.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Contingency** | **Overload** | **# of Days Constraint Active** | **Estimated Congestion Rent** | **Transmission Project** |
| Ph Robinson At1l\_H (3)345/138 kV | Meadow AT1 345/138kV | 14 | $33,467,561.08 | 4708 |
| Bm-Sr73 & Sr81 138kV | Bellaire - San Felipe 138kV | 3 | $7,119,922.62 | 4703 |
| DCKT Jewett - Singleton 345 kV | Btu\_Jack\_Creek - Twin Oak Switch 345kV | 16 | $4,959,861.57 | Hourton Import Project |
| Fort Worth Subsation to West Denton 138 kV | Jim Christal Substation - West Denton 138kV | 3 | $2,607,972.70 |  |
| DKCT Roans Prarie-Rothwood & Singleton-Tomball 345kV | Singleton - Zenith 345kV | 11 | $2,444,807.48 | Houston Import Project |
| Garfield-Hicross And Onion-Stoney\_R 138kV | Mcneil Lcra - Mcneil Aen 138kV | 3 | $2,384,574.67 |  |
| Lewisville Switch Axfmr22 345/138 kV | Carrollton Northwest 138 kV Reactor | 1 | $2,040,251.79 | 2013 to 2015 RTP |
| Lewisville Switch Axfmr22 345/138 kV | Fort Worth Subsation - West Denton 138kV | 2 | $1,697,644.28 |  |
| Btu\_Atkins Axfmr1 138/69 kV | Btu\_Briarcrest - Btu\_Nall\_Lane 69kV | 14 | $1,325,722.87 | 4574 |
| Ph Robinson At1l\_H (3)345/138 kV | Seminole Tnp - Friendswood Tnp 138kV | 1 | $1,322,908.13 |  |
| Sn-Str26 & Bfp-Vl82 | Hofman - Lake Jackson 138kV | 1 | $1,089,700.68 |  |
| DCKT Marion - Zorn and Clear Springs 345 kV | Clear Springs - Geronimo 138kV | 8 | $962,359.19 |  |
| Gila - Hiway 9 138 kV | Morris Street - Gila 138kV | 21 | $864,694.17 |  |
| Bevo Substation - Asherton 138 kV | Hamilton Road - Maverick 138kV | 3 | $676,009.33 | 16TPIT0024 |
| DCKT Chambers - King and Cedar Bayou - Jordan 345 kV | Brine - Langston 138kV | 3 | $543,836.38 |  |
| DCKT STP - Hillje and STP - Whitepoint 345 kV | Blessing - Lolita 138kV | 8 | $445,679.51 |  |
| Zorn-Marion & Cleasp 345kV | Comal - Henne 138kV | 7 | $424,355.80 | 4454 |
| Sn-Str26 & Bfp-Vl82 | Markham Tie To Aep - Van Vleck Switch 69kV | 3 | $376,809.52 |  |
| Basecase | Liston GTC | 21 | $290,113.24 |  |
| Hutto - Round Rock & Gabriel 138 kV | Gilleland - Mcneil Lcra 138kV | 11 | $282,384.33 | 5269 |
| DCKT Singleton - Zenith 345 kV | Betka - Hockley 138kV | 3 | $182,666.40 | 3682A,3682,3682C |
| Eagle Mountain 2 Compressor Station to Eagle Mountain Poi (5)138/138/138/138/138 kV | Eagle Mountain Ses - Wagley Robertson 138kV | 3 | $138,381.85 | 15TPIT0085 |
| Carrolton Northwest - Lewisville Switch 345 kV | Lewisville Switch - Jones Street Tnp 138kV | 4 | $96,794.28 |  |
| Laquinta - Lobo 138 kV | Bruni Sub 69\_1 138/69kV | 6 | $90,784.80 |  |
| Bosque Switch - Elm Mott 345 kV | Bosque Switch - Rogers Hill Bepc 138kV | 11 | $80,252.43 | 4356 |
| Bosque Switch - Elm Mott 345 kV | Rogers Hill Bepc - Elm Mott 138kV | 4 | $79,500.53 |  |
| Marbfa-Lakewy &Wirtz-Palefa 138kV | Flat Rock Lcra - Wirtz 138kV | 11 | $77,992.60 | 4465 |
| Emses-Sagna 138kV | Eagle Mountain Ses - Morris Dido 138kV | 3 | $68,299.99 | 4252 |
| Mercers Gap Sw to Comanche Switch (Oncor) 138 kV | Camp Bowie (Oncor) - Brownwood Switch 138kV | 6 | $65,243.28 |  |
| Hicks Switch - Alliance & Roanoke Switch 345 kV | Eagle Mountain Ses - Eagle Mountain Poi 138kV | 3 | $58,161.70 |  |
| Zorn-Marion & Cleasp 345kV | Henne - Zorn 138kV | 4 | $57,197.87 |  |
| Ph Robinson to Center 345 kV | Aritek - Chorin 138kV | 4 | $56,403.75 | 4426 |
| Basecase | Randado Aep - Zapata 138kV | 12 | $51,269.93 |  |
| Wharton to Caney (2)138/138 kV | El Campo - Lane City Pump 138kV | 7 | $47,561.38 |  |
| Basecase | Panhandle GTC | 8 | $46,310.13 | Panhandle Upgrade |
| Uvalde Aep - Odlaw Switchyard 138 kV | Hamilton Road - Maverick 138kV | 6 | $45,921.85 | 16TPIT0024 |
| Basecase | Zorillo to Ajo GTC | 5 | $38,463.87 | LRGV (lower Rio Grande Valley) Import Project |
| Aspermont Aep - Spur 138 kV | Girard Tap - Jayton 69kV | 3 | $33,106.38 |  |
| Victoria - Coleto Creek 138 kV (COLETO\_VICTOR1) | Coleto Creek - Victoria 138kV | 4 | $31,727.13 | Live Oak RPG |
| Lobo 2\_345\_138 345/138 kV | Javalina Tap - Molina 138kV | 3 | $25,151.29 | 4401 |
| Hiway\_9 - Citgo N Oak Park 138 kV | Citgo N Oak Park - Cantwell 138kV | 5 | $23,133.96 |  |
| Sweetwater Downtown to Haynes Substation (7)138/138/138/138/138/138/138 kV | Eskota Switch - Trent 69kV | 3 | $12,307.04 |  |
| Dyann-Wr&Eb-Wr 138kV | El Campo - Lane City Pump 138kV | 3 | $10,470.56 |  |
| DCKT Gibbons Creek - Singleton 345 kV | Jewett - Singleton 345kV | 5 | $6,487.27 |  |
| Ennis Switch - Desoto Switch 138 kV | Ennis West Switch - Waxahachie 138kV | 3 | $5,976.51 |  |
| DCKT Ferguson - Granite Mountain and Wirtz - Starcke - Paleface 138 kV | Flat Rock Lcra - Wirtz 138kV | 6 | $5,341.77 | 4465 |
| Lopeno to Zapata 138 kV | Javalina Tap - Molina 138kV | 4 | $3,632.91 | 4401 |
| Wharton to Caney (2)138/138 kV | Lane City Reactor | 3 | $683.96 |  |

## Generic Transmission Constraint Congestion

There were five days of activity on the Zorillo – Ajo GTC, eight days on the Panhandle GTC, and twenty-one days on the Liston GTC in June. There was no activity on the remaining GTCs during the Month.

Note: This is how many times a constraint has been activated to avoid exceeding a GTC limit, it does not imply an exceedance of the GTC occurred or that the GTC was binding.

## Manual Overrides for June

There were no manual overrides for the month of June 2016.

## Congestion Costs for Calendar Year 2016

The following table represents the top twenty active constraints for the calendar year based on the estimated congestion rent attributed to the congestion. ERCOT updates this list on a monthly basis.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Contingency** | **Binding Element** | **# of 5-min SCED Intervals** | **Estimated Congestion Rent** | **Transmission Project** |
| Ph Robinson At1l\_H (3)345/138 KV | Meadow AT1 345/138kV | 1,470 | $ 37,410,531.94 | 4708 |
| Villa Cavazos to Military Highway Aep (2)138/138 KV | Los Fresnos - Loma Alta Substation 138kV | 3,272 | $ 26,026,381.24 |  |
| Rnksw-W\_Dent&Lwssw-Krwsw 345kv | Fort Worth Subsation - West Denton 138kV | 1,774 | $ 10,027,611.63 |  |
| Hcksw-Allnc&Rnksw 345kv | Eagle Mountain Ses - Morris Dido 138kV | 1,420 | $ 8,755,553.47 | 4252 |
| Basecase | Panhandle GTC | 4,595 | $ 7,937,227.06 | Panhandle Upgrade |
| Bm-Sr73 & Sr81 138kv | Bellaire - San Felipe 138kV | 196 | $ 7,119,922.62 |  |
| Rosen Heights to Eagle Mountain Compressor (5)138/138/138/138/138 KV | Rosen Heights Tap 2 - Morris Dido 138kV | 857 | $ 6,945,775.57 | 4252 |
| Meadow to Ph Robinson 345 KV | Meadow AT1 345/138kV | 89 | $ 6,552,987.55 | 4708 |
| Jewet-Sng 345kv | Btu\_Jack\_Creek - Twin Oak Switch 345kV | 3,221 | $ 6,507,814.08 | Hourton Import Project |
| Basecase | Valley Import | 110 | $ 6,494,964.50 | LRGV (lower Rio Grande Valley) Import Project |
| Lwssw-Krwsw&Rnksw 345kv | Fort Worth Subsation - West Denton 138kV | 788 | $ 5,462,367.54 |  |
| Hcksw-Allnc&Rnksw 345kv | Rosen Heights Tap 2 - Morris Dido 138kV | 805 | $ 5,063,292.44 | 4252 |
| South Carbide to Loma Alta Substation 138 KV | La Palma - Villa Cavazos 138kV | 505 | $ 5,060,645.62 |  |
| Rns-Rtw & Sng-Tb 345kv | Singleton - Zenith 345kV | 2,090 | $ 5,047,008.96 | Houston Import Project |
| Mason Road to Obrien 138 KV | Betka - Hockley 138kV | 257 | $ 4,451,883.67 | 3682A,3682,3682C |
| South Texas # 1 & # 2 | Marion - Clear Springs 345kV | 18 | $ 4,402,597.52 |  |
| Nelson Sharpe to Ajo 345 KV | Javalina Tap - Molina 138kV | 4,406 | $ 4,208,950.27 | 4401 |
| Ph Robinson At4\_H (3)345/138 KV | Meadow AT1 345/138kV | 62 | $ 3,994,537.45 | 4708 |
| Eagle Mountain Ses Axfmr1l (3)345/138 KV | Eagle Mountain Ses AX2L 345/13.8/138kV | 329 | $ 3,993,367.46 |  |
| Eagle Mountain Ses Axfmr1l (3)345/138 KV | Eagle Mountain Ses AX2H 345/13.8/138kV | 813 | $ 3,865,585.22 |  |

# System Events

## ERCOT Peak Load

The unofficial ERCOT peak load for the month was 65,184 MW and occurred on June 15th during hour ending 17:00.

## Load Shed Events

None.

## Stability Events

None.

## Notable PMU Events

ERCOT analyzes PMU data for any significant system disturbances that do not fall into the Frequency Events category reported in section 2.1. The results are summarized in this section once the analysis has been completed.

There were no reportable events in June.

## TRE/DOE Reportable Events

None.

## New/Updated Constraint Management Plans

None.

## New/Modified/Removed SPS

None.

## New Procedures/Forms/Operating Bulletins

ERCOT has revised the following procedure manuals, effective June 30, 2016.

|  |  |
| --- | --- |
| **Procedure Title** | **POB** |
| [Communications Protocols](http://www.ercot.com/content/wcm/key_documents_lists/90055/Communication_Protocols.doc) | [746](http://www.ercot.com/content/wcm/pobs/100897/Power_Operations_Bulletin_746.doc) |
| [DC Tie Desk](http://www.ercot.com/content/wcm/key_documents_lists/90055/DC_Tie_Desk_Operating_Procedure.docx) | [747](http://www.ercot.com/content/wcm/pobs/100898/Power_Operations_Bulletin_747.doc) |
| [Real-Time Desk](http://www.ercot.com/content/wcm/key_documents_lists/90055/Real_Time_Desk_Operating_Procedure.docx) | [748](http://www.ercot.com/content/wcm/pobs/100899/Power_Operations_Bulletin_748.doc) |
| [Reliability Unit Commitment Desk](http://www.ercot.com/content/wcm/key_documents_lists/90055/Reliability_Unit_Commitment_Desk_Operating_Procedure.docx) | [749](http://www.ercot.com/content/wcm/pobs/100900/Power_Operations_Bulletin_749.doc) |
| [Resource Desk](http://www.ercot.com/content/wcm/key_documents_lists/90055/Resource_Desk_Operating_Procedure.docx) | [750](http://www.ercot.com/content/wcm/pobs/100901/Power_Operations_Bulletin_750.doc) |
| [Scripts](http://www.ercot.com/content/wcm/key_documents_lists/90055/Scripts.docx) | [751](http://www.ercot.com/content/wcm/pobs/100902/Power_Operations_Bulletin_751.doc) |
| [Shift Supervisor Desk](http://www.ercot.com/content/wcm/key_documents_lists/90055/Shift_Supervisor_Desk_Operating_Procedure.docx) | [752](http://www.ercot.com/content/wcm/pobs/100903/Power_Operations_Bulletin_752.doc) |
| [Transmission & Security Desk](http://www.ercot.com/content/wcm/key_documents_lists/90055/Transmission_and_Security_Desk_Operating_Procedure.docx) | [753](http://www.ercot.com/content/wcm/pobs/100904/Power_Operations_Bulletin_753.doc) |

# Emergency Conditions

## OCNs

None.

## Advisories

|  |  |
| --- | --- |
| **Date and Time** | **Description** |
| 06/06/16 16:30 | Physical Responsive Capability < 3000 MW: ERCOT is issued an Advisory due to Physical Responsive Capability being below 3000 MW. |

## Watches

None.

## Emergency Notices

|  |  |
| --- | --- |
| **Date and Time** | **Description** |
| 06/13/16 13:35 | Transmission Emergency Notice issued for a post-contingency over load in the Laredo-Hamilton Rd Area. |

.

# Application Performance

There were no issues to report for June.

## TSAT/VSAT Performance Issues

None.

## Communication Issues

None.

## Market System Issues

None.

# Appendix A: Real-Time Constraints

The following is a complete list of constraints activated in SCED for the month of June. Full contingency descriptions can be found in the Standard Contingencies List located on the MIS secure site at Grid 🡪 Generation 🡪 Reliability Unit Commitment.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Contingency** | **Constrained Element** | **From Station** | **To Station** | **# of Days Constraint Active** |
| BASE CASE | LISTON | n/a | n/a | 21 |
| SGILNU78 | GILA\_MORRIS1\_1 | GILA | MORRIS | 21 |
| DJEWSNG5 | JK\_TOKSW\_1 | TOKSW | JK\_CK | 16 |
| XATK89 | NAL\_BRIR\_1 | NALL\_LN | BRIRCRT | 14 |
| XPHR58 | MDO\_AT1 | MDO | MDO | 14 |
| BASE CASE | RANDAD\_ZAPATA1\_1 | RANDADO | ZAPATA | 12 |
| DRNS\_TB5 | SNGZEN99\_A | SNG | ZEN | 11 |
| SBOSELM5 | 1030\_\_B | BOSQUESW | RGH | 11 |
| DMARPA\_8 | 38T365\_1 | WIRTZ | FLATRO | 11 |
| DHUTGAB8 | 211T147\_1 | GILLCR | MCNEIL\_ | 11 |
| BASE CASE | PNHNDL | n/a | n/a | 8 |
| DSTPWHI5 | BLESSI\_LOLITA1\_1 | BLESSING | LOLITA | 8 |
| DMARZOR5 | 505T505\_1 | CLEASP | GERONI | 8 |
| SWRDYN8 | EL\_CAM\_LANCTY1\_1 | LANCTYPM | EL\_CAMPO | 7 |
| DCLEZOR5 | 86T235\_1 | HENNE | COMAL | 7 |
| SZEPCMN8 | 670\_\_B | BRNSW | CMPBW | 6 |
| SLAQLOB8 | BRUNI\_69\_1 | BRUNI | BRUNI | 6 |
| SBRAUVA8 | HAMILT\_MAVERI1\_1 | HAMILTON | MAVERICK | 6 |
| DFERPAL8 | 38T365\_1 | WIRTZ | FLATRO | 6 |
| BASE CASE | ZO\_AJO | n/a | n/a | 5 |
| SHIWCIT8 | 11T436\_1 | CITGO\_NO | CANTWELL | 5 |
| DGIBSNG5 | 260\_A\_1 | JEWET | SNG | 5 |
| SBOSELM5 | 1030\_\_A | RGH | ELMOT | 4 |
| SRANZA28 | JAVALT\_MOLINA1\_1 | JAVALTAP | MOLINA | 4 |
| SPHRCTR5 | ATKRIN87\_A | RIN | ATK | 4 |
| DCLEZOR5 | 89T204\_1 | ZORN | HENNE | 4 |
| DCRLLSW5 | 590\_\_A | LWSSW | LWVJS | 4 |
| SVICCO28 | COLETO\_VICTOR2\_1 | COLETO | VICTORIA | 4 |
| DWR\_EB28 | EL\_CAM\_LANCTY1\_1 | LANCTYPM | EL\_CAMPO | 3 |
| DBM\_BM\_8 | BI\_SF\_09\_A | BI | SF | 3 |
| DGARSTO8 | MCN\_MCN\_1 | MCNEIL\_ | MCNEIL | 3 |
| DEMSSAG8 | 6265\_\_A | EMSES | MRSDO | 3 |
| SSWDMGS8 | 6585\_\_A | ESKSW | TRNT | 3 |
| SSPUASP8 | JATN\_SPUR\_1C\_1 | GIRA\_TAP | DKEC | 3 |
| SFTWW\_D8 | AIR\_W\_DE\_1 | W\_DENT | JMCRSTL | 3 |
| SWRDYN8 | LANCTYR1\_1 | LAN\_CTY | LAN\_CTY | 3 |
| DHCKRNK5 | 6270\_\_A | EMSES | EGPOI | 3 |
| SBEVASH8 | HAMILT\_MAVERI1\_1 | HAMILTON | MAVERICK | 3 |
| SEMMEM28 | 6271\_\_A | EMSES | WGROB | 3 |
| DSNGZEN5 | BETHK\_66\_A | HK | BET | 3 |
| XLOB58 | JAVALT\_MOLINA1\_1 | JAVALTAP | MOLINA | 3 |
| DSN\_BFP8 | MRK\_VNVL\_1 | MRKHMSW | VNVLKSW | 3 |
| SRDODES8 | 940\_\_C | ENWSW | WXHCH | 3 |
| DCHBJOR5 | BRNLAN86\_A | LAN | BRN | 3 |
| XLOB58 | DILLEY\_JARDIN1\_1 | DILLEYSW | JARDIN | 2 |
| SFORYEL8 | FORTMA\_MASN1\_1 | FORTMA | MASN | 2 |
| XLWS158 | FTW\_W\_DE\_1 | W\_DENT | FTWORTH | 2 |
| SBIGDIL8 | HAMILT\_MAVERI1\_1 | HAMILTON | MAVERICK | 2 |
| DEMSSAG8 | 6265\_\_D | MRSDO | RHTP2 | 2 |
| SWEBVEN5 | 6300\_\_G | EVRSW | OAKT2 | 2 |
| DDILPE89 | BIG\_FO\_PEARSA1\_1 | BIG\_FOOT | PEARSAL1 | 2 |
| DWR\_EB28 | LANCTY\_LAN\_CT1\_1 | LAN\_CTY | LANCTYPM | 2 |
| XLK2W89 | OLSE\_BOS\_1 | BOSQUESW | OLSEN | 2 |
| BASE CASE | PAREDS\_CNTRLAV\_1 | PAREDES | MV\_CNTRA | 2 |
| DSHREVR5 | 6300\_\_G | EVRSW | OAKT2 | 2 |
| DCHBJOR5 | ATKRIN87\_A | RIN | ATK | 2 |
| SVICCOL8 | COLETO\_VICTOR1\_1 | COLETO | VICTORIA | 2 |
| XVIC89 | MAGRUD\_VICTOR2\_1 | VICTORIA | MAGRUDER | 2 |
| SGIBSNG5 | SNGXGC99\_1 | GIBCRK | SNG | 2 |
| DTRCELK5 | 1760\_\_A | SHBSW | TYLNW | 2 |
| XLOB58 | BESSEL\_LON\_HI1\_1 | LON\_HILL | BESSEL | 2 |
| SGILHI28 | GILA\_HIWAY\_2\_1 | GILA | HIWAY\_9 | 2 |
| DGARHIC8 | MCN\_MCN\_1 | MCNEIL\_ | MCNEIL | 2 |
| SJARDIL8 | DIL\_COTU\_1 | DILLEYSW | COTULAS | 2 |
| SSNDAU15 | 450\_\_A | SNDSW | AUSTRO | 2 |
| SBIGDIL8 | BAT\_CRST\_1 | BATESVL | CRSTLSW | 1 |
| XWI2N89 | WINKS\_MR2L | WINKS | WINKS | 1 |
| XPHR58 | G138\_10C\_1 | FRDSWOOD | SEMINOLE | 1 |
| SFALROM8 | JAVALT\_MOLINA1\_1 | JAVALTAP | MOLINA | 1 |
| SY4T18 | T0\_Y4\_1 | T0 | Y4 | 1 |
| SHLSWHT8 | 1030\_\_B | BOSQUESW | RGH | 1 |
| SSCLWF28 | 6560\_\_B | MRKLY | RICSW | 1 |
| SSWDMGS8 | 6780\_B\_1 | ROBY | LONGWRTH | 1 |
| SSWDMGS8 | 6780\_\_A | ESKSW | LONGWRTH | 1 |
| SMARO2B8 | BETHK\_66\_A | HK | BET | 1 |
| XLOB58 | FREER\_SAN\_DI1\_1 | SAN\_DIEG | FREER | 1 |
| BASE CASE | GLE\_MERI\_1 | MERIDIAN | GLENROSE | 1 |
| SWRDYN8 | LANCTY\_LAN\_CT1\_1 | LAN\_CTY | LANCTYPM | 1 |
| XASP89 | MUNDAY\_WEIN1\_1 | MUNDAYST | WEIN | 1 |
| BASE CASE | S104A\_1 | RIOHONDO | MV\_BURNS | 1 |
| BASE CASE | SNYDER\_WKN\_BK1\_1 | ENAS | WKN\_BKR | 1 |
| XLWS158 | 2650\_CBRATING\_1 | CRLNW | CRLNW | 1 |
| SMCEABS8 | MKLT\_TRNT1\_1 | TRNT | MKLT | 1 |
| SRAZD18 | 2584\_1 | DOWNIES | UVALDE | 1 |
| XLWS158 | 570\_B\_1 | POCKRUSC | CRNTH | 1 |
| SWHISTP5 | BLESSI\_LOLITA1\_1 | BLESSING | LOLITA | 1 |
| DCHB\_NB5 | CBYRNG87\_A | CBY | RNG | 1 |
| XATK89 | NOR\_TABO\_1 | TABOR | NORTHBR | 1 |
| SSKISIN9 | THREE\_RI\_69A1 | THREE\_RI | THREE\_RI | 1 |
| UFO5FOR1 | FORMOSA\_TR21 | FORMOSA | FORMOSA | 1 |
| SJMCN\_D8 | FTW\_W\_DE\_1 | W\_DENT | FTWORTH | 1 |
| SSPUASP8 | GIRA\_T\_SPUR1\_1 | SPUR | GIRA\_TAP | 1 |
| SSWDMGS8 | HAMLIN\_PLST1\_1 | HAMLIN | PLST | 1 |
| SAJORI25 | LASPUL\_RIOHON1\_1 | LASPULGA | RIOHONDO | 1 |
| XWFA89 | 6945\_\_A | LKWSW | WFALS | 1 |
| DSN\_BFP8 | HN\_LJ\_02\_A | LJ | HN | 1 |
| DAUSSND5 | MCN\_MCN\_1 | MCNEIL\_ | MCNEIL | 1 |
| DONISTO8 | MCN\_MCN\_1 | MCNEIL\_ | MCNEIL | 1 |
| SSPUASP8 | SPUR\_69\_1 | SPUR | SPUR | 1 |
| XWI2N89 | WINKS\_MR2H | WINKS | WINKS | 1 |
| DAUSSND5 | 211T147\_1 | GILLCR | MCNEIL\_ | 1 |
| SSPUMW18 | ASPM\_69T1 | ASPM | ASPM | 1 |
| DCHBJOR5 | CBYRNG87\_A | CBY | RNG | 1 |
| SLAQLOB8 | FALFUR\_PREMON1\_1 | FALFUR | PREMONT | 1 |
| BASE CASE | JAVALT\_MOLINA1\_1 | JAVALTAP | MOLINA | 1 |
| SSWDMGS8 | MKLT\_TRNT1\_1 | TRNT | MKLT | 1 |
| XDOW58 | MRK\_VNVL\_1 | MRKHMSW | VNVLKSW | 1 |
| BASE CASE | RIOHND\_ERIOHND\_1 | MV\_RIOHO | RIOHONDO | 1 |
| SCABWES8 | ARANSA\_SEAWAL1\_1 | ARANSAS | SEAWALL | 1 |
| XMCC58 | BNDVS\_DT1H | BNDVS | BNDVS | 1 |
| DAUSGAR5 | CKT\_975\_1 | DUNLAP | TRIDGE | 1 |