

June 2017 ERCOT Monthly Operations Report

Reliability and Operations Subcommittee Meeting

July 13th, 2017

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# Report Highlights

* The unofficial ERCOT peak for June was 67,617 MW.
* There were eleven frequency events in June. PMU data indicates the ERCOT system transitioned well in each case.
* There were seven instances where Responsive Reserves were deployed, all of which were the result of frequency events.
* There were thirteen RUC commitments in June.
* The level of reportable SCED congestion increased in June. This congestion was mostly due to planned outages as well as high wind output. There were twenty-six instances over 30 days on the Generic Transmission Constraints (GTCs) in June. There were twenty-one days on the Panhandle GTC, four days on the Valley Import GTC, and one day on the Laredo GTC in June. There was no activity on the remaining GTCs during the Month.

# Frequency Control

## Frequency Events

The ERCOT Interconnection experienced eleven frequency events in June, all of which resulted from Resource trips. The average event duration was approximately 0:04:50.

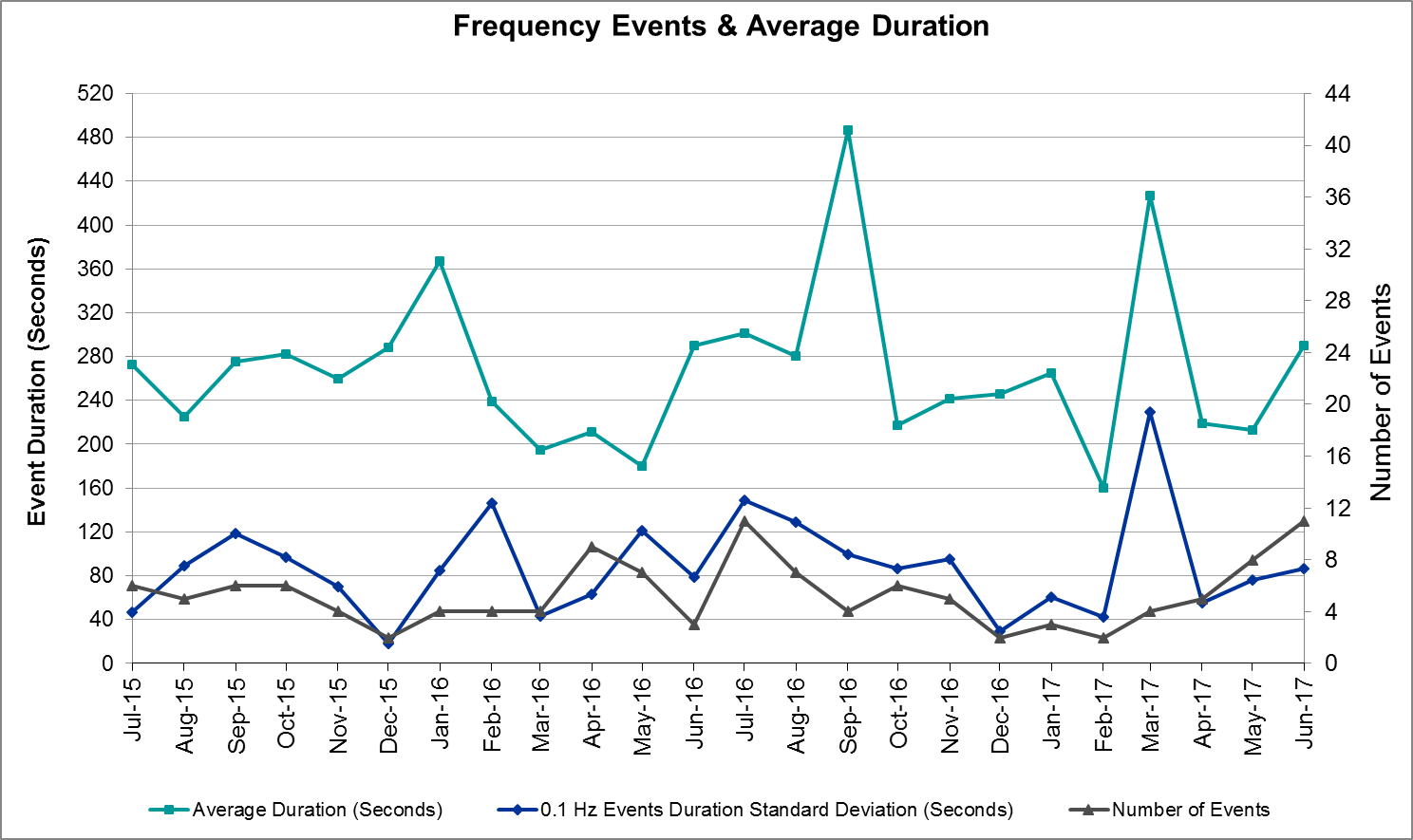
When analyzing frequency events, ERCOT evaluates PMU data according to industry standards. Events with an oscillating frequency of less than 1 Hz are considered to be inter-area, while higher frequencies indicate local events. Industry standards specify that damping ratio for inter-area oscillations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

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Date and Time** | **Delta Frequency** | **Max/Min Frequency** | **Duration of Event** | **PMU Data** | | **MW Loss** | **Load** | **Wind** | **Inertia** |
| **(Hz)** | **(Hz)** | **Oscillation Mode (Hz)** | **Damping Ratio** | **(MW)** | **%** | **(GW-s)** |
| 6/2/2017 10:03 | 0.080 | 59.90 | 0:04:14 | No PMU Data Available. | | 589 | 44,444 | 5% | 289,417 |
| 6/6/2017 18:08 | 0.074 | 59.90 | 0:06:29 | 0.64 | 7% | 452 | 57,110 | 4% | 322,984 |
| 6/7/2017 17:25 | 0.042 | 59.88 | 0:04:33 | 0.63 | 12% | 472 | 59,348 | 2% | 329,177 |
| 6/8/2017 12:03 | 0.042 | 59.91 | 0:02:46 | No PMU Data Available. | | 444 | 49,940 | 4% | 316,775 |
| 6/11/2017 3:52 | 0.067 | 59.90 | 0:03:49 | No PMU Data Available. | | 443 | 34,153 | 40% | 186,102 |
| 6/11/2017 21:42 | 0.112 | 59.84 | 0:04:00 | No PMU Data Available. | | 848 | 51,015 | 25% | 252,660 |
| 6/14/2017 16:55 | 0.080 | 59.91 | 0:07:33 | No PMU Data Available. | | 522 | 63,154 | 12% | 327,398 |
| 6/16/2017 7:46 | 0.038 | 59.89 | 0:04:31 | No PMU Data Available. | | 550 | 43,013 | 22% | 286,407 |
| 6/16/2017 16:14 | 0.066 | 59.91 | 0:06:41 | 0.89 | 12% | 508 | 65,681 | 11% | 344,942 |
| 6/19/2017 9:10 | 0.061 | 59.93 | 0:04:25 | No PMU Data Available. | | 449 | 45,773 | 3% | 309,133 |
| 6/27/2017 15:50 | 0.074 | 59.87 | 0:04:10 | 0.87 | 17% | 594 | 56,226 | 9% | 314,291 |

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:

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

Currently, the Critical Inertia Level for ERCOT is approximately 100,000 MW-s (Source: [link](http://www.ercot.com/content/wcm/key_documents_lists/77622/06.__Inertia_Background_for_ROS.pptx))



(Note: All data on this graph encompasses frequency event analysis based on BAL-001-TRE-1.)

## 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** |
|
| 6/2/2017 10:03:08 | 6/2/2017 10:05:54 | 0:02:40 | 68.36 |
| 6/6/2017 18:08:00 | 6/6/2017 18:13:12 | 0:05:04 | 345.37 |
| 6/7/2017 17:25:17 | 6/7/2017 17:30:10 | 0:04:48 | 618.50 |
| 6/8/2017 12:03:14 | 6/8/2017 12:03:18 | 0:00:00 | 0.00 |
| 6/11/2017 3:52:34 | 6/11/2017 3:55:45 | 0:03:07 | 300.95 |
| 6/11/2017 21:42:16 | 6/11/2017 21:45:25 | 0:03:04 | 755.44 |
| 6/14/2017 16:55:34 | 6/14/2017 16:55:40 | 0:00:00 | 0.00 |

## Load Resource Events

None.

# Reliability Unit Commitment

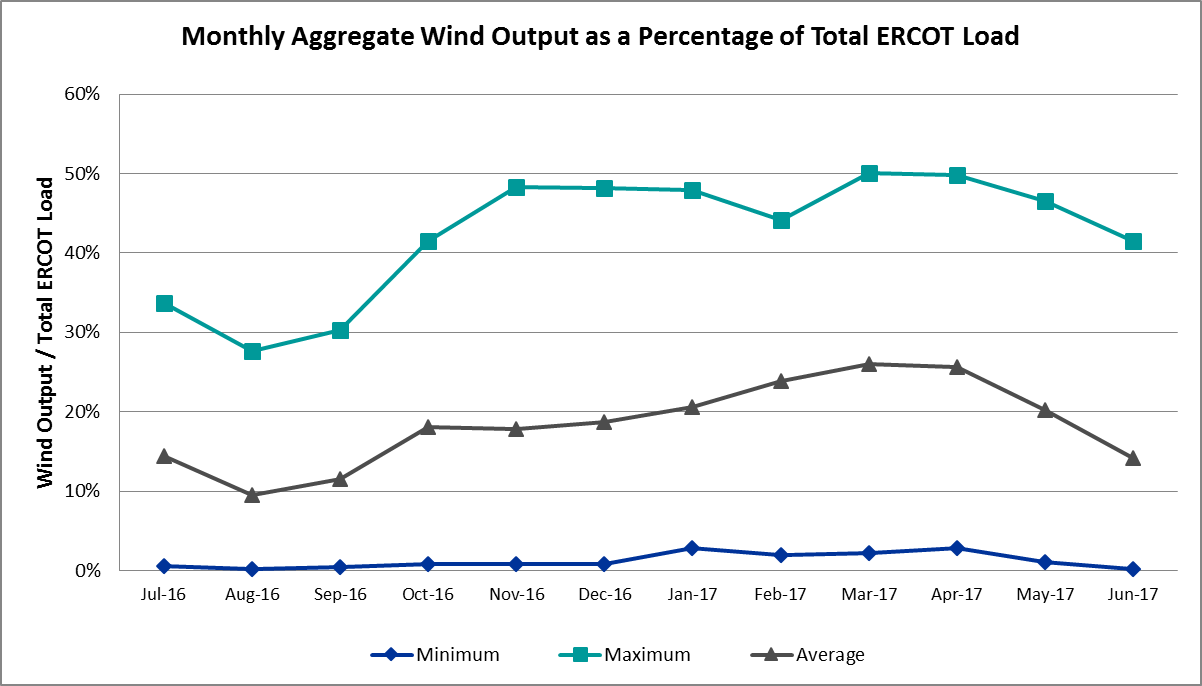
ERCOT reports on Reliability Unit Commitments (RUC) on a monthly basis. Commitments are reported grouped by operating day and weather zone. The total number of hours committed is the sum of the hours for all the units in the specified region. Additional information on RUC commitments can be found on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

There were no DRUC commitments in June.

There were thirteen HRUC commitments in June.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Resource Location** | **# of Resources** | **Operating Day** | **Total # of Hours Committed** | **Total MWhs** | **Reason for Commitment** |
| Coastal | 1 | 6/8/2017 | 8 | 4,240 | Local Congestion |
| Southern | 2 | 6/8/2017 | 12 | 6,061 | Valley Import |
| Southern | 1 | 6/9/2017 | 11 | 414 | Local Congestion |
| Far West | 3 | 6/9/2017 | 3 | 198 | Voltage Stability |
| Far West | 3 | 6/10/2017 | 5 | 330 | Voltage Stability |
| Coastal | 1 | 6/12/2017 | 5 | 845 | Local Congestion |
| North Central | 2 | 6/13/2017 | 8 | 3,480 | Local Congestion |
| Coastal | 1 | 6/14/2017 | 8 | 4,296 | N\_to\_H |
| Southern | 2 | 6/21/2017 | 4 | 321 | Local Congestion, Valley Import |
| Southern | 1 | 6/22/2017 | 19 | 3,886 | Valley Import |
| Far West | 1 | 6/24/2017 | 6 | 888 | Local Congestion |
| Southern | 3 | 6/27/2017 | 22 | 986 | Valley Import |
| Southern | 3 | 6/28/2017 | 33 | 1,591 | Valley Import |

# Wind Generation as a Percent of Load



# Congestion Analysis

The number of congestion events experienced by the ERCOT system decreased in June. There were twenty-six instances over 30 days 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 Name** | **Overloaded Element** | **# of Days Constraint Active** | **Congestion Rent** | **Transmission Project** |
|
| NORTH PHARR to POLK AVENUE LIN 1 | North Mcallen - West Mcallen 138kV | 15 | $21,634,283.93 | 4493 |
| Rns-Rtw & Sng-Tb 345kv | Singleton - Zenith 345kV | 29 | $18,526,512.51 | Houston Import Project |
| HCKSW-ALLNC&RNKSW 345kV | Blue Mound - Wagley Robertson 138kV | 12 | $17,261,623.85 | 15TPIT0085 |
| Basecase | PNHNDL GTC | 21 | $16,134,411.71 |  |
| Jewet-Sng 345kV | Btu\_Jack\_Creek - Twin Oak Switch 345kV | 29 | $5,941,092.75 | Houston Import Project |
| NORTH EDINBURG TRX 1382 345/138 | North Edinburg 345/1kV | 4 | $5,832,628.85 | 5604 |
| Nedin-Mv\_Wedn4&Mv\_Palm4 138k | Azteca Sub - Se Edinburg 138kV | 6 | $4,920,674.36 |  |
| Victoria-V\_Dupsw 138kV | Formosa - Lolita 138kV | 10 | $3,124,920.63 |  |
| LOBO TRX A2 345/138 | Asherton - Catarina 138kV | 5 | $2,146,649.36 |  |
| Wink Sub to PERMIAN BASIN SES LIN | Permian Basin Ses 138/1kV | 2 | $1,887,419.12 | West FarWest Transmission Project |
| Riohondo-Nedin 345kV&Harlnsw 138kV | Haine Drive - La Palma 138kV | 2 | $1,639,879.99 |  |
| WINK TNP to Wink Sub LIN 1 | Wink Sub 69/1kV | 1 | $1,560,127.72 | West FarWest Transmission Project |
| TWR (138) JFS-PA06 & CRN-JFS94 | Galena Park - Greens Bayou 69kV | 1 | $1,428,059.10 | 5944 |
| BALL PARK to FERN LIN 1 | Holbrook - Kirby 138kV | 10 | $1,407,806.59 | 3334 |
| NORTH EDINBURG TRX NEDIN\_3\_1 345/1 | North Edinburg 345/138kV | 2 | $1,251,866.39 | 5604 |
| Dow Chemical To Oasis  345kv | Sintek - Stratt 138kV | 1 | $1,250,144.87 |  |
| Marion to Zorn 345 KV | Marion - Clear Springs 345kV | 7 | $1,230,967.77 | 4473 |
| FOREST HILL SWITCH TRX FMR1 138/69 | Handley Ses 138/1kV | 2 | $1,152,675.56 |  |
| ASHERTON to Bevo Substation LIN 1 | Turtle Creek Switching Station - West Crystal City Sub 69kV | 4 | $1,106,625.92 | 6123 |
| WINK TNP to Wink Sub LIN 1 | Wink Sub 138/69kV | 1 | $1,105,936.05 | West FarWest Transmission Project |
| Basecase | North Mcallen - West Mcallen 138kV | 2 | $1,072,853.80 | 4493 |
| Asphalt Mines to Blewett (3) | Hamilton Road - Maverick 138kV | 13 | $1,009,525.70 | Maverick County Project |
| FORT STOCKTON PLANT TRX 69T1 138/6 | Solstice - Pig Creek Tap 138kV | 25 | $794,911.11 | Far West Texas Project |
| COLETO CREEK GEN COLETOG1 | Blessing - Lolita 138kV | 6 | $769,084.95 |  |
| Basecase | VALIMP GTC | 4 | $698,343.60 |  |
| Moss Switch to Odessa Ehv Sw | Permian Basin Ses - Yucca Drive Switch 138kV | 9 | $661,975.77 | West FarWest Transmission Project |
| CRLNW-LWSSW 345kV | Lewisville Switch - Jones Street Tnp 138kV | 3 | $620,309.13 | 5487 |
| Mgses-Qalsw&Lngsw-Mdssw 345k | Buzzard Draw Switch - Gunsight Switch 138kV | 4 | $605,632.36 |  |
| Fppyd1-Salem & Fayett 345kV | Smithville - Winchester 138kV | 9 | $597,141.38 | 5950 |
| Trses-Scses&Entpr 345kV | Lauren Lane Poi - Elkton 138kV | 7 | $466,118.20 |  |
| Mgses-Qalsw&Lngsw-Mdssw 345k | Koch Tap - Vealmoor - Sharyland Utilities 138kV | 3 | $462,613.50 |  |
| MERCERS GAP SW to COMANCHE SWITCH | Holder 138/69kV | 15 | $355,659.71 |  |
| Gibcrk-Sng 345 Kv | Jewett - Singleton 345kV | 25 | $278,601.22 | Houston Import Project |
| JARDIN to DILLEY SWITCH AEP LIN 1 | Dilley Switch Aep - Cotulla Sub 69kV | 7 | $264,787.37 | 5222 |
| Mgses-Qalsw&Lngsw-Mdssw 345k | Lamesa - Jim Payne Poi 138kV | 5 | $199,043.80 | 4239 |
| Basecase | Burns Sub - Rio Hondo 138kV | 4 | $195,295.74 |  |
| Fppyd1-Salem & Fayett 345kV | Sim Gideon - Winchester 138kV | 7 | $192,663.19 | 5267 |
| Lostpi-Austro&Dunlap 345kV | Flatonia - Hallettsville 138kV | 5 | $168,369.89 | 5922 |
| SAN MIGUEL 345\_138 KV SWITCHYARDS | San Miguel 345\_138 Kv Switchyards 345/1kV | 7 | $163,908.59 | 5218 |
| LAQUINTA to LOBO LIN 1 | Bruni Sub 138/69kV | 7 | $121,810.13 |  |
| Nlarsw-Asherton&Lardvnth 138 | Del Mar - Laredo Plant 138kV | 3 | $90,507.54 | 6011 |
| DMTSW-SCOSW 345KV | Knapp - Scurry Chevron 138kV | 4 | $86,526.95 |  |
| TWR (345) WHITE\_PT-LON\_HILL & STP | Blessing - Lolita 138kV | 8 | $79,346.78 |  |
| Trses-Scses&Entpr 345kV | Stryker-Cherokee Poi - Stryker Creek Ses 138kV | 4 | $75,291.92 | 4257 |
| DEL MAR to LAREDO PLANT LIN 1 | Laredo Vft North - Milo 138kV | 3 | $73,857.65 |  |
| INGLESIDE COGEN SWITCH to OXYCHEM | Dupont Pp1 - Ingleside - Dupont Switch - Ingleside 138kV | 3 | $60,371.56 |  |
| FAYETTE PLANT 1 to SALEM LCRA LIN | Fayetteville 138/1kV | 5 | $52,885.08 |  |
| BLUFF CREEK TRX BLUF\_CRK\_3\_2 345/1 | Nicole - Orient 138kV | 5 | $37,583.10 |  |
| Adamsville to Evant (3)138/1 | Comanche Switch (Oncor) - Mercers Gap Sw 138kV | 4 | $28,954.33 |  |
| BOSQUE SWITCH to ELM MOTT LIN 1 | Bosque Switch - Rogers Hill Bepc 138kV | 7 | $28,320.07 |  |
| Gail Sub to Key Sub (3)138/1 | Buzzard Draw Switch - Gunsight Switch 138kV | 5 | $21,100.73 |  |
| GRSES-GRVSW (345KV) & BOMSW (138KV | Rice Switch - Markley (Oncor) 138kV | 5 | $12,166.08 | 6028 |
| Fergus-Gilles & Horsba 138kV | Granite Mountain - Marble Falls 138kV | 4 | $8,323.54 | 4465 |
| COLETO CREEK to VICTORIA LIN 1 | Coleto Creek - Victoria 138kV | 3 | $1,841.78 | 16TPIT0034 |

## Generic Transmission Constraint Congestion

There were twenty-one days on the Panhandle GTC, four days on the Valley Import GTC, and one day on the Laredo 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

None.

## Congestion Costs for Calendar Year 2017

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** |
| Rns-Rtw & Sng-Tb 345kv | Singleton - Zenith 345kV | 12,194 | 59,651,673.75 | Houston Import Project |
| Basecase | PNHNDL GTC | 19,546 | 56,539,135.79 |  |
| HCKSW-ALLNC&RNKSW 345kV | Blue Mound - Wagley Robertson 138kV | 5,065 | 45,664,397.58 | 15TPIT0085 |
| Rns-Rtw & Sng-Tb 345kv | Singleton - Zenith 345kV | 8,337 | 31,951,822.06 | Houston Import Project |
| White\_Pt-Mccampbe&Hecker 138 | Whitepoint - Rincon 138kV | 1,352 | 24,325,582.27 | 2979 |
| CRLNW-LWSSW 345kV | Carrollton Northwest - Lakepointe Tnp 138kV | 6,300 | 23,917,330.89 | 5488 |
| NORTH PHARR to POLK AVENUE LIN 1 | North Mcallen - West Mcallen 138kV | 1,713 | 22,925,525.09 | 4493 |
| HCKSW-ALLNC&RNKSW 345kV | Wagley Robertson - Summerfield 138kV | 1,429 | 20,785,800.16 |  |
| NORTH PHARR to PHARR Magic Valley | North Mcallen - West Mcallen 138kV | 703 | 15,031,152.13 | 4493 |
| Hecker\_White\_Pt 138kv | Whitepoint - Rincon 138kV | 1,447 | 14,822,421.12 | 2979 |
| Nedin-Mv\_Wedn4&Mv\_Palm4 138k | Azteca Sub - Se Edinburg 138kV | 1,675 | 13,608,219.01 |  |
| Jewet-Sng 345kV | Btu\_Jack\_Creek - Twin Oak Switch 345kV | 8,517 | 12,201,742.07 | Houston Import Project |
| Victoria-V\_Dupsw 138kV | Formosa - Lolita 138kV | 1,896 | 11,071,428.56 |  |
| Jewet-Sng 345kV | Gibbons Creek - Twin Oak Switch 345kV | 306 | 10,861,578.84 | Houston Import Project |
| White\_Pt-Hecker&I\_Dupsw 138k | Whitepoint - Rincon 138kV | 761 | 9,477,211.29 | 2979 |
| NORTH EDINBURG TRX 1382 345/138 | North Edinburg 345/1kV | 367 | 8,173,743.87 | 5604 |
| Jewet-Sng 345kV | Singleton - Gibbons Creek 345kV | 2,887 | 7,620,579.90 | Houston Import Project |
| Jewet-Sng 345kV | Gibbons Creek - Singleton 345kV | 1,604 | 6,873,716.08 | Houston Import Project |
| FORMOSA GEN FORMOSG12 | Formosa - Lolita 138kV | 77 | 5,518,567.35 |  |
| Re Roserock Solar Plant to F | Barrilla - Fort Stockton Switch 69kV | 719 | 4,768,320.64 | West FarWest Transmission Project |

# System Events

## ERCOT Peak Load

The unofficial ERCOT peak load for the month was 67,617 MW and occurred on June 23rd 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

## New/Updated Constraint Management Plans

Annual Review Completed.

* Two RAPs Removed. No New
* Seven MPs Removed. 5 Added.
* No PCAPs Removed or Added.

## New/Modified/Removed RAS

None.

## New Procedures/Forms/Operating Bulletins

ERCOT has revised the following procedure manuals, effective June 30, 2017

|  |  |
| --- | --- |
| **Procedure Title** | **POB** |
| [Real Time Desk](http://www.ercot.com/content/wcm/pobs/127907/Power_Operations_Bulletin_793.doc) | 793 |
| [Reliability Risk Desk](http://www.ercot.com/content/wcm/pobs/127910/Power_Operations_Bulletin_794.doc) | 794 |
| [Reliability Unit Commitment Desk](http://www.ercot.com/content/wcm/pobs/127913/Power_Operations_Bulletin_795.doc) | 795 |
| [Resource Desk](http://www.ercot.com/content/wcm/pobs/127916/Power_Operations_Bulletin_796.doc) | 796 |
| [Scripts](http://www.ercot.com/content/wcm/pobs/127919/Power_Operations_Bulletin_797.doc) | 797 |
| [Shift Supervisor Desk](http://www.ercot.com/content/wcm/pobs/127922/Power_Operations_Bulletin_798.doc) | 798 |
| [Transmission and Security Desk](http://www.ercot.com/content/wcm/pobs/127925/Power_Operations_Bulletin_799.doc) | 799 |

# Emergency Conditions

## OCNs

|  |  |
| --- | --- |
| **Date and Time** | **Description** |
| 6/20/17 14:04 | OCN issued for Tropical Storm Cindy |

## Advisories

|  |  |
| --- | --- |
| **Date and Time** | **Description** |
| 6/07/17 15:54 | Advisory issued due to Physical Responsive Capability being below 3000 MW |
| 6/22/17 16:43 | Advisory issued due to Physical Responsive Capability being below 3000 MW |
| 6/23/17 14:28 | Advisory issued due to Physical Responsive Capability being below 3000 MW |
| 6/26/17 13:37 | Advisory issued due to Physical Responsive Capability being below 3000 MW |
| 6/28/17 13:34 | Advisory issued due DAM posting delay |
| 6/29/17 16:49 | Advisory issued due to Physical Responsive Capability being below 3000 MW |

## Watches

|  |  |
| --- | --- |
| **Date and Time** | **Description** |
| 6/9/17 10:56 | Transmission Watch issued for the Railroad DC Tie due to no market solution for the post contingency loss of SPOLPHA8 |
| 6/9/17 19:39 | Transmission Watch issued for the Railroad DC Tie due to no market solution for the post contingency loss of SPOLPHA8 |
| 6/21/17 20:25 | Transmission Watch issued for the Railroad DC Tie due to no market solution for a base case overload on the North McAllen to West McAllen 138kv circuit |
| 6/27/17 9:14 | Watch issued for the de-rate of the Railroad DC tie due to Rio Grande Valley import after a forced outage |

## Emergency Notices

None.

# Application Performance

## TSAT/VSAT Performance Issues

None.

## Communication Issues

None.

## Market System Issues

None.

# Model Updates

The Downstream Production Change (DPC) process allows ERCOT to make changes in the on-line Network Operations Model without loading a completely new model. The purpose of this process is to allow for reliable grid operations as system conditions change between designated Network Operations Model database loads. The DPC process is limited in scope to just those items listed below, with equipment ratings updates being the most common. ERCOT has seen a rise in the use of the DPC process to make on-line updates to the Network Operations Model in recent years, instead of through the standard Network Operations Model Change Request process.

* Static Line ratings (Interim Update)
* Dynamic Line ratings (non-Interim Update)
* Autotransformer ratings (non-Interim Update)
* Breaker and Switch Normal status (Interim Update)
* Contingency Definitions (Interim Update)
* RAP and RAS changes or additions (Interim Update)
* Net Dependable and Reactive Capability (NDCRC) values (Interim Update)
* Impedance Updates (non-Interim)

|  |  |
| --- | --- |
| **Transmission Operator** | **Number of DPCs** |

|  |  |
| --- | --- |
| AEP | 5 |
| ONCOR | 12 |
| TMPA | 1 |
| ERCOT | 11 |

# 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** |
| DJEWSNG5 | JK\_TOKSW\_1 | TOKSW | JK\_CK | 29 |
| DRNS\_TB5 | SNGZEN99\_A | SNG | ZEN | 29 |
| DGIBSNG5 | 260\_A\_1 | JEWET | SNG | 25 |
| XFTS89 | PIGTAP\_SOLSTI1\_1 | PIGTAP | SOLSTICE | 25 |
| XFTS89 | PIGTAP\_SOLSTI1\_1 | SOLSTICE | PIGTAP | 25 |
| BASE CASE | PNHNDL | n/a | n/a | 21 |
| SZEPCMN8 | HLD\_FMR1 | HLD | HLD | 15 |
| SPOLPHA8 | GCB\_100\_1 | N\_MCALLN | W\_MCALLN | 15 |
| SBRAUVA8 | HAMILT\_MAVERI1\_1 | HAMILTON | MAVERICK | 13 |
| DHCKRNK5 | 6270\_\_C | WGROB | BLMND | 12 |
| DVICV\_D8 | FORMOS\_LOLITA1\_1 | LOLITA | FORMOSA | 10 |
| SFERZ48 | Y1\_C4\_1 | C4 | Y1 | 10 |
| SMDLODE5 | 6342\_\_A | YUCSW | PBSES | 9 |
| DFPPFAY5 | 192T175\_1 | SMITHV | WINCHE | 9 |
| DWH\_STP5 | BLESSI\_LOLITA1\_1 | BLESSING | LOLITA | 8 |
| SMARZOR5 | 419T419\_1 | CLEASP | MARION | 7 |
| SLAQLOB8 | BRUNI\_69\_1 | BRUNI | BRUNI | 7 |
| SJARDIL8 | DIL\_COTU\_1 | DILLEYSW | COTULAS | 7 |
| DFPPFAY5 | 190T152\_1 | GIDEON | WINCHE | 7 |
| DTRSENT5 | 970\_\_C | ELKTN | LLPOI | 7 |
| XSA2N58 | SANMIGL\_ATAH | SANMIGL | SANMIGL | 7 |
| SBOSELM5 | 1030\_\_B | BOSQUESW | RGH | 7 |
| DNEDPAL8 | AZTECA\_SE\_EDI1\_1 | AZTECA | SE\_EDINB | 6 |
| UCOLCOL1 | BLESSI\_LOLITA1\_1 | BLESSING | LOLITA | 6 |
| DODEMDS5 | MDSSW\_MR1H | MDSSW | MDSSW | 5 |
| DAUSLOS5 | 144T132\_1 | FLATON | HALLET | 5 |
| XLOB58 | ASHERT\_CATARI1\_1 | ASHERTON | CATARINA | 5 |
| XBLU58 | NICOLE\_ORNT1\_1 | NICOLE | ORNT | 5 |
| SKEYWLV8 | 6137\_\_A | GUNSW | BUZSW | 5 |
| SSALFPP5 | FAYETT\_AT2L | FAYETT | FAYETT | 5 |
| DGREBOW5 | 6560\_\_B | MRKLY | RICSW | 5 |
| DMGSQAL5 | 6095\_\_D | LMESA | JPPOI | 5 |
| XNED258 | NEDIN\_138H | NEDIN | NEDIN | 4 |
| DTRSENT5 | 1255\_\_B | SCSES | STCKY | 4 |
| SADALA28 | 663\_\_A | MGPSW | CMNSW | 4 |
| SBEVASH8 | TURTLECK\_WCRYS\_1 | TURTLCRK | WCRYSTS | 4 |
| DFERHOR8 | 342T195\_1 | GRANMO | MARBFA | 4 |
| DMTSCOS5 | 6437\_\_F | SCRCV | KNAPP | 4 |
| DMGSQAL5 | 6137\_\_A | GUNSW | BUZSW | 4 |
| SGIBSN25 | SNGXGC75\_1 | GIBCRK | SNG | 4 |
| BASE CASE | VALIMP | n/a | n/a | 4 |
| BASE CASE | BURNS\_RIOHONDO\_1 | RIOHONDO | MV\_BURNS | 4 |
| DCRLLSW5 | 590\_\_A | LWSSW | LWVJS | 3 |
| SVICCOL8 | COLETO\_VICTOR1\_1 | COLETO | VICTORIA | 3 |
| SDELLAR8 | LARDVN\_MILO1\_1 | LARDVNTH | MILO | 3 |
| SVICCO28 | COLETO\_VICTOR2\_1 | COLETO | VICTORIA | 3 |
| DAUSSND5 | HWRDLN\_1 | HWRDTP | HWRDLN | 3 |
| SOXYING8 | I\_DUPP\_I\_DUPS2\_1 | I\_DUPP1 | I\_DUPSW | 3 |
| DMGSQAL5 | KOCHTAP\_VEALM\_1 | VEALMOOR | KOCHTAP | 3 |
| DNLALAR8 | DEL\_MA\_LAREDO1\_1 | LAREDO | DEL\_MAR | 3 |
| BASE CASE | SNYDER\_WKN\_BK1\_1 | ENAS | WKN\_BKR | 3 |
| DSALHUT5 | 450\_\_A | SNDSW | AUSTRO | 2 |
| DRIOHAR5 | HAINE\_\_LA\_PAL1\_1 | LA\_PALMA | HAINE\_DR | 2 |
| DMGSQAL5 | 6135\_\_E | GVLTP | GYVLM | 2 |
| DPBSHLT8 | 6101\_\_A | NOTSW | CHEYT | 2 |
| SGILHIW8 | GILA\_MORRIS1\_1 | GILA | MORRIS | 2 |
| SMCEABS8 | MKLT\_TRNT1\_1 | TRNT | MKLT | 2 |
| DMGSQAL5 | 6135\_\_A | GYVLM | GUNSW | 2 |
| SSACRED8 | BENFIC\_REDCRE1\_1 | REDCREEK | BENFICKL | 2 |
| SCOLLON5 | VICTO\_WARBU\_1A\_1 | VICTORIA | WARBURTN | 2 |
| SSMIGER8 | 428T428\_1 | SEGUIN | SEGUWE | 2 |
| XESK289 | ESKSW\_FMR1 | ESKSW | ESKSW | 2 |
| BASE CASE | GCB\_100\_1 | N\_MCALLN | W\_MCALLN | 2 |
| SSNDPB28 | LINTER\_SOLSTI1\_1 | LINTERNA | SOLSTICE | 2 |
| SFTLMES8 | LVOK\_SANTIA1\_1 | SANTIAGO | LVOK | 2 |
| SWINPBS8 | PBSES\_MR1H | PBSES | PBSES | 2 |
| SFAICOR8 | 342T195\_1 | GRANMO | MARBFA | 2 |
| SMDLODE5 | 6475\_\_C | ODEHV | TROTP | 2 |
| DCLEZOR5 | 87T233\_1 | MCCALA | HENNE | 2 |
| XFHL89 | HLSES\_MR1H | HLSES | HLSES | 2 |
| SBAKSCH5 | PIGTAP\_SOLSTI1\_1 | SOLSTICE | PIGTAP | 2 |
| DWTRTRC5 | 1750\_\_B | SGOVL | KLBTP | 2 |
| DGIBSNG5 | 240\_\_A | JEWET | SNG | 2 |
| XBLU58 | BALG\_FTCHAD1\_1 | FTCHADBT | BALG | 2 |
| XLOB58 | FREER\_SAN\_DI1\_1 | SAN\_DIEG | FREER | 2 |
| BASE CASE | REROCK\_TLINE\_1 | REROCK | LINTERNA | 2 |
| DCRLLSW5 | 591\_\_A | LKPNT | CRLNW | 2 |
| DCLEZOR5 | 86T235\_1 | HENNE | COMAL | 2 |
| SFTLMES8 | BGLK\_PHBL\_T1\_1 | BGLK | PHBL\_TAP | 2 |
| SPAUSAR8 | CONCHO\_SACH1\_1 | CONCHO | SACH | 2 |
| XNED358 | NEDIN\_1382 | NEDIN | NEDIN | 2 |
| SECTPBS8 | 6485\_\_A | MOSSW | PBSES | 2 |
| SPLDLME8 | 6135\_\_A | GUNSW | GYVLM | 2 |
| DFERHOR8 | 223T180\_1 | LAKEWY | MARSFO | 1 |
| SSCLWF28 | 6840\_\_B | NVKSW | ANARN | 1 |
| SN\_SLON5 | B\_DAVI\_RODD\_F1\_1 | B\_DAVIS | RODD\_FLD | 1 |
| DVICV\_D8 | GREENL\_WEAVER1\_1 | WEAVERRD | GREENLK | 1 |
| SBEVASH8 | HAMILT\_MAVERI1\_1 | HAMILTON | MAVERICK | 1 |
| XHH2G58 | HHGT\_T1H | HHGT | HHGT | 1 |
| DHILMAR5 | P4\_E5\_2\_1 | ELMCREEK | SKYLINE | 1 |
| DJEWSNG5 | 256\_A\_1 | TOKSW | GIBCRK | 1 |
| DTOKJK\_5 | 260\_A\_1 | JEWET | SNG | 1 |
| DCRLREN8 | 3740\_\_C | NHNSW | WELRD | 1 |
| SPALFRO8 | GCB\_100\_1 | N\_MCALLN | W\_MCALLN | 1 |
| BASE CASE | GLE\_MERI\_1 | MERIDIAN | GLENROSE | 1 |
| SWINPBS8 | PBSES\_MR1L | PBSES | PBSES | 1 |
| DTRCELK5 | 1760\_\_A | SHBSW | TYLNW | 1 |
| XLOB58 | DILLEY\_JARDIN1\_1 | DILLEYSW | JARDIN | 1 |
| DLEOPAL8 | E1\_R2\_1 | E1 | R2 | 1 |
| DJFSCRN8 | GBYGP\_17\_A | GBY | GP | 1 |
| XHHG58 | HHGT\_T2H | HHGT | HHGT | 1 |
| SKLELOY8 | LOYOLA\_69\_1 | LOYOLA | LOYOLA | 1 |
| SWOORI38 | TNAF\_FTS\_1 | TNAF | FTST | 1 |
| DAUSLOS5 | 355T255\_1 | FPPYD2 | LYTTON\_S | 1 |
| SZEPCMN8 | 670\_\_B | BRNSW | CMPBW | 1 |
| SSCLWF28 | 6840\_\_A | ANARN | CRDSW | 1 |
| DDL\_KR\_8 | BL\_TAP05\_1 | BL | BL | 1 |
| SPATDCR8 | BOW\_FMR1 | BOW | BOW | 1 |
| DCBYRN28 | CV\_LH\_03\_A | LH | CV | 1 |
| SMCEABS8 | ESKSW\_FMR2 | ESKSW | ESKSW | 1 |
| SGRMGRS8 | OLN\_FMR2 | OLN | OLN | 1 |
| DDOWOAS5 | SN\_STR26\_A | SN | STR | 1 |
| BASE CASE | SWEETWN3\_XT2 | SWEETWN3 | SWEETWN3 | 1 |
| DREARYS8 | 568\_\_A | RYSSW | NEVADA | 1 |
| XWLV258 | 6135\_\_A | GUNSW | GYVLM | 1 |
| SSCLWF28 | 6840\_\_B | ANARN | NVKSW | 1 |
| SILLFTL8 | CTHR\_SONR1\_1 | SONR | CTHR | 1 |
| DENTSCS5 | ELKTN\_MR3L | ELKTN | ELKTN | 1 |
| BASE CASE | LAREDO | n/a | n/a | 1 |
| SILLFTL8 | OZNR\_OZONA1\_1 | OZONA | OZNR | 1 |
| DRNS\_TB5 | SNGZEN98\_A | SNG | ZEN | 1 |
| SWOORI38 | TNAF\_FTS\_1 | FTST | TNAF | 1 |
| DMARZOR5 | 287T301\_1 | SMI | MCQUEE | 1 |
| SKNADM28 | 6240\_\_C | SACRC | DPCRK | 1 |
| XYUC89 | 6485\_\_A | MOSSW | PBSES | 1 |
| SMDLODE5 | PIGTAP\_SOLSTI1\_1 | SOLSTICE | PIGTAP | 1 |
| XRN2K58 | RNKSW\_MR2H | RNKSW | RNKSW | 1 |
| SWINWIN8 | WINKS\_MR2L | WINKS | WINKS | 1 |
| SREDMCC8 | 102T375\_1 | MCCALA | RNRD12 | 1 |
| DLOCRED8 | 144T132\_1 | FLATON | HALLET | 1 |
| DMARZOR5 | 505T505\_1 | CLEASP | GERONI | 1 |
| XFTS89 | 6342\_\_A | PBSES | YUCSW | 1 |
| DMARZOR5 | 91T335\_1 | COMAL | LOP337 | 1 |
| XLOB58 | BESSEL\_LON\_HI1\_1 | LON\_HILL | BESSEL | 1 |
| DSTPWHI5 | BLESSI\_LOLITA1\_1 | BLESSING | LOLITA | 1 |
| BASE CASE | BURNS\_HEIDLBRG\_1 | MV\_BURNS | MV\_HBRG4 | 1 |
| XLOB58 | COT\_HOLA\_1 | COTULAS | HOLANDS | 1 |
| DMLSENT5 | ELKTN\_MR3L | ELKTN | ELKTN | 1 |
| SWINWIN8 | PBSES\_MR1H | PBSES | PBSES | 1 |
| DMGSQAL5 | PIGTAP\_SOLSTI1\_1 | SOLSTICE | PIGTAP | 1 |
| SSNDPB28 | PIGTAP\_SOLSTI1\_1 | SOLSTICE | PIGTAP | 1 |
| SFTLMES8 | SANTIA\_SAPOWE1\_1 | SAPOWER | SANTIAGO | 1 |
| XSND58 | SNDSW\_MR2H | SNDSW | SNDSW | 1 |
| SWINWIN8 | WINKS\_FMR1 | WINKS | WINKS | 1 |
| SWINPBS8 | 6101\_\_A | NOTSW | CHEYT | 1 |
| SSNDPB28 | 6345\_\_B | GNTSW | SPRTP | 1 |
| XESK289 | 6940\_\_A | CLCTY | LORAN | 1 |
| SCR3CRL8 | 710\_\_A | CRLNW | NLSES | 1 |
| SRODB\_D8 | AIRLIN\_CABANI1\_1 | AIRLINE | CABANISS | 1 |
| XLME489 | LMESA\_FMR1 | LMESA | LMESA | 1 |
| DELMSAN5 | PAWNEE\_SPRUCE\_1 | CALAVERS | PAWNEE | 1 |
| SBAKBIG5 | PIGTAP\_SOLSTI1\_1 | SOLSTICE | PIGTAP | 1 |
| XFRI89 | SONR\_69-1 | SONR | SONR | 1 |
| SFERG08 | Y1\_C4\_1 | C4 | Y1 | 1 |