



West-North Stability Limits 2011-2012 Update

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RPG

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- **ERCOT began monitoring the West-North Stability Limit in 2007**
 - Monitored by Oncor prior to 2007
- **Main concern was undamped/ lightly damped oscillations between synchronous generation in west Texas and synchronous generation in the rest of ERCOT when west Texas had high power exports**
- **Limit is monitored by measuring flow on six 345 kV lines:**
 - Long Creek-Graham/ Cook Field to Graham
 - Tonkawa-Graham
 - Bowman-Graham
 - Bowman-Jacksboro
 - Red Creek-Comanche

Background continued (What is the matrix?)

- **Real-time calculation of limit is not practical at this time**
 - Annual offline study performed to calculate limits given certain key operating conditions that affect those limits
- **Matrix of various transmission outage and generation combinations used by ERCOT Operations to determine limit in real-time**
 - Current matrix has 14 transmission outage scenarios involving 345 kV lines in west Texas
 - Current matrix has 72 generation scenarios involving synchronous generation in west Texas (posted public version is simplified to 18)
 - Values in matrix can be based on voltage stability limit, small signal stability (oscillation) limit or transient stability limit
 - Whichever is most limiting for that cell in the matrix



- **Used DWG 2010 summer peak flat start case**
- **Conservative assumptions:**
 - Summer peak load conditions
 - Wind generation modeled as negative load
 - 3-phase bus fault contingencies
- **13 of the 72 generation scenarios...**
 - Covered 88% of the hours in 2010
 - Covered 90% of the hours in 2010 when the load was < 50 GW
 - Covered 97% of the hours in 2010 when the wind output was > 5 GW
- **6 of the 72 generation scenarios...**
 - Covered 88% of the hours in 2010 when the load was < 31 GW
 - Covered 97% of the hours in 2010 when the load was < 31 GW and the wind output was > 5 GW



- **In late 2010 ERCOT observed that between July 21, 2010 and November 28, 2010 one particular cell in the matrix was limiting 73% of the hours when the W-N Stability Limit was binding**
 - Further investigation revealed that the limit in that cell was based on a voltage stability limit
 - Used the 2010 HWHL case from the VRT study to calculate a new limit for lower load conditions (< ~53 GW Operations Load)
 - Limit increased > 600 MVA
 - Implemented 3rd dimension (load-based) matrix in ERCOT Operations
- **In spring 2011, construction/ maintenance outages caused transmission conditions to fall outside of existing matrix**
 - ERCOT performed specific planning studies for each transmission scenario for a limited number of generation scenarios

2011-2012 Matrix Question

- Do you want the red pill or the blue pill?
- Study case options



Case	Pros	Cons
Use existing matrix based on DWG 2010 Summer Peak Case	<ul style="list-style-type: none"> • Little change since last year • Frees resources to work on other priority work • Conservative assumptions 	<ul style="list-style-type: none"> • Overly conservative load? • No wind dynamic models
DWG 2011 Summer Peak Case	<ul style="list-style-type: none"> • Wind dynamic models • Conservative load 	<ul style="list-style-type: none"> • Overly conservative load?
VRT 2010 HWHL (~58 GW Load)	<ul style="list-style-type: none"> • Wind dynamic models • Middle-ground load level 	<ul style="list-style-type: none"> • Load level would not cover all situations
VRT 2010 HWLL (~36 GW Load)	<ul style="list-style-type: none"> • Wind dynamic models • Low load level may better correspond to high west export times 	<ul style="list-style-type: none"> • Load level would not cover all situations

2011-2012 Matrix Solution

- **Create three sets of tables based on load:**

1. **Summer peak table to be used when Operations load is $> \sim 53$ GW**

8% of 2010 hrs

- Copy of 2010-2011 matrix
- Add “worst-case” transmission outage scenario

2. **Mid-level load table to be used when Operations load is $< \sim 53$ GW and $> \sim 31$ GW**

67% of 2010 hrs

- Copy of 2010-2011 matrix
- Calculate and replace limits for the 13 high probability generation scenarios using the VRT 2010 HWHL case
- Add several multi-line outage scenarios, including a “worst-case” transmission outage scenario

3. **Off peak table to be used when Operations load is $< \sim 31$ GW**

25% of 2010 hrs

- Copy of Mid-level load table
- Calculate and replace limits for the 6 off peak high probability generation scenarios using the VRT 2010 HWLL case
- Add several multi-line outage scenarios, including a “worst-case” transmission outage scenario

- **Will need to look at impact and timing of CREZ facilities**
 - **Expected stability limit impact will be from the addition of these lines*:**
 - Brown-Killeen 345 kV line
 - Riley-Bowman 345 kV line
 - Riley-Krum West 345 kV line
 - West Shackelford-Sam Switch/ Navarro 345 kV line
 - Clear Crossing-Willow Creek 345 kV line
 - Big Hill-Kendall 345 kV line
 - **Other stability limits may need to be defined**
- * Speculative at this point – no studies have been run to verify

Questions?