NERC Frequency Response Standard, Current Status, Issues and 2010 to 2013 Field Trial Results

For: Operating Reliability Subcommittee (ORS)

By: Carlos Martinez – CERTS/ASR
Minneapolis, MN September 10, 2013
Frequency Response Standard (BAL-003)
Background, Current Status, Issues and Timeline
NERC Frequency Response Standard BAL-003
Current Status and Timeline

- **2007 March**: FERC Order 693 Requesting Changes to BAL-003, Defining Requirements for Frequency Response
- **2010 October**: FERC Extended Time for BAL-003 Mods to May 2013
- **2013 January**: Industry Voted and Approved BAL-003 Approved by NERC Board
- **2013 April**: BAL-003 Filed with FERC
- **2013 July**: FERC NOPR Proposing Approval for BAL-003 & Concerns with Primary Control Sustainability and Use of Medians for FRM
- **2013 4th Quarter**: NERC Response to NOPR and Expected FERC Approval
- **2015 January**: BAL-003 Requirements Effective
FERC NOPR Concern and Possible Directive on Early Withdrawn (Sustainability) of Primary Frequency Response

2010-2013 Field Trial Results and Trends on Sustainability
# Candidate Generation and Load Events - Identification Criteria, Yearly Number of Events from 2010 to 2013

**Criteria 1 (2010)** – Events in black color in monthly report:

<table>
<thead>
<tr>
<th>Interconnections</th>
<th>Events/Frequency Delta</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern</td>
<td>Total Events</td>
<td>Generation=90, Load=11</td>
<td>Generation=121, Load=21</td>
<td>Generation=98, Load=15</td>
<td>Generation=81, Load=8</td>
</tr>
<tr>
<td></td>
<td>Frequency Delta</td>
<td>+/- 36 mHz</td>
<td>+/- 40 mHz</td>
<td>+/- 40 mHz</td>
<td>+/- 40 mHz</td>
</tr>
<tr>
<td>Western</td>
<td>Events</td>
<td>Generation=81, Load=3</td>
<td>Generation=63, Load=3</td>
<td>Generation=62, Load=4</td>
<td>Generation=39, Load=2</td>
</tr>
<tr>
<td></td>
<td>Frequency Delta</td>
<td>+/- 60 mHz</td>
<td>+/- 70 mHz</td>
<td>+/- 70 mHz</td>
<td>+/- 70 mHz</td>
</tr>
<tr>
<td>ERCOT</td>
<td>Events</td>
<td>Generation=153, Load=75</td>
<td>Generation=174, Load=40</td>
<td>Generation=95, Load=10</td>
<td>Generation=56, Load=2</td>
</tr>
<tr>
<td></td>
<td>Frequency Delta</td>
<td>+/- 70 mHz</td>
<td>+/- 90 mHz</td>
<td>+/- 90 mHz</td>
<td>+/- 90 mHz</td>
</tr>
<tr>
<td>Hydro Quebec</td>
<td>Events</td>
<td>Generation=10, Load=0</td>
<td>Generation=29, Load=26</td>
<td>Generation=35, Load=20</td>
<td>Generation=35, Load=31</td>
</tr>
<tr>
<td></td>
<td>Frequency Delta</td>
<td>+/- 250 mHz</td>
<td>+/- 300 mHz</td>
<td>+/- 300 mHz</td>
<td>+/- 300 mHz</td>
</tr>
</tbody>
</table>

**Criteria 2 (2011)** – Events in pink color in monthly report:

Events reported by NERC-SA Group

**Criteria 3 (2013)** – Events in yellow color in monthly report:

**Eastern**: If frequency delta is greater than 30 mHz and the lowest frequency is below 59.96 Hz within the same 15-sec. window.

**ERCOT**: If lowest frequency is below 59.90 Hz or highest frequency is above 60.10 Hz in a 15-sec. window.

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**CERTS**

Consultant for Electric Reliability - Technology Solutions

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Eastern Mean Frequency Profiles Using Mean of Same Second for Generation Candidate Events from 2010 to 2013
Western Frequency Profiles Using Mean of Same Second for Generation Candidate Events from 2010 to 2013

- **2010**: Candidate Events = 81
- **2011**: Candidate Events = 63
- **2012**: Candidate Events = 62
- **2013**: Candidate Events = 39

**Yearly Candidate Events Time [Seconds]**

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ERCOT Mean Frequency Profiles Using Mean of Same Second for Generation Candidate Events from 2010 to 2013

Yearly Candidate Events Mean Frequency [Hz]

2010
2011
2012
2013

Yearly Candidate Events Time [Seconds]

Candidate Events= 153
Candidate Events= 174
Candidate Events= 95
Candidate Events= 56

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Hydro Quebec Mean Frequency Profiles Using Mean of Same Second for Generation Candidate Events from 2010 to 2013

Yearly Candidate Events Mean Frequency [Hz]

Yearly Candidate Events Time [Seconds]

Candidate Events = 10 29 35 35

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Interconnections Mean Frequency Profiles Using Mean of Same Second for Generation Candidate Events 2010 to 2013

Yearly Candidate Events Mean Frequency [Hz]

2010 | 2011 | 2012 | 2013

Eastern | Western | ERCOT

Yearly Candidate Events Time [Seconds]

Candidate Events: 90, 81, 153
Candidate Events: 121, 63, 174
Candidate Events: 93, 62, 95
Candidate Events: 81, 39, 56

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Mean Frequency Profiles Using Mean of Same Second for Generation Candidate Events from 2010 to 2013

- **Eastern**
- **Western**
- **ERCOT**

Yearly Candidate Events Time [Seconds]

Candidate Events:
- **2010**: 90, 81, 153
- **2011**: 121, 63, 174
- **2012**: 93, 62, 95
- **2013**: 81, 39, 56
Interconnections Frequency Response Sustainability Indices 2010 to 2013
Frequency Profile for Eastern 2003 Blackout (FERC NOPR)
NERC FRI Propose Sustainability Index Definition

Sustainability Index = \( \text{Mean}(\text{FreqT45 to FreqT180}) - \text{FreqValueB} \) [mHz]
Sustainability Index for Generation Events 2010 to 2013

\[ \text{Mean}(\text{FreqT}45 \text{ to FreqT}180) - \text{FreqValueB} \] \[ \text{[mHz]} \]

**NOTE:** A negative index (red points) is an indication of early withdrawal of primary frequency response.
Mean Frequency Profiles Using Mean of Same Second for Generation Candidate Events from 2010 to 2013

Yearly Candidate Events Mean Frequency [Hz]

Yearly Candidate Events Time [Seconds]

Candidate Events: 90, 81, 153, 10
Candidate Events: 121, 63, 174, 29
Candidate Events: 93, 62, 95, 33
Candidate Events: 81, 39, 56, 35

Eastern, Western UFLS First Step
ERCO=59.30[Hz], HQ=58.50[Hz]

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