NASPI
Planning Implementation
Task Team

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October 5, 2010
Agenda

1. NASPI PITT Workplan

2. Baselining Power System Performance

3. Synchro-phasor Data Validation

4. Ian Dobson’s presentation
1. Planning Workplan

- Align with the needs of SGIG projects

Workplan

1. Baselining of Power System Performance
2. System Model Validation
3. Load Characterization
4. Data Mining and Event Detection
5. Sycnhro-Phasor Data Validation

- Presented to NERC PC
2. Power System Performance Baselining

- Phase angles across an interconnection
- Frequency response
  - pre-disturbance, dip and settling frequency, time of minimum dip, size of generation event, etc
- Power Oscillations
  - frequency, damping, energy, mode shapes
- Voltage stability and power-angle sensitivities
- ...

Western Interconnection Baselining
Phase Angle Baselining

- No work is currently done for 2010

- Need to define phase angle clusters (look forward to Ian Dobson’s talk)

- Need to develop a tool that generates monthly baselining reports
Frequency Response Baseline for the Western Interconnection

WECC MW per 0.1 Hz response, ON-PEAK

WECC MW per 0.1 Hz response, OFF-PEAK
Palo Verde Unit Outage, June 18 2010
1,334 MW
Relestone Plant Outage, June 23 2010
1,470 MW
Relestone Plant Outage, June 23 2010
1,430 MW
RAS Event, September 27 2010
2,529 MW generation, 1005 load

Round Mountain - Table Mountain #1 opened
Chief Joseph 1400 MW brake insertion

Round Mountain - Table Mountain #2 opened
AC RAS Gen.drop 2529 MW

DWR Load shed of 1005 MW?
## Frequency Response Summary

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Event Information</th>
<th>Disturbance Size (MW)</th>
<th>Load Loss (MW)</th>
<th>MW/0.1 Hz @ 0.1 Hz</th>
<th>MW/0.1 Hz @ 30 seconds</th>
<th>Initial Frequency (Hz)</th>
<th>Minimum Frequency (Hz)</th>
<th>Frequency at 30 seconds (Hz)</th>
<th>WECC Total Generation (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-06-05</td>
<td>10:18</td>
<td>Intermountain 2-unit simultaneous outage</td>
<td>1900</td>
<td>872</td>
<td>1357</td>
<td>59.99</td>
<td>59.772</td>
<td>59.85</td>
<td>103,011</td>
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<td>2010-06-18</td>
<td>8:07</td>
<td>Palo Verde U1 outage</td>
<td>1334</td>
<td>883</td>
<td>1647</td>
<td>59.997</td>
<td>59.846</td>
<td>59.916</td>
<td>100,989</td>
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<td>2010-06-23</td>
<td>12:45</td>
<td>Revelstoke plant outage</td>
<td>1470</td>
<td>942</td>
<td>1652</td>
<td>59.997</td>
<td>59.841</td>
<td>59.908</td>
<td>119,771</td>
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<td>2010-06-23</td>
<td>14:13</td>
<td>Revelstoke plant outage</td>
<td>1430</td>
<td>941</td>
<td>1723</td>
<td>60.002</td>
<td>59.85</td>
<td>59.919</td>
<td>122,046</td>
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<td><em>NORM-ON PEAK</em></td>
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<td><em>NORM OFF-PEAK</em></td>
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<td><em>DESIGN</em></td>
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* Consider using total generation rather than time of day as an indicator
Oscillations Baselining

- Mode Meter estimates damping of inter-area power oscillations from ambient noise data

![Graph showing Malin500 voltage over time](image)
Oscillations Baselining

- Dan Trudnowski did the original oscillation baselining for 2008 season
  - Reported at NASPI meeting in Vancouver
- A baselining tool is installed in BPA lab in May 2010
  - Many unusual operating conditions during 2010
WECC Open Loop Operation – July 29, 2010

The diagrams show data from the WECC Open Loop Operation for July 29, 2010, with the following metrics:

- Top diagram: Damp (%) plotted over time (24 hours).
- Middle diagram: Frequency (Hz) plotted over time (24 hours).
- Bottom diagram: Frequency spectrum over time (24 hours).

The data from BEL2 MW is highlighted in the top diagram.
Alberta separated – September 2, 2010

3 hours
Observations

- Greater variability in oscillation damping and frequency on daily scale compared to 2008
  - Trying to understand the reasons
- Significantly less consistency in damping estimates (5% to 20% swings over 20 min period)
  - Need to understand the performance issues

Need to develop a tool that generates monthly baselining reports

Take a closer at the unusual operating conditions
3. Synchro-Phasor Data Validation

- PMU data can be corrupted, and the data quality flags may not be able to tell you that.
- How to make sure that the synchro-phasor data can be trusted for real-time applications – operator alarms or automated controls?
- The data can look “unusual” because (a) the data is corrupted or (b) the system goes through a disturbance. How can we tell the difference?
Ian Dobson