BPA’s Annual Joint Operating Committee Annual Meeting

February 2, 2022
Agenda

1. Welcome and Introductions (10 min) Cherilyn Randall
2. NERC IRPTF Recommendations, IEEE P2800, and implications for new generator interconnections – (30 to 45 min) Ryan Quint (NERC)
3. BPA Generator Interconnection checklist (15 min) – Dave Kirsch
4. Test requirements, what we expect from GOs (15-20 min) – Elliott Mitchell-Colgan
5. Q&A (15 min)
6. Break (10 min)
7. Upcoming EMT modeling (10 min) – Jeff Barton
8. Oversupply Management Protocol (30 min) Sarah Arison
9. Long term outages for this upcoming year (15 min) Cherilyn Randall
10. Q&A (15 min)
Introduction & JOC Rules
JOC Rules

- JOC meetings are open meetings to all interested parties, though they are targeted towards generation owners/operators.

- Non-JOC member participation can be limited to ensure JOC members (BPA and generator owners/operators) are able to address all issues.
JOC Rules Continued

- JOC members (BPA and generator owners/operators) may propose agenda items, recurring or non-recurring, for future JOC meetings.

- JOC meetings are for discussing and reporting on operational issues that affect large portions of the generation fleet. Development of new policies or procedures may require a series of meetings outside the JOC meetings. Issues that affect only one or two generators will be handled outside the JOC.
NERC IRPTF
Ryan Quint, NERC
Generator Interconnection Checklist
Generator Interconnection Checklist

• Standard was created in the Technical Operations workgroup.

• Replaces the older “Operations Requirements for Generation Interconnection, STD-N-000002” standard.

• Supporting document to the BPA STD-N-000001 “Technical Requirements for Interconnection to the BPA Grid”.

• Details a process required by BPA for a generator commencing operations approximately 180 days prior to Commercial Operations.
Old BPA Standard: “Operations Requirements for Generation Interconnection, STD-N-000002”

- Created in 2010 to add clarification to wind generators integrating onto the grid.
- Focused primarily on BPA Control Center needs 6 weeks prior to Commercial Operations (metering, SCADA displays, AGC controls, RAS).
- New controls, design and operating requirements were created specific to variable generation. Those items were mentioned for coordination.
Old BPA Standard: “Operations Requirements for Generation Interconnection, STD-N-000002”

The standard required updating:

• New technology developed since 2010
• Clarify unclear expectations and requirements (customers and internal BPA organizations).
• Use milestones consistent with FERC LGIA definitions (In-Service/Backfeed, Initial Synchronization, Trial Operations, Commercial Operations).
• Addition of generator Trial Operations testing period as a requirement to Commercial Operations.
New Standard

• Three documents were created, all inter-related (Excel for worksheet through process, Word and Visio for clarity)
  
  • Generation Commissioning Milestones Required for Commercial Operations, STD-N-000001, Number 02 (Word Document)
  
  • Generation Commissioning Task Checklist Required for Commercial Operations, STD-N-000001, Number 03 (Excel Document)
  
  • Generation Commissioning Process Flow for Commercial Operations, STD-N-000001, Number 04 (Visio Document)
STD-N-000001, Number 02 (Word Document)

- Intent is to provide clarifications for common questions and misunderstandings.
- Layout aligns with other two documents.
- Key milestones outlined showing steps towards Commercial Operations.
**STD-N-000001, Number 03 (Excel Document)**

- Intent is to provide specific tasks and ownership and is the tool used during coordination meetings.
- Key terms are defined in a sheet within the document.
- Layout aligns with other two documents.
- Steps can be added or removed as needed.
- Milestone 1 ends with In-Service and backfeed.

### Generator Interconnection Checklist

<table>
<thead>
<tr>
<th>Category</th>
<th>Task Description</th>
<th>Data Init</th>
<th>Data Complete</th>
<th>Days to Init</th>
<th>Days to Complete</th>
<th>Parent</th>
<th>Owner</th>
<th>Status</th>
<th>Notice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation and posting of the design model is complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC modeling is submitted</td>
<td>150</td>
<td>07/25/21</td>
<td>PM</td>
<td>PM</td>
<td>Report Manager</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial BPA TCC, AC, Customer Kickoff Meeting</td>
<td>90</td>
<td>10/23/21</td>
<td>TTIE</td>
<td>TTIE</td>
<td>SCADA AC Coordinating Team</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCADA AC points list is published in EPR</td>
<td>10</td>
<td>10/23/21</td>
<td>TTIE</td>
<td>TTIE</td>
<td>SCADA Modeling Team</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generator one line and interconnection block diagrams are provided</td>
<td>90</td>
<td>10/23/21</td>
<td>GOUTI</td>
<td>GOUTI</td>
<td>Generator Operator Contact</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power studies, voltage stability studies are complete and applications (SCAs) are approved</td>
<td>90</td>
<td>10/23/21</td>
<td>TOOP</td>
<td>TOOP</td>
<td>TOOP Study Engineer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coordinate with Project Management, and Field Construction as needed</td>
<td>90</td>
<td>10/23/21</td>
<td>TOOC</td>
<td>TOOC</td>
<td>TOOC Project Manager</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Document the MTF limit for the kiln operations period</td>
<td>60</td>
<td>11/21/21</td>
<td>TOOP</td>
<td>TOOP</td>
<td>TOOP Projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remedy agreements (ASAS and/or local or GSO) is TOD</td>
<td>60</td>
<td>11/21/21</td>
<td>TSE</td>
<td>TSE</td>
<td>Account Executive</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All PAS NETW/DEC Requirements met</td>
<td>60</td>
<td>11/22/21</td>
<td>TOOC</td>
<td>TOOC</td>
<td>TOOC Project Manager</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generator Supplies all Technical Plant Data to TOO</td>
<td>60</td>
<td>11/22/21</td>
<td>TPX</td>
<td>TPX</td>
<td>Customer Service Executive</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Days Communication Systems Turn-Up Engine</td>
<td>30</td>
<td>12/1/21</td>
<td>TFX</td>
<td>TFX</td>
<td>Field POC, Coordinating, CC POC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generator 3 interconnection is registered to EIP (Electric Industry Registry)</td>
<td>30</td>
<td>12/1/21</td>
<td>TFX</td>
<td>TFX</td>
<td>Field POC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer connected to GRS</td>
<td>30</td>
<td>12/1/21</td>
<td>TFX</td>
<td>TFX</td>
<td>Field POC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POC communication equipment released to BPA Operations</td>
<td>30</td>
<td>12/22/21</td>
<td>TFX</td>
<td>TFX</td>
<td>Field POC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Determine if an emergency operations threshold is necessary, if the 30-day line is not an unacceptable</td>
<td>30</td>
<td>12/22/21</td>
<td>TFC</td>
<td>TFC</td>
<td>Field POC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer supplied DTS, one battery, (one, occurred, 3, battery, five, battery) communication equipment</td>
<td>30</td>
<td>12/22/21</td>
<td>TFC</td>
<td>TFC</td>
<td>Field POC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid Bus monitors, tested and ready to BPA Operations</td>
<td>30</td>
<td>12/21/21</td>
<td>TFX</td>
<td>TFX</td>
<td>Field POC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notify Control Center teams, Field and any Generator related ops of upcoming backfeed data</td>
<td>30</td>
<td>12/22/21</td>
<td>TFX</td>
<td>TFX</td>
<td>Field POC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All site equipment modeled and initial full tests passed (including inverter, DTS, One Battery, Tocs, CTs, PTs, meters and communication equipment)</td>
<td>14</td>
<td>01/07/22</td>
<td>TFX</td>
<td>TFX</td>
<td>Field POC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final design, tested, and ready to BPA Operations</td>
<td>14</td>
<td>01/07/22</td>
<td>TFX</td>
<td>TFX</td>
<td>Field POC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial metering successful on Generation Line</td>
<td>14</td>
<td>01/07/22</td>
<td>TFX</td>
<td>TFX</td>
<td>Field POC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Pre-decisional. For Discussion Purposes Only.**
• Milestone 2 ends with Initial Sync of the generator.
• Milestone 3, Trial Operations, is new.

- The main activity in Milestone 3 is testing the Voltage and Frequency controls.
- Tests are outlined in Required Voltage and Frequency Control Performance Commissioning Tests, STD-N-000001, Number 01.
- If future test requirements are added, this standard will outline them.

<table>
<thead>
<tr>
<th>Milestone 2: Initial Sync</th>
<th>01/21/22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant calls BPA Dispatch and sync to grid</td>
<td>GO, TPX, GO, BPA Field</td>
</tr>
<tr>
<td>Verify Final Relay In-Service Test</td>
<td>TFX/TE</td>
</tr>
<tr>
<td>Verify Final Meter In-Service Test</td>
<td>TSE Field Engineer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Milestone 3: Trial Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Go has been made aware:</td>
</tr>
<tr>
<td>• How to call on Contingency Reserves</td>
</tr>
<tr>
<td>• How to schedule</td>
</tr>
<tr>
<td>• Points of contact for BPA operational requirements</td>
</tr>
<tr>
<td>Successful validation of meter to control center systems</td>
</tr>
<tr>
<td>Successful test of the OGB/PGM response</td>
</tr>
<tr>
<td>All field equipment has been released to BPA Operations</td>
</tr>
<tr>
<td>Voltage and Frequency Control testing is completed and approved per &quot;Required Voltage and Frequency Control Performance Commissioning Tests&quot; supplemental document to Standard N-000001</td>
</tr>
<tr>
<td>Voltage and Frequency Control tests are submitted to and validated by BPA Ops &amp; Transmission Planning</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Milestone 4: Commercial Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Operations letter is sent to the customer from the AE, GO is allowed to schedules power for sale</td>
</tr>
</tbody>
</table>

Pre-decisional. For Discussion Purposes Only.
Trial Operations test results are required and will be reviewed by BPA.

Milestone 4 is the Commercial Operations designation for the generator. This will be communicated through the Account Executive after all tasks are complete to BPA’s expectations.
• Intent is to show high level process flow for quick glance and as an aid during coordination meetings.
Voltage and Frequency Control Testing

- Required Voltage and Frequency Control Performance Commissioning Tests, STD-N-000001, Number 01.

- These tests are referred to during the Milestone 3, Trial Operations phase.

- This supporting document and the three generator commissioning discussed are referred to in BPA’s Technical Requirements for Interconnection to the BPA Transmission Grid standard.
Questions?
Commissioning Tests for Voltage & Frequency Control
Commissioning Tests for Voltage and Frequency Control

- Purpose of Testing:
  - Verify voltage control performance, frequency control performance, and plant reactive capabilities prior to releasing the plant to commercial operation

- Scope of commissioning test requirements
  - Voltage control
  - Plant reactive capability at low active power output
  - Frequency tests
Measurements and Terminology

High side of step-up transformer
Not necessarily POI,
POI pertains to ownership

PCC Voltage
PCC Active and Reactive Power
Collector Substation Voltage

230-kV
34.5-kV

Status
Voltage Control Requirements R1

According to Technical Requirements for Interconnection to the BPA Transmission Grid STD-N-000001:

- The power plant shall operate in **voltage control mode with no dead-band**.
- The power plant shall demonstrate effective **reactive power droop of 7-12%**
  - The reactive droop requirement applies at the Point of Common Coupling.
- Required reactive power rise time is **less than 5 seconds**
- The power plant voltage controller shall coordinate control of all plant level shunt capacitors and reactors where they are required by interconnection requirements.
Voltage Control Test T1

- Expected performance in figures

Reactive Droop

\[ \text{Reactive Droop} = -\left( V_{\text{step, pu}} - \Delta V_{\text{pu}} \right) / \left( \Delta Q_{MVAR} / \text{Plant MW}_{\text{base}} \right) \]
Sample Calculation of Reactive Droop

<table>
<thead>
<tr>
<th>Description / Variable Name</th>
<th>Initial</th>
<th>@ 5[s]</th>
<th>@ 30[s]</th>
<th>Delta (Δ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage Step (PU) / $V_{step,pu}$</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>-0.03</td>
</tr>
<tr>
<td>PCC Voltage V (PU of 230 kV) / $V_{pu}$</td>
<td>1.045</td>
<td></td>
<td>1.033</td>
<td>-0.012</td>
</tr>
<tr>
<td>Plant PCC Reactive Power Q (Mvar) / $Q_{MVAR}$</td>
<td>-5</td>
<td>-28</td>
<td>-30</td>
<td>-25</td>
</tr>
<tr>
<td>MW Base / $MW_{base}$</td>
<td>125</td>
<td>125</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Droop</td>
<td></td>
<td></td>
<td></td>
<td>0.09</td>
</tr>
<tr>
<td>Change in Q within Rise Time as a % of total change</td>
<td>0</td>
<td>-23</td>
<td>-25</td>
<td>92%</td>
</tr>
</tbody>
</table>

Example: 125 MW wind power plant

A 3% voltage step down test resulted in a 1.2% voltage decrease and -25 Mvar reactive power decrease at the PCC.

Reactive Droop = \( \left( -0.03 - (-0.012) \right) / (-25 / 125) = 0.09 \), or 9%
Reactive Capability Requirement R2

- BPA requires capability of providing the Minimum Plant Reactive Capability.
- Minimum Plant Reactive Capability is defined as +/-33% of the plant’s nameplate MW in dynamic MVARs at the POM.
- Reactive capability verification is also required by the NERC MOD-025 Standard.

![Figure: rectangular PQ requirement.](image)

- $Q_{\text{max}} = 33\% P_{\text{gen}_{\text{max}}}$
- $Q_{\text{min}} = -33\% P_{\text{gen}_{\text{max}}}$
Sample Q at Low Power Output Calculation

<table>
<thead>
<tr>
<th>Description / Variable Name</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative Input Voltage Reference Step (PU) / ( V_{step,pu} )</td>
<td>4%</td>
</tr>
<tr>
<td>MW Base / ( MW_{base} )</td>
<td>125</td>
</tr>
<tr>
<td>Reactive Power Absorbed at PCC (Mvar) / ( Q_{min} )</td>
<td>47</td>
</tr>
<tr>
<td>Plant PCC Reactive Power Q (%) / ( Q_{pu} )</td>
<td>37.6%</td>
</tr>
</tbody>
</table>

Example: 125 MW wind power plant

*The plant is producing 0 MW and 0 Mvar. Then a 2% voltage step down, and 4 additional 0.5% steps test resulted in the plant absorbing (bucking) 47 Mvar at the PCC.*

*Reactive Capability at Low Power Output* = \( \frac{47}{125} \times 100 = 37.6\% \). This exceeds 33%, and thus passes the test.
Frequency Control Requirements R3

According to Technical Requirements for Interconnection to the BPA Transmission Grid STD-N-000001:

- Power-frequency controller governor droop should be set between 3% and 5%.
- The total governor dead band (intentional plus unintentional) not to exceed +/-0.06% of 60HZ (+/-36 mHZ).
- Plant secondary controls, such as load controllers, when used, must have a frequency bias setting, ensuring that plant controls do not restrict frequency response.
Frequency Control
Performance Test R3

- Expected performance in figures

\[ \text{Governor Droop} = \frac{\Delta f_{pu}}{\Delta P_{MW}} / \text{PlantMW}_{\text{base}} \]
# Sample Calculation of Frequency Droop

<table>
<thead>
<tr>
<th>Description / Variable Name</th>
<th>Initial $t=t_0=0$[s]</th>
<th>$t = 5$[s]</th>
<th>$t = 30$[s]</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Step (MW) / $-F_{\text{step,pu}}$</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>0.01</td>
</tr>
<tr>
<td>Plant PCC Active Power (MW) / $P_{\text{MW}}$</td>
<td>90</td>
<td>70</td>
<td>68</td>
<td>-22</td>
</tr>
<tr>
<td>MW Base / $MW_{\text{base}}$</td>
<td>125</td>
<td>125</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Droop</td>
<td></td>
<td></td>
<td></td>
<td>0.0568</td>
</tr>
<tr>
<td>MW Change within Rise Time as a % of total change</td>
<td>0</td>
<td>20</td>
<td>22</td>
<td>90.9%</td>
</tr>
</tbody>
</table>

A 125 MW wind power plant was operating at 90 MW on average prior to the step in frequency setpoint. Following the 1% step in frequency setpoint, the plant MW output reduced to 68 MW on average (at $t_0 + 30$[s]).

Active Droop = $-0.01 / \left( \frac{68-90}{125} \right) = 5.68\%$, which is within the test accuracy accounting for generation variability, and therefore would be considered to pass the 5% requirement.
Submit to BPA Transmission Customer Service Engineer

Provide CSV file with test recordings with the following specifications:

- minimum sample rate of 30 samples per second
- PCC voltage (kV or per unit)
- PCC Active power (MW)
- PCC Reactive power (Mvar)
- 34.5 kV voltage (kV or per unit)
- shunt capacitor and reactor status/Mvars, if applicable
Links and References

- BPA Standard STD-N-000001 “Technical Requirements for Interconnection”:


- IEEE P2800: https://standards.ieee.org/project/2800.html

- FERC Orders:
  - Order 827: https://www.ferc.gov/sites/default/files/2020-06/RM16-1-000.pdf
  - Order 842: https://www.ferc.gov/sites/default/files/2020-06/Order-842.pdf

- NERC MOD-025/026/027
Questions?
Or email your Customer Service Engineer

- Topics covered:
  - Voltage Control at normal active power output
  - Plant reactive capability at low active power output
  - Frequency control tests
  - Submission requirements
Appendix: Commissioning Tests for Voltage and Frequency Control
Testing is required in STD-N-000001 Technical Requirements for Interconnection:

- STD-N-000001 Governs Interconnections of:
  - Small Generators
  - Large Generators
  - Loads

- STD-N-000001 Covers:
  - Voltage control
  - Frequency control
  - Disturbance ride-through
  - Model submission
  - Others
### Sample Calculation of Rise Time

<table>
<thead>
<tr>
<th>Description / Variable Name</th>
<th>Initial</th>
<th>@ 5[s]</th>
<th>@ 30[s]</th>
<th>Delta (Δ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage Step (PU) / $V_{step, pu}$</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>-0.03</td>
</tr>
<tr>
<td>PCC Voltage V (PU of 230 kV) / $V_{pu}$</td>
<td>1.045</td>
<td>1.033</td>
<td></td>
<td>-0.012</td>
</tr>
<tr>
<td>Plant PCC Reactive Power Q (Mvar) / $Q_{MVAR}$</td>
<td>-5</td>
<td>-28</td>
<td>-30</td>
<td>-25</td>
</tr>
<tr>
<td>MW Base / $MW_{base}$</td>
<td>125</td>
<td>125</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Droop</td>
<td></td>
<td></td>
<td></td>
<td>0.09</td>
</tr>
<tr>
<td>Change in Q within Rise Time as a % of total change</td>
<td>0</td>
<td>-23</td>
<td>-25</td>
<td>92%</td>
</tr>
</tbody>
</table>

The power plant reactive power decreases by 23 Mvar within 5[s] after the voltage step and 25 Mvar within 30[s].

Percent change = 23/25 * 100% = 92% exceeds the 90% definitional to rise time. Thus the plant passes the test.
Sample Calculation of Rise Time

<table>
<thead>
<tr>
<th>Description / Variable Name</th>
<th>Initial $t=t_0=0,[s]$</th>
<th>$t = 5,[s]$</th>
<th>$t = 30,[s]$</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Step (MW) / $-F_{step,pu}$</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>0.01</td>
</tr>
<tr>
<td>Plant PCC Active Power (MW) / $P_{MW}$</td>
<td>90</td>
<td>70</td>
<td>68</td>
<td>-22</td>
</tr>
<tr>
<td>MW Base / $MW_{base}$</td>
<td>125</td>
<td>125</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Droop</td>
<td></td>
<td></td>
<td></td>
<td>0.0568</td>
</tr>
<tr>
<td>MW Change within Rise Time as a % of total change</td>
<td>0</td>
<td>20</td>
<td>22</td>
<td>90.9%</td>
</tr>
</tbody>
</table>

The plant had achieved 20 MW change within the first 5[s] of the frequency step and 22MW in 30[s].

Change during allowable Rise Time window: 20/22 = 90.9%, which exceeds the 90% definitional to rise time, and thus the plant passes the test.
EMT Modeling
Regulatory Requirement

BPA is required under FAC-002 to ensure the reliability of generation interconnections

R1. Each Transmission Planner and each Planning Coordinator shall study the reliability impact of: (i) interconnecting new generation, transmission, or electricity end-user Facilities and (ii) materially modifying existing interconnections of generation, transmission, or electricity end-user Facilities. The following shall be studied: [Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]
Inverter Based Resources

Recent experience has shown that positive sequence modelling alone is not sufficient to ensure reliability

- Odessa event report described various plant performance deficiencies that compromised reliability
- Other events, especially in California, have shown significant performance problems with inverter based resources
Inverter Based Resources

Very recent California event

- Incident occurred in December, 2021
- 400 MW battery had oscillations up to 100 MW for about an hour.
- Plant operators took manual action to stop the oscillation by going to manual mode.
Performance Based

**BPA will expect that generators will ride through expected system events**

- **Common disturbances**
  - single and multi-phase faults
  - loss of generation on the system
  - step changes in frequency for any reason
- **Normal switching**
  - line switching
  - shunt switching
  - generator switching

- **Expected topology changes**
  - Maintenance or construction outages
  - Other changes that affect Short Circuit Ratio
  - Non-interaction with nearby equipment
  - other generators
  - active or passive reactive devices
BPA EMT Requirements

BPA is discussing possible requirements

- EMT models to be submitted as part of the interconnection process
- Attestation or verification that the equipment will have acceptable performance per expected system events and conditions
- Verification of correct model and correct parameters at the time of interconnection
- Changes to equipment or parameters require a data submission
- Process for modelling and testing to resolve performance issues that arise during operation
Modeling Details

Models should be sufficient to capture common operational issues

- PLL Loss of synchronization
- Feeder protection operation
- Plant controller operation
- Inverter controls
- Negative interactions between all of the above controls
- Performance with expected Short Circuit Ratios
- Interactions with nearby equipment
Testing and Verification

BPA will seek to verify that the equipment installed will not compromise reliability

- Attestation, modelling results, type testing, field tests may be requested in some combination to prove performance
- Performance based requirements apply
- BPA may request data to resolve system problems that arise after interconnection
Data Requirements

NERC experience has shown that sufficient data is invaluable to resolving problems

- NERC has made data requirements recommendations based on event analysis
- BPA is discussing standards to ensure sufficient post-event data is available
- Data requirements may include:
  - DFR data (from controllers or dedicated devices)
  - DDR data (from controllers dedicated devices)
  - PMU data (relay data or dedicated PMU)
  - Fault codes (controllers)
- Data retention should be sufficient so that fault data is not overwritten before collection
Thank You!
Additional resources

NERC - IRPWG work plan:

IEEE - P2800.2 kickoff meeting:

NERC Odessa Disturbance Report:

NERC Major Event Analysis Reports:
https://www.nerc.com/pa/rrm/ea/Pages/Major-Event-Reports.aspx

NERC Inverter Based Resources Reliability Guideline (2018):

NERC IBR Interconnection Improvements Guideline (2019):

Pre-decisional. For Discussion Purposes Only.
Additional resources continued

P2800.2 PAR Summary

- **Title:**
  - Recommended Practice for Test and Verification Procedures for Inverter-based Resources (IBRs) Interconnecting with Bulk Power Systems
- **Scope:**
  - Define **recommended practices** for test and **verification procedures to confirm plant-level conformance** of IBRs interconnecting with bulk power systems in compliance with IEEE Std 2800
  - Applies to IBRs in transmission and sub-transmission systems
  - May also apply to isolated IBRs interconnected to an AC transmission system via dedicated voltage source converter high-voltage direct current (VSC-HVDC) transmission facilities, e.g., offshore wind farms
  - Specifications for the equipment, conditions, tests, modeling methods, and other verification procedures that should be used to demonstrate conformance with IEEE P2800
- **Includes:**
  - Type tests (unit level, not full compliance)
  - Design evaluation, including modeling
  - As-built evaluation and commissioning tests
  - Post-commissioning model validation, monitoring, periodic tests, and periodic verifications
- **Recommended practice:** Uses “should” language, not “shall” language.
  - In recognition that prescribing uniform procedures across all IBR types and utility locations would be very challenging
Oversupply 2021 Season Overview
2021 OMP Recap

- The Jan-Jul water volume for 2021 was 82.2 MAF vs 2020 which was 101.6 MAF. Typically, the Jan-Jul water volume average is 103.3 MAF. It’s hard to say what this year’s runoff will yield.

- In 2021, there were no OMP triggered events.

- Since there were no OMP events, BPA did not waive any losses.

- No generators were displaced.

- No displacement costs to report.
Upcoming OMP Generator Costs 2022 Submittal Period

- The submittal period for generators to provide their facility’s displacement costs will begin March 1, 2022.
  - Generators must register on the Accion site.
  - Accion will email current year participants when site is live.
  - Submissions must be completed by March 15.

- Per Attachment P, generators must submit their facility’s displacement costs for inclusion in the Least-Cost Displacement Curve. Before submitting displacement costs, please ensure they are eligible for reimbursement.
  - Failure to submit displacement costs will result in a displacement cost of $0/MWh for that facility.
Minimum Generation Reminders

- Minimum Generation Values are entered into the Customer Data Entry (CDE) System.
  - Min Gen levels are equal to or less than a resource’s schedule or generation estimate.
  - Hourly values may be modified until 57 minutes before the operating hour.
  - Resources may follow their maximum ramp rate when following a Dispatch Order to reduce to their Min Gen.
Loss Waivers

- Waiving Loss Obligations
  - BPA will make the determination to waive losses on the day prior to the WECC preschedule trading day.
  - Loss obligations will be cleared from the OATI Loss Module/CDE by 5am on the WECC preschedule trading day.
  - If a transmission customer schedules loss returns for a waived hour, then its loss tags will be curtailed for that hour.
  - No changes were made to last year’s loss waivers program.
OMP Annual System Test

- OMP Annual System Test was conducted the week of January 24th.
- OMP was tested for multiple hours due to testing of new OMP systems for EIM readiness.
- No displacement of generation below schedules was required.
  - All Generators should have limited to Schedule (or Generation Estimate for behind-the-meter).
  - No Cost Generators were not required to reduce to Minimum Generation
- No OMP credits or FTC will applies during the test period(s)
  - Generators that failed to respond, will likely receive follow up after the fact from BPA.
  - Compliance with other Dispatcher directives is always necessary.
Where to Find More Information

- Questions regarding the Accion website should be directed to:  
  https://oversupply.accionpower.com/_bpa_1901/accionhome.asp

- For BPA’s OMP Business Practice, go to:  

- For BPA’s OATT Attachment P, go to:  

- For other questions on BPA OMP, email techforum@bpa.gov with “Oversupply” in the subject heading.
2022 Outages
# 2022 Outages

<table>
<thead>
<tr>
<th>Start Time</th>
<th>Stop Time</th>
<th>Description</th>
<th>Paths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fri 04/01/2022</td>
<td>Tue 05/31/2022</td>
<td>SLATT: 500/230KV TRANSFORMER 1 (SPRING DERATE)</td>
<td>GEN</td>
</tr>
<tr>
<td>00:01:00 PPT</td>
<td>23:59:00 PPT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mon 05/02/2022</td>
<td>Thu 05/05/2022</td>
<td>CENTRAL FERRY: PCB 5388 RELAYS</td>
<td>GEN</td>
</tr>
<tr>
<td>08:00:00 PPT</td>
<td>15:00:00 PPT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mon 05/09/2022</td>
<td>Fri 06/03/2022</td>
<td>JONES CANYON-TUMBLE CREEK SECTON OF JONES CANYON-SANTIAM NO 1 230KV LINE</td>
<td>GEN, WOCS, WOM</td>
</tr>
<tr>
<td>08:30:00 PPT</td>
<td>16:00:00 PPT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mon 05/09/2022</td>
<td>Fri 05/13/2022</td>
<td>JOHN DAY: 500/230KV TRANSFORMER 1</td>
<td>GEN, JDAY, WOJD</td>
</tr>
<tr>
<td>08:00:00 PPT</td>
<td>15:00:00 PPT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mon 05/09/2022</td>
<td>Thu 05/12/2022</td>
<td>CENTRAL FERRY: PCB 5391 RELAYS</td>
<td>GEN</td>
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</table>
BPA Outage Coordination Webpage

- [https://www.bpa.gov/transmission/Reports/Pages/Proposed-Outages.aspx](https://www.bpa.gov/transmission/Reports/Pages/Proposed-Outages.aspx)

BPA Outage Coordination

BPA Outage Coordination Policy

BPA has an Outage Coordination Policy that requires specific equipment to be coordinated within certain timelines. BPA needs planned outage information to support Operational Planning studies and will be requesting equipment and facility outage information from other utilities. This meets the RC West Outage Coordination Process for Balancing Authorities and Transmission Operators.

Appendix 2 (the Equipment List) and Appendix 5 of the Policy are located on the RC West secure website at the following link:

[https://rc.caiso.com/libraries/procedures/ba-top-operating-procedures](https://rc.caiso.com/libraries/procedures/ba-top-operating-procedures)

For questions, please email BPAOutage@bpa.gov

Long-Range Significant Outage Plans and Mid-Range Outage Plans Page

This page provides links to Outage Plans for the Long-Range Significant Outages and Mid-Range Outage Planning Processes. Schedule for Mid-Range Outage Coordination Process - (Posted 05/23/2019)
Long Range Significant Outages

The following outages are for information purposes only. Outages are still being adjusted and/or moved. These outages are subject to change.

NOVEMBER 2021-JANUARY 2022 (08/11/2021)
DECEMBER 2021-FEBRUARY 2022 (09/03/2021)
JANUARY 2022-MARCH 2022 (10/01/2021)
FEBRUARY - APRIL 2022 (12/03/2021)
APRIL 2022 - JUNE 2022 (01/04/2022)

APRIL 2022 (02/04/2021)
MAY 2022 (03/03/2021)
JUNE 2022 (04/01/2021)
JULY 2022 (05/05/2020)
AUGUST 2022 (06/01/21)
SEPTEMBER 2022 (07/02/2021)
OCTOBER 2022 (08/11/2021)
NOVEMBER 2022 (09/02/2021)
DECEMBER 2022 (10/01/2021)
JANUARY 2023 (12/02/2021)
FEBRUARY 2023 (12/01/21)
MARCH 2023 (01/04/22)
### Monthly Spreadsheets

Look for your POI Substation or Line name

<table>
<thead>
<tr>
<th>Id</th>
<th>Foreign IDs</th>
<th>DART</th>
<th>Start Time</th>
<th>Stop Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1126434</td>
<td></td>
<td>Fri 08/25/2017 10:30:00 PPT</td>
<td>Fri 04/01/2022 18:00:00 PPT</td>
<td>MCC - OLYMPIA-GRAND COULEE NO 1 237KV LINE - OPERATING AT 230KV</td>
</tr>
<tr>
<td>2</td>
<td>1400384</td>
<td></td>
<td>Sat 10/10/2020 08:00:00 PPT</td>
<td>Sun 04/10/2022 16:00:00 PPT</td>
<td>BCH - MICA CREEK: 500KV REACTOR (MCA 5RX4)</td>
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<tr>
<td>3</td>
<td>9741845</td>
<td>1421102</td>
<td>Wed 02/03/2021 09:00:00 PPT</td>
<td>Fri 04/01/2022 17:00:00 PPT</td>
<td>USBR- GRAND COULEE 287/230KV TRANSFORMER KX-17-A (OLYMPIA-GRAND COULEE NO 1 287KV LINE OPERATING AT 230KV)</td>
</tr>
<tr>
<td>4</td>
<td>9283721</td>
<td>1405060</td>
<td>Mon 05/10/2021 07:00:00 PPT</td>
<td>Sun 05/22/2022 17:00:00 PPT</td>
<td>BIG EDDY-QUENT CREEK NO 2 230KV LINE</td>
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<tr>
<td>5</td>
<td>9464728</td>
<td>1398248</td>
<td>Tue 07/06/2021 09:30:00 PPT</td>
<td>Tue 07/19/2022 14:00:00 PPT</td>
<td>HEW- 451-B SUBSTATION AND DOE 451B-B-1409 LINE SECTIONALIZING DISC, PCB B-1413, PCB B-1418</td>
</tr>
<tr>
<td>6</td>
<td>9708685</td>
<td>1402516</td>
<td>Mon 08/02/2021 08:00:00 PPT</td>
<td>Fri 08/05/2022 13:00:00 PPT</td>
<td>CAPTAIN JACK: 500KV CAP GROUP 3 INCLUDING PCB 4928</td>
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<td>7</td>
<td>1419000</td>
<td>11/01/2021 08:00:00 PPT</td>
<td>Fri 04/16/2022 16:00:00 PPT</td>
<td>Thu 04/14/2022 06:30:00 PPT</td>
<td>AVA- LOLO-OXBOW 230KV LINE</td>
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<td>9610658</td>
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<td>Thu 04/14/2022 06:30:00 PPT</td>
<td>HANFORD: PCB 4092 INCLUDING MODS 4091 &amp; 4093</td>
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<td>OLIVIA-GRAND COULEE NO 1 287KV LINE</td>
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<td>10</td>
<td>8864973</td>
<td>1391516</td>
<td>Fri 04/01/2022 18:00:00 PPT</td>
<td>Fri 04/01/2022 19:00:00 PPT</td>
<td>USBR- GRAND COULEE 287/230KV TRANSFORMER KX-17-A (OLYMPIA-GRAND COULEE NO 1 287KV LINE OPERATING AT 230KV)</td>
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<tr>
<td>11</td>
<td>9547075</td>
<td>1413840</td>
<td>Mon 04/04/2022 01:00:00 PPT</td>
<td>Fri 04/15/2022 17:00:00 PPT</td>
<td>GRAND COULEE: PCB 2302, PCB 2306</td>
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<tr>
<td>12</td>
<td>9556156</td>
<td>1405216</td>
<td>Mon 04/04/2022 05:00:00 PPT</td>
<td>Thu 04/14/2022 17:30:00 PPT</td>
<td>H.E.W.- A-B-A-6 SECTION OF MIDWAY-HEW NO 2 230KV LINE, TCLA</td>
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<tr>
<td>13</td>
<td>9413409</td>
<td>1408888</td>
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<td>Thu 04/07/2022 14:30:00 PPT</td>
<td>H.E.W.- A-B-A-6 SECTION OF MIDWAY-HEW NO 2 230KV LINE, TCLA</td>
</tr>
</tbody>
</table>

Look for “Gen” in “Paths” column
Reminders
Reminders

- Sign up for Tech Forum notifications at
  - https://www.bpa.gov/contact/forms/pages/transmission-contact-information.aspx

- Background information on BP’s Rate Case (BP-24) and/or Transmission Terms and Conditions (TC-24) is available at:
  - https://www.bpa.gov/Finance/RateCases/Pages/default.aspx

- Stay tuned for Tech Forum notification of upcoming proposed changes to BPA’s Business Practices.