Final Notes as of August 9, 2017

Operating Committee
May 10, 2017 – 1:00 PM to 5:00 PM
Northwest Power Pool Conference Room

The meeting agenda and attendance list are included as Attachments #1 and #2, respectively.

1. **Introductions, Arrangements, and Agenda Changes** Chad Edinger (TWPR), Chair
   a. Anti-Trust Statement

2. **Action Items from February 8, 2017 Meeting** – Status Review
   - The solar eclipse subject will be included on the May OC Agenda for discussion. *Agenda item 9.a*
   - NWPP Staff (Don Badley) will coordinate review of EEP with Chad Edinger and Tony Nguyen. *Agenda item 10*
   - NWPP Staff will distribute the Outage Coordination Reliability Guideline to OC for comment. All comments are due back to ChaRee DiFabio by February 22, 2017. All comments received will be addressed by the small group and then redistributed to the OC by March 1, 2017. A web-conference (doodle poll for availability) will then be held for potential adoption on or about March 8, 2017. *Completed*
   - NWPP staff will begin requesting and receiving solar data through ICCP links; this is similar to that sent to Peak Reliability. *In process*
   - Greg Park will follow-up with OTS of any new training topics from the NWPP. *Agenda item 6*
   - NWPP staff will follow-up with the OC regarding their training needs for 2017. *Completed*

3. **Notes of February 8, 2017 Meeting** – Accept or Modify Don Badley, NWPP

   Don Badley reported that two editorial changes were made to the original notes of the February 8, 2017 OC meeting. The revised notes were distributed to the OC and posted to the OC portal on the NWPP web site. The revised notes were accepted by the OC without dissent.

4. **NWPP Corporate Update** Jerry Rust, NWPP
   a. Forecast of Expenditures for 2017-2018 – Accept

   Jerry Rust provided a summary of the OC portion of the detailed Forecast of Expenditures for the 2017-18 Operating Year; refer to Attachment #3.

   Raj Hundal moved to approve the OC portion of the NWPP Forecast of Expenditures for 2017-2018; Meg Albright seconded the motion. The motion carried without dissent.

   Jerry announced that Don Badley is retiring on January 2, 2018 and Greg Park has been hired to fill his position on staff. Greg will begin working on staff on June 5, 2017. Greg will shadow Don through the end of 2017.

5. **Review of Joint Meeting** Chad Edinger, OC Chair
   a. NWPP Agreement Discussion

   Raj Hundal commented on the unresolved business issues in the portion of the NWPP Agreement having to do with membership eligibility. The issues involve providing greater clarity regarding the requirements that must be met for an entity to join the NWPP. Specifically, the sections are as follows.

   Section 3.2. Membership Availability for Other Eligible Entities

   d. It shall be the responsibility of each Committee to review and evaluate membership requests received in accordance with Section 3.2(b), and the exclusive prerogative of

each Committee to determine (i) how to interpret its eligibility criteria (as set forth in the applicable provisions of this Agreement and any supplemental policies or criteria adopted in accordance with this Agreement), and (ii) whether to accept or decline an entity's request to become a Member of such Committee.

Section 3.3. Required Actions to Establish Membership Following Committee Determination

If one or more Committees to which an Eligible Entity has requested membership elect to accept the Eligible Entity's request for membership, the Eligible Entity shall become a Member as of the date on which it has executed and delivered to the Service Corporation a signature page to this Agreement and a General Services Agreement, or such later date as indicated by the applicant in its transmittal of the executed signature page and General Services Agreement; provided, however, that with respect to any Committee for which execution of additional documents or agreements is a condition of membership, (a) membership on that Committee shall be contingent upon satisfactory execution and delivery of such additional documents or agreements, and (b) if an Eligible Entity has not satisfied the requirements for membership on at least one Committee within 30 days following delivery of its executed signature page and General Services Agreement, the Eligible Entity's membership shall be rescinded as of the date it purported to become a Member and the Eligible Entity shall be deemed for all purposes to have never been a Member.

Jerry Rust added that PAC has requested their standard boiler-plate be added to the Agreement; PAC's language will be sent to the committees for their consideration.

Raj requested that the next distributed copy of the Agreement be thoroughly vetted by each member to assure there are no 11th hour changes. The small group is hoping the next version will be the final version for eventual signature.

There will be another Joint Meeting of the NWPP committees on August 9, 2017 from 09:00 to 12:00 to address the NWPP Agreement hopefully for last time, prior to sending it out for signature.

6. **Operations Training Subcommittee (OTS)**
   a. Activity – Update — Greg Park (CHPD), Chair

Greg Park gave a PowerPoint presentation at the Joint meeting to update OTS activity. It was requested that the presentation be appended to these notes; refer to Attachment #4.

   b. Chair – Update — Chad Edinger, OC Chair

Chad Edinger asked Greg Park to continue serving as OTS Chair even after Greg becomes an employee of the NWPP corporation. Greg agreed to serve.

It is noted here that the OTS charter was reviewed and it was confirmed that the OTS chair is not required to be an OC member representative, that the OC Chair is given authority to determine who the OTS chair will be.

7. **NERC Essential Reliability Services Work Group –** Update — Rich Hydzik, AVA

Rich Hydzik used a PowerPoint presentation to update the activities of the Event Analysis Subcommittee (EAS); refer to Attachment #5. The presentation covered lessons learned, including lessons learned from near misses.

Also, Attachment #5 was used to cover the Essential Reliability Services Work Group (ERSWG) activity. Of particular interest was the fact that they are looking into system inertia and frequency-response. Rich reviewed the measures they are developing and the deliverables that will be produced.

8. **NERC RTA Guidance** Rich Hydzik, AVA

Rich Hydzik used Attachment #5 to share information about the Real-time Assessment Task Force work. The guidelines they are working on were reviewed. And, a document is expected to be issued during the week of May 15th.

Action Item:
NWPP staff to distribute RTA Guidance document to the OC.

9. **NERC Request for CPS1 and BAAL Data** Open Discussion

Kathy Downey and several other members complained about the request for "voluntary" data regarding CPS1 and BAAL data. The two major complaints are that 1) the request is for additional information as to what had been requested in the past and 2) it is expensive to provide.

Action Item:
NWPP staff to distribute BAAL and CPS1 Calculations. Entities will supply Jerry Rust with any incremental costs they may incur.

10. **Recent and Upcoming Operational Events**

a. August 21, 2017 solar eclipse and impacts on solar production Chad Edinger, TPWR

Chad Edinger used a PowerPoint presentation developed by the California ISO to discuss the impact of the solar eclipse that will occur on August 21, 2017; refer to Attachment #6.

Jerry Rust commented on an internal study done by the NWPP staff comparing results of a modeling study to a real event. The results give great pause to the predictability of real events through modelling studies.

Action Item:
NWPP staff to distribute the April 11, 2017 *NWPP Reality vs Modeling* paper to NWPP OC; refer to Attachment #8.

b. Review of November 9, 2016 CISO BA Event Webinar Don Badley, NWPP

During the Joint Meeting, Don Badley presented a graph showing 1-minute average WECC BAA ACE values vs. 1-minute average frequency to a CISO caused event on November 9, 2016. A brief chronology is included with these notes; refer to Attachment #7. At the lowest frequency point, BAAs in the NWPP contributed almost 1,600 MWs to support frequency.

11. **Annual Energy Emergency Plan –** Status Update Chad Edinger, OC Chair

Chad Edinger reported that Harley Johnson (TPWR), Tony Nguyen d(BCHA) and Don Badley are working on reviewing and modifying the NWPP Energy Emergency Plan process. Results of their work will be aired at the August 2017 OC meeting.

Action Item:
NWPP staff to distribute draft changes to the Annual Energy Emergency Plan to OC by July 1, 2017. The OC should be prepared to provide any issues and comments back to NWPP staff by July 14, 2017 for the small group to address. NWPP Staff will distribute the final draft to the OC no later than July 28, 2017 for OC consideration during their August 9, 2017 meeting. The intent of the OC is to consider approving the document on August 9, 2017.

Action Item:
NWPP staff and OTS to address AEEP training during their July meeting with the recommendation for how delivery of the training should occur. Potential training may occur at some point in September.

12. **Reliability Coordinator Report** TBA, PRRC

The RC was not able to attend the meeting.

Action Item:
The participants in the NWPP will provide a report of the May 15-16, 2017 Peak Reliability Users Group meeting during the August 9, 2017 meeting.

13. **Recent and Upcoming NERC/WECC Voting & Comments** Chad Edinger, TPWR

Chad Edinger reported that comments on TPL-001-5, specifically Project 2015-10 Single Points of Failure are due May 24, 2017.

14. **Review of Action Items Decided at this Meeting** Don Badley, NWPP

- Distribute revised copy of the NWPP Agreement version to be sent out for comments.
- Append the OTS PowerPoint presentation to the OC notes.
- Remove 45-day Outage process from web page.
- Attach Reality vs. Modelling document to Notes.
- Distribute RTA document to OC.
- NWPP staff to distribute NERC request for BAAL and CPS1 data that will be used to assess present control performance to performance prior to implementation of BAL-001-2. Entities will supply Jerry Rust with any incremental (additional) costs they may incur to provide the data.
- Distribute revised draft EEP by July 1. Comments back by 14th, responses and final version back to OC by July 28th, vote on August 9th.
- Participants in the RC Users Group meeting will report results at next OC meeting.

15. **Current Operations** All

Jeff Heminger reported that DOPD will cease to be part of Hourly Coordination on June 30, 2017.

Chad Edinger reported that TPWR is replacing their EMS and they are planning cutover in July 2018.

Tony Nguyen reported that BCHA is upgrading their EMS to a new platform on May 13, 2017.

The TPC Chair will change at their next meeting. Chelsea Loomis, NWMT, will be the new TPC Chair with Jared Ellsworth, IPC, will serve as the TPC Vice Chair.

CHPD highest water year ever recorded at Rocky Reach in April, exceeded by about 10%. 170% of average in April.

16. **Next Meetings – 2017**

Aug 9 Joint Meeting 9:00 A.M. to Noon Portland, OR [Wednesday]
Aug 9 1:00 P.M. to 5:00 P.M. Portland, OR [Wednesday]
Nov 8 Portland, OR [Wednesday]

Agenda as of May 4, 2017

Operating Committee
May 10, 2017 – 1:00 PM to 5:00 PM
Northwest Power Pool Conference Room

Agenda

⇨ **Action Item**

1. **Introductions, Arrangements, and Agenda Changes** — Chad Edinger (TWPR), Chair
   a. Anti-Trust Statement

2. **Action Items from February 8, 2017 Meeting** – Status Review
   - The solar eclipse subject will be included on the May OC Agenda for discussion. *Agenda item 9.a*
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   - NWPP staff will begin requesting and receiving solar data through ICCP links; this is similar to that sent to Peak Reliability.
   - Greg Park will follow-up with OTS of any new training topics from the NWPP. *Agenda item 6*
   - NWPP staff will follow-up with the OC regarding their training needs for 2017. *Completed*

⇨ 3. **Notes of February 8, 2017 Meeting** – Accept or Modify — Don Badley, NWPP

4. **NWPP Corporate Update** — Jerry Rust, NWPP
⇨ a. Forecast of Expenditures for 2017-2018 – Accept

5. **Review of Joint Meeting** — Edinger
   a. NWPP Agreement Discussion

6. **Operations Training Subcommittee (OTS)**
   a. Activity – Update — Greg Park (CHPD), Chair
   b. Chair – Update — Edinger

7. **NERC Essential Reliability Services Work Group –** Update — Rich Hydzik, AVA

8. **NERC RTA Guidance** — Hydzik

9. **NERC Distributed Energy Resources Paper** — Hydzik

10. **Recent and Upcoming Operational Events**
    a. August 2, 2017 solar eclipse and impacts on solar production — Alan Soe, NVE
    b. Review of November 9, 2016 CISO BA Event Webinar — Edinger

11. **Annual Energy Emergency Plan –** Status Update — Edinger

12. **Reliability Coordinator Report** — TBA, PRRC

13. **Recent and Upcoming NERC/WECC Voting & Comments** Edinger

14. **Review of Action Items Decided at this Meeting** Badley

15. **Current Operations** All

16. **Next Meeting –**

Aug. 9	Portland, OR	Wednesday
Nov 8	Portland, OR	Wednesday

NWPP Operating Committee Meeting
May 10, 2017
Meeting Attendance

Name	Organization
Darren Wilkie	Alberta Electric System Operator
Kit Blair	Avangrid
Rich Hydzik	Avista Corporation
Helen Hamilton Harding	B.C. Hydro
Tony Nguyen	B.C. Hydro
Mark Willis	Balancing Authority of Northern California
Margaret (Meg) Albright	Bonneville Power Administration
Greg Park	Chelan County PUD
Jeff Heminger	Douglas County PUD
Jesus Lopez	Grant County PUD
Chris Nebrigich	Idaho Power Company
Kathryn Downey	PacifiCorp
Bob Frost	Portland General Electric Company
Raj Hundal	Powerex
Thomas Bagnell	Puget Sound Energy
Denise Lietz	Seattle City Light
Chad Edinger	Tacoma Power
Gareth Tomlinson	Tacoma Power
Mark Campeau	Tacoma Power
Craig Speidel	Western Area Power Administration - UGP
Attending via telephone	
Mike McGowan	NorthWestern Energy
Antonio Franco	Gridforce Energy Management
Jinm Farrar	Turlock Irrigation District
NWPP Staff	
Don Badley	NWPP Corporation
Jerry Rust	NWPP Corporation
ChaRee DiFabio	NWPP Corporation

NORTHWEST POWER POOL
Reliability through Cooperation

2017-2018 Forecast of Expenditures for the Operating Committee

All Northwest Power Pool Committees must approve their respective forecast of expenditures in accordance with the NWPP Agreement

Article IX: Finances

- Section 9.1.1 Forecast of OC Expenses: The NWPP staff shall prepare an annual NWPP budget forecast of OC expenses for presentation to the OC for the approval by the OC Members. The OC Members shall have final approval authority by two-thirds affirmative vote over the annual and supplemental NWPP budgets allocable to OC Members.

Northwest Power Pool General Services Agreement
Section 2. Annual Budget Forecast and Support Services

Section 2.1 Development and Approval of Annual Budget Forecast. Not less than 60 days before the start of each fiscal year, the NWPP Corporation will prepare and present to those Pool Committees and Groups whose approval is required under the Northwest Power Pool Agreement an Annual Budget Forecast. An Annual Budget Forecast will be deemed approved for purposes of this Agreement if (but only if) it is approved in accordance with the voting procedures specified in the Northwest Power Pool Agreement for the Pool Committee and Group approval of Annual Budget Forecast.

Actual Expenditures
July 1, 2016 to June 30, 2017 vs.
Estimate *(10 Months actual + 2 Months est.)*

	Forecasted 2016-2017	Estimated	Change
Forecast	$3,201,518	$3,150,000	–$51,518

Estimated annual expenditure as compared to budget ~ 98.39%

NERC CEH Training

- NERC CEH training hours provided over July 1, 2016 to June 30, 2017 (as of May 1, 2017)
  - *Face-to-Face ~ 1,000 Hours*
  - *On-Line E-Learning ~ 3,000 Hours*

OC Forecast of Expenditures
July 1, 2017 to June 30, 2018

	2016-2017	2017-2018	% Change
OC Budget	$1,152,464	$1,145,040	-.64%

Forecast of Expenditures
July 1, 2017 to June 30, 2018

- 56% of the budget is salaries of FTEs
- 27% of the budget is associated with employee overheads such as health insurance, pension, and others
- 7% of the budget is associated with office expense
  - 90% of the budget is associated with employees and office
- ~10% of the budget is variable (meetings and meeting expenses

NWPP OTS Meeting

April 26, 2017

Attendees

- Alberta (AESO)
- Avangrid
- BANC/Sacramento MUD
- Bonneville Power Adm.
- Chelan
- Douglas PUD
- Grant County PUD
- Idaho Power
- NaturEner
- Pacificorp
- Pond Oreille PUD
- Puget Sound Electric
- Seattle City Light
- Tacoma Power
- USBR – Grand Coulee
- WAPA – Upper Great Plains

Attendees (non-Members)

- NWPP
- Quality Training Systems

Peak RC Update

- Group desires a January – February drill for 2018. Wed and Thursday's would be preferred for some entities for coverage.
- Peak has expressed interest in expanding drill to two days (1st day optional for smaller entities.)
  - 1st day would be for larger entities to perform a complete blackstart
  - 2nd day for a drill similar to this year.

Peak RC - Continued

- Many members of the NWPP are utilizing the Peak RC HAA suite of advanced application tools.
- Some members felt NWPP training on utilizing the tool may be a benefit for the NWPP members.
- May look into using the NWPP “remote training” tools in development (D.Pennington will update)

5

Quality Training Systems

- Updated the group on their presence in the Pacific Northwest (Seattle office).
- Offer “Train the Trainer” type courses
  - Group felt that T-the-T opportunities is lacking in the region
- Discussed training opportunities hosted by QTS in the Northwest

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Training Priorities

- Online Training, Sharing Portal and Fundamentals training
  - Various groups working on these topics with NWPP staff.
  - Hope to start producing material next quarter.

Training Priorities

- Lessons Learned/ Best Practices
  - NWPP looking to produce “podcasts” for training on shift without taking away operators focus on the system.
  - Sharing opportunities for overall improvement should not be limited to BES but all aspects of system operations (distribution and other safety events also)

Training Priorities

- Vendor Training Coordination
  - Two “trial” sessions scheduled.
    - TPWR will provide classroom space for SOS in their offices September 18-22
    - NWPP will provide classroom space for GTS October 31-November 2
  - Working on work order with NWPP staff
  - Topics will be selected by members.
  - Want to coordinate 2018 training well in advance.

Training Priorities

- New Standards
  - Will be a standing agenda item at future meetings.
  - This topic has the potential of eliminating a vast amount of overlapping work among the members.
  - WECC OTS was a great platform for sharing and is now lost. NWPP OTS should replace this opportunity.
  - RSG to work with OTS on BAL-002 implementation and training needs.

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EAS, ERSWG/DER, and RTATF Update

Rich Hydzik, Avista
NWPP Operating Committee
May 10, 2017

RELIABILITY | ACCOUNTABILITY

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Event Analysis Subcommittee

- Lessons Learned
  - LL20161202 SCADA System Software Design Flaw Prevented Processing of Alarms and Events
  - LL20161201 Loss of ICCP – Local Control Center Notifications
  - LL20170401 Dispatched Reduction in Generation Output Causes Frequency Deviation –CAISO Event 11/09/2017
  - LL20170302 Loss of State Estimator due to Propagated Database Values With Invalid Data
  - LL20170301 Slow Circuit Breaker Operation Due to Lubrication Issues
- Generating Unit Winter Weather Readiness Guideline
  - Completing review – goes to NERC OC in June
- How can we capture near misses?

Event Analysis Subcommittee

- CAISO Lesson Learned
  - Webinar to industry on 3/31/2017
- Presentation
  - http://www.nerc.com/pa/rrm/Webinars%20DL/March%2031%20NERC%20Call%20110916%20Freq%20Event%20final%20%5bRead-Only%5d.pdf
- Webinar
  - www.nerc.com/pa/rrm/Webinars%20DL/NERC%20WECC%20Lesson%20Learned%20Webinar-20170331%201548-1.wmv

Essential Reliability Services WG/DER

- Revised ERSWG Scope Document
  - Continue the development and refinement of ERS Sufficiency Assessments (no longer to be called Sufficiency Guidelines). This includes:
  - Ongoing analysis of current trends.
    - Observations and results to be included in the annual State of Reliability (SOR) Report.
  - Development of forward looking(predictive) analyses of selected ERS Measures.
    - Observations and results to be included in the NERC Long Term Reliability Assessment (LTRA).
  - Development of historical analysis of select ERS Measures.
    - These will be illustrated in the SOR reports going forward.

Essential Reliability Services WG/DER

- Measures
  - M1 – Synchronous Inertial Response (SIR) at Interconnection Level (KE)
  - M2 – Initial Frequency Deviation Following Largest Contingency (ROCOF)
  - M3 – Synchronous Inertial Response (SIR) at Interconnection Level (KE)
  - M4 – Frequency Response at Interconnection Level
  - M5 – Real-time Inertial Model (Industry Practice)
  - M6 – Net Demand Ramping Variability (CPS1 trend)
  - M7 – Reactive Capability on the System (Moving away from this)

Essential Reliability Services WG/DER

- ERSWG Activities
  - Monitor activities of the subcommittees and working groups related to ERS Measures.
  - Evaluate other tools and/or processes for assessing the sufficiency of ERS Measures for both current and future states.
  - Develop recommendations for practices and requirements, including reliability standards, as necessary, that cover the planning, operations planning, and real-time operating procedures associated with ERS.
  - Identify and recommend subgroups (existing or new) of the Operating and Planning Committees to ensure ongoing both historical and forward looking trending/analysis of ERS Measures.

Essential Reliability Services WG/DER

- ERSWG Activities –DER Related
  - Lead the implementation of recommendations from the February 2017 DER Report (accepted February 2017) as directed by the NERC Board of Trustees.
    - MOD-032-1 SAR
      - Replace Applicable Entity LSE with DP
    - DER Data Collection Guideline
  - Assess incorporation of DER data into the ERS Sufficiency Assessments and Measures.

Essential Reliability Services WG/DER

- ERSWG Deliverables
  - Develop technical reference documents or assessment briefs, as necessary, on recommended ERS Sufficiency Assessments and Measures.
  - Develop briefings for use with policy makers, as necessary, on various ERS issues.
  - Support historical and forward looking ERS assessments for the State of Reliability and the Long Term Reliability Assessment Reports. Propose, develop and implement new data collection and analytical processes, as needed.
  - Develop various DER related technical reference documents and/or data collection guidelines.
  - Next meeting 5/17-5/18 in Atlanta

Real Time Assessment Task Force

- December 2016 NERC OC meeting
- Real Time Assessment Task Force formed
- Produce Compliance Implementation Guidance
  - TOP-001-3 R13 – Each Transmission Operator shall ensure that a Real-time Assessment is performed at least once every 30 minutes.
  - IRO-008-2 R4 – Each Reliability Coordinator shall ensure that a Real-time Assessment is performed at least once every 30 minutes.
- EMS/SCADA Outages?
- Transfer to Back Up Control Center?
- State Estimator / Real-time Contingency Analysis Failure?
- Document was approved by NERC OC on 5/5/2017

Real Time Assessment Task Force

- Section 1 – Background
- Section 2 – RTA Expectations
- Section 3 – Compliance Implementation and Evidence
- Section 4 – Entities with No EMS Network Applications

- Section 3 – Compliance Implementation and Evidence

Potential System Operating States	Description of RTA	Examples of Compliance Evidence
Required SCADA and Inter-Control Center Communications Protocol (ICCP) data is available. **RTA tools are solving.**	- Monitor pre-Contingency state via EMS alarming and/or other situational awareness tools - Examine post-Contingency state via RTCA or other on-line simulation tool	- Provide a log of Real-time EMS alarms - Provide a status of ICCP data link - Provide a sample of RTCA run logs and output files - Provide SE solution logs
Required SCADA and ICCP data is available. **RTA tools are not solving.**	- TOP: Rely on RC RTA tools if applicable, request RC and neighboring TOPs to continue monitoring system - RC: Rely on neighboring RC RTA tools if applicable and notify TOPs to continue monitoring the system - Monitor pre-Contingency state via SCADA, EMS alarming and/or other situational awareness tools - Conduct offline studies which are representative of real-time system conditions	- Logs/voice recordings for RC notification. - Provide a log of Real-time EMS alarms - Provide log of RTA tools failure - Provide samples of saved power flow cases, analysis results, or manual logs - Provide Operating Planning Analysis results and the comparison (e.g. Operator Log) of real-time conditions versus studied system conditions

NERC NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Real Time Assessment Task Force

- Section 3 – Compliance Implementation and Evidence

Potential System Operating States	Description of RTA	Examples of Compliance Evidence
Partial SCADA and ICCP data is available. (Loss of some data sources)[2] **RTA tools are solving.**	- Utilize other tools such as SE to compensate for lost telemetry	- Provide a log of Real-time EMS alarms - Provide SE availability logs if applicable
	- Monitor pre-Contingency state via EMS alarming and/or other situational awareness tools where data is available - Examine post-Contingency state via RTCA or other simulation tool - If necessary, receive manual statuses/flow information updates from applicable internal personnel and/or external entities[2]	- Provide a sample of RTCA run logs or output files, Operator logs or voice recordings for receiving data from internal personnel and/or external entities (if applicable)[2]

- Section 3 – Compliance Implementation and Evidence

Potential System Operating States	Description of RTA	Examples of Compliance Evidence
ICCP data is available. (Loss of some data sources) RTA tools are not solving.	notify RC and neighboring TOPs to continue monitoring system if RC tools are working - RC: Rely on neighboring RC RTA tools if applicable and notify TOPs and neighboring RCs to continue monitoring the system if tools are working - Monitor pre-Contingency state via EMS alarming and/or other situational awareness tools - Retrieve an off-line study case from when SE was solving or utilize an appropriate offline study case, apply applicable inputs, and simulate the post-Contingent state - If necessary, receive manual statuses/flow information updates from applicable internal personnel and/or external entities[3]	notification. Provide a log of Real-time EMS alarms. - Provide log of RTA Tools failure. - May or may not be able to create a valid off-line model. If so, provide example of a saved model case and analysis results in the form of a report to operators. - Operator logs or voice recordings for receiving data from internal personnel and external entities (if applicable)[2] - Provide Operating Planning Analysis results and the comparison (e.g. Operator Log) of real-time conditions versus studied system conditions

NERC NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Real Time Assessment Task Force

- Section 3 – Compliance Implementation and Evidence

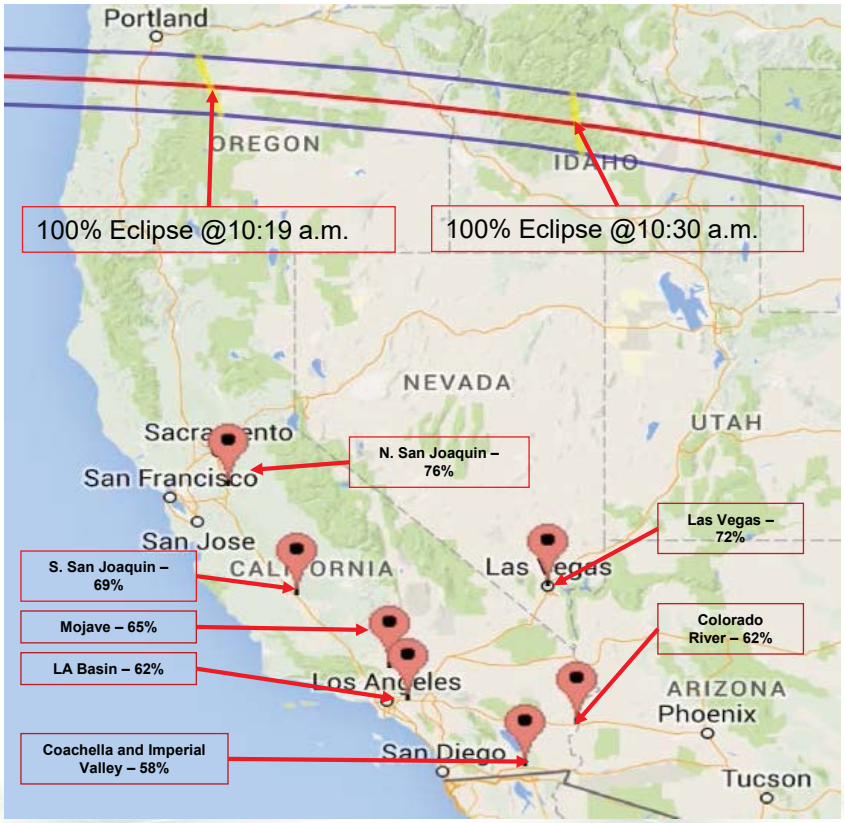
Potential System Operating States	Description of RTA	Examples of Compliance Evidence
Complete loss of SCADA and ICCP data. RTA tools are unavailable.	- Inform the RC and neighboring TOPs of the current state of operation - TOP: Rely on RC RTA tools if applicable; notify RC and neighboring TOPs to continue monitoring system if tools are working - RC: Rely on neighboring RC RTA tools if applicable and notify TOPs and neighboring RC(s) to continue monitoring system if tools are working - Advise local staff of the current state and potential need to man critical stations - Conduct Offline studies representative of Real-time system conditions	- Operator and Phone Logs - Applicable Loss of EMS procedures - Alternative monitoring capabilities (e.g. synchrophasor data) and/or the execution of off-line studies

Briefing on solar eclipse
- ISO impact analysis: August 21, 2017 solar eclipse

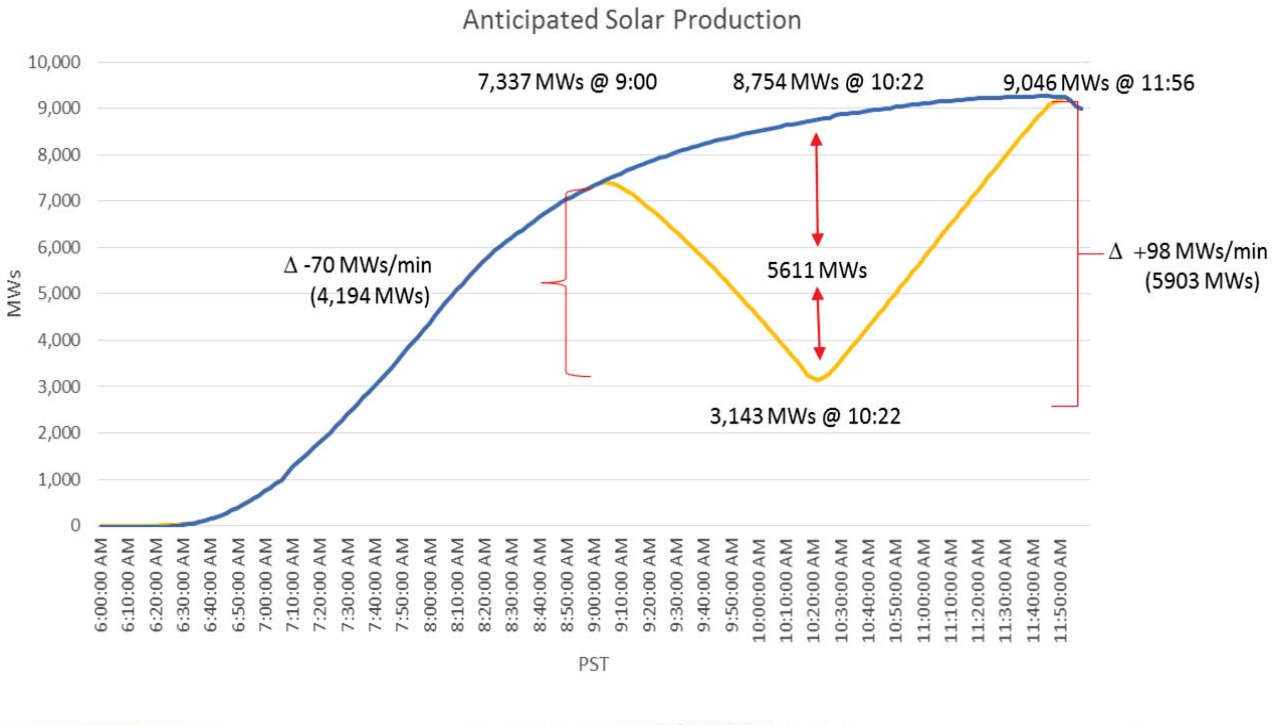
Amber Motley
Manager, Short Term Forecasting

Board of Governors Meeting
General Session
May 1, 2017

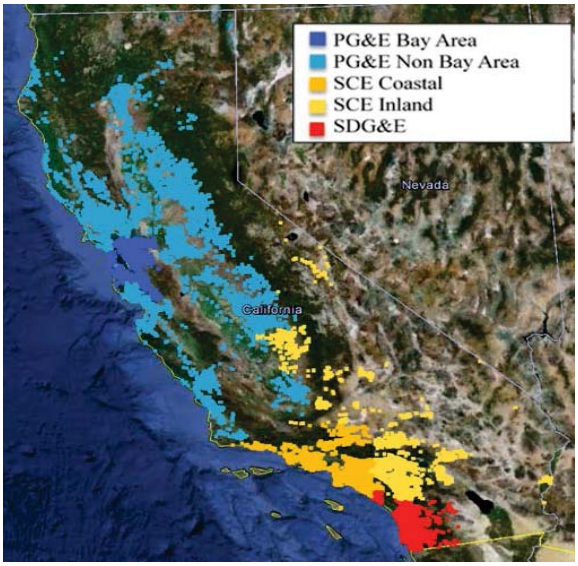
Effect on the ISO balancing area

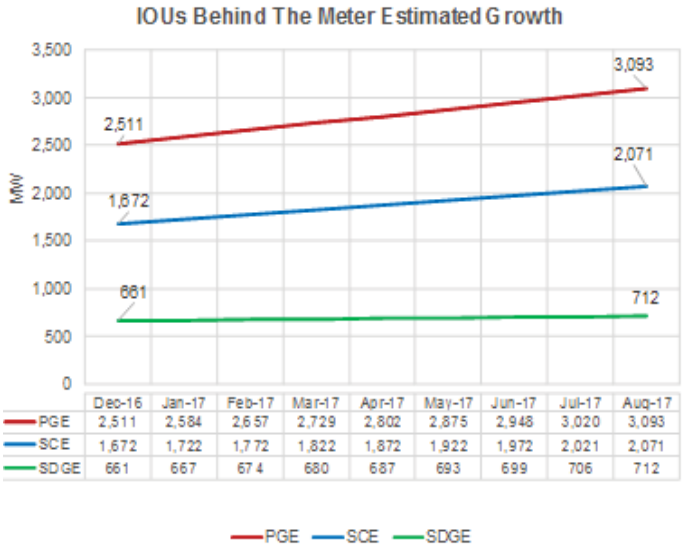


Potential MW impact on grid connected solar



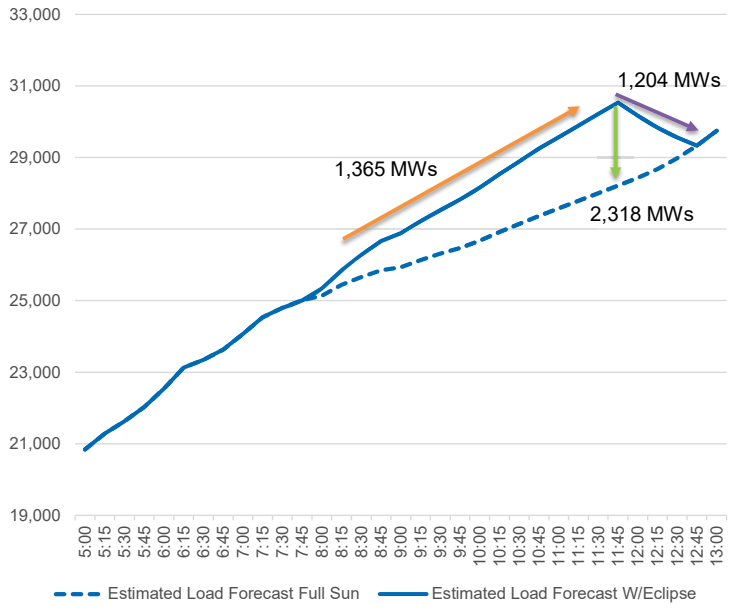
Expected capacities of behind-the-meter solar





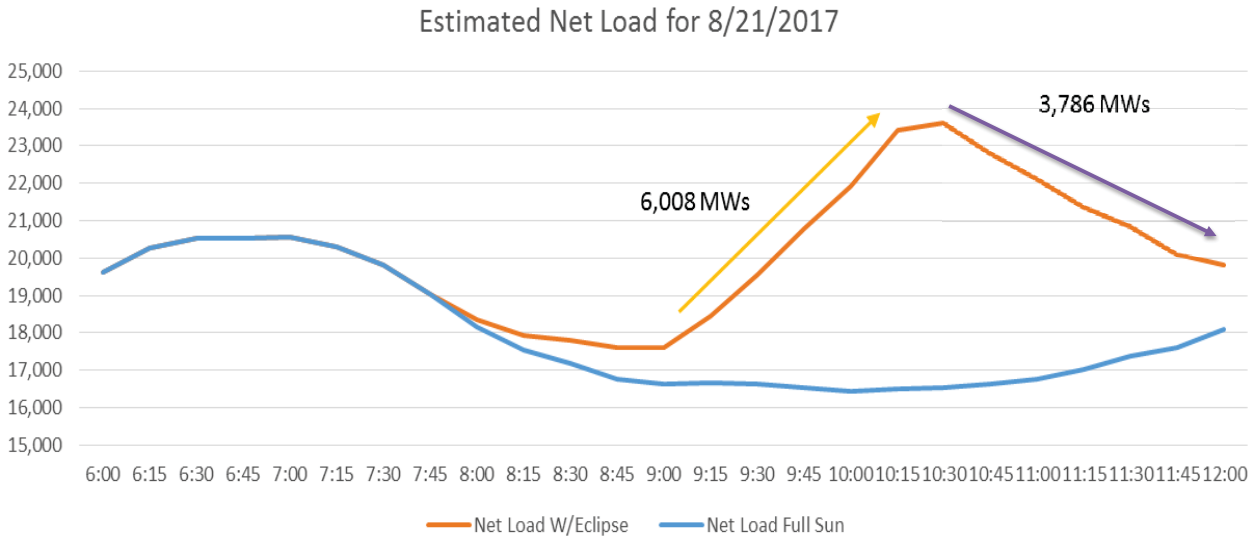
	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17
PGE	2,511	2,584	2,657	2,729	2,802	2,875	2,948	3,020	3,093
SCE	1,672	1,722	1,772	1,822	1,872	1,922	1,972	2,021	2,071
SDGE	661	667	674	680	687	693	699	706	712

Potential impact of behind-the-meter on ISO load



Time (HB)	MW Change	% Load Increase
9:00	953	4%
9:15	1085	4%
9:30	1218	5%
9:45	1350	5%
10:00	1483	6%
10:15	1616	6%
10:30	1748	6%
10:45	1881	7%
11:00	1990	7%
11:15	2100	8%
11:30	2209	8%
11:45	2318	8%
12:00	1739	6%
12:15	1159	4%
12:30	580	2%

Potential impact on net load



Solar eclipse summary

- Large scale solar reduction:
  - Estimated to be 4,194 MW's
- Gross load increase
  - Estimated to be 1,365 MW's
  - Note this based off clear sky, no marine layer
- Net load effect
  - Estimated to be an increase of 6,008 MW's
  - Note this accounts for estimated wind production
- Ramp rate
  - Typical average ramp rate is around 29 MW/Min
  - Ramp rate during eclipse will be approximately 90 MW/Min on the return and 70 MW/Min on the drop off

Expected impact on EIM entities

Entity	Distribution MWs	Grid Connected MWs
APS	569	506
NVE	169	350
PAC		9
PSE		0.5
Total	738	866

Lessons learned from Europe

- Transmission System Operators
  - Higher reserves
  - Committed to zero Area Control Error
  - Strategic use of pump storage
  - Limited generation planned outages
  - Reduced high voltage direct current line capacities between the Nordic, United Kingdom and Continental Europe.
  - Activated emergency telecommunications, with back up
  - Specialized training for operators.
  - Raised awareness with market players and distribution system operators.
- Germany
  - Procured 2 times normal regulations
  - Germany established special operational concepts for reserves
- Italy
  - Reduce northern net transfer capability
  - Reduced day ahead PV production from 7 a.m. to 2 p.m.

Market mechanisms and processes used during the solar eclipse

• Reserves procurement	• Gas supply needs
• Flex-ramp usage	• SC interaction
• Special operating procedures	• WECC/Peak RC coordination
• Use of EIM transfer capability	• Hydro generation
• Internal market simulation	• Flex alerts*
• Market participant coordination	• Pre-curtailment of renewables*
• Ramp rate limitations on return of renewables*	• Virtual bid behavior suspension*
• Manual operator intervention*	• Day +2 conference bridge

Our Forecast Service Providers will be **producing a forecast accounting for the solar eclipse** that will automatically feed through the ISOs daily processes. The aggregate forecast for large scale solar will be available to the market participants, as well as public, through the OASIS applications.

* Potential processes that may be used

Timeline

- September – December 2016 (Completed)
  - Announced eclipse study at the September 2016 Market Performance and Planning Forum and requested input
  - Stakeholder web conference October 2016
  - Circulate with scheduling coordinators for comment
  - Comments due November 3, 2016
  - Start roof top solar effects on load study
- January – June 2017 (In Progress)
  - Develop Solar Eclipse Procedure
  - Publish procedure
  - Present procedure at the May Board of Governors meeting
  - Present final procedure at the July Market Performance Planning Forum
  - Following Event; review Solar Eclipse and identify lessons learned

Thank you.

FREQUENCY EVENT
November 9, 2016

Is the market and automation through EIM driving frequency? And, if so, can reliability of the BES be jeopardized?

- At 11:00 a normal data transfer process with inputs for the market occurred on schedule. A conflict in the process corrupted an input that was then transferred into the market software. The next market run at 11:15 failed and advisory results were sent out based on the last successful run at 10:59. The issues and troubleshooting continued through the hour until the issue was found and fixed around 12:10. Additional related issues were discovered and fixed at approximately 12:39.

- Around 11:59, the market runs started producing undesirable results. The ISO System Operators intervened by identifying and blocking the undesirable dispatches. This continued until 13:35 in order to keep the undesirable instructions from being sent to the market participants via ADS. During this time period the ISO System Operators sent out multiple market messages to Scheduling Coordinators in order to raise awareness and prevent resources from following undesirable startup or shutdown instructions. Scheduling Coordinators were encouraged to call the ISO to validate instructions before starting or shutting down any units.

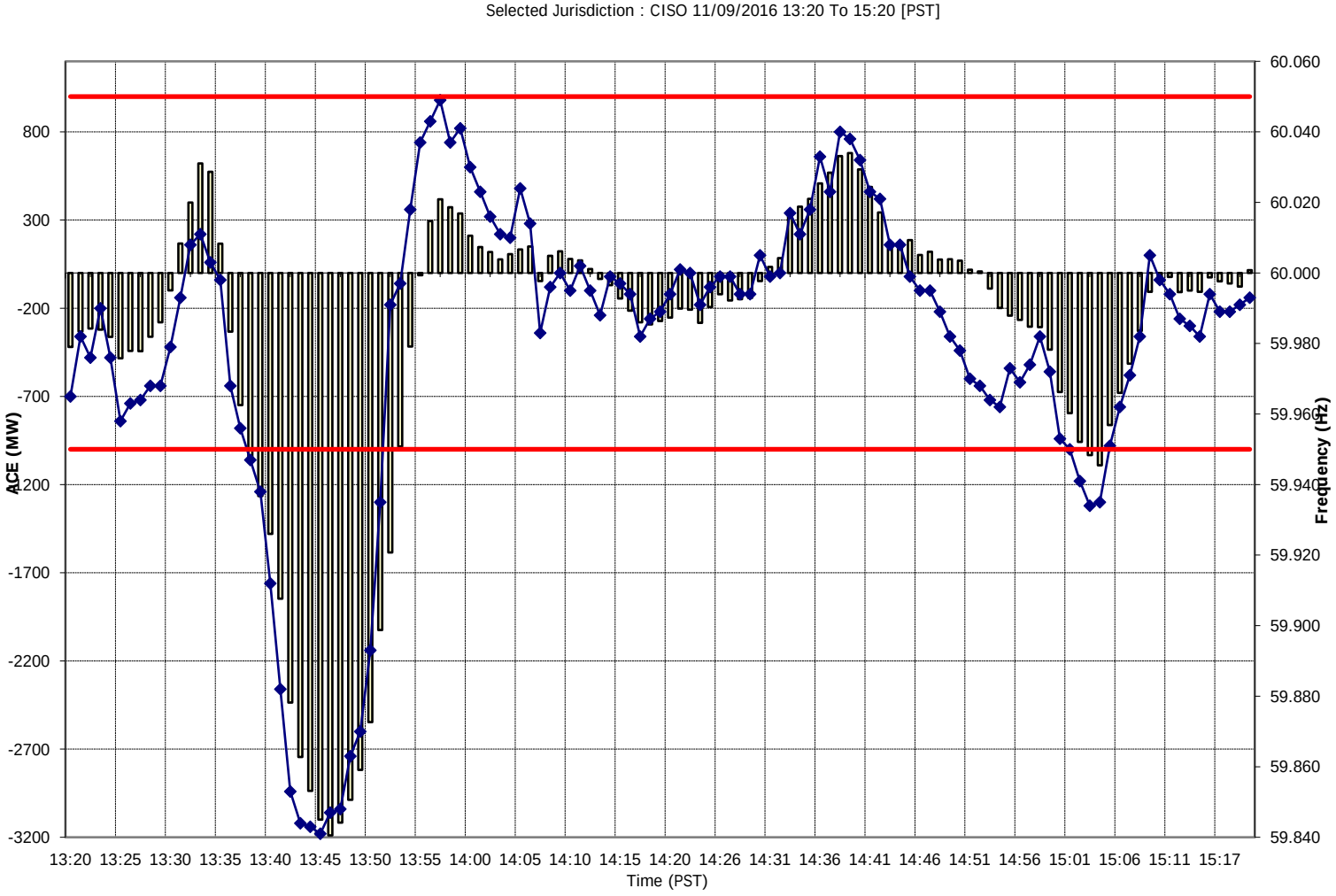
- 13:33 the ISO market software sent out decremental dispatch instructions of approximately 2500 MW to multiple generator resources via the Automatic Dispatch System (ADS) before the ISO's System Operators could block or override the dispatch instructions. The ISO's Operators verbally instructed Scheduling Coordinators to not follow the dispatches, but 1214 MW of the dispatch included fast moving resources and 730 MW of additional resources which automatically responded to the dispatch signal and reduced their output over an 11 minute period. This reduction in generation output caused the CAISO ACE and System Frequency to deviate.

- At 13:35 BAAL was exceeded. At 13:45 ACE was at its lowest point -3245MW and Frequency was 59.834 HZ.

- 13:53 BAAL was within limits, ACE and Frequency were recovered.

- During the lowest frequency minutes, Balancing Authorities in the NWPP area were over-generating by almost 1,600 MW to support frequency.

FREQUENCY EVENT
November 9, 2016



FREQUENCY EVENT
November 9, 2016

Reality vs. Modeling
April 11, 2017

Introduction and Background

The bulk power system is made up of three main parts: generation, transmission and load (i.e. customer electric demand). The electric industry uses terms such as reliable, unreliable, or system reliability as qualitative measures of the relative strength or balance of the bulk power system. Reliability is the term used by the electric industry to describe and measure the performance of the bulk power system. It is the degree to which the performance of the elements of that system results in power being delivered to consumers within accepted standards and in the amount desired. The degree of reliability may be quantitatively measured by the range of operating conditions under which the system performs within acceptable parameters.

Meeting the reliability expectations of the consumers requires the bulk power system to be planned, designed, constructed, operated, maintained, and restored, as necessary following the loss of the electric infrastructure, as described by specific, pre-determined test and criteria. As such, the bulk power system is constantly evaluated, assessed, and planned to ensure an adequate supply of electricity is available and deliverable and that the capacity required meeting current and future needs is sufficient.

Basic reliability principles are developed so that the:

- Interconnected bulk power systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions.
- Information necessary for planning and operation of interconnected bulk power systems shall be made available to those entities responsible for planning and operating the system reliably.
- Plans for emergency operation and system restoration of interconnected bulk power system shall be developed, coordinated, maintained and implemented.
- Facilities for communication, monitoring and control shall be provided, used and maintained for the reliability of interconnected bulk power systems.
- Personnel responsible for planning and operating interconnected bulk power systems shall be trained, qualified and have the responsibility and authority to implement actions.
- The security (operational reliability) of the interconnected bulk power systems shall be assessed, monitored and maintained on a wide area basis.

Power System Planning

Power system planning encompasses the development, evaluation and assessment of various potential outcomes for one or more years into the future. Operational planning can and does use similar concepts as long-term planning except the focus is the time period between one day and one year into the future. Both long-term and operational planning must address the uncertainty in the assumptions, such as forecasted load, generation dispatch, the status of transmission elements, and regional assumptions affecting transmission, (loop) flows, all of which define the operational state of the network. The primary difference between long-term and operational planning is in the range and types of uncertainty that must be addressed.

The dictionary defines reliability as consistently dependable performance. The reliability of the bulk power system is based on adequacy, i.e., having the necessary generating capability and transmission line capacity, as well as operating reliability (the ability to meet demand under expected and unforeseen conditions.) Both characteristics are necessary to provide a desired level of reliability. Power system planners consider several metrics under different scenarios in the design and testing of the bulk power system to meet minimum reliability levels.

Generators and transmission elements are the building blocks of the bulk power system. The number and configuration of generators and transmission lines contribute to the reliability of the bulk power system. The planning process assesses the performance of the existing bulk power system with respect to various reliability objectives to determine its ability to meet a forecasted requirement with adequate reliability. The essential reliability measures are frequency and voltage. The Bulk Power System is defined to operate with a set frequency range and a set voltage range. When both ranges are within their respective defined ranges the Bulk Power System is at a desired level of reliability.

Purpose of WECC Base Cases

The purpose of providing WECC-approved base cases to WECC membership is to assure coordination between members in developing a case representative of current or anticipated system topology and conditions, as required by the applicable NERC Reliability Standards. These cases are intended for use in effectively operating the current system and studying system adequacy in the future.

Posted base cases for the operating horizon represent realistic, reasonable conditions WECC-wide for specific seasons and time periods.

Essential Reliability Services

Voltage Support: Required to maintain system-level voltages on the BPS within established limits, under pre- and post-contingency situations, thus preventing voltage collapse or system

instability. Voltage issue are more local and addressed by the local entity without large scale impacts.

Frequency Support: Required to support stable frequency on the synchronized BPS and to maintain continuous load and resource balance by employing automatic response functions of a resource in response to deviations from normal operating frequency. The BPS must have the ability to raise or lower generation or load, automatically or manually, under normal and post-contingency conditions. Frequency issue are at the Interconnection, which cause wide spread outages.

Analyses

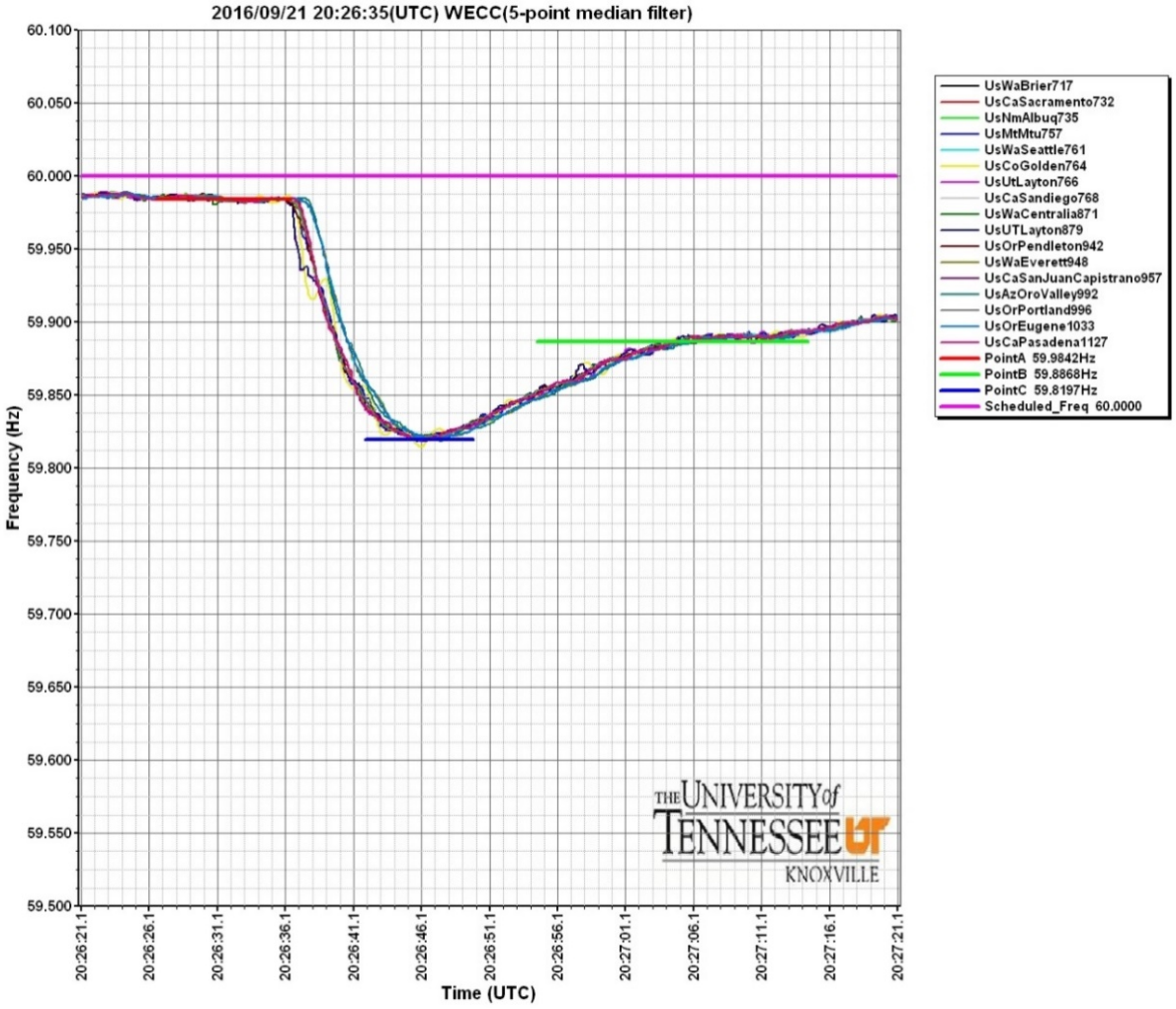
To adequately measure operational planning, a system planner will review actual events and compare them to the results of the event as modeled in the WECC-approved base case. When reviewing the actual event as compared to the model event, the system planner uses the actual measured essential reliability services of frequency and voltage as compared to the resulting modeled frequency and voltage. When there is a significant difference, the input assumptions in the base-case should be reviewed and updated until a more real situation is emulated by the program.

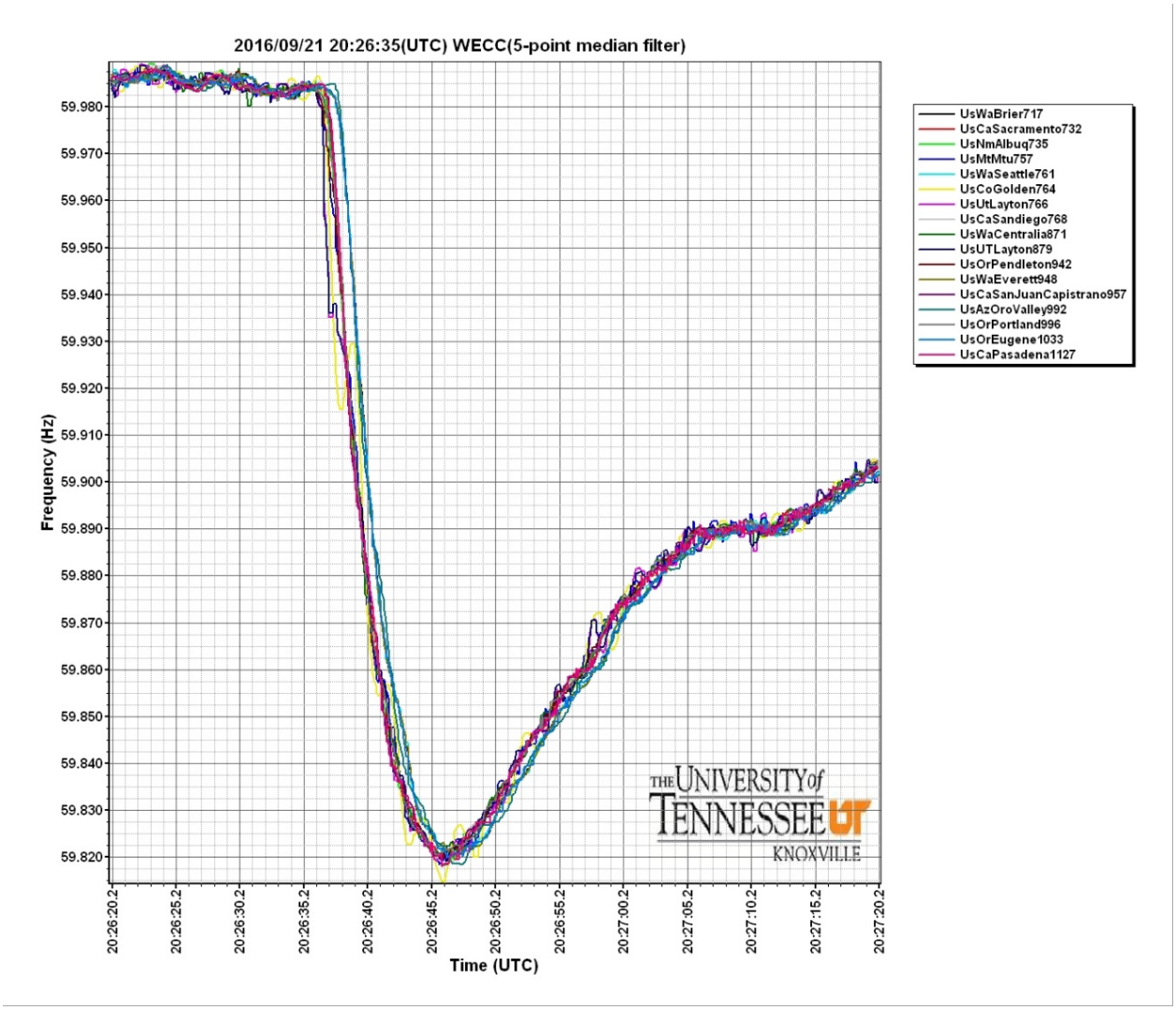
Events Review and Findings

The following two events were modeled utilizing the WECC base-case and compared to the actual results:

Event # 1
September 21, 2016
Time – 20:26:35 UTC
Disturbance - loss of 1,391 MW generation
Pre-Disturbance Frequency (Point A) – 59.9842 Hz
Nadir Frequency (Point C) – 59.8197 Hz
Point B – 59.8868 Hz

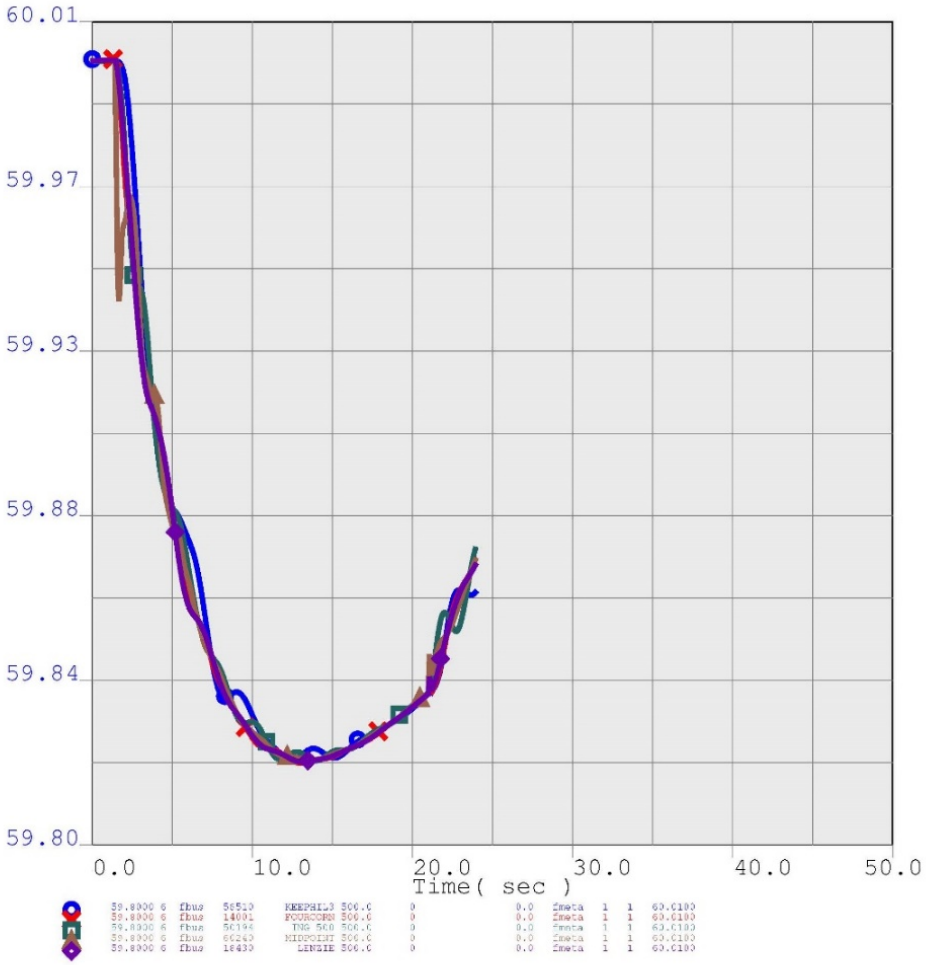
The following frequency graphs illustrate the event as it occurred in real time.


2016/09/21 20:26:35(UTC) WECC(5-point median filter)
Frequency (Hz)
60.100
60.050
60.000
59.950
59.900
59.850
59.800
59.750
59.700
59.650
59.600
59.550
59.500
20:26:21.1
20:26:26.1
20:26:31.1
20:26:36.1
20:26:41.1
20:26:46.1
20:26:51.1
20:26:56.1
20:27:01.1
20:27:06.1
20:27:11.1
20:27:16.1
20:27:21.1
Time (UTC)
THE UNIVERSITY of TENNESSEE KNOXVILLE
UsWaBrier717
UsCaSacramento732
UsNmAlbuq735
UsMtMtu757
UsWaSeattle761
UsCoGolden764
UsUtLayton766
UsCaSandiego768
UsWaCentralia871
UsUTLayton879
UsOrPendleton942
UsWaEverett948
UsCaSanJuanCapistrano957
UsAzOroValley992
UsOrPortland996
UsOrEugene1033
UsCaPasadena1127
PointA 59.9842Hz
PointB 59.8868Hz
PointC 59.8197Hz
Scheduled_Freq 60.0000



Simulating the event utilizing the WECC base case, adjusting for the known load and generation produced the following frequency graph.

JBridger trip 1376 MW
2016 OFF-PEAK 16LS
NWPP - BASED LOAD FLAGS SET



2016 Off-PEAK Summer - JBridger 1-2 trip +DJ4 1376 MW
WECC 2016 REGIONAL ASSESSMENT UFLS FOR PRC-006
OCT 2016 PERFORMED BY WECC UFLS-RG (BL=1)
GEN LOSS = 1100 MW Jim Bridger 266 MW DAVEJON4
ALL COMMENTS FROM TSS AND OC REVIEW ARE INCLUDED

Page 1

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\2016\cases\wecc\jb-event

Tue Feb 07 11:41:57 2017

As illustrated the WECC base case failed to emulate the actual results. This presents a problem for operational planners and standard developers.

NERC Reliability Standard BAL-003-1.1 and the required Interconecction Frequency Response was determined utilizing the WECC base case model. Since actual results do not reflect any resemblance to the WECC base case model under the same circumstances, is the reliability of the Interconnection safe as required in the Standards.

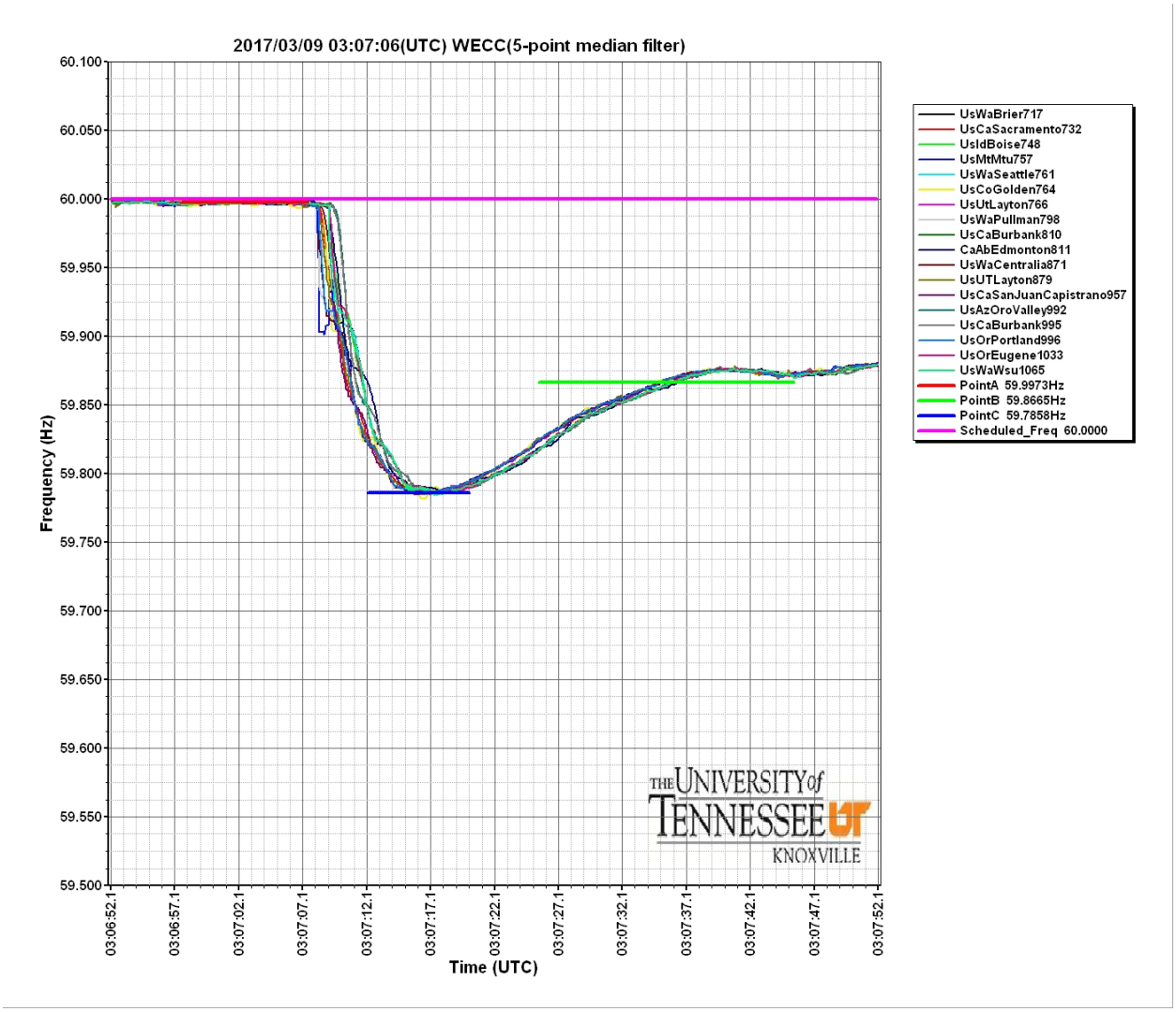
By modifying the WECC base case to reflect no frequency response from the southern area of the Western Interconnection (California, Arizona, and New Mexico) the model produced the following frequency graph.

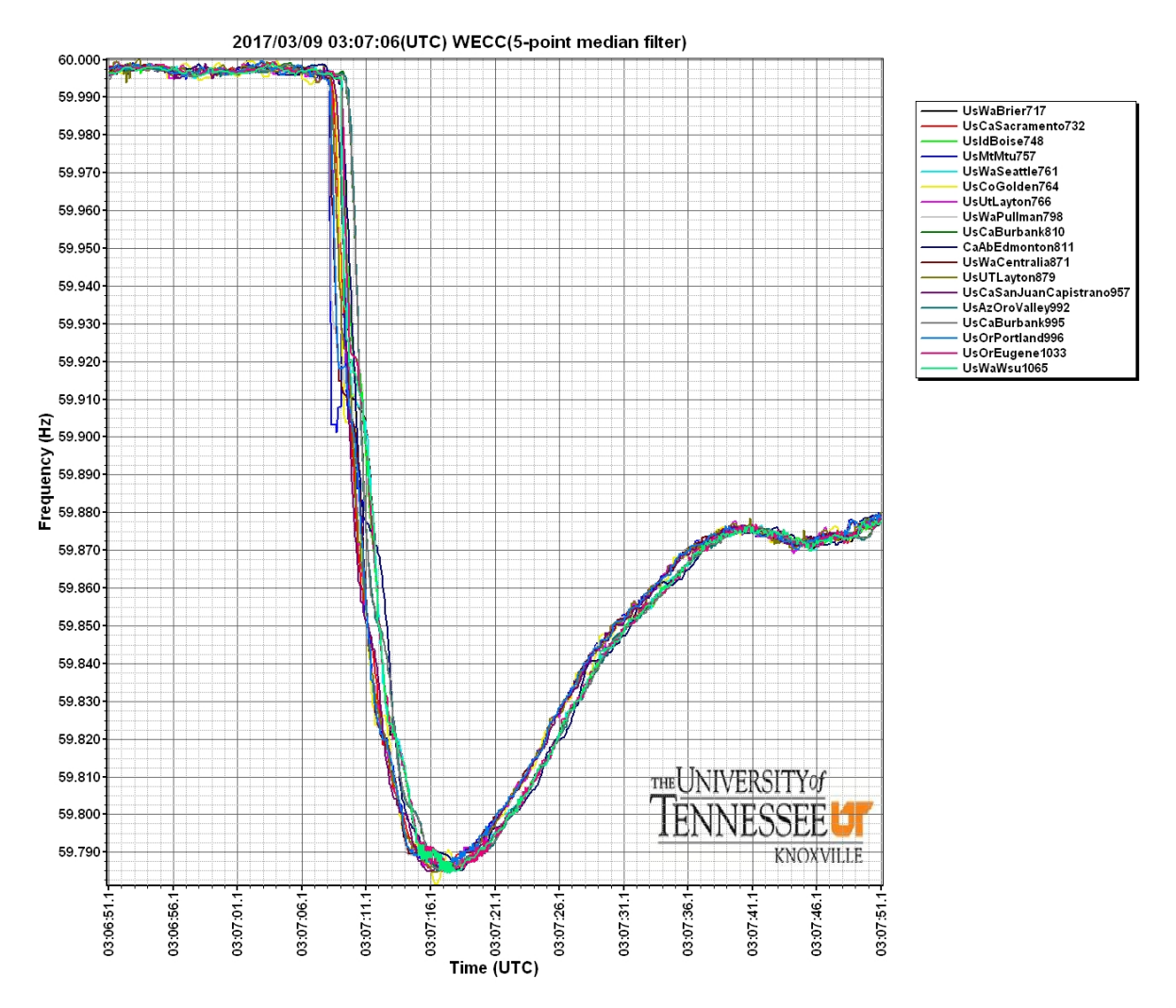
The above comes close to the actual frequency graph.

However, many other changes other than just modifying frequency response could influence the model frequency graph.

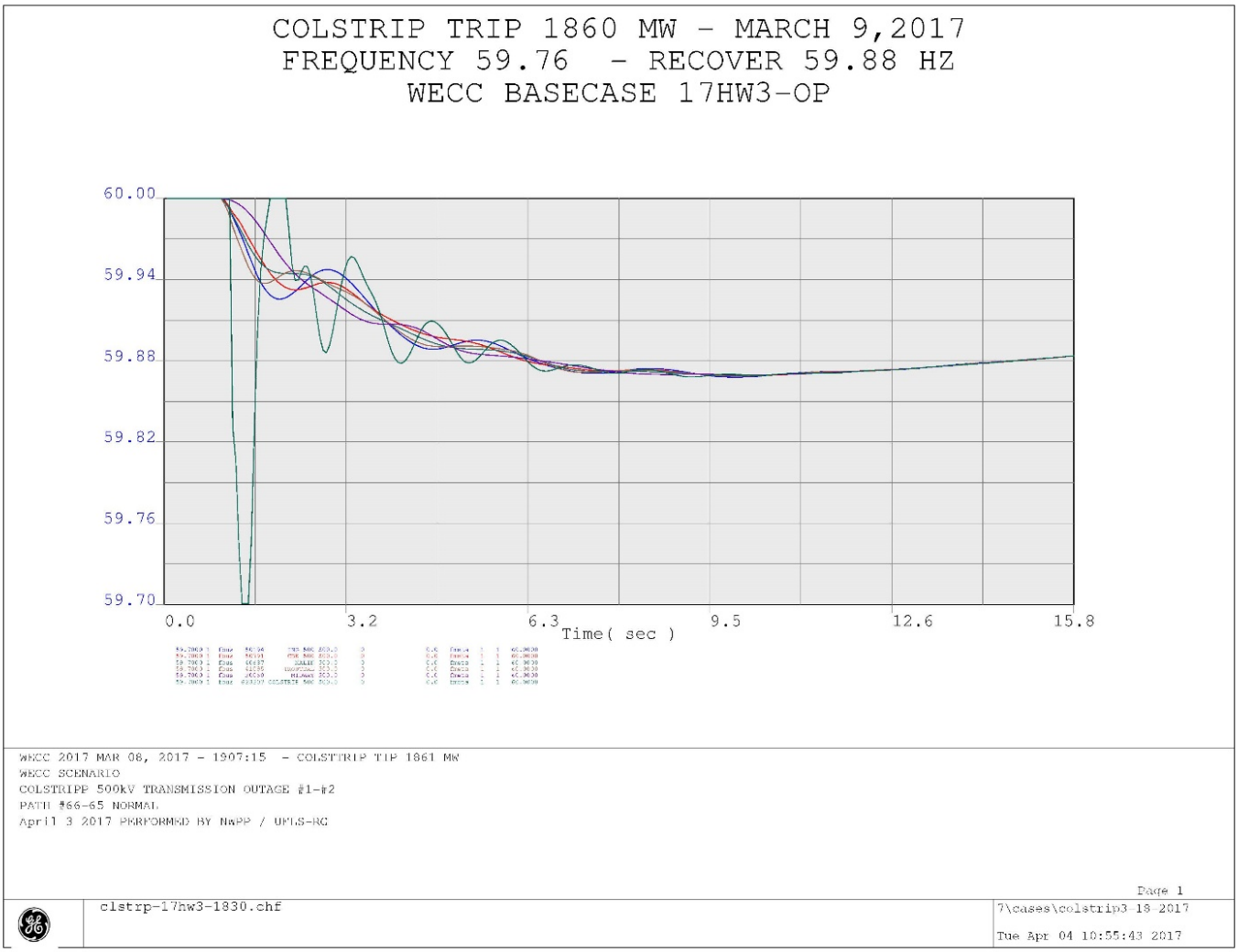
Event # 2
March 9, 2017
Time – 03:07:36 UTC
Disturbance - loss of 1861 mw generation
Pre-Disturbance Frequency (Point A) – 59.9973 Hz
Nadir Frequency (Point C) – 59.7858 Hz
Point B – 59.8665 Hz

The following frequency graphs illustrate the event as it occurred in real time.





Simulating the event utilizing the WECC base case, adjusting for the known load and generation produced the following frequency graph.



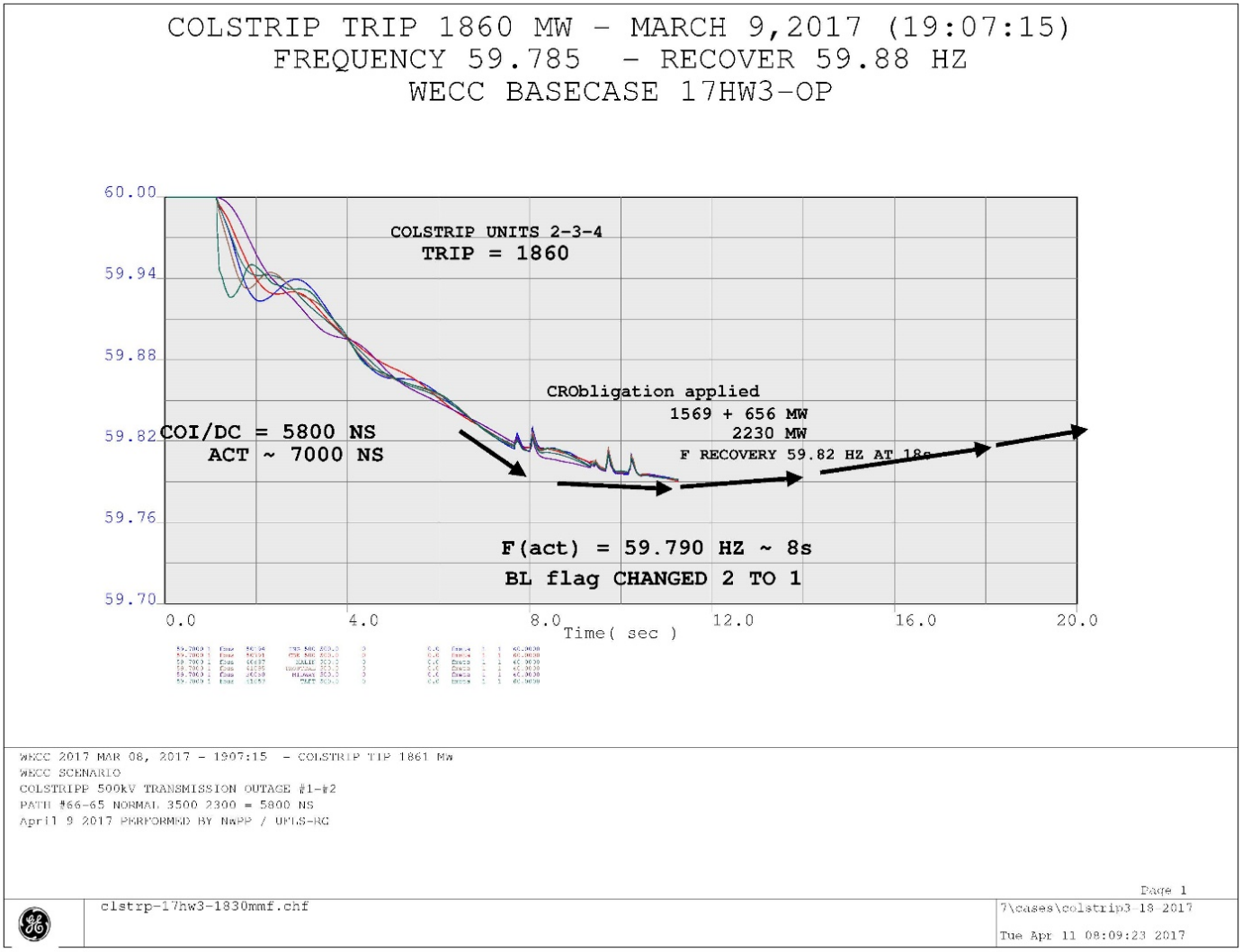
Again, this illustrates the WECC base case failed to emulate the actual results. And again, this presents a problem for operational planners and standard developers.

Several changes to the WECC base case were necessary to create a scenario which emulated the actual results, as follows:

- The AC intertie was set at 3,500 MW N-S
- PDCI was set at 2,500 MW N-S
- Almost all the generation in the Western Interconnection was base loaded
- Chief Joseph, Mc Nary, John Day, and Bonneville were regulating, with Grand Coulee base loaded

- Generating Units from 10 MW to ~ 90 MW were not base loaded and were responsible for frequency regulation

Adjusting the WECC base case utilizing the above produced the following frequency graph.



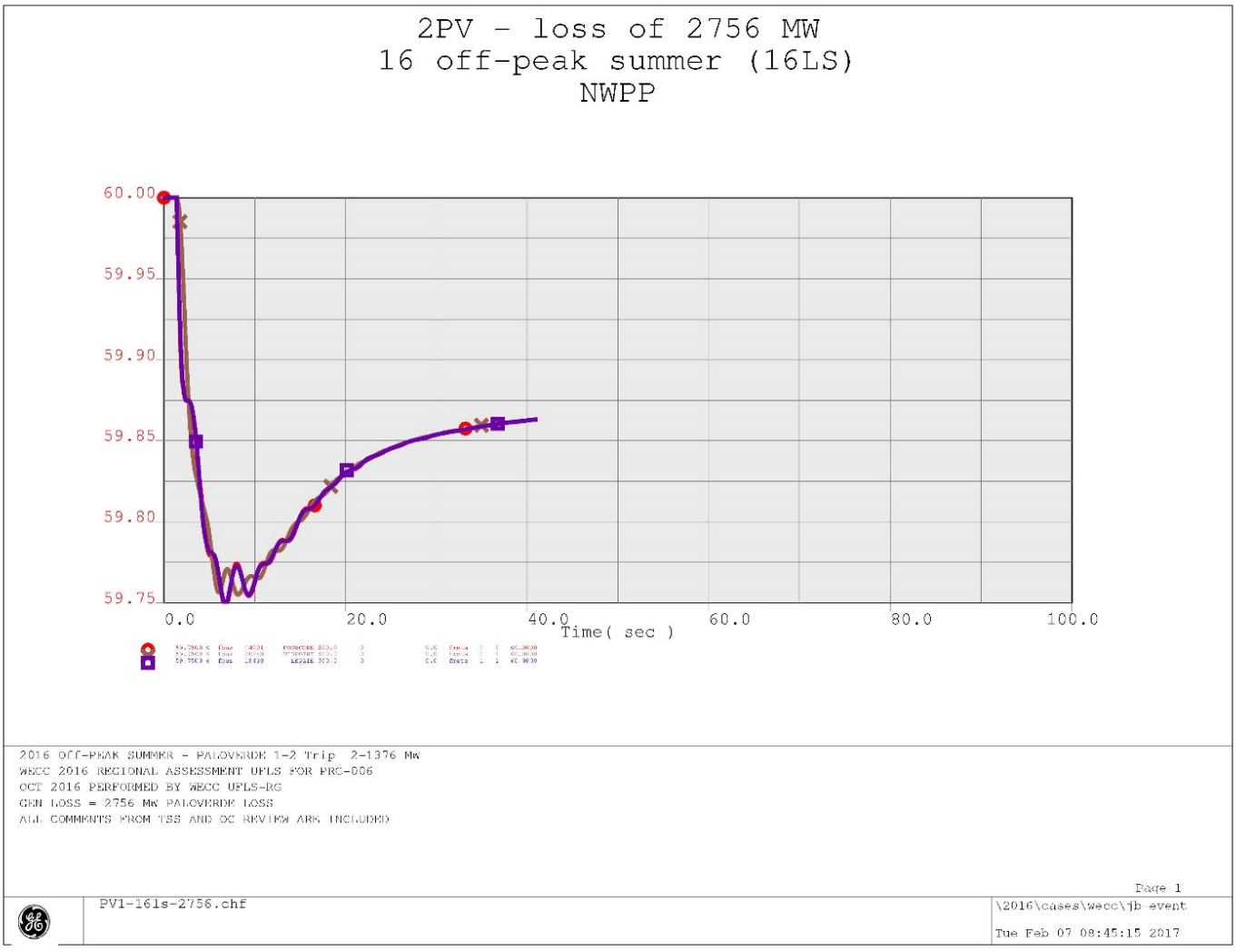
Again, similar to Event #1, after making all the necessary adjustments to the WECC base case, a frequency graph can be produced that emulates the actual frequency graph that occurred during real-time.

This indicates that the WECC base case is in need of significant adjustment if it is to be relied upon for any type of reliability study.

Test of BAL-003-1.1

Bal-003-1.1 establishes the Interconnection Frequency Response Obligation (IFRO) based on the resource contingency criteria (RCC), which is the largest category C (N-2) event identified in the last 10 years. For the Western Interconnection the RCC is 2,740 MW.

Using the adjusted WECC base case from the above event #1, the following frequency graph was produced.



The above results are well within the assumptions associated with BAL-003-1.1