

Anticipating and Preparing for Multiple Reliability Coordinators in the Western Interconnection

I. Overview

The purpose of this whitepaper is to inform utility commissioners and policymakers of the importance of the Reliability Coordination¹ (RC) function to assure the reliability of the Bulk Electric System. In light of the ongoing developments around the changing RC structure in the Western Interconnection, the key question is whether there will be at least the same, or better, level of reliability when multiple RCs share responsibility for the coordinated operation across the boundaries and seams of the adjacent Reliability Coordinator Areas. The issues determined to be of greatest concern to reliability are elaborated in [Section IV](#) of this document. These issues include:

- System Operating Limit and Interconnection Reliability Operating Limits Coordination
- Wide Area View and the Future of the Westwide System Model
- Outage Coordination
- Remedial Action Scheme Coordination
- Oscillatory Dynamics

[Appendix I](#) describes the functional role of an RC and their responsibilities in greater detail.

This whitepaper is compiled through research on the relevant issues, reviews of applicable North American Electric Reliability Corporation (NERC) and Federal Energy Regulatory Commission (FERC) documents, and extensive interviews with relevant personnel at the North American Electric Reliability Corporation (NERC), the Western Electricity Coordinating Council (WECC), Peak Reliability, the Southwestern Power Pool (SPP), and the California ISO (CAISO).

II. Reliability Coordination in the Western Interconnection – Background and Certification

A. Background

The RC (RC) function was first established in the Western Interconnection in the late 1990s. The role, initially described as “security coordination,” has evolved with NERC setting forth a defined role in the

¹ The use of capitalized terms in this document indicates that the term is a defined term from either the [NERC Glossary of Terms Used in Reliability Standards](#) or [Appendix 2 to the NERC Rules of Procedure: Definitions Used in the Rules of Procedure](#).

*Reliability Functional Model*² along with the creation of mandatory Reliability Standards, including many of which were specifically written for RCs. NERC's actions established and clarified RC responsibilities and set expectations for ensuring grid reliability.

In 2005, WECC began the effort to consolidate the RC function from three entities into a single entity. This move was spurred by perceived weaknesses and needs apparent in the three RC approach in place at that time; including a lack of independence and seams issues. The initiative focused on addressing the following needs:

- Independence – WECC members desired an organization solely focused on reliability, not hosted by any individual operating or market organization
- Creation of a single detailed network model for the entire Interconnection that represented all aspects of the Bulk Electric System; this became known as the West-wide System Model (WSM)
- Visibility of the entire Interconnection - detailed view of displays (Wide Area overview, substations, lines, generation), alarms, major paths, capacities, and all the data necessary telemetered from each entity
- Integrated day-ahead and Real-time studies of the entire Interconnection
- Common set of wide area Real-time analytical tools (addressing issues such as voltage and transient stability) based on the WSM
- Event management and coordination of restoration activities, when necessary
- Coordinated equipment outage management tool for the entire Interconnection to use for day-ahead and seasonal studies and provide contingencies analysis

This effort culminated with a plan to build and staff the WECC RC function at two essentially identical facilities, in Vancouver, WA and Loveland, CO, which commenced operations on January 1, 2009.

Changes began to come to Peak Reliability following the September 8, 2011 southwestern outage which led to the bifurcation of WECC.³⁴ The Alberta Electric System Operator (AESO) subsequently left Peak as a funding party January 1, 2014, although AESO continues to receive certain services from Peak.⁵ The pace of change accelerated in September 2017 with the announcement of the creation of the Mountain West Transmission Group and their announcement that they would become Regional Transmission Organization (RTO) administered by Southwest Power Pool (SPP) that would include the provision of RC services. Another significant disruption occurred in December of 2017 when Peak announced a formal agreement to explore the provision reliability services and markets in the West in a partnership with PJM Connex (a subsidiary of the PJM independent system operator from Norristown, PA). This led to CAISO's January 2, 2018 announcement that they would be withdrawing from the Peak Funding Agreement and would begin operating an RC beginning September 1, 2019. The final alignment of the

² Reliability Functional Model: Function Definitions and Functional Entities, Version 5 ("Functional Model") published by NERC, (2010). Available at <http://www.nerc.com/pa/Stand/Pages/FunctionalModel.aspx>.

³ See Section II, below.

⁴ See Section II, below.

⁵ AESO primarily serves as the RC for Alberta, Canada but AESO is not registered with, or certified by, NERC as the RC but "provides services consistent with Alberta legislation" according to NERC's website -

<http://www.nerc.com/pa/rm/TLR/Pages/Reliability-Coordinators.aspx>. AESO continues to retain access to the WSM and other tools and services from Peak under contract.

Reliability Coordinator Areas remains unknown but beginning in the summer of 2019 at least two RCs will be in parallel operations and before the end of 2019 SPP and CAISO will be operating RCs in the Western Interconnection. The efforts of the WECC RC and, subsequently, Peak Reliability (“Peak”) over the last nine years demonstrate a growth of RC competencies, improved tools, and enhanced capabilities to ensure reliability coordination across the Western Interconnection.

B. Certification

Certification is governed by the NERC Rules of Procedure Section 500 (see Rule 501.2, and Appendix 5A - the *Organization Registration and Certification Manual*⁶). While certification is a required precondition to allowing an RC to begin operations, it sets forth only the bare minimum of activities, tools, and training for an organization to be compliant with the applicable Reliability Standards. The certification process is largely a quantitative analysis not a qualitative analysis. It serves as a one-size fits all process for all reliability entities and does not account for any lessons learned not captured in a Reliability Standard. In fairness, the Reliability Standards addressing RC operations are intended to address those conditions most likely to cause instability, cascading, and separation based on investigations of previous system events and observations. However, successful certification, did not prevent the Southwest Outage on September 8, 2011, nor did it obviate the need for the agreed-upon \$13 million dollars of “reliability enhancement measures” by WECC to mitigate and correct the failures that exacerbated the Southwest Outage event.

Both CAISO and SPP will need to undergo certification by WECC prior to beginning their RC operations.⁷ Accordingly, SPP and CAISO are already working with WECC to coordinate and schedule their respective RC certifications.

Certification should be viewed as only the starting point for determining whether the RC entities are able to perform the RC function based on the applicable NERC Reliability Standards. It does not provide any sort of qualitative analysis of the ability to uphold an equivalent level of reliability across the Western Interconnection. No evaluation of the efficacy of RC services can be deemed acceptable simply by the entity becoming certified in accordance with the NERC Rules of Procedure.

III. September 8, 2011 Outage and Mitigations

On September 8, 2011, an event that began at a substation in Arizona over a course of 11 minutes led to a load loss in excess of 30,000 MWh leaving approximately 2.7 million customers⁸ without power, many for multiple hours or even in to the next day.⁹ The WECC RC, as the responsible RC, was determined by a joint Federal Energy Regulatory Commission (FERC) and NERC investigation to have violated nine

⁶ *Rules of Procedure of the North American Electric Reliability Corporation* (hereinafter “Rules of Procedure”), (2018).

⁷ Similarly, if Peak intends to run a market similar to the existing independent system operators and regional transmission operators currently operating, they will need to become certified as a Balancing Authority and Transmission Operator. This is in addition to developing and filing an Open Access Transmission Tariff with FERC.

⁸ Customers from San Diego Gas and Electric, Comisión Federal de Electricidad in northern Baja California, Imperial Irrigation District, Arizona Public Service, and the Western Area Power Administration’s Lower Colorado system.

⁹ *Western Electricity Coordinating Council, Order Approving Stipulation and Consent Agreement* (hereinafter “WECC Agreement Order”), 151 FERC ¶61,175 at P 7, (2015).

Requirements of five Reliability Standards¹⁰ that “undermined the reliability of the [Bulk Power System] and contributed to the September 8 event.¹¹ As a result of the violations, WECC and FERC agreed to substantial remedies and sanctions including a total civil penalty of \$16 million, of which \$13 million was offset due to “reliability enhancements” which FERC believed would “substantially exceed the amount of the offset.”¹²

The reliability enhancements are actions above and beyond those required by the Reliability Standards. The two primary reliability enhancements were a substantial increase in staffing (including the addition of 18 RC operators) and the bifurcation of the WECC Regional Entity and WECC RC into two legally separate entities, WECC and Peak Reliability.¹³ The increase in staffing is the primary driver in the increase of Peak’s budgets where approximately 72% of the 2018 budget is devoted to personnel expenses.¹⁴ Other reliability enhancements included *inter alia* improved data sharing, better planning (seasonal, next-day, and current-day), improved Remedial Action Scheme modeling for Real-time Contingency Analysis, improved phase angle estimation, incorporation of Interconnection Reliability Operating Limits (IROLs) into its System Operating Limit (SOL) methodology, and improved situational awareness.¹⁵ Peak also adopted a continuous improvement model to improve tools, communication, training, and operations.¹⁶

Of these mitigating and remedial measures, only a few are captured in new or revised Reliability Standards or improved tools. Some, like increased staffing requirements which mandated two RC operators per desk,¹⁷ appear as if they will become a relic of the transition underway. Additionally, it is unclear what additional services the new RCs will offer that enhance reliability beyond those required by the standards including the reliability messaging tool, hosted advanced applications, the WECC Interchange Tool, Enhanced Curtailment Calculator. It is expected that both SPP and CAISO will offer similar or comparable tools, but it is unclear when and how such tools will be offered.

IV. Specific Issues and Challenges to be Addressed in a Multiple RC Environment

A. System Operating Limit and Interconnection Reliability Operating Limits Coordination

NERC defines a System Operating Limits (SOL) as:

¹⁰ The WECC RC violated FAC-011-2 R3; FAC-014-2 R1; IRO-003-2 R1 and R2; IRO-004-1 R1; and IRO-005-2 R5, R9, R12, and R15.

¹¹ WECC Agreement Order at P 18.

¹² *Id.* at P 22.

¹³ *Id.* at P 23.

¹⁴ 2018 Peak Proposed Business Plan and Budget (2017).

¹⁵ WECC Agreement Order at PP 25-55.

¹⁶ A continuous improvement model is “an ongoing effort to improve products, services or processes.” American Society for Quality, available at <http://asq.org/learn-about-quality/continuous-improvement/overview/overview.html> (2017).

¹⁷ *Id.*

The value (such as MW, Mvar, amperes, frequency or volts) that satisfies the most limiting of the prescribed operating criteria for a specified system configuration to ensure operation within acceptable reliability criteria. System Operating Limits are based upon certain operating criteria. These include, but are not limited to:

- Facility Ratings (applicable pre- and post-Contingency Equipment Ratings or Facility Ratings)
- transient stability ratings (applicable pre- and post- Contingency stability limits)
- voltage stability ratings (applicable pre- and post-Contingency voltage stability)
- system voltage limits (applicable pre- and post-Contingency voltage limits)¹⁸

An Interconnection Reliability Operating Limit (IROL) is defined as:

A System Operating Limit that, if violated, could lead to instability, uncontrolled separation, or Cascading outages that adversely impact the reliability of the Bulk Electric System.¹⁹

One of the fundamental responsibilities of an RC is the responsibility to manage IROLs, and to ensure SOLs do not evolve into IROLs. Specifically, RCs must develop and implement an IROL methodology²⁰ and an SOL methodology,²¹ to initiate Transmission Loading Relief²² or unscheduled flow mitigation²³ to prevent or manage SOL/IROL conditions, to identify SOL and IROL exceedances in Real-time and day-ahead timeframes,²⁴ to coordinate actions to ensure operations remain within IROLs,²⁵ and to monitor the Wide Area view to prevent the occurrence of any IROL condition.²⁶ This job may become substantially more difficult if there is not a common understanding of what constitutes an IROL across different portions the Western Interconnection. There needs to be a common information model and a common understanding between the RCs to understand what constitutes an IROL, emergency conditions, and other issues that may extend beyond any individual Reliability Coordinator Area. During the course of our interviews, the desire for a common IROL and SOL methodology was expressed by several individuals. The acceptance and use of a common methodology is believed to enhance system reliability.

B. Wide Area View and the Future of the Westwide System Model

One of the primary tasks of the Reliability Coordinator is to monitor a “Wide Area view.” Wide Area is defined as “[t]he entire Reliability Coordinator Area as well as the critical flow and status information from adjacent Reliability Coordinator Areas as determined by detailed system studies to allow the calculation of Interconnected Reliability Operating Limits.”²⁷ Additionally, the Functional Model states the RC “maintains Real-time operating reliability of its Reliability Coordinator Area and in coordination

¹⁸ *Glossary of Terms Used in NERC Reliability Standards* (hereinafter “Glossary”), (2018).

¹⁹ *Id.*

²⁰ Reliability Standard FAC-014-2 – Establish and Communicate System Operating Limits.

²¹ Reliability Standard FAC-011-3 – System operating Limits Methodology for the Operations Horizon.

²² Reliability Standard IRO-006-5 – Transmission Loading Relief.

²³ Reliability Standard IRO-006-WECC-2 – Qualified Transfer Path Unscheduled Flow (USF) Relief.

²⁴ Reliability Standard IRO-008- 2 – Reliability Coordinator Operational Analysis and Real-time Assessments.

²⁵ Reliability Standard IRO-009-2 – Reliability Coordinator Actions to Operate within IROLs.

²⁶ Reliability Standard IRO-002-5 – Reliability Coordination – Monitoring and Analysis.

²⁷ *Id.*

with its neighboring Reliability Coordinator's wide-area view. The wide-area view includes situational awareness of its neighboring Reliability Coordinator Areas."²⁸

The Westwide System Model (WSM) is a singular model covering the entire Western Interconnection in the United States, Canada, and Mexico that applies over 169,000 measurements. The WSM satisfies the needs of a Wide Area view and has been referred to as "the crown jewel of the Western Interconnection."²⁹ It is available for use by Peak Reliability and all Balancing Authorities and Transmission Operators in the west.³⁰ It was initially created in 2009 and has been continuously improved by WECC and Peak. It is also used to perform a diverse series of tasks from analyzing Real-time transient stability to populating the dispatch training simulator used by Peak to run Interconnection-wide System restoration drills.

The parties largely agree that they desire to see the continued maintenance, updating, and sharing of the WSM. How this will happen remains an open question. The upkeep includes timely additions, modifications, or deletions of grid elements and distribution to all WSM users. If Peak continues these tasks in the future, Peak will need to be compensated for these efforts. If Peak can no longer perform these duties, an amicable solution must be reached among the parties to ensure this critical component to situational awareness and planning is not lost in the transition reducing the ability of the remaining RCs to prevent, detect, and respond to risks to grid operations.

Currently, access to the WSM is governed by the Universal Data Sharing Agreement (UDSA)³¹ and facilitated by Peak. Additionally, the fate of the UDSA is unknown. While some observers may view the UDSA as flawed, the UDSA allows for a controlled environment for data sharing across the Western Interconnection. The RC parties, as well as other western Balancing Authorities and Transmission Operators, need to be thinking about the future of this agreement or a suitable replacement.

Furthermore, once the WSM is adapted for each Reliability Coordinator Area, each RC may turn off some of the view for areas beyond their responsibility for monitoring and initiating actions. This could limit the ability to see cross-border issues stemming from IROLs, SOLs, RAS, oscillatory, and other events. It may also limit the ability to perform holistic System restoration training, drills, and simulations on a scale such as those currently run by Peak perhaps reducing the effectiveness or timeliness of System restoration from a Bulk Electric System event.³²

C. Outage Coordination

Reliability Standard IRO-017-1 requires outage coordination "to ensure that outages are properly coordinated in the Operations Planning time horizon and Near-Term Transmission Planning Horizon."³³ While this standard only addresses outage coordination within each RC Area, outage coordination is also

²⁸ *Id.* at p. 30.

²⁹ Interviews with Bob Cummings from NERC (Feb. 2, 2018), Brett Wangen from Peak Reliability (March 1, 2018).

³⁰ AESO also continues to utilize the WSM under its services agreement with Peak.

³¹ Peak Reliability, Universal Data Sharing Agreement (2016). Available at <https://www.peakrc.com/aboutus/DataSharing/Documents/2016%20Universal%20Data%20Sharing%20Agreement%20FINAL%20032516.pdf>.

³² Reliability Standard EOP-006-2 – System Restoration Coordination.

³³ Reliability Standard IRO-017-1 – Outage Coordination.

of critical importance across RC Area boundaries. In order to properly model Operational Planning Analyses, all RCs must have all necessary outage inputs in a timely manner. This must be addressed in the IRO-014-3 RC to RC Operating Agreements in a manner satisfactory to all parties.³⁴

The question of how each RC will coordinate and utilize all outage information to ensure all areas including seams are studied appropriately. Due to the Interconnection-wide interdependencies of outage coordination, it is assumed that each RC will model all outages in all RC footprints in the Interconnection that may impact the RC conducting the study. If that does not occur, the rationale for such omissions should be discussed and the responsibility for conducting such modeling must be clearly established and the results shared. This level of coordination will require common outage nomenclature and study and any conflicts be resolved in a timely manner.

D. Remedial Action Scheme Coordination

A Remedial Action Scheme³⁵ (also formerly known as a special protection system) is generally defined by the following in the NERC Glossary.

A scheme designed to detect predetermined System conditions and automatically take corrective actions that may include, but are not limited to, adjusting or tripping generation (MW and Mvar), tripping load, or reconfiguring a System(s). RAS accomplish objectives such as:

- Meet requirements identified in the NERC Reliability Standards;
- Maintain Bulk Electric System (BES) stability;
- Maintain acceptable BES voltages;
- Maintain acceptable BES power flows;
- Limit the impact of Cascading or extreme events

There are in excess of 250 Remedial Action Schemes throughout the Western Interconnection. The likelihood of any RAS scheme crossing RC boundaries is quite high.³⁶ In fact, the lack of awareness of a RAS that crossed BA boundaries is the cause of one of the WECC RC's September 8, 2011 violations.³⁷ Since then, RAS modeling for contingency analysis has been a qualitative benefit of the single RC to ensure their effect on contingency identification and mitigation is well known. Coordination of RAS between existing and new RC entities must be thoroughly coordinated.

E. Oscillatory Dynamics

One way in which the Western Interconnection is different than the Eastern Interconnection is the presence of unique oscillatory dynamics that can present themselves across hundreds, or even thousands, of miles. These are sometimes referred to as "clear air events" in that they may arise, seemingly, out of nowhere, under what appear to be normal operating conditions. This is due to the nature of the Western Interconnection where long transmission lines link generation to distant load centers. In the Eastern Interconnection, transmission lines are generally much shorter, transmission

³⁴ Reliability Standard IRO-014-3 – Coordination Among Reliability Coordinators, Requirement R1 part 1.4.

³⁵ A good primer on RAS is the webinar presented by WIRAB on September 29, 2017 and available at <https://westernenergyboard.org/2017/09/wirab-webinar-introduction-to-remedial-action-schemes-ras-in-the-west/>.

³⁶ For example, the WECC-1 RAS (described in the webinar above).

³⁷ WECC's violated IRO-005-2 Requirement R12 "because it was not aware of [a] RAS and separation scheme at the San Onofre switchyard." WECC Agreement Order at P 20.

lines are more densely networked, and generation is located closer to load. Consequently, stability limits are often more important than thermal limits across the Western Interconnection and a problem in Colorado may impact operations in California. Therefore, coordination and communication before, during, and after these events, including the sharing of state estimation, will be key to maintaining stability across the Western Interconnection. The concepts of ensuring a Wide Area View, mitigating seams and boundary issues, and utilizing common models will be important to prevent such events from growing into a reliability problem.

This issue has presented itself several times in operations of the Western Interconnection, notably in the outages that occurred August 10, 1996.³⁸ Thorough discussion of these conditions must be addressed in operator training and coordination between the RCs.

V. RC to RC Agreements

Perhaps the biggest change in the future of the Western Interconnection with insertion of additional RCs is the need for detailed RC to RC agreements to clearly delineate RC responsibilities that occur along seams or boundaries between the RCs. *Reliability Standard IRO-014-3 – Coordination Among Reliability Coordinators* intends “to ensure that each Reliability Coordinator’s operations are coordinated such that they will not adversely impact other Reliability Coordinator Areas and to preserve the reliability benefits of interconnected operations.”³⁹ This coordination includes the creation and maintenance of Operating Procedures, Processes, and Plans to address proper notification to adjacent RCs, energy and capacity shortages, outage coordination, and communications. Templates for what this will look like already exist among the RCs in the Eastern Interconnection, and Peak has some experience with this along the borders of AESO footprint and its limited DC connections with SPP at several locations. Of the potential RCs, SPP already has significant experience with this, as it borders the Midcontinent ISO and the Tennessee Valley Authority.

Preparation and negotiation of these contracts will be slow and painstaking. These cannot simply be drawn up by lawyers or managers. At a minimum, these agreements must address:

1. Criteria and processes for notifications.
2. Energy and capacity shortages.
3. Control of voltage, including the coordination of reactive resources.
4. Exchange of information including planned and unplanned outage information to support its Operational Planning Analyses and Real-time Assessments.⁴⁰
5. Provisions for periodic communications to support reliable operations.⁴¹

³⁸ This event is discussed at length in NERC’s *1996 System Disturbances: Review of Selected 1996 Electric System Disturbances in North America*, pp. 39-50, (2002). Available at <https://www.nerc.com/pa/rrm/ea/System%20Disturbance%20Reports%20DL/1996SystemDisturbance.pdf>.

³⁹ Reliability Standard IRO-014-3 – Coordination Among Reliability Coordinators.

⁴⁰ This issue is explored in a WIRAB webinar presented on May 31, 2017, available at <https://westernenergyboard.org/2017/05/wirab-webinar-introduction-to-next-day-studies/>.

⁴¹ *Id.* at Requirement R1.

These coordination agreements should address at least all the issues raised in this white paper and many more. There needs to be frank, open, and honest discussions among operators at the RC, BA, and TOP level, and also with Planning Coordinators that can recreate past events and anticipate future operating conditions in an increasingly complex operating environment.

Appendix I - Reliability Coordinator Overview

The Reliability Coordinator (RC) sits atop the operating hierarchy envisioned by the North American Electric Reliability Corporation (NERC). NERC defines the RC as “the entity that is the highest level of authority who is responsible for the Reliable Operation of the Bulk Electric System, has the Wide Area view of the Bulk Electric System, and has the operating tools, processes and procedures, including the authority to prevent or mitigate emergency operating situations in both next-day analysis and real-time operations. The Reliability Coordinator has the purview that is broad enough to enable the calculation of Interconnection Reliability Operating Limits, which may be based on the operating parameters of transmission systems beyond any Transmission Operator’s vision.”⁴² Accordingly, the NERC Rules of Procedure requires that “all areas are under the oversight of one and only one Reliability Coordinator” as well as each Balancing Authority and Transmission Operator.⁴³ Moreover, “the Reliability Coordinator is the highest operating authority; the underlying premise is that the reliability of a wide area.”⁴⁴

The responsibilities or “functional tasks” of the RC are elaborated in the *NERC Reliability Functional Model – Version 5* (“Functional Model”) and includes:

1. Monitor all reliability-related parameters within the reliability area, including generation dispatch and generation/transmission maintenance plans.
2. Identify, communicate, and direct actions if necessary to relieve reliability threats and limit violations in the reliability area.
3. Develop Interconnection Reliability Operating Limits (to protect from instability and Cascading).
4. Assist in determining reliability-related services requirements for balancing generation and load, and transmission reliability (e.g., reactive requirements, location of operating reserves).
5. Perform reliability analysis (actual and contingency) for the reliability area.
6. Direct revisions to transmission maintenance plans as permitted by agreements.
7. Direct revisions to generation maintenance plans as permitted by agreements.
8. Direct implementation of emergency procedures including load shedding.
9. Direct and coordinate system restoration.
10. Curtail Confirmed Interchange that adversely impacts reliability.⁴⁵

⁴² Glossary.

⁴³ Rules of Procedure, Rule 501 parts 1.4.1-1.4.2.

⁴⁴ For additional information about RC tasks and responsibilities and how those will be evaluated through the NERC certification process, please review WIRAB and WECC’s joint webinar presented March 30, 2018. Available at <https://westernenergyboard.org/2018/03/wirab-webinar-reliability-coordinator-rc-certification-process-for-new-rcs-in-the-west/>.

⁴⁵ Functional Model at p. 29.

Further, “the Reliability Coordinator is the highest operating authority; the underlying premise is that the reliability of a wide-area takes precedence over reliability of any single local area. Only the Reliability Coordinator has the perspective/vision necessary to act in the interest of wide-area reliability.”⁴⁶

⁴⁶ Reliability Functional Model Technical Document published by NERC, (2010). Available at https://www.nerc.com/pa/Stand/Functional%20Model%20Archive%201/FM_Technical_Document_V5_2009Dec1.pdf.

Appendix II – Table of Interviewees

Name	Organization
Bob Cummings	NERC
Peter Colussy	California ISO
Saad Malik	Peak Reliability
Brett Wangen	Peak Reliability
Carl Monroe	SPP
Steve Ashbaker	WECC