

Reliability Coordinator (RC) Services California ISO Implementation Plan Overview

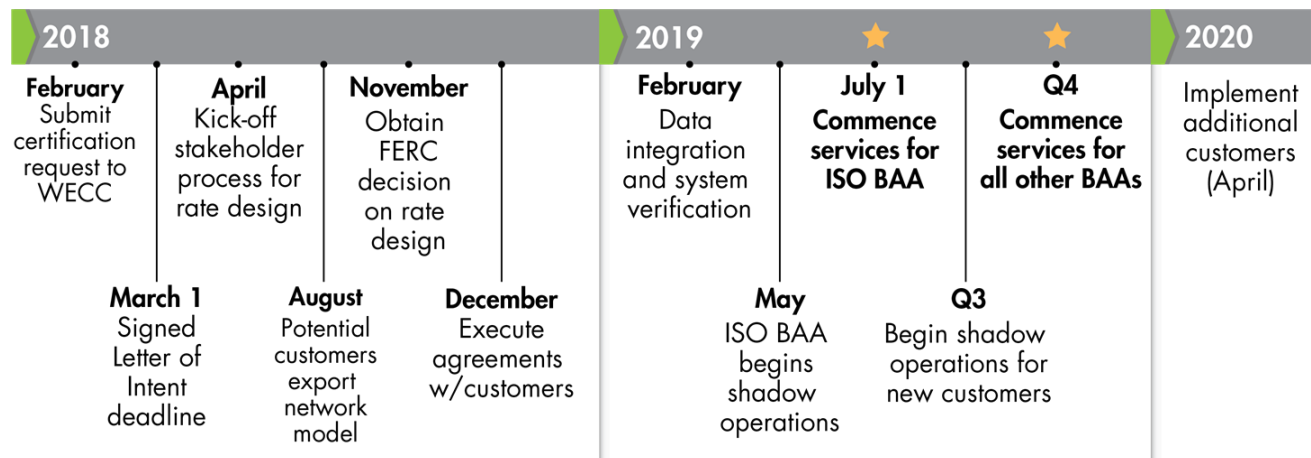
PURPOSE

This is an overview of the California Independent System Operator’s implementation plan to develop and provide Reliability Coordinator (RC) services to Balancing Authorities (BAs) and Transmission Operators (TOPs) in the Western Interconnection.

BACKGROUND

The California ISO began RC readiness efforts on January 2, 2018 with a notice to Peak Reliability (Peak) that the ISO would withdraw from the funding agreement supporting Peak’s role as RC, effective September 1, 2019. The ISO plans to provide RC services for its own BA area commencing July 1, 2019. On February 1, 2018, the ISO submitted an application to WECC requesting to start the RC certification process. Additionally, the ISO stated it would offer RC services to other BAs and TOPs in the Western Interconnection. Figure 1 reflects the ISO’s RC implementation timeline.

Figure 1: ISO RC Implementation Timeline



IMPLEMENTATION TIMELINE

The ISO is working to achieve Western Electricity Coordinating Council (WECC) certification to provide RC services starting on July 1, 2019. The ISO Balancing Authority Area, as well as BAs and TOPs within the California state borders and Baja Mexico, will take RC services on this date. The ISO will expand its RC service area to additional BAs and TOPs that have agreed to take RC services from the ISO, through a WECC certification review on November 1, 2019. Figure 2 below shows this timeline. Figure 3 is a map of the potential RC footprint based on the non-binding tentative commitments that WECC has posted.

Figure 2: RC Certification Timeline

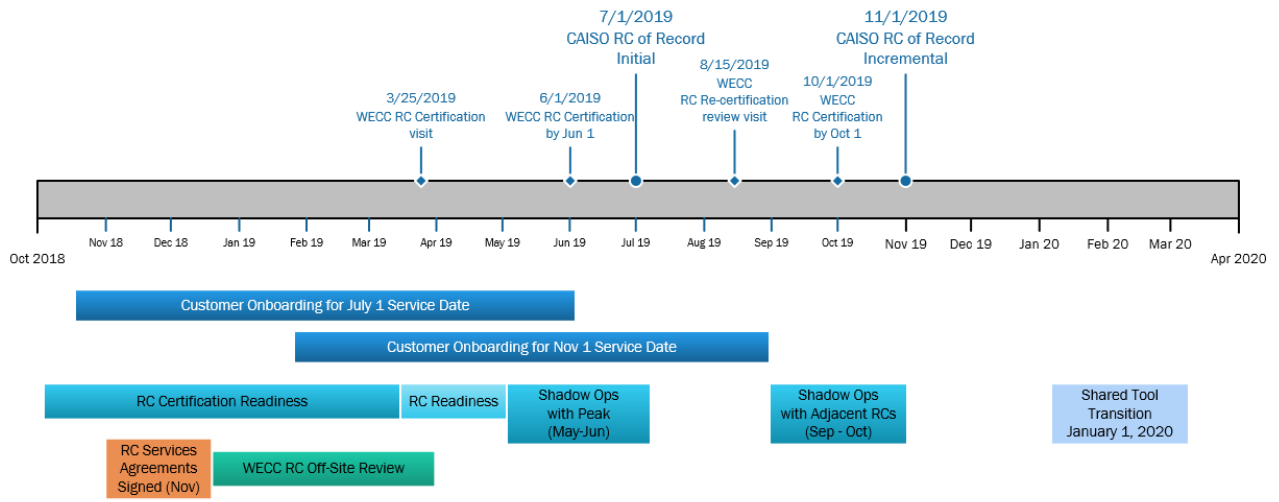
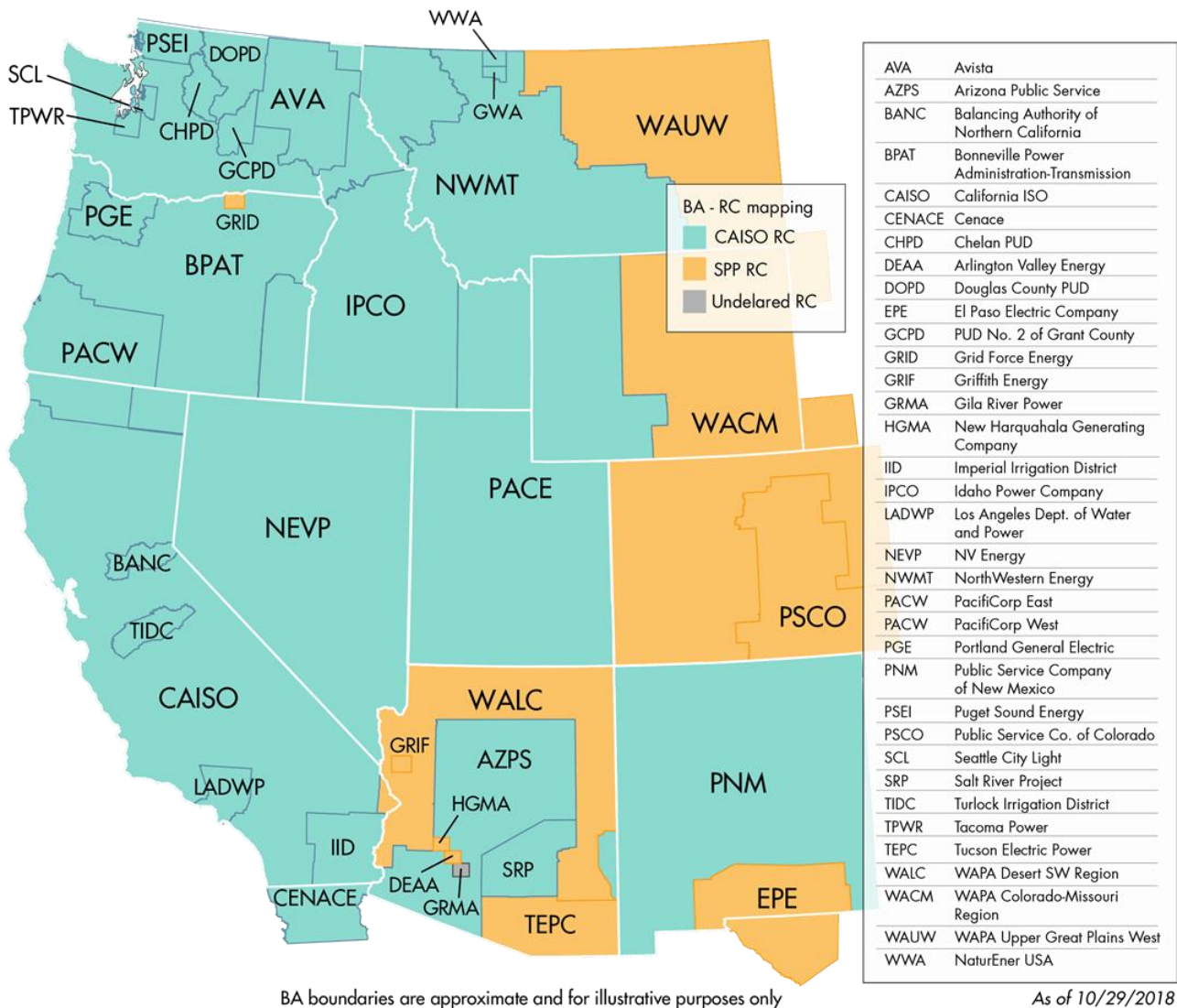


Figure 3: Tentative Commitment Map



IMPLEMENTATION APPROACH

The ISO's implementation of RC services involves four tracks:

Track 1: Development of RC services rate design, terms and conditions. The ISO held an open stakeholder process to develop the rate design, terms and conditions for RC services and filed related tariff revisions with the Federal Energy Regulatory Commission (FERC). FERC approved the tariff amendments as proposed.

Track 2: Development of key deliverables required for WECC certification. The RC Project Steering Committee (RPSC) and Work Groups are coordinating to develop these deliverables.

Track 3: Customer onboarding, data exchange, system integration of BA/TOPs' applications with the ISO's applications, development of the long-term framework for RC Oversight, Readiness Criteria.

Track 4: System development, implementation of tools and technology, shadow operations.

Track 1 – RC Rates, Terms and Conditions

The ISO hosted three public meetings in Folsom, Phoenix, and Portland in January 2018. These meetings provided background information on the ISO's decision to become an RC and some preliminary steps. Following these meetings, the ISO conducted a stakeholder process from April – July 2018 to develop the rate design and other tariff provisions necessary to support the ISO's efforts to become a RC. The ISO Board of Governors approved the design on July 26, 2018. The ISO submitted tariff language supporting the rate design and an RC Services Agreement to FERC August 31, 2018. FERC approved the tariff amendments related to RC services on Nov. 14, 2018.

Track 2 – Reliability Coordinator Certification Readiness

The development of the deliverables needed for WECC RC Certification started with the establishment of an RC Project Steering Committee (RPSC) comprised of representatives from BAs and TOPs who expressed interest, through letters of intent, in taking RC Services from the ISO. During the RC implementation phase, the RPSC will provide guidance and input and approve the deliverables necessary to achieve WECC certification. Work Groups working under the direction of the RPSC are responsible for the development of the following:

- Operating Procedures (Normal, Abnormal and Emergency)
- Real Time Outage Coordination
- Operating Reserve Sharing Group Coordination
- SOL Methodology
- Operations Planning Analysis
- Outage Coordination
- Data Exchange Specifications; Document exchange secure site
- Restoration Plan; Plan submittal schedule and review process
- Training Program; Administration and Tracking

The RPSC is also responsible for developing and approving the Oversight Committee Charter that prescribes the membership, responsibilities and procedures of the Reliability Coordinator Oversight Committee and its working groups.

The RPSC is in the process of approving deliverables and is targeting completion by November 2018. The approved deliverables will be submitted to the WECC certification team in either November or December 2018.

The ISO and RPSC are tracking the progress of the work groups through weekly status updates.

Track 3 – Customer Onboarding

The ISO has developed an RC onboarding plan to provide RC customers with details of onboarding activities and to answer questions regarding onboarding and processes unique to RC customers.

The onboarding plan outlines the process to obtain RC services from the ISO and provides links to documentation that will be used by the ISO and RC customers to ensure readiness in the following areas.

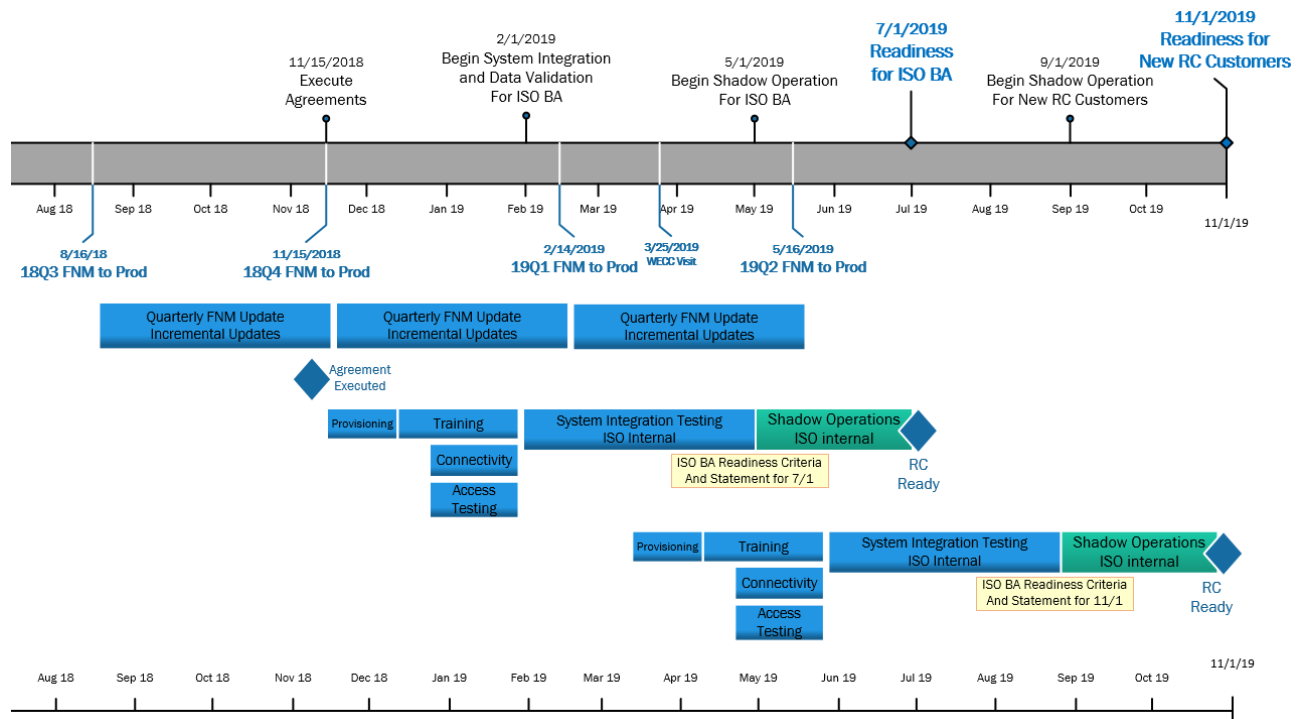
- Agreement Execution
- Network Model Integration
- Access and Provisioning
- Training
- Connectivity Testing
- System Integration
- Data Validation
- Shadow Operations
- RC Readiness Criteria

The ISO has already started work with several entities to review and validate their integration into the ISO's Energy Management System (EMS) model for purposes of providing RC services to these entities. The ISO will complete this integration for each entity receiving RC services from the ISO using one of the following approaches:

1. ISO EMS model incremental enhancements: This approach will support integration for entities already in the ISO's model but require incremental updates. The estimated time to complete integration using this approach is three months.
2. Common Information Model (CIM) or Full Integration: This approach will support integration for entities with a plan in place to complete full model integration before transitioning to the ISO for RC services. These entities will need to submit a CIM export to the ISO. The estimated time to complete integration using this approach is eight months.

Based on these approaches, the ISO has established an onboarding plan that ensures the ISO can complete its EMS Model integration for all entities that intend to take RC services on either July 1 or November 1, 2019 by the second quarter of 2019 as shown in Figure 4: On-Boarding Timeline.

Figure 4: Customer Onboarding Timeline



The ISO will use an Onboarding Progress Tracking Spreadsheet with each RC customer to track readiness. As shown in Table 1.

Table 1: Customer Onboarding Testing Phases

RC Testing Phase	Start Time	Duration	Primary Objective	Participants
Connectivity Testing	1 month before System Integration Testing	1 month	RC customer systems can connect to ISO systems.	RC customer; ISO technical teams
Access Testing	1 month before System Integration Testing	1 month	RC customer users and systems can access ISO systems.	RC customer users; ISO Customer Service

System Integration Testing	5 months prior to RC effective date	Approximately 1 month	RC customer can integrate their systems with ISO RC systems with RC valid data.	RC Customer; ISO Technology and Operations
Data Validation	Upon completion of System Integration Testing	Approximately 2 months	RC customer and ISO validate that data submitted by the RC customer is sufficient for RC functionality.	RC Customer; ISO Technology and Operations
Shadow Operations	2 months prior to RC effective date	2 months	Shadow Operations is the time when RC customer and ISO confirm readiness.	RC customer;6+ ISO Operations

The ISO and RPSC are tracking onboarding progress is via weekly status updates.

The ISO has made the following Customer Readiness Documents available for prospective RC customers:

- Full Network Model Overview
- Outage Coordination Overview
- RC System Integration and Data Validation Overview
- Day in the Life Reliability Coordinator Services
- Hosted Advance Network Applications Overview

Readiness and Shadow Operations Criteria

The RPSC has developed draft Readiness and Shadow Operations Criteria.

The Readiness Criteria take into account the timelines necessary for full RC implementation in 2019:

- WECC RC certification (March 2019)
- Initial RC footprint (July 1, 2019)

Table 2: ISO Applications used by RC Services

System	Summary System Impact
AIM (Access Identity Management)	Manage provisioning for RC customer access to ISO systems for BA and TOP contacts.
ALFS (Automate Load Forecast System)	Manage demand forecast data. Make Load forecast data available to others RC customers.
BRICK (Bulk Reliability In Compact Kit)	Simulator based System Restoration training to RC customers such as BAs, TOPs, and GOPs.
RCBSAP (RC Base Schedule Aggregation Portal)	Manage external schedule submission. Unit Generation Schedule Forecast for all BAs and TOPs in RC area. Interchange forecast schedule for all BAs and TOPs in RC area.
CMRI (Customer Market Results Interface)	Publish BA/TOP data to secure interface. Make Load forecast data available to RC customers.
ECC (Enhanced Curtailment Calculator)	Manage Unscheduled Flow Mitigation Process via ECC.
EMNA (Energy Management Network Application)	Topology Estimation application to support SE for RC Customer footprint. Inter-Control Center Communications.
EMS (Energy Management System)	Provide data to Data Pool / Data Availability (RC only).
HANA (Hosted Advanced Network Applications)	Provide view of the ISO's Real Time Contingency Analysis (RTCA) data to other TOPs/BAs in real time (RC only) and PTOs (ISO). Enhance monitoring and alarming to include visual flow type displays Allow RC customers (BAs/ TOPs) to license the ISO's RTCA in order to perform their own Real Time Assessments for their respective jurisdictions using the ISO RC's Hosted Advanced Network Application (HANA).
MRI (Market Results Interface) Settlements	RC Security model and posting of settlements statements and invoices.

OMS (Outage Management System)	OMS <ul style="list-style-type: none"> • Manage outages • Perform outage studies • Scheduled and Forced Outage Information • Provide database for Path Limit and Path Total Transfer Capability (TTC) to all TOPs WebOMS (component of OMS) <ul style="list-style-type: none"> • Provide Outage Management System • Exchange outage data with adjacent RCs
PI-Vision (formerly PI-Coresight)	Real-Time situational awareness displays.
Grid Messaging Tool (equivalent to PEAK Reliability Messaging Tool)	Provide reliability messaging system. Potential replacement of AWE Tool and MNS messaging (consolidate all messaging into a single tool for various audiences).
RIMS (Resource Interconnection Management System)	Receive Model from non-market RC customers (TOP and BA Entities). Convert to CIM format.
SharePoint	Secure file share for exchanging documentation and Procedures with TOPs/ BAs. Comply with ISO tariff, system security information, and Info Sec requirements for exchange of restricted information. Data and information exchange via common site. Make EMS modeling data available to others. Coordination of Day Ahead Analysis between BA/TOP including document exchange. Coordination of Seasonal Assessment process and document exchange between BA/TOP.
WIT (WECC Interchange Tool)	Provide WECC Interchange Tool (WIT).

RC Customer Training

The onboarding training program is intended to make the onboarding process for ISO RC services practical, efficient, and straightforward for customers. The goal of the ISO's onboarding training process is to ensure that each RC customer is prepared, informed, and engaged in all aspects of receiving RC services.

Onboarding training for RC customers will be focused on seven primary subjects listed in Table 3 below:

Table 3: RC Customer Training Subjects

Topic	Objective	Tool	Training Description	Delivery Method	Targeted Start
Outages	RC customers will submit transmission and generation work and limitations.	OMS	Training will consist of foundational concepts and training on the OMS application.	Foundational CBT Application CBT	Jan 2019
Schedules	RC customers will submit generation and interchange data	RC BSAP	Training will enable users to submit schedule data.	Application CBT	Jan 2019
Messaging	CAISO RC and RC customers will communicate reliability messages throughout the interconnection.	GMS	Training will enable users to successfully use the features of the messaging tool.	Application CBT	Feb 2019
Model Changes	Model change and BA/TOP system topologies are integral to BES reliability. ISO RC and other systems require up-to-date information.	RIMS	Training will enable users to provide up-to-date model information.	Foundational CBT Application CBT	Feb 2019
Access	RC customers must provision secure access to ISO RC systems and tools to its users.	AIM	Training will enable users to submit access requests via the Access and Identity Management process.	Application CBT	Feb/Mar 2019
Hosted Advanced Network Applications	These applications are used for wide area situational awareness and reliability assessment by RC, TOP and BA users.	HANA	Training will enable users to perform real-time assessments by utilizing HANA tool State Estimator, RTCA	Foundational CBT Application CBT	Mar 2019

			and study user environments.		
Restoration Drill	This is an annual NERC mandated requirement between the RC and BA and TOPs to perform emergency restoration drills	BRICK	Training will enable users to use the BRICK simulator and perform coordinated restoration activities.	Application CBT	Mar 2019
Limits	Establish communication methodology for facility ratings and changes.	N/A	WebEx discussion on facility rating limits or changes with ISO	Webinar	Jan 2019

In parallel with the onboarding process, RC customers will also be integrated into the ISO’s Customer Service model for ongoing support services.

ISO RC STAFFING PLAN

In preparation for providing RC services, the ISO has developed a scalable staffing plan. The ISO’s RC operators will be on a six-week rotation, which allows for relief and training time. Similar to the current ISO BA and TOP operations, as part of the normal emergency preparation program, the ISO RC operations plan considers forecasted conditions in order to determine if additional staffing may be needed, and can draw from RC operators and engineers during relief and training times.

For an expanded ISO RC footprint, the ISO will increase its RC staffing plan. Considering a scenario with the largest possible RC area, ISO will have staffing comparable to Peak, which is in addition and separate from the ISO BA and TOP staffing. The ISO RC will have three RC operators on day and night shifts respectively, each with a section of the footprint under the RC function. For example, separate RC operators for the Northwest, California and Southwest/Rocky Mountain areas. The ISO also plans a similar expansion of operations engineering staff to support the RC function providing Outage Coordination analysis, Day-Ahead Operations Planning analysis, and dedicated real-time operation shifts for the expanded RC footprint.

As described above, the RC can benefit from the ISO BA Operations Planning staff that includes 25 operations engineers coordinating and analyzing outages as well as supporting advanced network applications such as Real Time Contingency Analysis (RTCA), Real Time Voltage Stability Analysis (RT-VSA), Real Time Dynamic Stability Analysis (RT-DSA), and the look-ahead applications that predict system condition up to 2-3 days into the future. Additionally, the ISO RC will be incorporated into the emergency preparation program under which the ISO considers forecasted conditions to determine if additional staffing may be needed, and can draw from off-shift RC operators and engineers.

For emergency conditions, the ISO has an Emergency Response Coordination (ERC) program, which handles communication with ISO staff and executives and stakeholders, allowing system operations staff to concentrate on reliable BES operations and emergency response. This ERC program has been successfully implemented since 1998 and was followed during the September 8, 2011 Southwest power outage.

In addition, the ISO currently has a round-the-clock service desk and processes that automatically page on-call system subject matter experts in the event of data and tool anomalies or failures. The service desk removes the burden from system operations staff responding to multiple customer inquiries and provides fast response to technology issues, allowing the RC operators to concentrate on BES reliability.

Further, ISO support staff includes an Operational Readiness training and management group. This Director-led group supports tool development, testing and implementation; procedure writing and administration; and an operations training and simulation team with dedicated training staff. The RC staff will have 40 hours dedicated to training in every shift rotation, to ensure RC staff has the opportunity to accumulate Continuing Education Hours (CEH) to contribute to their RC certification and train on ISO tools, system operating procedures and guides. The RC staffing plan includes RC operation from both the Folsom and Lincoln facilities daily.

Reliability Coordinator Staffing

The ISO RC management started recruiting, interviewing, and hiring RC staff in March 2018.

- As of November 2018, 72% of the RC staff have been hired with phased start dates between 2018 and July 2019.
- The majority of the RC staff will be on site at the ISO by January 2019, with the remaining RC staff starting no later than July 1, 2019.
- All RC current or projected hires are currently, or will be, WECC RC Certified.
- The Operations Engineering Services Department has added additional staffing positions in both Operations Planning group as well as Day-Ahead and Real-Time Operations Engineering group. This will allow the ISO to add an additional Real-Time Operations Engineering 24x7 desk as well as an Operations Planning Assessment Day Ahead Engineering desk to be added.

RC Operator Training Plan

RC operators will have be two training periods: one for the California RC footprint (Jan 1- March 15, 2019) and for the expanded footprint (July 1 – September 1, 2019). During each training period, the ISO will incorporate training on:

- Situational awareness tools
- Task guides
- Seams Agreements
- Balancing Authority Areas and Transmission Operator systems

RC Task Guides have been drafted and are currently being reviewed by RC staff, in addition to the ISO's System Operations and Operational Readiness training team. The ISO is also developing Knowledge and Skills Assessments.

Starting in late 2018 and continuing through 2019, the ISO RC staff members will visit Balancing Authorities and Transmission Operators to establish RC operating relationships and to learn area specific awareness, procedures and protocols directly from RC customers' operations staff.

Reliability Coordinator Desk Certification

On January 1, 2019, RC operators will begin the RC desk certification process. The desk certification process begins with RC training as mentioned above and culminates with an interview on Task Guides by a Lead RC and Director of RC.

The ISO will implement the additional desk for Real-Time Operations Engineering by May 1, 2019, in time for shadow operations.

RELIABILITY COORDINATOR JOINT OPERATIONS

Joint Operating Agreements establish a framework for adjacent RCs in the west to work collaboratively to support the reliability of the western interconnection. The ISO expects to have the following RC agreements and will make them available to the public:

- **ISO – Peak**
The drafting of this agreement is currently in progress and will be in effect July 1, 2019 – December 1, 2019 or the time when Southwest Power Pool (SPP) becomes the adjacent RC of record to the ISO. The ISO anticipates finalizing this agreement on or before February 1, 2019, in time for the WECC RC certification for the ISO RC function.
- **ISO – AESO**
Upon Northwest BA/TOPs confirmation of ISO RC services, the ISO will draft a similar RC agreement as it has with Peak incorporating the RC seams between ISO and AESO. This agreement is expected to be effective November 1, 2019. The ISO expects to finalize this agreement on or before August 1, 2109, in anticipation of WECC RC certification review.
- **ISO – BC Hydro**
Upon Northwest BA/TOPs confirmation of ISO RC services, the ISO will draft a similar RC agreement as it has with Peak and AESO incorporating the RC seams between ISO and BC Hydro. This agreement is expected to be effective November 1, 2019. The ISO expects to finalize this agreement on or before August 1, 2109, in anticipation of WECC RC certification review.
- **ISO – SPP**
Upon Southwest BA/TOPs confirmation of ISO RC services, the ISO will draft a similar RC agreement as it has with Peak incorporating the RC seams between ISO and SPP. The ISO expects this agreement will take effect on the date that SPP becomes the RC of record for its western customers adjacent to the ISO RC footprint. The SPP has announced a transition date of December 2019.

WECC CERTIFICATION AND COMPLIANCE

NERC maintains an Organization Certification Program to ensure entities that apply to register or are registered to perform certain reliability functions (including RC) meet or exceed minimum criteria demonstrating their capability to perform these tasks. The process for registration is described in Section 500 and Appendix 5A of the NERC Rules of Procedure. WECC is the NERC designated Regional Entity for the Western Interconnection and will be responsible for certifying that the ISO has the tools, processes, training, and procedures in place to operate reliably. A thorough review of all applicable standards is underway in relation to operating procedures, tools, and processes to ensure reliable operation that exceeds compliance with minimum reliability standards.

WECC is planning to conduct a full certification review the week of March 25, 2019 for the ISO BA plus BA/TOPs within the California state boundary and Mexico, which have agreed to take RC services along with the ISO BA/TOPs. This review will include an on-site visit by WECC and other observers, including a member from one of the current BAs, a member from one of the current TOPs, a member of another RC, NERC representatives. During this site visit, the ISO will provide documentation and answer any questions to demonstrate readiness for RC certification.

A certification review will be required once the footprint is expanded to include BA/TOPs agreeing to take RC services from the ISO RC as of November 1, 2019. This review is anticipated to occur in or around August 2019 in order for the ISO to receive certification for an expanded RC footprint by September 1, 2019.

MULTIPLE RC TRANSITION DECISIONS

The ISO, Peak, AESO, SPP and BC Hydro have formed an RC-to-RC committee with the focus on RC processes, procedures, and tools that will need to be transitioned and modified to support multiple RCs in the West. Table 4 outlines several of the key transition items identified to date and timeline and proposal for the final transition on January 1, 2020.

Table 4: RC Transition Decision Matrix

Decision	Peak – CAISO: July 1 & Nov 1, 2019	SPP – CAISO- Peak: December 1, 2019	SPP-CAISO January 1, 2020	Decision Deadline
Non-Real Time Data Exchange specification and protocol between RCs (load forecast, Transmission and Generation outages, outage data, net scheduled interchange values)	Process is currently established and will remain the same. Peak will be data repository and host all data	Process is currently established and will remain the same. Peak will be data repository and host all data	ISO offers to be data repository and will host all data.	10/24/18 - RCs agree on recommendation and pulling interchange data from WIT
Western Model	Peak continues to maintain WSM for its use in its EMS and ECC	Peak continues to maintain WSM for its use in its EMS and ECC	CAISO builds (stiches), maintains, validate and shares Western Interconnection EMS Network Model Each RC will submit their model to CAISO in a common format	10/24/18 - RCs agree on recommendation and pulling interchange data from
Real Time Data Exchange and communication protocol for BAs and TOP across RC areas (ICCP and PMU)	Current Communication protocol (WON) will remain the same. PMU network is being developed and will continue	Current Communication protocol (WON) will be re-branded as RCnet and actual protocol for RC-RC remain the same	Current Communication protocol (WON) will be re-branded as RCnet and actual protocol for RC-RC remain the same	N/A

Decision	Peak – CAISO: July 1 & Nov 1, 2019	SPP – CAISO- Peak: December 1, 2019	SPP-CAISO January 1, 2020	Decision Deadline
		PMU network is being developed and will continue	PMU network is being developed and will continue	
Exchange of Operational Planning Studies, Seasonal Assessments	Process is currently established and will remain the same	Process is currently established and will remain the same	Process is currently established and will remain the same	N/A
Protocol for Management of Unscheduled Flow via ECC across RC area	Process is currently established and will remain the same- The UFMP procedure for Peak and ISO is being developed	ISO manages Path 66 SPP manages Path 30/31/36	ISO manages Path 66 SPP manages Path 30/31/36	10/24/18 - RCs agreed on recommendation
Enhanced Curtailment Calculator (ECC) Tool	Peak maintains OATI contract Utilize current process: Peak makes decision based on input from ECC Task Force	Peak maintains OATI contract Utilize current process: Peak makes decision based on input from ECC Task Force	ISO offers to manage ECC and utilize data from ISO model	10/24/18 - RCs agreed on recommendation EMS
Protocol for WIT inadvertent payback across RCs / administrative processes	Process is currently established and will remain the same – This is not RC function	This is not RC function	This is not RC function	N/A
WIT Tool	Peak maintains OATI contract Utilize current process	Peak maintains OATI contract Utilize current process	ISO can maintain WIT	Decision pending
Exchange of RAS data, contingencies, area procedures	Utilize WECC RAS RS until PRC-012	Utilize WECC RAS RS until PRC-012	Utilize WECC RAS RS until PRC-012	Decision pending 6 months prior to 1/1/2021 Effective date of PRC-012

Decision	Peak – CAISO: July 1 & Nov 1, 2019	SPP – CAISO- Peak: December 1, 2019	SPP-CAISO January 1, 2020	Decision Deadline
Time monitor / time Error Correction protocol	Process is currently established and will remain the same	Process is currently established and will remain the same	Process to rotate among RCs	Decision pending
Process for maintaining Peak historic data and which data is unique to peak or other entities are using for compliance that they may be relying on Peak to maintain	Data unique to Peak will need to be stored per data retention policy. Data that comes from BA/TOPs stored at the originating BA/TOP Each BA, TOP and RC are responsible for their compliance	Each BA, TOP and RCs are responsible for their compliance	Each BA, TOP and RCs are responsible for their compliance	Decision pending
Data submission to WECC and NERC	Peak to maintain process until July 1. As of July 1 CAISO will start to submit for its current RC area. As of November 1 ISO will submit for its entire footprint	Each RC will send data for its RC area to WECC and NERC	Each RC will send data for its RC area to WECC and NERC	Decision pending
Process and timeline for review of adjacent RC restoration plans	Process is currently established and will remain the same	Process is currently established and will remain the same	Process is currently established and will remain the same	N/A
Coordination of SOL methodology and Outage coordination processes	Process is currently established and will remain the same	Process is currently established and will remain the same	Process is currently established and will remain the same	N/A
GMD Notifications	Process is currently established and will remain the same	Process is currently established and will remain the same	Process to rotate among RCs	Decision pending

Decision	Peak – CAISO: July 1 & Nov 1, 2019	SPP – CAISO- Peak: December 1, 2019	SPP-CAISO January 1, 2020	Decision Deadline
Coordination WECC 1 RAS reporting Authority	Process is currently established and will remain the same	Process is currently established and will remain the same	Process is currently established and will remain the same	N/A
OATI Messaging: Unscheduled Flow (USF) and Merchant Alert Protocol (MAP)	Process is currently established and will remain the same	ISO could support USF and MAP messaging	CAISO could support USF and MAP messaging	Reach RC working with customers on use for MAP.