Transmission Outage Whitepaper

California ISO
February 3, 2010

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

Over the last two years, the California ISO (CAISO) has been developing a strategy to transform the current SLIC outage reporting system into a set of integrated component tools and modules which will improve the ability of the CAISO to coordinate and manage generation and transmission outages within the CAISO Balancing Authority Area.

More recently, the CAISO has been working with the Participating Transmission Owners (PTO), that currently submit outages to SLIC, to identify areas of improvement within the transmission outage reporting process. Focus was given to areas that will:

- Improve grid reliability and market efficiency
- Reduce grid operating costs
- Improve transmission outage reporting quality and accuracy
- Measure and evaluate the effectiveness of the transmission outage management business practices, in partnership with the PTO.

The purpose of this document is to present the ISO's plan for improving transmission outage reporting and outage coordination practices, as a first step, in achieving the benefits of the overall strategy.

The changes to the transmission outage process are presented as different initiatives that can be evaluated and implemented separately on their own timeline. Some involve changes to an existing process while others involve technical changes in CAISO systems and/or PTO systems. These initiatives do not represent changes in CAISO policy but rather a voluntary agreement between PTO with common understanding on how to improve the Outage Management process impacting all stakeholders. If policy changes are necessary in order to proceed on any on these initiatives, a parallel Stakeholder process will be introduced to address any concerns.

The initiatives proposed in this document are as follows:
- Initiative 1: Seven-Day Advanced Outage Submittal
- Initiative 2: Submission of Critical Outage Data as Formatted Data
- Initiative 3: Managing Outage Data in Real-time
- Initiative 4: Outages Affecting Interties
- Initiative 5: Multiple Configurations In a Single Outage
- Initiative 6: Identifying Project Information within an Outage
    Initiative 7: Standardized Outage Short Descriptions

The CAISO is requesting that stakeholders submit their comments on this plan to Travis Robinson (throbinson@caiso.com) by February 18, 2010.

2 BACKGROUND

CAISO's Transmission Outage Management standards and practices can and should be evaluated on the merits of improving grid reliability, promoting market efficiency and reducing overall system operational costs.

Unlike the previous market system which used a limited number of pricing zones, the newer CAISO nodal market system utilizes thousands of pricing nodes to develop a cost based optimal market solution. The new nodal system allows the CAISO more flexibility to select and commit market resources at the least possible cost while maintaining grid reliability.

When outages are reported late, are cancelled on short notice, or are extended past the initial outage period, the overall costs of managing the grid and running the markets increase. This is largely due to the fact that CAISO loses the ability to plan and develop an optimal market solution and must react to unexpected outage events. Potential impacts include:
- Inaccuracy in modeling
    - Late outages are not modeled in the Day Ahead Market (DAM)
    - Modeled outages are factored into the DAM but do not actually occur
- Previously identified issues become invalidated and new issues may be created
- Limited options in response to unplanned events – Less time for outage analysis and potentially increased cost from using higher priced resources to maintain grid reliability

This paper covers aspects of transmission outage reporting and provides recommendations in the form of initiatives for improving current outage reporting practices. In some cases, these improvements can be implemented immediately, in others, a phased approach will be taken as both CAISO and PTO systems need to be modified to implement improvements to the transmission outage process.

3   TRANSMISSION OUTAGE INITIATIVES

3.1   SEVEN-DAY ADVANCED OUTAGE SUBMITTAL

To fully realize the benefits of the new market system, it is essential that transmission outage information is made available in time for the advanced market runs. These market runs, referred to as the Day 3-2-1 process, begin three days prior to the operating day and are used to optimize a market solution. The initial run of the market is performed 3 days prior to the operating day and can be used to identify any issues in the input data or market solution. If issues are identified, they are resolved in time for the second day run. The third day run is the binding Day Ahead Market which benefits from the test runs performed on the previous two days. Currently, approximately 80% of transmission outage requests are received within 3 to 4 days of the start of the outage as shown in Figure 1 below. Requests made this close to the operating day are often not included in the advanced market analysis because of insufficient time to evaluate the market impacts and consequently end up being processed closer to real-time when prices for energy are higher and the opportunities to utilize less costly and more efficient resources are limited by availability.
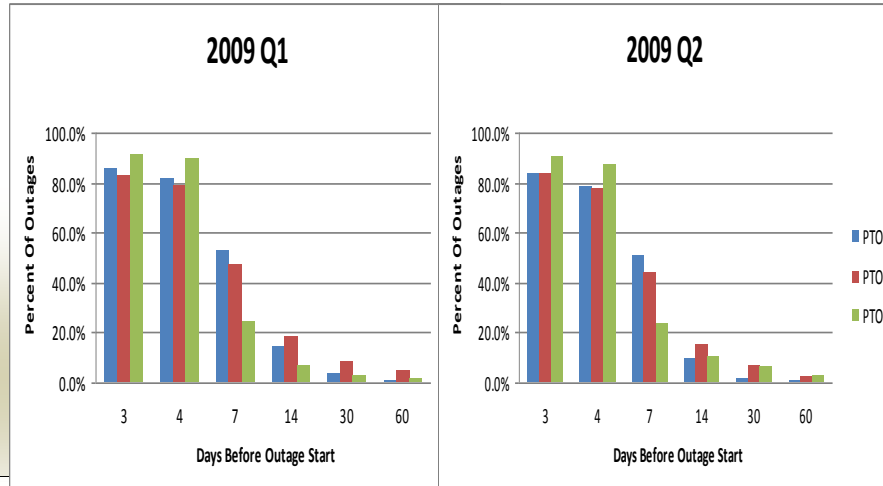
Figure 1: Outage Submittal Timing

The quality of the service provided by the CAISO Outage Management Team is directly related to the Team's ability to accurately assess the impact of transmission outages. In the past, the impact was primarily focused on maintaining the reliability of the Grid. With the release of the new market systems and the availability of more accurate pricing information, Outage Management will now be able to conduct a more detailed impact analysis based on the potential costs of congestion while maintaining Grid reliability. CAISO will be able to determine, among multiple outage scenarios, which outages should be approved based on reliability and provide advisory information for system cost impacts. Having this impact information will allow the CAISO to better respond to the PTO outage requests and partner with them in developing an outage schedule that minimizes impact to the electrical system and considers the opportunity to decrease congestion costs.

The CAISO is requiring that transmission outages be submitted 7 days in advance. The new reporting timeline will provide sufficient time for the Outage Coordination team to conduct appropriate analysis and engineering studies to optimize an outage solution with the PTO ahead of the advance market runs. The advanced submission will also allow the CAISO to complete outage analysis and provide approvals in time to comply with WECC reporting requirements. The expectation is that outages submitted 7 days in advance will complete the required studies and modeling for both the EMS and Market models. Figure 2 shows an overlay of the existing 3 Day Outage Coordination Process on the desired timeline which includes both outage and market processes. By moving up the timing of submitting outages to 7 days before an outage starts, CAISO will be able to perform traditional outage modeling analysis and provide the best available information to the market systems as they initiate the advance market runs.
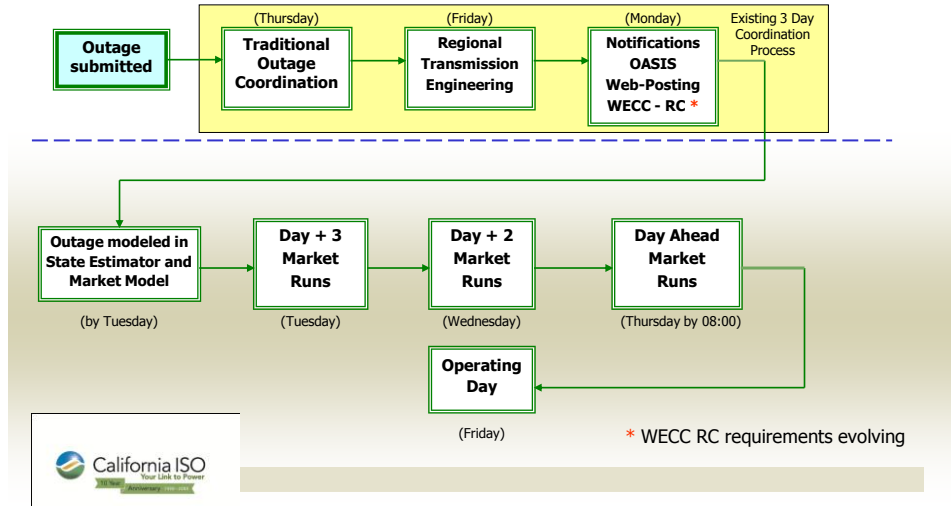
Desired Outage – Market Topology Process

Figure 2: Seven Day Submittal Process Flow Diagram

Since the markets run every day and the Outage Management process is performed on business days, the seven day submittal will be implemented as a 3 business day plus 4 calendar day timeline as displayed in Figure 3.

Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Business Days ahead of outage	Actual Days ahead of outage:
Submit		Bus D1	Bus D2	Bus D3	DA+2	DA+1	DA	RT								5 days	8 days
	Submit	Bus D1	Bus D2	Bus D3	DA+2	DA+1	DA	RT								5 days	7 days
		Submit	Bus D1	Bus D2	Bus D3	DA+2	DA+1	DA	RT							4 days	7 days
			Submit	Bus D1	Bus D2	Bus D3	DA+2	DA+1	DA	RT						4 days	7 days
			Submit	Bus D1	Bus D2	Bus D3		DA+2	DA+1	DA	RT					5 days	8 days
			Submit	Bus D1	Bus D2	Bus D3			DA+2	DA+1	DA	RT				6 days	9 days
				Submit	Bus D1	Bus D2			Bus D3	DA+2	DA+1	DA	RT			6 days	9 days
					Submit	Bus D1			Bus D2	Bus D3	DA+2	DA+1	DA	RT		6 days	9 days
						Submit			Bus D1	Bus D2	Bus D3	DA+2	DA+1	DA	RT	5 days	9 days
Holiday Example:					Submit	Bus D1			Holiday	Bus D2	Bus D3	DA+2	DA+1	DA	RT	5 days	10 days

Figure 3: Seven Day Submittal Timeline

Initiative	CAISO	PTO
Seven-Day Advanced Outage Submittal Benefits: • Allows for outage evaluation and approvals before the advanced market runs • Gives opportunity to provide reliability and economic feedback to PTO before Day Ahead market	• Provide approval of outage requests prior to the Day321 process • Provide feedback to PTO during Day321 process such as outage modeling issues, advisory outage requirements, economic analysis and potential issues resulting from changes in system conditions • Establish metrics to evaluate effectiveness of this initiative	• Submit outage requests according to advanced timeline prior to the start of the outage

3.2 SUBMISSION OF CRITICAL OUTAGE DATA AS FORMATTED DATA

Outage data critical to outage evaluation and operations needs to be captured as formatted data so that it can be evaluated and passed to all necessary systems with a minimum of manual intervention. SLIC External Interfaces will be modified to capture all data that is identified as critical to the outage evaluation process as formatted data.

Currently, most equipment status information is captured in free-form text and requires manual interpretation as to what the equipment status will be during the outage. SLIC External Interfaces will be modified so that accurate status can be submitted for equipment that will not be in its normal status during the outage. Since different systems (CAISO and non-CAISO) require different levels of equipment status and have different equipment naming conventions, SLIC will standardize on the CAISO "Full Network Model" naming convention and require all equipment not in its normal state to be identified. For example, a line outage will consist of identifying the line that will be out of service (WECC requirement and Market Participant requirement) and the switches that will be operated during the outage (CAISO requirement).

Also, line rerates due to an outage are captured in free-form text and require manual data entry to convert it to a usable form by the CAISO's market and EMS. SLIC External Interfaces will be modified so line rerate data can be submitted as formatted data and passed on to necessary systems without manual intervention.

All equipment names and identifiers will use the naming convention in the CAISO Full Network Model. The list of equipment for each model will be available in advance of a new model production date so PTO will have enough time to load any changes in equipment into their systems.

Initiative 2: Submit Critical Outage Data as Formatted Data

Initiative	CAISO	PTO
Submit critical outage data in formatted fields rather than free-form text. Benefits: • Reduces manual processes and potential for modeling errors in the EMS and Market models • Provides direct control of critical data to the PTO • Complies with WECC requirements for equipment status	• Modify SLIC External Interfaces to allow for critical data to be directly submitted by PTO and consumed by the Market and EMS systems with no manual intervention • Provide list of equipment in CAISO Reliability (EMS) Network Model to PTO • Establish metrics to evaluate the effectiveness of this initiative	• Submit status of all equipment not in its normal state via SLIC External Interfaces in formatted fields using naming convention identified in the current CAISO Reliability (EMS) Network Model.
Example Data for Line Outage. Note: Sample XML is provided for discussion purposes only and is subject to change	<equipment> <name>30060_MIDWAY _500_24156_VINCENT _500_BR_1 _2</name> <id>Line_454</id> <status>Out Of Service</status> <type>Line</type> </equipment> <equipment> <name>822_CB5</name> <id> Switch_12335</id> <status>Open</status> <type>Disconnect</type> </equipment> <equipment> <name>922_CB5</name> <id> Switch_12324</id> <status>Open</status> <type>Disconnect</type> </equipment> <equipment> <name>712_CB5</name> <id> Switch_12334</id> <status>Open</status> <type>Disconnect</type> </equipment> <equipment> <name>812_CB5</name> <id> Switch_12344</id> <status>Open</status> <type>Disconnect</type> </equipment>

Example Data For Line Rating Change
Note: Sample XML is provided for discussion purposes only and is subject to change
	`<equipment>`
	    `<name>24021_CENTER S_230_24100_OLINDA _230_BR_1 _1</name>`
	    `<id>Line_455</id>`
	    `<status>Line Rating Rerate</status>`
	    `<type>Line</type>`
	    `<rating>`
	        `<units>MVA</units>`
	        `<normal >478</normal>`
	        `<emergency>606</emergency>`
	    `</rating>`
	`</equipment>`

3.3 MANAGING TRANSMISSION OUTAGES IN REAL-TIME

The CAISO manages outage requests based on a defined outage workflow process. It is important that the PTO and Market Participants (MP) utilize the external SLIC Web Client and the SLIC APIs to provide updated status of all planned and forced outages throughout the outage lifecycle. Using the application interfaces is the most efficient means to manage outage requests and provide the documented evidence to satisfy audit and WECC regulatory compliance requirements.

Since the Market and Reliability software is evaluating future time periods, it is critical that the scheduled outage start and end times are as accurate as possible in SLIC. This is especially important for outages that are scheduled back to back in the same area; if the first outage does not come back in time and the second outage's start time is not updated as appropriate, the market will run with both outages modeled until the first one completes resulting in potential price variations and additional resource procurement.

SLIC currently has functionality to change outage status to ETOTIMEOUT (Estimated Time Out Timeout) and ETRTIMEOUT (Estimated Time of Return Timeout) when the scheduled start or end time is approaching and SLIC has not received an update for the outage. The ETOTIMEOUT status can be used by the PTO as a notification that the outage will soon be active in the market and to update the start time if the outage will not be starting at the scheduled time. Similarly, the ETRTIMEOUT can be used as a notification that the outage will become inactive in the market and to update the end time if the outage will not be ending at the scheduled time. Currently, SLIC changes status three (3) minutes prior to the start/end of the outage, but since the market runs in a more advanced timeframe, SLIC will be modified to change the statuses forty-five (45) minutes before the planned start/end times of the outage to provide opportunity for the PTO to update scheduled times before the market runs.

Initiative	CAISO	PTO
Submit real-time status for all outages via SLIC External Interfaces Benefits: • Notification of outage status can be provided automatically instead of phone call • Provides timely information to EMS and Market models • Provides timely information to WECC • Provides notification to PTO when outages are about to be included in the next Market run	• Modify SLIC Timeout status to indicate when a scheduled outage will be included or excluded in the next Market run • Establish automatic process to upload outages submitted in real-time to the WECC outage system • Train CAISO real-time dispatchers to process outage updates in SLIC instead of receiving updates by phone • Establish metrics to evaluate the effectiveness of this initiative	• Submit real-time outages via SLIC External Interfaces • Monitor SLIC for outages in Timeout status and reschedule to appropriate time if they will not start or end at scheduled time • Submit requests via SLIC External Interfaces to receive CAISO final OK to begin scheduled outages • Submit request via SLIC External Interfaces to receive final OK to return outage to service • Submit real-time updates to the outage via SLIC External Interfaces if outage details change or times need to be rescheduled.

3.4 OUTAGES AFFECTING INTERTIES

Outages affecting interties require additional analysis to ensure that contract limits are satisfied and to make additional schedule adjustments when needed. Scheduling is performed hourly with changes occurring at the top of the hour. If an outage that affects an intertie is scheduled to return at the top of the hour then the next scheduling hour path limit will be set at a value assuming that the outage will return on time. In that situation, if the outage return is delayed, even by a few minutes, all scheduling limits will have to be adjusted for the next hour because the outage is not coming back on time. If the outage was scheduled to return on the half hour instead and is delayed a few minutes, it would not be necessary to adjust next hour's schedules. This would reduce the potential of having to make last minute scheduling changes in real-time.

Initiative	CAISO	PTO
Schedule return time on the half hour for outages affecting scheduling paths Benefits: • Benefits all market participants by reducing potential of modifying hourly schedules and path limits if outage return is delayed	• Establish metrics to evaluate the effectiveness of this initiative	• For outages that affect scheduling paths, schedule the outage return time on the half hour.

3.5   MULTIPLE CONFIGURATIONS IN SINGLE OUTAGE

Some outages can involve multiple system configurations during the outage time period and should be processed as one outage on an all or nothing basis. Currently these outages cannot be modeled since only one configuration can be modeled per outage. A proposal to have this type of outage split into multiple outages for each configuration is not practical because of the difficulty in establishing and maintaining links between the outages (to consider them as a package) and it would be impractical to process each outage separately. SLIC External Interfaces will be modified to allow the PTO to identify the different configurations involved in the outage along with start/end times in which each configuration will be active.

Initiative 5: Implement Multiple Configurations in Single Outage

Initiative	CAISO	PTO
Implement Multiple Outage Configurations in Single Outage Ticket Benefits: • Allows PTO to schedule outages that involve multiple grid configurations under one outage	• Modify SLIC External Interfaces to allow for multiple outage configurations • Establish metrics to evaluate the effectiveness of this initiative	• Submit configurations with start and end time for when configuration will be in effect during outage.

Example Data for Multiple Configuration Outage
Note: Sample XML is provided for discussion purposes only and is subject to change
	`<equipment_configuration>`
	    `<start_time>04/12/2010 16:00:00</start_time>`
	    `<end_time>04/12/2010 18:00:00</end_time>`
	    `<equipment>`
	        `<name>30060_MIDWAY _500_24156_VINCENT _500_BR_1 _2</name>`
	        `<id>Line_454</id>`	

```
                                        <status>Out Of Service</status>
                                        <type>Line</type>
                                </equipment>
                        </ equipment_configuration>
                        < equipment_configuration>
                                <start_time>04/12/2010 18:00:00</start_time>
                                <end_time>04/12/2010 20:00:00</end_time>
                                <equipment>
                                        <name>30060_MIDWAY _500_24156_VINCENT
                        _500_BR_1 _1</name>
                                        <id>Line_454</id>
                                        <status>Out Of Service</status>
                                        <type>Line</type>
                                </equipment>
                        </ equipment_configuration>
```

3.6   IDENTIFYING PROJECT INFORMATION IN OUTAGE

The CAISO Full Network Model Business Practice Manual requires that all projects affecting the full network model be identified in Resource Interconnection Management System (RIMS) 120 days in advance. Projects may necessitate new operating procedures, EMS display changes, outage modeling changes and updates to operational tools; because of this, it is critical that the CAISO knows when the phases of a project are placed into service to coordinate when operational changes become effective. Identifying which outage releases a project's phase into service is an effective way of tracking when these changes should occur.

SLIC External Interfaces will be modified so that project information can be associated with an outage and allow the PTO to indicate when the phase is complete. An outage can be associated with a project and a phase using the project identifier and phase number as defined in the CAISO RIMS application. Multiple outages can be associated with a phase, but only one outage should be identified as the outage that completes the phase. This will give clear indication as to when changes to the grid topology will need to take place.

To help communicate what projects and associated outages CAISO has on record, a periodic report will be established and distributed to appropriate personnel at the PTO. Any projects that do not have an associated outage should be investigated and an update made to a new or an existing outage with project information. Any known projects that are missing on the periodic report indicates that the project may not be entered in the CAISO RIMS application and appropriate personnel should be notified at the PTO to verify the missing project information.

Initiative 6: Identify Project Information within Outage

Initiative	CAISO	PTO
Identify Outages That Are	• Send periodic report	• Identify missing or

Related To Projects Benefits: • Provides more accurate estimated commercial operation for new equipment • Helps communicate project status between operations and planning groups at both the PTO and CAISO	showing upcoming projects and associated outages to PTO for data verification • Modify SLIC External Interfaces to allow PTO to report project related information • Establish metrics to evaluate the effectiveness of this initiative	inaccurate data in periodic reports • Submit project related information using CAISO RIMS project and project phase identifiers via SLIC External Interfaces.

Example Data for Outage Associated with a Project
Note: Sample XML is provided for discussion purposes only and is subject to change
	`<project>`
	    `<id>PGEX234</id>`
	    `<phase>3</phase>`
	    `<outage_completes_phase>true`
	    `</outage_completes_phase>`
	`</project>`	

3.7 STANDARDIZED OUTAGE SHORT DESCRIPTIONS

Outage data is posted in multiple locations (www.caiso.com and OASIS) accessible by Market Participants (MP) and is also uploaded to WECC to support their reliability studies. Many times it is difficult for the MP or WECC to determine what type of work is involved in the outage if the short description is not clear and concise. WECC has access to details to determine the type of work, but the MPs only have access to the short description and may not be familiar with the terminology used. CAISO will establish guidelines regarding use of short descriptions.

Initiative 7: Standardized Outage Short Descriptions

Initiative	CAISO	PTO
Use short descriptions that clearly define outage Benefits: • Provides clear outage description to internal and external entities	• Establish guidelines for short descriptions collaboratively with PTO	• Use established guidelines for outage short descriptions

4 OUTAGE REPORTING METRICS

The CAISO Outage Management Team is working to improve the quality of services it provides to the PTO and Market Participants. In order to help accomplish this, it is important to

accurately measure and evaluate the effectiveness of Outage Management business practices. CAISO is working to establish a metrics reporting capability with which CAISO can share accurate information to the PTOs and assist them in strengthening practices that will ensure grid reliability and decrease outage management costs.

The metrics outlined below are being proposed to help the CAISO continuously monitor and improve the transmission outage initiatives and processes.

Initiative	Metric	Desired Outcome
1. Seven day outage submittal	• Number of outages submitted 7 days in advance • Number of outages approved before the Day321 process • Number of outages that have late extensions • Number of outages that are cancelled • Number of outages not submitted 7 days in advance	• Increased number of outages submitted 7 days in advance • Increased number of outages included in the Day321 process • Outage cancellation rate does not grow significantly • Decreased number of outage late extensions
2. Submit critical outage data in formatted fields rather than free-form text.	• Number of outages correctly submitted without manual intervention	• Increased number of outages correctly submitted without manual intervention
3. Submit real-time status for all outages via SLIC External Interfaces	• Number of outages in SLIC with accurate start and end times within a defined threshold	• Number of outages with accurate start and end times reflected in SLIC increases
4. Schedule return time on the half hour for outages affecting scheduling paths	• Number of outages affecting scheduling paths with a scheduled return time on the half hour • Number of outages affecting scheduling paths which require CAISO to modify energy schedules going into the next schedule hour	• Increased number of outages affecting scheduling paths with a scheduled return time on the half hour increases • Decreased number of outages requiring CASIO to modify energy schedules going into the next schedule hour
5. Implement Multiple Outage Configurations in Single Outage Ticket	• Number of outages which have multiple configurations in a single SLIC outage ticket	• Improved visibility for outages which may impact the grid reliability or market systems

	• Number of outages that could not be modeled because multiple outage configuration functionality was not used	• Decreased number of outages that could not be modeled
6. Identify project information within Outages	• Number of outages which are associated with projects • % of RIMS projects represented with an outage	• Mapping between outages an RIMS projects increases for better communication between CAISO and PTO
7. Standardized Outage Short Descriptions	• No metric defined at this time	• % of outages that follow short description guidelines increases

5 IMPLEMENTATION

This section of the paper outlines the timeline to implement the proposed changes to transmission outage reporting.

5.1 PHASED IMPLEMENTATION

The table below shows when PTO should begin to adhere to the recommendations of this paper. Phase 1 (2010: Q1) includes practices that are considered achievable in the near term by modification of business processes. Phase 2 (2010: Q2-Q3) includes practices that are expected to require system and application changes by the PTO and the CAISO and a period of testing within a non-production/simulation environment.

Initiative	Stakeholders	Target Dates 2010			
		Q1	Q2	Q3	Q4
1. Seven day advance outage submittal	• PTO • CAISO • MP		X		
2. Submit critical outage data in formatted fields rather than free-form text.	• PTO • CAISO • WECC			X	
3. Submit real-time status for all outages via SLIC External Interfaces	• PTO • CAISO • WECC		X		
4. Schedule return time on the half hour for outages affecting scheduling paths	• PTO • CAISO • MP	X			
5. Implement Multiple Outage Configurations in Single Outage Ticket	• PTO • CAISO			X	

	• WECC				
6. Identify project information within Outages	• PTO • CAISO • WECC	X*		X*	
7. Standardized Outage Short Descriptions	• PTO • CAISO • WECC • MP	X			

Dates with an 'X*' indicate that manual actions can be taken in the near term with additional plans to automate the initiative at a later date.

5.2 CHANGES TO THE CAISO OUTAGE MANAGEMENT BPM

The BPM is currently under review for possible modifications as a result of these initiatives. Any proposed policy changes will be managed through the CAISO Stakeholder Process.

5.3 CHANGES TO THE CAISO TARIFF

The Tariff is currently under review for possible modifications as a result of these initiatives. Any proposed policy changes will be managed through the CAISO Stakeholder Process.

6 ASSUMPTIONS

- Transmission Outages which are submitted 7 days in advance will be approved before the Day321 process (See Figure 3).

- Equipment naming standards and conventions will be shared with the participants

- Planned changes in the CAISO network equipment model/list will be made available to the PTO 2 weeks in advance of the next Network Model promotion.

- Metrics will be developed to help evaluate the effectiveness and success of any process changes and system enhancements made to Transmission Outage Management

7 NEXT STEPS

February 4, 2010 – Publish Whitepaper
February 18, 2010 – Written comments due to Travis Robinson (throbinson@caiso.com)
February 19, 2010 – Establish working groups with PTO for implementation
Date To Be Determined – Outage Management Business Practice Manual changes, if needed
Date To Be Determined – File Tariff language changes, if needed