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Seattle City Light EIM Gap Analysis Project
Final Report

Prepared For: Seattle City Light

City of Seattle

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1. EXECUTIVE SUMMARY

a. INTRODCUTION AND BACKGROUND

Seattle City Light (SCL) has contracted with Utilicast to perform an EIM Gap Analysis which required a thorough review of existing personnel, processes, metering and information technology and inventorying those elements that will require changes or needing to be adopted prior to joining the CAISO Energy Imbalance Market (EIM).

This is a final report of the gap analysis Utilicast performed which identifies the future state requirements necessary to operate in the EIM. This work assumes a project Go Live implementation date of April 1, 2019.

This report is organized into several sections. The Executive Summary provides the results of the gap analysis and considers the delivery and implementation risk to the project compared to the timeline of joining EIM. Following the Executive Summary is the Gap Analysis section, which is a description of the gaps that exist and what is involved is closing those gaps and being able to participate in the CAISO EIM.

The content is organized by areas that are readily converted into a project plan for delivery rather than from an organizational standpoint. Subsections are provided to explicitly address areas such as real-time operations, particulars around base schedule submission, project management, bidding etc. Within these areas is an assessment of the work SCL must undertake to join and successfully operate in EIM. In addition, Utilicast has included detailed interface diagrams with data and interval requirements. And following this is a review of SCL As-Is processes and an identification and mapping of the new processes SCL will need to join the EIM. Included in this work are detailed functional requirements for each organization to be able to operate successfully in the EIM.

Following this is a series of attachments that captures previous deliverables which are a required part the final report. This includes: **Attachment A, Project Charter** which outlines the EIM project objectives covering system and interface design, and implementation and integration goals, recommended organizational re-alignment and training objectives to efficiently support EIM operations and obtain targeted revenues;

Attachment B – Functional Requirements, a detailed worksheet that not only lists out the functional requirements for all work streams but also details application interfaces and process gaps and additional information associated with the Gap analysis work; **Attachment C, Recommend Organizational Structure** which details the organizational gaps and changes and decisions SCL needs to make prior to joining the CAISO EIM. The decisions that are made in this regard may have other impacts that will also need to be addressed prior to EIM implementation. **Attachment D – Summary of Changes to Metering and Communications** is a review of metering gaps that exist and what is needed to be ready for EIM participation. This section also covers some of the settlements timelines and requirements.

The main assumption underpinning this report is the implementation of new or upgraded information technology systems that will include all the normal components of a bid-to-bill system including settlement and shadow settlement functionality, but will also include a transmission scheduling and a base schedule component and potentially a meter data repository.

Utilicast has included high level requirements that will allow SCL to prepare a Request for Information (RFI) that will solicit additional information from various vendors that will feed back into established requirements. As a part of this and the overall EIM Implementation project, SCL will also need to more fully develop detailed RFPs for the EIM system to drive an expedited delivery schedule to ensure a successful delivery of the project.

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b. **KEY GAPS – CONCLUSIONS**

There were three large gaps noted by Utilicast. The single biggest gap at SCL pertains to the system and interface additions or upgrades that need to be put in place prior to joining the EIM. The replacement of an aging FIS SunGard system with a new EIM system that has bid-to-bill functionality in addition to shadow settlements and a transmission base scheduling capability stands out. The replacement of this aging system will be on the projects critical path and will dictate the overall project timing. It will also add to the number of interfaces that would ordinarily by needed for EIM participation as it is not just interfaces exchanging data to and from the CAISO, but internal SCL interfaces between existing SCL systems and the new EIM. This work will be done in conjunction with adding a network model to the Monarch OSI system at System Operations.

The second largest gap centers on adding an EIM desk at System Operations and hiring, as well as training, an additional 5 NERC certified operators. The EIM desk is the primary interface with the EIM market and is responsible for ensuring market operations are working correctly, and the market is in-sync with actual network and generation conditions in the field. It is worth mentioning various options were considered in trying to avoid adding an EIM desk, but even with CAISO enhancements that are due to be delivered in the next couple of years, unless transmission switching can be absorbed elsewhere in System Operations the need for a desk cannot be avoided.

The third main area of focus is the reconfiguration of settlements function to be equipped with staff fully trained for CAISO settlements and shadow settlement activities. SCL greatly benefits from not needing to apportion EIM Entity charges to third party customers, but even with that, there is still a significant effort involved in getting systems, procedures and personnel ready to process, analyze and dispute CAISO settlements. This is particularly important given the volume of data and the stringent CAISO deadlines for disputing an invoice.

Utilicast has recommended the addition of an Outage Management System (OMS). While it is conceivable that this activity could be done manually in

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the CAISO OMS, manual input of outage cards would leave SCL exposed to risk. That is because in the EIM, outage cards are not only used for true outages they are also used to limit generating plant availability. This higher volume of outage cards will need to be processed in a very precise manner otherwise they will either be rejected by the market or will not have the desired outcome. That said, if SCL is looking for ways to control the budget, this might be one option to have taken out of scope. Prior to doing that SCL should have discussions with Puget Sound Energy (PSE) who went down this path but now are apparently regretting their decision. Consideration should also be given to the new NERC Standard IRO-017 that is scheduled to go into effect and the impact it will have on processing outage management data.

There were a number of other gaps that are outlined below. These are fairly typical for EIM participation and do not pose a significant risk in a well-organized and managed project.

In the organizational review discussed in Attachment C, Utilicast recommended SCL add a total of eight (8) full time equivalents (FTEs) for the EIM effort, with a net headcount increase of only four (4) FTEs. This is because four of the eight staff can be repurposed from the BPA slice contract which expires in October 2017, well ahead of the expected EIM go-live date. These eight (8) additions include the five (5) EIM desk operators discussed above. The other areas recommended for increase were one (1) FTE in Merchant Operations, and two (2) FTES in Settlements. In addition to the eight (8) FTEs, consultancy support is recommended for the network model initiative and for preparing adequate risk management oversight and controls.

In terms of SCL's metering and communications, Utilicast concluded that SCL generation was compliant with CAISO's requirements once SCL's meter upgrade initiative is concluded. Deficiencies were flagged on intertie metering that will warrant further discussion with CAISO. Load metering cannot be deemed compliant with CAISO requirements until intertie metering is considered satisfactory by CAISO. At that point Utilicast believes SCL load metering will then be compliant with the CAISO requirements as it will be an aggregate of generation and intertie metering.

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As part of the metering review Utilicast also recommended SCL become a Scheduling Coordinator Metered Entity to avoid cost increases and permit SCL to maintain its existing installation and maintenance metering standards, as well as purchase appropriate software to validate, edit and estimate MV-90 metering data.

Finally, Utilicast undertook a rigorous review of Seattle City Light's existing processes and identified where those processes would change as a participant in the EIM. In addition, process maps were generated for the new processes that will be required as an EIM participant. A comprehensive set of functional requirements were also prepared and mapped to new or existing processes. Requirements for a replacement EIM information technology system that could be issued to vendors as part of a request for information (RFI) were also prepared. These items are too unwieldy to include in the final report and have been attached as electronic appendices. These documents are very much living documents as there were some limitations, unknowns and outstanding decisions when they were prepared and should be updated as the outcome of the decision-making process is known.

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2. GAP ANALYSIS OVERVIEW

As expected when a utility is joining a market for the first time there are going to be several gaps that need to be addressed from a process, IT, resource and training standpoint. SCL is no different, and outlined below are items that have been grouped into 23 key areas that SCL needs to focus on prior to joining the EIM.

There were three larger gaps noted by Utilicast that warrant a lot of attention. The single biggest gap pertains to the system and interface additions or upgrades that need to be put in place prior to joining the EIM. Of those changes the replacement of an aging FIS SunGard system with a new EIM system that has bid-to-bill functionality, in addition to settlements, shadow settlements and transmission base scheduling capability stands out.

The replacement of this aging system will be on the EIM project's critical path and will dictate the overall timing of the project. It will also add to the number of interfaces that ordinarily would be needed for EIM participation, as it is not just interfaces exchanging data to and from the CAISO, but internal SCL interfaces between existing SCL systems and the new EIM. This exponentially increases the level of end to end testing that needs to be done.

It is worth bearing in mind the EIM system implementation is being done in conjunction with establishing and adding a network model to the Monarch OSI system at System Operations, which typically is the longest lead time item. Typically a utility has a network model to begin with and is aligning it to the CAISO network model for consistent state estimator solutions.

The second largest gap centers on adding an EIM desk at System Operations and hiring, as well as training, an additional 5 NERC certified operators. The desk is the primary interface with the EIM market and has a number of responsibilities, including ensuring market operations are working correctly, and the market is in-sync with actual network and generation conditions in the field.

Various options were considered in trying to avoid adding an EIM desk, but even with CAISO's expected future enhancements that are due to be

delivered in the next couple of years, unless transmission switching can be absorbed elsewhere in System Operations, the need for a desk cannot be avoided despite it being a very marginal decision. It is simply not safe to have switching interrupted in any way and that is what would likely happen if the existing desk absorbed EIM activities.

The third main area of focus is the reconfiguration of the settlements function to be equipped and fully trained for CAISO settlements and shadow settlements. SCL will benefit from not having to apportion EIM Entity charges to third party customers. Yet even with that, there is a significant effort involved in getting systems, procedures and personnel ready to process, analyze and dispute CAISO settlements. This is particularly true given the volume of data and the stringent CAISO deadlines for disputing an invoice.

Utilicast has recommended the addition of an outage management system. That said it is conceivable that this activity could be done manually in the CAISO Outage Management System. However, manual input of outage cards would leave SCL exposed to risk in the market, as outage cards are not only used for true generation and transmission outages they are also used to limit generating plant availability. This higher volume of outage cards need to be processed in a very precise manner otherwise they will either be rejected by the market or not have the desired outcome in market optimization. That said, if SCL is looking for ways to control budget, this might be one option that conceivably could be taken out of scope. Prior to doing that though, SCL should have discussions with Puget who opted to use CAISO's portal to enter outage cards, but are apparently somewhat regretting their decision. Consideration should also be given to the new NERC Standard IRO-017 that is scheduled to go in to effect, and the impact this will have on processing outage management data.

Other options may be available to limit project scope and reduce budget, including manually uploading generation base schedules and bids, and eliminating shadow settlements. Utilicast is not recommending such an approach even with SCL's size relative to some of the larger utilities in EIM, because such an approach exposes the company to more risk and limits

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SCL's ability to identify settlement issues and limits the automated risk management controls that can be put in place.

There were a number of other gaps that are outlined below. These are fairly typical for EIM participation and do not pose a significant risk in a well-organized and well managed project. Testing does warrant a special mention. It will be important for SCL to be well prepared and organized for EIM testing. As described below, there are many facets to the testing, and it will be important to have a testing plan and test cases prepared well in advance, and to have SCLs subject matter experts positioned to execute those test plans at the appropriate time.

With regard to training, it should be recognized even after all the CAISO training is completed, operators will not be completely ready for EIM duties. It is highly recommended to have tailored training from a consultant who can provide experienced EIM trainers who have also been on an EIM desk.

Similarly, SCL should consider requesting generating plant and energy bid cause and effect training from the CAISO, so merchant employees are better able to understand the consequences of employing different generating unit configurations in the market. To be clear, SCL would not be asking CAISO for training on "how to bid", but on the cause and effect of different approaches.

a. SYSTEM AND INTERFACE GAPS

The single biggest gap at SCL pertains to the system and interfaces additions or upgrades that need to be put in place prior to joining EIM. This section discusses the main system needs and details all the CAISO interfaces and data exchanges. The internal interfaces will be identified once new systems and existing system upgrades have been decided upon.

The main system replacement is currently being called the new EIM system. The functional requirements for this system and the tools required have broadly been captured below in Figure 1.

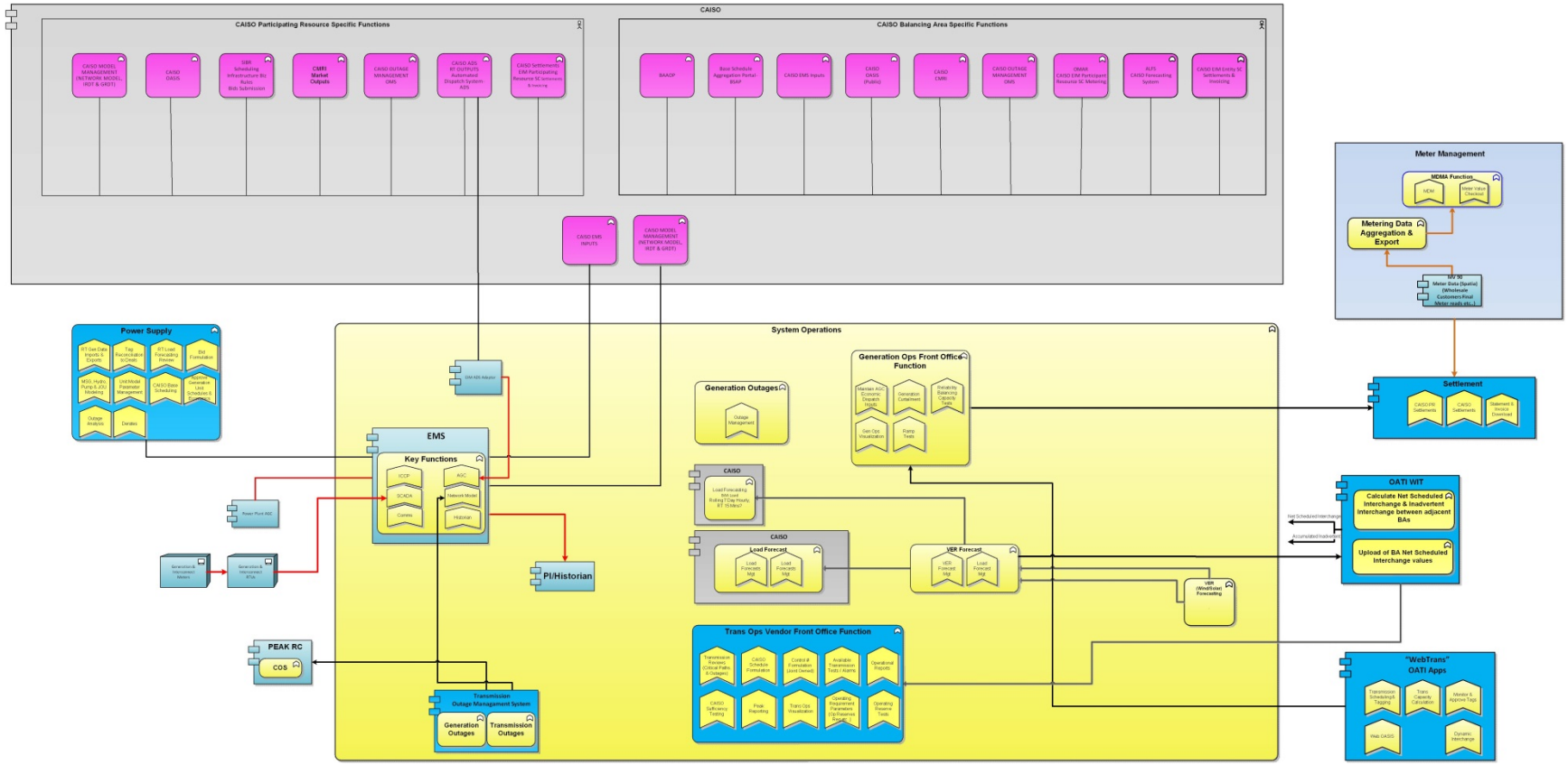

Figure 1 – EIM Functional Diagram

Note: Interface points highlighted Fuchsia are CAISO and in Blue are Bid to Bill interface components.

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At a high level this system will act as a bid-to-bill upgrade or replacement of FIS SunGard and will have settlement, shadow settlement, as well as, transmission and base scheduling capabilities, and potentially meter data storage functionality.

There is a lot of functionality in this one system, which should help from a data exchange viewpoint.

The complexity of this system will dictate project timelines and the critical path of the project. It also necessitates the need to map out the internal interface design of the SCL systems once the functionality and specifications of this new system have been fully developed.

Discussed in more detail below is the recommendation to procure an outage system in addition to the new EIM system. There is also a need to purchase software for validating, estimating and editing meter data in the MV90 system. Indeed, SCL may have a need to purchase meter data warehouse software if the new EIM system is unable to deliver that functionality.

The functions outlined in the diagram above Figure 1will be the primary focus of EIM and includes bringing together the system and 90 plus interfaces needed to submit and retrieve data between SCL and CAISO.

As indicated earlier, Attachment B - Functional Requirements contains the full details the particulars and intervals associated with this data exchange which we have illustrated below in Figure 2 and Figure 3. In Figure 1 the Items highlighted in grey are applications that have yet to be procured by SCL.

Note: The Gap Analysis for SCL EIM system has already identified a large number of interfaces (95) to date.

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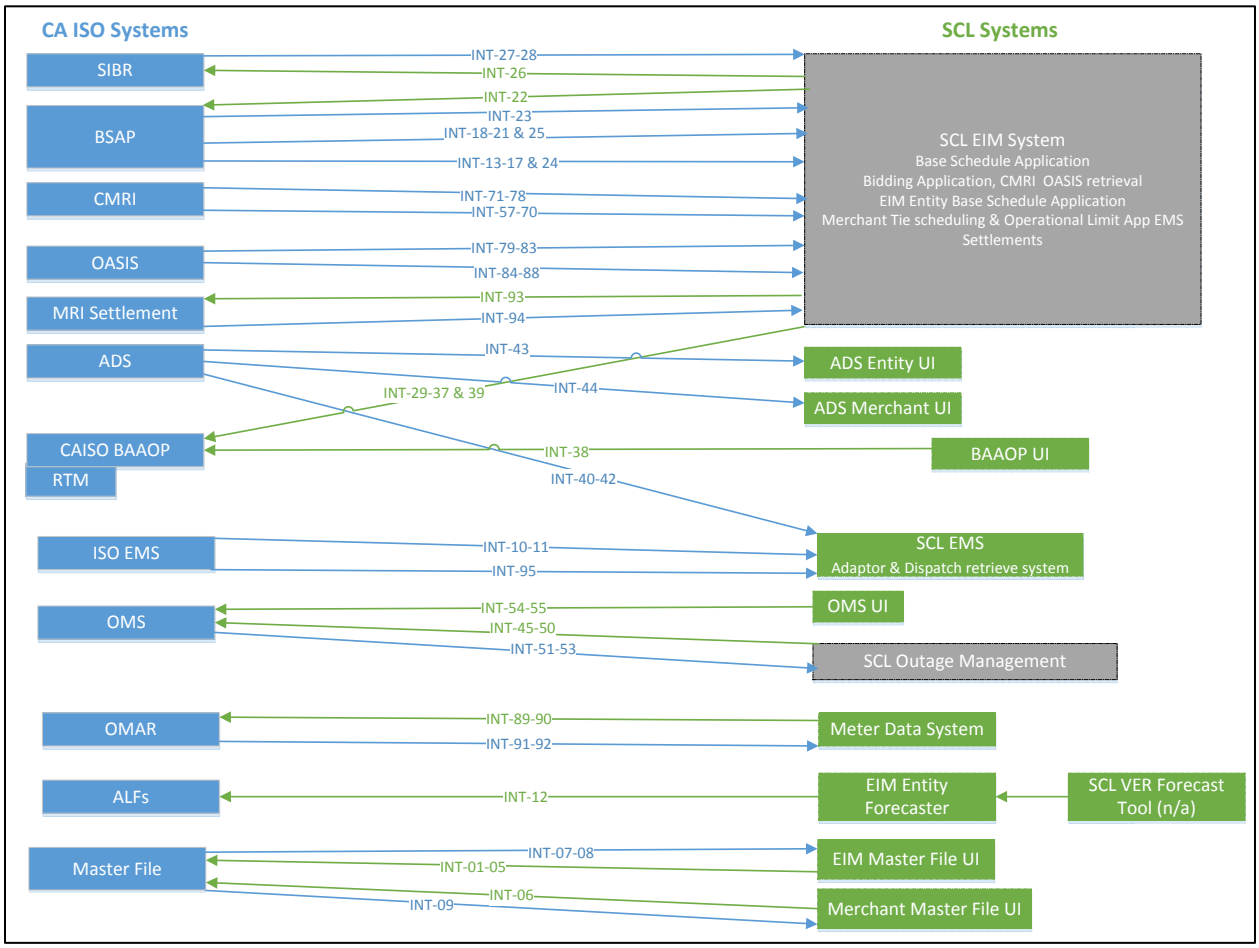

Figure 2 – CAISO to SCL Application Interfaces

The number of interfaces may expand if SCL determines that more data is needed for situational awareness or if data is need to put particular controls in place. Final count on the number of interfaces may also change as a result of policy or market developments at the CAISO. The number of interfaces is not atypical for EIM participation. As such, careful tracking and monitoring of these developments is key to a successful SCL launch.

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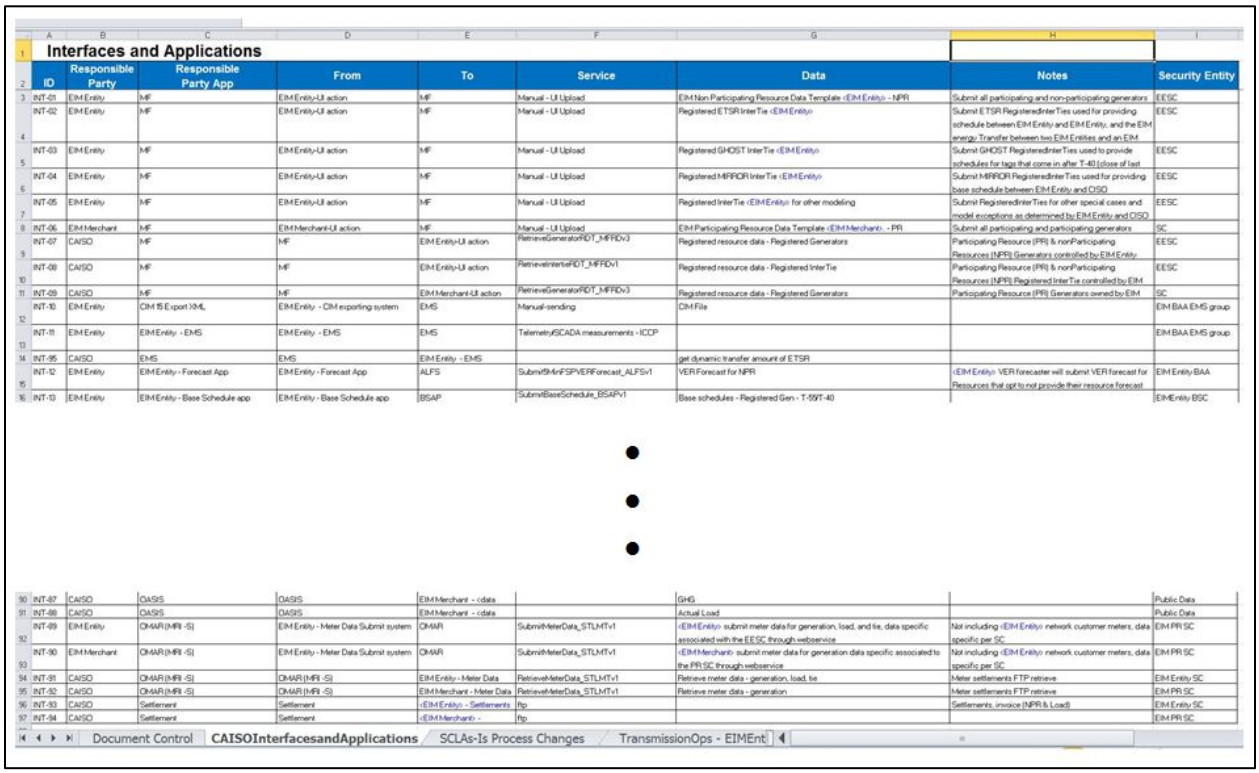

Interfaces and Applications

ID	Responsible Party	Responsible Party App	From	To	Service	Data	Notes	Security Entity
INT-01	EIM Entity	MF	EIM Entity-UI action	MF	Manual - UI Upload	EIM Non Participating Resource Data Template <EIM Entity> - NPR	Submit all participating and non-participating generators	EESC
INT-02	EIM Entity	MF	EIM Entity-UI action	MF	Manual - UI Upload	Registered ETSR InterTie <EIM Entity>	Submit ETSR RegisteredInterTies used for providing schedule between EIM Entity and EIM Entity, and the EIM energy Transfer between two EIM Entities and an EIM	EESC
INT-03	EIM Entity	MF	EIM Entity-UI action	MF	Manual - UI Upload	Registered GHOST InterTie <EIM Entity>	Submit GHOST RegisteredInterTies used to provide schedules for tags that come in after T-40 (close of last	EESC
INT-04	EIM Entity	MF	EIM Entity-UI action	MF	Manual - UI Upload	Registered MIRROR InterTie <EIM Entity>	Submit MIRROR RegisteredInterTies used for providing base schedule between EIM Entity and CISO	EESC
INT-05	EIM Entity	MF	EIM Entity-UI action	MF	Manual - UI Upload	Registered InterTie <EIM Entity> for other modeling	Submit RegisteredInterTies for other special cases and model exceptions as determined by EIM Entity and CISO	EESC
INT-06	EIM Merchant	MF	EIM Merchant-UI action	MF	Manual - UI Upload	EIM Participating Resource Data Template <EIM Merchant> - PR	Submit all participating and participating generators	SC
INT-07	CAISO	MF	MF	EIM Entity-UI action	RetrieveGeneratorRDT_MFRDv3	Registered resource data - Registered Generators	Participating Resource (PR) & nonParticipating Resources (NPR) Generators controlled by EIM Entity	EESC
INT-08	CAISO	MF	MF	EIM Entity-UI action	RetrieveIntertieRDT_MFRDv1	Registered resource data - Registered InterTie	Participating Resource (PR) & nonParticipating Resources (NPR) Registered InterTie controlled by EIM	EESC
INT-09	CAISO	MF	MF	EIM Merchant-UI action	RetrieveGeneratorRDT_MFRDv3	Registered resource data - Registered Generators	Participating Resource (PR) Generators owned by EIM	SC
INT-10	EIM Entity	OIM 15 Export XML	EIM Entity - OIM exporting system	EMS	Manual-sending	OIM File		EIM BAA EMS group
INT-11	EIM Entity	EIM Entity - EMS	EIM Entity - EMS	EMS	Telemetry/SCADA measurements - ICCP			EIM BAA EMS group
INT-95	CAISO	EMS	EMS	EIM Entity - EMS		get dynamic transfer amount of ETSR		
INT-12	EIM Entity	EIM Entity - Forecast App	EIM Entity - Forecast App	ALFS	Submit5MinPSPVERForecast_ALFSv1	VER Forecast for NPR	<EIM Entity> VER forecaster will submit VER forecast for Resources that opt to not provide their resource forecast	EIM Entity BAA
INT-13	EIM Entity	EIM Entity - Base Schedule app	EIM Entity - Base Schedule app	BSAP	SubmitBaseSchedule_BSAPv1	Base schedules - Registered Gen - T-65/T-40		EIMEntity BSC
INT-87	CAISO	OASIS	OASIS	EIM Merchant - <data		GHG		Public Data
INT-88	CAISO	OASIS	OASIS	EIM Merchant - <data		Actual Load		Public Data
INT-89	EIM Entity	OMAR (MRI -S)	EIM Entity - Meter Data Submit system	OMAR	SubmitMeterData_STLMTv1	<EIM Entity> submit meter data for generation, load, and tie, data specific associated with the EESC through webservice	Not including <EIM Entity> network customer meters, data specific per SC	EIM PR SC
INT-90	EIM Merchant	OMAR (MRI -S)	EIM Entity - Meter Data Submit system	OMAR	SubmitMeterData_STLMTv1	<EIM Merchant> submit meter data for generation data specific associated to the PR SC through webservice	Not including <EIM Entity> network customer meters, data specific per SC	EIM PR SC
INT-91	CAISO	OMAR (MRI -S)	OMAR (MRI -S)	EIM Entity - Meter Data	RetrieveMeterData_STLMTv1	Retrieve meter data - generation, load, tie	Meter settlements FTP retrieve	EIM Entity SC
INT-92	CAISO	OMAR (MRI -S)	OMAR (MRI -S)	EIM Merchant - Meter Data	RetrieveMeterData_STLMTv1	Retrieve meter data - generation	Meter settlements FTP retrieve	EIM PR SC
INT-93	CAISO	Settlement	Settlement	<EIM Entity> - Settlements	ftp		Settlements, invoice (NPR & Load)	EIM Entity SC
INT-94	CAISO	Settlement	Settlement	<EIM Merchant> -	ftp			EIM PR SC

Document Control | CAISOInterfacesandApplications | SCLAs-Is Process Changes | TransmissionOps - EIMEnt

Figure 3 – Detailed List of CAISO and SCL Interfaces and Applications

b. EIM ENTITY DESK GAP

SCL does not have the bandwidth at System Operations to fully absorb all the EIM Entity operator activities within its existing generation and transmission desks and continue to operate safely. As such, this creates a gap that causes a dedicated EIM Entity desk to be created. This section describes the gaps associated with the EIM Entity Desk or EIM real-time operational oversight for the BA.

Various options were considered in trying to avoid adding an EIM desk, but even with CAISO's expected future enhancements that are due to be delivered in the next couple of years, unless transmission switching can be absorbed elsewhere in System Operations, the need for a desk cannot be avoided despite it being a very marginal decision. It is simply not safe to have switching interrupted in any way and that is what would likely happen if the existing desk absorbed EIM activities

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The functions that the EIM Entity desk will perform include, but are not limited to, managing generation and transmission planned and forced outages and availability limits, submission of real-time interchange schedules, oversight of SCL's generation base schedule submissions, management of ETSR limits, managing transmission limits, load and transmission conforming, implementing corrective actions for failed CAISO tests, submission of balanced schedules at T-40 and oversight of dispatch signals being sent to participating generating units. Furthermore, this desk will be key to not only making sure the CAISO EIM is getting all necessary information timely to run the market, but is also the primary point of contact and liaison with the CAISO market operator (MO) for real time operations and during a system event.

The EIM desk, not the generating desk, will also review generating plant unit commitment instructions and DOTs in the BAAOP user interface and will be able to block or modify them for each unit if necessary and appropriate. The operator will also be expected to freeze all intertie transfers in the event of market disruption or energy emergency.

Some thought needs to be given to the personnel manning the EIM desk. The operators will obviously be NERC certified and have a desire to do shift-work. At the same time, it will be important to select individuals who either have a deep knowledge of CAISO market operations and how the CAISO model optimizes or individuals that have an aptitude to learn these components quickly. Utilities have typically struggled to staff these positions, and have ended up poaching individuals from each other to maintain desired staffing levels.

At a minimum, it is recommended shift supervisors are trained on EIM. This is important in an event, as each desk will need to operate in unison with system protection being of primary importance. Failure to be coordinated could cause the market to undermine the generation or transmission desks actions if system conditions have not been updated in the market.

As the supervisor ultimately makes the judgement call in an event, it's important supervisors are sufficiently trained to be able to distinguish between a true system event, erroneous market data that is incorrectly

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indicating an event, and vice versa. The training will also help. In terms of support and another set of eyes, the EIM desk operator will troubleshoot market anomalies that are not being seen on the network or at the generating plant.

c. NETWORK MODEL GAP

SCL must provide a Network model that is consistent across the company, consistent with SCL neighbors, and consistent with the CAISO's network model. Beginning with the Peak model is a good starting point and by asking CAISO to provide that model it will at least be in-sync with their format, which could save time on the project. SCL will then need to make updates to ensure that:

- Modeling points separated by company (e.g. points in the SCL BA are under SCLXX, points in PACE are in PACE, etc.)
- Point naming convention meets CAISO requirements, including:
    - Station names are unique and are no longer than eight characters;
    - Branch names are unique;
    - No spaces in names of network components;
    - SCADA measurement names are unique, without special characters and do not exceed 24 characters; and
    - Generator names match AGC names.
- Each intertie location included in measuring NAI maps one-for-one in the network model.
- Interties conform to Company from/to specification.
- Transmission lines are modeled down to 69kV. Each generation unit / aggregation is configured in the Network model as it will be used in EIM.
- Each load which is being measured is within the boundaries of the BA in the Network Model.
- Each type of limit required by the CAISO is specified in the Network model.
- Non-conforming loads are identified.

- Quality of telemetry measurements are scaled, modeled and tuned to provide reliable state estimator solution.

The CAISO updates Network models quarterly with submission of updates due about 6 months in advance of the effective date. The graphic in Figure 3 below depicts a high-level overview of the Full network model (FNM) update business process flow. From that summary, we can see that there are multiple steps in this process which have been grouped into the FNM scope process and the FNM implementation process. The FNM scope process is used to define the scope of the changes to be made in the planned FNM update, while the FNM implementation process is used to make the changes included in the FNM scope, test them and place them into production. From the graphic below, we can also see that data gathering can take up to 6 months before the scope cutoff and the start of the implementation process

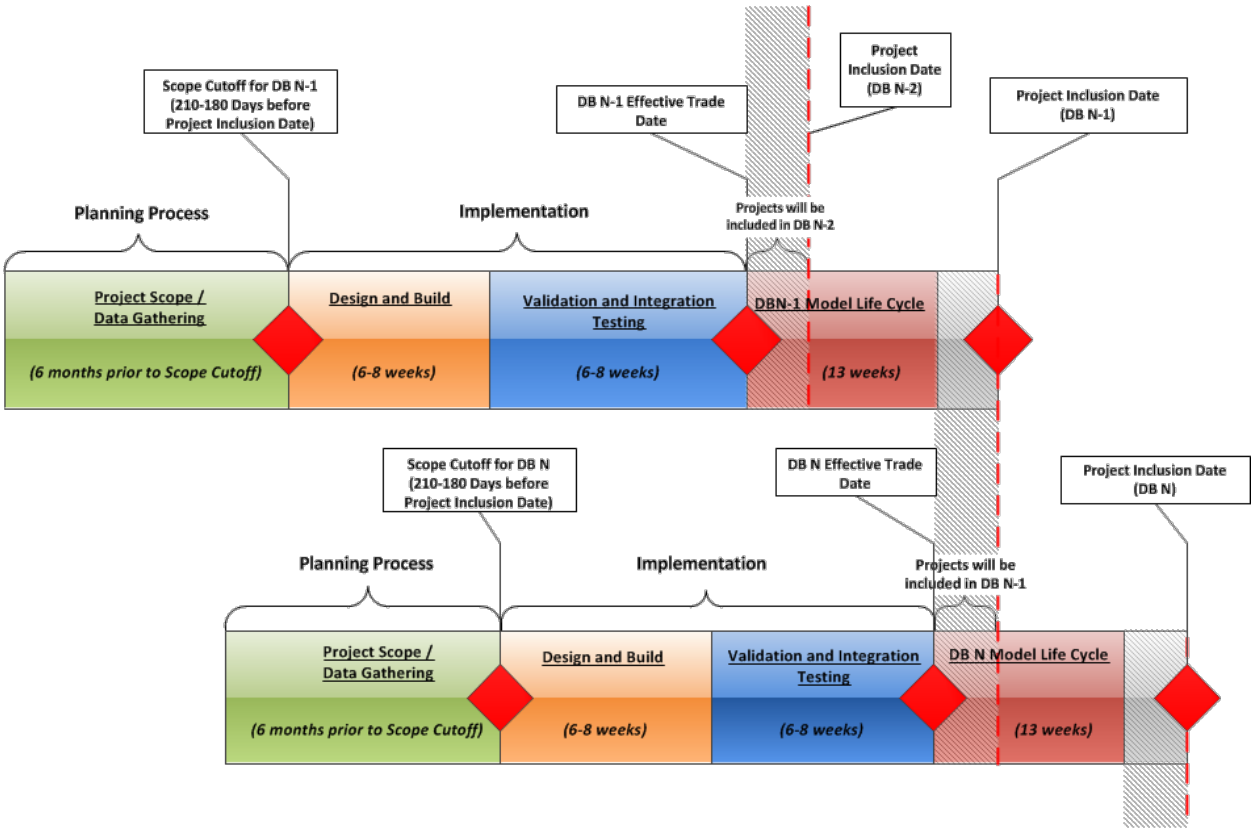

Figure 4 - FNM Update Process Flow and Timeline

Once the Network model is created, it needs to be exported in CIM 10 or CIM 15 format and provided to the CAISO. CAISO actually downgrades CIM 15 formats to CIM 10 when they import the model submissions. This can cause some discrepancies and may require additional testing if SCL uses a CIM 15 export. Formats may change by 2019, as CAISO are changing out their SCADA EMS next year, yet another item for SCL to track.

d. NETWORK MODEL TELEMETRY

To participate in EIM, SCL will need to provide Telemetry data to CAISO via ICCP so that CAISO can execute their State Estimator. Communications via two vendors and two separate routes to both Folsom and Alhambra will need to be established.

Every 5-minutes a dispatch operating target (DOT) is received for each participating resource via CAISO's automated dispatch system (ADS) XML data feed. It is not possible to manage the 5-minute dispatches manually. The most common approach is to automatically pull the ADS DOT into the EMS, combine the EIM DOT with any other needed deployments of Regulation or Operating Reserves and generate a single set point for each unit. That set point is then passed automatically to each Participating Resource Plant DCS.

In order to integrate the EIM provided DOT and any Regulation of Operating Reserve deployment, the EMS must be capable of running in a market / mixed operating mode, which Monarch OSI has done for other utilities.

e. BASE SCHEDULE CREATION AND SUBMISSION GAP

The EIM is reliant on the Balancing Area Authority (BAA) performing a key role in administering the Market. These functions are performed by what is known as the "EIM Entity" in the System Operations organization. The EIM entity maintains responsibility over the BAA and is responsible for submitting much of the information used by CAISO in market optimization and awards. Before EIM market optimization, base Energy Transfer schedules between EIM BAAs are submitted along with the generation and intertie base schedules. The base Energy Transfer schedules are assumed

to be feasible and are used as the financial baseline for imbalance energy settlement in the EIM. SCL currently has a significant gap in the creation of base schedules in a CAISO acceptable format and submission of baseline data for market optimization. This section describes the gaps associated with:

- Generation Base Schedule Creation
- Intertie Base Schedule Creation
- ETSR limit determination and submission
- Real-Time Interchange Management and Schedule Creation
- Energy Bid Creation and submission

f. DAY AHEAD BASE SCHEDULES

During the Day-Ahead period, SCL "must" submit Base Schedules for Participating Resources for a rolling 7-day period.1 This information is used in the CAISO Day-Ahead Market and forward market studies. The CAISO will provide results to SCL indicating whether it detects transmission infeasibility, but the results are not binding. No unit commitment, awards, dispatches or prices are provided. This submission is driven by CAISO tariff requirements.

By 10:00 a.m., on the day preceding the Operating Day, the EIM Entity submits on behalf of non-participating resources and participating resources an EIM Resource Plan, which must cover a seven-day horizon with hourly granularity beginning with the Operating Day. At SCL it is expected that Merchant Operations will create and submit to CAISO's Base Schedule Aggregation Portal (BSAP), generation base schedules for all SCL owned and managed participating and non-participating resources, energy bids, as well as available balancing capacity for participating resources. Technically, the EIM Entity is responsible for the submission of Base Schedules for non-participating resources, but typically Merchant Operations has the role in determining the schedules for owned non-

1 Note that these submissions are not for participation in the Day-Ahead Market but are a kind of "preview" which is used in some of the CAISO forward processes. The accuracy standard for this information is not high.

participating resources. SCL does not need to consider 3rd Party generation resources at this time, but the norm is to have the EIM Entity gather those schedules from non-participating customers and submit them. Participating generation resources deal directly with the CAISO for submission and settlement.

The remaining elements of the EIM Resource Plan will be submitted by the EIM entity. The resource plan comprises:

- EIM base schedules of EIM entities and EIM participating resources, which include hourly-level schedules for resources, and hourly-level scheduled interchange
- Energy bids for participating resources
- EIM upward available balancing capacity
- EIM downward available balancing capacity
- EIM reserves to meet NERC/WECC contingency reserve requirements

g. OPERATING DAY GENERATION BASE SCHEDULES

Merchant Operations will perform updates to the day ahead participating and non-participating generation base schedules during the operating day, after SCL has determined its position for the day. There are three base schedule and ancillary service plan submission timelines – T-75 minutes to the start of the Operating Hour, T-55 and T-40. Updates may occur right up to the T-75 and T-55 submission deadlines if needed. Energy bids will also be updated, but the energy bid submission deadline will occur earlier at T-75. Merchant Operations are typically responsible for the T-75 and T-55 submission, while the BAA / EIM Entity is the only party permitted make changes between T-55 and T-40 to the T-40 submission.

The CAISO will provide results to SCL indicating whether it detects imbalances, congestion or ramping insufficiency following each submission, with the results of the T-40 submission becoming financially binding for the Operating Hour. The first test results become available following T-75, when the CAISO has run four sufficiency tests. After the first set of results become available, it is anticipated that Merchant Operations will make adjustments to generation Base Schedules for load forecast movements

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and/or sufficiency test results and submit them by T-57 (a deadline which will be set by SCL to allow time for data transfer, but which all other EIM Entities have set at T-57) in preparation for the T-55 cut-off for sufficiency tests.

At the same time, System Operations would gather updated tags and submit aggregated Intertie Base Schedules to BSAP for all intertie points at T-57 for the T-55 cut-off. The effort involved in aggregating intertie base schedules to the boundary tie points with other BAs should not be underestimated.

Following T-55, the CAISO will again run the four sufficiency tests and provide the results. At this point, Merchant Operations will be locked out of the base scheduling aggregation portal (BSAP), and it is the EIM Entity's responsibility to balance and make any needed adjustments prior to the T-40 cut-off. There will be coordination between the EIM Entity and Merchant Operations (by phone) if Generation Base Schedules require adjustments. However, this is not required by EIM and the EIM Entity may make whatever adjustments it deems necessary to properly position and operate the network within pre-existing policies and procedures. Following the T-42 submission to BSAP, base schedules are fixed for the purposes of settlements at T-40.

Figure 5 below illustrates the real-time submission and sufficiency test timelines.

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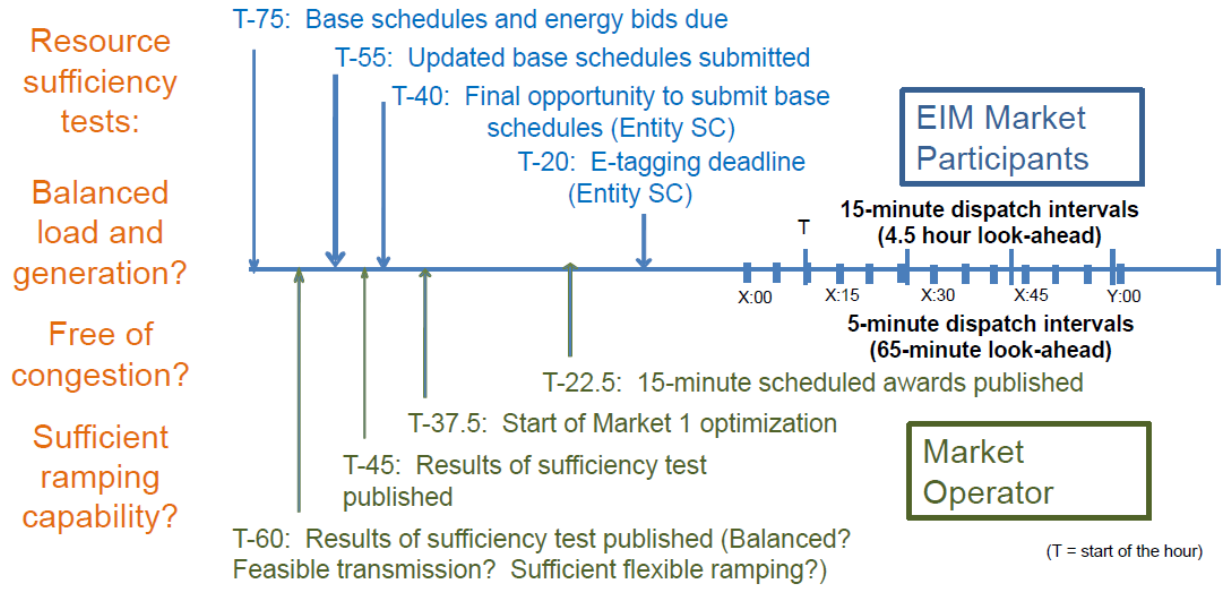

Figure 5 - EIM Real-Time Submission and Sufficiency Test Timeline

h. INTERTIE BASE SCHEDULES

There are several variations on how the intertie base schedules are created depending on the Balancing Areas involved. Prior to EIM participation, System Operations, in conjunction with Settlements, will need to identify each Intertie location and some properties of that location and ensure the methods described below are included in the new EIM system functionality. Logic will need to be defined to automatically aggregate tag data for each intertie location. For base schedules, the aggregation process is performed at least three times prior to each Operating Hour, as described above and updates are interfaced to the market every 5 minutes in real time. Some of the key considerations for different types of interchange are outlined below:

- SCL as an EIM Entity – to/from a Non-EIM Entity – pending, approved and changes to approved schedules should be aggregated to Transaction IDs. Combining all three types of tags provides the best supply position as pending tags and pending changes to approved tags are typically not denied. Transaction IDs group interchange base schedules by import or export at the Intertie

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(defined by what is known as an Intertie ID that maps to the network model). They can be further divided by appending a distinguishing code. There are variations for this situation as well:

  - Dynamically scheduled imports – If a dynamically scheduled import from a non-EIM BA exists, there are two options: A registered import tie system resource or a tie generator. If SCL were to have any dispatchable resources in adjacent BAs, it might be useful to model them as tie generators so that they can be dispatched by EIM.
  - Dynamically scheduled exports – If there are exports dynamically scheduled to a Non-EIM BA, these are mapped to registered export tie system resources.

  The Market treats interchange at these locations similarly to intertie schedules that are used today. For static imports/exports, the schedule is held constant throughout the hour. For dynamics, actual energy is updated after the fact.

- SCL as an EIM Entity – to/from an EIM Entity – pending, approved, and pending changes to approved schedules are aggregated to EIM transfer system resources (ETSRs). Similar to above, this creates aggregated scheduled interchange on an intertie specific basis. However, the CAISO interprets this similar to establishing the base operating point for a “pseudo generation resource” at the intertie location. The energy for ETSRs is “dispatched” during the hour by the Market. SCL determines the limit for this dispatch and provides that to CAISO. The tagged schedules are not modified by the dispatch.
- SCL as an EIM Entity – to/from CAISO – transactions which involve CAISO are created as Mirror Transactions. This approach is used to avoid double counting since CAISO already has representation of this schedule in their systems. This concept is similar to creating aggregated schedules except for the Mirror resource. This situation is not anticipated to apply to SCL at Go-Live.

For each of these scenarios, SCL will need to map each tag which crosses a BA boundary to one of the intertie locations for each hour.

As it does today, SLC will continue processing Tags up to T-20 minutes, which is after the conclusion of the Base Scheduling process. These “late” Tags will be created as “Ghost” schedules in the creation of Real-Time Interchange Schedules, which is described below.

i. REAL-TIME INTERCHANGE MANAGEMENT

On an on-going basis, System Operations will be calculating and providing real-time interchange schedules (RTIS) to BAAOP for use in the Real-Time Market (RTM). The process for creating RTIS is similar to the process for creating intertie base schedules in that tags are aggregated for each intertie location. A few distinctions between RTIS and intertie base schedules are notable:

- Intertie base schedules are calculated for the hour and submitted up to 40 minutes before the hour begins (T-40). RTIS is calculated on a 5-minute granularity and is submitted every 5-minutes for a rolling 5-hour window.
- Intertie base schedules are based on the hourly energy profile at the time of Base Schedule submission. RTIS is ramped to account for schedule changes during and between hours.
- RTIS can, optionally, include 5-minute projected energy for dynamic tags. If there is potential for significant variation between the energy on a dynamic schedule across the intertie, then EIM will achieve better results if it is aware of these changes. If EIM is aware, it will dispatch based on the 5-minute projected NSI. If EIM is not aware, SCL will need to regulate (or let ACE deviate within RBC) for the differences. RTIS is also affected by any schedule curtailments.
- Tie generators are included in base schedules but they are excluded from RTIS calculations

Interchange curtailments will be immediately communicated to the market and incorporated into the next market optimization run. The next 5-minute market run, or real-time dispatch (RTD) will rebalance, causing a re-dispatch of generation across the EIM footprint (internal and external generation) and adjusting ETSR transfers between EIM Entities. Small curtailments can be absorbed easily, but large curtailments (i.e., MW

impact is greater than available ramping capacity) can cause issues in the market, which result in price spikes.

Updating RTIS to account for dynamic schedules will require telemetry or some other projection of what the actual energy profile will be (not applicable to SCL but for example short term VER forecast). The value of this update will depend on how stable the energy profile is on the dynamic schedule. A dynamic import to serve load might see only minor changes from interval to interval, and not warrant the additional complexity. A dynamic schedule to wheel wind output across SCL BA might result in a significant change from interval to interval that would make a more precise accounting process relevant.

Note that while RTIS is updated for schedule changes, it is not updated for changes in flows on ETSRs due to EIM dispatches.

Prior to EIM participation, System Operations will need to establish the logic for creating the ETSR Limit for each ETSR. There are actually three ETSR limits for each ETSR. The first is a “Transfer Limit” which is a single value for the hour. The second is a “Static Limit” which is for the Fifteen Minute Market (FMM). The third limit is a “Dynamic Limit”, which is used in the 5-minute Real-Time Dispatch. The Dynamic limit is actually a limit to the deviation from the static limit used in the FMM. Some of this complexity is driven by BPA for EIM Entities which use the BPA system. It may be possible for SCL to use the same value for all three limits, as some EIM Entities do, but that would only be the case where there is not a reason to use the BPA system.

Throughout the Operating Day, each ETSR Limit must be updated based on the RTIS. If dynamic schedules are not accounted for, this can be done on an hourly basis for an hourly granularity. If SCL chooses to account for dynamic schedules in RTIS on an ETSR, then the limit for those ETSRs will need to be updated on a rolling 5-minute basis with a 5-minute granularity for a rolling 5 future hours. RTIS must also be updated after the fact with actual values.

j. **REAL-TIME INTERCHANGE SCHEDULE CREATION**

SCLs new EIM system will have the capability to automatically obtain all tagged schedules, including curtailments, for calculating RTIS on an ongoing basis. The system will also perform the ramp calculation to determine 5-minute RTIS for submission to CAISO. The EIM system will automatically manage the submissions of RTIS to BAAOP for each intertie for each interval. In addition, the latest available transmission capacity (ATC) and dynamic limits will be obtained to calculate the ETSR Limit for each ETSR prior to submission to BAAOP.

k. **ENERGY BID CREATION**

Merchant Operations will submit bid curves for each Participating Resource for each Operating Hour. Bid curves are due by T-75 minutes prior to the Operating Hour. These curves are the economic input the CAISO uses to determine the dispatch of participating resources in Real-Time. SCL will ultimately create a library of bid curves to draw upon.

SCL's EIM system will have the capability to automatically create suggested bid curves based on the basic cost information and pre-defined strategies or similar day / similar hour type analysis. The specifications have not been fully determined but consideration may be given to generation optimization algorithms, LMP forecasting engines and other bid formulation features if the selected vendor offers such capability.

There is a need for resources that serve load in the CAISO BA through the EIM to comply with California's greenhouse gas cap and trade regulations. CAISO allows EIM participating resources to include the costs of compliance in an EIM bid adder and incorporates this cost into its dispatch of generation as appropriate. CAISO will not consider this cost when it dispatches this generation that is attributable to serving load outside CAISO, and therefore, greenhouse gas regulation compliance costs will not affect locational prices outside the CAISO balancing authority area. SCL needs to consider all the accounting ramifications that come from greenhouse gas compliance and note that this is an active and ever changing topic at the CAISO that SCL should plug into and monitor.

Submitted bids can be mitigated for local market power reasons. CAISO is authorized to adjust a resource's submitted energy bid downward to the

level of the resource's cost based bid (opportunity cost for hydro), or default energy bid, when the resource has been determined to wield local market power. The local market power mitigation procedure is administrated by an automated process. Local market power mitigation is based on the assessment of the competitiveness of the transmission constraints, which is a calculation done by CAISO, for the on-peak and off-peak hours. Default energy bids may be determined by at least four methodologies. SCL will have discussions with the Market Monitor to discuss how best to determine DEBs for SCL's hydro units.

Another form of energy bid is available in the EIM, and it pertains to available balancing capacity. The EIM entity (or Merchant Operations for SCL generation) may identify Available Balancing Capacity (ABC) that it wishes the EIM to utilize to address any infeasibility in its balancing authority – sort of like an operating reserve.

EIM participating and non-participating resources can provide ABC (upward and/or downward available capacity) to its EIM BA.

An important distinction is that the generation is only utilized in the host BA and cannot be exported by the market. ABC resources are only deployed as a last resort to avoid penalty pricing and allow the market model to come up with a solution that would otherwise not be available to equate supply and demand.

To be able to dispatch any ABC, in the applicable EIM, the market optimization requires the EIM base schedule, and an energy bid curve from the resource identified as having ABC. In order to make the designated ABC participate in the applicable EIM area, there must be an economic bid submitted for that resource for the relevant trading hour. For non-participating resources, the EIM entity will have established default energy bids with the CAISO. In instances where a non-participating resource is deployed for ABC purposes, the generation desk may have to dispatch that resource if the unit does not have an automated capability through SCL's EMS system.

I. OUTAGE MANAGEMENT GAP

System Operations currently uses Peak's COS system to log and manage generation and transmission outages. Planned outages are also tracked via spreadsheet. All other EIM Entities have utilized outage management systems in EIM, except for Puget. It is recommended that SCL contacts Puget to discuss their experience of manually entering outages into the EIM. The CAISO does have a web portal for its Outage Management System (OMS), but it is somewhat cumbersome and operators need to be extremely precise in entering the correct data otherwise the outage will be rejected or not achieve the desired outcome. Part of this has to do with the volume of outage cards being submitted, as it is not only true outages that are being submitted, it is also de-rates that get submitted on outage cards, but more particularly the rules for managing outages, may not match internal processes well or even be intuitive to an operate. As such, the SCL outage management tool should have a programmatic interface for the submission and management of generation and transmission outages. That said, if vendor bids for the outage management system are higher than budget, outage management may be an area where a system replacement could be avoided.

CAISO considers the EIM Entity the single point of contact for outages, so ultimately the responsibility resides with System Operations.

The EIM Entity is responsible for performing engineering studies, modeling, and approving outages on transmission and generation facilities within the EIM Entity Balancing Authority Area. The CAISO does not evaluate or approve any outages submitted by the EIM Entity. That said, many EIM participants have placed the responsibility for determining limits and logging outages and ambient derates on Merchant Operations, with System Operations having final approval for outages.

There is a need to reflect outage information in the CAISO markets as soon as possible in order to allow the EIM to accurately reflect their operations in the market results. Additionally, approved EIM Entity outages must be consistent with the Full Network Model. The timely submission of outages directly impacts the network topology configuration, availability of the electrically connected resources, and/or the MW dispatch range of the available resources. Delays in submission of the forced outage information

may result in inaccurate real-time imbalance calculation for the look–ahead market intervals, and as a result price signals that may not represent the actual system conditions.

At SCL, Merchant Operations will likely manage generation availability limits and these changes will route through the System Operations EIM desk for approval and submission to CAISO – approval will be automated so no additional resource is needed.

System Operations will likely continue to manage true generation outages. The submission of transmission and generation outages need to be routed through System Operations as discussed above. It should be understood managing outages will require considerably more effort and precision than current outage management even for actual generation and transmission true outages, not de-rates.

For generation outages, planned and forced (less than 7 days) outages over 10 MWs must be logged in the outage management system. Additionally, SCL is expected to submit derates for all participating resources.

Inaccurate modeling of generation availability has two consequences. First, if derates are not accurate (e.g. a unit's Pmax is 100 MWs but it is only capable of 95 MWs) it may receive a dispatch with which it cannot comply. In this case, the generator could be charged for not meeting its dispatch target. This is not a major financial impact if the deviations are small. However, eventually, the Department of Market Monitoring will inquire about consistently failing to meet dispatch instructions. Second, the base schedule and bid creation process must use limits which match the availability that has been logged with CAISO or the base schedule or bids may be rejected by CAISO.

For Transmission outages, SCL must submit outages on any modeled equipment that affects system topology. There are two consequences to not accurately managing transmission outages in EIM. The first is that the CAISO State Estimator will be inaccurate. The second related consequence is that the Market solution may see congestion when it does

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not actually exist or not see congestion when there are actually transmission overloads.

All outages are submitted with planned start and end dates/times. CAISO OMS automatically transitions EIM Entity outages to OUT and IN-SERVICE (i.e., actual start and actual end, respectively) when the planned start and end date/time arrives. This means that an outage scheduled to start at 08:00 is assumed to have started at 08:00 unless it is pushed out before that time. In addition, the market optimization is forward looking and will make decisions based on anticipated start and end of outages. For example, the 15-minute market that runs at 07:20 will issue commitment instructions to relieve congestion it anticipates as a result of an outage that is scheduled to start at 08:00. Thus, the importance of accurate outage schedules is greatly increased in EIM. There are a number of rules and complications on the way that CAISO manages outages. For example, once an outage starts, it cannot be canceled; it must be end dated and once an outage ends, it cannot be extended so a new outage would need to be created required. There are numerous rules like this which are significantly different than current processes making the learning process to actively manage outages and availability within an EIM challenging.

AN APPROVED TRANSMISSION OUTAGE MUST SPECIFY THE FOLLOWING:

- **IDENTIFICATION AND LOCATION OF THE TRANSMISSION SYSTEM ELEMENT(S) TO BE MAINTAINED**
- **NATURE OF THE MAINTENANCE TO BE PERFORMED**
- **MODELED SYSTEM OUTAGE BOUNDARIES TO FACILITATE THE EQUIPMENT OUTAGE**
- **DATE AND TIME THE MAINTENANCE OUTAGE IS TO BEGIN**
- **DATE AND TIME THE MAINTENANCE OUTAGE IS TO BE COMPLETED**
- **EMERGENCY RETURN TIME – THE TIME REQUIRED TO TERMINATE THE MAINTENANCE AND RESTORE THE TRANSMISSION SYSTEM TO NORMAL OPERATION, IF NECESSARY**

AN APPROVED GENERATION OUTAGE SUBMISSIONS MUST SPECIFY THE FOLLOWING:

- **GENERATING UNIT OR SYSTEM UNIT NAME AND LOCATION CODE**
- **NATURE OF THE MAINTENANCE TO BE PERFORMED**
- **DATE AND TIME THE OUTAGE IS TO BEGIN**
- **DATE AND TIME THE OUTAGE IS TO BE COMPLETED**

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- **EMERGENCY RETURN TIME – THE TIME REQUIRED TO TERMINATE THE OUTAGE AND RESTORE THE GENERATING UNIT TO NORMAL CAPACITY, IF NECESSARY**

GENERATION START-UP TIME SHOULD NOT BE INCLUDED IN AN OUTAGE, AS IT IS DOCUMENTED IN THE MASTER FILE

It will be important to have SCL's new EIM system pull successfully logged outages from CAISO OMS to support bid and schedule creation. Having these systems obtain derates and outages directly from CAISO is preferred, as this ensures that the valid Market outages are used. The downside of this approach is that the outage may not make it to the market for some reason and then the wrong outage will get pulled back.

It should be recognized that Merchant Operations would have access to certain areas of the new outage management system for submitting derates. Hourly generation min/max capabilities need to be submitted to the CAISO. These can deviate from the Master File values due to planned or forced outages or ambient derates. The personnel formulating and submitting bids in Merchant Operations need to be aware of these limits.

There is a very real compliance risk when the same system is used by the Merchant and the EIM entity. Indeed, some utilities preclude it, because of this risk. SCL audit will want to be informed about which systems have this access and rigorously test for compliance, as the penalties can be steep.

m. GENERATION DISPATCH GAP

Within EIM, the generation dispatch is a function of the Merchant determined Bid Curves and the Market Clearing, so the decision about what units to dispatch in Real-Time is not determined by the System Operations Generation Desk, even if they have the responsibility for managing generation at SCL. The Generation Desk would receive start-up instructions and DOTs, however, it is recommended that DOTs be automatically routed through the EMS and then to the plant DCS. If practicable, it is also recommended the Generating Plant Controllers receive start-up and DOTs for situational awareness purposes.

During Real-Time, up to five hours in advance of the Operating Interval, CAISO will provide advisory and binding unit commitments and advisory Dispatches via their Automated Dispatch System (ADS). Startup

instructions will be advisory until the last interval in which the unit could start based on the Startup Times in the Master File. At SCL this information should be monitored by the generation desk in Real-Time and Merchant Operations real time desk may want visibility for SCL's owned generation units.

The CAISO will issue Fifteen Minute Market (FMM) Awards and 5-Minute dispatch signals for all SCL Participating and Non-Participating Resources via the Automated Dispatch System (ADS). The 15-minute market (FMM) is executed by the Real-Time Pre-Dispatch (RTPD) process and will issue commitment instructions (unit starts, stops and transitions) every fifteen minutes. Each run starts at 37.5 minutes before the start of the interval and publishes within 15 minutes.

The 5-minute market (RTM) is executed by the Real-Time Dispatch (RTD) process and will issue Dispatch Operating Targets (DOTs) every five minutes. Beginning just prior to the Operating Hour and every five minutes through the Operating Hour, the CAISO will provide DOTs for every EIM Registered Resource. Typically, only Participating Resources will receive dispatches other than their Base Schedules. Non-Participating Resources are not optimized by the market and are typically dispatched at their base schedule. However, sometimes they are manually dispatched by the EIM Entity, limited by an outage, or dispatched to deploy Available Balancing Capacity when an infeasibility market condition occurs.

System Ops (EIM desk) will have the opportunity to review these unit commitment instructions and DOTs in the BAAOP and block or modify them for each unit. In this way, the EIM Entity is essentially administering the EIM Market within its BA footprint. Once instructions and DOT are reviewed and any actions are taken, they become binding and are distributed by the CAISO via ADS.

The FMM awards are financially binding but don't require a physical response. The 5-Minute dispatches are issued after the T-7.5 market run with resource ramping ahead of the 5-minute Dispatch Operating Target (DOT) to achieve the DOT at the mid-point of the 5-minute period.

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EIM does not include dispatch of regulation or operating reserves. Therefore, System Operations needs to combine the DOTs provided by ADS with any other deployments which may be needed and create a single set point for each Unit. To manage the volume of set point changes, the set point needs to be provided directly to the Unit for automatic response.

Throughout the Operating Hour, the EIM desk will also be observing which critical transmission elements are binding within the BAAOP. When a SCL transmission element is on the critical list, the EIM desk should review the state-estimated flows which were used to bind that element and ensure they are accurate. Likewise, if flows are approaching limits in real-time, EIM desk should locate the elements in BAAOP to ensure the state-estimated flows are correct in the market. If adjustments are needed, they can be made through the Transmission Conformance process. This is another way in which SCL administers EIM for its BA.

If a generation resource in the SCL BA experiences a forced outage, the outage must be reported to the market as soon as possible. For small losses (e.g., less than 50MW, which is the Peak-reportable threshold), System Operations can let the market rebalance. For larger losses, System Operations will respond by deploying Operating Reserves, as it does today. It may also request reserve deployment from the NWPP Reserve Sharing Group. To prevent the EIM for compensating for lost generation, the EIM desk will need to flag in BAAOP that a contingency is in progress. This action freezes EIM transfers and will conform the load within the BAAOP by the amount of the loss. As reserves are deployed and dynamic reserve sharing adjusted, the EIM desk will adjust load conforming to keep the market aligned.

n. **SITUATIONAL AWARENESS GAP**

Currently, Transmission Operations has a few PI displays for RBC monitoring, load trends, and generation output trends. SCL has no situational awareness capabilities associated with operating in EIM or a Market. Situational Awareness displays are not mandatory for participation in EIM, and some information is provided to the EIM Entity desk through

BAAOP. However, SCL may want to consider adding some PI displays or custom displays such as:

1. Unit Details – A display that shows the current operational parameters (market rated mins, maxes, etc.), loading (energy, A/S), dispatches and operating levels. Integrates operational, economic and actual information in one place with color coding and other logic. Fleet-wide summary and individual unit breakouts should both be considered.
2. Driving Lanes – A display that shows the upper and lower ranges that can be reached from the currently committed resources and integrates updated operational ratings with current operating conditions over time.
3. EIM Enhanced NSI – A display that shows NSI, EIM transfers and EIM-adjusted NSI on a rolling 5-minute basis.
4. Sufficiency Tests – A display that shows pre-submission internal validations of the Sufficiency Tests as well as the actual results from CAISO. This display should be included in the Scheduling and Settlement system.
5. Transfer and Price Bubbles – Show the potential and actual ETSR flow and prices for each Node. This provides a view of how the market is utilizing EIM transfer capabilities in Real-Time.
6. DOT Comparison – Displays unit EIM DOT, EMS Set Point and actual performance over time. Allows real-time awareness and analysis of differential EIM and EMS instructions and unit performance relative to these.

o. SETTLEMENTS AND METER DATA GAP

This section describes the EIM settlements and metering gaps. The key functions are the acquisition, validation and submission of meter data, processing and validation of EIM settlements, calculation of shadow settlements, and invoicing. Not in scope is the allocation of EIM charges to customers.

A major gap is the lack of a settlement or shadow settlement system. As such, it is understood the requirements issued for SCL's new EIM system will include settlement and shadow settlement functionality.

During the Real-Time Market, the CAISO publishes FMM awards, Real-Time dispatches and LMPs for each SCL BA resource and location. While the primary operational destination for this information is not the settlement system, this information is needed for shadow settlement purposes. Several other pieces of data are also available from CAISO (load forecasts and actuals, transmission availability, shadow prices on specific constraints, etc.). This information will likely be useful for analysis and should be retrieved and stored.

Following the operating day, meter data must be compiled, validated and submitted to CAISO for all generation resources and all intertie locations. Load meter data is not required to be explicitly measured but rather can be calculated as generation plus imports less exports.

Also, following the Operating Day, the CAISO will issue a Settlement Statement. The EIM Entity will be settled for imbalance energy and other charges associated with Load, Intertie and non-participating resource deviations from base schedules. Settlement statements are composed of charge codes which are essentially the algebraic equations used to calculate each payment. There are 36 Charge Codes which apply to the EIM Entity. The charge code data ("Billing Determinants") contains a very granular breakdown of all the inputs (e.g. 5-minute DOTs, 5-minute meter data, 5-minute prices) and the equations defining the charge codes can cover several pages. A given operating day can be settled about 10 times over the course of a year when there are changes to one or more inputs. Most companies have a "shadow settlements" function which validates the charges which is a significant new process for SCL. If issues are discovered with the CAISO calculated settlements, disputes may be filed with the CAISO to request an adjustment on a future "resettlement".

Settlement statements are grouped onto invoices for financial reconciliations and payment once a week (in contrast to bilateral settlements which are traditionally done monthly). At some point a handoff

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to the Accounting group will take place. The processing of CAISO Invoices is an Accounting function.

California has Greenhouse Gas (GHG) regulations which may influence the pricing and dispatch of SCL generation resources. SCL will need to account for energy from GHG producing resources which is sold to California.

p. METER DATA SUBMISSION, SETTLEMENT & ALLOCATION PROCESSING

The settlement process with the CAISO requires that SCL submit settlement quality generation meter data for all generation resources, including 3rd party (not applicable at SCL) and non-participating resources. CAISO also requires final tagged energy for all interchange, including any schedule curtailments or dynamic schedules. Additionally, final calculated BA-level load must be submitted to the CAISO. This function is the responsibility of the EIM Entity.

While there are different options for performing these functions, it is likely efficient to use SCL's new EIM system to submit meter data as it should include interfaces for this submission. Additionally, there will be a need for an interface to import all relevant verified, estimated, and edited meter data from the MV90 for shadow settlements. Final schedule data is assumed to be included within the new EIM system via the tag interface used for RTIS calculation. An alternative would be to have Meter data submitted to CAISO and to pull this data back from MRI-M into the new EIM system.

The new EIM system will be configured to automatically retrieve CAISO information required for shadow settlement calculations, including ADS dispatch instructions, LMPs and other data. It will also automatically obtain all settlement statements and invoices from CAISO, and check them against other data to determine if they are correct. Discrepancies would be automatically flagged for analysis and the workflow will support the creation and submission of a dispute to CAISO if any errors are discovered. In addition to the shadow settlements functions, a clean and coherent set of settlement data is required for analysis of strategies and creation of reports (P&L, EQR, etc.).

q. IMBALANCE ENERGY SETTLEMENTS GAP

Generation meter data is collected as necessary for assessing imbalance energy. Some meters will be directly polled by MV90, and other reads will be pulled from the Monarch EMS. Generation data pulled from EMS does will not reach the MV90 system.

SCL will be required to collect settlement quality meter data (SQMD) for each generation resource in the BAA and each intertie location. That data must go through a validation, editing and estimating (VEE) process to ensure that it is settlement quality. At SCL, there will be a need to purchase VEE software. SQMD must be submitted to the CAISO for each generation resource for the Operating Day by 48 business days after the Operating Day for use in the T+55 Settlements calculations. More detail on timelines and submissions is outlined in Attachment C.

Imbalance Energy settlement for participating generation resources are calculated by the CAISO and sent directly to the Participating Resource Scheduling Coordination (PRSC). For non-participating resources and load, charges are assessed on the EIM Entity and ordinarily would be allocated to the appropriate parties.

SCL should consider building in this functionality now as it may be less expensive doing it now compared to doing it in the future as the vendor likely at least has the module.

Load meter data is not required to be aggregated for EIM participation and the EIM Load Aggregation Point (ELAP) load value can be determined by calculating the net of generation, imports, exports and losses. However, the individual load meters will be needed to allocate EIM charges assessed to load imbalance if SCL ever has 3rd customers in its BA.

It is anticipated that the actual imbalance energy settlements from CAISO will be processed in the new EIM system or at least have the functionality should SCL require it in the future.

r. **METERING SOFTWARE GAP**

It is also anticipated that MV90 will become the source system for all meter data so that the VEE process can be performed for all required resources. Otherwise a meter data warehouse will need to be purchased to

accomplish this task. No central data warehouse strategy has been defined for this effort. In the future, SCL may wish to consider a data warehouse that allows aggregation of market, generation, outage and other data for analysis and production of load meter data.

s. METERING GAP

Utilicast's review has concluded that SCL generation will be compliant with CAISO's requirements once SCL's meter upgrade initiative is concluded. Additionally, the review has highlighted some deficiencies with intertie metering that will warrant further discussion with CAISO. Since the outcome of the discussions on intertie metering have the potential to impact load metering compliance, further discussion will be needed on SCL's approach to load submissions. A more detailed discussion on that topic and the metering and communication gaps in general are outlined in Attachment D.

t. MASTER FILE GAP

To participate in EIM, SCL will need to document and submit details on the operating and cost characteristics of each participating and non-participating resource (including PURPA resources contracted to SCL). This will include details on the startup, ramping, min, max, fuel type, GHG properties and many other characteristics as well as O&M cost information for creation of default energy bids (which will be used in the event market power mitigation procedures are triggered or SCL does not receive EIM market based rate authority).

Some important decisions will include whether to model plants as separate units or as an aggregate, and whether there are any "rough" or forbidden operating regions on the hydro resources.

This effort is undertaken by Merchant Operations with input from Generation. A detailed understanding of the Master File components will be needed prior to populating the Resource Data Template (RDT) and that includes how SCL wants resources represented in the market. All of which have a consequence on the Network Model and Metering infrastructure and potentially project timelines so these decisions need to be made early in the project and if flexibility can be preserved at low cost SCL should employ

that strategy. Since meter upgrades and network model changes have a long lead time in the EIM, if plants aren't operating as SCL desire it may take some time to make the appropriate changes not only in the master file but such that the resources can be correctly modeled and settled in the market.

Managing generation outages and availability is an important process in EIM. Generation ambient derates are considered "outages" in the EIM and SCL will need to provide hourly updates to minimum and maximum output capabilities and ramp rates. In most cases, the Merchant Operations team provides these updates for generation resources.

u. **LOAD FORECAST GAP**

An external vendor currently provides an hourly Load Forecast to SCL each business day. It is likely that SCL will want to use the CAISO Load Forecast in EIM, because it prevents the imposition of penalties for poor forecasts. Utilicast recommends using the CAISO load forecast to limit costs and SCL penalty exposure. The CAISO load forecast is typically used by all other EIM participants and is typically highly accurate with the right inputs.

SCL will need to assist CAISO in creating a SCL forecast by supplying historical data and working with CAISO staff to identify Meta data stations in the City of Seattle area. Please note the effort gathering data below.

CAISO forecasts load demand for each hour of the next nine Operating Days utilizing advanced neural-network forecasting software. In order to accurately forecast the load, the software requires historical load profiles and utilizes different weather forecasting data sources such as:

- Defined EIM Entity Balancing Authority Areas to forecast.
- Defined national weather stations within EIM Entity Balancing Authority Areas
- CAISO will contract to receive hourly weather data from weather forecast vendor (s) for stations and historical weather data, to use as an input for EIM load forecast.
- The five-minute average historical load data (at least two years) to train the forecast software.

- PI tags for EIM load data points as input to collect five-minute average data that feeds into software.

Using the above data for input into the neural-network forecasting software, the CAISO can then create and continually monitor its load and weather forecasting results to ensure the average forecast error is minimized.

v. CREDIT AND RISK MANAGEMENT GAP

SCL maintains their list of valid counterparties in SCL's TRM system and maintains credit to support transactions. EQR reporting is performed by the risk management team. SCL will need to post and maintain credit with the CAISO.

EIM Participants must comply with all applicable aspects of CAISO's Credit Management Policy. The requirements are outlined in their Credit Business Practice Manual and are too unwieldy to include in this report. For EIM participants, since virtual bidding, reliability must run contracts, and congestion revenue rights are not applicable to the EIM, these portions of the financial responsibilities of the BPM are not applicable, so ignore them when reviewing the BPM. In short, the CAISO calculates estimated and actual liabilities based on a participant's transactions, settlements and unpaid invoices. SCL will want to monitor its total CAISO liabilities and ensure that sufficient credit is posted.

EIM does not create any requirements to calculate or monitor risk statistics. Participation in EIM has the potential to slightly increase the price volatility faced by SCL for imbalance energy, as the market can solve at very high or low prices in some circumstances. However, SCL exposure to this market is likely to be around a small percentage of average load, which makes the potential impact of the Market small relative to other risks SCL faces e.g. price risk on bilateral transactions, outages etc.

There are no specific EIM requirements for a Risk Management system. However, the NEW EIM System will have tools and a risk module that can be utilized for EIM risk management purposes.

Below in Figure 6 is a comparison of EIM tools and applications used at various utilities either participating or in the process of joining the CAISO EIM.

Utilicast **EMI Application Tools - Comparitive Evaluation - Task 8** V1.0 Rschaal Feb 21, 2017

	PacifiCorp	NV Energy	APS	PSE	Idaho Power	PGE	SCL
Outage Management	Sagali Compass (now MCG)	Sagali Compass (now MCG)	3 systems, GMIS Generation => Sun net (TOA) Trans => PCI for CAISO	CAISO Portal - PSE regrets	Versify - will need to build for Tx	PCI	Manual
Effectiveness	4	4	3	2	8	TBD	TBD
EMS	Monarch OSI	Monarch OSI	Siemens	Alstom	Alstom	Monarch OSI	Monarch OSI
Effectiveness	8	8	5	6	8	TBD	TBD
Merchant Base Schedules & Bids	MCG IAM	PCI	PCI	PCI	OATi	PCI	FIS PowerOps
Effectiveness	6	5	7	6	8	TBD	TBD
BA Interchange	MCG CAS	OATI	PCI	PCI	OATi	OATi	FIS PowerOps
Tagging	MCG CAS	OATI	OATi	PCI	OATi	OATi	FIS PowerOps
Effectiveness	5	5	7	5	8	TBD	TBD
Settlement	Ventyx	Ventyx	PCI	PCI	OATi	PCI/OATi	Manual
Effectiveness	6	6	8	6	8	TBD	TBD
Financial Accounting	EAS	EAS	PCI	SAP	OATi	PeopleSoft	Manual
Effectiveness	6	6	5	6	8	TBD	TBD
Meter Data Warehouse	MV90/?	MV90/?	MV90/PCI	MV90/PCI	MV90, OATi	MDM (in house)	MV90 ver3
Effectiveness	TBD	TBD	7	6	8	TBD	TBD
Situational Awareness	Pi Historian	Pi Historian	PI / PCI Custom displays	Pi Historian / Alstom	Pi Historian / Alstom	Pi Historian	Pi Historian
Effectiveness	5	5	4	6	8	TBD	TBD
VER forecasting	DNV GL	DNV GL	Univ of Arizona	3rd Party	(in house) Weather from Univ of Arizona	Vendor evaluation	TBD
Effectiveness	7	7	6	6	8	TBD	TBD

Effectiveness is a subjective score on how well the Application's works with the EIM (scale of 1-10 with 10 being the best)

Figure 6 – EIM Applications Tools Comparison

w. **TRAINING AND TESTING GAP**

A significant amount of training will be needed to prepare for new processes, software applications, bidding strategies and generator set-up needed etc. for EIM participation. Training may be grouped in the following way:

Firstly, ensuring the SCL resources who will be participating in the requirements and designs for the new systems and processes receive training to prepare for the project. This is more related to understanding the Market and the capabilities of the applications SCL chooses to purchase.

Secondly, SCL resources who will participate in testing will require training to prepare for the testing. The emphasis will be on the processes in their particular area of expertise within the EIM and on the capabilities of any new applications SCL has purchased, as well as on the various interfaces, data exchanges including timing that come with EIM. Additionally, training on the anticipated business processes and on the test approach will be included. This group will likely be part of the EIM project team and will be tasked with Site Acceptance Test (SAT), System Integration Test (SIT) and Functional Integration Test (FIT), User Acceptance Test (UAT) as well as day in the life cycle testing. The focus of SAT is proving that any new of modified applications, custom displays or workflows perform as required in a standalone manner. The focus of SIT and FIT is proving that the interfaces connecting applications work as expected and allow users to perform their jobs using the applications in an integrated manner. The focus of UAT is ensuring that end users who may not have been involved in the project on a day-to-day basis confirm that the integrated systems perform as required.

Testing is a significant effort for a project like joining EIM and is expected to last for several months. One of the most effective ways to learn the market and the capabilities of the new systems is to be involved in testing. While consulting support can help to define the testing strategy, create complex test cases and test data required to flex the systems, as well as share the burden of working through test cases, it is recommended that SCL dedicate resources to the testing effort.

Following SCL testing, there will be a lengthy period of Market Simulation. Market Simulation is joint testing with CAISO to ensure that SCL systems function as expected in an integrated manner with CAISO's systems. There are three phases of Market Simulation: Day-in-the-Life (DIL), Structured Scenarios and Parallel Operations. Each phase is progressively more intense. DIL is mostly about working through a standard Operating Day and ensuring all basic functionality is present. Structured scenarios are about proving that the correct market outcomes are achieved in more complex scenarios, by isolating coordinating the testing of particular aspects of the EIM process as it impacts SCL and to ensure it is impacting other EIM participants correctly. Parallel Operations is about proving that the SCL system can be operated correctly and continuously in EIM while simultaneously executing as a stand-alone BA.

Finally, in the third phase, SCL end users who will participate in EIM on a day-to-day basis and others the company wants to train will receive training to prepare for Go-Live. At this time, the emphasis will be on understanding the Market and the capabilities of the applications SCL chooses to purchase. Additionally, training on the anticipated business processes and on the test approach will be included. Cost estimates for training on the test approach are accounted for in the Testing cost estimates.

It should be recognized even after all the CAISO training is completed operators will not be completely ready for EIM duties. It is highly recommended to have tailored training from a consultancy that can provide experienced EIM trainers who have also been on an EIM desk.

Similarly, SCL should consider requesting generating plant and energy bid cause and effect training from CAISO, so merchant employees are better able to understand the consequences of employing different generating unit configurations or modeling in the market.

x. EIM PROGRAM MANAGEMENT GAP

Joining the EIM will be a major effort on many levels. SCL will need to centrally coordinate, plan and monitor the process and technology implementations described above.

A centralized Program Management function is needed for a coordinated planning and implementation of required EIM processes and systems and to ensure overall readiness.

It is likely that SCL will define eight to fifteen work streams, which will have both resource and milestone interdependencies. For projects of this magnitude, it is useful to partner a strong internal leader / project manager who understands the organization and relationships with a consulting resource who has expertise in project management and has EIM subject matter expertise.

In addition to the program management efforts, a number of agreements and other processes need to be navigated with the CAISO to register as an EIM participant. Additionally, SCL will need to register roles and obtain certificates for interacting with CAISO's systems. Lastly, SCL will be required to apply for Market Based Rates (MBR) as part of its EIM project. This is a study which assesses SCL Market Power within its BAA.

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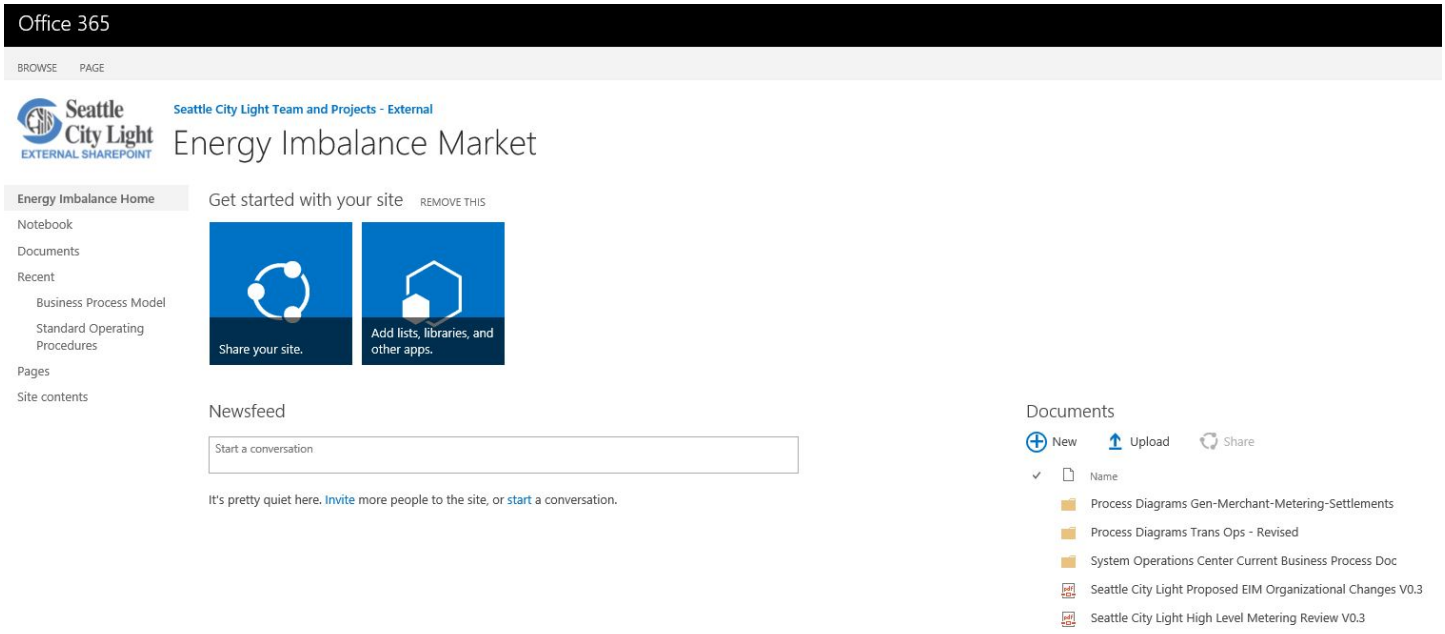
3. PROCESS REVIEW AND FUNCTIONAL REQUIREMENTS ANALYSIS

Utilicast undertook a rigorous review of Seattle City Light's existing processes and identified where those processes would change as a participant in the EIM. In addition, the new processes needed to successfully operate in the EIM were identified and high-level process maps prepared that showed the new EIM processes and the changes to existing processes. Some limitations and unknowns existed when preparing the new processes, process maps and functional requirements. Namely, what systems would be used by SCL and more specifically what functionality would be included in particular systems. This work was uploaded into SCL's SharePoint Drive as seen below.



As seen in Attachment B, a comprehensive set of functional requirements were prepared for SCL. These requirements were grouped by function and mapped to the processes discussed above. The functional requirements spreadsheet also captures all the decision points for SCL and also identifies areas that were considered to be out of scope for SCL and not required for EIMAdditionally, some organizational and other decisions were outstanding at the time this work was prepared. As such, the documents that were prepared are very much living documents and should be updated as the outcome of the decision-making process is known.

4. LIST OF ACRONYMS

Acronym	Definition
AC	Alternating Current
ACE	Area Control Error
ACH	Automated Clearing House
ACR	All Constraints Run
ADNU	Area Delivery Network Upgrade
ADR	Alternative Dispute Resolution
ADS	Automated Dispatch System
AGC	Automatic Generation Control
AIM	Access and Identity Management
ALFS	Automated Load Forecast System
AP	Accounts Payable
APL	Aggregated Pricing Location
APNode/APN	Aggregated Pricing Node
AR	Accounts Receivable
AS	Ancillary Services
ASMP	Ancillary Services Marginal Price
ATC	Available Transfer Capability
AWE Notice	Alert, Warning or Emergency Notice
BA	Business Associate
BAID	Business Associate Identification
BCR	Bid Cost Recovery
BPM	Business Practice Manual
BPM PRR	Business Practice Manual Proposed
BSAP	Balance Schedule Aggregator Portal
C.F.R.	Code of Federal Regulations
CAISO	California Independent System Operator
CBE	Convergence Bidding Entity
CBEA	Convergence Bidding Entity Agreement
CBM	Capacity Benefit Margin
CCR	Competitive Constraint Run
CCVT	Coupling Capacitative Voltage Transformer
CDWR	California Department of Water Resources
CDWR-SWP	California Department of Water Resources,
CEC	California Energy Commission
CIDI	Customer Inquiry, Dispute and Information
CIM	Common Information Model
CIRA	Customer Interface for Resource Adequacy
CMRI	Customer Market Results Interface
CNode	Connectivity Node

COG	Constrained Output Generator
CPA	Competitive Path Assessment
CPM	Capacity Procurement Mechanism
CPS	Control Performance Standards
CPT	Converted Physical Trade
CPUC	California Public Utilities Commission, or its
CRN	Contract Reference Number
CRR	Congestion Revenue Rights
CRRBA	CRR Balancing Account
CSV	“Comma separated value”
CTC	Competition Transition Charge
CVR	Converted Rights
DAM	Day-Ahead Market
DC	Direct Current
DCF	Distribution Compensation Factor
DERA	Distributed Energy Resource Agreement
DERP	Distributed Energy Resource Provider
DGD	Distributed Generation Deliverability
DMM	Department of Market Monitoring
DNP 3	Distributed Network Protocol, Version 3
DOP	Dispatch Operating Point
DOT	Dispatch Operating Target
DP	Deviation Penalty
DRPA	Demand Response Provider Agreement
DSHBAOA	Dynamic Scheduling Host Balancing
E&P	Engineering & Procurement Agreement
EAL	Estimated Aggregate Liability
ECN	Energy Communications Network
EEP	Electrical Emergency Plan
EIR	Eligible Intermittent Resource
ELC Process	Extremely Long-Start Commitment Process
ELSC	Extremely Long-Start Commitment
ELSR	Extremely Long-Start Resource
EMS	Energy Management System
ERA	Energy Resource Area
ESP	Energy Service Provider
ETC	Existing Transmission Contract
ETCC	Existing Transmission Contract Calculator
EZ-Gen	Existing Zone Generation Trading Hub
FERC	Federal Energy Regulatory Commission
FMM	Fifteen Minute Market
FMU	Frequently Mitigated Unit

FNM	Full Network Model
FOR	Forbidden Operating Region
FPA	Federal Power Act
FTP	“file transfer protocol”
GADS	Generating Availability Data System
GDF	Generation Distribution Factor
GIA	Generator Interconnection Agreement
GIDAP	Generator Interconnection and Deliverability
GIP	Generator Interconnection Procedures
GL	General Ledger
GMC	Grid Management Charge
HASP	Hour-Ahead Scheduling Process
HVAC	When used in documents that adopt the definitions in this Appendix A of the ISO
HVTRR	When used in documents that adopt the definitions in this Appendix A of the ISO
HVWAC	High Voltage Wheeling Access Charge
IBAAOA	Interconnected Balancing Authority Area
ICAOA	Interconnected Control Area Operating
ICCP	Inter-Control Center Communication
ID	Identification Code
IFM	Integrated Forward Market
IIE	Instructed Imbalance Energy
IOU	Investor Owned Utility
ISO	Independent System Operator
IST	Inter-SC Trade
ITSS	Interchange Transaction Scheduling System
KW	Kilo Watt
KWh	Kilo Watt Hours
LAC	Local Access Charge
LAP	Load Aggregation Point
LCRIF	Location Constrained Resource
LCRIG	Location Constrained Resource
LDF	Load Distribution Factor
LDNU	Local Delivery Network Upgrade
LFDP	Load Following Deviation Penalty
LGIA	Standard Large Generator Interconnection Agreement or Large Generator
LGIP	Standard Large Generator Interconnection Procedures or Large Generator
LGISPA	Large Generator Interconnection Study
LMP	Locational Marginal Price
LMPM	Local Market Power Mitigation

LOLE	Loss of Load Expectation
LOLP	Loss of Load Probability
LRA	Local Regulatory Authority
LSE	Load Serving Entity
LTRR	Local Transmission Revenue Requirement
LUO	Load Uplift Obligation
LVAC	When used in documents that adopt the definitions in this Appendix A of the ISO
LVTRR	When used in documents that adopt the definitions in this Appendix A of the ISO
LVWAC	Low Voltage Wheeling Access Charge
MCC	Marginal Cost of Congestion
MCDPU	Minimum Curtailable Demand Payment
MCL	Marginal Cost of Losses
MCP	Market Clearing Price
MDEF	Meter Data Exchange Format
MDMA	Meter Data Management Agent
MDT	Minimum Down Time
MEEA	Market Efficiency Enhancement Agreement
MIP	Mixed Integer Programming
MLC	Minimum Load Cost
MLS	Marginal Losses Surplus
MNDC	Maximum Net Dependable Capacity
MOLmax	Maximum Operating Limit
MOLmin	Minimum Operating Limit
MP	Market Participant
MPM	Market Power Mitigation
MPM-RRD	Market Power Mitigation – Reliability
MPT CRR	Multi-Point Congestion Revenue Right
MRI-S	Market Results Interface - Settlements
MRTU	Market Redesign & Technology Upgrade
MRTU IOD	MRTU Initial Operation Date
MSA	Meter Service Agreement
MSA	Meter Service Agreement for CAISO
MSA SC	Meter Service Agreement for Scheduling
MSC	Market Surveillance Committee
MSS	Metered Subsystem
MUT	Minimum Up Time
MW	Mega Watt
MWh	Mega Watt Hours
NA	Network Application
NERC	North American Electric Reliability

NERC GADS	NERC Generating Availability Data System
NGR/	Non-Generator Resources
NOROCAF	Negative Operating Reserve Obligation
NQC	Net Qualifying Capacity
NRC	Nuclear Regulatory Commission
O&M	Operating & Maintenance
OASIS	Open Access Same-Time Information
OBAALSE	Out-of-Balancing Authority Area Load
OCO	Outage Coordination Office
OMAR	Operational Meter Analysis and Reporting
OMS	Outage Management System
OPF	Optimal Power Flow
OTC	Operating Transfer Capability
PBR	Performance-Based Ratemaking
PDR	Proxy Demand Resource
PG&E	Pacific Gas and Electric Company
PGA	Participating Generator Agreement
PHY	Physical Trade
PIR	Participating Intermittent Resource
PIRP	Participating Intermittent Resource Program
PKI	Public Key Infrastructure
PLA	Participating Load Agreement
PMS	Power Management System
Pnode	Pricing Node
PNP	Priority Nomination Process
POD	Point of Delivery
POR	Point of Receipt
PSP	Physical Scheduling Plant
PSS	Power System Stabilizers
PT	Price Taker
PTB	Pass Through Bill
PTDF	Power Transfer Distribution Factor
PTO	Participating TO or Participating
PTP CRR	Point-to-Point Congestion Revenue Right
PURPA	Public Utility Regulatory Policies Act
QF	Qualifying Facility
QF PGA	Qualifying Facility Participating Generator
RA	Resource Adequacy
RAC	Regional Access Charge
RAS	Remedial Action Scheme
RASMP	Regional Ancillary Service Marginal Price

RASSP	Regional Ancillary Service Shadow Price
RDRR	Reliability Demand Response Resource
RIG	Remote Intelligent Gateway
RMDAPS	Revenue Meter Data Acquisition and
RMR	Reliability Must-Run
RMR Charge	Reliability Must-Run Charge
RMR	Reliability Must-Run Contract
RMR	Reliability Must-Run Generation
RMR Unit	Reliability Must-Run Unit
RMT	Reliability Must-Take
RNU	Reliability Network Upgrades
RPTOA	Responsible Participating Transmission
RRD	Reliability Requirement Determination
RT	Real-Time
RTCD	Real-Time Contingency Dispatch
RTD	Real-Time Dispatch
RTDD	Real-Time Disturbance Dispatch
RTED	Real-Time Economic Dispatch
RTM	Real-Time Market
RTM	Real-Time Market Pumping Bid Cost
RTMD	Real-Time Manual Dispatch
RTO	Regional Transmission Organization
RTRR	Regional Transmission Revenue
RUC	Residual Unit Commitment
SaMC	Settlements and Market Clearing
SC	Scheduling Coordinator
SCA	Scheduling Coordinator Agreement
SCADA	Supervisory Control and Data Acquisition
SCE	Southern California Edison Company
SCED	Security Constrained Economic Dispatch
SCID	Scheduling Coordinator ID Code
SCUC	Security Constrained Unit Commitment
SDG&E	San Diego Gas & Electric Company
SE	State Estimator
SFT	Simultaneous Feasibility Test
SIBR	Scheduling Infrastructure and Business
SMDM	Supplemental Market Data Management
SMEC	System Marginal Energy Cost
SMPM	System Market Power Mitigation
SPS	Special Protection Scheme
SQMD	Settlement Quality Meter Data

SQMDS	Settlement Quality Meter Data System
SRE	Standard Ramping Energy
SRS	Secondary Registration System
STUC	Short-Term Unit Commitment
SUC	Start-Up Cost
SUDC	Small Utility Distribution Company
SUDC	Small Utility Distribution Company Operating
TAC	Transmission Access Charge
TAC Area	Transmission Access Charge Area
TCA	Transmission Control Agreement
TCP/IP)	Transmission Control Protocol/Internet
TEA	Transmission Exchange Agreement
TO	Transmission Owner
TOC	Transmission Operations Center
TOR	Transmission Ownership Right
TOU	Time of Use
TPD	Transmission Plan Deliverability
TR	Transmission Rights
TRBA	Transmission Revenue Balancing Account
TRM	Transmission Reliability Margin
TRR	Transmission Revenue Requirement
TRTC	Transmission Rights and Transmission
TTC	Total Transfer Capability
UDC	Utility Distribution Company
UDCOA	Utility Distribution Company Operating
UDP	Uninstructed Deviation Penalty
UFE	Unaccounted For Energy
UIE	Uninstructed Imbalance Energy
VAN	Value Added Network
VEE	Validation, Estimation and Editing
VSTLP	Very Short-Term Load Predictor
VT	Voltage Transformer
WAC	Wheeling Access Charge
WECC	Western Electricity Coordinating Council
WSCC	Western System Coordinating Council

5. ATTACHMENT A – PROJECT CHARTER

6. ATTACHMENT B – FUNCTIONAL REQUIREMENTS (DETAILED WORK SHEET)

7. ATTACHMENT C – RECOMMENDED ORGANIZATIONAL STRUCTURE

8. ATTACHMENT D – SUMMARY OF CHANGES TO METERING AND COMMUNICATIONS