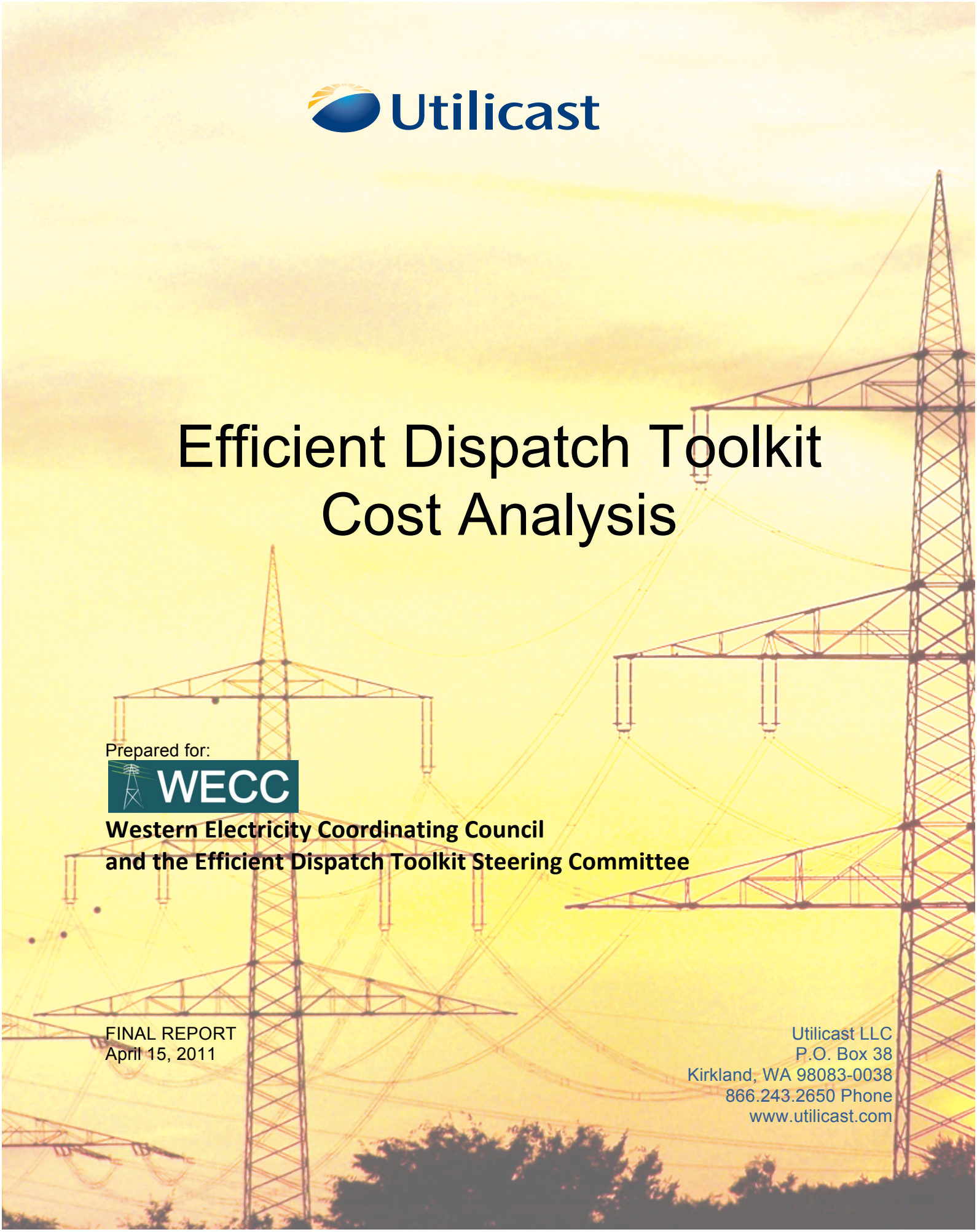

Efficient Dispatch Toolkit Cost Analysis

Prepared for:

Western Electricity Coordinating Council
and the Efficient Dispatch Toolkit Steering Committee

FINAL REPORT
April 15, 2011

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Abbreviations

AC2	PJM's Advance Control Center
AGC	Automated Generation Control
BA	Balancing Authority
BPA	Bonneville Power Administration
CAISO	California Independent System Operator
CIP	Critical Infrastructure Protection
CRM	Customer Relationship Management
DTS	Dispatcher Training Simulator
ECC	Enhanced Curtailment Calculator
EDT	Efficient Dispatch Toolkit
EDTTRS	EDT Technical Review Subcommittee
EIA	Enterprise Interface Application
EIM	Energy Imbalance Market
EIS	SPP's Energy Imbalance Service market
EMS	Energy Management System
ERCOT	Electricity Reliability Council of Texas
FERC	Federal Energy Regulatory Commission
FTE	Full Time Equivalent
GOP	Generator Operator
ICCP	Inter- Control Center Protocol
ITS	Imputed Transmission Service
LSE	Load-Serving Entity
MISO	Midwest ISO
MO	Market Operator
MP	Market Participant
NERC	North America Electricity Reliability Corporation
NSI	Net Scheduled Interchange
NYISO	New York ISO
RC	Reliability Coordinator
SCADA	Supervisory Control and Data Acquisition
SIBR	CAISO's Scheduling Infrastructure and Business Rules
SCED	Security Constrained Economic Dispatch
SME	Subject Mater Expert
SPP	Southwest Power Pool
TDF	Transfer Distribution Factors
TSP	Transmission Service Provider
WECC	Western Electricity Coordinating Council

1. Executive Summary

Utilicast was asked to assess the costs associated with deploying the Efficient Dispatch Toolkit (EDT) across two candidate footprints within the Western Interconnection. There were two primary cost areas considered in the assessment: 1) Market Operator and 2) Market Participant. Pre-defined cost categories were provided to Utilicast for each of these cost areas.

The cost assessment has a large amount of uncertainty given four major unknowns:

1. Market Operator Identity - Since the target Market Operator is not known, the cost assessment assumed that either a new or existing organization would provide the EDT and supporting capabilities.
2. Implementation Efficiency – Since the Market Operator is unknown, it is difficult to assess the experience of the team that would implement the EDT. It is also difficult to assess the schedule and urgency associated with the implementation.
3. Market Size - Since the target footprint is not known, a scaling factor was introduced to account for costs associated with variable footprint sizes.
4. Participation - Since the overall market participation is unknown and many costs are optional, the Market Participant costs focused on asset owning entities. A similar approach was utilized in recent cost assessments at Southwest Power Pool (SPP).

Each cost category was assessed independently. The highest and lowest cost scenarios were identified for each cost category using permutations of the four unknown areas above.

The prescribed approach yielded results that have greater uncertainty than other cost assessments. Attributes of the results include:

- Sum of High Costs may result in an artificially high number (it is a sum of independent highest cost scenarios that may or may not be applicable to a given entity)
- Likewise, the sum of the Low Costs may result in an artificially low number.
- Cost assessment does not capture all market participation costs.

Utilicast recommends further refinement of the cost assessment where assumptions are provided for each major unknown. The result of the refinement would be costs with tighter uncertainty bands for each specified scenario.

1.1 Market Operator Costs

1.1.1 Operating Costs

A dominant component of the cost assessment is the annual operating costs of the Market Operator. The operating costs for the Market Operator ranged from an incremental cost of $33.9M to an existing entity to $128.9M to a new entity.

The diagram at the right shows the annual operating costs from the cost assessment side-by-side with the operating costs of the domestic Market Operators. When assessing the

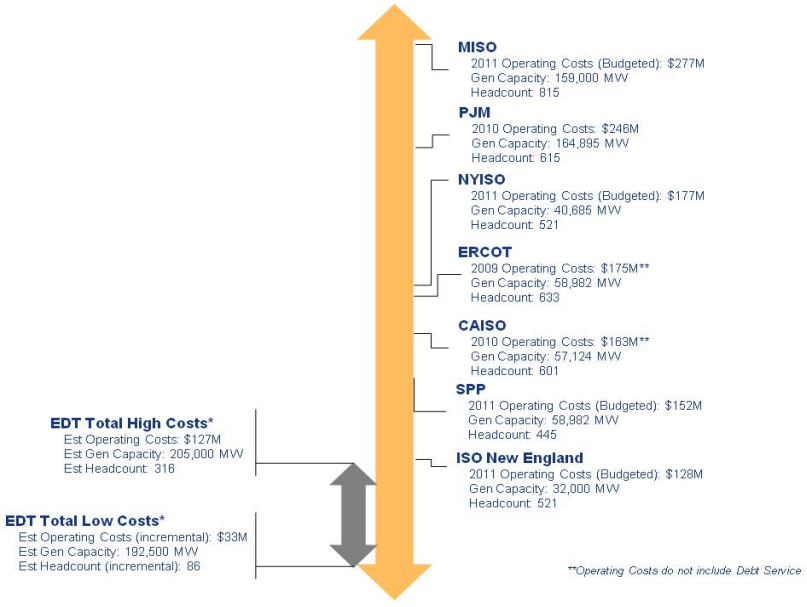


Figure 1 – Market Operator Costs

operating cost of each Market Operator, it is important to note the size as well as the functions of the market they manage. Appendix C.1 provides an overview of the market functions for each Market Operator.

While these Market Operators provide services beyond the current EDT scope, the diagram provides a good reasonableness check to the overall study.

1.1.2 Start-Up Costs

Due to the uncertainties associated with an unknown Market Operator, the range of start-up costs required to implement EDT is wide. Identifying or further defining the capabilities of the Market Operator would result in a tighter confidence band of these costs.

The start-up costs of the Market Operator ranged from $25.6M to $220.2M.

1.2 Market Participant Costs

Market Participants are difficult to assess given the mix of Market Participant segments, the number of optional capabilities and the unknown level of participation.

Utilicast applied best practices and practicability of approaches conducted for recent cost studies at SPP and ERCOT. As such, Utilicast followed an approach that focused on the aggregate costs associated with Balancing Authorities in determining a total Market Participant cost. This cost was presented for two footprint scenarios: a footprint excluding CAISO and Alberta (Footprint 1) and a footprint excluding CAISO, Alberta, British Columbia, BPA, WAPA and embedded Northwest BAs (Footprint 2).

The total start-up costs for Market Participants in Footprint 1 ranged from $41.31M to $120.02M and $25.52M to $74.13M for Footprint 2.The total operating costs for Market Participants in Footprint 1 ranged from $46.46M to $131.51M and from $28.70M to $81.23M for Footprint 2.

Market Participants costs will be different for each type of participant and must be considered separately for Transmission Providers, Balancing Authorities (BAs), Generator Operators and Load-Serving Entities. However, publically available data on Market Participant costs is not widely available. To better reflect the variation in costs for each business type, graphs were created illustrating the potential cost to an entity within the confidence band.

Breakdown of Market Operator Start-Up Costs

Start-up costs were calculated to cover software, hardware, infrastructure, staff, and overhead.

Software comprised the largest start-up expense for the Market Operator. This would likely remain true regardless of whether the Market Operator is a new or existing entity.

On average, infrastructure costs were the second highest start-up expense. If the Market Operator is an existing entity and does not require the construction of a control room, the infrastructure expense would be greatly reduced and would make up a smaller percentage of total cost.

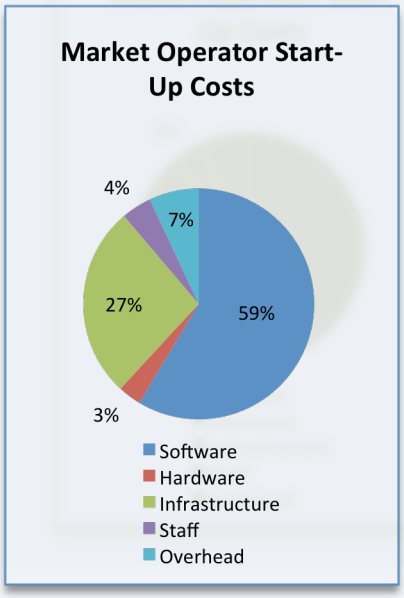


Figure 2 – Market Operator Start-Up Costs

The accuracy of the Market Participant Costs could be improved through the implementation of a survey. A cost survey would involve having each WECC Market Participant provide its own cost assessment. Each completed survey would be summarized to provide an overall estimate. A survey was not employed for this cost assessment given cost and schedule constraints.

1.3 Other Considerations

In addition to providing costing information, Utilicast was asked to provide additional information that could impact costs:

1. Implementation Timeline – Utilicast estimated that the implementation timeline would be 3.5 to 5 years. The estimate was based on similar initiatives. Factors that could impact the timeline and result in additional costs are included in this report.
2. Market Participant Anecdotes – Utilicast spoke with several SPP Market Participants to obtain qualitative information regarding their experiences with the current market solution. Market Participants also commented on the accuracy of the cost analysis that was conducted for the SPP market.
3. Cost Contouring – In an effort to reduce some uncertainty in the results, Utilicast provided contours to indicate where costs are most likely to fall within each range. The cost contours were generated by a survey administered to three Utilicast Subject Matter Experts. These contours are for illustrative purposes only and should not be used for any follow-up quantitative analysis.
4. Cost Overrun Drivers – The report presents the leading causes for cost overruns on projects similar in scope to EDT. Mitigation options were also presented.

2. Background

At its April 2010 meeting, the WECC Board of Directors (Board) approved a proposal for a Cost-Benefit Analysis of the Efficient Dispatch Toolkit (EDT), subject to final approval of the 2011 Business Plan and Budget. The 2011 Business Plan and Budget received final approval from FERC in October 2011. While there are many factors that must be considered in future decisions beyond the monetary costs and benefits, this study was commissioned to provide the Board and the WECC Membership with credible data to support informed decision-making.

The first part of WECC's Cost-Benefit Analysis was a study of the benefits associated with the proposed EDT. This analysis was performed by Energy and Environmental Economics (E3), Inc. and is excluded from this Cost Analysis.

At the beginning of January 2011, Utilicast was appointed by WECC to identify the costs associated with the proposed EDT and complete the second part of WECC's Cost-Benefit Analysis.

Utilicast was asked to identify all quantifiable costs as either start-up costs (capital and pre-operational costs), ongoing costs (operational costs), or both. Due to several unknowns that largely influence the costs, estimates were to be presented as a range. Furthermore, costs were to be broken down into Market Operator costs and Market Participant costs.

The analysis was to remain neutral on candidate Market Operator organizations and whether the Market Operator should be a new or existing entity. In order to remain neutral on the Market Operator, the Cost Analysis was designed to exclude costs associated with any specific candidate Market Operator organizations.

The Market Participant costs in this analysis focus on the cost to Balancing Authorities. The Cost Analysis also excludes segmentation and costing of different Market Participant entities. Additional information on approach for estimating Market Participant costs can be found in the Market Participant section of this analysis.

3. Methodology

Utilicast carried out the cost analysis in the phases show in the figure below.

Figure 3 – Cost Analysis Process

Finalizing Costing Areas

WECC and the EDT Technical Review Subcommittee (EDTTRS) provided Utilicast with "Attachment 1 – Discussion Paper – Cost Analysis". This document described the cost components anticipated in the implementation of the proposed Efficiency Dispatch Toolkit (EDT). Descriptions of each of the cost areas were provided as a high-level depiction of what should be included in the cost analysis.

In the first phase of the cost analysis, Utilicast utilized its experience and expertise to add to and supplement the categories provided by WECC and the EDTTRS. These findings were reviewed with WECC and the EDTTRS then published on WECC's webpage upon approval.

Collect Data

In collecting data for the Cost Analysis, Utilicast relied primarily on data from publically available sources. This included annual financial reports from other Market Operators, minutes from board meetings, presentations, white papers, government reports and FERC filings. In areas where data was incomplete or inadequate, Utilicast referred to third parties such as vendors, consultants and other industry experts.

Utilicast developed a set of assumptions for each cost category to establish the difference between the high costs and the low costs. High costs were defined as the maximum amount associated with the specified function to implement the EDT market; whereas the low costs were the minimum amount. Neither the high nor the low costs were intended to represent a specific entity.

Utilicast divided the data further into capital costs, pre-operational costs, and operational costs.

- Capital Costs - Expenditures required to obtain the assets needed to implement and run the market. Examples included software, hardware, facilities, and equipment.
- Pre-Operational Costs - The ongoing expenses required to run the project before the market goes live. These costs were not expected to be capitalized. Examples include labor, rent, utilities, supplies, travel and meetings prior to the market going live.
- Operational Costs - The ongoing annual costs required to operate the organization after the market has gone live. Examples included labor, rent, supplies, software licenses and hardware maintenance.

Normalize Data

The data was normalized to represent the high and low costs anticipated in implementing the EDT. To accomplish this, Utilicast assessed the consistency and applicability of the source data. Preference was given to data that most closely aligned to the proposed EDT market design. In instances where the available data was for more complex market models, the data was scaled. Utilicast relied on its experience in other market implementations in determining the ratios to apply in scaling the data.

Since the data and costs were collected using a bottom up approach, Utilicast conducted a final review of the costs to ensure reasonability and consistency with other market implementations.

Summarize, Refine and Present Findings

Utilicast delivered its summary findings to WECC and presented to the EDTTRS on March 10, 2011. As a result of that meeting and a follow up meeting on March 24, 2011, Utilicast refined its data and clarified the following:

- High costs were defined as the maximum amount associated with the specified function to implement the EDT market; whereas the low costs were the minimum amount. Neither the high nor the low costs were intended to represent a specific entity.
- The sum of the high costs may result in an artificially high cost. Likewise, the sum of the low costs may result in an artificially low cost.
- Utilicast provided contour charts to illustrate likely cost bands for a new entity and an existing entity. In the example contour below, the new entity is likely to incur costs on the higher end of the range, whereas an existing entity's costs are anticipated to remain lower. The darker gradient represents a higher level of confidence in the cost to an entity.

Figure 4 – High vs. Low Cost Example

- Whether the Market Operator is an existing entity or a new entity, determining the costs to that entity requires consideration of the different set of capabilities and facilities that could be leveraged to run EDT. With that said, the cost to an existing entity is expected to be unique and different from other existing entities.
- In determining the total Market Participant cost, Utilicast heeded guidance from the EDTTRS and followed the approach applied in SPP's EIS Cost Benefit Analysis. This resulted in an aggregated Market Participant cost based on the BAs in the market. Utilicast provided costs for two footprint scenarios, as defined by E3 in their Benefits Study.
- The Market Participant costs identified in this Cost Analysis should not be used for budgetary purposes. Rather, Market Participants should use the cost assumptions and data as a guide in determining the individual costs to their organization.

Final finding were presented at the April 7, 2011 WECC Stakeholder meeting and are captured within this Cost Analysis.

4. Market Operator Costs

This section addresses the monetary costs that the Market Operator would incur if EDT is implemented. Although there has been some discussion over which entity would be the Market Operator, the analysis remained neutral on the subject. While WECC is providing the forum for this analysis, WECC itself is only one of several options for a Market Operator. Nonetheless, recognizing inherent uncertainties and design variables, costs were represented as a range and, in certain cases, varied between an existing entity and an entirely new entity.

4.1 Software

The largest upfront costs associated with the creation of a Market Operator are associated with software. Since the creation of Market Operators in the early 1990's, the industry has seen a large standard deviation associated with these initial costs.

4.1.1 General Assumptions

The software costs encompass the following phases of a software implementation: requirements, evaluation and selection, design, build and test, market trials or simulation, production deployment, maintenance and upgrades, and licenses and fees.

The software was assessed in twelve Cost Categories. For each category, high and low cost estimates were provided. As discussed in the Methodology section, these high and low costs do not align to a specific scenario or target Market Operator. Each category was assessed independently yielding totals that define aggregate high and low confidence bands.

Utilicast benefited from a large source of publically available information from other U.S. Market Operator initiatives. Cost data from other real-time market implementations along with cost estimates provided by software vendors were weighted above other sources.

Operational costs in this category are based on software maintenance and licensing costs, and were approximated using simple ratios. These ratios were based on the complexity of the software and were derived from multiple sources.

4.1.2 Cost Categories

Security Constrained Economic Dispatch (SCED)

The Security Constrained Economic Dispatch (SCED) is the brain behind the market operation. The SCED software is used to calculate the dispatch and price signals.

The objective of the SCED is to determine the most economical dispatch of individual resources across the grid. The EDT employs SCED to "balance" the system. The Market Operator will run the SCED every five minutes using offers by individual resources and deliverability information from the Energy Management System (EMS).

Another important function of the SCED is the calculation of locational energy prices across the market footprint. These prices provide real-time incentives to resources to provide energy in specific locations.

Differences in costs are less related to market size then they are to relative complexity of the solution. Customization to the SCED engine is very expensive as this is very complicated software. Each change has impacts on many different function points and requires extensive regression testing to ensure the software is deriving the least cost solution.

In establishing the high cost, Utilicast assumed the Market Operator would implement a SCED with customized design elements that were moderately to significantly different from what has been implemented in other markets. A "risk adder" was also included in the cost of the software to account for poor scope governance and multiple change requests.

Conversely to the high assumptions, costs could be minimized by using software that is preexisting with very little modification. The low cost was assumed to be the cost to transform WECC's existing EMS into SPP's existing EIS solution. This included required EMS upgrades, software and market components.

Utilicast calculated the high capital cost by scaling the cost of SCED implementations at ERCOT, PJM, CAISO and SPP to the expected market complexity of EDT. Utilicast also consulted with SMEs and a software vendor to verify its estimates.

Due to the complexity of the system and licensing requirements, Utilicast assumed the operational costs to maintain the SCED software would be 15% of the capital cost.

The start-up cost range for SCED was $4.9M to $20.8M. The operational cost range for SCED was $1.9M to $3.1M and was directly proportional to the capital costs.

Energy Management System (EMS)

Similar to SCED, the Energy Management System (EMS) is analytical software that is a major component in the overall software cost. The objective of an EMS is to monitor the state of the power grid. The Market Operator will need an EMS to provide security analysis, constraint logging, system topology, short-term load forecasts, generator response, alarms and other data required to price and operate the market.

EMS costing also includes supporting systems such as Supervisory Control and Data Acquisition (SCADA), Dispatcher Training Simulator (DTS) and a Data Historian.

Through SCADA software, Balancing Authorities (BAs) and other Market Participants supply telemetered data to the EMS and, in return, receive data and control signals from the EMS. The Market Operator SCADA system allows the Market Operator to communicate directly with Balancing Authorities and other members. A data concentrator (e.g. Remote Terminal Unit) is located at the Market Participant's site, and, after collecting data from the industrial metering equipment, communicates with the Market Operator's SCADA system using (Inter- Control Center Protocol (ICCP). The system allows real-time bi-directional transfer of data into the system database for storage and real-time transfer to the EMS system.

Another component of the EMS is the Dispatcher Training Simulator (DTS) system. The DTS is a replica of the SCADA system in a test environment that is used to train Market Operators.

The last primary component of an EMS is a Data Historian. A Data Historian System serves as a data archive for operational data. It provides visualization tools for presenting data to operators and provides a permanent archive of data for post-event study and analysis.

The EMS and its supporting systems must be highly available. A remote backup of the EMS is required to support business continuity in the event that the primary site becomes unavailable. In the event that the Market Operator's primary control room is unavailable, the back-up system can assume all EMS functions.

The high cost range was derived by making an assumption that the EDT would require a new EMS. This would be applicable to a new entity or the utilization of an existing entity's EMS that does not currently have visibility into the Western Interconnect (i.e. MISO, SPP). Without visibility into the Western Interconnection, an existing entity would likely require a new EMS and/or significant modeling considerations to support the EIM market. As with the SCED software, a "risk adder" was included in the cost of the software to account for poor scope governance and multiple change requests.

EMS costs could be substantially reduced through the utilization of an existing EMS, upgraded to meet EIM requirements. The lowest implementation costs could be realized by the use a third party EMS that already has visibility into the Western Interconnection (i.e. WECC, CAISO, BPA) and making only market related changes.

Utilicast calculated the high capital cost by scaling the cost of the nodal implementation at ERCOT to the expected market complexity of EDT. Utilicast also consulted with SMEs and a software vendor to determine its low capital costs and verify its estimates. In both cases, hardware required to the support EMS were included in the EMS cost category.

Due to the complexity of the system and licensing requirements, Utilicast assumed the operational costs to maintain the EMS software would be 15% of the capital cost.

The start-up cost range for EMS was $1.0M to $36.0M. The operational cost range for EMS was $0.1M to $5.4M and was directly proportional to the capital costs.

Settlements

Another significant software cost component is the settlements software. The settlement process calculates the quantity of energy imbalance for each asset, the invoice dollars for energy imbalances, and allocates over- and under-collection of revenues to Market Participants. Settlement statements are produced and published for each operating day. The Market Operator must remain revenue neutral.

The settlements process is run after-the-fact and utilizes a large quantity of data such as dispatch signals, prices, metered quantities and determinants identified in the market design. It will allocate settlement responsibilities (debits and credits) among the market participants, estimate credit exposure, and maintain records of corrections and true-ups. The settlement software would need to be able to produce and retain standard financial, audit-quality records.

In addition to the core Settlement software, two additional software systems were included in this category: Dispute Management and Invoicing. Dispute Management is a work management tool that facilitates the creation, assignment and completion of Market Participant disputes. Invoicing software is used to track balances and trigger payments between the Market Operator and the Market Participants.

Developing systems to implement tariffs can be very challenging. Often settlement language and requirements are developed by tariff experts without the help of system architects. In addition, the level of automation in the final settlement process can impact costs substantially.

Cost drivers for settlement systems are centered around a number of factors including:

- Customized design elements – More customized design elements typically result in higher implementation costs related to the design, build, and testing of the software.
- Poor scope governance – Scope changes on a settlement system are particularly expensive due to the performance requirements and regression testing needed with each change.

- Requirements different from what was implemented in other markets – Many risks and issues are addressed during the testing phases of the project implementation. However, there may be unintended consequences as a result of implementing settlement calculations that have not been tested elsewhere. These issues are realized after the market has launched and typically result in higher operating costs, especially as it pertains to uplift calculations.

Utilizing a system that has been implemented in other markets would likely lead to the lowest implementation cost for a settlements system. The low cost estimate assumes the requirements and charge codes do not differ significantly and there are very few modifications or customizations made to the product.

Utilicast calculated the capital cost by scaling the cost of settlements systems implemented at ERCOT and CAISO to the expected market complexity of EDT. Utilicast also consulted with SMEs and a software vendor to verify its estimates.

Due to the complexity of the system and licensing requirements, Utilicast assumed the operational costs to maintain the settlements software would be 15% of the capital cost.

The start-up cost range for Settlements was $4.6M to $15.0M. The operational cost range for Settlements was $0.5M to $2.3M and was directly proportional to the capital costs.

Customer Relationship Management (CRM)

The Market Operator will need to manage Market Participant registration data as well as non-settlement inquiries and issues associated with the EDT. CRM software is a customer service tool used to manage participant data and interactions, including technical support.

“Out of the box” CRM software can be procured from multiple vendors. However, CRM systems often require customization, system integration and process alignment in order to be effective.

The high range of CRM costs would be realized by standing up a CRM application from scratch. In this case, costs would include the procurement of the software product, licensing and customizations. Estimates for CRM implementation costs were based on publically available data.

The low range is assumed to be achieved through an existing entity with well-defined and effective CRM application or tools and customer service procedures. Costs associated with this scenario were assumed to be the labor required to implement new workflows based on the new market and Market Participants.

Utilicast assumed the operational costs to maintain the CRM software would be 10% of the capital cost.

The start-up cost range for CRM was $0.1M to $2.0M. The operational cost range for CRM was $0.0M to $0.2M and was directly proportional to the capital costs.

User Interface

In order for Market Participants to send and receive data (such as offers, meter data and settlement statements), a secure electronic user interface also must be developed. Due to the sensitivity of the commercial and reliability data involved, this interface likely will need a secure connection with digital certificates, firewalls, router filter and other similar security measures.

The User Interface for bid/offer submissions and market information should be made such that Market Participants, regardless of their size and ability to procure software, can participate in the EIM. As in other markets, the User Interface is assumed to be accessible via a portal acting as an interface to internal market applications and providing data to the Participant.

The implementation of User Interfaces in other markets has varied significantly in terms of cost and complexity. As a part of MRTU, CAISO rolled out the Scheduling Infrastructure Business Rules (SIBR) system. This system allows Market Participants to submit bids and offers directly into the system or using an XML upload feature. Upon submission of a bid or offer, the SIBR system processes a series of business rules and provides feedback to the Participant regarding the validity and usability of their bid by the market systems. CAISO created the SIBR system such that each of the rules used to validate the bids and offers is configurable and can be modified should the market rules change. Systems such as this can be very expensive to implement, but should allow for lower cost modifications in the future.

Utilicast scaled the implementation of User Interfaces at CAISO and ERCOT to determine the high cost estimate for the EDT Market Operator. This cost could be incurred by either a new entity or an existing entity dependent upon the capabilities and requirements.

Low costs were assumed to be achievable in the utilization of an existing entity's User Interface system(s). Utilicast assumed there would be minor modifications to the User Interface as a result of implementing EDT.

Utilicast assumed the operational costs to maintain the User Interface application(s) would be 10% of the capital cost.

The start-up cost range for User Interfaces was $0.5M to $4.8M. The operational cost range for User Interfaces was $0.1M to $0.5M and was directly proportional to the capital costs.

Interface with Existing Data/Software

Software will need to interface with current existing systems, tools and data. In addition, the Market Operator's software will need to interface with Market Participant's EMS software to distribute dispatch signals.

Implementation of interfaces can include a high degree of complexities in data flow and management. ERCOT, with the nodal market, and PJM, with the AC2 project, implemented new Enterprise Interface Application (EIA) systems. EIA systems can be very expensive to implement properly, but are expected to allow for lower cost modifications.

Costs can be further inflated with the introduction of a centralized repository of operating parameters that participants may regularly update and internal applications access for data. CAISO, with the Master File, and ERCOT, with Network Model Management System (NMMS), incurred significant integration and testing cost as a result of these applications.

High costs were established assuming the use of EIA, complex web layers and custom applications. Utilicast scaled the integration costs of CAISO and ERCOT to the expected interface requirements of EDT implementation to determine a high cost estimate. The number of interfaces necessary to implement EDT were estimated based on SPP's EIS interface requirements.

The low cost range can be realized through an existing Market Operator with adaptable interfaces and/or the use of point-to-point interfaces. The low cost was created assuming five consultants would develop the interfaces at $150 per hour for a period of two years. This was approximately 17% of the total low capital cost. In verifying this cost, Utilicast found that interface development was typically 10-20% of a project's total cost.

Utilicast assumed the operational costs to maintain the interfaces would be 5% of the capital cost.

The start-up cost range for Interfaces with Existing Data/Software was $3.1M to $32.0M. The operational cost range for Interfaces with Existing Data/Software was $0.1M to $1.6M and was directly proportional to the capital costs.

Enhanced Curtailment Calculator (ECC)

The proposed Enhanced Curtailment Calculator (ECC) is a tool used for calculating curtailment responsibilities. Currently, curtailments on the six Qualified Paths in WECC must follow the Unscheduled Flow Mitigation Plan (UFMP). There is an existing curtailment calculator that many WECC members use to meet the requirements of the UFMP. To properly account for settlements in the EDT, certain enhancements must be made to the current curtailment calculator. In addition, the Unscheduled Flow Administrative Subcommittee (UFAS), which is responsible for updating the UFMP, is considering making enhancements to the current curtailment calculator. Enhancements that are not currently scheduled for implementation, but that are not necessary for the EDT, were not included in this cost analysis.

The following are enhancements to the ECC that were identified as being necessary for the EDT:

Source/sink rather than zonal representation

In the current implementation of the curtailment calculator, Transfer Distribution Factors (TDFs) are calculated only between defined zones, rather than from specific source to specific sink. In some cases, the zones are quite large and this type of approximation would not provide the granularity necessary for the EDT to function properly. The Enhanced Curtailment Calculator (ECC) must include the capability to allow for TDFs to be calculated from source to sink. This enhancement is not scheduled for implementation.

Due to the voluntary nature of the EIM portion of the EDT, there has been discussion over whether this level of granularity is necessary in any non-market areas of the footprint. However, in terms of the Cost-Benefit Analysis, the majority of the cost will be driven by the capability alone, and is not expected to vary significantly based on the footprint. Therefore, even if the capability is not used in the non-market area, the cost was assumed to be the same.

Real-time model updates

In the current implementation of the curtailment calculator, TDFs are only calculated twice a year. When real-time transmission outages occur, the impact on TDFs is not captured by the current curtailment calculator. For the EDT to function properly, the ECC must include the capability for the TDFs to be updated on a closer-to-real-time basis.

Recognition of untagged flows

In the current implementation of the curtailment calculator, only tagged flow is considered. In most cases, this means that flow within a Balancing Authority will not be included. Since this

untagged flow constitutes a large portion of flow on the system, it will need to be considered in the ECC for the EDT to function properly.

Expansion to all relevant paths

In the current implementation of the curtailment calculator, only the six Qualified Paths are included. Curtailments on other paths are managed by the Transmission Operators at their discretion. However, for the EDT to function properly, information about curtailments must be fed into the EIM from the curtailment calculator. Therefore, the ECC must be expanded beyond the Qualified Paths.

There have been discussions regarding whether the expansion is necessary for all paths in WECC, for all Rated Paths in WECC, or for some other subset of paths in WECC. For the purposes of the Cost-Benefit Analysis, the majority of the cost will be driven by the capability alone, and the cost was assumed to not vary significantly based on the extent of the expansion.

Communication to EIM

The purpose of the above-listed enhancements is to enable the EIM to properly account for curtailments by identifying them as constraints in the dispatch engine. These enhancements will yield a more reliable and efficient market. Therefore, the ECC must be able to communicate with the EIM.

The low end of the range was intended to represent the cost of enhancements that are necessary for the EDT but that are currently not scheduled for implementation by UFAS. The high end of the range was intended to represent the cost of all enhancements necessary for the EDT, regardless of whether the UFAS was contemplating them. When analyzing the costs to the ECC, there were no enhancements identified as necessary for the EDT that UFAS was contemplating.

The capital and operating cost range for enhancements to the ECC was based on technical expertise and consultation with a software vendor.

The start-up cost range for ECC was $0.3M to $0.4M. The operational cost range for ECC was $0.1M to $0.2M.

Corporate Applications

The Market Operator will need corporate software applications such as financial management software, human resource applications, payroll services, legal applications (such as e-Tariff filing tools), and document management software. While these systems do not directly integrate with the market systems, they are necessary to support any organization as the Market Operator.

The high range assumed a new entity would need to procure and implement all corporate applications from scratch. The new Market Operator would need to implement a corporate webpage, electronic tariff filing, document management software, and financial systems.

The low range assumed that corporate applications from an existing entity would be utilized with only minor modifications to the existing systems.

Public sources of company start-up costs were utilized in determining an estimate for corporate applications and verified by third party vendors where possible.

Utilicast assumed that the operational costs to maintain corporate applications would be 10% of the capital cost.

The start-up cost range for Corporate Applications was $0.1M to $2.5M. The operational cost range for Corporate Applications was $0.0M to $0.3M and was directly proportional to the capital costs.

Additional Tools, Spreadsheets & Work Aids

The Market Operator will likely need additional tools, spreadsheets and/or work aids to complete the functions of the EDT. These may be used as a stopgap measure until the planned software can be enhanced or acquired or the tools, spreadsheets or work aids may be used as a permanent solution to complete the EDT job functions.

Tools in this section have been overlooked by a number of market implementations. Generally organizations believe that between the EMS and SCED software that all problems are solved. Unfortunately, the bulk electric grid can be unpredictable, and it is important, especially on new implementations, to have manual backup to each and every process. Spreadsheets and smaller helper applications help fill this gap.

The high estimate included new custom credit management system as well as spreadsheets and work aids to monitor power flow, registry and other control room analytical tools (e.g. flowgate monitoring, BA shortage calculation). The cost to procure a credit management system was determined based on data available from other Market Operators and verified by a third party vendor. The cost to develop work aids and tools was assumed to be driven by two consultants working for one year at $150 per hour.

The low range assumed that all tools and work aids were developed using spreadsheets and in house developers. The cost to develop work aids and tools, including a credit management tool, was assumed to be driven by two FTEs working for one year at $150,000 including salary, benefits and taxes.

Utilicast assumed the operational costs to maintain tools, spreadsheets and work aids would be 10% of the capital cost.

The start-up cost range for Additional Tools, Spreadsheets & Work Aids was $0.3M to $2.5M. The operational cost range for Additional Tools, Spreadsheets & Work Aids was $0.0M to $0.3M and was directly proportional to the capital costs.

Market Considerations: Footprint

In implementing the EDT, conclusions on open market design issues may result in costs to the Market Operator and/or Market Participants. Decisions on market design issues were not expected to be determined prior to the completion of this Cost Analysis. Consequently, assumptions had to be made regarding the possible implications and resulting cost impacts to both the Market Operator and Market Participants. The size of the footprint was one such cost.

Participation in the EIM would be voluntary on a BA/TSP basis. As such, the cost impact of a smaller market footprint versus a larger market footprint was assessed. Prior to performing the cost analysis, footprint considerations were thought to have the largest impact on the software. However, in further

examination of each cost to the Market Operator, Utilicast determined the greatest impact as a result of a larger footprint would be on the organization's staff levels. Though there may be costs to the software and hardware as a result of a larger footprint, the costs were determined to be statistically insignificant in affecting the overall cost number for the Market Operator. For the sake of consistency, this cost category remained in the Software cost area.

Utilicast analyzed the headcount of other Market Operators relative to the generation capacity and found a linear relationship of employees per MW. As such, a larger footprint was determined to add 79 additional FTEs to a new entity and 20 FTEs to an existing entity.

The high costs were calculated assuming the 79 FTEs would be paid $150,000 per year including salary, benefits, and payroll taxes as well as a signing and relocation bonus of $30,000 per employee.

The low costs were calculated assuming the 20 FTEs would be paid $150,000 per year including salary, benefits, and payroll taxes. No signing or relocation bonuses were assumed in the low cost estimate.

Should a smaller footprint be applied, there would be no change to the staffing levels assumed in the Staff cost section below.

The start-up cost range for Footprint Market Considerations was $0.0M to $2.4M. The operational cost range for Footprint Market Considerations was $3.0M to $11.9M.

Market Considerations: Transmission Accounting and/or Reconciliation

Since the Market Operator will execute a centralized generation dispatch across the market footprint, there will be continuous unscheduled utilization of the transmission system. Transmission service for five-minute incremental utilization of the transmission system will need to be tracked and settled through software.

At the time of writing, it is unclear if the Market Operator will charge a single "postage stamp" rate for transmission service or if each Transmission Service Provider will have its own rate for such service. Either way, there will be software costs associated with systems to charge Market Participants and distribute revenue to Transmission Service Providers.

Assumptions were made regarding the design on how this will function in determining the cost to the Market Operator. Settlement software can be purchased or configured to provide this function. Depending on the complexity of the final design, spreadsheets may also be utilized.

The high range represents the cost of a simple Transmission Settlement system. Because the cost is largely dependent on design decisions yet to be determined, Utilicast assumed a percentage of SPP's Transmission Accounting system to determine the high cost.

For the low range, Transmission Billing would be settled by the Market Operator utilizing spreadsheets developed in house. It was assumed that 3.5 FTEs would develop these spreadsheets over a period of two years at a cost of $150,000 per year including salary, benefits, and payroll taxes.

Utilicast assumed the operational costs to maintain the transmission account system or tools would be 10% of the capital cost.

The cost estimated in this category is not reflective of the design that is expected to be implemented; rather it provides an estimate of the expected cost range.

The start-up cost range for Transmission Accounting/Reconciliation Market Considerations was $1.0M to $3.7M. The operational cost range for Transmission Accounting/Reconciliation Market Considerations was $0.1M to $0.6M and was directly proportional to the capital costs.

Market Considerations: Documentation

Documentation will need to be produced and made available specifying the detailed design and workings of the market. Documentation to be produced should include Market Protocols, Operating Protocols, and Business Practice Manuals as well as, reliability and economic studies and/or user interface documents.

The cost range associated with documentation was attributed to labor costs and categorized as a pre-operational expense.

High costs were calculated based on 20 FTEs from legal, market design, engineering, settlements, and IT engaged over the period of one year at a cost of $150,000 per FTE as well as 5 consultants at a cost of $150 per hour for one year.

Low costs were calculated based on 10 FTEs from legal, market design, engineering, settlements, and IT engaged over the period of one year at a cost of $150,000 per FTE.

Travel, meetings, and other expenses that may be incurred as a result of this work were captured as Overhead costs.

The start-up cost range for Documentation Market Considerations was $1.5M to $4.6M. Since this is expected to be a onetime cost, there are no operational costs associated with Documentation Market Considerations.

4.1.3 Findings

Given that the Market Operator is an unknown entity, it is difficult to determine a tighter confidence interval at this point. During discussions with the EDTTRS, Utilicast agreed to provide additional insight into the results by assessing the likely costs of two generic scenarios: 1) Market Operator is a new entity and 2) Market Operator is an existing entity. As a guide to more practically interpret the results, Utilicast has provided likely costs bands for these two generic scenarios.

In summary, software start-up costs were approximately 63% of the total start-up costs for the Market Operator. Higher costs were attributed to complex or customized systems as well as poor governance, scope creep and/or inadequate requirements. Lower start-up costs would be obtainable if existing software is utilized with no or minor modifications

The software start-up cost ranged from $17.3M to $126.4M. A more accurate cost would require the identification of the Market Operator to perform the duties of the EIM and its ability to leverage existing systems. It is important to note that the high and low costs do not align to a specific scenario or target Market Operator. Rather the aggregated high and low costs yield a confidence band of the estimated cost.

Software operating costs were found to be approximately 19% of the total operating costs for the Market Operator. The operating costs of the software were largely proportional to the capital cost of the software. Higher operational costs were assumed for highly customized and complex systems.

The costs associated with delivering software for imbalance energy markets has varied widely across the United States and for a variety of reasons. The historical drivers associated with Software cost overruns are: 1) Incorporation of unique regional market design concepts, 2) Permitting new design concepts after the development phase has commenced, 3) Unclear program governance or management structure, 4) Nebulous software vendor scope definitions (exponential risk with increased vendors) and 5) Lack of Market Participant readiness. These key cost drivers are illustrated in the following table.

Table 1 – Cost Drivers

Cost Overrun Driver	Impact	Mitigation Approach
Incorporation of unique regional market design concepts	New market design concepts increase vendor development and testing costs. Unproven designs are more susceptible to flaws that require rework.	Adopt a proven market design. Select vendors that have previously implemented desired market design.
Permitting new design concepts after the development phase has commenced	Changing requirements during the development phase creates a "moving target" effect that requires additional testing and implementation time.	Mandate individual cost benefit assessments for all late requirements. Queue all late requirements for future releases.
Unclear program governance or management structure	Vendors receive direction from an array of stakeholder, technical and business entities.	Define a single point of contact for managing vendor deliveries and milestone payments. Define a robust change management process.
Nebulous software vendor scope definitions	Vendors do not collectively deliver a complete solution causing additional costs. Data definitions and interfaces are incongruent.	Create detailed specifications that clearly state vendor functional scope and data interfaces. Work with smaller set of software vendors.
Lack of Market Participant readiness	Compulsory Market Participants are not ready to operate assets at the conclusion of integration causing a schedule delay. Market Trials are not a true indication of market activity causing late software refinements.	Create a robust Market Participant training and outreach program. Reimburse costs associated with reliability functions. Schedule Balancing Authority improvements early in schedule. Create a Market Participant readiness scorecard.

See Appendix A.1 for a detailed breakdown of the Software costs.

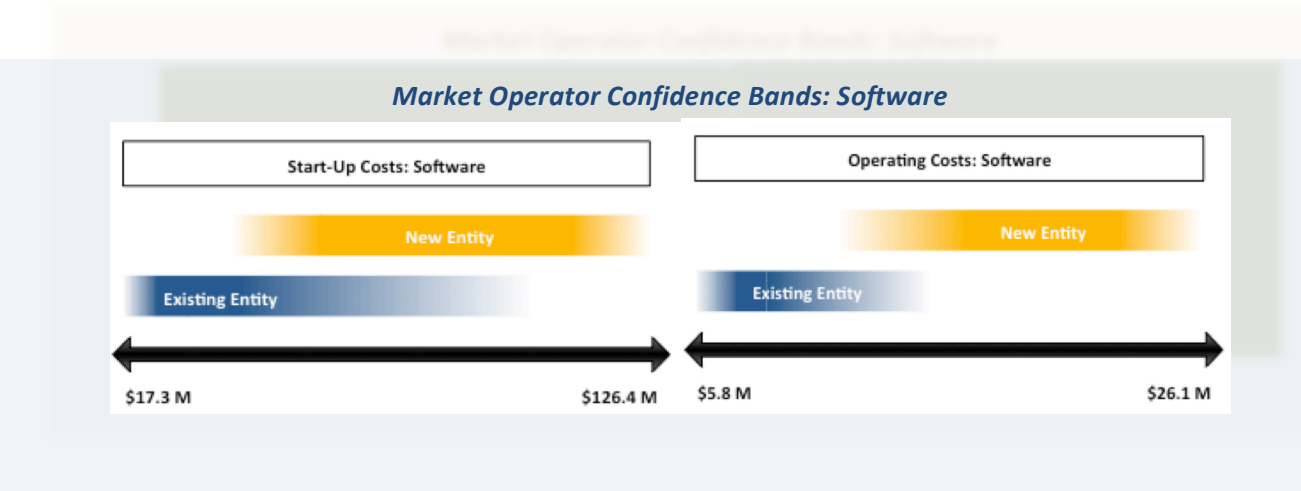


Figure 5 – Market Operator Confidence Bands for Software

4.2 Hardware

To accommodate the software listed above for the market and back office systems, additional computers will be necessary. This hardware will have both initial and ongoing costs. Initial costs include the procurement of hardware such as servers, desktops, and other hardware. Ongoing costs include upgrades, fees, and other costs required to maintain the hardware.

4.2.1 General Assumptions

The cost of hardware was in large part based on the costs recently incurred by WECC in its RC Build Out Project. The cost of hardware was verified against the cost of hardware in capital project reports of other Market Operators.

The operating cost of the hardware was assumed to be 10% of the capital costs.

4.2.2 Cost Categories

Servers

The additional software is substantial and will need additional dedicated servers to accommodate it. For both the high and the low costs, Utilicast assumed the Market Operator would maintain three environments with a total of 200 servers (Production: 100 servers, Integration: 50 servers, and Development: 50 servers).

For the high cost, Utilicast assumed the addition of two enterprise class servers to be used for database needs and EMS.

The low cost assumes that commodity servers would be used for the database and EMS production/failover instead of enterprise class servers. This is a possible scenario whether the Market Operator is a new or existing entity.

The operational cost of maintaining this hardware was assumed to be 10% annually.

Desktop Computers

In addition to servers, there would be a need for desktop computers for the additional personnel discussed in the Staff section. This would include computers for both the control room and for back office staff.

The high cost assumed 340 new computers (computers for 325 employees plus 15 computers for testing, visitors, and staff). The high cost estimated a cost of $4,000 per computer.

The low cost assumed the cost of 93 computers (computers for 89 employees plus 4 additional computers for testing, visitors, and staff). The low cost estimated a cost of $3,100 per computer.

The cost for maintaining these computers is captured in the Other Overhead Expenses cost category.

Additional Hardware & Equipment

Additional Hardware may be required by the Market Operator to run the EDT market. Additional hardware may include but is not limited to: additional memory, back-up and disaster recovery systems, power supply and network power management, racks, routers, surge protection, switching devices, surveillance equipment, and printers and copiers.

The high range is based on a new entity being selected for the Market Operator while the low range was based on an existing entity acting as the Market Operator. Utilicast consulted with SMEs who have extensive experience with market implementations and infrastructure needs. As a result, it was assumed that an existing entity would need relatively little additional hardware. The SMEs also agreed and it was assumed that the high cost should rise to approximately three times the low cost.

Telecommunications

Telecommunications was not a cost category originally identified for the Cost Analysis. However, in reviewing the Annual Reports of other Market Operators and interviews with SMEs, it became clear that it was important to separate out the telecommunications cost. The use of internet, telephones, faxes, inbound voice and data lines are all required to conduct business. However, telecommunications is vital to market operations and operators in performing their duties.

The high range of telecommunication costs were based on the telecommunications expenses of other Market Operators. These expenses were scaled to the estimated size of the EDT market.

An existing entity would have much of the telecommunication in place and would need only minimal additions. Therefore, the low range was assumed to be approximately 10% of the high cost.

4.2.3 Findings

The capital cost of hardware is consistent with recent purchases made by WECC and other Market Operators. An existing entity may see cost savings if it is able to utilize existing hardware for the EDT market. However, additional servers and computers for incremental staff will still be required.

Hardware start-up costs are approximately 6% of the total start-up costs for the Market Operator and range from $2.4M to $5.7M.

Ongoing costs to maintain the hardware, including upgrades, fees and other costs are approximately 3% of the Market Operator's total operating costs. The operating costs of hardware are largely proportional to the capital cost of hardware. The total range of hardware operating cost was estimated to be $0.9M to $3.8M. See Appendix A.2 for a detailed breakdown of the Hardware costs.

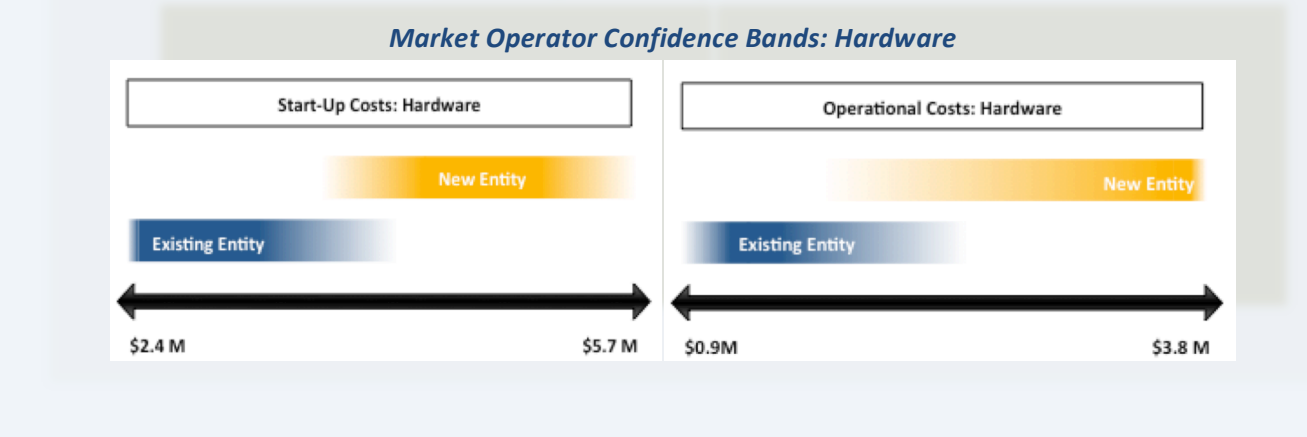


Figure 6 – Market Operator Confidence Band for Hardware

4.3 Infrastructure

The Market Operator will be required to modify or increase infrastructure. The cost to the Market Operator is expected to be significantly higher for a new entity but may also be high for an existing entity. The cost for an existing entity will be dependent upon the entity's ability to utilize existing facilities and infrastructure. As such, the infrastructure cost should be considered a range and should be further assessed upon identification of the Market Operator.

4.3.1 General Assumptions

The incremental cost of build out, furniture, and lease space was based on the costs recently incurred by WECC in its RC Build Out Project. The original cost categories included Control Room Space, Backup Capability, and Heating, Ventilating and Air Conditioning (HVAC). These costs were incorporated in the Control Room costs. Utilicast added two additional cost categories: 2nd Control Room and Building, Leasing & Facilities – Operating Costs.

High costs were assumed based on the Market Operator's need to procure new infrastructure. High costs could be applicable to a new entity or an existing entity and would dependent upon the existing infrastructure that can be leveraged.

Low costs were assumed based on the Market Operator's ability to leverage existing infrastructure. This is possible if the Market Operator is an existing entity and is able to leverage existing infrastructure. This may also be possible if the Market Operator (as a new or existing entity) contracts a third party to host the operation functions of the market and utilize existing infrastructure. A host entity may levy costs, or "charge backs", to the Market Operator in order to recover operating costs such as leases, utilities, office supplies, etc. However, Utilicast assumed that if WECC was the host entity, charge backs would not be imposed as overall societal costs. Therefore, charge backs costs were assumed to be greater than the low cost option, unless noted otherwise, and captured within the high and low cost range.

4.3.2 Cost Categories

Control Room

To maintain the market, there will need to be a control room manned 24hrs x 7 days a week with situational awareness. Substantial physical and electronic security would likely be implemented to protect staff and assets. The Market Operator may be able to utilize existing facilities or may require new accommodations.

To calculate the high range of control room costs, Utilicast used costs associated with the construction of WECC's new RC, SPP's control room and data center, PJM's AC2 project, and CAISO's new Iron Point Facility. Control room build costs were evaluated and scaled to assume 33,000 square feet. This cost included the facility, HVAC, build out, control room furniture, and generation requirements. This cost may be incurred by a new entity or an existing entity that does not have the space to facilitate the additional needs of the EDT market.

In lieu of building a new control room, a low cost option is for an existing entity to host the operation functions in their facilities. The host entity must have the space to accommodate additional employees as well as the data center needs for EDT market functions. Capital costs were assumed to be attributed to minor modifications to existing facilities. Ongoing operating costs were assumed for charge back fees or operating costs of the facility, whichever is less.

2nd Control Room/Backup Capability

Markets in the United States generally follow a pattern of operating from a Primary site and having an idle backup site. This is done for maximum uptime as well meet as NERC requirements.

High costs were assumed for the build out of a second control room. The cost was assumed to be the same as the Control Room cost above. This cost may be incurred by a new entity or an existing entity that does not have the space to facilitate the additional needs of the EDT market.

If an existing entity hosts the operation functions for EDT in their facilities, it was assumed they would have adequate space and backup capabilities. This cost was assumed to be included in the Control Room cost.

Critical Infrastructure Protection (CIP)

Although it is unclear whether the Market Operator would be a NERC Registered Entity, it would be prudent to maintain the critical infrastructure protection of the control room. As a base assumption for the cost calculation, the requirements in the NERC Critical Infrastructure Protection standards (CIP) were used to identify the necessary protection. This included secure access, redundant systems and diversely routed communications.

The high range assumes implementation of CIP standards and the acquisition of two enterprise servers. Operating cost included one employee plus outside services. The SPP 2007 budget detailing their CIP standards project was used as a primary source in this calculation.

If the Market Operator is an existing entity and is already CIP compliant, the cost would be greatly reduced. Expected costs include additional licenses and software upgrades as well as one employee and outside services.

Space for Office Functions

Outside of the Control Room, there will also be an increase in staff that must be accommodated with additional office space and furniture. This space would include, at a minimum, costs for a lease, insurance, furnishing and maintenance.

The cost of build-out, furniture, and lease space was based largely on the costs recently incurred by WECC in its RC Build-Out Project. Capital costs included furniture, common area equipment, build-out and tenant improvements for 331 employees (see Staff Costs for additional information on staffing assumptions).

In the low cost estimate, Utilicast assumed that an existing entity that becomes the Market Operator would be able to accommodate 90 additional desks. Capital costs include the cost for furniture for the additional employees. Operating costs include incremental supplies, insurance and other miscellaneous costs.

Building, Leases & Facilities – Operating Costs

Operating costs such as utilities, supplies, repairs, insurance and other miscellaneous costs will be incurred for both a new entity and an existing entity.

Using financial reports and budgets of other Market Operators, the operating costs of buildings, leases and facilities were averaged to establish the high cost. The project was assumed to be implemented within five years. Pre-operational costs were further assumed to be two years at half of the total high operating costs and three years at full high operating costs.

Should an existing entity become the Market Operator, Utilicast assumed the existing entity's facilities would be leveraged from the start of project. Costs were expected to remain constant through the duration of the implementation. Pre-operational costs were assumed to be 3.5 years at the low operating costs.

4.3.3 Findings

Infrastructure costs should be considered as a range and will be dependent on the existing facilities and infrastructure of the Market Operator. High costs may be incurred by either a new entity or an existing entity if their current facilities cannot accommodate additional staff and data center needs.

Conversely, an existing entity may incur low costs if they have capacity to run the EDT market from their facilities. Low costs may also be possible for a new entity if a third party Market Operator hosts the operation functions utilizing their infrastructure.

Due to the high costs associated with building new facilities and the low costs associated with utilizing existing facilities, Infrastructure start-up costs are presented as a wide range, $3.2M to $62.9M. This range can be further narrowed upon identification of the Market Operator.

Infrastructure start-up costs are approximately 21% of the total start-up costs for the Market Operator. The construction of two control rooms accounts for 20% of all capital costs for the Market Operator.

Infrastructure operating costs are relative to the capital costs. As a result, the operating infrastructure costs are a wide range, $0.7M to $9.5M. These costs are approximately 5% of the total operating costs for the Market Operator. The operating costs of an existing entity are incremental to its current operating costs. Infrastructure operating costs are comparable to the operating costs of other Market Operators.

See Appendix A.3 for a detailed breakdown of the Infrastructure costs.

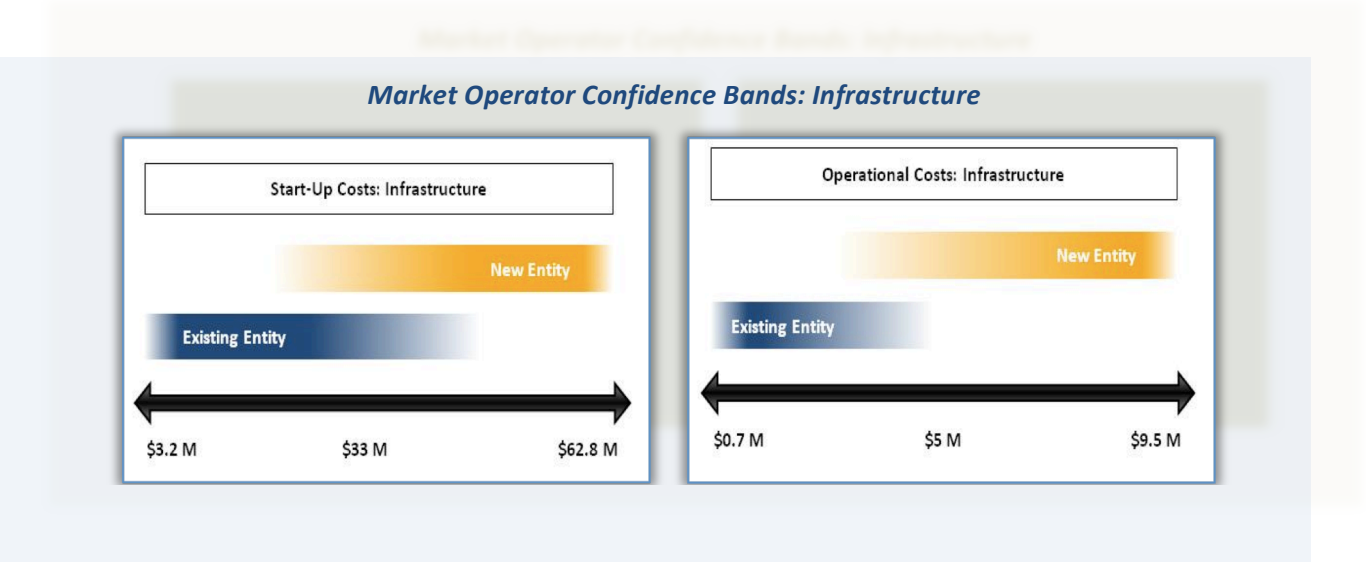


Figure 7 – Market Operator Confidence Bands for Infrastructure

4.4 Staff

Additional staff is expected to be necessary regardless of whether the Market Operator is an existing entity or a new entity. The number of required staff or full time equivalents (FTEs) is expected to be significantly greater for a new entity and therefore drives the high cost estimate. The low cost estimate is reflective of the number of incremental FTEs required to run the market within an existing entity. The number of incremental FTEs to an existing entity would be dependent on the size of that entity's current staff and its ability to take on the additional functions of the EDT market. Therefore, the costs associated with the Market Operator staff should be considered a range and adapted to the organization's specific needs and abilities before inclusion in a budget.

4.4.1 General Assumptions

Utilizing departmental and historical headcount data from SPP, ERCOT, CAISO and PJM, Utilicast approximated the number of FTEs required for a new entity to run the EDT market. With the exception of Market Monitoring, these counts were the basis for the high cost estimates. The Market Monitoring costs were determined to be the highest when outsourcing this function to a third party.

To calculate the low cost, Utilicast assessed the ability of existing staff to absorb the new workload. A percentage was then applied to the high staff counts to approximate the incremental FTEs to an existing entity. Incremental FTE requirements are a general estimation and not based on a particular organization.

Utilizing data from WECC and CAISO's 2010 Annual Report, Utilicast assumed executive management staff would be paid an average of $300,000 per year and all other staff would be paid an average of $150,000 per year. This cost includes salaries, benefits, and payroll taxes. All employees were assumed to be paid the same amount regardless of level, experience or expertise. Differences in salaries to account for cost of living or the use of satellite locations were not applied and should be considered after the Market Operator has been identified. Utilicast's assumptions were confirmed by the 2006 U.S. General Accounting Office (GAO) report which calculated the average FTE salary and benefits to be $134,000 or $144,938 in 2010 dollars.

Where applicable, consultant labor was assumed to be $150 per hour.

Bonuses required to recruit and obtain new employees were categorized as pre-operational expenses. Signing and relocation bonuses were assumed to be $30,000 for each FTE and $100,000 for executive management staff.

Utilicast did not identify capital costs associated with staff. Capital expenditures required for staff to carry out their responsibilities (such as computers, desks, office supplies, etc) were captured under other cost categories within this Cost Analysis.

4.4.2 Cost Categories

Business Capability and Organizational Design

Regardless if the Market Operator is an existing entity or new entity, the responsibilities of the EIM functions will need to be assigned to the capabilities or departments of the business. This will guide the organizational design for the Market Operator, staff level requirements, job descriptions, and processes and procedures across the business.

This cost category is comprised of the pre-operational labor required to develop business design and strategy documentation. High costs were determined assuming this work would be completed by five

internal resources and four consultants over the course of six months. Low costs were determined assuming the work would be completed by two internal resources over the course of one year.

Control Room Staff

The Control Room will need to be staffed 24/7 to carry out the market functions. Even if the Market Operator is an existing entity with control room staff, dedicated operators will be necessary. All control room staff were assumed to be NERC-certified operators.

Operator training and simulation provide operators with current policies, equipment, and the knowledge necessary to perform their duties. Operator training also covers NERC certification guidelines. As such, staff required to conduct operator training has been included in Control Room staff as opposed to Training Staff.

A new entity was assumed to require 68 control room staff including a manager, shift supervisors, dispatchers, and staff for operator training and procedures. Signing and relocation bonuses were assumed for each of the 68 FTEs in the high cost estimate.

An existing entity was assumed to require 17 incremental control room staff. No signing and relocation bonuses were assumed under the low cost estimate.

Market Engineers

Software and modeling engineers will be necessary to maintain the software and functionality of the market.

A new entity was assumed to require 55 market engineers. This included staff to perform scheduling 24/7, modeling, market administration and analysis, and market design functions. Signing and relocation bonuses were assumed for each of the 55 FTEs in the high cost estimate.

An existing entity was assumed to require 10 additional market engineers. As in the EMS software assumptions, Utilicast assumed for the low cost that an existing entity would have visibility into the Western Interconnection and would not require extensive additions to the modeling staff. An existing entity that does not have insight into the Western Interconnect may have more complex modeling requirements necessitating additional staff. No signing and relocation bonuses were assumed under the low cost estimate.

EMS Engineers

Engineers will be necessary to maintain the EMS. For a new entity, a full EMS staff was assumed to be needed. For an existing entity, the workload was assumed to be absorbed by the existing staff.

A new entity was assumed to require 16 EMS engineers. Signing and relocation bonuses were assumed for each of the 16 FTEs in the high cost estimate.

An existing entity was assumed to require 4 additional EMS engineers. As in the EMS software assumptions, Utilicast assumed for the low cost that an existing entity would have visibility into the Western Interconnection and would not require extensive EMS needs. No signing and relocation bonuses were assumed under the low cost estimate.

Training Staff

To facilitate participation in the market, the Market Operator will need staff to provide training to internal staff as well as Market Participants on all aspects of market participation, including both

market operation concepts and software training. Operator training and simulation is included in Control Room Staff and not included in the Training Staff estimate.

A new entity was assumed to require 5 training staff. Signing and relocation bonuses were assumed for each of the 5 FTEs in the high cost estimate.

An existing entity was assumed to require 1 additional training staff. No signing and relocation bonuses were assumed under the low cost estimate.

Settlement Staff

Staff will be necessary to facilitate settlement of the market and dispute resolution.

A new entity was assumed to require 20 settlements staff. Signing and relocation bonuses were assumed for each of the 20 FTEs in the high cost estimate.

For the low estimate, Utilicast assumed that the Market Operator is an existing entity that has a settlements department and existing staff could absorb some of the workload. However, the addition of a new market with separate market rules, charge codes and disputes would likely require additional dedicated staff to an existing entity. Therefore an existing entity was assumed to require 10 additional settlements staff. No signing and relocation bonuses were assumed under the low cost estimate.

Regulatory Staff

Regulatory staff would oversee tariff administration and interface with FERC on tariff issues. If the Market Operator had to be a registered entity or take on any NERC Standards responsibility, the regulatory staff would ensure the Market Operator was in compliance with these responsibilities. Though regulatory staff may perform legal functions, the costs for regulatory and legal staff have been separated.

A new entity was assumed to require 5 regulatory staff. Signing and relocation bonuses were assumed for each of the 5 FTEs in the high cost estimate.

An existing entity was assumed to require 1 additional regulatory staff. No signing and relocation bonuses were assumed under the low cost estimate.

Market Monitor

To prevent gaming or market manipulation, market rules would need to be put into place and a Market Monitor would be necessary to ensure adherence to these market rules. The Market Monitor could be a third party or the duties could be carried out internally.

The high cost estimate assumed the Market Monitor function would be performed by a third party. The operational cost was calculated based on a percentage of PJM's market monitoring costs that more closely aligns with other third party market monitoring costs. This cost could be incurred by either a new entity or an existing entity.

A new or existing entity was assumed to require 5 market monitoring staff. Because EDT will have separate market rules and unique market characteristics, Utilicast assumed the workload associated with market monitoring could not be absorbed by current staff. No signing and relocation bonuses were assumed under the low cost estimate.

Stakeholder Support

Market Participants would need to be able to contact support staff from the Market Operator on account, software, data, connectivity, and settlements issues. Operational support would be required on a real-time basis and available 24/7. There would also need to be support staff available for new committees dealing with market issues.

A new entity was assumed to require 6 stakeholder support staff. Signing and relocation bonuses were assumed for each of the 6 FTEs in the high cost estimate.

An existing entity was assumed to require 2 additional stakeholder support staff. No signing and relocation bonuses were assumed under the low cost estimate.

Legal Staff

If the Market Operator is a new entity, staff would need to be established to maintain the legal functions of the entity. Utilicast assumes that the staff of an existing entity could absorb some of the ongoing workload.

Additional legal needs, such as tariff filings, market-to-market agreements, and participant agreements may be outsourced to a third party. These costs have been categorized as overhead costs under Professional Fees.

A new entity was assumed to require 15 legal staff. Signing and relocation bonuses were assumed for each of the 15 FTEs in the high cost estimate.

An existing entity was assumed to require 4 additional legal staff. No signing and relocation bonuses were assumed under the low cost estimate.

IT Staff

Additional IT staff will be necessary to support the new market software and hardware regardless of whether the Market Operator is a new or existing entity. However, an existing entity would see efficiencies with the existence and experience of an IT department to support the additional systems required for the EDT. Consistent with relative size of the IT department to the total staff at SPP, ERCOT, and CAISO, the IT department was assumed to be approximately 23% of the total staff.

As such, a new entity was assumed to require 75 IT staff. Signing and relocation bonuses were assumed for each of the 75 FTEs in the high cost estimate.

An existing entity was assumed to require 21 additional IT staff. No signing and relocation bonuses were assumed under the low cost estimate.

Management

With the establishment of a new organization or the introduction of a new market to an existing entity, the Market Operator will need a leadership team to guide and support the objectives of the organization. The number of management staff would depend on the structure of the Market Operator's organization, the size of the existing staff, and the potential need for re-structuring an existing entity.

A new entity was assumed to require 10 executive management staff. This included a CEO, CIO, CFO, COO and senior directors. This staff was assumed to be paid an average of $300,000 per year

inclusive of salaries, benefits, and payroll taxes. Signing and relocation bonuses of $100,000 were assumed for each of the 10 management staff in the high cost estimate.

An existing entity was assumed to require 4 additional executive management staff. As in the high cost assumptions, the management staff was assumed to be paid an average of $300,000. Signing and relocation bonuses of $100,000 were assumed for each of the 10 management staff in the high cost estimate.

Additional Support Staff

Support staff, such as Human Resources, administrative assistants, security and accounting would be needed by the Market Operator. However, the amount of new staff in these areas would be dependent on the existing staff and their ability to absorb the additional duties.

A new entity was assumed to require 50 support staff. No signing and relocation bonuses were assumed for support staff.

An existing entity was assumed to require 10 additional support staff. No signing and relocation bonuses were assumed for support staff.

4.4.3 Findings

The number of staff required to fulfill the market duties would be dependent on the entity established or chosen to carry out these functions.

Utilicast estimates a new entity would require 325 FTEs. Most positions within the organization would need to be filled by experienced and highly trained staff. As factors such as the cost of living, organizational structure, and organizational duties are further defined, assumptions to the staff cost may need to be refined. Based on the assumptions presented above, Utilicast estimates the high operational cost to be $57.2M annually with a pre-operational cost of $9.9M to recruit and acquire new staff.

An existing entity would need to assess its ability to fulfill the market duties with its current staff and adjust the assumptions to meet its pay scale requirements. Additionally, an existing entity would need to determine if any functions, such as market monitoring or legal, would be outsourced to a third party. Thus, the cost of staff to an existing entity should be considered a range.

Generalizing the staffing level of an existing entity, Utilicast determined 89 FTEs would need to be added to an organization. This would be an incremental cost of $13.8M annually and $0.7M to recruit and retain employees.

The following table depicts the number of staff estimated to perform the required duties independently versus the number of staff that could be added to an existing organization in order to execute the market's functions.

Table 2 – Potential Staffing Requirements

Staff	High Staff Count	Low Staff Count
Control Room Staff	68	17
Market Engineers	55	10
EMS Engineers	16	4
Training Staff	5	1
Settlement Staff	20	10
Regulatory Staff	5	1
Market Monitor	N/A	5
Stakeholder Support	6	2
Legal Staff	15	4
IT	75	21
Management	10	4
Additional Support Staff	50	10
TOTAL	**325**	**89***

*Incremental number of staff that would be added to a Third Party Market Operator.

Staff start-up costs range from $0.7M to $9.9M. Start-up costs include capital and pre-operational expenses. Staff start-up costs are approximately 4% of the total start-up costs for the Market Operator.

Staff operating costs range from $13.8M to $57.2M. Staff are approximately 42% of the total operating costs for the Market Operator and are the largest operating expense for the Market Operator.

Figure 8 – Market Operator Confidence Bands for Staff

See Appendix A.4 for a detailed breakdown of the Staff costs.

4.5 Overhead

Overhead expenses required to operate the business include insurance, interest, professional fees, audits, and other operating costs such as travel and training. These costs are expected to be incurred regardless of whether the Market Operator is an existing entity or a new entity.

4.5.1 General Assumptions

In determining overhead expenses, Utilicast relied upon data found in the Annual Reports and budgets of SPP, CAISO, PJM, NYISO, ERCOT and MISO. In most cases, this data was scaled to match similar market design and size, then averaged to determine the Market Operator's cost. Third party vendors were consulted to confirm costs and provide estimates as needed.

4.5.2 Cost Categories

Records/Data Retention

The Market Operator will likely be required to submit reports and be subject to audits based on either the tariff or the agreements that are implemented. As such, the Market Operator will be required to maintain records and data for specified amounts of time. The costs associated with data retention and storage included off-site storage services which were found to be the least cost option. On-site storage was assumed to require 200 square feet and an additional FTE to maintain the records at $75,000 including salary, benefits and taxes.

Financing Costs

To fund the project, there will likely be a loan associated with startup. Utilicast assumed an interest rate of 7% based on the interest rates recently incurred by WECC and ERCOT (6.25% and 6% respectively). This rate was applied to both the high and low start-up costs of the Market Operator.

Financing costs should be reassessed upon identification of the Market Operator. The following factors should be considered in determining the financing costs and are limitations in the approach applied by Utilicast in this Cost Analysis.

- Summation of the high costs could create an artificially high cost estimate. If the Market Operator is able to manage capital cost, specifically the cost of software and hardware, their actual costs may be significantly lower.
- Similarly, summing the low costs could create an artificially low cost estimate. An existing entity may require a new control room to facilitate the EDT market. In this case, the cost to an existing entity would be higher than a sum of the low costs.

  As a result, applying the interest rate to these sums may not accurately reflect the Market Operator's financing cost. After the Market Operator has been determined, a better representation of the financing costs can be made.
- A loan term was not assumed and the interest rate was not amortized. An existing entity with favorable credit or cash reserves may have a shorter loan term and/or more favorable interest rate. A more accurate interest rate and loan term can be applied upon identification of a Market Operator.
- The financing costs were categorized strictly as pre-operational expenses. If the loan term is determined to exceed the project timeline, then the Market Operator will also incur operational costs for the remainder of the term. A better representation of the financing costs can be made upon determination of the loan term.

Insurance

The Market Operator will likely require insurance to protect against liabilities associated with this role. The insurance needs were assumed to include property insurance, excess liability, general & professional liability, general liability umbrella, earthquake, and directors & officers insurance.

High costs were determined based on the highest insurance costs of other ISOs. Low costs were created based on the insurance costs of other entities of comparable size and market design. Costs were gathered based on presentations and financial reports specifically for WECC, SPP, ERCOT, and PJM.

External Audits and Internal Audit Co-Sourcing

The Market Operator will need to regularly perform audits such SAS 70 and Sarbanes-Oxley. Cost data was gathered based on the financial reports of existing entities and confirmed by a third party service provider.

Other Professional Fees

The Market Operator will likely incur operating costs associated with professionals outside of the organization. These may include outside legal assistance, reliability and economic planning, market design consultations, and security services.

Data was gathered from the financial reports of existing entities and averaged to determine the high cost. If an existing entity was the Market Operator, Utilicast assumed they would be able to extend the scope of work with professional service providers to include new needs.

Other Operating Costs

The Market Operator will likely incur additional costs associated with travel, training and professional dues. High costs were assessed averaging the other operating costs found in the financial reports of existing entities. Utilicast assumed existing entities would see efficiencies and economies of scale not realized by a new entity. The low costs were assumed to be half of the high cost estimate.

Pre-operational costs to cover training, travel, meetings and other operating costs prior to going live were also calculated. Utilicast assumed costs of $1500 per month over two years for 20 FTEs as the high cost and for 10 FTEs as low cost.

4.5.3 Findings

With the exception of financing costs, the overhead costs to the Market Operator were assumed to be consistent with the costs incurred by other Market Operators of similar size and market design. Overhead operating costs are approximately 31% of the total operating costs for the Market Operator and range from $12.6M to $32.3M.

Given more certainty of the Market Operator, Utilicast believes that better and more accurate financing costs can be derived. Until such time, finance costs were estimated to range from $1.7M to $14.4M. Financing costs account for approximately 89% of the Market Operator's start-up costs. The Market Operator's start-up costs are estimated to range from $2.0M to $15.1M and are approximately 6% of the total start-up costs.

See Appendix A.5 for a detailed breakdown of the Overhead costs.

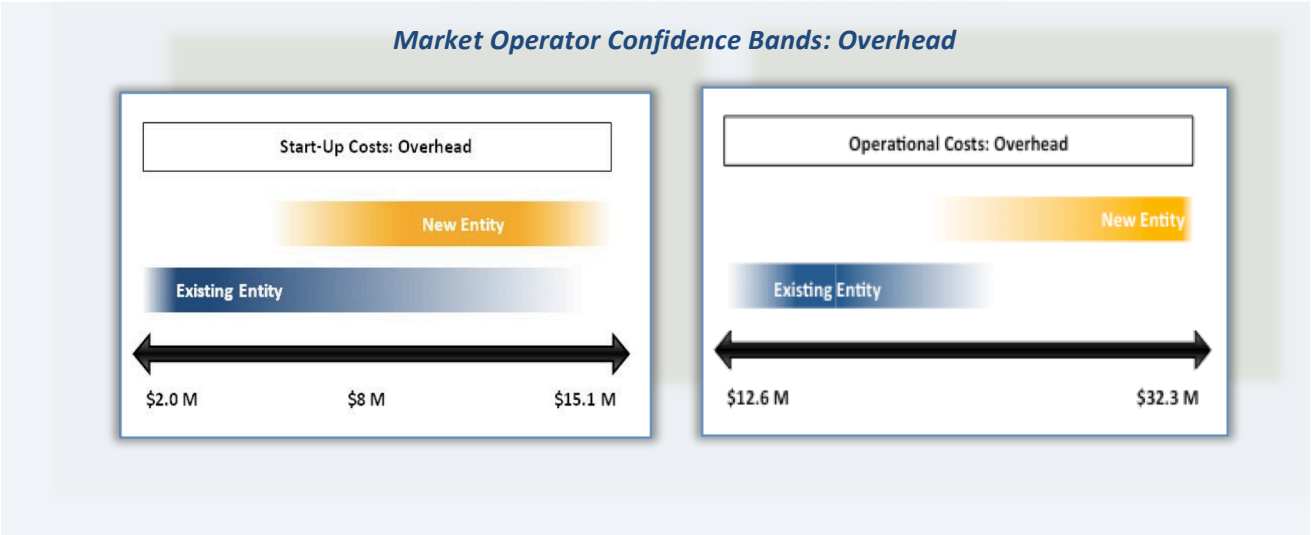


Figure 9 – Market Operator Confidence Bands for Overhead

5. Market Participant Costs

Market Participants costs will be different for different types of participants and must be considered separately for Transmission Providers, Balancing Authorities (BAs), Generator Operators and Load-Serving Entities. However, publically available data on Market Participant costs is not widely available.

Utilicast referred to the approaches applied in the Cost Benefit Analysis' of other markets. Specifically, Utilicast reviewed the approaches taken by CRA International and Resero Consulting in their 2008 *Update on the ERCOT Nodal Market Cost-Benefit Analysis* and Charles River Associates' 2005 *Cost Benefit Analysis of SPP's EIS market*.

Cost Approach and Findings for ERCOT's Nodal Market

To collect data, CRA International and Resero Consulting surveyed seven ERCOT market participants from a variety of segments in the market. This data was used to derive costs for ERCOTs 20 largest Market Participants that made up 73% of ERCOT's total capacity. CRA International and Resero Consulting then disseminated the cost across the total footprint to determine a total cost to Market Participants.

The resulting total cost to Market Participants was $175M. Costs varied significantly across participants based on their generation size and capacity within ERCOT. More notably, CRA International and Resero Consulting found a Market Participant's involvement in other markets largely influenced their cost; participation in other markets significantly lowered a Market Participant's capital costs. The average cost to Market Participants with prior market experience was $225 per MW of installed capacity and $2,796 for Market Participants with no prior market experience.

CRA International and Resero Consulting found insufficient data to project the incremental operating expense for Market Participants.

Cost Approach and Findings for SPP's EIS Market

Transmission Owners were asked by Charles River Associates to estimate the costs they would incur over a 9 year period as a result of implementing specific market functions. Data was collected from 11 transmission owners and was refined through follow up data requests and meetings with the transmission owners.

The resulting total cost to Market Participants was $107M. Costs varied significantly across participants based on their

SPP Member Feedback

The following quotes were obtained by Utilicast after requesting feedback from some of the participants involved in the SPP Cost Benefit study and market go live.

> *"It was difficult to see the difference in EIS related [costs] and things we were doing as a result of something else."*

> *"Our cost estimates provided in the original EIS cost benefit analysis was … pretty accurate."*

> *"We never did an after-the-fact study of the benefit of the EIS market. This was because it was so obviously beneficial to us."*

> *"[We had been] paying pretty hefty incremental and decremental imbalance penalties prior to EIS go-live. Thus, [we] saw significant cost-savings right from the start."*

> *"Tracking and truing up of imbalance positions went away [therefore resulting in] time/effort savings."*

Figure 10 – SPP Member Feedback

then-current interactions with SPP as well as the resources they had in place that could be leveraged in implementing the new market. In the cost benefit analysis for SPP, the average operating expense per respondent was $1.5M and average capital expense per respondent was $2.4M.

Cost Approach to determining MP's costs as a result of EDT

In the March 10, 2011 EDTTRS meeting, Utilicast presented the problem statement to participants along with the findings from SPP and ERCOT's cost benefit studies. With guidance from the EDTTRS, Utilicast followed the approach utilized in the SPP Cost Benefit Analysis and focused the Market Participant costs with asset owning companies: BAs.

Cost data was collected utilizing the Cost Benefit Analysis reports for SPP and ERCOT and refined based on the input of industry SMEs and third party vendors. Data was summed by cost category then multiplied by the number of BAs expected in a footprint.

Footprint 1 was assumed to exclude CAISO and Alberta. Footprint 2 was assumed to also exclude British Columbia, BPA (and embedded BAs) and WAPA. The total number of BAs in each footprint was calculated by E3 in their Benefit Study and applied to this Cost Analysis.

Findings

The total Market Participant costs are detailed in the table below. The average capital expense per BA was $2.4M. The average operating expense per BA was $2.6M.

Table 3 – Market Participant Costs

Aggregate Market Participant Costs
Both Footprint Scenarios

Cost Category	BA High Costs				BA Low Costs			
	Footprint 1		Footprint 2		Footprint 1		Footprint 2	
	Capital Costs	Operational Costs	Capital Costs	Operational Costs	Capital Costs	Operational Costs	Capital Costs	Operational Costs
Software	$71.40	$19.72	$39.90	$12.18	$34.00	$6.80	$19.00	$4.20
Hardware	$12.92	$1.29	$7.22	$0.80	$5.61	$0.56	$3.14	$0.35
Staff	$15.30	$76.50	$8.55	$47.25	-	$20.40	-	$12.60
Other	$20.40	$34.00	$11.40	$21.00	$1.70	$18.70	$0.95	$11.55
TOTAL	$120.02	$131.51	$67.07	$81.23	$41.31	$46.46	$23.09	$28.70

Market Participant costs are expected to vary significantly across participants based on:

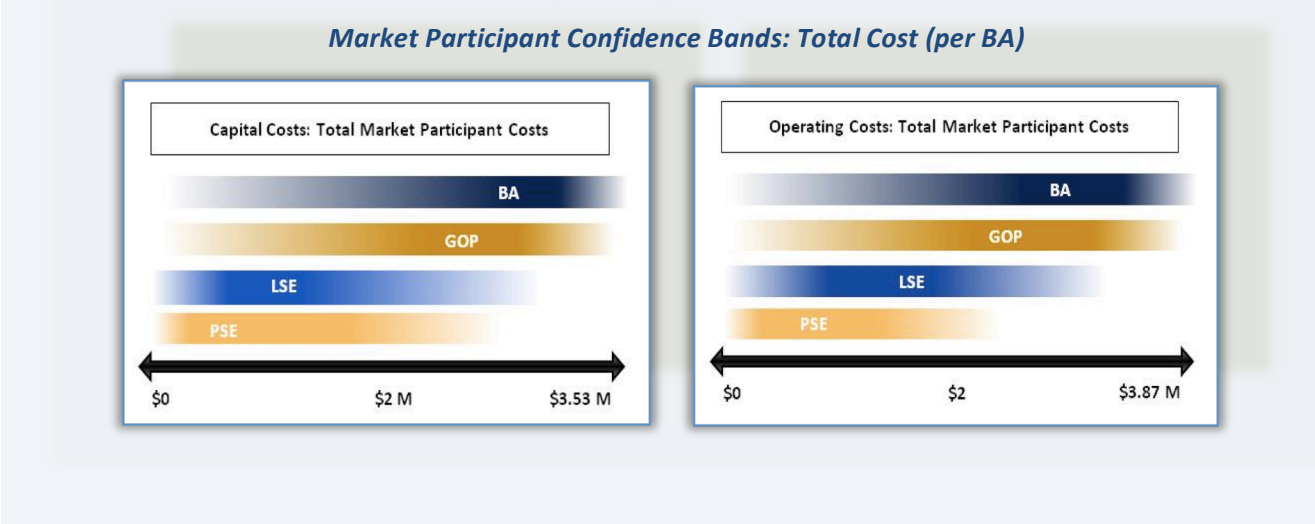
- Whether a third party, WECC, or a new entity becomes the MO and the MP's current interaction with that MO.
- The entity type (i.e. a BA that is also a GOP will likely incur higher costs than a GOP).
- The size and ratio of generation capacity the MP holds within the footprint.

In addition to these factors, Market Participants should determine their individual costs by assessing the impact of EDT on their organization's capabilities. Examples of costs Market Participants should evaluate include, but are not limited to, the age and complexity of their AGC model, SCADA datapoints, planned EMS upgrades, the desire for optional software to bid into the market and/or calculate shadow settlements, available hardware capabilities, facilities required to house new hardware, ability to re-task staff, the need to increase

headcount, regional cost of living and salary assumptions, as well as the Market Participant's appetite for constulants as opposed to carrying out the work internally.

Capital costs were expected to be higher for Balancing Authorities due to the anticipated software impacts and subsequent hardware and staffing requirements to carry out the EDT functions. Poor governance and/or scope creep could increase the cost for Market Participants. Costs are expected to range across all entity types based on the size of the entity, its participation in other markets, and its ability to leverage existing facilities, hardware, software, and staff.

The operating costs of an entity were an incremental cost to its current operating costs. However, Market Participants' operational costs were thought to be largely influenced by the size of the organization, its participation in other markets, and its ability to leverage existing staff and assets.



Costs for entity types other than BAs were not specified in this Cost Analysis. The detailed cost breakdown for each cost category, found in appendix B.1, identifies the entity types expected to also incur that cost. Market

Participants looking to assess the cost impact of EDT on their organization may use this as a basis for determining their costs. However, Market Participants are strongly discouraged from using these numbers as a

basis for their budget. Like the Market Operator, each Market Participant should assess their individual capabilities and ability to leverage existing assets to determine their specific costs and budget.

5.1 Software

The largest upfront costs associated with the implementation of a new market are associated with software.

5.1.1 General Assumption

Cost data was not widely available for Market Participants. As such, the data provided in the SPP Cost Benefit Analysis was assumed to be accurate and applicable to potential EIM participants. Utilicast confirmed this assumption based on the comments and feedback from SPP members (see the "SPP Member Feedback" sidebar above). Data was further verified with SMEs and third party vendors where possible.

Given the large number of variables that contribute to each Market Participant's cost and due to the lack of available cost data for Market Participants, costs for entity types other than BAs were not identified in this Cost Analysis.

Optional software for Market Participants was not included in the analysis.

Operating costs for software was assumed to be 20% of capital costs.

5.1.2 Cost Categories

EMS

The highest software cost for Market Participants is expected in the changes to the EMS. This includes AGC and SCADA upgrades and related engineering modifications. These costs would be incurred by BAs and GOPs.

Receive Net Schedule Interchange Signals

The BAs will need to have the ability to receive Net Scheduled Interchange (NSI) signals from the Market Operator. The NSI will be used as inputs into their Automated Generation Control application. The BAs also will need to process Generator Operators' dispatch and response for full situational awareness. This cost includes data and communication required to facilitate the exchange and would only be incurred by BAs.

Receive Dispatch Signals

The Generator Operators will need to have the ability to receive dispatch signals from the Market Operators. Generator Operators will need to maintain attributes on their units so the Market Operator has an accurate set of information for the dispatch engine. This cost includes data and communication required to facilitate the exchange and would be incurred by BAs and GOPs.

Settlements

Market Participants may implement a shadow settlements system or utilize a tool to consider the dispatch signals, prices, and any other applicable charges identified in the market design.

The high cost estimate assumes Market Participants upgrade or purchase new settlements systems to obtain settlement allocations and assess charges from the Market Operator, as well as maintain records of corrections and true-ups. The cost associated with the acquisition of a shadow settlements system was verified with a third party vendor. TSPs may incur additional costs in implementing Transmission Billing extensions.

The low cost estimate assumes Market Participants will track settlements manually using applications such as Excel.

Interface with Existing Data/Software

As mentioned above, the software will need to interface with the Market Operator's tools and data. In addition, the Market Operator's software will need to interface with Market Participants' EMS software to distribute dispatch signals. There would be a startup cost for initial procurement of this software, and ongoing maintenance and license fees.

The cost of building these interfaces was assumed to require a consultant for two years on the high range and one year on the low range.

Communications Interface

A communications interface with the Market Operator will be necessary. To some extent, existing infrastructure may be able to be used and rerouted.

The cost of this interface was assumed to require a consultant for one year on the high range and a half year on the low range.

5.1.3 Findings

Software capital costs are approximately 65% of the total required start-up costs for Market Participants. BA's and GOPs are expected to have higher software costs related to EMS upgrades, receiving NSI signals and dispatch signals.

Software operating costs are approximately 15% of the total operating costs for Market Participants. Operating costs of software are largely proportional to the capital cost of the software. Higher operational costs are expected for systems that are highly customized and complex.

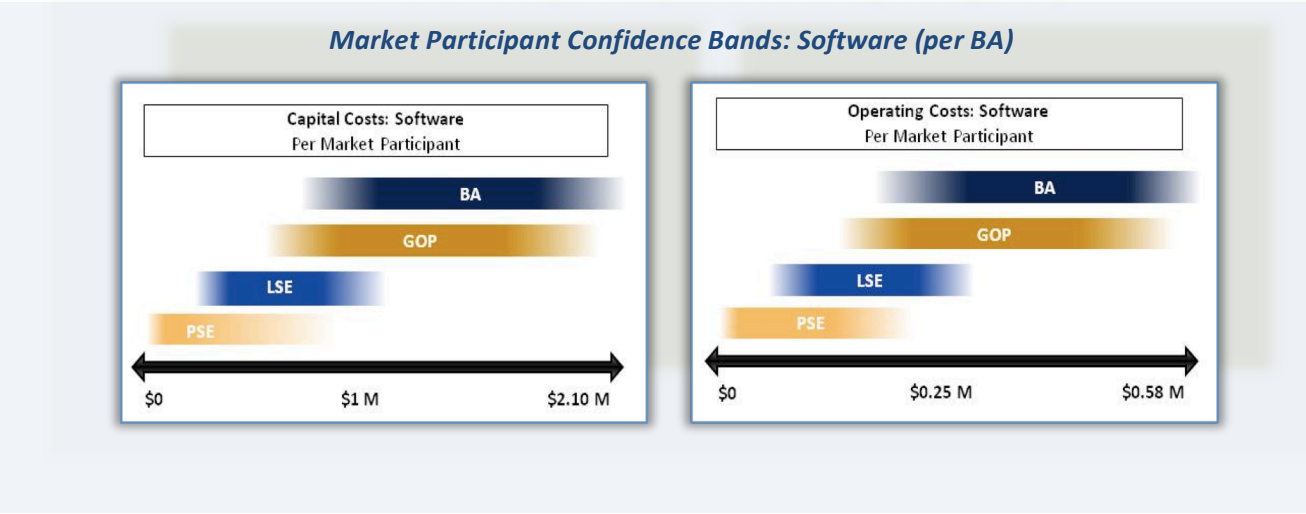


Figure 12 – Market Participant Confidence Bands for Software

5.2 Hardware

To accommodate the software listed above and back office systems, additional hardware may be necessary. The procurement of any hardware will have both initial and ongoing costs. Initial costs include the acquisition of hardware such as servers, desktops, and other hardware. Ongoing costs include upgrades, fees, and other costs required to maintain the hardware.

5.2.1 General Assumption

Cost data was not widely available for Market Participants. As such, the data provided in the SPP Cost Benefit Analysis was assumed to be accurate and applicable to potential EIM participants. Data was verified with SMEs and third party vendors where possible.

Given the large number of variables that contribute to each Market Participant's cost and due to the lack of available cost data for Market Participants, costs for entity types other than BAs could not easily be determined and were not identified in this Cost Analysis.

In determining the cost to individual Market Participants, an assessment and determination of its existing hardware availability and capabilities should be made against the software and staff requirements of EDT.

Operating costs for software was assumed to be 10% of capital costs.

5.2.2 Cost Categories

Servers

This cost is expected to be relative to the complexity of software implemented as a result of EDT. BAs and GOPs will likely have greater server needs than LSEs and PSEs. Server needs should be evaluated by each Market Participant, based on their current server availability and capabilities.

In the high cost estimate, Utilicast assumed an organization would require 20 servers, which were assumed to cost $10,000 each based on costs recently incurred by WECC.

In the low cost estimate, Utilicast assumed an organization would require 10 servers, which were assumed to cost $10,000 each based on costs recently incurred by WECC.

Desktop Computers

Additional desktop computers may be necessary for the market interface, EMS and back office functions.

In the high cost estimate, Utilicast assumed an organization would require 15 desktop computers for staff plus an additional 5 computers for testing efforts. Computers were assumed to cost $4,000 each, an upgrade from costs recently incurred by WECC.

In the low cost estimate, Utilicast assumed an organization would require 4 desktop computers for staff plus an additional computer for testing efforts. Computers were assumed to cost $3,000 each and were based on the costs recently incurred by WECC.

This cost is relative to the staff added to an organization and/or the software requirements as a result of EDT. However, an organization may require little to no additional desktop computers if they already have sufficient hardware available.

Additional Hardware & Equipment

Additional Hardware may be required by the Market Participants to run the EIM and EDT. Additional hardware may include but is not limited to: changes to back-up and disaster recovery systems, power supply and network power management as well as additional memory, racks, routers, surge protection, and switching devices.

This cost is relative to the hardware capital costs spent by a Market Participant. However, an organization may require little to no additional hardware if they have sufficient hardware available.

5.2.3 Findings

Hardware costs for a Market Participant would be largely dependent on the capabilities of existing hardware and its ability to be utilized for EDT. Hardware costs were also largely proportional to the complexity of the software required to support market functions. Hardware costs were not expected to be consistent across different entities.

Hardware capital costs were approximately 11% of the total required start-up costs for Market Participants.

Hardware operating costs were approximately 1% of the total operating costs for Market Participants.

The operating costs of hardware were proportional to the capital cost of hardware acquired.

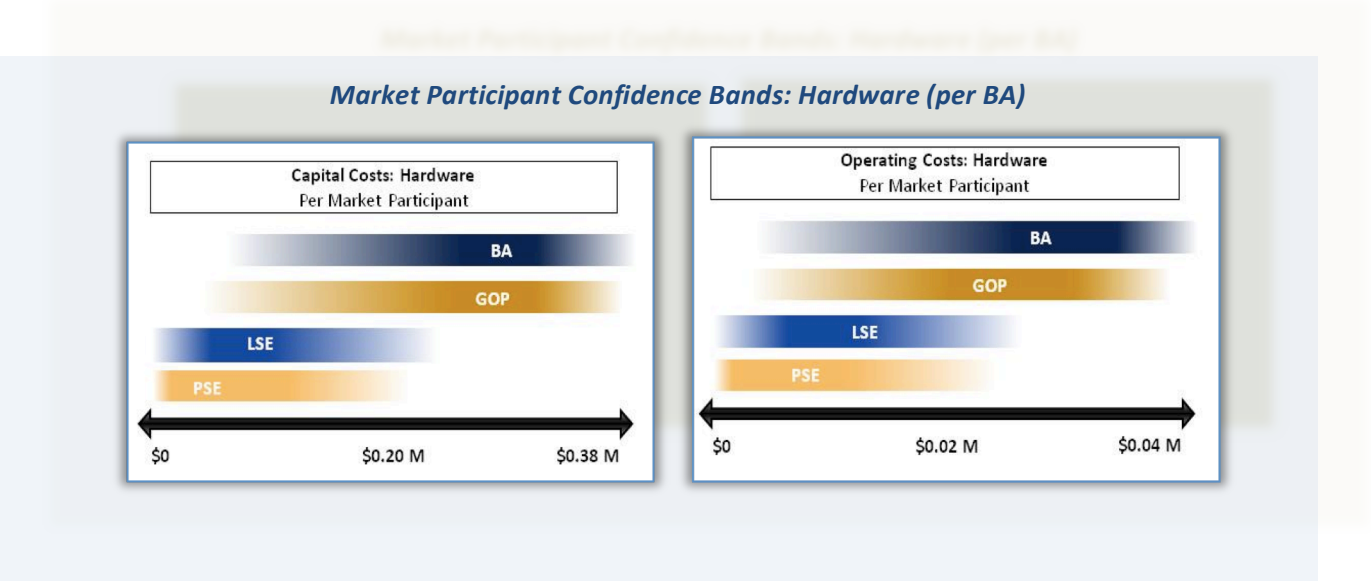


Figure 13 – Market Participant Confidence Bands for Hardware

5.3 Staff

The staff necessary to interface with the Market Operator will vary based on the entity type. BAs and GOPs with additional responsibilities as a result of EDT may find the need for more employees than an LSE or PSE. To some extent, this may require re-tasking of existing staff rather than acquiring new staff.

5.3.1 General Assumption

To capture the range of possibilities, this cost was represented as a range from the addition of no new staff (completely covered by re-tasking) to new staff for each changing function.

The original cost categories included Business Organization, Market Operations Staff, and Settlements Staff. These cost categories were reorganized to be consistent with the data available on Market Participant staffing: Business Staff, IT Staff and Other Staff.

Staff was assumed to be paid an average of $150,000 including salary, benefits and payroll taxes. This amount may need to be adjusted by Market Participants to fit their current pay scale and cost of living requirements.

Pre-operational costs in the high range were assumed to cover signing and relocation bonuses and were assumed to be an average of $30,000 per employee. The low cost range assumed no signing and relocation bonuses would be paid.

5.3.2 Cost Categories

Business Staff

Business staff includes the staff required to carry out the functions of the market. This includes Market Operations staff necessary to enter bids and offers into the market and to make market decisions as well as settlements staff to create shadow settlements, review settlement statements, and ensure accurate accounting. In some instances, these roles may be re-tasked from existing traders or settlements staff.

For the high cost range, Utilicast assumed the addition of 10 FTEs and 2 FTEs for the low cost range.

IT Staff

Increased software and hardware assets will likely result in a need for additional IT staff. This increase is expected to be proportional to the software and hardware capital costs of a Market Participant. It may be possible for a Market Participant to re-task duties of existing IT staff. Each Market Participant should assess its IT requirements and staff levels in determining a cost to their organization.

Utilicast assumed the addition of 3 FTEs for the high cost range and 1 FTE for the low cost range.

Other Staff

Other staff includes the needs for additional support staff such as administrative assistants, HR, communications, security, etc. Each Market Participant should assess the additional demands of EDT on its current staff level in determining a cost to their organization.

Utilicast assumed the addition of 2 FTEs for the high cost range and 1 FTE for the low cost range.

5.3.3 Findings

Staff costs will be largely dependent on the current staff levels of an organization, the ability for staff to be re-tasked and the additional responsibilities to an organization as a result of EDT. Each Market Participant

will likely have a different cost regardless of their entity type. However, in general, LSEs and PSEs would be expected to need less incremental staff and thus have lower start-up and operating costs.

Capital costs related to staff were approximately 10% of the total required start-up costs for Market Participants. These costs ranged from $0 to $0.45M.

Staff operating costs were the largest operating expense for a Market Participant. This cost accounted for approximately 54% of the total operating costs for Market Participants. Though the costs were not calculated, LSEs and PSEs are expected to need less incremental staff and thus have lower operating costs.

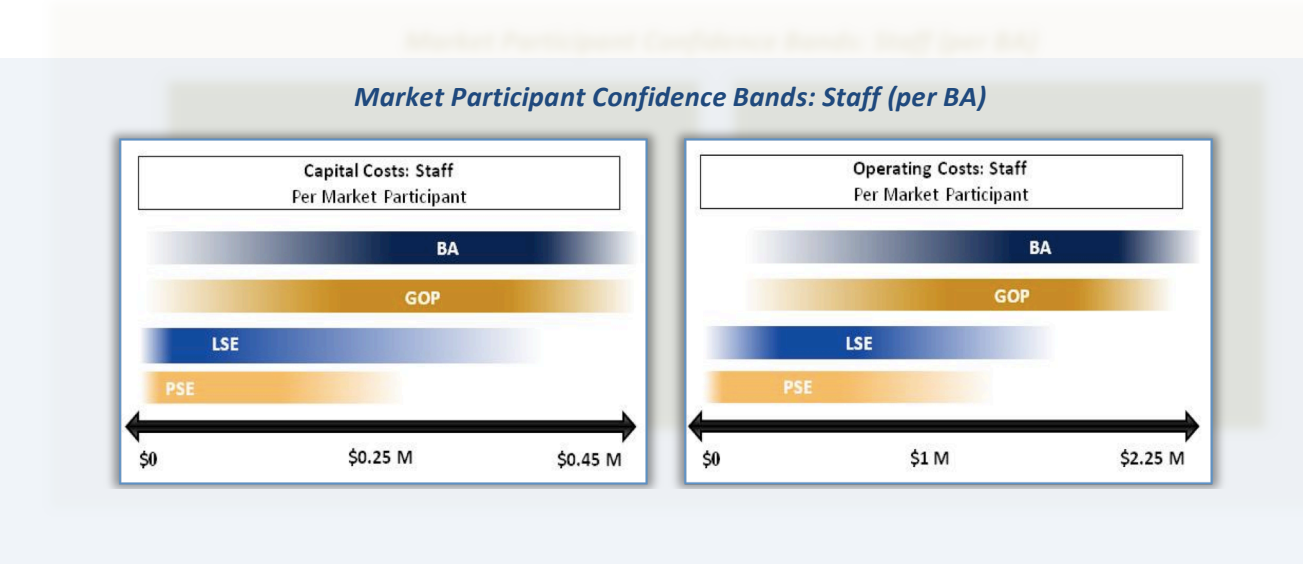


Figure 14 – Market Participant Confidence Bands for Staff

5.4 Other

Other costs will also be incurred as a result of the implementation of EDT.

5.4.1 General Assumptions

Other costs are expected to be unique to each Market Participant.

5.4.2 Cost Categories

Records/Data Retention

Market Participants will be required to maintain records and data for specified amounts of time. The costs associated with data retention and storage, including any requirements for off-site storage were assumed to be nominal in the high cost range. The low cost range assumed there would be no additional cost to an organization as a result of the EDT implementation.

Though BAs and GOPs would be expected to have a larger increase in data, the costs associated with records and data retention will be based more on the organization's current data management capacity.

Other Professional Fees

Market Participants may incur operating costs associated with professionals outside of the organization. These may include outside legal assistance, reliability and economic planning, or market design consultations. Market Participants may also enter into consulting contracts to meet staff augmentation needs or to provide specialized skills and expertise.

The high capital cost was calculated using the high costs for Market Participants anticipating to use professional services as a result of SPP's EIS market. Depending on the Market Participant's use of consultants and need for outside legal counsel, this cost could be one of the largest costs to a participant. However, other Market Participants may not choose to use outside services and thus would eliminate this cost.

The operating costs for professional fees depend on the Market Participant's use of consultants and need for outside legal counsel. The high operating cost was determined based on the highest cost reported by Market Participants participating in SPP's EIS market. The low operating cost was determined using an average of the professional fees expected to be incurred by Market Participants participating in SPP's EIS market

Training

Training will be a major cost to a Market Participant, regardless of the entity. Training may be Web-based or in-person. The capital cost includes the cost of travel and training prior to the launch of the new market. Operational costs account for the cost of travel and training post go-live.

5.4.3 Findings

Other costs Market Participants may incur include travel, training, and professional services. The use of professional services will be the largest driver in Market Participants' other costs. Professional fees, such as the use of consultants or outside legal counsel, accounted for 77% of other costs.

Each Market Participant is expected to have costs unique to its organization and costs may not be consistent across entity types.

Other capital costs were approximately 14% of the total required start-up costs for Market Participants.

Other operating costs were approximately 30% of the total operating costs for Market Participants. Professional fees, such as the use of consultants or outside legal, accounted for 84% of the other operating costs.

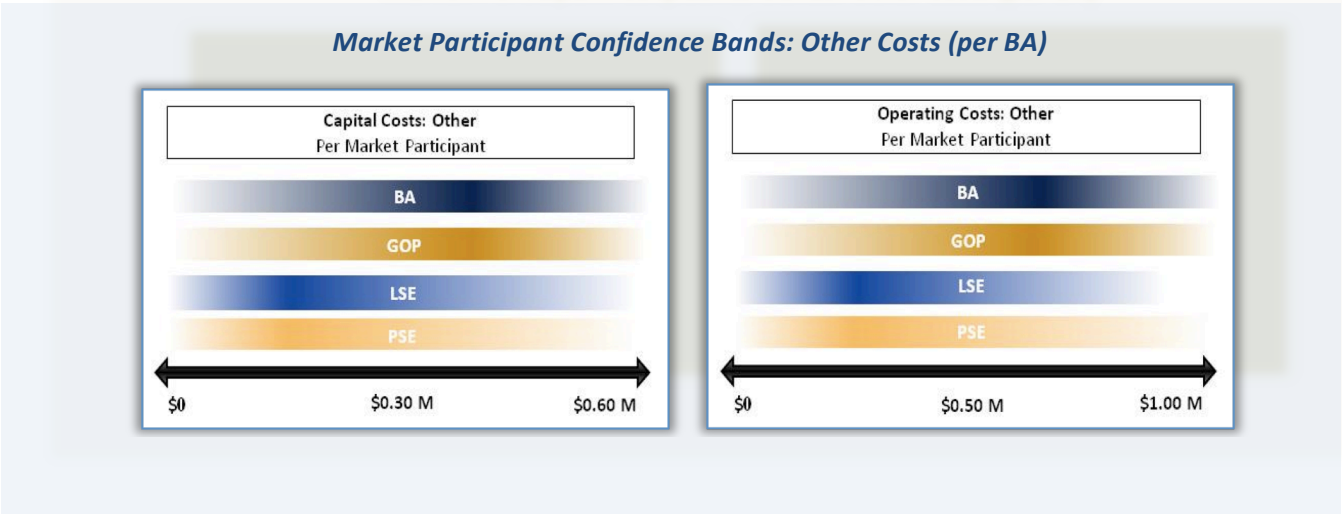


Figure 15 – Market Participant Confidence Bands for Other Costs

Timeline Assumptions

Figure 16 – Potential Timeline

In addition to the large standard deviation associated with the initial costs, the industry has seen a wide horizon of time required to complete these projects. Market implementations are typically complex projects requiring the involvement of staff, stakeholders, government entities, multiple vendors and contractors. Each represents a variable to the project required to successfully implement a market.

Based on Utilicast's experience in implementing markets around the world, WECC stakeholders requested Utilicast to provide insight into the project timeline and the impacts changes to the timeline could have on a project.

The above timeline represents a high level view of the phases required to implement a market. Based on the market complexities of EDT and EIM, as well as efficiencies that can be leveraged from similar markets already implemented, Utilicast assumed EDT would take approximately 3.5 to 5 years to implement.

Costs could increase due to additional time spent on any one phase.

- Prolonged debate on market design issues, delays in vendor delivery or testing progress, FERC orders, and lack of Market Participant participation are all examples of delays to the timeline experienced by other markets and have resulted in increased pre-operational costs.

- Scope creep and continued change requests are typically costly and require additional time to vet, develop and test. This cost is typically a failure of the project to provide adequate time or emphasis on the development and documentation of requirements.

- Poor program governance and/or lack of sponsorship can result in miscommunication, market or technical redesign efforts, ineffective financial controls and delayed decision making, all of which can result in additional time and costs to the project.

- Delays in Market Participant readiness, specifically during the trials phase, can result in a delay to the entire program and add to the program's costs. Market Trials require sufficient engagement by Market Participants in order to run the market systems and produce fruitful results. The inability for Market Participants to participate could skew results or delay the start of the test, resulting in increased carrying costs.

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Appendices

Appendix A.1: Market Operator Software Cost Estimates

(in millions)	High Cost Assumptions	High Cost Estimate			Low Cost Assumptions	Low Cost Estimate		
		Capital	Pre-Operational	Operating		Capital	Pre-Operational	Operating
Security-Constrained Economic Dispatch (SCED)	• Customized design elements • Poor scope governance • Requirements are moderately to significantly different from what was implemented in other markets	20.8	-	3.1	• Cost to transform existing WECC EMS into SPP's existing EIS solution • Includes required EMS upgrades, software components and MOS; excludes Settlements, Scheduling and ECC	4.9	-	1.9
Energy Management System (EMS)	• New EMS and/or significant modeling considerations and requirements to support the EDT market • Utilization of a third party EMS that does not have visibility into the Western Interconnect (i.e. MISO, SPP).	36.0	-	5.4	• Utilize an existing EMS upgraded to meet EIM requirements • Utilize a third party EMS that has visibility into the Western Interconnect (i.e. CAISO, BPA)	1.0	-	0.1
Settlements	• Customize design elements • Poor scope governance • Requirements are moderately to significantly different from what was implemented in other markets	15.0	-	2,3	• Utilize a system that has been implemented in other markets. • Requirements and charge codes cannot differ significantly and no modifications or customizations made to the product.	4.6	-	0.5
Customer Relationship Management (CRM) Software	• Implementation of new CRM system. Includes software licenses, service, implementation, & customization, and administrative personnel	2.0	-	0.2	• Add workflows to existing third party market operator's CRM application.	0.1	-	-
User Interface	• Implementation of Enterprise Interface Application (EIA) including complex web layers and custom applications.	4.8	-	0.5	• Utilize third party MO with incremental license costs • Web logic portal platform • Includes RSA web security	0.5	-	0.1
Interface with	• EIA or interface bus solution				• Point to point interface solution (database to			

Appendix A.1: Market Operator Software Cost Estimates

(in millions)	High Cost Assumptions	High Cost Estimate			Low Cost Assumptions	Low Cost Estimate		
		Capital	Pre-Operational	Operating		Capital	Pre-Operational	Operating
Enhancements to curtailment calculator (ECC)	• Customize design elements • Poor scope governance	0.4	-	0.2	• Customize design elements	0.3	-	0.1
Corporate Applications	• Includes corporate webpage, etariff (including configuration and integration into document management system and customization and hierarchical index for maintenance), document management software, and Oracle.	2.5	-	0.3	• Utilize corporate applications from third party market operator. • Minor modifications to existing applications	0.1	-	-
Additional Tools, Spreadsheets, or Work Aids	• Includes new and custom credit management system as well as spreadsheets and work aids to monitor power flow, registry and other control room analytical tools (flowgate monitoring). • Consultant support in development of work aids and tools.	2.5	-	0.3	• All tools and work aids developed using spreadsheets and in house.	0.3	-	-
Market Design Considerations: Footprint of the Market	• Size of the footprint will impact the size of the MO specifically in regards to staff levels • Incremental cost of having 79 additional FTEs for a new entity in a larger footprint	-	2.4	11.9	• Size of the footprint will impact the size of the MO specifically in regards to staff levels • Incremental cost of 20 additional staff for a third party entity given a larger footprint.	-	-	3.0
Market Design Considerations: Transmission Accounting and/or Reconciliation	• Cost largely dependent on design decisions yet to be determined. The cost estimated in this category is not reflective of the expected design; rather, it provides an estimate of the highest expected cost.	3.7	-	0.6	• Transmission Billing will be settled by the Market Operator utilizing spreadsheets developed in house. The cost estimated in this category is not reflective of the expected design; rather it provides an estimate of the lowest expected cost.	1.0	-	0.1
Market Design Considerations: Documentation	• Preoperational costs comprised of labor costs requited to develop documentation necessary for the market implementation (i.e. protocols, business practice manuals, external specifications and requirements).	-	4.6	-	• Preoperational costs comprised of labor costs requited to develop documentation necessary for the market implementation (i.e. protocols, business practice manuals, external specifications and requirements).	-	1.5	-

Appendix A.2: Market Operator Hardware Cost Estimates

(in millions)	High Cost Assumptions	High Cost Estimate			Low Cost Assumptions	Low Cost Estimate		
		Capital	Pre-Operational	Operating		Capital	Pre-Operational	Operating
Servers	• Production: 100 Server • Integration: 50 servers • Development: 50 Servers • Cost of servers: $10k each and 10% maintenance for operate PLUS 2 enterprise servers to the low estimate a $1M @Each	4.0	-	0.4	• Required regardless if third party or new entity becomes the MO. • Production: 100 Server • Integration: 50 servers • Development: 50 Servers • Cost of servers: $10k each and 10% maintenance for operate	2.0	-	0.5
Desktop Computers	• Cost of computers for new entity and to account for higher end equipment: $4000 per person @ 340 FTEs (includes 15 additional computers for testing, visitors, staff)	1.4	-	-	• Cost of computers required for incremental staff: $3100 per person @ 90 FTEs (includes 4 additional computers for testing, visitors, staff)	0.3	-	-
Additional Hardware	• Additional hardware required for new MO to operate. Assumed to be three times the low cost.	0.3	-	-	• Assume to be negligible for a third party MO.	0.1	-	-
Telecommunications	• Telecommunications costs at equivalent size ISOs/markets.	-	-	3.4	• Operational costs are proportional to the percent increase in capital costs (~10% of high cost)	-	-	0.4

Appendix A.3: Market Operator Infrastructure Cost Estimates

(in millions)	High Cost Assumptions	High Cost Estimate			Low Cost Assumptions	Low Cost Estimate		
		Capital	Pre-Operational	Operating		Capital	Pre-Operational	Operating
Control Room	• Average cost of building a new control room and data center at approximately 33,000 sq ft.	16.3	-	-	• Third Party MO with sufficient facilities to accommodate additional desks for the EIM market. • Operating costs includes charge backs from a third party MO or the costs associated with WECC running the market.	0.2	-	0.4
Control Room Space - 2nd Control Room	• Average cost of building a second control room or back-up control center at approximately 33,000 sq ft.	16.3	-	-	• Build out of an additional control or back-up control center not necessary. • Charge back or operating cost to utilize third party backup control room included in the control room operating costs & fees.	-	-	-
Critical Infrastructure Protection (CIP)	• Implementation of CIP standards plus 2 enterprise servers • Operating cost includes 1 FTE & outside services	2.8	-	0.3	• Utilize a third party MO that is CIP compliant. Includes for additional licenses & software upgrades • Operating cost includes 1 FTE & outside services	0.2	-	0.3
Backup Capability	• Included in Control Room numbers	-	-	-	• Included in Control Room numbers	-	-	-
Heating, ventilating and air conditioning (HVAC)	• Included in Control Room numbers	-	-	-	• Included in Control Room numbers	-	-	-
Space for Office Functions	• Capital costs include furniture, common area equipment, and build out & tenant improvements for 340 FTEs. • Operating costs include cost to operate 30,000 sq ft of office space, utilities, supplies, insurance and other misc costs.	2.0	-	2.8	• Third party MO facilities can accommodate 90 additional desks. • Capital costs include furniture for 90 FTEs. • Operating costs (including incremental supplies, insurance and other misc costs) are below $100,000.	0.4	-	-
Building, Leases & Facilities - Operating Costs	• Operational costs are the average building, leases & facility costs of other ISOs. • Pre-Operational Costs are 2 yrs at half the operating costs and 3 yrs at full operating costs.	-	25.6	6.4	• Pre-Operational cost are 3.5 yrs of the low cost operating expenses. • Assume the third party MO facilities will be leveraged from the start of project. As such the costs are expected to remain constant for 3.5 years during implementation.	-	2.5	-

Appendix A.4: Market Operator Staff Cost Estimates

(in millions)	High Cost Assumptions	High Cost Estimate			Low Cost Assumptions	Low Cost Estimate		
		Capital	Pre-Operational	Operating		Capital	Pre-Operational	Operating
Business Capability and Organizational Design	• Preoperational costs comprised of labor costs required to develop business design, strategy and documentation necessary for the MO (i.e. organizational design, entity strategic plan, roles & responsibilities, departmental SLAs, etc).	-	1.0	-	• Preoperational costs comprised of labor costs required to incorporate the new market into the third party MO (i.e. organizational design, revised entity strategic plan, roles & responsibilities, departmental SLAs, etc).	-	0.3	-
Control Room Staff	• 68 Control Room Staff (includes Manager, shift supervisors, dispatchers, training & procedures) @ $150k per year (includes benefits & payroll taxes) • Pre-Op cost = relocation & signing bonuses of $30K per person	-	2.0	10.2	• Third party MO utilizes current staff and adds 17 operators to staff @ $150k per year • Pre-Op cost = no relocation & signing bonuses	-	-	2.6
Market Engineers	• 55 Market Engineers @ $150k per year (includes benefits & payroll taxes) • Pre-Op cost = relocation & signing bonuses of $30K per person	-	1.7	8.3	• Third party MO utilizes current staff and adds 10 staff @ $150k per year • As in the EMS software assumptions, the third party MO has visibility into the Western Interconnect and does not require extensive additions to Modeling staff • Pre-Op cost = no relocation & signing bonuses	-	-	1.5
Energy Management System (EMS) engineers	• 16 EMS Engineers @ $150k per year (includes benefits & payroll taxes) • Pre-Op cost = relocation & signing bonuses of $30K per person	-	0.5	2.4	• Third party MO utilizes current staff and adds 4 staff @ $150k per year • Pre-Op cost = no relocation & signing bonuses	-	-	0.6
Training Staff	• 5 Training Staff @ $150k per year (includes benefits & payroll taxes) • Pre-Op cost = relocation & signing bonuses of $30K per person	-	0.2	0.8	• Third party MO utilizes current staff and adds 1 staff @ $150k per year • Pre-Op cost = no relocation & signing bonuses	-	-	0.2

Appendix A.4: Market Operator Staff Cost Estimates

(in millions)	High Cost Assumptions	High Cost Estimate			Low Cost Assumptions	Low Cost Estimate		
		Capital	Pre-Operational	Operating		Capital	Pre-Operational	Operating
Settlements Staff	• 20 Market Settlement Staff (including disputes) @ $150k per year (includes benefits & payroll taxes) • Pre-Op cost = relocation & signing bonuses of $30K per person	-	0.6	3.0	• Third party MO utilizes current staff and adds 10 staff @ $150k per year • As in settlement software assumptions, assume charge code and settlement processes are not moderately to significantly different from current market. • Pre-Op cost = no relocation & signing bonuses	-	-	1.5
Regulatory Staff	• 5 Regulatory Staff @ $150k per year (includes benefits & payroll taxes) • Pre-Op cost = relocation & signing bonuses of $30K per person	-	0.2	0.8	• Third party MO utilizes current staff and adds 1 staff @ $150k per year • Pre-Op cost = no relocation & signing bonuses	-	-	0.2
Market Monitor	• Market Monitor functions outsourced to an Independent Market Monitor	-	-	7.0	• Third party MO utilizes current staff and adds 5 staff @ $150k per year to complete functions in house • Pre-Op cost = no relocation & signing bonuses	-	-	0.8
Stakeholder Support	• 6 Stakeholder support Staff @ $150k per year (includes benefits & payroll taxes) • Pre-Op cost = relocation & signing bonuses of $30K per person	-	0.2	0.9	• Third party MO utilizes current staff and adds 2 staff @ $150k per year • Pre-Op cost = no relocation & signing bonuses	-	-	0.3
Legal Staff	• 15 Legal Staff @ $150k per year (includes benefits & payroll taxes) • Pre-Op cost = relocation & signing bonuses of $30K per person • Includes a mix of external legal counsel	-	0.5	2.3	• Third party MO utilizes current staff and adds 4 staff @ $150k per year • Pre-Op cost = no relocation & signing bonuses	-	-	0.6
IT Staff	• 75 IT Staff @ $150k per year (~30 of total staff) • (includes benefits & payroll taxes) • Pre-Op cost = relocation & signing bonuses of $30K per person	-	2.3	11.3	• Third party MO utilizes current staff and adds 20 staff @ $150k per year • Pre-Op cost = no relocation & signing bonuses	-	-	3.0

Appendix A.4: Market Operator Staff Cost Estimates

(in millions)	High Cost Assumptions	High Cost Estimate			Low Cost Assumptions	Low Cost Estimate		
		Capital	Pre-Operational	Operating		Capital	Pre-Operational	Operating
Management Staff	• 10 Management Staff (includes CEO, CIO, CFO, COO, and Sr Directors) @ $300K per yr (includes benefits & payroll taxes) • Pre-Op cost = relocation & signing bonuses of $100K per person	-	1.0	3.0	• Third party MO utilizes current staff and adds 4 staff @ $300k per year • Pre-Op cost = relocation & signing bonuses of $100K per person	-	0.4	1.2
Additional Support Staff	• 50 Additional Support Staff including finance (10), HR (5), communications (5), and security (15) @ $150k per year (includes benefits & payroll taxes) • Pre-Op cost = no relocation & signing bonuses	-	-	7.5	• Third party MO utilizes current staff and adds 10 staff @ $150k per year • Pre-Op cost = no relocation & signing bonuses	-	-	1.5

Appendix A.5: Market Operator Overhead Cost Estimates

(in millions)	High Cost Assumptions	High Cost Estimate			Low Cost Assumptions	Low Cost Estimate		
		Capital	Pre-Operational	Operating		Capital	Pre-Operational	Operating
Records/Data Retention	• On-site storage	-	-	0.2	• Off-site storage	-	-	0.1
Financing Costs	• Finance entire high cost Capital and Pre-Op Expense at 7% • Not amortized over an assumed term	-	14.4	-	• Finance entire low cost Capital and Pre-Op Expense at 7% • Not amortized over an assumed term	-	1.7	-
Insurance	• Highest insurance expense of other ISOs.	-	-	3.0	• Insurance costs of other ISOs of comparable size and market design modified to include specific needs in the west (i.e. earthquake insurance)	-	-	0.8
External audits and internal audit co-sourcing	• Estimated high cost for third party SAS 70 & financial audits	-	-	0.7	• Estimated low cost for third party SAS 70 & financial audits	-	-	0.5
Other Professional Fees	• Average professional fees of other ISOs	-	-	12.0	• Third party MO covers most professional fees as a part of normal operating expenses. 25% of high costs.	-	-	3.0
Other Operating Costs	• Average additional costs of other ISOs (includes travel, training, meetings, dues & fees, and other operating costs) • Preoperational costs include travel, training, meetings, etc for 20 FTEs for 2 yrs at $1500 per month.	-	0.7	16.5	• Utilize third party or WECC as MO. Half the cost of the average costs of other ISOs (includes travel, training, meetings, dues & fees, consulting contracts, and other operating costs) • Preoperational costs include travel, training, meetings, etc for 10 FTEs for 2 yrs at $1500 per month.	-	0.4	8.3

Aggregate Market Participant Costs

Both Footprint Scenarios

Cost Category	BA High Costs				BA Low Costs			
	Footprint 1		Footprint 2		Footprint 1		Footprint 2	
	Capital Costs	Operational Costs	Capital Costs	Operational Costs	Capital Costs	Operational Costs	Capital Costs	Operational Costs
Software	$71.40	$19.72	$39.90	$12.18	$34.00	$6.80	$19.00	$4.20
Hardware	$12.92	$1.29	$7.22	$0.80	$5.61	$0.56	$3.14	$0.35
Staff	$15.30	$76.50	$8.55	$47.25	-	$20.40	-	$12.60
Other	$20.40	$34.00	$11.40	$21.00	$1.70	$18.70	$0.95	$11.55
TOTAL	$120.02	$131.51	$67.07	$81.23	$41.31	$46.46	$23.09	$28.70

Cost Category	BA High Costs		BA Low Costs	
	Capital Costs	Operational Costs	Capital Costs	Operational Costs
Software	$2.10	$0.58	$1.00	$0.20
Hardware	$0.38	$0.04	$0.17	$0.02
Staff	$0.45	$2.25	-	$0.60
Other	$0.60	$1.00	$0.05	$0.55
TOTAL	$3.53	$3.87	$1.22	$1.37

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Appendix B.2: Market Participant Software Cost Estimates

Cost Categories	Assumptions	Entity Types Expected to incur cost	High Cost Estimate (in millions)		Low Cost Estimate (in millions)	
			Capital	Operating	Capital	Operating
EMS Upgrades	▪ AGC and SCADA Upgrades and Related Engineering	▪ BA ▪ GOP	0.70	0.14	0.25	0.05
Balancing Authorities - Receive NSI signals	▪ Data and Communications	▪ BA	0.20	0.04	0.10	0.02
Generators - receive dispatch signals	▪ Data and Communications	▪ BA ▪ GOP	0.20	0.04	0.10	0.02
Settlements - Shadow Settlements	▪ High Cost: EIS Charge Types plus Transmission Billing extensions ▪ Low Cost: Manual (Excel)	▪ BA ▪ GOP ▪ LSE ▪ PSE	0.10	0.18	0.10	0.02
Interface with existing data/software	▪ High Cost: Two consultant years ▪ Low Cost: One consultant year	▪ BA ▪ GOP ▪ LSE ▪ PSE	0.60	0.12	0.30	0.06
Communications interface with the MO	▪ High Cost: One consultant year ▪ Low Cost: One half consultant year	▪ BA ▪ GOP ▪ LSE ▪ PSE	0.30	0.06	0.15	0.03
Total Estimated Software Cost			**$2.10**	**$0.58**	**$1.00**	**$0.20**

Appendix B.3: Market Participant Hardware Cost Estimates

Cost Categories	Assumptions	Entity Types Expected to incur cost	High Cost Estimate (in millions)		Low Cost Estimate (in millions)	
			Capital	Operating	Capital	Operating
Servers	• $10K per server • High Cost: 20 servers • Low Cost: 10 servers	• BA • GOP • LSE • PSE	0.20	0.02	0.10	0.01
Desktop Computers	• $2K per computer • High Cost: 15 desktops plus 5 test • Low Cost: 4 desktops plus 1 test	• BA • GOP • LSE • PSE	0.08	0.01	0.02	0.00
Additional Hardware	• Network and other devices	• BA • GOP • LSE • PSE	0.10	0.01	0.05	0.01
Total Estimated Hardware Cost			**$0.38**	**$0.04**	**$0.17**	**$0.02**

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Appendix B.4: Market Participant Staff Cost Estimates

Cost Categories	Assumptions	Entity Types Expected to incur cost	High Cost Estimate (in millions)		Low Cost Estimate (in millions)	
			Capital	Operating	Capital	Operating
Business Staff	▪ $150K per employee (including benefits and taxes) ▪ High Cost: 10 incremental FTEs with $30K bonus & relocation ▪ Low Cost: 2 incremental FTEs	▪ BA ▪ GOP ▪ LSE ▪ PSE	0.30	1.50	0.00	0.30
IT Staff	▪ $150K per employee (including benefits and taxes ▪ High Cost: 3 incremental FTEswith $30K bonus & relocation ▪ Low Cost: 1 incremental FTEs	▪ BA ▪ GOP ▪ LSE ▪ PSE	0.09	0.45	0.00	0.15
Other	▪ $150K per employee (including benefits and taxes ▪ High Cost: 2 incremental FTEs ith $30K bonus & relocation ▪ Low Cost: 1 incremental FTEs	▪ BA ▪ GOP ▪ LSE ▪ PSE	0.06	0.30	0.00	0.15
Total Estimated Staff Cost			**$0.45**	**$2.25**	**$0.00**	**$0.60**

Appendix B.5: Market Participant Other Cost Estimates

Cost Categories	Assumptions	Entity Types Expected to incur cost	High Cost Estimate (in millions)		Low Cost Estimate (in millions)	
			Capital	Operating	Capital	Operating
Training	▪ Travel Costs and outside training	▪ BA ▪ GOP ▪ LSE ▪ PSE	0.10	0.10	0.05	0.05
Records/Data Retention		▪ BA ▪ GOP ▪ LSE ▪ PSE	0.00	0.10	0.00	0.00
Other Professional Fees	▪ High Cost: Average cost for MPs anticipating to use professional services as a result of SPP's EIS market ▪ Low Cost: Average MP cost for SPP EIS market	▪ BA ▪ GOP ▪ LSE ▪ PSE	0.50	0.80	0.00	0.50
Total Estimated Other Cost			**$0.60**	**$1.00**	**$0.05**	**$0.55**

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Appendix C.1: Comparison of Current Market Functions Across Market Operators

		CAISO	ERCOT	ISO-NE	MISO	NYISO	PJM	SPP	Proposed EDT-EIM
Transmission	Service Provider (Tariff Admin)	X	X	X	X	X	X	X	
	Reliability Coordinator	X	X	X	X	X	X	X	Dependent on the MO
	Transmission Planner	X	X	X	X	X	X	X	
	Balancing Authority	X	X	X	X	X	X	Planned	
Wholesale Power Markets	Real-Time Market	X	X	X	X	X	X	X	Proposed
	Real-Time Market LMP	X	X	X	X	X	X	Planned	
	Day-Ahead Market	X	X	X	X	X	X	Planned	
	Virtual Bidding	X	X	X	X	X	X	Planned	
	Congestion Market	X	X	X	X	X	X	Planned	
	Regulation Market	X	X	X	X	X	X	Planned	
	Operating Reserves Market	X	X	X	X	X	X	Planned	
	Forward Capacity Market			X	Planned	X	X		
	Demand Response Market	X	X	X	X	X	X		

*The chart above is a modification of Todd Ramey's "EIM Start-Up & Exiting Issues" presentation dated March 7-8, 2011.