



Preliminary Draft—Grid West Cost Estimate

Grid West Cost Estimate

For Discussion Purposes Only

Last Updated On – August 24, 2005

1.0 Executive Summary

As a part of the Grid West Technical Support effort, The Structure Group (“Structure”) performed a detailed bottom-up cost estimate for the startup capital costs and annual operating expenses associated with the implementation of the Grid West Basic Features. The estimate is a result of over six-months of detailed research and benchmarking. The purpose of this white paper is to summarize the Grid West cost estimate. It provides an overview of the approach, the estimation tool, the proposed organization design, and the proposed implementation plan used to develop the estimate.

Highlights of this paper include:

- The Grid West cost estimate is a bottom-up estimate based on the functionality defined during a 12-month conceptual design effort (design layers 1 and 2).
- The proposed functional scope for Grid West as an Independent Transmission Provider under Order No. 888 is smaller than that of existing regional transmission organizations approved under Order No. 2000 (e.g., no day-ahead energy market or unit commitment, etc.)
- A structured approach--which included vendor quotes, facility surveys, and industry benchmarking--was used to develop the estimate.
- A detailed estimation tool to modify assumptions and perform sensitivity analysis was developed to calculate Grid West’s startup costs and annual operating expenses.
- To verify results, the bottom-up cost estimates for various components were benchmarked, where possible, against similar components of existing transmission organizations (e.g., facility costs, labor costs, system costs, etc.)
- To estimate labor costs, a preliminary organization design was developed. The proposed organization consists of 6 divisions, 24 departments, and 305 full time employees. The number of FTEs is less than many RTOs, which is consistent with Grid West’s smaller scope.
- A 24-month phased implementation, starting immediately following Decision Point 4, has been developed to roll out the Grid West Basic Features functionality.
- The cost estimate assumes both the market design and the protocols are ready for implementation (design layers 3 and 4 complete), the operational board has been selected, all requests for proposals are complete and the vendor selection process is ready to begin at Decision Point 4.
- Startup costs, which include both capital expenditures and pre-operational expenses, are estimated to be \$133 million.



Preliminary Draft—Grid West Cost Estimate

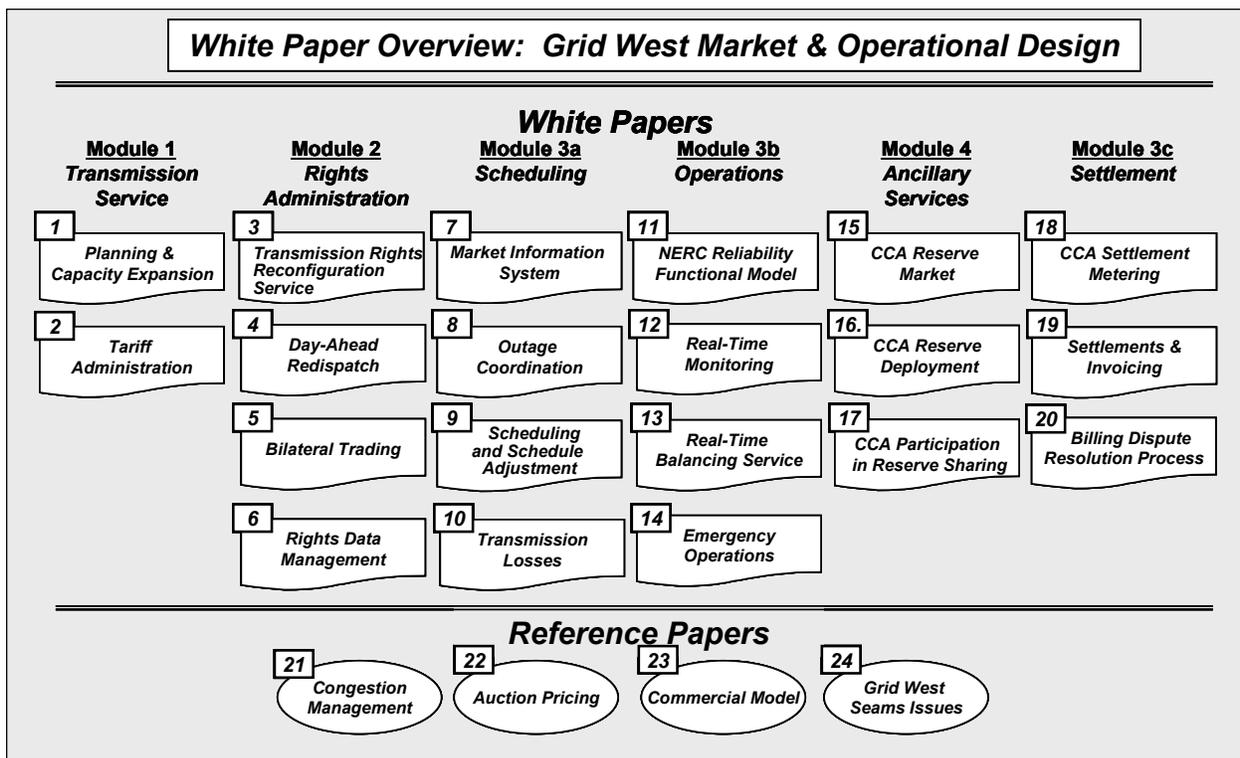
- Annual operating expenses, not including expenses associated with the financing of the startup costs, are estimated to be \$66 million.

2.0 Background

As a part of the Grid West Technical Support effort, Structure was retained to develop a conceptual market design and a bottom-up cost estimate. The purpose of the cost estimate is to provide the region with an initial estimate of the costs associated with implementing the proposed Grid West Basic Features. This project is one of several work streams intended to provide input into the decision making process for Decision Point 2.

Structure’s cost estimate is a bottom-up estimate based on functionality defined during a conceptual design effort carried out in 2004 and 2005. The twelve-month effort was divided into multiple layers. In the first layer, Structure helped define the overall Grid West processes and how they might be sequenced. As a part of the second layer, Structure assisted in further definition of the proposed functionality in conjunction with the Transmission Services Liaison Group and Consolidated Control Area Working Group. The objectives of layer 2 design were to ensure that the proposed functionality was conceptually consistent and described in sufficient detail to support the cost estimate. As a result of the design effort, 23 design white papers were developed (#2 and #23 were discussed but not completed). The inventory is summarized in Figure 2.0.

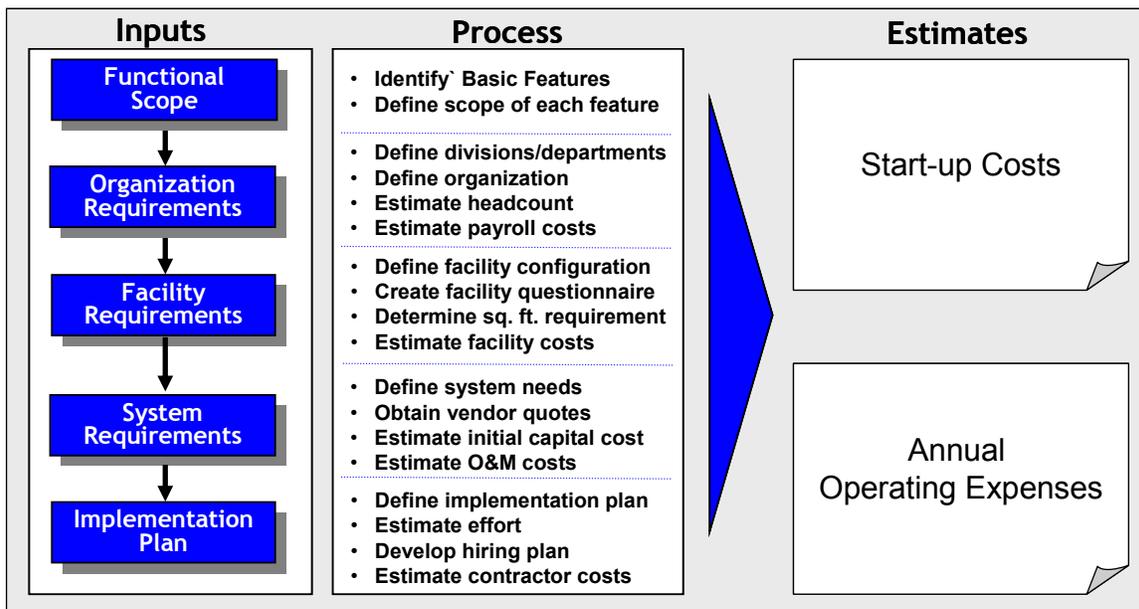
Figure 2.0 – White Paper Inventory



3.0 Approach

Structure started work on the Grid West cost estimate during layer 2 of the design effort. To develop the cost estimate, we applied the following approach shown in Figure 3.0.

Figure 3.0 – Approach



Over a period of six months, Structure met with participants, interviewed vendors, developed a sample organization, and drafted an implementation plan. As the study was being developed, Structure presented its findings to both the Transmission Services Liaison Group and the Consolidated Control Area Working Group. Additionally, Structure met with the authors of the RTO West Stage 2 cost estimate that had been previously developed. The feedback from these groups is reflected in our estimate.

4.0 The Numbers

Our estimate is broken into three parts: 1) startup capital costs, 2) annual operating expenses, 3) representative revenue requirements. Startup capital costs include both capital costs (e.g., hardware, software, etc.) and pre-operational expenses (e.g., labor costs, lease costs, etc.). Annual operating expenses include operational costs (e.g. labor and benefits, lease costs, etc.), but do not include the expenses associated with

Preliminary Draft—Grid West Cost Estimate

the financing of the startup costs. The representative revenue requirement is the total of the annual operating expense and the costs associated with financing the startup and development costs.

4.1. Startup Capital Costs

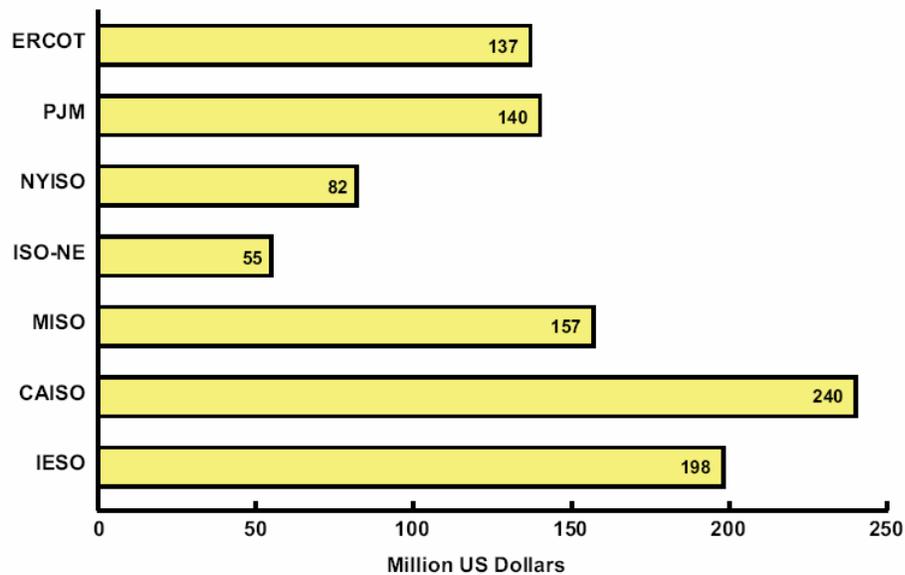
To implement Grid West Basic Features, the developmental board will have to hire employees, procure information systems, lease facilities, and obtain outside services. Some cost items, such as the procurement of systems, are referred to as capital expenditures. Others, such as Grid West labor costs prior to market start, are referred to as pre-operational expenses. Together, capital expenditures and pre-operational expenses represent the total startup capital costs associated with the implementation of the Grid West Basic Features. The largest startup capital cost items include information systems, Grid West labor expenses, and outside services. Table 4.1 summarizes our findings.

Table 4.0 – Startup Costs

Cost Category	Estimate	% of Total
Capital Expenditures		
- Systems	\$40,111,000	30%
- Outside Services	\$18,648,000	14%
- Data, Voice, Network	\$8,514,000	6%
- Facilities (Leasehold Improvements)	\$5,436,000	4%
Total	\$72,709,000	55%
Preoperational Expenses		
- Grid West Labor	\$32,392,000	25%
- Facilities	\$6,074,000	5%
- Hardware/Software Expenses	\$1,384,000	1%
- Employee Expenses	\$1,442,000	1%
- Insurance	\$1,500,000	1%
- Other	\$1,345,000	1%
Total	\$44,137,000	33%
Interest During Construction/Flotation	\$15,836,000	12%
Total Startup	\$132,682,000	

After completing our bottom-up estimate of startup capital costs, we compared our findings with existing transmission organizations. Figure 4.1 summarizes the start up-costs for various RTOs/ISOs.

Figure 4.1 – Startup Costs Benchmarking



Source: Cambridge Energy Research Associates.
50201-4

Many of the startup cost categories, including labor, facilities, and outside services are dependent on the implementation plan. Delays in implementation can result in significant increases in each of these cost categories. Additional information regarding the implementation plan can be found in section 8.0.

4.2. Annual Operating Expenses

Annual operating expenses include those associated with the operation of Grid West Basic Features. The most significant cost driver during operations is Grid West labor costs, representing 54% of the total operating expenses with an additional 5% for employee bonuses and recruiting for an overall total of 59%. Table 4.2 summarizes our findings.

Table 4.2 – Annual Operating Expenses

Cost Category	Estimate	% of Total
Annual Operating Expenses		
- Grid West Labor & Benefits	\$38,626,000	59%
- System Expenses	\$5,232,000	7%
- Data ,Voice, & Network	\$2,967,000	4%
- Outside Services	\$4,186,000	6%
- Capital Enhancements	\$4,011,000	6%
- Facilities	\$3,569,000	5%
- Employee Expenses	\$2,135,000	3%
- Insurance	\$2,000,000	3%
- Other	\$2,953,000	3%
Operating Expense	\$65,679,000	

After completing an analysis of the costs, we compared our findings with other transmission organizations. Using 2004 and 2005 budget numbers, we compared several key cost categories. Table 4.3 shows our findings.

Table 4.3 – Annual Operating Expenses

Cost Driver	Grid West	Average RTO
Employees	~ 54%	~ 45-55%
Outside Services	~ 13%	~ 20-25%
Systems	~ 8%	~ 7-10%
Facilities	~ 5%	~ 3-8%
Data, Voice, Network	~ 5%	~ 4%
Insurance	~ 3%	~ 2-6%
Training & Travel	~ 3%	~ 3%
Other	~ 9%	~ 4-8%

4.3. Representative Revenue Requirements

The scope of our work did not include the development of an annual revenue requirement. We were asked, however, to provide an illustrative example of the potential total carrying costs and a per-unit cost. In addition to the start-up costs we estimated, the utilities funding Grid West development estimate that they will have funded approximately \$36,000,000 before Decision Point 4 (\$16,000,000 to date and ~\$20,000,000 for activities between Decision Points 2 and 4.) To estimate a representative revenue requirement, we assumed a 10-year amortization period for startup and development costs. Furthermore, we assumed startup costs would be financed using bonds issued at a coupon rate of 5.5%. Table 4.3 summarizes our findings.

Table 4.3 – Representative Revenue Requirement

Cost Category	Estimate	% of Total
Carrying Costs		
- Annual Operating Expense	\$65,679,000	72%
- Amortization of startup costs (over 10 years)	~ 13,268,000**	15%
- Interest on startup costs (5.5%)	~ \$6,574,000	7%
- Amortization of development costs (10 years)	~ \$3,600,000**	4%
- Interest on startup costs (5.5%)	~ \$1,782,000	2%
Revenue Requirement	\$90,900,000	
Annual Load (MWh)	291,000,000	
\$/MWh	\$0.31/MWh	

5.0 Organization Design

To estimate labor costs, Structure reviewed the resource requirements for the proposed functionality and developed a preliminary organization design. A sample of this analysis is provided in Figure 5.0.

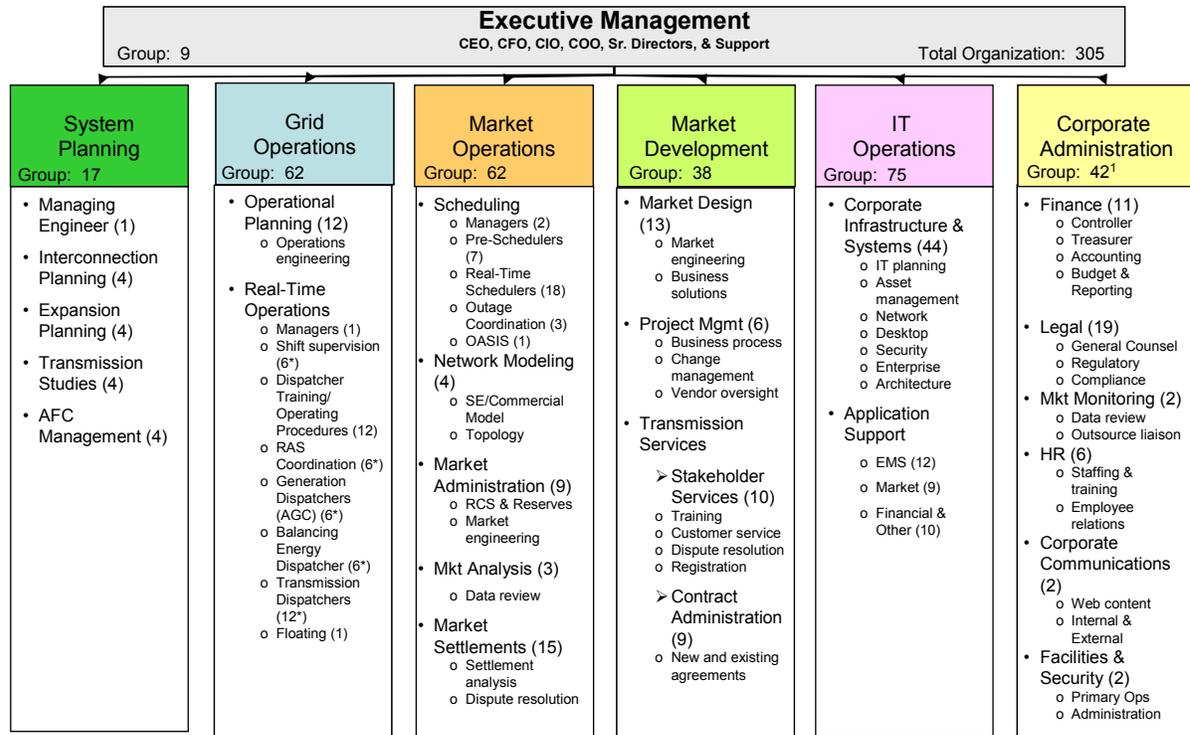
Figure 5.0 – Sample Resource Analysis (Grid Operations)

Functional Scope & Assumptions		Cost Factors	
<ul style="list-style-type: none"> Transmission Authority responsibilities for the GWMT and Balancing Authority responsibilities for CCA. RAS functionality similar to BPA Coordinate emergency operations together with PNSC/TO Operates Balancing Energy and Reserve Markets for CCA 		<ul style="list-style-type: none"> Number of desks (aka “24x7” positions) Staffing of “24x7” positions Staffing of backup facility Control room facilities (consoles, mapboard, etc.) 	
Resource Requirements			
Role	Description	Type	Count
Real-time Manager	Manages real-time grid operations	Non-shift	1
Dispatcher Training	Perform dispatcher training	Non-shift	6
Documentation/Business Process	Maintain operating procedures and business process doc.	Non-Shift	6
Shift Supervisor	Supervises control room	Shift	6
RAS Coordinator	Coordinates operation of RAS	Shift	6
Generation Dispatcher	Oversees generation control and dispatch activities	Shift	6
Balancing Energy Dispatcher	Oversees the balancing energy and reserve markets	Shift	6
Transmission Dispatcher	Oversees transmission system operations	Shift	12
Floating Resource	Assists real-time manager on various activities	Non-Shift	1
Totals			50

Based on our resource analysis, Structure developed a preliminary organization, consisting of 24 departments and 305 employees within a total of six divisions. The six divisions include: System Planning, Grid Operations, Market Operations, Market Services and Development, IT Operations, and Corporate Administration. Figure 5.1 below shows the proposed design.

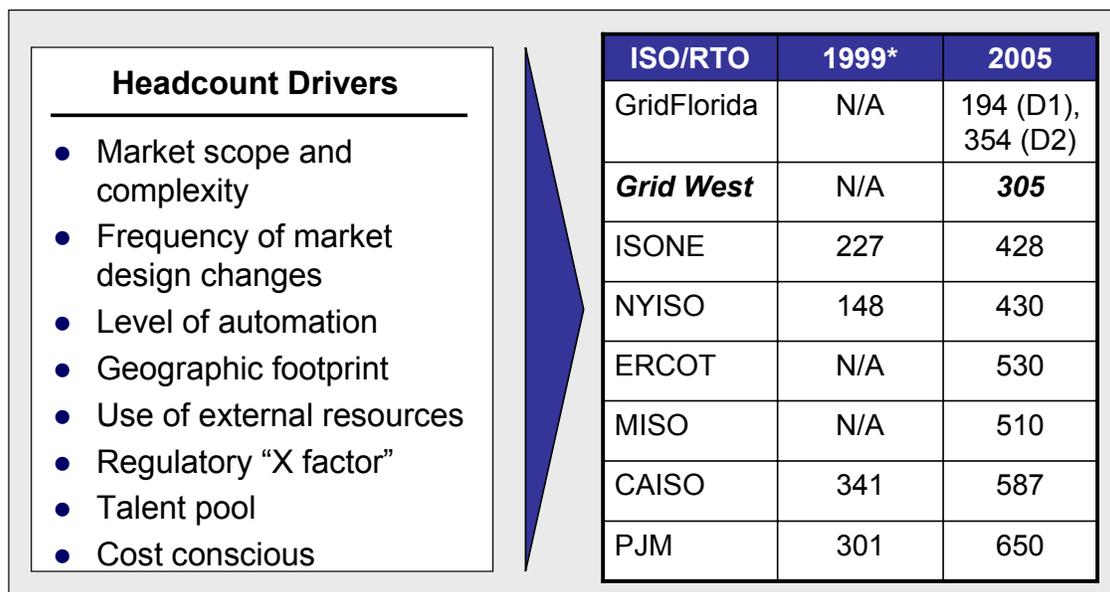
Preliminary Draft—Grid West Cost Estimate

Figure 5.1 – Proposed Organization Design



The organization design was benchmarked against existing RTOs/ISOs. Figure 5.2 below shows the results of our employee headcount benchmarking.

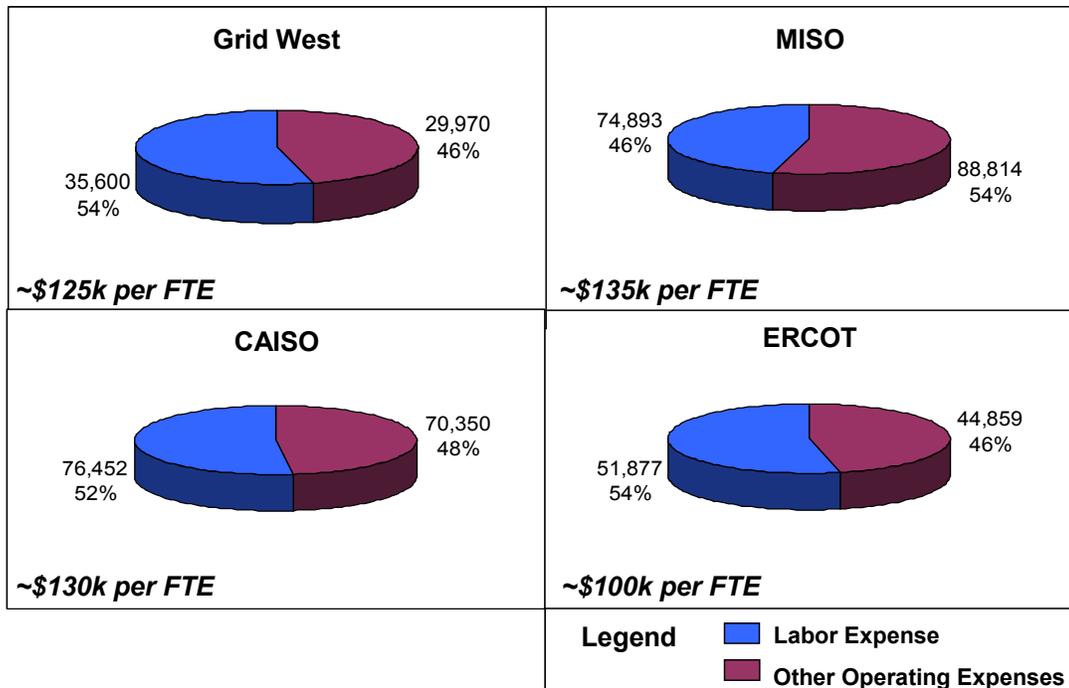
Figure 5.2 – Employee Benchmark



The number of full-time resources (“FTEs”) is smaller than most RTOs/ISOs; however, we believe this is consistent with Grid West’s minimalist approach. For example, we performed a side-by-side analysis of CAISO departments and headcount with Grid West department and headcount. In most cases the differences in headcount are directly attributable to functional scope. Information on the assumptions related to the organization design can be found in Section 10.

To calculate the total labor costs, we developed a tiered compensation model. Each of the 305 FTEs were assigned to one of eleven salary levels and assigned to one of four start dates. This information was used to calculate both the startup and on-going labor costs. We benchmarked the total estimated average salary against existing RTOs/ISOs. The results are included in Figure 5.3.

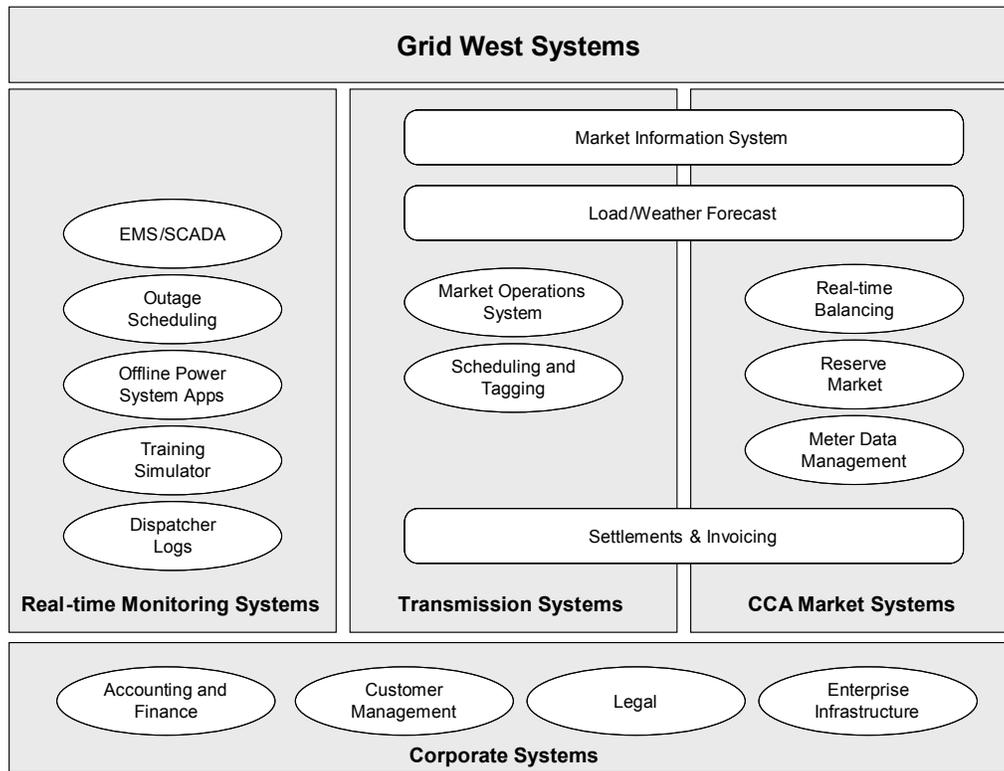
Figure 5.3 – Annual Salary Benchmark



6.0 System Inventory

As a part of the Consolidated Control Area Working Group sessions, Structure helped identify the systems required to operate the Grid West Basic Features. Systems were divided into four categories, including: 1) real-time monitoring, 2) transmission systems, 3) CCA market systems, 4) corporate systems. The proposed system inventory is summarized in Figure 6.0.

Figure 6.0 – Proposed System Inventory



Using this system inventory, Structure contacted experienced system vendors to obtain budgetary estimates for hardware and software systems. Vendors were provided with descriptions of the required solution, as well as any supporting design white papers. Over a dozen vendors replied with budgetary quotations, including hardware, software, and configuration costs. The results have been aggregated to a system group level and are summarized in Figure 6.1.

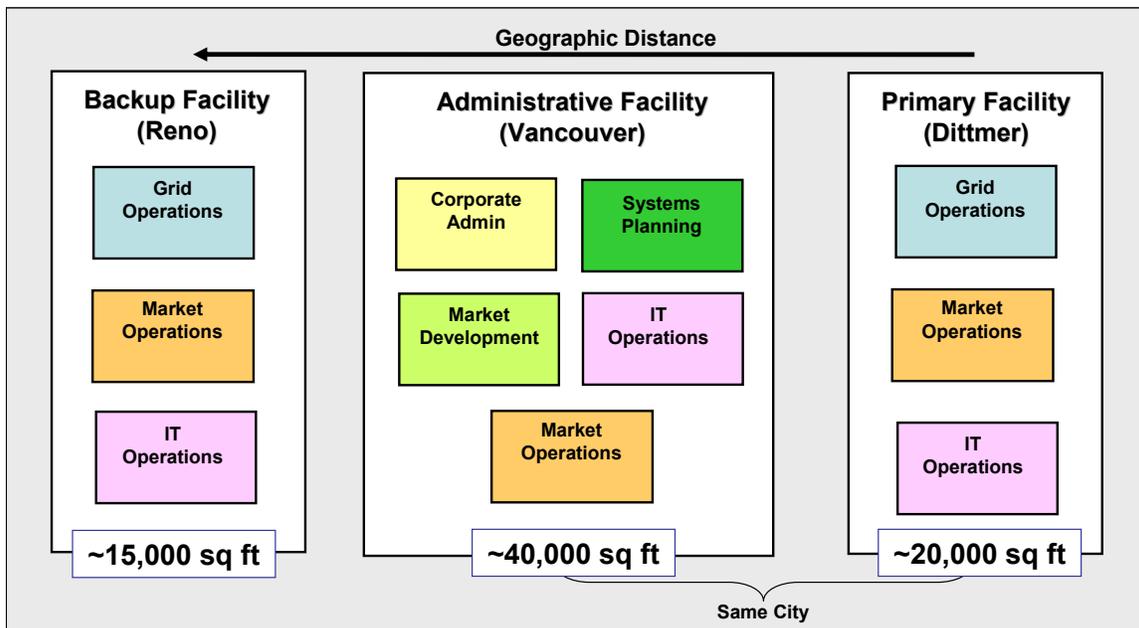
Figure 6.1 – System Costs

System Group	Software	Hardware Primary	Hardware Backup	Total
Real-time monitoring	\$8,142,000	\$2,472,000	\$1,610,000	\$12,224,000
Transmission systems	\$8,222,000	\$1,067,000	\$1,067,000	\$10,356,000
CCA market systems	\$7,935,000	\$1,118,000	\$1,118,000	\$10,172,000
Corporate systems	\$5,204,000	\$2,155,000	\$0	\$7,359,000
Total	\$29,503,000	\$6,813,000	\$3,795,000	\$40,111,000

7.0 Facilities

The facility analysis was based on several key assumptions provided to us at the start of the effort. First, our analysis assumed Grid West would use existing (“brownfield”) sites for both the primary and backup control facilities. For the primary control facility, Grid West would use available space within the Bonneville Power Administration’s (“BPA”) Dittmer facility. Additionally, for the backup control center, Grid West would use existing space at the Sierra Pacific Power Company’s (“SPPC”) Reno facility. Given the distance between the primary and backup control centers and the finite space within the Dittmer facility, we assumed an administrative building would be required. Thus, we used a three facility configuration to calculate the Grid West facility costs. For estimate purposes only, the divisions identified in the proposed organization design were assigned to one or more of the facilities. The results are summarized in Figure 7.0.

Figure 7.0 – Facility Configuration



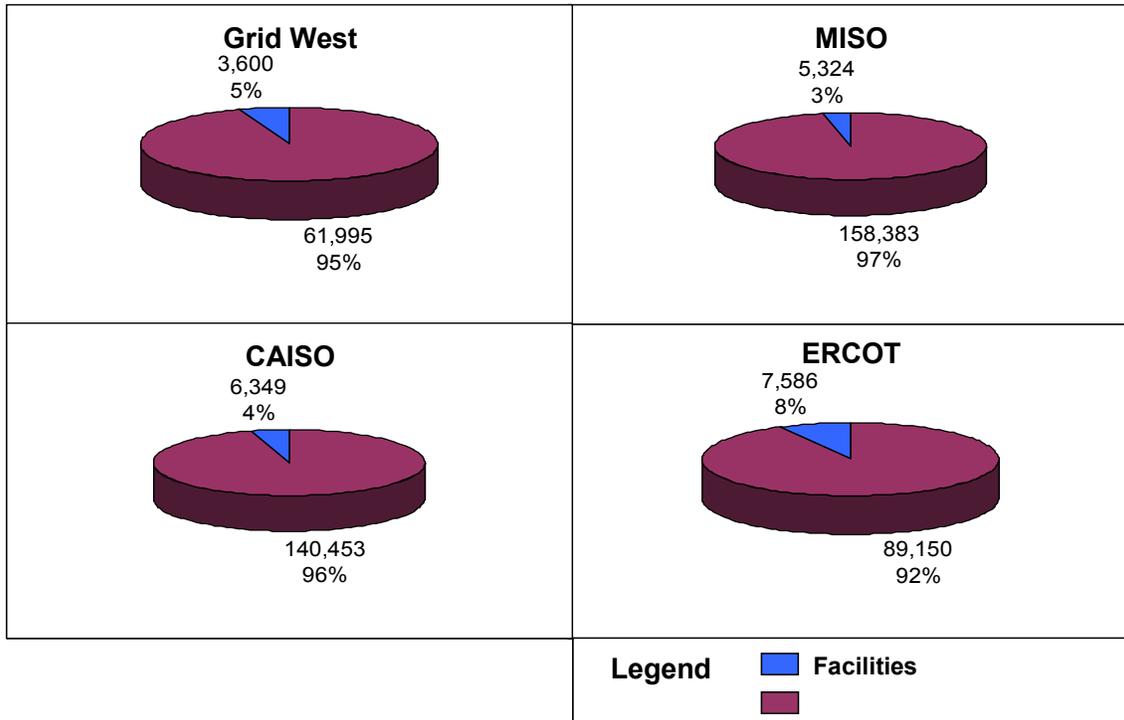
Based on these assumptions, we developed a headcount for each facility. This headcount was used to determine the required square footage per facility. For the primary and backup facilities we obtained lease rates that were applied to the square footage requirements to determine an annual lease costs. For the administrative facility, we used estimated market rates to calculate lease costs. The results are summarized in Figure 7.1.

Figure 7.1 – Facility Headcount & Annual Facility Lease Cost



The total annual facility costs were compared to existing RTOs/ISOs. The results have been summarized in Figure 7.2.

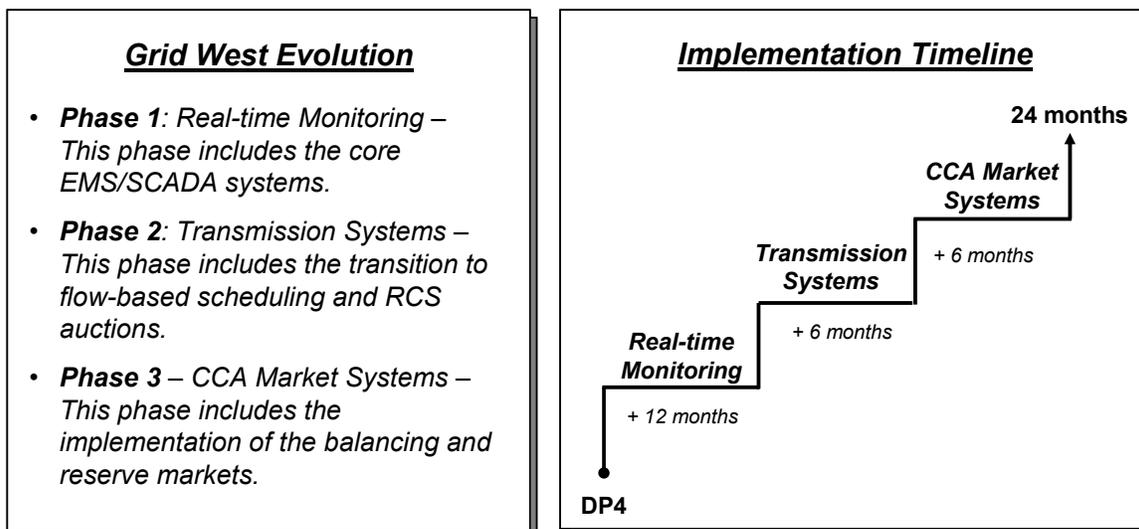
Figure 7.2 – Annual Facility Cost Benchmarks



8.0 Implementation Plan

Structure proposed a two-year phased implementation to roll-out the Grid West Basic Features. This is consistent with the implementation of existing RTOs/ISOs. The phases identified include: 1) real-time monitoring, 2) transmission systems, and 3) CCA market systems. The real-time monitoring functions are central to Grid West’s role as the transmission/reliability authority. Once those systems are in place and tested, additional functionality can be introduced. We assumed Grid West would roll-out the transmission system functionality, which includes flow-based scheduling and the reconfiguration auctions. However, participants may choose to implement the CCA market systems prior to the transmission systems. The order of the sequencing does not impact the overall effort estimate or associated cost. Figure 8.0 summarizes the proposed phasing plan.

Figure 8.0 – Proposed Phasing



Based on the proposed phasing, we developed an effort estimate for the two year implementation. The effort estimate focused on external resource needs. Internal resources, hired as a part of the startup, will support these project teams. The results are summarized as a part of Table 8.1.

Table 8.1 – Proposed Estimated Effort

Project Team	FTEs	Effort (Days)	Cost
Project Management	5	2700	\$4,320,000
Technical Architecture	3	1620	\$2,592,000
System Development	0	0	\$0
Solution Integration	15	3750	\$6,000,000
Training	2	360	\$576,000
Outreach	3	540	\$864,000
Communications	1	180	\$288,000
Cutover & Production Support	8	480	\$768,000
External Legal	2	800	\$2,000,000
Security Consulting	2	400	\$640,000
Independent Audit Services	2	600	\$600,000
Total		11,430	\$18,610,000

9.0 Conclusions

Grid West's scope is less complicated than many existing RTOs/ISOs. Therefore, it is reasonable to assume that Grid West costs should be less than other transmission organizations. However, operation of a RTO requires a significant amount of infrastructure and resources. Therefore while the costs are less than existing RTOs/ISOs they are still significant. Finally, cost increases are not a necessity. Good management and scope control can help keep costs at a constant level. However, if this is not done, costs will certainly increase.

10.0 Assumptions

The cost estimate is based on assumptions related to personnel, infrastructure, systems, and general project implementation costs. The assumptions, rates, and system lifecycle breakdown are all derived from industry experience, benchmarks, and vendor input. The following are key assumptions we used in developing the estimate:

General

- The cost model provides an estimate of the total costs for startup and a snapshot for the first year of operation.
- The model is not intended to show accounting treatment.
- The cost model assumes a 2 year implementation.
- All values are undiscounted 2005 dollars.
- Insurance costs range among ISOs/RTOs depending upon coverage needs (e.g. exposure to credit risks etc.); Grid West estimate is based on similar coverage with CAISO and ERCOT to include general & professional liability and directors & officers insurance.
- Any pass through cost (e.g. FERC fees for existing public utilities) will not be treated as new.
- New incremental fees will be incurred since Grid West will be jurisdictional and are included (the FERC fees are \$0.0485/MWh currently and it is estimated that BPA load will incur \$2 million in incremental fees).
- General contingency is \$0; systems contingency is 15% for each system group.
- Change will be rolled out in a controlled, 3 year cycle.

Facilities

- A configuration of 3 facilities is assumed:
 - Administrative office, Vancouver, WA;
 - Primary operations center, BPA Dittmer; and
 - Backup operations center, Reno.
- A temporary administrative office will house approximately 50 employees for 6 months.
- A permanent administrative office will be leased.
- Dittmer and Reno sites have infrastructure that will be leveraged for reduced costs.
- Dittmer and Reno lease costs will include facility O&M.
- Build-out costs including operations consoles and UPS/backup generation are estimated for all sites.
- A UPS is assumed for the administration building for an ordered shut down.
- Data, network and voice infrastructure is estimated for all sites (e.g. data circuits between Grid West and all required parties, cyber security etc.)

Systems

- Grid West will be the transmission/reliability authority.
- Redundant systems are assumed at the backup facility for critical systems.
- Ongoing systems maintenance is assumed to be 15% for both hardware and software.

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- Maintenance is incurred during startup period on hardware for second year. No maintenance is incurred on software during startup period.
- Systems development for implementation will be included in vendor quotes.

Outside Services

- Outside services will be used for peak times and for subject matter expertise.
- Market monitoring will be outsourced.
- The majority of legal work will be completed by internal resources in a stable environment once the regulatory and legal framework is in place during implementation.
- Systems' change requests to enhance current market functions are estimated as 10% of the initial total systems cost.

Staffing

General

- Six divisions have been identified: Corporate Administration, Market Services & Development, Market Operations, Grid Operations, IT Operations and Systems Planning.
- An organizational pyramid structure is assumed with executives, senior directors, managers, specialists and analysts. Managers are required for larger groups or for high expertise groups (no managers without direct reports).
- Salary ranges are based on average BPA pay scale (steps averaged, 2-3 grades grouped), Monster.com data and industry knowledge.
- Benefits' loading is 30% (e.g. FICA, workers comp, matching, payroll & benefits administration outsourcing).
- Annual bonuses are estimated at 10%.
- Recruiters will be used in the early stages for 30% of employees.
- Human Resources to be staffed quickly to recruit employees and to minimize the use of recruiting agencies in order to save costs.
- Relocation & starting bonuses is estimated at 30% for first 30% of employees.
- Starting bonus and relocation will be \$2,500/employee for remaining 70% of employees.
- Annual expenses per employee are \$7,000 (e.g. supplies, dues, travel and training).
- Operational board will cost \$700,000/year (recruiting costs will be incurred before Decision Point 4 as part of the interim funding agreement).
- Annual salary increase is 3.0%; all 2005 dollars.
- Primary operations staff will be located at Dittmer with some roles to be staffed at the back-up facility (split responsibility).
- It is assumed that the legal and regulatory framework is in place for go-live
- Hiring will occur in 4 waves:
 - Q1 2008 (first tier of management)
 - Q2 2008 (second tier of management, key subject matter experts)
 - Q2 2009 (most staff roles)
 - Q3 2009 (last staff roles before go-live)

Corporate Administration

- The group includes Executive Management, Finance, Legal, Market Monitoring, Corporate Communication, Human Resources, and Facilities.
- Payroll and benefits administration responsibilities will be outsourced and overseen by a Human Resources manager.
- Human resources staffing based on a 1:50 employee ratio (industry standard).
- Minimal market monitoring staff (liaison) will be required since market monitoring activities will be outsourced.
- Facilities management for the primary operations center and the backup facility will be provided as part of the leases for the Dittmer and Reno sites.

Market Services & Development

- The group includes Market Design, Project Management Office, Stakeholder Services and Contracts Administration.
- A team will be dedicated to project management and will oversee market enhancements.
- 30 wholesale participants (e.g. TOs, IPPs) will be active in the market.
- The ratio of customer representatives to active participants will be 1:3.
- The customer representatives will be responsible for developing and providing training.
- Each customer representative will have market knowledge and each will specialize in different market functions (e.g. connectivity) to provide a second line of defense for answering questions.
- The customer representatives will be well integrated into the organization to understand market rules and work well with the other groups.
- New market rules will be implemented in a reasonable time frame and changes will be controlled.

Market Operations

- The group includes Scheduling, Market Administration, Network Modeling, Market Analysis and Market Settlements.
- Staff will be dedicated to market engineering functions to keep existing market running.
- There will be 3 real time scheduling desks.
- For each shift position, there will be 6 shift rotations.
- The responsibility for higher voltage levels only reduces headcount requirements compared to existing ISOs (e.g. CAISO).
- Drivers are numbers of change, number of ties, and existing contracts.
- The need for investigation and outage review will be minimal (assumed honesty in the market).
- Some functions will be housed at the backup facility for a staffed backup center.

Grid Operations

- The group includes Operations Planning and Real Time Operations.
- Grid Operations is typically second largest group (usually behind IT), but often includes Scheduling & Outage Coordination functions (e.g. CAISO), but these functions are grouped in Grid West Market Operations.

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- There will be 6 desks (RAS coordination, generation dispatch, balancing energy dispatch, transmission dispatch (2) and shift supervisor)
- For each shift position, there will be 6 shift rotations.
- The responsibility for higher voltage levels only reduces headcount requirements compared to existing ISOs (e.g. CAISO).
- TOs will retain many responsibilities
- The number of dispatch trainers is limited by fewer changes and slower roll-out.
- PNSC will act as the reliability coordinator (not a Grid West function).
- Some functions will be housed at the backup facility for a staffed backup center.

IT Operations

- The group includes Corporate Infrastructure & Systems and Application Support.
- A thorough systems lifecycle will be used to minimize the use of custom applications.
- Third party applications will be used whenever possible.
- IT is typically around 25 to 35% of total headcount; the headcount is closer to 25% after system development is removed for custom applications (current GW design is at 75 FTE or 25% of total).
- The IT headcount requirement depends on the number of custom applications and in-house systems development work.
- Application support is housed within IT, not functional groups.
- Corporate IT is sized based on overall headcount (comparable ratio to other ISOs/RTOs).

System Planning

- The group includes Interconnection Planning, Expansion Planning, AFC Engineering, and Transmission Studies & Modeling.
- System Planning will work with TOs for integrated planning efforts.
- System Planning will be a key role in the Northwest.
- PNSC will continue their analysis.
- The group will be similar to the CAISO benchmark.