



Transmission Improvements Group Going-Forward Cost Estimate Report

August 31, 2005



Presentation Outline

- **Purpose/Background**
- **Approach and Assumptions**
- **TIG Overview**
- **Functional and Site Mapping**
- **Cost Estimates**
- **Cost Allocation**
- **Additional Cost Considerations**
- **Questions/Comments**



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Purpose/Background

- **To develop a budgetary-type estimate for the going-forward cost of implementing the TIG Proposal**
- **To develop a basic understanding of the cost components of the estimate related to the Regional and Consolidation of Control Areas (RABA) Functions in the TIG Proposal**



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Approach

- **Limited time and resources prohibit full bottom-up approach**
- **Next best option, adjust Grid West cost estimate**
- **Adjust Grid West cost estimate**
 - Where functions are different
 - Where level of effort is different
 - Where infrastructure requirements are different
- **Adjustments made with involvement of TIG Team Leaders and Coordinator**
- **Final adjustments made by Nexant based upon experience and projections**
- **Results summarized in a format that allows for comparison with Grid West cost estimates**



Approach (cont'd)

- **Recognizes that some costs may be sunk or committed, however, they are included in all estimates**
- **Recognizes that participants will incur costs to take advantage of the TIG Proposal, however this report does not attempt to estimate these costs or include in the overall estimate**
- **Cost estimates to include**
 - Development Costs
 - Startup Costs
 - Annual Operating Costs
- **Estimates include only going-forward costs (from Decision Point 2 onward)**



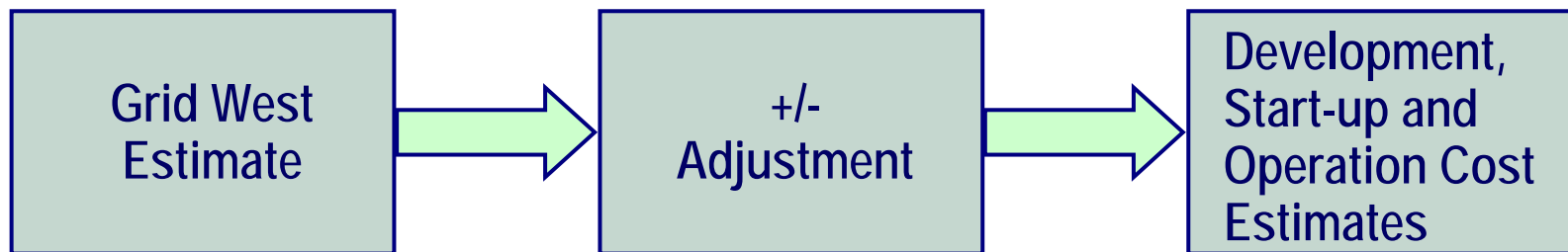
Approach (cont'd)

- **In addition, there is interest in how costs might be allocated into**
 - Costs to implement the Regional Functions of the TIG proposal
 - Costs to implement the RABA Functions of TIG
- **For additional insight, costs were allocated to Regional and RABA Functions by**
 - Determining costs to implement all functions of TIG
 - Determining costs to implement only the Regional Functions of the TIG Proposal by excluding costs associated solely with RABA Functions (shared costs are included)
 - Allocating the costs to RABA by taking difference between cost estimates for all TIG functions and cost estimate for Regional-only Functions

Approach Summary

- Use Grid West cost estimate as the starting point
- Compare TIG and GW functions and requirements
- Perform analysis and make adjustments
- Develop TIG going-forward cost estimates for -

Development, Start-up and Annual Operation





Assumptions

- **TIG to rely on existing entities and agreements to the extent possible and cost effective**
- **Dittmer facility can be utilized to support additional reliability/real-time functions**
- **At a minimum, provision needs to be made to back up RABA Functions**
- **However, other functions will also be backed up at the backup facility**



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TIG Functions

■ Regional Functions

- These functions will be provided to all TIG Participants within the region
- Functions could be performed by a variety of entities, including NWPP, PNSC, consultants/contractors and perhaps others

■ RABA Functions

- These functions will be provided to the Transmission Owners who choose to consolidate
- The Consolidated Control Area Operator is called the RABA, short for the Reliability Authority & Balancing Authority, which will provide the services as directed by the RABA Participants



List of Regional Functions

■ **Common OASIS**

- Provides one-stop shopping for transmission products/services
- Moves Transmission Providers toward common tariffs

■ **Flow-Based ATC**

- Establishes a common flow-based ATC process to be used from long-term to real-time, for planning, scheduling, and operation

■ **Congestion Management**

- Augments current congestion processes with a “broker” that can dispatch generation to clear congestion based on price signals from Transmission Providers and Generation Owners

■ **Market Monitoring**

- Monitors regional transmission and energy markets and the conduct of market participants



List of Regional Functions (cont'd)

■ **Transmission Planning**

- Develop a biennial regional transmission expansion plan through Northwest Transmission Planning (NTP) process
- Establish Transmission Expansion Review Council (TERC) to review and endorse the biennial plans

■ **Reserve Sharing**

- Expand the NWPP reserve sharing programs to improve efficiency and to support bilateral sales

■ **Regulation Improvement**

- Adopt a regional regulation-sharing program
- Implement ACE Diversity Interchange (ADI) process

■ **Visibility Improvement**

- Enhance system monitoring, modeling, analysis, and data exchange
- Add HA/DA grid stability monitoring and analysis



TIG Overview – List of CCA Functions

■ Reliability Authority (RA)

- Calculates operating limits, coordinates area outages, monitors operations, evaluates schedules and all the above for reliability, and takes or directs reliability actions, including congestion management

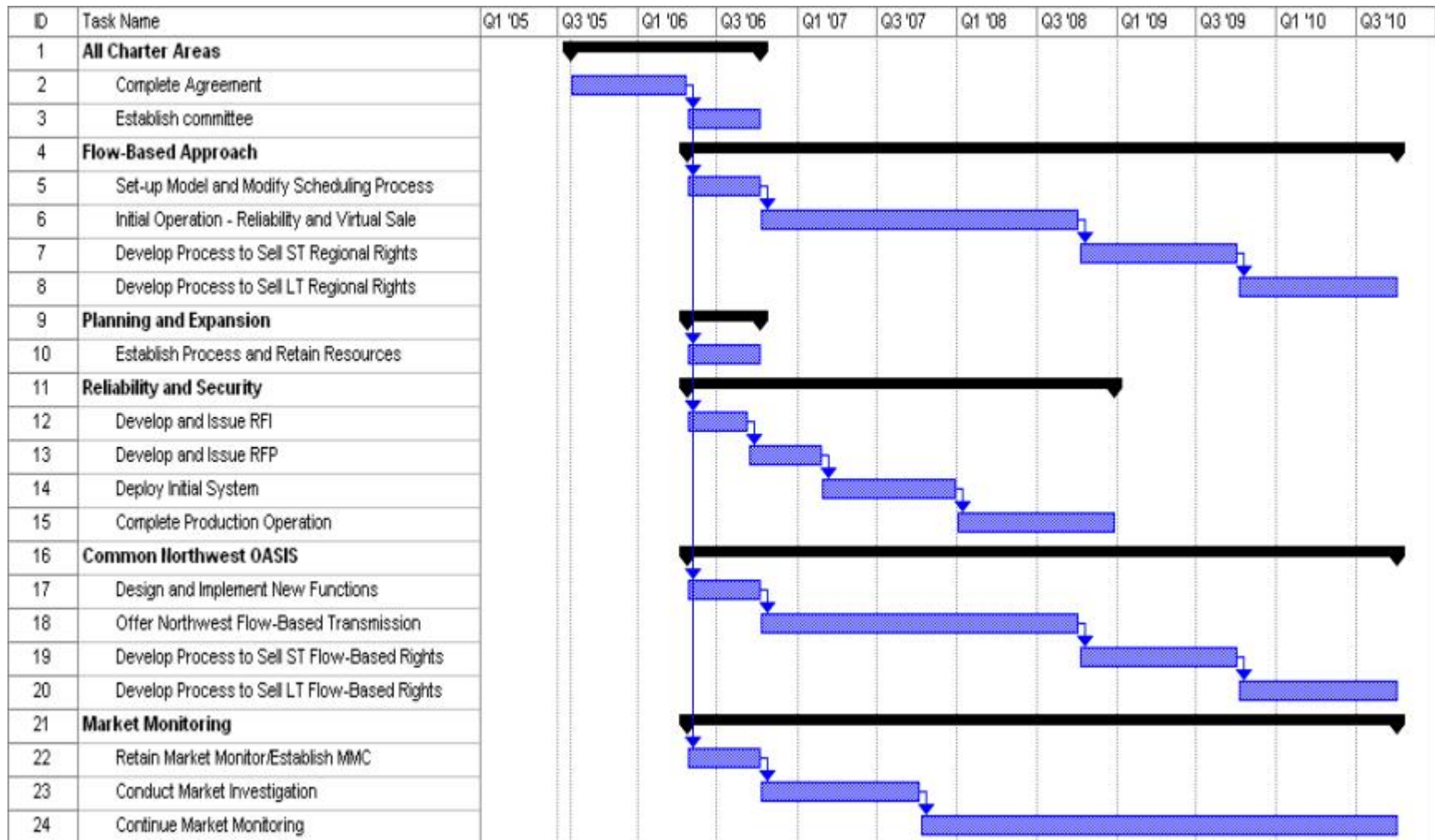
■ Transmission Operator (TX Operator)

- Has operational control of the consolidated portion of the grid and directs the actions of the Transmission Owners, who have physical control

■ Balancing Authority (BA)

- Runs AGC and dispatches generation offered by the RABA Participants to follow load, manage contingencies and clear congestion

TIG Implementation Timeline





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Functional And Site Mapping

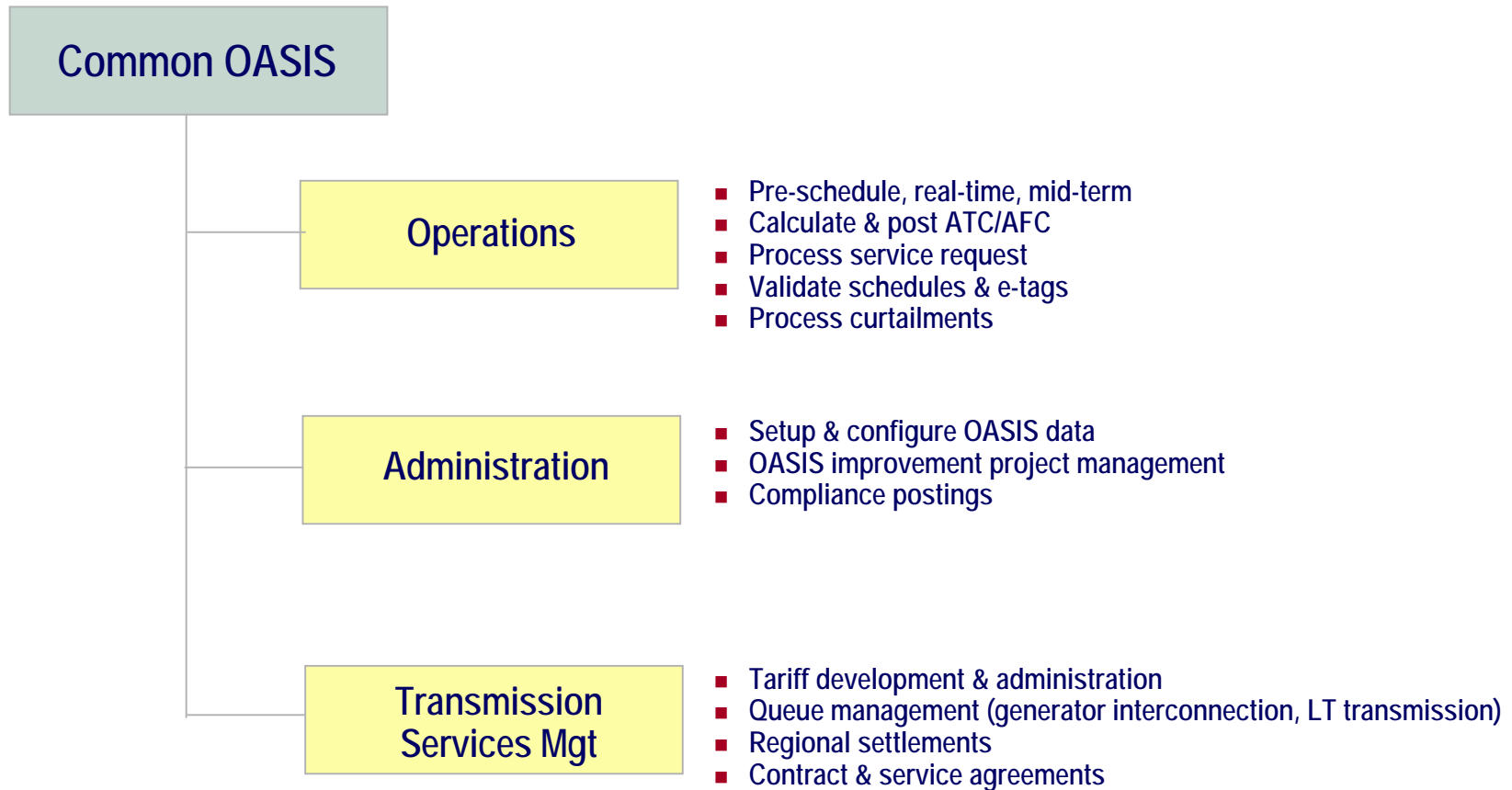
- **Performed as a part of cost estimating; not a part of a design process**
- **Represents a feasible approach that can be used for developing cost estimates**
- **Other implementation approaches are available which might be less expensive to implement**
- **Site Mapping supports infrastructure review**
- **Mapping process also included development of business processes at high level**



Common OASIS Functions

- **Pre-schedule, real-time, mid-term OASIS operation**
- **Calculate and post ATC/AFC**
- **Process service requests; support validation of schedules and e-tags; process curtailments**
- **Set-up and configure OASIS data; OASIS improvement project management; compliance postings**
- **Tariff development and administration; queue management (generator interconnections, LT transmission requests)**
- **Regional tariff settlements; contract and service agreements**

Common OASIS Functions

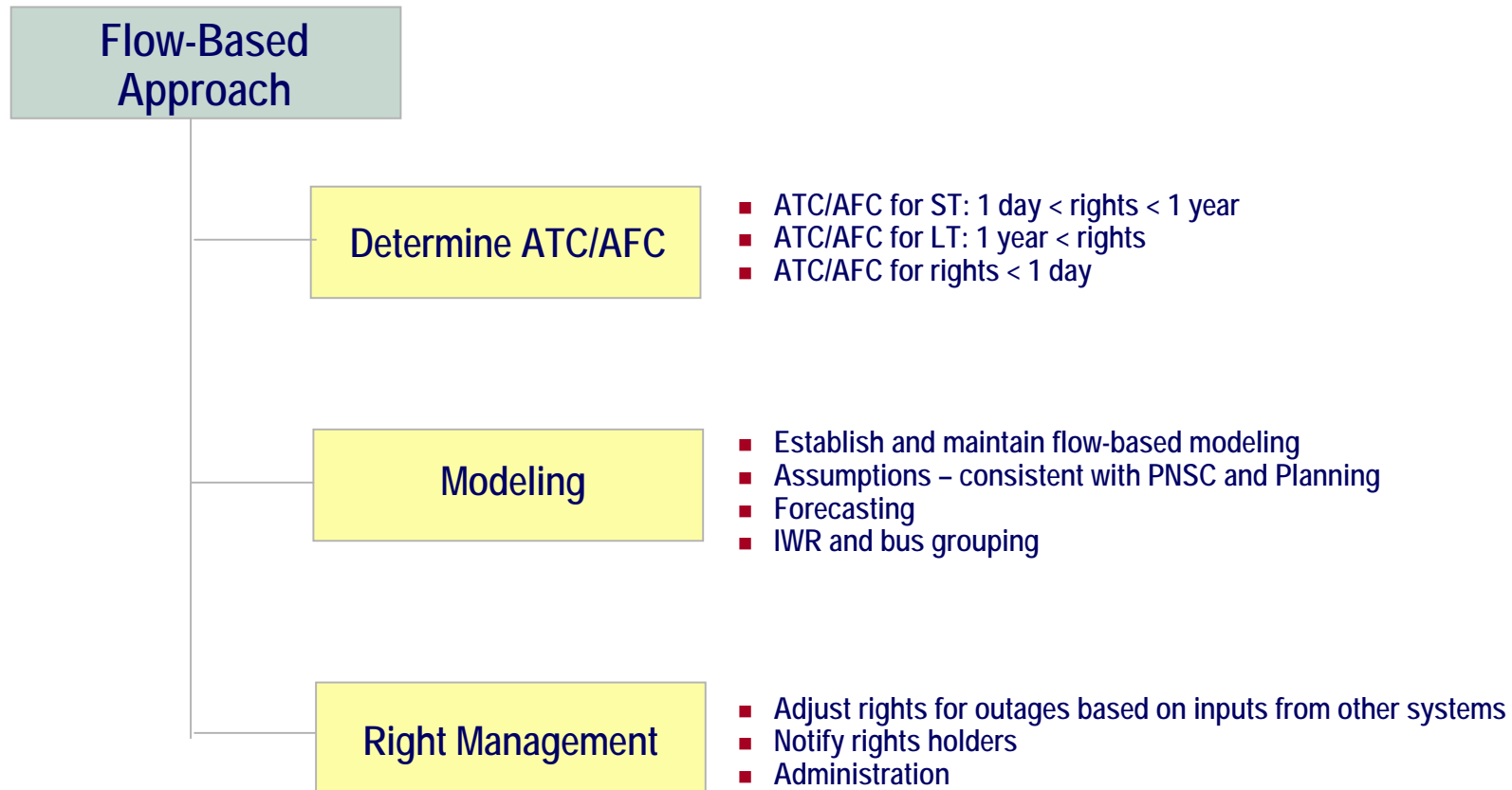




Flow-Based Approach Functions

- **ATC/AFC for LT, ST and less than a day**
- **Establish and maintain flow-based modeling; assumptions consistent with PNSC and planning; forecasting; IWR and bus grouping**
- **Adjust rights for outages; notify right holders; administration**
- **Develop and analyze planning models; transmission projects and their impacts on ATC/AFC**
- **Process DA schedule submittals**
- **Support HA/RT congestion analysis and control area schedule adjustment after acceptance**

Flow-Based Approach Functions

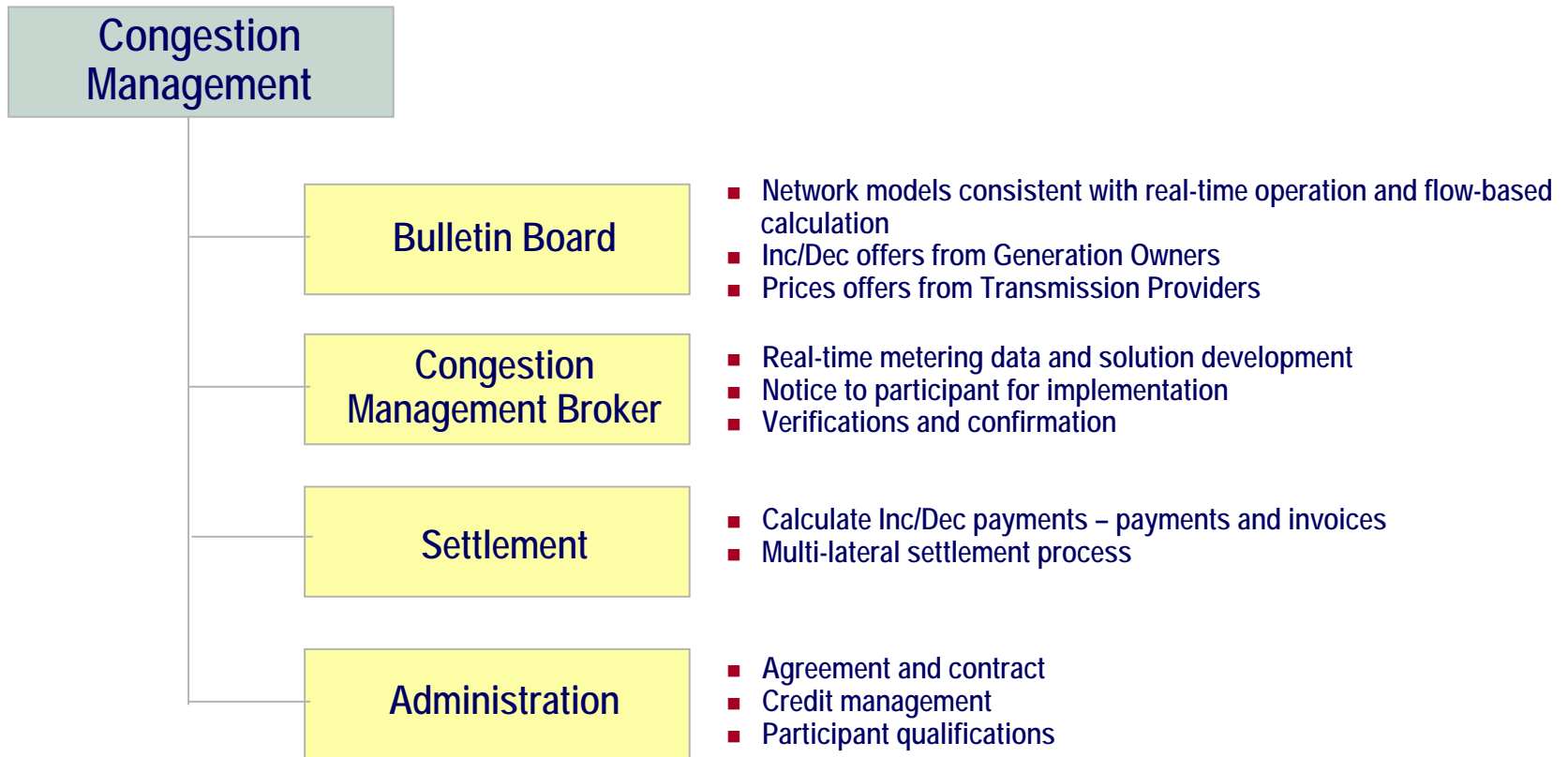




Congestion Management Functions

- **Based upon network models consistent with real-time operation and flow-based calculation**
- **Inc/Dec and ceiling price offers from Generation Owners and Transmission Providers**
- **Real-time metering data and solution development**
- **Notice to participants for implementation; verification and confirmation**
- **Calculate Inc/Dec payments; process payments and invoice; oversee multi-party settlement process**
- **Administer agreement and contracts; credit management; participant qualifications**

Congestion Management Functions



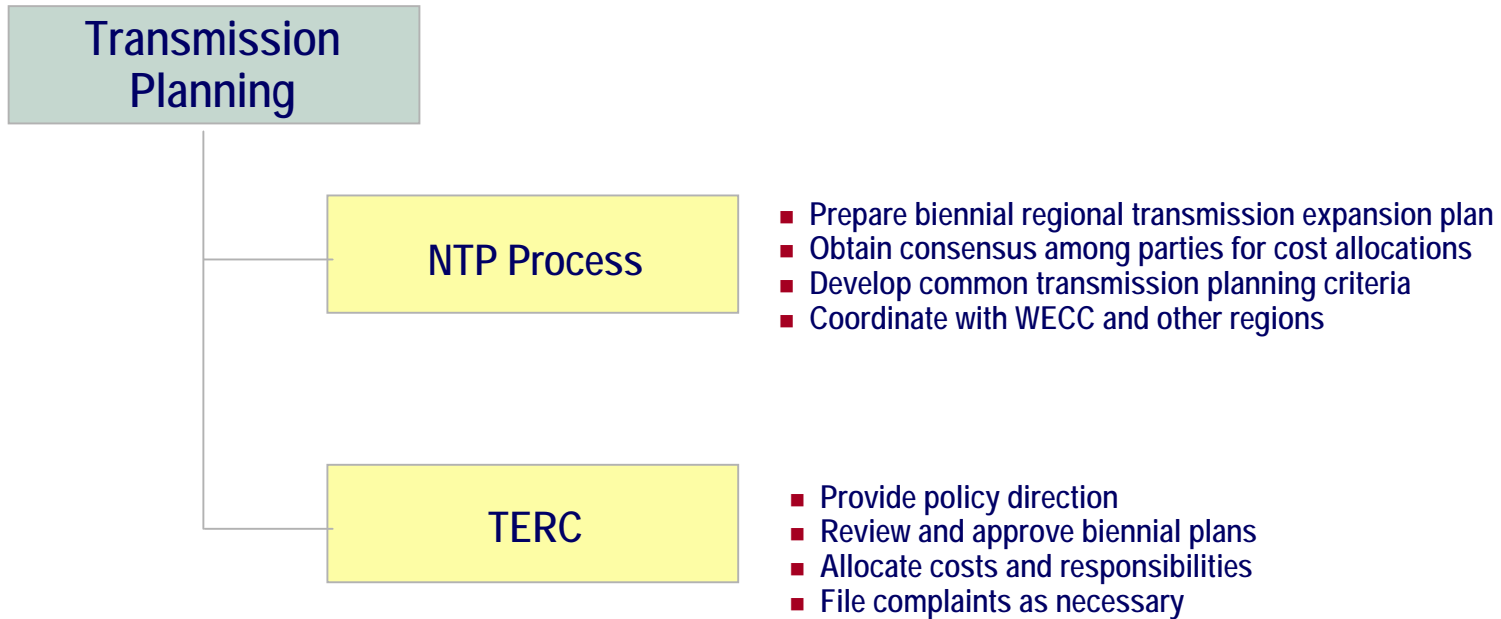


Transmission Planning Functions

- **Northwest Transmission Planning (NTP) Process**
 - Prepare biennial regional transmission expansion plan
 - Provide project costs, benefits, schedules, and sponsors
 - Obtain consensus among interested parties for cost allocations
 - Develop common transmission planning criteria
 - Provide 10-year overall assessment
 - Coordinate with WECC and other regions

- **Transmission Expansion Review Council (TERC)**
 - Provide policy direction
 - Review and approve the biennial plans
 - Allocate construction costs and responsibilities
 - File complaints to FERC if necessary

Transmission Planning Functions





Reserve Sharing Functions

- **Expand and improve existing NWPP reserve-sharing program**
- **Support posting of buy and sell (trade) offers on bulletin board; bilateral trades developed by parties (e.g. by phone)**
- **Update NWPP with trade results**
- **Update PNSC with trade results**
- **Bilateral contract management**
- **Qualification of participants**

Reserve Sharing Functions

Reserve Sharing

Requirements

- Expand and improve NWPP reserve sharing program
- Maintain and update processes

Bulletin Board & Operations

- Post buy/sell on bulletin board
- Process bilateral trade via phone
- Update NWPP and PNSC with results

Administration

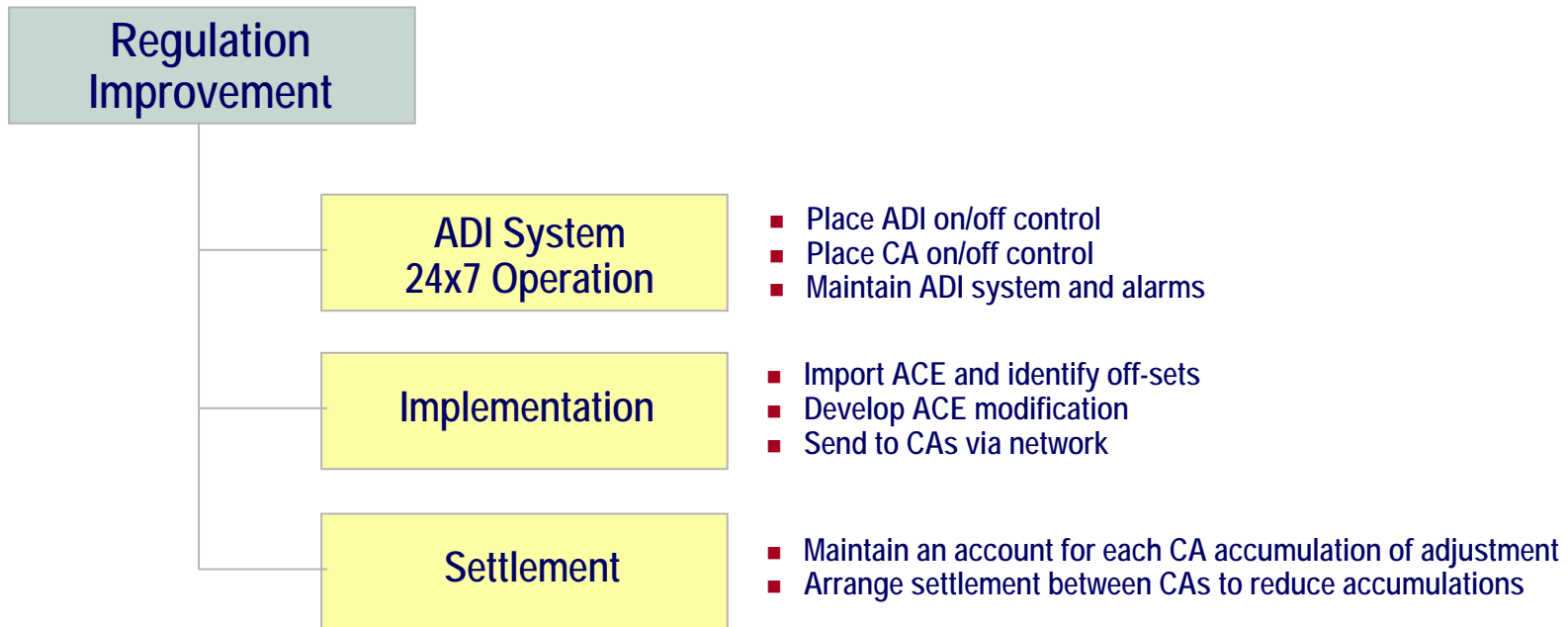
- Bilateral contract management
- Qualification of program participants



Regulation Improvement Functions

- **Improve individual control area systems and software**
- **Adopt ACE Diversity Interchange (ADI) system**
 - Place ADI on/off control; Place CA on/off control
 - Maintain ADI system and alarm processor
 - Import ACE and identify off-sets; develop ACE modifications
 - Send modifications to CAs via network (4 sec AGC controls)
 - Maintain an account for each CA accumulation of adjustment
 - Arrange for “settlement” between CAs to reduce accumulations

Regulation Improvement Functions





Visibility Improvement Functions

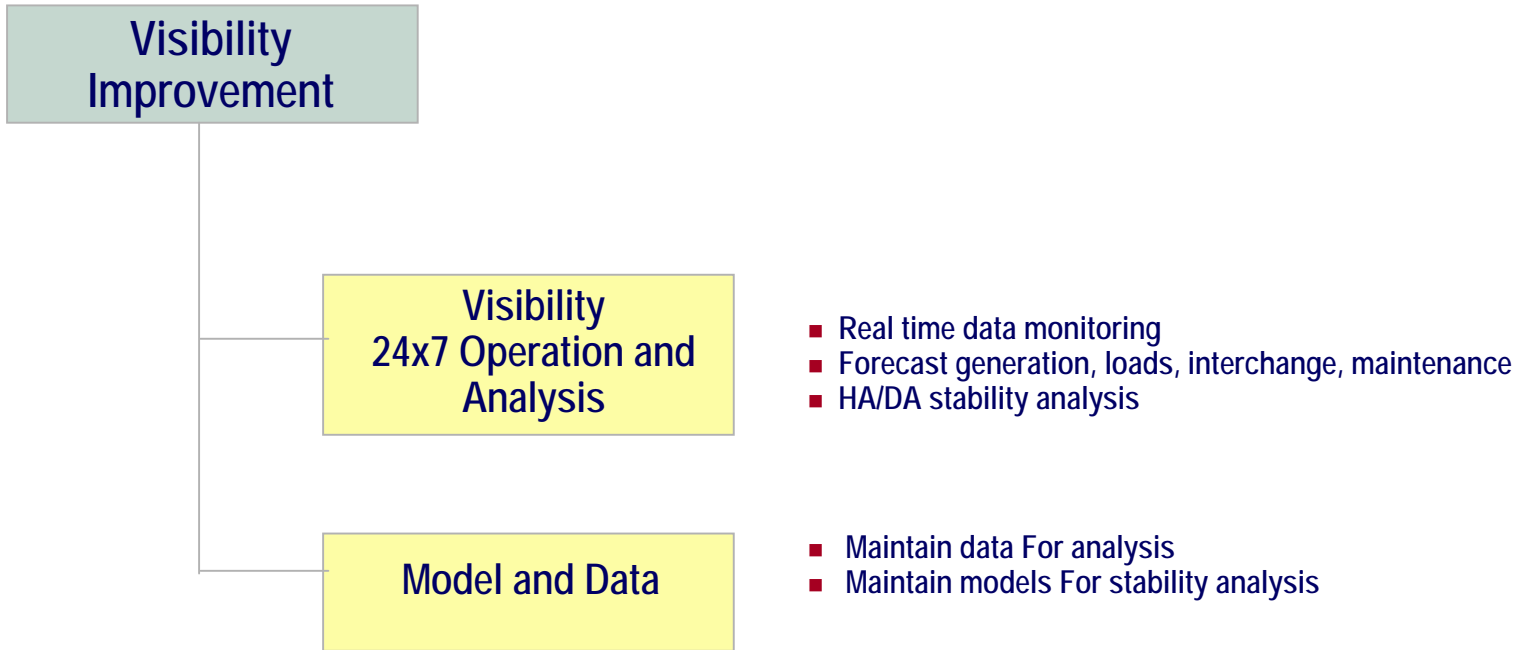
■ Analysis and Operation

- Real-time data monitoring
- Forecast system operation for load, generation, interchange, and maintenance
- Perform transient and voltage stability analysis on HA and DA
- Incorporate flow-based analysis for pre-schedules
- Compare with results from congestion management outputs

■ Maintain monitoring, modeling, analysis, and data exchange capability

- Maintain data and models to reflect most up to date information

Visibility Improvement Functions



TIG Functional Mapping

<i>Functions</i>	<i>Business Process</i>	<i>Performed By</i>
Common OASIS	Operations	3rd party contractor
	Admin. & Trans. Services	Regional staff *
Flow-Based ATC	Determine ATC/AFC, Modeling, Rights Management	Regional staff *
Congestion Management	Bulletin Board/ Settlement, Admin., Operations	3rd Party/Regional staff *
Market Monitoring	All functions	Consultant

* Regional staff refers to resources that would perform these Regional Function processes. These resources could be contractors, consultants, outsource entities, or employees.

TIG Functional Mapping (cont.)

<i>Functions</i>	<i>Business Process</i>	<i>Performed By</i>
Transmission Planning	Plan Development	Contractor or NWPP
	TERC	Regional committee
Reserve Sharing	Bulletin Board Postings	3rd party contractor
	Requirements & Admin	NWPP
Regulation Improvement	ADI System	Regional staff * or PNSC
	Admin, Settlement	Regional staff *
Visibility Improvement	Real-time monitoring & modeling, HA/DA analysis	Regional staff * or PNSC

* Regional staff refers to resources that would perform these Regional Function processes. These resources could be contractors, consultants, outsource entities, or employees.

TIG Location Mapping

<i>Functions</i>	<i>Business Process</i>	<i>Located</i>
Common OASIS	Operations	Anywhere
	Admin. & Trans. Services	Portland (desirable)
Flow-Based Approach	Determine ATC/AFC, Modeling, Right Management	Portland (desirable)
Congestion Management	Bulletin Board/Settlement, Admin.	Anywhere/Portland Anywhere (backup)**
	Operations	Dittmer (primary) Anywhere (backup)**
Market Monitoring	All functions	Anywhere

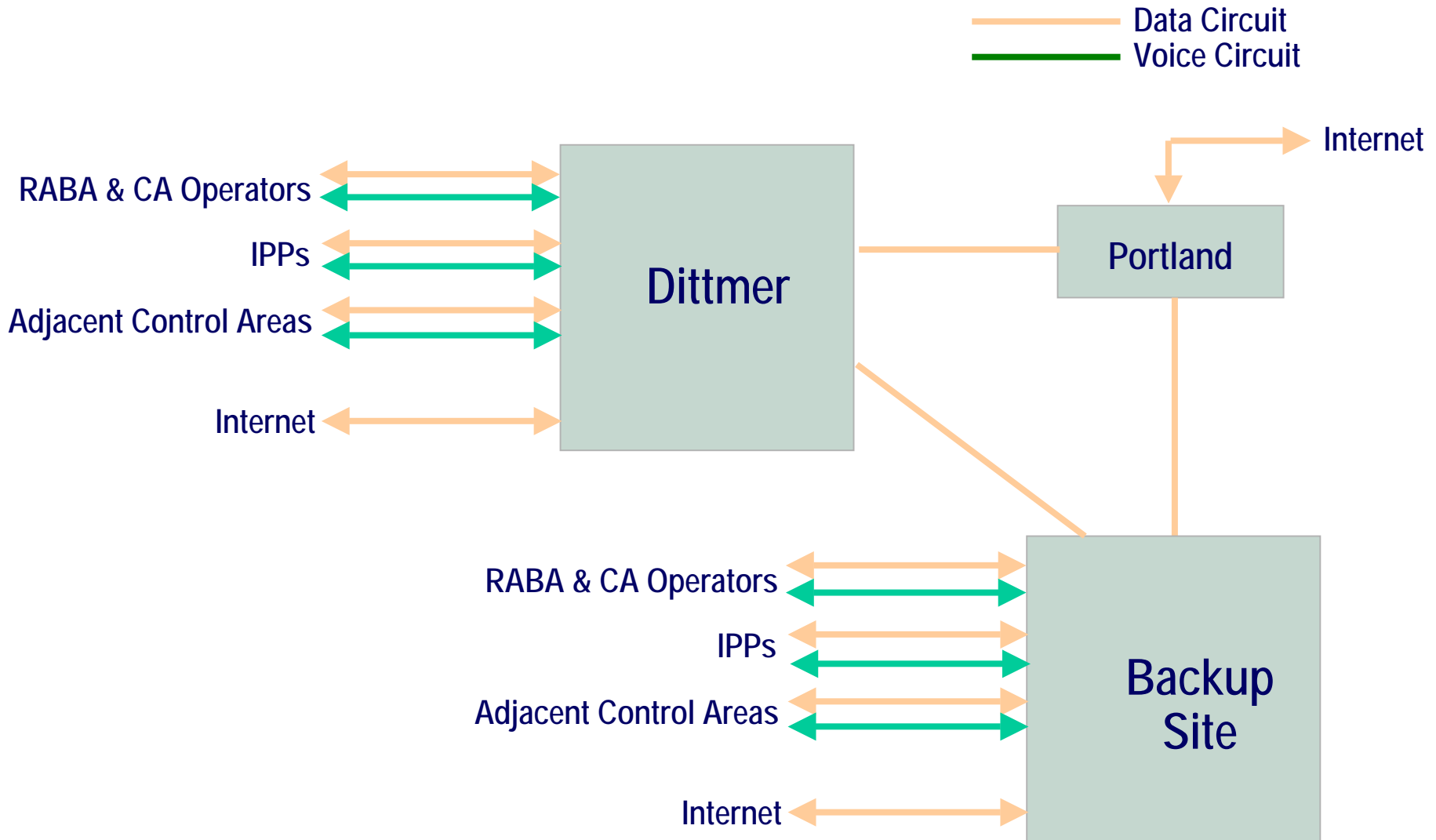
** Backup location must meet applicable requirements of NERC, WECC, etc.

TIG Location Mapping (cont'd)

<i>Functions</i>	<i>Business Process</i>	<i>Located</i>
Transmission Planning	Plan Development	Anywhere
	TERC	Portland (desirable)
Reserve Sharing	Bulletin Board	Anywhere
	Requirement & Admin	NWPP
Regulation Improvement	ADI System	Dittmer
	Admin., Settlement	Anywhere (backup)**
Visibility Improvement	Real-time monitoring & modeling, HA/DA analysis	Portland (desirable)
		Dittmer
		Anywhere (backup)**

** Backup location must meet applicable requirements of NERC, WECC, etc.

Conceptual Mapping





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Cost Estimates - Background

■ Cost Categories

- Development
- Startup
- Annual Operating Costs

■ List of Differences

- Examples of differences between Grid West and TIG Proposals that result in adjustments to Grid West estimates

■ Costs Estimates

- In format comparable to Grid West estimates



Cost Estimate Summary

- **Equivalent Employee Count – 166 FTE**
 - Includes work performed by contractors, consultants, and employees
- **Startup Costs Including Financing and Development Costs - \$82.2 Million**
- **Annual Operating Costs Including Amortization of Startup Costs - \$50.5 Million**

Cost Estimates

Development Costs

- **Covers costs prior to start of implementation**
- **Differences**
 - Shorter TIG development time (approx 6 months vs. 24 months)
 - Staggered startup of functions – started when available
- **Cost of Development**
 - Approx \$1M for TIG (Design and engineering costs are included in Startup Cost Estimate)
- **TIG Development Costs rolled into Startup and Annual Operating Cost Estimates**



Cost Estimates

Manpower Costs

Largest of Going-Forward Costs in the Annual-Operating Estimate

List of Differences

- **TIG reliability functions similar, although TIG RABA is smaller**
 - TIG RABA has smaller grid footprint
 - Requires fewer operation resources, fewer support resources, and fewer administrative resources

- **TIG has fewer market functions**
 - No CCA Reserves Market and Settlement
 - No Schedule Adjustment Process
 - Reduces number of operation personnel, support, and admin resources

Cost Drivers and Estimates

Manpower Costs (cont'd)

List of Differences (cont'd)

- **Rights Reconfiguration and Settlement not included in TIG**
 - Fewer processes to support
 - Reduces number of operation personnel, support, and admin resources
- **Very limited FERC Filings**
 - Reduces administrative effort and resources
 - Reduces legal resources
 - Reduces support and admin resources
- **Fewer equivalent employees**
 - Reduces employee training and travel related costs
 - Reduces employee benefit and HR costs
 - Reduced infrastructure costs – phones, computers, IT support, etc.

Cost Estimates

Manpower Costs

TIG Cost Estimate Equivalent Employee Count	
Area	Count
System Planning	10
Grid Operations and Support	71
Commercial Operations	36
Contract/Settlement Support	7
IT Operations	27
Administrative Support	15
Grand Total	166

Equivalent Employee Count includes work performed by contractors, consultants, and employees

Cost Estimates System Cost



2nd Largest Going-Forward Cost in Annual-Operating Estimate

List of Differences

- **Fewer market functions in TIG Proposal reduces**
 - Market-related computer systems costs
 - Consultant implementation and project-management costs
 - Ongoing enhancement, operation, and maintenance costs
- **Rights reconfiguration and settlement not included, reduces**
 - Rights reconfiguration systems costs
 - Consultant implementation and project-management costs
 - Ongoing enhancement, operation, and maintenance costs
- **Smaller number of equivalent employees and reduced legal work reduces**
 - Support (corporate) system costs
 - Consultant implementation and project-management costs
 - Ongoing enhancement, operation, and maintenance costs



Cost Estimates System Cost (cont'd)

List of Differences (cont'd)

- **Fewer and smaller systems reduces**
 - Power and telecom requirements
 - HVAC requirements
 - Outside services costs

TIG vs. Grid West

Real-Time Monitoring Systems Comparison

Grid West Systems	TIG	Comments – TIG Functions
EMS/SCADA	yes	<ul style="list-style-type: none"> - A complete system is needed for RABA and other real-time functions - Need to build and use real-time models for ATC/AFC calculation, congestion management, and visibility improvement
Outage Scheduling	yes	<ul style="list-style-type: none"> - For RABA and outage data needed for Visibility and Flow Based Approach
Offline Power System Apps	yes	<ul style="list-style-type: none"> - A suite is needed for RABA and other functions - Enhanced tools are needed for transmission visibility improvement
Training Simulator	yes	<ul style="list-style-type: none"> - A system is needed for RABA and other real-time functions including congestion management
Dispatcher Logs	yes	<ul style="list-style-type: none"> - A system is needed for RABA and other real-time functions - Enhanced tools are needed for congestion management

TIG vs. Grid West

Transmission Systems/Commercial Systems Comparison

Grid West Systems	TIG	Comments – TIG Functions
Market Info System	n/a	Key information will be posted on Common OASIS
Load Forecasting	yes	- Needed for flow-based calculation - Needed for RABA
Settlement System	yes	- Reduced settlement functions are needed in various TIG functions
Market Op Systems	n/a	- Common OASIS, congestion management, reserve sharing bulletin boards are introduced to handle similar activities in TIG
Scheduling & Tagging	yes	- Reduced version is needed for RABA as a CCA and scheduling information is needed for Flow Based Approach and Congestion Management
Real-time Balancing	yes	- Reduced version is needed for RABA as CCA operator
Reserve Market	n/a	- A bulletin reserve sharing board is introduced
Meter Data	yes	- Reduced version is needed for congestion management
Not Applicable	new	- A new ADI system is introduced in TIG - A Common OASIS system is introduced in TIG - A Congestion Management Bulletin Board is introduced in TIG - A Reserves Bulletin Board is introduced in TIG

TIG vs. Grid West Support Systems Comparison

<i>Grid West Systems</i>	<i>TIG</i>	<i>Comments – TIG Functions</i>
Accounting and Financial Systems	reduced	- Addition of smaller system
Customer Management	n/a	- This function is embedded in “administration” capability of various TIG functions
Legal	reduced	- No new legal system for TIG, use basic office support systems
Enterprise Infrastructure	reduced	- Addition of smaller standard systems and use of existing systems where possible

Cost Estimates Startup Costs



List of Differences

- **Impacts of fewer number of equivalent employees previously listed**
- **Impacts of fewer and smaller systems previously listed**
- **Smaller number of equivalent employees reduces**
 - Facilities and improvement costs
 - Insurance costs during startup
 - Backup site costs

Cost Estimates

TIG Startup Costs (cont'd)

TIG COST ESTIMATE - START UP COSTS (MILLIONS)						
Systems		Software	Primary Hardware	Backup Hardware	Total	\$28.0
	RT Monitoring	\$8.1	\$2.5	\$1.6	\$12.2	
	Transmission Sys	\$6.0	\$1.1	\$1.1	\$8.1	
	Commercial System	\$3.0	\$0.6	\$0.6	\$4.1	
	Support Systems	\$2.1	\$0.5	\$0.0	\$2.6	
	O&M				\$0.94	
Equivalent Employees						\$17.9
Development & Consulting		Service	Person Days			\$12.4
		Implementation	6,496			
		External Audit	60			
		TIG Development	630			
		Total	7,606			
Facilities						\$13.4
	Primary Site		Subtotal	\$6.11		
	Leasehold Improvements	\$5.05				
	Pre-operational Lease	\$0.87				
	Pre-operational Expenses	\$0.19				
	Backup Site		Subtotal	\$5.62		
	Leasehold Improvements	\$4.73				
	Pre-operational Lease	\$0.75				
	Pre-operational Expenses	\$0.15				
	Admin Site		Subtotal	\$1.71		
	Leasehold Improvements	\$1.28				
	Pre-operational Leases	\$0.44				
Insurance & Other						\$1.6
Interest During Construction						\$8.9
GRAND TOTAL						\$82

Cost Estimate

Annual Operating Costs

List of Differences

- **Impacts of fewer number of equivalent employees as previously listed**
- **Impacts of fewer and smaller systems as previously listed**
- **Lower capital costs (for startup) reduces ongoing**
 - Interest and
 - Amortization costs
- **Non FERC jurisdictional**
 - Avoid \$2M in fees
 - Reduces legal costs

Cost Estimates

TIG Annual Operating Costs (cont'd)

TIG COST ESTIMATE - ANNUAL OPERATING EXPENSES				
Equivalent Employees		166 FTE		\$22.2
Facilities				\$3.9
Primary		Unit Cost		\$1.40
	Lease	\$23-25/sq ft yr	\$0.46	
	Furnishings	\$5/sq ft yr	\$0.10	
	Data & Network	N/A	\$0.84	
	Utilities, Voice, Building Services	Included	\$0.00	
Backup				\$1.33
	Lease	\$27/sq ft yr	\$0.41	
	Furnishings	\$5/sq ft yr	\$0.08	
	Data & Network	N/A	\$0.84	
	Utilities, Voice, Building Services	Included	\$0.00	
Admin				\$0.97
	Lease	\$19/sq ft yr	\$0.28	
	Furnishings	\$5/sq ft yr	\$0.07	
	Data & Network	N/A	\$0.08	
	Utilities, Voice, Building Services	N/A	\$0.54	
Other				\$0.20
Systems		Software O&M	Hardware O&M	\$3.5
	Real-Time Monitoring Systems	\$1.06	\$0.53	
	Transmission Systems	\$0.78	\$0.28	
	Commercial Systems	\$0.39	\$0.15	
	Support Systems	\$0.27	\$0.07	
Outside Services				\$7.2
	Ongoing Production Support		\$0.7	
	Cyber Security Audit		\$0.5	
	Financial Audit		\$0.5	
	External Legal		\$0.3	
	Market Monitoring		\$1.0	
Insurance & Other				\$1.3
Interst and Amortization				\$12.4
GRAND TOTAL				\$50.5



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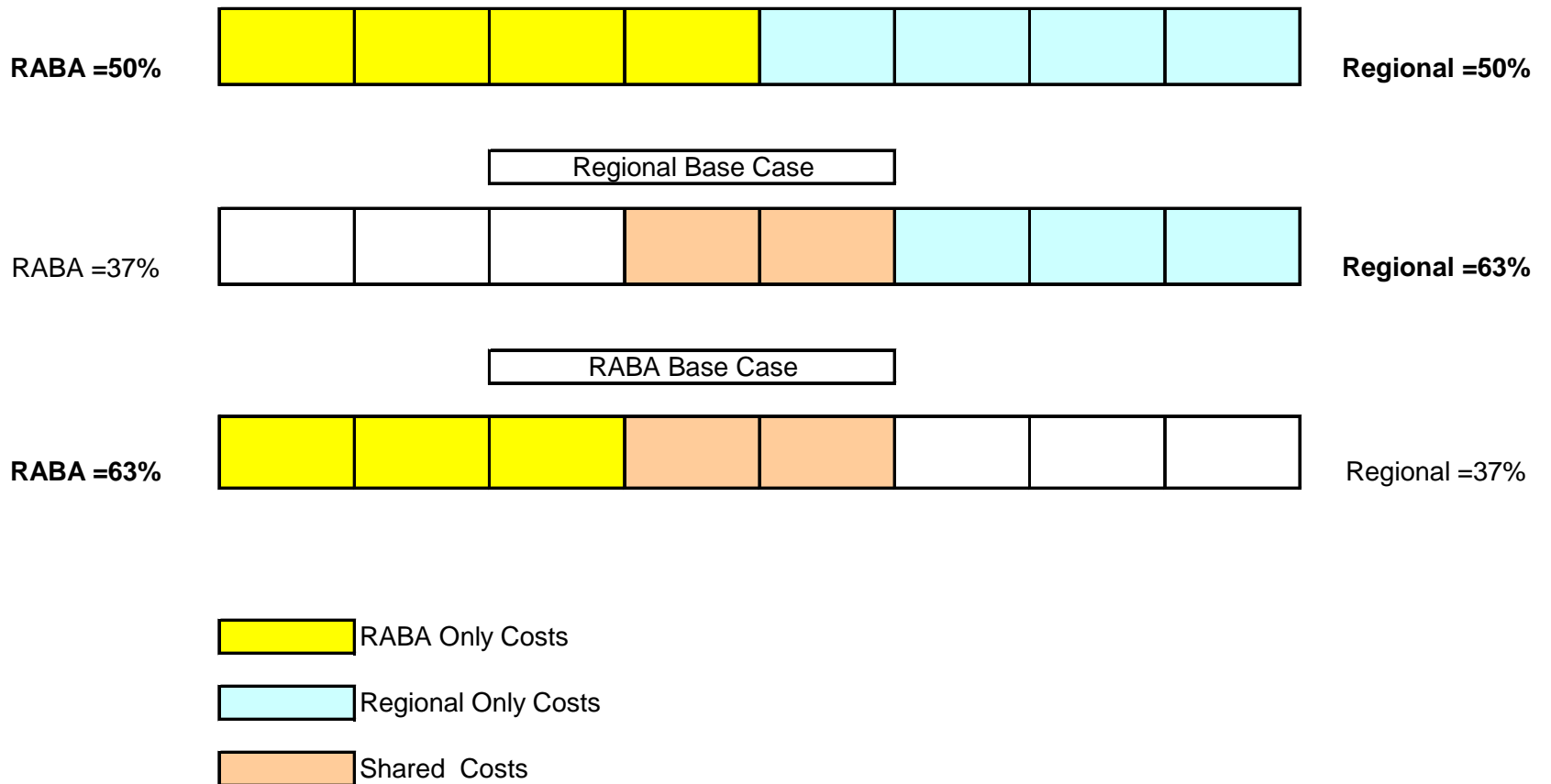


Cost Allocation Background

- **Interest in understanding cost by RABA/Regional Function**
- **Cost allocation a function of**
 - Identifying costs associated with only RABA and costs associated with only Regional Functions
 - Allocating costs shared by the functions
- **Allocation of shared costs more an art than science**
- **Such an allocation was not conducted**
- **Such an allocation should reflect final design and actual costs**

The Art Of Cost Allocation

Cost Allocation Example



Summary Of Cost Allocation

Using A Regional Base Case Approach

	Equivalent Employee Count	Startup Costs Including Development	Annual Operating Costs
Regional Functions	108	\$58M	\$28.1M
RABA Functions	58	\$24M	\$22.4M
TOTAL	166	\$82M	\$50.5M



Cost Allocation Outcomes

- **Summary of cost allocations used Regional Base Case approach and RABA Functions as an increment**
- **Effectively associates all shared costs with cost of implementing Regional Functions**
- **“Accurate” allocation would split shared costs between RABA and Regional Functions**
- **“Accurate” allocation would result in an increase in costs associated with the RABA Functions compared to the costs in Summary of Cost Allocation**



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Additional Cost Considerations

- **Cost estimates will likely change as more information is known**
 - More certainty will allow improved accuracy and allow for less conservative approach in some areas, for example
 - Consultant Estimates to Manage and Implement Startup
- **Cost efficiencies may become clearer as the project moves forward**
 - Opportunities to piggy back work on existing resources or to develop a more efficient organization may develop
 - Opportunities to take full advantage of existing entities and infrastructure may develop



Additional Cost Considerations

- **Cost savings through avoidance of other required work**
 - Implementing work within TIG to address new FERC initiatives
 - Implementing work within TIG to address new reliability legislation requirements
- **Opportunity to utilize existing infrastructure/operations will reduce the net overall cost of the TIG Proposal**
 - Existing space and support systems are an example
 - Existing grid operations functions may move from organizations to the RABA Function, depending upon the final design of the TIG Proposal



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Questions

Questions/Comments about the cost estimates?