RTO West Benefit/Cost Study
RRG Report

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Tabors Caramanis & Associates

Ellen Wolfe — Assef Zobian

(916) 791-4533 — (617) 354-5304

ewolfe@tca-us.com — azobian@tca-us.com

Organizational Outline

- *TCA was contracted to examine several quantitative and qualitative aspects of benefits and costs of implementing a Regional Transmission Operator (RTO) in the northwest*
- *Most of our effort was focused on RTO impacts on energy flows, market dynamics and energy pricing through the use of the quantitative tool GE MAPS*
  - This analysis produced some simulated quantitative results
  - The study approach, results and detailed assumptions are presented in Section I of the Preliminary Report
- *TCA performed quantitative benchmarking analyses for other benefit/cost elements, such as RTO and exchange costs*
  - These results are of a different nature (actual data from other markets or expert opinion) and therefore cannot be summed with the MAPS results
  - Benchmarking elements are presented in Section II
- *Qualitative investigation of other potential impacts of an RTO is outlined in Section III*
- *A market concentration study is in progress and will be included in the Final Report*

Caveats Regarding Study and Results

- *Preliminary results will receive further review*
- *MAPS analysis is intended to enhance understanding of the behavior of the system*
  - Though we have in the past found MAPS results to correlate with actual market conditions, output is simply an indicator, and is driven by the input assumptions used in the analysis, including hydro scheduling and wheeling rates
- *TCA's other analyses provide a variety of numerical and qualitative costs and benefits*
  - They are not comprehensive or exhaustive of possible outcomes
  - They require stakeholders to judge and weigh information contained in this analysis for themselves

Section I

Energy Impact Analysis:
GE MAPS Study

Overview of GE MAPS Study

- *TCA performed quantitative analysis of the WSCC system With and Without the RTO West and qualitatively assessed other impacts*
  - GE MAPS was used because it can model the operating procedures and contractual and physical transmission constraints currently used and/or proposed for the WSCC
  - The energy impact analysis using GE MAPS provides insights into the theoretical economic operation of the WSCC markets With and Without RTO West
  - A base case including Without RTO and With RTO runs have been performed
- *Study review under way*
  - Additional With and Without runs will be performed to reflect different input assumptions
  - Sensitivity runs have been defined by Study Group to test impact of different policy elements

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Using MAPS to Determine Benefits

- *MAPS can model the market operation With and Without an RTO*
- *The Without RTO market conditions included these elements:*
  - Pancaked transmission wheel-out rates (on company basis)
  - Pancaked loss wheel-out rates
  - Contract path flows
  - Carrying reserves on individual company's units and requirements on company's peak loads
  - Scheduling maintenance of generation units according to individual company's loads
  - Input hourly hydro generation to reflect average historic output; scheduled pump storage (outside PNW) against company's loads

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Using MAPS to Determine Benefits (cont.)

- *The With RTO market conditions include these elements:*
  - No pancaked transmission or loss rates, only region-wide wheel-out rate
  - No contract path flows
  - Carrying reserve on most efficient resource within the RTO West region; the reserve requirements are on the entire region's peak load
  - Optimize unit commitment and least-cost security-constrained dispatch on region-wide basis (all generation resources within the RTO area)
  - Scheduling maintenance of generation units according to regional load
  - Input hourly hydro generation to reflect average historic output; scheduled pump storage and hydro generation (outside PNW) against regional load
- *Note that the first three changes are contractual and not determined by the engineering characteristics of power systems*

GE MAPS and WSCC Modeling

- *The GE MAPS model is a security-constrained dispatch model that simulates the operation of the electricity market over time*
- *Assumes marginal-cost bidding, although we can override with strategic bids*
- *Least-cost dispatch subject to thermal and contingency constraints*
- *Calculates hourly, locational-based marginal price of electricity*
- *Zonal prices can be calculated either as load-weighted average or simple average of locational prices*
- *Congestion cost is calculated as shadow prices multiplied by the power flows on each interface*

GE MAPS and WSCC Modeling (cont.)

- *Load forecast: based on most recent forecast as provided by RTO West*
- *Fuel price forecast: based on EIA forecast for natural gas*
- *Transmission system: based on load flow representation that includes all transmission upgrades for summer 2004, as provided by RTO West*
- *Environmental adders: based on expected NOx regulations for 2004, ignored in the generation bids per RTO West request*
- *See MAPS input assumptions in full report for details*

Treatment of Wheeling Charges

- *Wheeling charges apply to power flowing out of a region or control area (wheel-outs and wheel-throughs)*
- *With RTO West case: no wheeling charges for flows within each RTO (RTO West, California ISO, and West Connect). Data as provided by RTO West*

Wheeling Charges ($/MWh)

Region / Utility	*With RTO*	*Without RTO*	*Region / Utility*	*With RTO*	*Without RTO*	*Region / Utility*	*With RTO*	*Without RTO*
RTO West			California			WestConnect		
Avista Corp.	3.80	1.50	PG&E - high voltage only	1.77	1.77	Arizona Public Service	3.00	3.50
Idaho Power Company		1.50	PG&E - low voltage	3.76	3.76	El Paso Electric		5.50
Montana Power Co.		1.50	SCE - high voltage only	2.05	2.05	Public Service of New Mexico		2.84
PacifiCorp		1.50	SCE - low voltage	2.28	2.28	Salt River Project		4.12
Portland General Electric		1.50	SDG&E - high voltage only	2.01	2.01	Texas-New Mexico Power		5.34
Puget Sound Energy		1.50	SDG&E - low voltage	4.85	4.85	Tucson Electric Power		6.52
Sierra Pacific Resources			California - Oregon Border (COB)	1.83	1.83	WAPA Lower Colorado		2.13
Zone A (Sierra Pacific Power)		2.86	Palo Verde intertie	2.03	2.03	WAPA Rocky Mountain		4.17
Zone B (Nevada Power)		1.21	Nevada - Oregon Border (NOB)	1.84	1.84	WAPA Upper Missouri		4.04
Bonneville Power Administration			Mead intertie (MEAD - WALC)	2.05	2.05	Imperial Irrigation District		1.00
Network		1.50	Victorville intertie	2.05	2.05			
Southern intertie		2.20	Sylmar AC	2.05	2.05			
Montana intertie		3.56	LADWP	9.00	9.00			
BC Hydro		1.50						
Alberta (includes losses)	3.00	3.00						

Notes:

With RTO West case: RTO West tariff is $3.60, plus a $0.20 administrative charge.
BPA charge applies to wheel-outs and wheel-ins. When wheeling power over an intertie, the intertie rate is added to the network rate.
California and WestConnect charges apply to wheel-outs, except for Imperial Irrigation, which applies to wheel-ins and wheel-outs.
No charges apply to flows within the California ISO (PG&E, SCE, and SDG&E) for both scenarios.

Modeling of Tariff Losses

- Tariff losses are applied to power flowing out of a region or control area (wheel-outs and wheel-throughs)
- With RTO West case: RTO West is split into two sub-regions, BC Hydro and the rest of RTO West (load-weighted average of individual companies). Tariff losses are applied to flows between the two sub-regions and flows to external regions

Loss Factors

Region / Utility	*With RTO*	*Without RTO*	*Region / Utility*	*With RTO*	*Without RTO*	*Region / Utility*	*With RTO*	*Without RTO*
RTO West			California			WestConnect		
Avista Corp.		3.00%	PG&E - high voltage only			Arizona Public Service		2.50%
Idaho Power Company		3.60%	PG&E - low voltage			El Paso Electric		3.00%
Montana Power Co.		4.00%	SCE - high voltage only			Public Service of New Mexico		3.00%
PacifiCorp		4.48%	SCE - low voltage			Salt River Project		2.30%
Portland General Electric		1.60%	SDG&E - high voltage only			Texas-New Mexico Power		3.34%
Puget Sound Energy		2.70%	SDG&E - low voltage			Tucson Electric Power	Included in wheeling charge	3.30%
Sierra Pacific Resources	2.83%		California - Oregon Border (COB)	3.0%	3.0%	WAPA Lower Colorado		3.00%
Zone A (Sierra Pacific Power)		2.34%	Palo Verde intertie			WAPA Rocky Mountain		5.50%
Zone B (Nevada Power)		1.32%	Nevada - Oregon Border (NOB)			WAPA Upper Missouri		4.00%
Bonneville Power Administration			Mead intertie (MEAD - WALC)			Imperial Irrigation District		3.0%
Network		1.90%	Victorville intertie					
Southern intertie		3.00%	Sylmar AC					
Montana intertie		3.00%	LADWP	4.8%	4.8%			
BC Hydro	6.05%	6.05%						
Alberta (included in wheeling charge)	-	-						

Notes:

BPA loss factor applies to wheel-outs and wheel-ins. When wheeling power over an intertie, the intertie rate is added to the network rate.
California and WestConnect losses apply to wheel-outs, except for Imperial Irrigation, which applies to wheel-ins and wheel-outs.
No charges apply to flows within the California ISO (PG&E, SCE, and SDG&E) for both scenarios.
No charges apply to flows within Westconnect for With RTO West scenario.

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Physical Transmission Constraints

- Same data used in both cases
- Seasonal ratings used for lines in northwest as provided by RTO West
- 2001 Path Rating Catalog used for remaining areas
- All proposed transmission projects that come on line before 2004 are included

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Contract Path Limits

- *Contract path power flow limits (from the WSCC and WGA study) used for the Without RTO West case*
- *No contract path flows used in the With RTO West case*

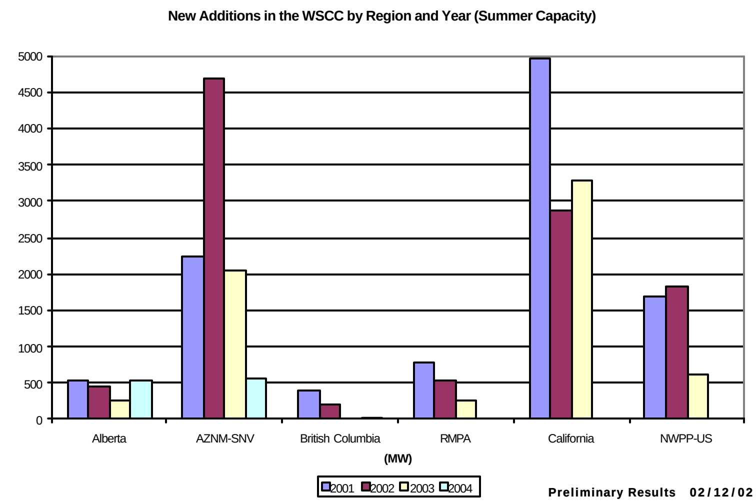
Operating Reserves

- *Defined reserves for three regions in the With RTO West case (to capture transmission constraints), while reserves are defined on a company basis for the Without RTO West case*
- *7% operating reserves, ½ spinning reserves and ½ non-spinning reserves*
- *Although there is currently a reserve-sharing agreement among NWPP and AZ-NM-SNV power areas, the current requirement is that each control area carries its own reserve, which is not the same as having a regional requirement*

With RTO West	*Without RTO West*
Same levels, but Three regions: 1. BC Hydro 2. Northwest 3. Montana-Utah	Company basis: 7% reserves: 1/2 spinning, 1/2 non-spinning

New Generation Units

A significant number of new units are planned to come on line by 2004, most of these tend to be in California and the southwest



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Quantification of Benefits

- *Quantification of benefits from the GE MAPS analysis is based on comparisons of:*
  - Generation production cost
  - Load payments (based on spot market purchases)
  - Generation revenues (based on spot market payments)
- *The comparisons were made both across the system and on a regional basis*

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Explanation of Benefits

- Several variables make up the RTO West benefits:
  - Lower production cost
  - Lower transmission congestion cost
  - Higher exports to neighboring regions
  - Lower prices to loads (assuming inelastic demand, the benefits would have been higher if we used elastic demand since it would increase with lower prices)

Annual Benefits

RTO West loads paid	$	1,347	million less
RTO West generators received	$	953	million less
Total benefit	$	395	million
Additional generation cost	$	37	million
Net benefit	$	358	million/year

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MAPS Results

Summary of Benefits- $3.80/MWh Wheeling Rate

- Comparison between status quo and RTO West:
  - Energy prices go down, decreasing load payments and generators' revenues
  - Spinning reserve market prices go down, having a similar effect as energy prices
  - RTO West production costs increase because exports increase as we eliminate pancaked wheeling charges

Summary of Benefits ($M) - Difference Between With and Without RTO Cases

	A	B	C	D	E	F	G	H
Sub-Region	Cost of Energy to Load	Uplift Payment	Spinning Reserve Payment	Total Load Cost A+B+C	Generation Cost	Value of Energy to Generators	Generator Net Revenue B+C+F-E	Net Impact G-D
RTO West	(1,347.5)	(2.3)	(246.0)	(1,595.7)	36.7	(953.0)	(1,237.9)	357.8

Figures shown are annual impacts in real 2000$s for the year 2004

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Summary of Benefits- $3.80/MWh Wheeling Rate (cont.)

- *Comparison between status quo and RTO West:*
  - *Total production cost goes down because of more efficient dispatch (if energy prices were the same, then net energy revenues would have been higher)*

Summary of Benefits ($M) - Difference Between With and Without RTO Cases								
	A	B	C	D	E	F	G	H
Sub-Region	Cost of Energy to Load	Uplift Payment	Spinning Reserve Payment	Total Load Cost A+B+C	Generation Cost	Value of Energy to Generators	Generator Net Revenue B+C+F-E	Net Impact G-D
ALBERTA	(62.7)	0.2	(1.6)	(64.1)	(3.7)	(63.4)	(61.1)	3.0
BRITCOL	(126.4)	(2.7)	(5.8)	(135.0)	(107.7)	(224.3)	(125.3)	9.7
RTO West W/O BC	(1,221.0)	0.4	(240.2)	(1,460.7)	144.3	(728.6)	(1,112.6)	348.1
CA ISO	(798.7)	13.3	(59.1)	(844.5)	(162.5)	(967.0)	(850.3)	(5.8)
Rocky Mtn	(239.6)	0.3	(66.8)	(306.1)	(52.6)	(235.5)	(249.3)	56.8
W Connect	(443.7)	(4.9)	(103.6)	(552.2)	(38.2)	(490.4)	(560.7)	(8.5)
Total	(2,892.2)	6.6	(477.1)	(3,362.7)	(220.3)	(2,709.2)	(2,959.4)	403.3

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Figures shown are annual impacts in real 2000$s for the year 2004

Summary of Benefits- $3.80/MWh Wheeling Rate (cont.)

- *The total benefit in the WSCC region is around $400 million/year*
- *There are two components to this benefit*
  - Savings in production cost due to more efficient dispatch (about $220 million/year)
  - Lower transmission congestion cost due to lower transmission congestion (about $180 million/year)

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MAPS Results

Summary of Benefits- $2/MWh Wheeling Rate

- As expected, lowering wheeling rates from $3.80/MWh to $2/MWh causes a transfer of wealth from the low-cost exporting areas to the high-cost importing areas. The wheeling-out rate effectively retains most of the benefits inside RTO West. Also, total net benefits increase by a few $million
- Total RTO West benefits are not very sensitive to this change in wheeling rates ($351M + $5M) compared to ($348M + $10M)

Summary of Benefits ($M) - Difference Between With and Without RTO Cases

	A	B	C	D	E	F	G	H
Sub-Region	Cost of Energy to Load	Uplift Payment	Spinning Reserve Payment	Total Load Cost A+B+C	Generation Cost	Value of Energy to Generators	Generator Net Revenue B+C+F-E	Net Impact G-D
ALBERTA	(41.1)	0.1	(1.2)	(42.1)	(0.4)	(41.1)	(41.7)	0.4
BRITCOL	(83.4)	(2.8)	(5.0)	(91.3)	(106.6)	(184.9)	(86.2)	5.1
RTO West	(1,027.7)	0.3	(235.6)	(1,263.0)	147.7	(528.9)	(911.9)	351.1
CA ISO	(850.9)	14.1	(61.5)	(898.4)	(182.8)	(1,034.1)	(898.8)	(0.3)
Rocky Mtn	(219.9)	0.3	(66.5)	(286.2)	(49.4)	(217.3)	(234.2)	52.0
W Connect	(434.9)	(5.0)	(103.3)	(543.2)	(37.9)	(474.3)	(544.7)	(1.5)
Total	(2,658.0)	7.0	(473.2)	(3,124.2)	(229.3)	(2,480.6)	(2,717.5)	406.6

Figures shown are annual impacts in real 2000$s for the year 2004

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MAPS Results

Average Energy Price Change: RTO West - $3.8/MWh Wheeling Rate

As we expect, annual average energy prices go down in most load areas in the With RTO West case

		Annual Average Energy Price ($/MWh)		
Area	Region	Without RTO	With RTO	% Change
Avista Corp	RTO West	38.63	32.81	(15.06)
BC Hydro + W Kootenay	RTO West	37.03	34.98	(5.54)
Bonneville Power Admin	RTO West	38.02	32.81	(13.72)
Chelan Douglas Grant PUD	RTO West	37.57	32.78	(12.75)
Idaho Power Company	RTO West	34.01	31.87	(6.30)
Montana Power Company	RTO West	28.43	29.21	2.76
Nevada Power Company	RTO West	31.87	29.13	(8.60)
Pacificorp East	RTO West	30.06	27.78	(7.57)
Pacificorp West	RTO West	36.20	32.74	(9.57)
Portland General Electric	RTO West	35.79	32.79	(8.38)
Puget Sound Energy	RTO West	38.84	32.77	(15.64)
Seattle City Light	RTO West	38.09	32.77	(13.99)
Sierra Pacific Power	RTO West	48.48	39.12	(19.30)
Tacoma Public Utilities	RTO West	37.68	32.77	(13.03)

Figures shown are annual impacts in real 2000$s for the year 2004

TCA will calculate load-weighted average prices for each region for the final report

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MAPS Results

Average Energy Price Change: Other WSCC- $3.8/MWh Wheeling Rate

Similar patterns occur throughout the WSCC

		Annual Average Energy Price ($/MWh)		
Area	**Region**	**Without RTO**	**With RTO**	**% Change**
Alberta Power	Alberta	21.83	20.80	(4.73)
LA Dept of Water & Power	CA ISO	31.91	30.42	(4.67)
Pacific Gas & Electric	CA ISO	39.18	35.51	(9.36)
San Diego Gas & Electric	CA ISO	31.13	29.76	(4.39)
Southern California Edison	CA ISO	31.19	29.70	(4.80)
Public Service of Colorado	Rocky Mtn	31.02	25.11	(19.07)
WAPA Colorado-Missouri	Rocky Mtn	26.10	25.42	(2.61)
WAPA Upper Missouri	Rocky Mtn	30.96	26.44	(14.61)
Arizona Public Service	W Connect	30.00	26.50	(11.69)
El Paso Electric	W Connect	35.76	30.20	(15.53)
Imperial Irrigation District	W Connect	31.07	28.43	(8.51)
Public Service New Mexico	W Connect	31.31	26.68	(14.78)
Salt River Project	W Connect	29.96	26.40	(11.88)
Tucson Electric Power	W Connect	29.83	26.15	(12.33)
WAPA Lower Colorado	W Connect	29.71	26.24	(11.70)

Figures shown are annual impacts in real 2000$s for the year 2004

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Energy Impact Analysis – Next Steps

- *Rerun base cases with data updates*
- *Run sensitivity cases*
  - With RTO case, but with pancaked loss rates as in Without RTO
  - With RTO case with zero export fee out of RTO West
  - Low water and high gas price cases
  - With RTO case, but with scheduling limits back in
  - With RTO case with ancillary services "self-provided" within each CA
- *Finalize results, release report*
  - End of February deliverable

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Section II

Other Benefit/Cost Study Quantitative Analyses

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Other Analyses Including Quantification

- *Benchmarking of actual RTO cost data*
  - Approach, results and implications
- *Benchmarking of actual exchange costs*
  - Approach, results and implications
- *Benchmarking of market participants' "Schedule Coordinator" costs of interfacing with RTO*
  - Approach
  - Results to follow in final report
- *Industry survey of the value of lost load*
  - Approach, findings and implications

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Setup/Operation Costs of RTOs

- *TCA collected data from various sources related to costs to develop and maintain ISOs/RTOs in North America*
  - Provides some sense of RTO costs
- *October 2000 Benefit/Cost report estimated RTO West expected costs much lower than industry averages*
  - $82M startup, $50M annual O&M
  - Based on bottom-up analysis and generally viewed as "lean"

Setup/Operation Costs of RTOs

	Annual O&M Costs $Mil	Ann. Amort./ Depr./ Int. Costs $ Mil	Total Annual Rev Req w/ debt& Interest	Annual Energy TWh	Unit O&M Costs $/MWh	Unit Rev Req $/MWh	Peak Demand 2000 MW	Transm Miles	# FTE employees	Staffing FTE/TWh	Start-up Costs $ Millions
PJM 2000	70.2	31.6	101.8	256	0.27	0.40	49,417	8,000	384	1.50	140
PJM without PJM West (2002)			128.9	256		0.50		8,000			
PJM with PJM West (2002)			137.3	314		0.44		13,100			
New York	53.7	6.9	60.6	149	0.36	0.41	30,311	10,800	222	1.49	82
New England	55.7		55.7	122	0.46	0.46	23,300	7,000	323	2.65	55
Calif ISO			228.0	270		0.84	45,990	25,526	544	2.01	
ERCOT	44.6	77.4	122.1	281	0.16	0.44	57,606	37,000	250	0.89	137
Alberta TA			15.1	54		0.28	7,785	10,540	49	0.91	
Ontario	57.6	28.4	86.0	150	0.39	0.58	23,428	18,000	417	2.79	172
Weighted Average $/MWh RTO Carrying Cost						0.51					
Weighted Average $/MWh RTO Carrying Cost, Without CA ISO						0.45					

With 281.2 TWh annual energy, annual RTO Cost at $.51/MWh = $142M
at $.45/MWh = $126M

RTO Cost Discussion Items

- *Application of these values to an RTO West valuation requires judgment about the comparable level of effort required for the RTO West*
- *Various attributes are not distinguished in the preceding table*
  - ISO costs may include upgrades that would have occurred with or without the RTO
    - Regional upgrades
    - SCADA upgrades
    - Y2k upgrades
  - RTO West costs are direct costs, not adjusted for parallel savings by the TOs or CAOs
  - RTO West costs do not include the costs of stakeholder participation in the development process
- *Numbers should be viewed as "ball park," given, for example, the averaging of dollar values from different years*

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Setup/Operation Costs of RTOs – Notes & Sources

Notes/Sources:

1. All values in $US

2. Direct comparisons across regions must be undertaken with care. Some shared regional functions and cost responsibilities are handled outside of ISO cost structure.

3. Some start-up costs not reflected or associated with previous tight pool structure and cost recovery

4. Cost values actual or projected for 2000 or 2001, except where noted.

5. New England annual depreciation and interest costs are accounted for outside of the NE-ISO tariff structure

6. Ontario, PJM, New England, and NY values from Ontario Independent Market Operator (IMO) Business Plan 2001-2003, November 2000

7. NY ISO transition costs were obtained from the NY ISO Annual Report, 2000

8. ERCOT values taken from Public Utility Commission of Texas Docket 23320 filings

9. Alberta values from Transmission Administrator (TA) and Power Pool of Alberta (PP) Annual Review / Report documents for 2000, and Cox Report (see note 12)

10. Ontario start-up costs based on 1999 - 2001 capital expenditures from the IMO Business Plan 2001-2003, page 32 ($CA 254 Million)

11. ERCOT start-up costs based on 2000 - 2001 capital expenditures as reported in the "Year 2001 ERCOT Fund Summary" in Docket 23320 filing

12. California numbers are from 2001 and are from Participant Charges at Electricity Exchanges, Pools and ISOs: Towards a Benchmarking Study, prepared for the Power Pool of Alberta by Paul Cox, December 29, 2000, and revised May 9, 2001

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Setup/Operations of Secondary Exchanges

- *Task plan called for investigating costs of secondary exchanges, namely transmission exchanges*
- *No public data was found regarding transmission exchanges*
- *TCA developed original survey, and broadened survey to include exchanges in general, primary and secondary*
  - Results focus on energy exchanges
  - We believe that per-transaction costs of transmission trades would be comparable
- *TCA has combined results of survey responses and other benchmarking studies*
- *Results may provide insights into the added costs of facilitating energy/transmission product trades*

Summary of Exchange Costs

Exchange	Type(s) of Market(s)	Primary or Secondary	Annual Volume (ranges)	Number of Control Areas	Start-up Capital Cost US$Million	Operating Cost US$Million	Transaction Fee (per MWh) US$s	Transaction Fee Applied to:
1	Energy: day-ahead and intra-day	Primary physical and secondary financial	54,000 GWh for 2000, approx. 57,000 GWh for 2001	1	10.85	6.83	0.069	buyers and sellers
2	Energy: spot (hourly and blocks)	Not available	<10,000 GWh	6	11.60	Not provided	0.036	buyer and seller
3	Energy: spot, forward	Primary. An exchange to match bilateral trades.	<10,000 GWh	6 (note 1)	3.9	2.5		
4	Energy: day-ahead	Primary	10,000 GWh to 40,000 GWh	1	Not provided	3.9		
5	Energy: real-time, reserves	Primary	40,000 GWh to 70,000 GWh	1	4	4.0	0.138	buyers and sellers
6	Energy: day-ahead, forward	Primary	<10,000 GWh	1	2.5	Not provided		
7	Energy: spot, forward		10,000 GWh to 40,000 GWh		Not available	Not available	0.002	contracts
8							0.030	buyer and seller
9	Energy: spot, forward; clearing facility		>100,000 GWh			1.00	0.028	buyers and sellers
10			>100,000 GWh	1		62.00		
11			>100,000 GWh			5.70		buyers
Average charge per MWh traded(note 2)							$ 0.10	

Sources: Blue is from APEX survey responses
Green is from the web site
Purple is from the Alberta survey.

Notes 1. 6 Transmission Areas
2. Transactions applied to buys and sells are doubled for purposes of average

Exchange Cost Insights

- *Transaction fees provide a proxy for the all-in costs of the exchange, including a profit margin*
- *Only a fraction of RTO West throughput would use the services of an exchange (Total – bilateral – RTO market volume)*
- *A market participant's use of the exchange would likely add more value than costs (though the value added is presumed to exist in the MAPS assumption of liquidity)*
- *Exchange costs often include costs of scheduling with the system operator/RTO, thereby offsetting the need for SC infrastructure*

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Summary of Exchange Costs Notes/Sources

1. *No complete set of either startup and operating costs data, or transaction fee data, was provided. TCA chose to use the transaction fee data, where provided, to average for a simple proxy. Parties are advised to estimate actual costs, and relevance of exchange data for themselves*
2. *To develop the transaction fee average, TCA doubled the transaction fees if the exchange applied the fee to both buyers and sellers. The transaction fee averaging used a simple average, rather than weighted average.*
3. *Anonymity was offered to those responding to TCA's survey; exchange names have been suppressed to this end*
4. *Exchange data for exchanges 1 through 6 are from TCA's international survey of exchanges, winter 2001 – 2002*
5. *Exchange data for exchange 7 were gathered from the exchange's public web site*
6. *Exchange data for exchanges 8 through 11 are from Cox, op. cite.*

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Setup/Operations of SC Businesses

- *The marketplace will incur the costs of interacting with the RTO*
- *A majority element of these costs is the cost to set up the data communication and scheduling practices, such as those of a Schedule Coordinator (CAISO) or Qualified Scheduling Entity (ERCOT)*
- *The objective was to collect data regarding establishment and operation of an SC operation*
  - TCA is not aware of existing data on this topic
  - TCA is administering a survey
  - Results will be included in the final report

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Value of Loss-of-Load Benchmarking

- *TCA reviewed sources from industry*
  - Many regions in the country have markets for load response, suggesting that some fraction of the load is willing to be curtailed at this level of compensation
  - Much less data exists regarding the value of involuntary load curtailment
- *The expectation is that the value of lost load will be used in conjunction with estimates of impacts on outage frequency and duration*
  - Outage frequency and duration are being developed outside of this study

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Value Of Loss-of-Load – Involuntary Load Interruption

- *Several sources of data were found*
  - California Manufacturers' Association => Estimated direct losses from rolling blackouts last summer to be $6.8 billion direct costs, and $14.9 billion indirect costs. Given 20 hours of rolling blackouts of 3647 MW, this was roughly $30k/MWh lost value
  - Power System Economics, by Steven Stoft reports on previous studies
    - Australia:
      - Values LoL at $16k/MWh and uses LoL at $10k/MWh for purposes of purchasing installed capacity
    - England
      - Trading agreements value loads at over $50k/MWh ($CA or $US unclear)

Section III

Qualitative Investigation of Other Potential Impacts of an RTO

An RTO has a Wide Variety of Other Potential Benefits and Costs

- *TCA gathered possible benefits and costs from industry literature*
- *These have been grouped into several topic areas:*
  - RTO focus, coordination and information exchange
  - RTO consolidation of functionality
  - Organizational relationships established by RTO process
  - RTO independence
- *TCA also surveyed marketers in the northwest, addressing perceived benefits of the RTO West*
- *Many of these impacts are generally viewed as material*
  - However, this study did not examine the quantitative anticipated value of each, nor the extent to which benefits or cost have played out in other markets

The RTO Is Seen as Offering More Focus, Coordination and Information Exchange

- *Potential benefits:*
  - Planned outage management
    - The RTO's "big picture" perspective will allow it to make more accurate assessments of the effect of proposed maintenance schedules on reliability
  - Reduced failure propagation
    - The RTO, through tightened communications and coordination, may reduce conditions that cause failures to propagate throughout an entire region, relative to the geographically fragmented approach by which the transmission system is operated today.
  - Voltage/frequency management
    - Today neighboring control areas can experience frequency oscillations and voltage support issues due to the interaction of generating units and transmission operation in neighboring control areas.
    - The RTO West would likely provide increased ability to manage frequency and voltage given broader information and broader control of transmission and generation resources and loads

The RTO Is Seen as Offering More Focus, Coordination and Information Exchange (cont.)

- *Potential benefits (continued):*
  - Loop/parallel path flow
    - An RTO can better manage parallel path flow, because of
      - Improved access to region-wide information on the transmission system network conditions
      - Region-wide power scheduling authority
      - More efficient pricing of congestion
  - Scheduling, system monitoring, checkouts and settlements
    - Traditional information exchanges will be automated and/or no longer required with an RTO. These include:
      - Information exchange on schedules, system state and real-time flows on interacting transmission elements (nomograms)
      - Real-time check-out and coordination of schedules and reservations on inter-control area ties
      - Inadvertent interchange and accounting, data collection and data sharing, and settlement

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The RTO Is Viewed to Offer More Focus, Coordination and Information Exchange (cont.)

- *Potential benefits (continued):*
  - Impacts of a single control area on reserves and transmission capacity
    - Available Transmission Capacity (ATC) will likely increase due to:
      - A reduced need to set aside transmission capacity to compensate for the inability to manage transmission and generation resources in neighboring control areas
      - Better scheduling of transmission line maintenance
      - Standard approaches to defining path ratings and transfer capabilities
    - Automatic Generation Control (AGC)
      - To the extent benefits have not already been captured through the regional reserve sharing policies, AGC requirements will decrease mainly because of higher load diversity and larger geographic regional requirement determination
    - Reserve sharing other than spinning reserve benefits captured by MAPS
      - As with AGC, single largest contingency requirements may further decrease with an RTO
      - To the extent the northwest requires additional reserves for use of non-firm transmission between existing control areas, this need should decrease with an RTO
      - Having available more efficient resources for reserves will reduce the costs of reserves

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The RTO Is Viewed to Offer More Focus, Coordination and Information Exchange (cont.)

- *Potential benefits (continued):*
  - Real-time balancing efficiency
    - Scheduling and balancing, which would have otherwise been managed through inter-control area tie arrangements, will be managed under a single entity
    - This will permit an aggregation and simplification of the balancing function, as well as a more efficient balancing solution
  - Long-term planning and expansion benefits
    - Centralized coordination will allow grid expansion to be planned in the most economically efficient manner while maintaining or improving grid regional reliability
    - Generation additions – types and mix
      - Generation additions would likely be more optimal, given that an RTO will create efficient price signals and locational benefit signals, and that a broader market will allow more efficient use of generating resources (more baseload, and reduced need for service area peaking units)
      - As the RTO results in lower capacity requirements, benefits will be recognized in the long run through reduced need for generating capacity additions

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The RTO Is Viewed to Offer More Focus, Coordination and Information Exchange (cont.)

- *Neutralizing impact*
  - Ongoing industry coordination may create benefits even absent RTO formation
- *Potential costs*
  - Loss of detailed experience/expertise
    - Some parties believe that by forming a large, centralized RTO, the unique experience of the operators of individual transmission systems may be lost

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RTO Consolidation of Functionality Creates Impacts

- *Potential benefits*
  - Cost efficient
    - A single RTO should be more efficient as the breadth increases, thereby reducing costs relative to the sum of the costs of the individual control centers
  - Having a single OASIS site should reduce costs and improve liquidity
    - Overall OASIS management costs should decrease
    - Market participants should benefit from "one-stop shopping" and standardization
    - Consistency in OASIS practices should also facilitate seamless trades across RTOs
  - A single region-wide tariff will reduce costs and encourage market competitiveness
    - Both relative to each operator maintaining tariffs and for market participants
    - Levels the playing field for small unsophisticated players
  - Standardized business practices
    - In addition to standardized tariffs, other business practices will be standardized with the RTO, thereby reducing transaction costs of market participants

RTO Consolidation of Functionality Creates Impacts (cont.)

- *Neutralizing impact*
  - Ongoing industry standardization may create benefits even absent RTO formation
- *Potential costs*
  - Increased complexity
    - An RTO may be more complex and therefore cost more for market participants to schedule and settle with than would each individual control area

The RTO Formation Establishes New Relationships

- *Potential Benefits*
  - The legal relationships created by the RTO may provide an enhanced business structure
    - By working through legal liability issues, the formation of the RTO may reduce total costs of managing liability between parties
  - Credit management is formalized by the RTO
    - The RTO will put in place structures that will facilitate credit management to at least some extent
  - The formation of the RTO may cause resolution of ongoing regional/local regulatory issues
- *Potential Costs*
  - Resources are required to form new relationships
    - Direct RTO costs likely rolled into quantified RTO cost data
    - Developing relationship structure requires stakeholder resources pre-RTO
  - Entity tax implications
    - RTO may cause new tax treatment (the details of which are outside the scope of this study)

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The Independent Nature of the RTO Will Have Impacts

- *Potential benefits*
  - The RTO's independent transmission maintenance scheduling is viewed by some to be advantageous
  - RTOs may eliminate – through structural separation – the economic incentive to act in ways adverse to other control areas in the region
  - An independent RTO would remove any mechanism for influencing ATC values based on energy portfolios
- *Potential costs*
  - Separating transmission operations from generation operations requires formalizing management of the interrelationship of generation impact on transmission and transmission impacts on generation (e.g., now need formal procedures/markets for VAR control)

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End