



**RTO West Benefit Cost Study
Preliminary Results, Sensitivity Cases
Prepared for BPA
March 27, 2002**

Presented below are the results of the analysis performed for BPA and its customers. Three types of data are provided. First the base case is restated for convenience and comparison. Secondly, the results of the additional sensitivity cases are shown, and third, prices are provided for each of the load zones defined by BPA.

The details of the results follow.

RTO West Base Case

The following table restates the Base Case analysis (Without vs. With RTO)

**Table 1
Summary of Benefit Cost Study Base Case**

Summary of Benefits (\$M) - Base Case [With RTO - Without RTO]								
	A	B	C	D	E	F	G	H
Sub-Region	Load Energy Payment	Uplift Payment	Spinning Reserve Payment	Total Load Payment A+B+C	Generation Cost	Generator Energy Revenue	Generator Net Revenue B+C+F-E	Net Impact G-D
ALBERTA	(53)	0	(1)	(54)	(8)	(51)	(44)	10
BRITCOL	(70)	(2)	(3)	(75)	(87)	(147)	(65)	10
CA ISO	(526)	13	(50)	(563)	(174)	(711)	(573)	(10)
Rocky Mtn	(266)	0	(77)	(343)	(58)	(253)	(272)	70
Rest of RTO West	(1,174)	1	(209)	(1,383)	124	(755)	(1,087)	295
W Connect	(426)	(1)	(111)	(539)	(37)	(429)	(504)	34
Total	(2,516)	11	(451)	(2,956)	(239)	(2,345)	(2,546)	410

The following sensitivities were considered in contrast to the RTO West benefit Cost Study Base Case:

- With RTO \$2 Wheel-Out Rate
- High Water/Average Gas Prices
- Spinning Reserve Opportunity Cost Analysis
- With RTO Excluding BPA

The following section provides a discussion of the sensitivity runs, and an overview of results.

With RTO \$2 Wheel-Out Rate

Case considered:

- In this sensitivity we changed the With RTO case to lower the wheel out rate for the RTO West area to \$2/MWh as compared to the \$3.80/MWh rate in the Base Case. The Without RTO run is identical to the Without RTO Base Case.

Results:

- Compared to the Base Case, Load Energy payments increase by \$200M across the WSCC system and by \$206M within RTO West (including British Columbia).

- Generation net revenues decrease by \$202M across the WSCC system; the change within RTO West and British Columbia is similar (\$208M decrease).
- The net impact on the system does not change significantly, the Generation Cost savings are higher (\$2 million) and transmission rent savings are lower (\$3 million), yielding a change in Net Impacts of only \$1M.

Table 2

Summary of Benefits (\$M) - [RTO With \$2/MWh Wheel Out - Without RTO]								
	A	B	C	D	E	F	G	H
Sub-Region	Load Energy Payment	Uplift Payment	Spinning Reserve Payment	Total Load Payment A+B+C	Generation Cost	Generator Energy Revenue	Generator Net Revenue B+C+F-E	Net Impact G-D
ALBERTA	(38)	0	(1)	(38)	(6)	(36)	(31)	7
BRITCOL	(34)	(2)	(2)	(38)	(85)	(111)	(31)	7
CA ISO	(559)	15	(53)	(597)	(188)	(754)	(604)	(7)
Rocky Mtn	(254)	0	(77)	(331)	(55)	(241)	(263)	68
Rest of RTO West	(1,005)	1	(206)	(1,210)	132	(576)	(913)	297
W Connect	(426)	(1)	(111)	(538)	(39)	(428)	(502)	36
Total	(2,315)	13	(451)	(2,753)	(241)	(2,147)	(2,344)	409

High Water/Average Gas Prices

Case considered:

- In this sensitivity we used hydro energy data from a wet year in both With RTO & Without RTO runs.
- For plants in the BPA area we used data provided from a HOSS model simulation for 1974 (model results using 1974 precipitation, 30% higher than median year data).
- For BC Hydro plants we used data for an extreme wet year as provided (3% higher than median).
- Hydro data for the rest of the WSCC was developed using EIA 759 data for 1997 which was a wet year in most of the WSCC

Results:

- The larger amount of hydro energy lowers the energy market clearing prices and tends to lessen the overall impact of RTO formation on both loads and generators.
- The reduction in Load Energy payments due to RTO formation is much smaller than in the Base Case (\$618M within RTO West and British Columbia compared to \$1244M).
- Similarly the change in Generator Net Revenues is much smaller than in the Base Case (\$275M within RTO West compared to \$1153M).
- WSCC-wide Net Impacts decrease by \$164M compared to the Base Case. Within RTO West and British Columbia, the Net Impacts decrease by \$97M.

Table 3

Summary of Benefits (\$M) - High Water Case [With RTO - Without RTO]								
	A	B	C	D	E	F	G	H
Sub-Region	Load Energy Payment	Uplift Payment	Spinning Reserve Payment	Total Load Payment A+B+C	Generation Cost	Generator Energy Revenue	Generator Net Revenue B+C+F-E	Net Impact G-D
ALBERTA	(55)	1	(2)	(56)	(7)	(64)	(58)	(2)
BRITCOL	28	(10)	(11)	6	(74)	(59)	(7)	(13)
CA ISO	115	(12)	(8)	95	49	137	68	(27)
Rocky Mtn	(189)	(1)	(59)	(250)	(43)	(174)	(191)	59
Rest of RTO West	(645)	(0)	157	(489)	(41)	(466)	(268)	221
W Connect	(221)	(3)	(15)	(239)	(34)	(247)	(230)	8
Total	(967)	(26)	60	(933)	(151)	(872)	(686)	246

Spinning Reserve Opportunity Cost Analysis

Case considered:

- These runs are identical to the Base Case. However, in calculating benefits, we use the hourly opportunity cost of spin instead of the market clearing prices for thermal spinning reserve units.
- We assume zero marginal cost for hydro units in GE MAPS and so we are not able to capture the true opportunity cost of spin. Results reported here reflect zero opportunity cost of spin for hydro units. For thermal units, we capture the opportunity costs based on the marginal costs of the units as modeled in GE MAPS (locational market clearing price minus marginal cost).

Results:

- Spinning reserve payments factor into both load payments & generator revenues, therefore cause no change in Net Impact.
- The reduction in spinning reserve payments is \$315M across the WSCC (from \$451M to \$136M) when they are calculated as described above. The decrease in spinning reserve payments for the RTO West, including British Columbia, is \$143M.

Table 4

Summary of Benefits (\$M) - Base Case [With RTO - Without RTO] Opportunity Cost of Spinning								
	A	B	C	D	E	F	G	H
Sub-Region	Load Energy Payment	Uplift Payment	Spinning Reserve Payment	Total Load Payment A+B+C	Generation Cost	Generator Energy Revenue	Generator Net Revenue B+C+F-E	Net Impact G-D
ALBERTA	(53)	0	(1)	(54)	(8)	(51)	(44)	10
BRITCOL	(70)	(2)	1	(71)	(87)	(147)	(61)	10
CA ISO	(526)	13	(10)	(523)	(174)	(711)	(533)	(10)
Rocky Mtn	(266)	0	(9)	(275)	(58)	(253)	(205)	70
Rest of RTO West	(1,174)	1	(71)	(1,244)	124	(755)	(949)	295
W Connect	(426)	(1)	(46)	(474)	(37)	(429)	(440)	34
Total	(2,516)	11	(136)	(2,641)	(239)	(2,345)	(2,231)	410

Using Opportunity Costs of Spinning Reserves for Thermal Units Only!

With RTO Excluding BPA

Case considered:

- We ran the With RTO case without including BPA in the proposed RTO West. This entails:
 - The RTO exists with all other participating entities except BPA
 - Only those contract paths that involve BPA are retained, along with the corresponding wheeling charges (as in the base case)

- B.C.HYDR-NORTHWES
- IDAHO-NORTHWES
- LADWP-NORTHWES
- MONTANA -NORTHWES
- NORTHWES-PG AND E
- NORTHWES-SIERRA
- NORTHWES-W KOOTEN
- RTO West continues to have \$3.80/MWh wheel out rate (including wheel-outs to BPA)
- Maintenance and operating reserves are scheduled separately for BPA

Results:

- When the RTO does not include BPA, Net Impact across the WSCC system decreases by \$96M, from \$410M to \$313M.
- The RTO West, including British Columbia, benefits by \$206M, a reduction of \$99M from the Base Case. (Note: the RTO West region continues to be inclusive of impacts on BPA.)
- The rest of the WSCC sees minimal change in net impact.

Table 5

Summary of Benefits (\$M) [With RTO Excluding BPA - Without RTO]								
	A	B	C	D	E	F	G	H
Sub-Region	Load Energy Payment	Uplift Payment	Spinning Reserve Payment	Total Load Payment A+B+C	Generation Cost	Generator Energy Revenue	Generator Net Revenue B+C+F-E	Net Impact G-D
ALBERTA	(48)	0	(1)	(49)	(7)	(47)	(41)	8
BRITCOL	(118)	(1)	(4)	(123)	(86)	(192)	(111)	12
CA ISO	(440)	9	(43)	(474)	(159)	(610)	(485)	(11)
Rocky Mtn	(202)	0	(76)	(278)	(45)	(194)	(225)	53
Rest of RTO West	(1,484)	2	(173)	(1,655)	104	(1,186)	(1,461)	194
W Connect	(375)	(2)	(107)	(483)	(38)	(356)	(426)	57
Total	(2,667)	8	(403)	(3,063)	(232)	(2,586)	(2,749)	313

Energy Price Comparison

Table 6 presents the annual average locational energy prices for the base case and each of the sensitivities.

Table 7 presents the simple average of the hourly zonal energy prices. The hourly zonal energy prices are calculated as the load weighted average of the locational (nodal) market-clearing prices in each zone. The zone definition was provided by BPA. The results show decreases in all regions except load zone “L”, where the analysis shows a 6% increase will result. In the balance of the zones, prices are shown to decrease from 3% in load zone “A” to 24% in load zone “J”.

Table 6
Annual Average Energy Prices, Base Case and Sensitivities

Annual Average Energy Price (Real 2000\$/MWh)													
Area	Region	Base Case			RTO \$2 Wheel-Out Rate			High Water/Avg Gas Price			BPA out of RTO		
		Without RTO	With RTO	% Change	Without RTO	With RTO	% Change	Without RTO	With RTO	% Change	Without RTO	With RTO	% Change
BC Hydro + W Kooteny	RTO-West	35.80	34.59	(3.38)	35.80	35.16	(1.79)	29.54	30.06	1.78	35.80	33.86	(5.42)
Avista Corp	RTO-West	35.50	29.68	(16.41)	35.50	30.36	(14.49)	25.26	22.07	(12.62)	35.50	29.79	(16.08)
Bonneville Power Admin	RTO-West	34.82	29.73	(14.63)	34.82	30.43	(12.62)	24.30	22.26	(8.36)	34.82	29.32	(15.81)
Chelan Douglas Grant PUD	RTO-West	34.18	29.71	(13.06)	34.18	30.41	(11.00)	24.11	22.35	(7.30)	34.18	28.85	(15.57)
Idaho Power Company	RTO-West	30.30	28.89	(4.65)	30.30	29.50	(2.65)	26.81	24.77	(7.59)	30.30	27.75	(8.42)
Montana Power Company	RTO-West	25.24	26.79	6.12	25.24	27.35	8.36	16.94	19.10	12.73	25.24	21.84	(13.49)
Nevada Power Company	RTO-West	33.75	30.29	(10.27)	33.75	30.57	(9.44)	32.44	29.87	(7.92)	33.75	28.94	(14.28)
Pacificorp East	RTO-West	30.16	27.40	(9.15)	30.16	27.74	(8.00)	27.27	25.61	(6.08)	30.16	26.49	(12.16)
Pacificorp West	RTO-West	32.73	29.66	(9.39)	32.73	30.37	(7.22)	24.76	22.78	(7.99)	32.73	26.73	(18.32)
Portland General Electric	RTO-West	33.42	29.71	(11.11)	33.42	30.42	(8.98)	24.03	22.59	(5.99)	33.42	26.38	(21.06)
Puget Sound Energy	RTO-West	35.60	29.75	(16.44)	35.60	30.45	(14.48)	25.28	22.11	(12.54)	35.60	30.16	(15.28)
Seattle City Light	RTO-West	34.82	29.73	(14.61)	34.82	30.43	(12.60)	24.53	22.20	(9.47)	34.82	29.42	(15.51)
Sierra Pacific Power	RTO-West	40.99	33.17	(19.07)	40.99	33.72	(17.75)	34.75	28.40	(18.28)	40.99	33.71	(17.75)
Tacoma Public Utilities	RTO-West	34.42	29.73	(13.61)	34.42	30.43	(11.58)	24.11	22.13	(8.20)	34.42	28.99	(15.78)

Annual Average Energy Price (Real 2000\$/MWh)													
Area	Region	Base Case			RTO \$2 Wheel-Out Rate			High Water/Avg Gas Price			BPA out of RTO		
		Without RTO	With RTO	% Change	Without RTO	With RTO	% Change	Without RTO	With RTO	% Change	Without RTO	With RTO	% Change
Alberta Power	ALBERTA	23.98	23.14	(3.50)	23.98	23.39	(2.44)	21.55	20.70	(3.95)	23.98	23.21	(3.22)
LA Dept of Water & Power	CA ISO	34.39	30.99	(9.88)	34.39	30.96	(9.98)	29.37	29.82	1.54	34.39	31.22	(9.23)
Pacific Gas & Electric	CA ISO	32.88	31.31	(4.79)	32.88	31.12	(5.35)	28.55	29.15	2.12	32.88	31.61	(3.86)
San Diego Gas & Electric	CA ISO	32.20	30.98	(3.82)	32.20	30.95	(3.91)	29.59	29.90	1.05	32.20	31.28	(2.88)
Southern California Edison	CA ISO	32.93	31.41	(4.61)	32.93	31.37	(4.74)	30.23	30.29	0.22	32.93	31.66	(3.85)
Public Service of Colora	Rocky Mtn	32.66	25.80	(21.00)	32.66	25.97	(20.48)	28.54	24.35	(14.69)	32.66	26.84	(17.83)
WAPA Colorado-Missouri	Rocky Mtn	26.75	25.84	(3.43)	26.75	26.03	(2.69)	25.74	24.10	(6.37)	26.75	26.90	0.54
WAPA Upper Missouri	Rocky Mtn	27.59	24.69	(10.54)	27.59	25.14	(8.91)	24.05	18.09	(24.79)	27.59	25.92	(6.08)
Arizona Public Service	WConnect	31.17	27.79	(10.85)	31.17	27.80	(10.81)	28.63	26.88	(6.10)	31.17	28.23	(9.43)
El Paso Electric	WConnect	36.17	30.62	(15.33)	36.17	30.62	(15.33)	34.18	30.74	(10.07)	36.17	30.86	(14.68)
Imperial Irrigation Dist	WConnect	30.69	28.72	(6.42)	30.69	28.72	(6.44)	28.02	28.01	(0.03)	30.69	29.01	(5.49)
Public Service New Mexico	WConnect	33.16	27.77	(16.25)	33.16	27.80	(16.14)	29.45	26.87	(8.76)	33.16	28.33	(14.57)
Salt River Project	WConnect	31.12	27.71	(10.98)	31.12	27.72	(10.94)	28.58	26.79	(6.29)	31.12	28.15	(9.57)
Tucson Electric Power	WConnect	31.14	27.44	(11.87)	31.14	27.46	(11.80)	28.31	26.45	(6.59)	31.14	27.95	(10.23)
WAPA Lower Colorado	WConnect	31.11	27.46	(11.74)	31.11	27.50	(11.62)	28.46	26.48	(6.97)	31.11	28.01	(9.96)

Table 7
Monthly Simple Average Zonal Load-Weighted Average Prices, Without & With RTO

Without RTO: Monthly Simple Average of Zonal Load-Weighted Average Hourly Prices (\$/MWh)																	
Month	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Jan	49.63	35.98	36.35	34.48	35.16	36.53	35.03	34.43	30.58	45.44	34.29	25.16	30.70	29.24	34.35	35.76	36.31
Feb	39.06	36.34	36.71	34.77	36.10	36.83	35.47	35.02	31.39	41.77	34.77	25.90	32.38	31.92	34.80	36.12	36.70
Mar	33.75	33.03	33.41	31.06	32.48	33.62	31.92	31.30	28.40	36.02	32.64	24.28	30.02	30.31	32.62	32.82	33.36
Apr	30.22	28.36	28.73	26.82	28.87	28.63	27.65	27.47	26.74	33.32	29.58	23.53	27.76	26.89	29.65	28.14	28.78
May	34.58	29.89	30.13	29.03	30.58	29.87	29.33	29.32	29.07	40.66	30.75	22.59	28.73	27.46	30.82	29.57	30.07
Jun	34.01	31.05	31.24	30.04	31.13	30.94	30.34	30.26	28.87	40.66	33.34	21.60	28.24	26.98	33.28	30.69	31.15
Jul	36.43	36.88	37.23	35.87	36.96	37.57	36.14	35.81	34.26	45.12	37.30	27.06	33.44	32.22	37.25	36.66	37.04
Aug	26.73	32.36	32.71	31.38	32.44	32.95	31.68	31.46	28.39	37.06	32.70	22.78	29.02	28.39	32.67	32.14	32.57
Sep	32.80	34.87	35.22	33.91	34.74	35.46	34.19	33.91	30.20	42.00	33.48	24.41	30.11	28.78	33.53	34.65	35.10
Oct	36.10	39.04	39.39	38.09	37.41	39.71	38.24	37.76	31.30	41.00	34.84	27.14	31.83	31.43	34.95	38.82	39.27
Nov	37.02	39.13	39.48	38.16	37.98	39.94	38.23	37.63	32.96	41.81	35.90	28.25	33.33	32.33	35.98	38.90	39.31
Dec	38.49	39.44	39.78	38.34	38.57	40.41	38.49	37.79	33.52	46.84	35.00	30.11	33.88	32.48	35.12	39.21	39.57
Year	35.74	34.70	35.04	33.50	34.37	35.21	33.90	33.52	30.48	40.99	33.72	25.24	30.79	29.87	33.75	34.46	34.94

With RTO: Monthly Simple Average of Zonal Load-Weighted Average Hourly Prices (\$/MWh)																	
Month	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Jan	52.56	30.73	30.73	30.73	30.80	30.76	30.76	30.72	29.24	35.76	28.97	27.33	27.81	26.40	29.09	30.73	30.73
Feb	37.11	31.06	31.06	31.04	31.01	31.14	31.08	31.03	29.62	33.30	30.92	27.92	28.93	28.50	31.04	31.07	31.06
Mar	33.07	28.52	28.52	28.50	28.46	28.58	28.54	28.50	27.75	30.46	28.81	26.41	27.20	27.28	28.92	28.52	28.52
Apr	29.45	24.29	24.29	24.29	24.28	24.31	24.31	24.30	24.42	26.32	26.46	24.23	24.56	24.02	26.69	24.29	24.29
May	33.53	24.68	24.53	24.45	24.43	24.16	24.47	24.45	24.91	28.02	27.69	24.21	25.26	24.86	28.01	24.56	24.49
Jun	31.12	25.27	24.86	24.87	25.03	23.41	24.68	24.91	27.59	30.13	30.60	19.99	27.70	27.11	30.54	24.93	24.79
Jul	31.46	29.84	29.83	29.85	29.89	29.87	29.88	29.86	29.59	34.89	34.06	26.96	29.08	27.94	33.86	29.83	29.80
Aug	25.11	26.88	26.86	26.84	26.84	26.91	26.90	26.85	26.58	31.27	30.44	25.28	26.54	25.83	30.43	26.87	26.84
Sep	29.94	28.43	28.43	28.39	28.42	28.52	28.47	28.40	27.23	33.49	30.86	25.66	26.61	25.63	30.85	28.43	28.42
Oct	37.20	36.28	36.27	36.17	36.01	36.51	36.27	36.13	31.97	37.65	31.93	29.19	29.58	28.67	32.09	36.28	36.23
Nov	38.24	36.87	36.87	36.81	36.77	37.00	36.87	36.79	34.68	39.10	32.02	32.58	32.47	30.73	32.19	36.87	36.85
Dec	36.68	34.51	34.51	34.46	34.44	34.64	34.51	34.43	32.46	37.54	29.68	31.58	30.63	29.06	29.76	34.51	34.49
Year	34.63	29.79	29.74	29.71	29.70	29.66	29.73	29.70	28.84	33.17	30.20	26.78	28.03	27.16	30.29	29.75	29.71