

Transmission Solutions - 2013

Review of the Alternatives

- ✓ Alternatives 1, 2, 3 & 4
- ✓ Sensitivities

Overall Economics



Steering Committee Meeting

April 29, 2004 - SLC

Rocky Mountain Area Transmission Study

Where we are

- **Final Draft: Alternatives 1 – 4**
- **Focus: Alternative 3**
 - Four export options
 - VOM savings essentially the same for the four options
 - Sensitivities run: Hydro, Gas, CO₂, add Mohave & DSM
 - Potentially very wide range of VOM (low hydro to ↔ low gas)
- **Comparative economics**
 - In progress
 - Fixed costs added to VOM
 - Need consensus on method, assumptions for comparative economics

Summary of Runs

Alternative S	Options	Sensitivities
Alternative 1		
Alternative 2		
Alternative 3	<ul style="list-style-type: none"> ➤ Option 1 – Montana & Tesla ➤ Option 2 – UT & Tesla ➤ Option 3 – UT & Grizzly ➤ Option 4 – SWIP & Tesla 	<p><i>Alternative 3 – Option 3</i> CO2 (\$5 & \$15) Gas (low: \$4.50) Hydro (high & low) Add Mohave</p>
Alternative 4	<p><i>Alternative 3 = Option 3 +</i></p> <ul style="list-style-type: none"> ➤ Option 1 - Wyo to SF (DC) ➤ Option 2 – Wyo to LA (DC) 	
DSM	<ul style="list-style-type: none"> ➤ Option 1 ➤ Option 2 	

Generation Alternatives for 2013

State	Bubble	Gen Type	Name Plate Generation Values			
2013 ALTERNATIVE CASES			1	2	3	4
Colorado	Colorado East	Coal	1250	500	1540	2500
		Gas	210	210	210	603
		Wind	800	500	800	1500
	Colorado West	Coal				
		Gas				
		Wind			250	250
Idaho	KGB	Coal				
		Gas				
		Wind	125	125	125	125
	Mid Point/Boise/Snake	Coal	575			
		Gas				
		Wind				440
Montana	Montana West	Coal			260	260
		Gas			260	260
		Wind	225	280	500	1000
	Broadview	Coal		250	500	750
		Gas				
		Wind	0		950	1000
Colstrip/Crossover	Coal		359	609	1109	
	Gas					
	Wind		50	100	200	
Utah	Bonanza	Coal				
		Gas				
		Wind				
	IPP	Coal	200		950	950
		Gas				
		Wind				
Utah North	Coal					
	Gas					
	Wind	250	100	200	320	
Utah South	Coal	575	575	575	575	
	Gas	525	140	140	140	
	Wind			120	250	
Wyoming	Big Horn Basin	Coal				
		Gas				
		Wind	250	250	250	250
	Black Hills	Coal				
		Gas				
		Wind				125
LRS	Coal					
	Gas					
	Wind		500	500	1500	
SW Wyoming	Coal					
	Gas					
	Wind	925	1150	1000	2450	
Wyoming	Coal		700	1400	2100	
	Gas	50		50	50	
	Wind				800	
WYO(IDA)	Jim Bridger	Coal		575	575	575
	Yellowtail	Gas				
		Wind			160	230
		Coal				
Total Coal			2600	2959	6149	8559
Total Gas			785	350	660	1053
Total Wind Nameplate			2575	2955	4955	10440
Total Firm Energy			3900	3900	7800	11700

✓ Alternative 1- Compilation of existing IRP's - minimal new transmission

Configured incremental resource additions in each state to meet projected load growth plus reserves in that state. (Load growth is 3900 MW from 2008 – 2013 for RM states). Major wind in CO-E and SW Wyoming close to load centers

✓ Alternative 2- “Pseudo” IRP for sub-region

Focus on Powder River coal and open range wind. Solves for same load growth as Alternative 1. Requires more transmission than Alternative 1

✓ Alternative 3- Export 1 X RM load growth

Builds off Alternative 2. Additional Powder River and Utah coal and open range wind necessitating more transmission for export

✓ Alternative 4- Export 2 X RM load growth

Still more Powder River (and Utah) coal and open range wind, and additional DC line

← 20% of wind nameplate applies toward capacity

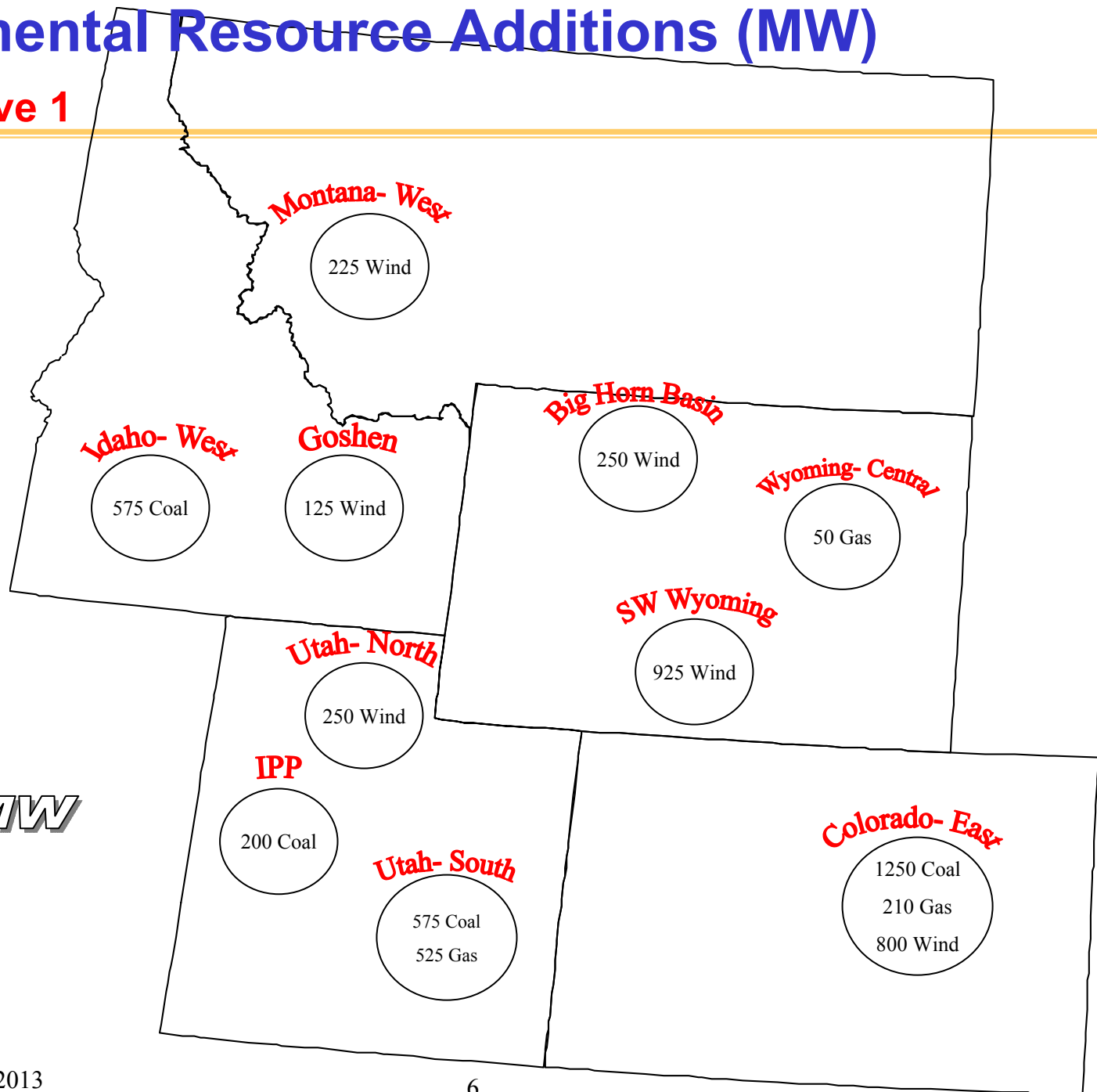
Alternative 1



Rocky Mountain Area Transmission Study

Incremental Resource Additions (MW)

Alternative 1

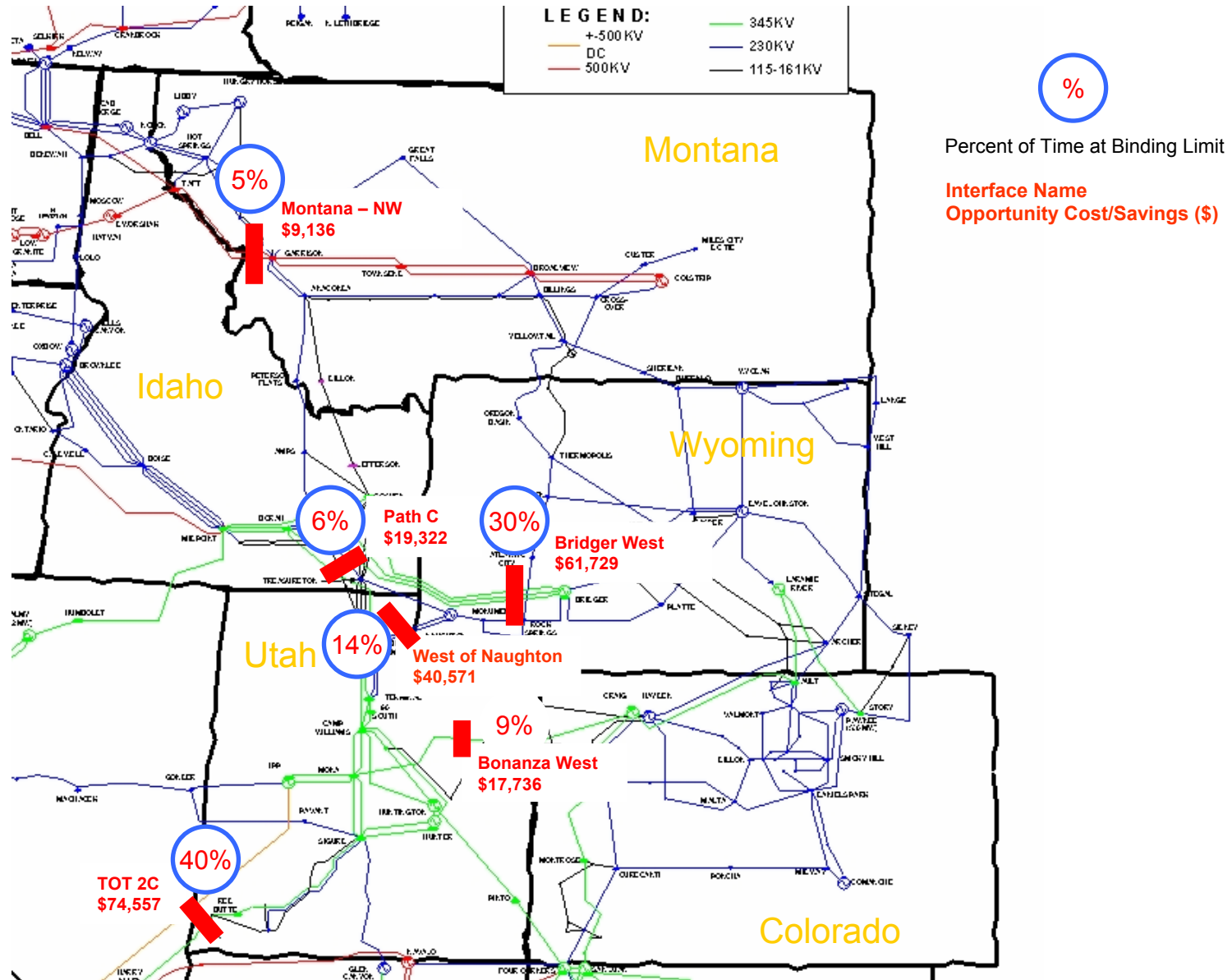


Total
3,900 MW

Congestion If No Transmission Is Added

Alternative 1, (Top 6 Paths)

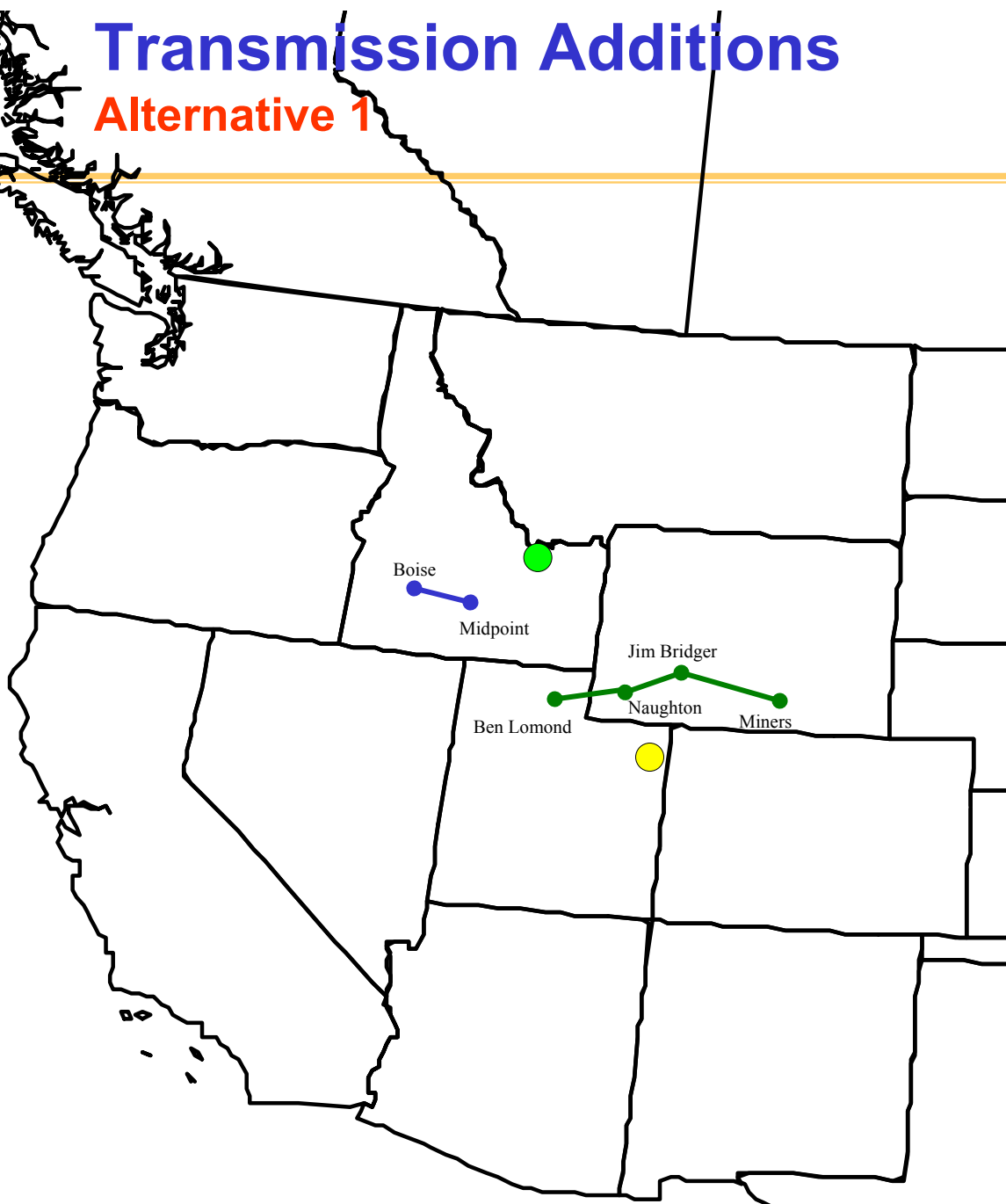
3,900 MW added to Rocky Mtn. States



Alternative 1 - no transmission additions

Transmission Additions

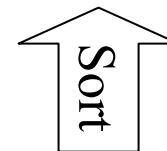
Alternative 1



Opportunity Costs with Tx Solutions

Alternative 1

Line	Interface	Existing Limits		No Added Gen/Tx		Add Gen/No Tx		Add Gen/Tx	
		Reverse Limit (MW)	Forward Limit (MW)	Opportunity Cost (\$)	% Time at Binding Limit	Opportunity Cost (\$)	% Time at Binding Limit	Opportunity Cost (\$)	% Time at Binding Limit
1	TOT 2C	(300)	300	9,094	13%	74,557	40%	55,894	35%
2	BRIDGER WEST	N/A	2,200	1,626	3%	61,729	30%	5,801	4%
3	West of Naughton (E-S&W)	N/A	920	6,436	3%	40,571	14%	2,015	1%
4	PATH C	(1,000)	1,000	3,269	1%	19,322	6%	5,408	2%
5	BONANZA WEST	N/A	785	497	1%	17,736	9%	11,758	8%
6	MONTANA - NORTHWEST	(1,350)	2,200	-	0%	9,136	5%	12,589	9%
7	Montana - Southeast	(450)	600	7,785	6%	8,549	8%	8,695	10%
8	TOT 3	N/A	1,424	10,351	9%	8,341	7%	4,012	4%
9	TOT 2B2	(300)	265	1,147	2%	7,882	6%	7,055	6%
10	TOT 1A	N/A	650	719	2%	7,197	5%	6,895	6%
11	PAVANT, INTRMTN - GONDER 230 KV	(235)	440	10,224	10%	5,225	5%	5,748	6%
12	IDAHO - MONTANA	(337)	337	13,352	3%	4,847	1%	1,567	0%
13	TOT 2B1	(600)	560	8,280	2%	3,179	4%	-	0%
14	BROWNLEE EAST	N/A	1,850	14,254	3%	1,680	0%	3,243	1%
15	IDAHO - NORTHWEST	(1,200)	2,400	7,315	3%	1,165	1%	3,701	3%
17	TOT 2A	N/A	690	12,704	6%	755	1%	256	0%
18	Bridger East	(600)	600	N/A	N/A	618	0%	-	0%
19	Yellowtail South (N-S)	N/A	625	1,168	0%	560	0%	3,085	1%
20	SW Wyoming to N Utah	(400)	400	156	0%	519	0%	-	0%
21	WEST OF BROADVIEW	N/A	2,573	195	0%	433	0%	183	0%
22	TOT 7	N/A	890	868	3%	310	1%	94	1%



Annual VOM with Transmission Solutions

Alternative 1 – (\$Millions)

Line	Area	No Added Gen/Tx (a)	No Tx Constraints (b)	Add Gen/No Tx (c)	Add Gen/Add Tx (d)	Value of Gen Additions Delta (c - a)	Value of Gen & Tx Additions Delta (d - a)	Value of Tx Additions Delta (d - c)	VOM Savings with No Tx Constraints (b - c)
1	NEW MEXI	515	470	449	449	(67)	(66)	1	21
2	ARIZONA	4,154	4,295	3,958	3,934	(196)	(220)	(24)	337
3	NEVADA	1,229	1,215	1,192	1,145	(37)	(85)	(48)	23
4	WAPA L.C	564	514	448	453	(115)	(110)	5	65
5	MEXICO-C	675	943	880	879	204	204	(0)	64
6	IMPERIAL	40	15	18	18	(22)	(22)	(0)	(3)
7	SANDIEGO	845	647	780	787	(65)	(57)	7	(133)
8	SOCALIF	2,623	1,016	1,493	1,510	(1,130)	(1,113)	17	(476)
9	LADWP	743	202	304	290	(439)	(453)	(13)	(101)
10	IPP	250	275	274	274	24	24	0	0
11	PG AND E	4,514	2,813	3,359	3,315	(1,155)	(1,199)	(44)	(546)
12	NORTHWES	2,023	2,188	2,191	2,202	168	179	11	(3)
13	B.C.HYDR	417	553	540	540	124	123	(1)	13
14	AQUILA	6	34	32	32	26	26	(0)	2
15	ALBERTA	1,468	1,743	1,433	1,434	(35)	(34)	1	310
16	IDAHO	23	0	0	2	(22)	(21)	1	(0)
18	MPC	0	0	0	0	0	0	0	0
19	SIERRA	267	253	235	235	(32)	(31)	0	18
20	WYO	49	68	62	65	13	15	2	6
22	BONZ	69	69	68	68	(1)	(0)	0	1
23	UT N	259	173	163	162	(96)	(97)	(1)	10
24	UT S	387	589	524	538	138	152	14	65
25	COL E	1,160	911	732	783	(428)	(377)	51	180
26	COL W	200	200	200	200	(1)	(0)	0	1
28	B HILL	103	66	58	60	(46)	(43)	2	9
29	LRS	83	83	83	83	(0)	0	0	0
30	JB	261	307	331	334	69	72	3	(24)
32	BDVW	17	17	17	17	(0)	(0)	(0)	0
33	CRSOVRCO	165	165	165	165	(0)	(0)	(0)	0
Total		23,109	19,826	19,989	19,974	(3,120)	(3,135)	(15)	(163)

- ✓ Negative (red) values indicate reduction in fuel cost due to displacement
- ✓ Positive (black) values indicate increased fuel cost due to higher dispatch

Total Annual VOM Savings

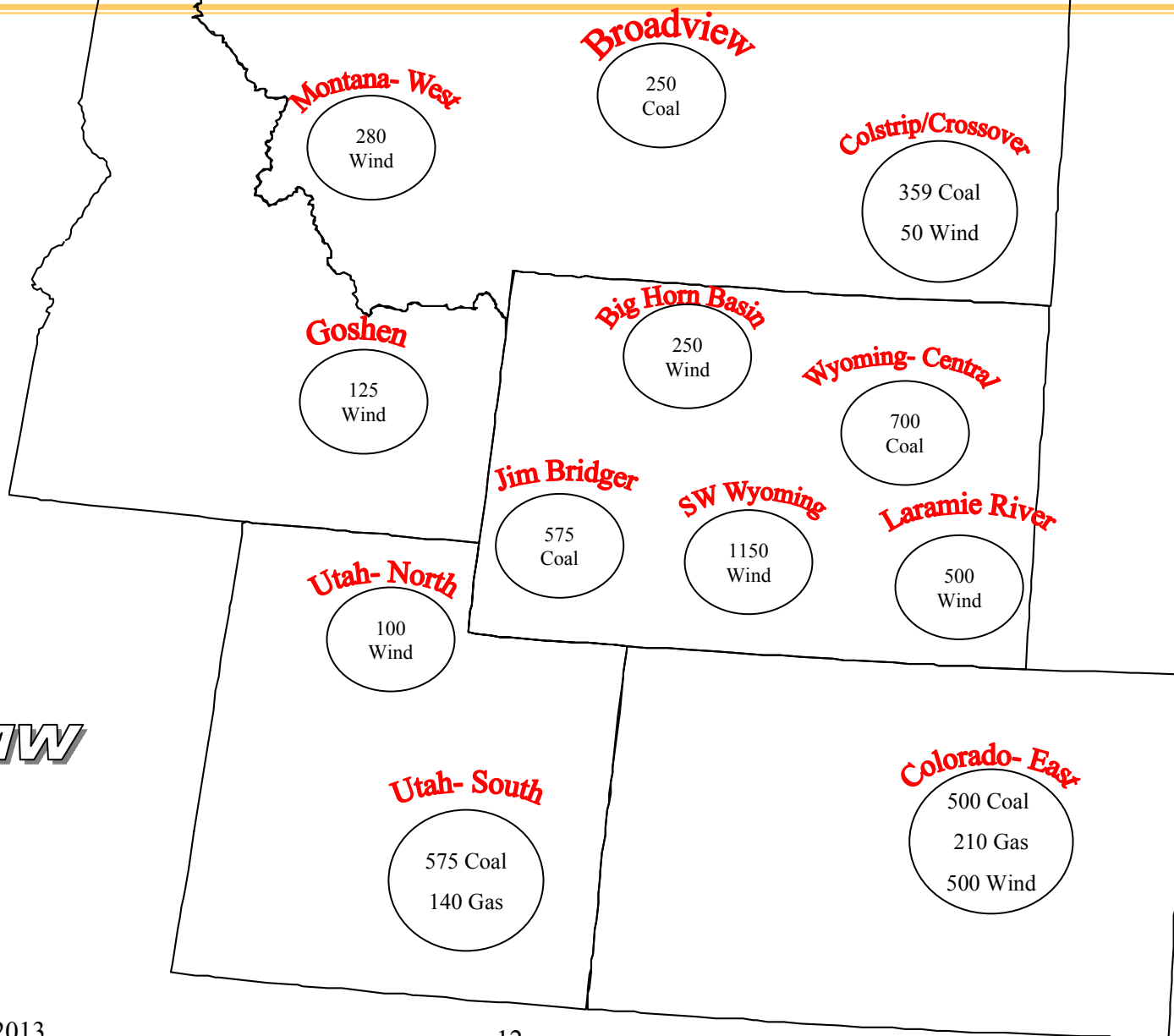
Alternative 2



Rocky Mountain Area Transmission Study

Incremental Resource Additions (MW)

Alternative 2

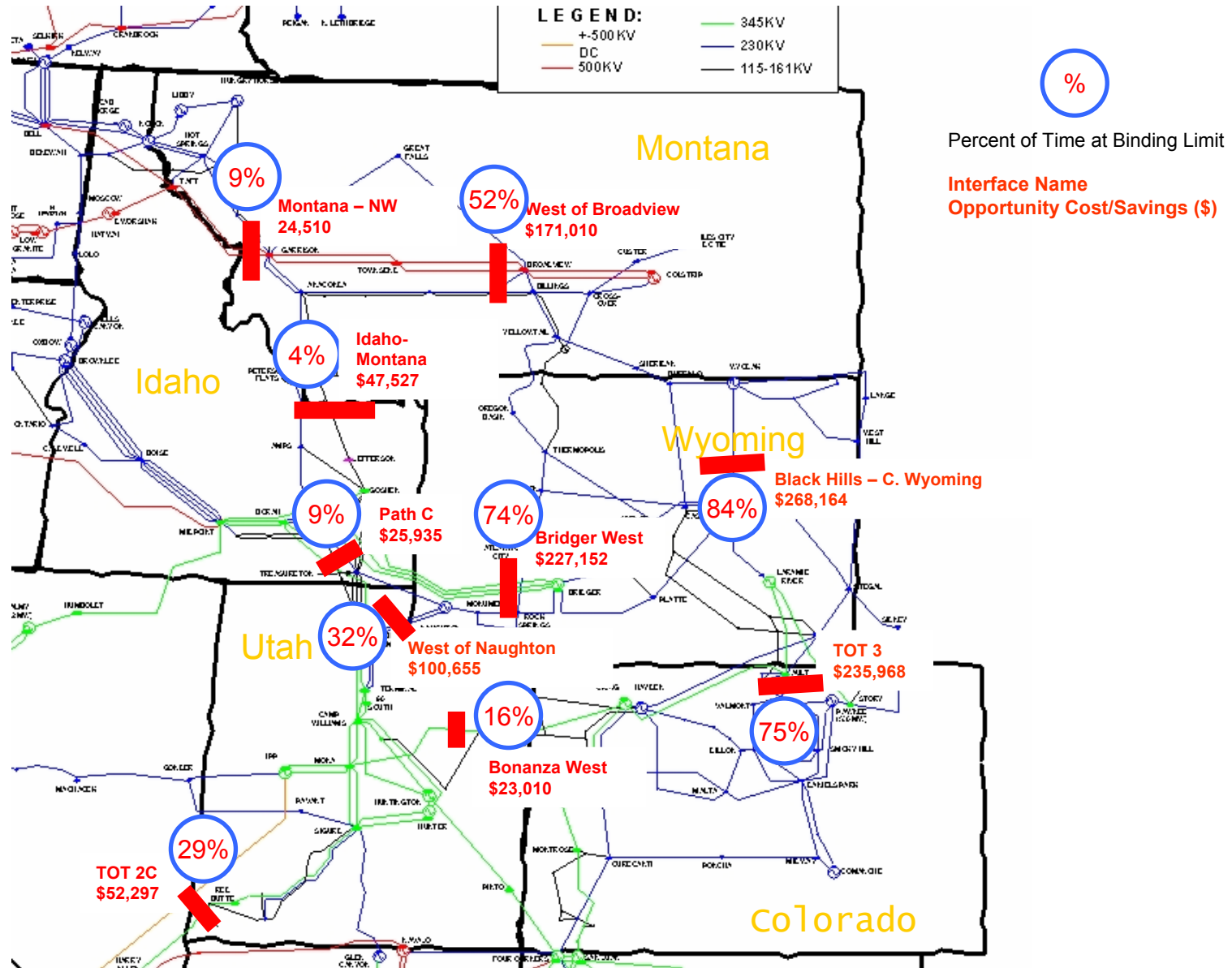


Total
3,900 MW

Congestion If No Transmission Is Added

Alternative 2, (Top 10 Paths)

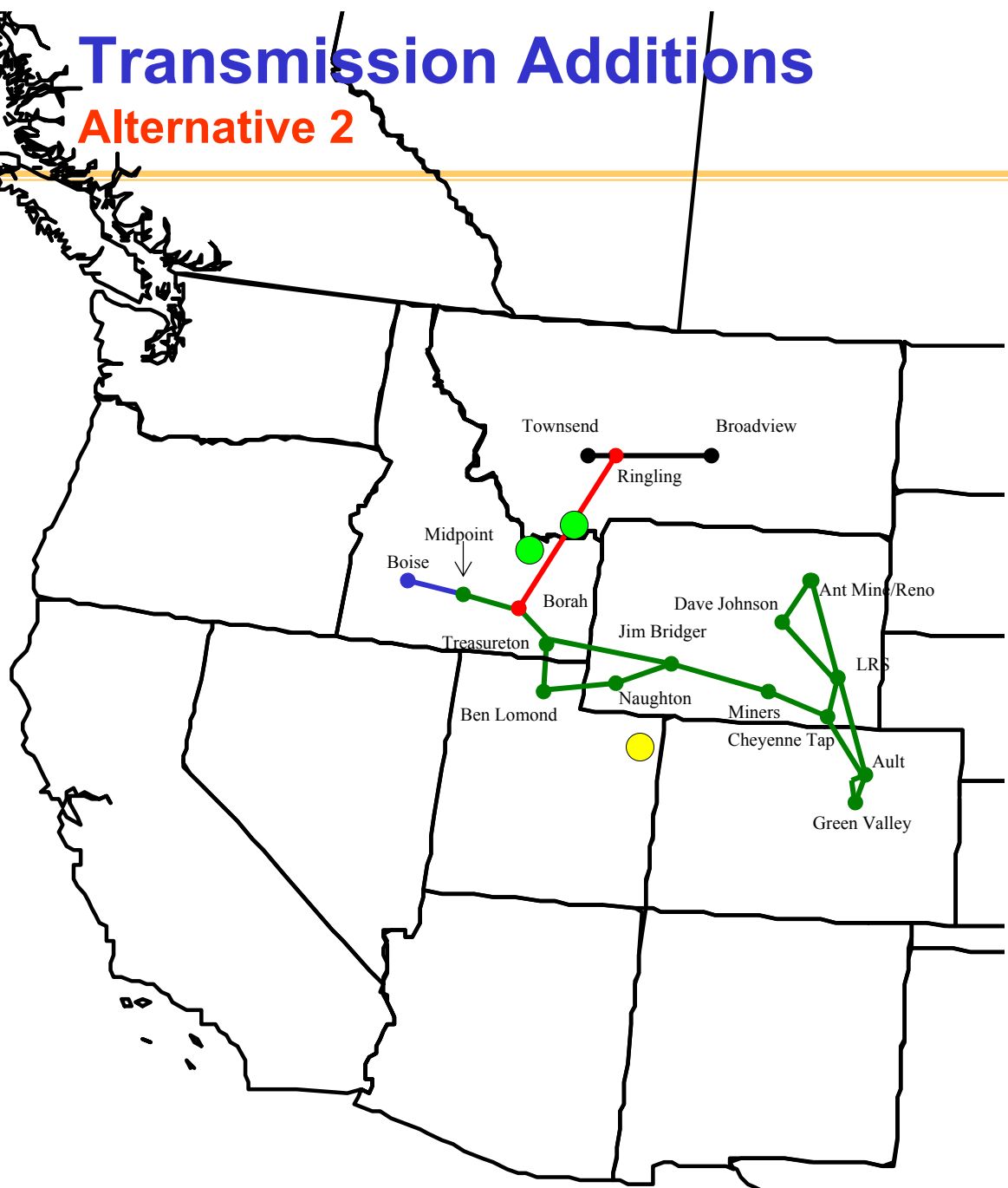
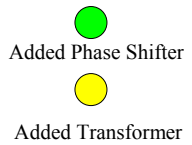
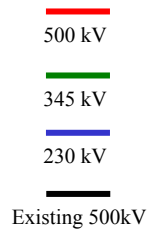
3,900 MW added to Rocky Mtn. States



Alternative 2 - no transmission additions

Transmission Additions

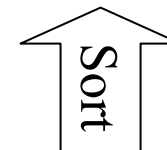
Alternative 2



Opportunity Costs with Transmission Solutions

Alternative 2

Line	Interface	Existing Limits		No Added Gen/Tx		Add Gen/No Tx		Add Gen/Tx	
		Reverse Limit (MW)	Forward Limit (MW)	Opportunity Cost (\$)	% Time at Binding Limit	Opportunity Cost (\$)	% Time at Binding Limit	Opportunity Cost (\$)	% Time at Binding Limit
1	TOT 2C	(300)	300	9,094	13%	74,557	40%	55,894	35%
2	BRIDGER WEST	N/A	2,200	1,626	3%	61,729	30%	5,801	4%
3	West of Naughton (E-S&W)	N/A	920	6,436	3%	40,571	14%	2,015	1%
4	PATH C	(1,000)	1,000	3,269	1%	19,322	6%	5,408	2%
5	BONANZA WEST	N/A	785	497	1%	17,736	9%	11,758	8%
6	MONTANA - NORTHWEST	(1,350)	2,200	-	0%	9,136	5%	12,589	9%
7	Montana - Southeast	(450)	600	7,785	6%	8,549	8%	8,695	10%
8	TOT 3	N/A	1,424	10,351	9%	8,341	7%	4,012	4%
9	TOT 2B2	(300)	265	1,147	2%	7,882	6%	7,055	6%
10	TOT 1A	N/A	650	719	2%	7,197	5%	6,895	6%
11	PAVANT, INTRMTN - GONDER 230 KV	(235)	440	10,224	10%	5,225	5%	5,748	6%
12	IDAHO - MONTANA	(337)	337	13,352	3%	4,847	1%	1,567	0%
13	TOT 2B1	(600)	560	8,280	2%	3,179	4%	-	0%
14	BROWNLEE EAST	N/A	1,850	14,254	3%	1,680	0%	3,243	1%
15	IDAHO - NORTHWEST	(1,200)	2,400	7,315	3%	1,165	1%	3,701	3%
17	TOT 2A	N/A	690	12,704	6%	755	1%	256	0%
18	Bridger East	(600)	600	N/A	N/A	618	0%	-	0%
19	Yellowtail South (N-S)	N/A	625	1,168	0%	560	0%	3,085	1%
20	SW Wyoming to N Utah	(400)	400	156	0%	519	0%	-	0%
21	WEST OF BROADVIEW	N/A	2,573	195	0%	433	0%	183	0%
22	TOT 7	N/A	890	868	3%	310	1%	94	1%



Annual VOM Cost with Tx Solutions

Alternative 2 (\$Millions)

Line	Area	No Added Gen/Tx	No Tx Constraints	Add Gen/No Tx	Add Gen/ Add Tx	Value of Gen Additions	Value of Gen & Tx Additions	Value of Tx Additions	VOM Savings with No Tx
		(a)	(b)	(c)	(d)	Delta (c - a)	Delta (d - a)	Delta (d - c)	Constraints
1	NEW MEXI	515	470	448	447	(68)	(68)	(0)	22
2	ARIZONA	4,154	4,292	3,954	3,970	(199)	(183)	16	338
3	NEVADA	1,229	1,215	1,244	1,241	14	11	(3)	(29)
4	WAPA L.C	564	513	459	449	(105)	(115)	(10)	55
5	MEXICO-C	675	942	876	879	201	203	2	65
6	IMPERIAL	40	15	19	18	(21)	(22)	(1)	(4)
7	SANDIEGO	845	645	778	769	(66)	(75)	(9)	(133)
8	SOCALIF	2,623	1,016	1,454	1,482	(1,168)	(1,141)	27	(438)
9	LADWP	743	199	303	307	(440)	(435)	5	(104)
10	IPP	250	253	253	253	3	2	(1)	0
11	PG AND E	4,514	2,807	3,517	3,336	(997)	(1,179)	(182)	(710)
12	NORTHWES	2,023	2,186	2,191	2,203	168	180	12	(5)
13	B.C.HYDR	417	554	547	539	130	122	(8)	8
14	AQUILA	6	34	31	32	25	26	0	3
15	ALBERTA	1,468	1,743	1,430	1,437	(38)	(31)	7	313
16	IDAHO	23	0	1	3	(21)	(20)	2	(1)
18	MPC	0	0	0	0	0	0	0	0
19	SIERRA	267	253	234	227	(33)	(39)	(6)	20
20	WYO	49	76	70	76	20	26	6	6
22	BONZ	69	69	68	68	(1)	(0)	1	1
23	UT N	259	173	148	160	(111)	(98)	13	25
24	UT S	387	461	403	413	16	26	10	58
25	COL E	1,160	867	806	650	(354)	(510)	(156)	61
26	COL W	200	200	200	200	(0)	(0)	0	0
28	B HILL	103	66	65	59	(39)	(44)	(6)	2
29	LRS	83	83	76	83	(7)	0	7	7
30	JB	261	307	262	307	1	46	45	45
32	BDVW	17	37	34	36	17	19	2	3
33	CRSOVRCO	165	177	166	172	2	7	6	11
Total		23,109	19,654	20,036	19,815	(3,072)	(3,293)	(221)	(383)

✓ Negative (red) values indicate reduction in fuel cost due to displacement

✓ Positive (black) values indicate increased fuel cost due to higher dispatch

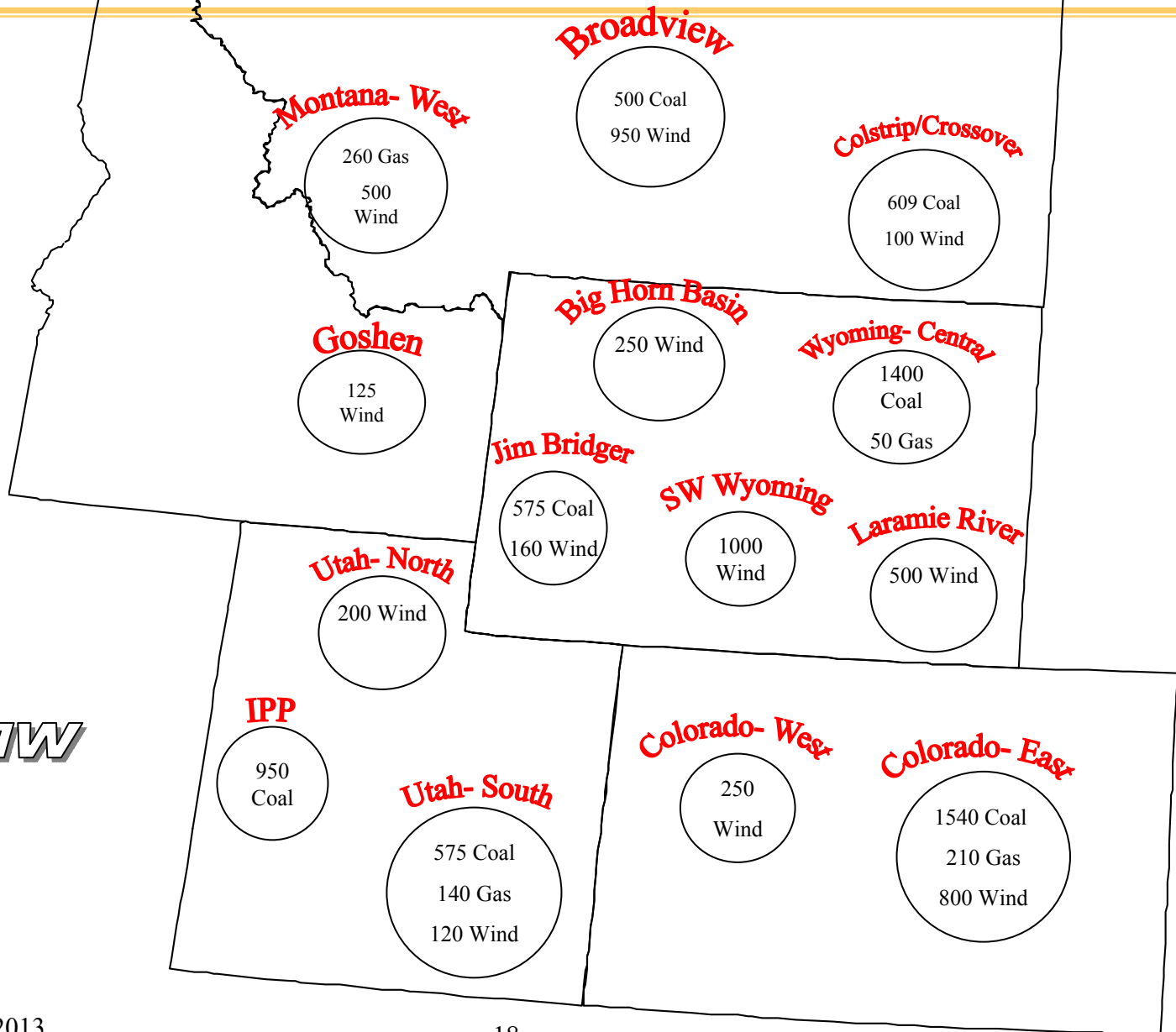
Alternative 3



Rocky Mountain Area Transmission Study

Incremental Generation Additions (MW)

Alternative 3

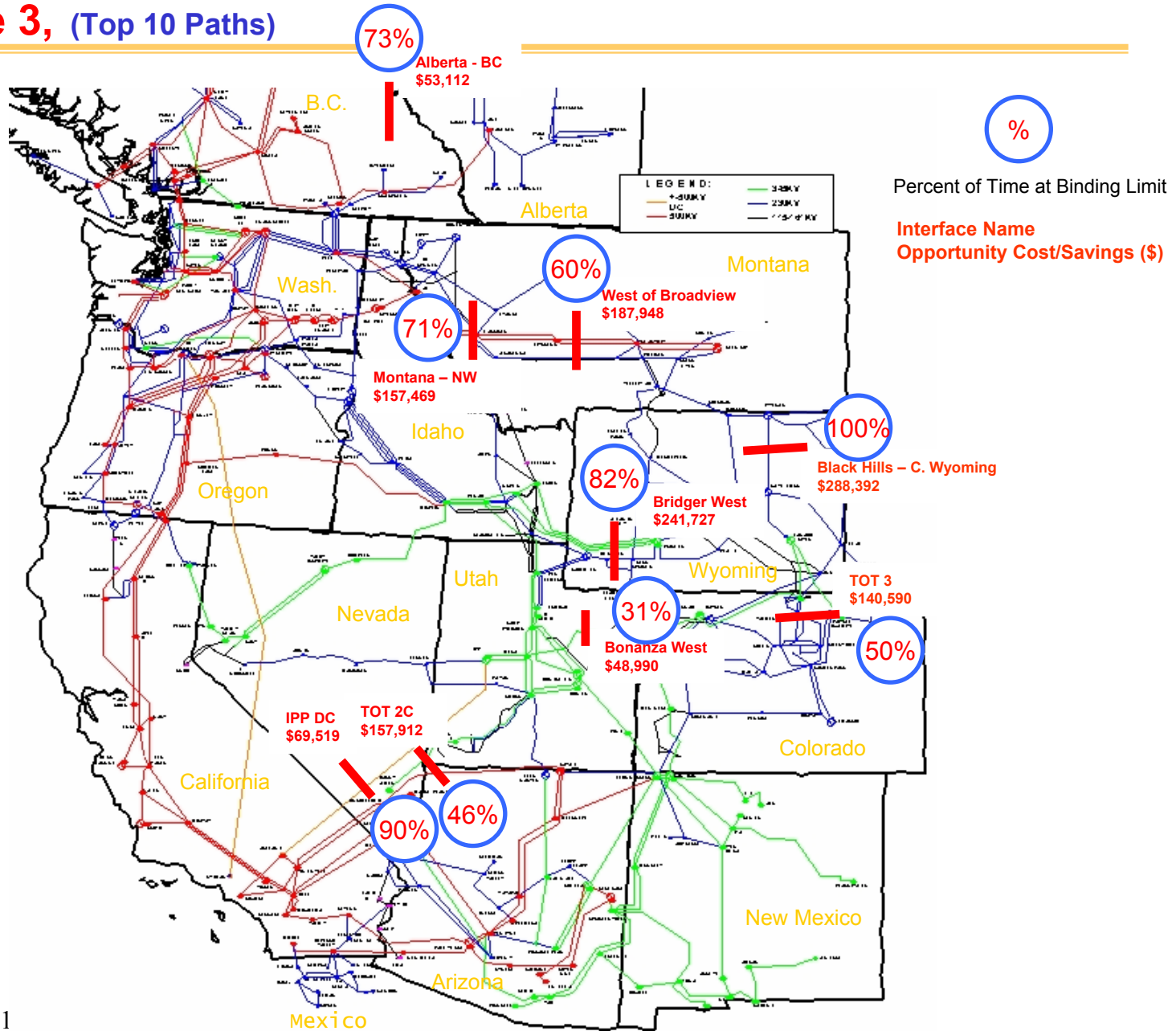


**Total
7,800 MW**

Congestion If No Transmission Is Added

Alternative 3, (Top 10 Paths)

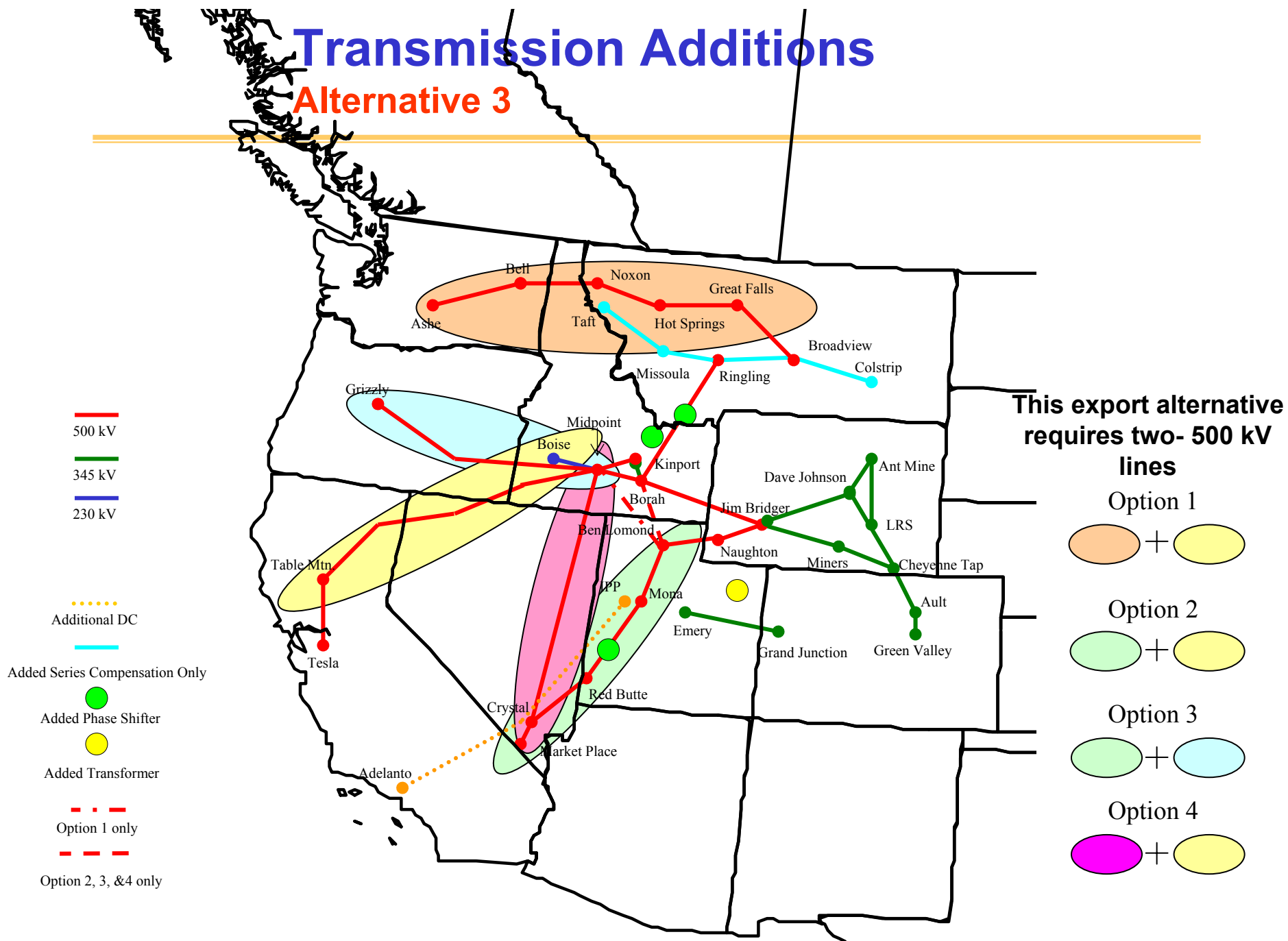
7,800 MW added to Rocky Mtn. States



Alternative 3- no transmission additions

Transmission Additions

Alternative 3

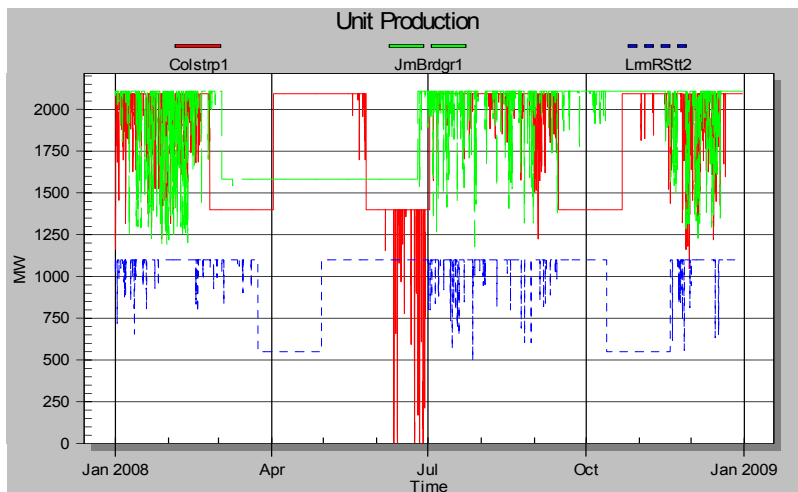


This page left blank intentionally

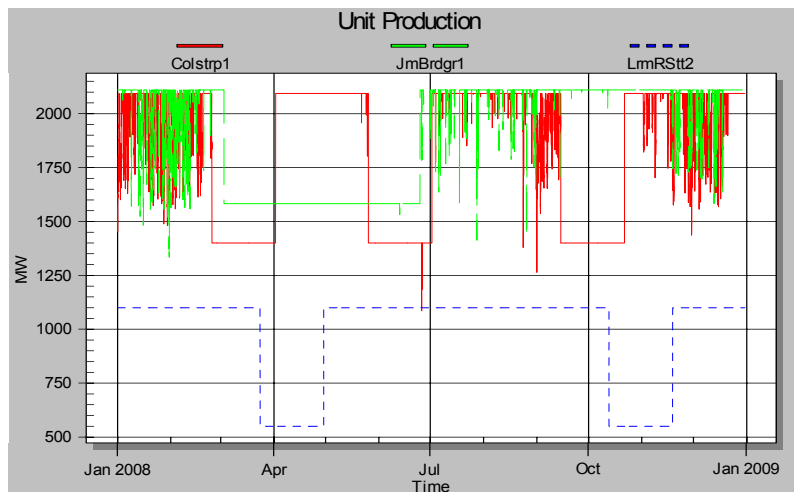
All Four Options Entail Excessive Cycling

- * Transmission instability and excessive wear & tear on plants
- * Due to wind volatility & high hydro generation in June (wind & hydro are fixed inputs to the model)

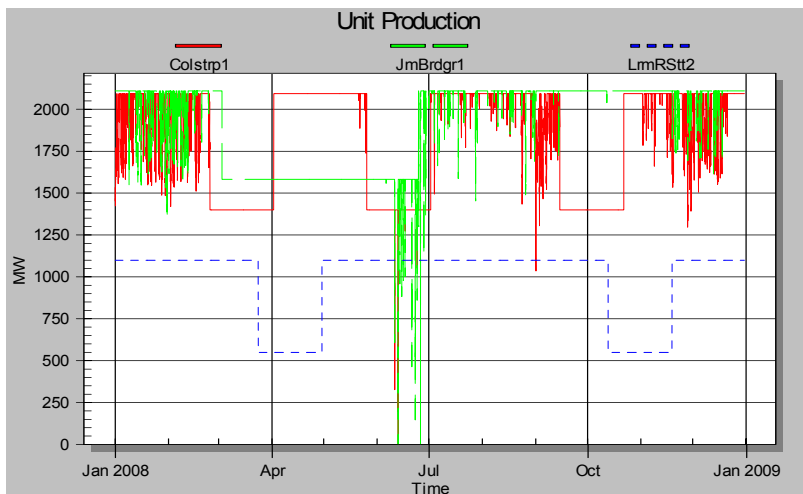
Option 1 - Add Gen/Tx



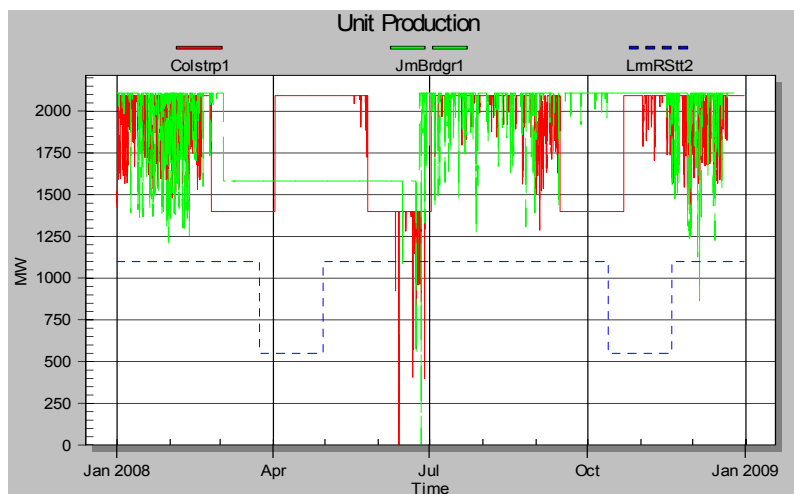
Option 2 - Add Gen/Tx



Option 3 - Add Gen/Tx



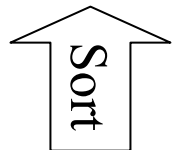
Option 4 - Add Gen/Tx



Opportunity Costs with Transmission Solutions

Alternative 3

Row	Interface	Opp. Cost (\$)		Mont & Tesla		Ut & Telsa		Ut & Grizzly		SWIP & Telsa	
		No Added Tx	% Binding	Option 1	Option 2	Option 3	Option 4				
1	Black Hills to C Wyoming	288,392	100%	-	0%	-	0%	-	0%	-	0%
2	BRIDGER WEST	241,727	82%	43,495	24%	17,917	13%	12,907	10%	27,298	14%
3	WEST OF BROADVIEW	187,948	60%	25,541	10%	42,105	15%	44,633	16%	45,147	16%
4	TOT 2C	157,912	46%	128,369	53%	23,335	22%	22,037	20%	43,869	20%
5	MONTANA - NORTHWEST	157,469	71%	34,847	24%	24,181	28%	25,917	28%	25,622	28%
6	TOT 3	140,590	50%	4,668	5%	4,745	5%	5,884	6%	3,560	4%
7	IPP DC LINE	69,519	90%	29,428	69%	21,456	68%	24,906	68%	26,994	72%
9	ALBERTA - BRITISH COLUMBIA	53,112	73%	38,988	64%	40,148	66%	38,847	60%	40,359	60%
10	BONANZA WEST	48,990	31%	33,242	22%	29,420	17%	25,471	14%	4,319	3%
11	North of Miguel	43,937	55%	35,441	60%	34,869	62%	36,434	63%	36,516	61%
12	WOR -n- El Dor to Lugo	40,721	53%	29,973	56%	31,767	57%	33,467	56%	31,037	60%
13	TOT 2B2	33,590	24%	19,699	14%	10,211	8%	12,113	9%	9,848	8%
15	West of Naughton (E-S&W)	28,997	11%	-	0%	1,242	1%	5,834	5%	-	0%
14	SOUTHERN NEW MEXICO (NM1)	24,319	40%	25,197	34%	24,548	32%	24,758	32%	24,639	32%
16	TOT 1A	21,756	18%	15,844	14%	3,224	4%	2,734	4%	312	0%
17	PAVANT, INTRMTN - GONDER 230 KV	20,105	10%	1,647	2%	324	0%	905	1%	10,098	7%
18	SOUTHWEST OF FOUR CORNERS	15,389	7%	7,679	4%	13,377	6%	13,380	6%	16,521	7%
23	TOT 2A	14,692	10%	5,542	4%	6,013	4%	7,207	5%	3,996	4%
21	SW Wyoming to N Utah	14,492	3%	-	0%	-	0%	-	0%	-	0%
22	Combined PACI & PDCI	14,367	21%	15,611	21%	11,142	20%	15,692	24%	10,179	17%
20	NW to Canada, East BC	14,267	8%	10,530	9%	13,573	11%	16,476	12%	14,080	10%
19	COI	13,750	61%	8,306	45%	10,924	50%	12,870	60%	7,132	34%
24	PATH C	9,187	5%	-	0%	-	0%	-	0%	-	0%
26	N to S Utah	6,177	3%	204	1%	-	0%	-	0%	911	2%
25	IDAHO - MONTANA	5,812	2%	1,283	0%	14,711	18%	17,276	20%	15,731	20%
31	PACIFIC DC INTERTIE (PDCI)	5,321	20%	1,898	8%	1,154	6%	769	4%	1,408	0%
28	TOT 7	5,274	4%	-	0%	-	0%	-	0%	3	0%
29	Montana - Southeast	5,010	9%	10,322	8%	31,248	15%	53,203	25%	46,782	24%
43	ARIZONA - CALIFORNIA	4,719	26%	3,539	33%	3,864	40%	3,652	38%	3,864	40%
32	Combined 4a, 4b	4,495	6%	7,364	11%	6,309	7%	6,470	6%	9,704	9%
30	IDAHO - NORTHWEST	4,364	2%	2,766	2%	400	0%	-	0%	1,102	1%
37	NORTHWEST - CANADA	4,087	3%	7,366	4%	4,226	3%	5,980	4%	4,349	3%
38	CA INDEPENDENT - MEXICO (CFE)	3,881	43%	3,869	43%	3,833	42%	3,873	43%	3,929	43%
33	NORTHERN - SOUTHERN CALIFORNIA	3,615	20%	2,774	10%	2,566	9%	1,792	7%	982	4%
27	Southern CA Imports	3,427	27%	6,244	56%	5,739	55%	6,531	70%	6,569	56%
35	Idaho to LV (SWIP)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	22,237	25%
34	Idaho to N. California	N/A	N/A	-	0%	-	0%	N/A	N/A	-	0%



* Yellow highlights indicate increase interface ratings

Annual VOM with Transmission Solutions

Alternative 3 (\$Millions)

Row	Area Name	No Added Gen/Tx	No Tx Additions	No Tx Constraints	Option 1 (Mont & Telsa)	Option 2 (Ut & Tesla)	Option 3 (Ut & Grizzly)	Option 4 (SWIP & Telsa)
1	NEW MEXI	515	421	450	433	435	434	434
2	ARIZONA	4,154	3,630	4,100	3,669	3,725	3,714	3,725
3	NEVADA	1,229	1,304	1,072	1,226	962	927	1,020
4	WAPA L.C	564	422	473	416	420	418	409
5	MEXICO-C	675	867	877	869	866	866	868
6	IMPERIAL	40	17	12	14	14	14	14
7	SANDIEGO	845	693	555	653	645	654	657
8	SOCALIF	2,623	1,405	844	1,307	1,291	1,318	1,296
9	LADWP	743	274	153	277	252	257	276
10	IPP	250	339	341	338	340	339	341
11	PG AND E	4,514	3,488	2,291	2,900	2,983	3,155	2,911
12	NORTHWES	2,023	2,192	1,970	1,940	1,988	1,908	2,016
13	B.C.HYDR	417	531	517	477	482	471	485
14	AQUILA	6	31	34	30	31	29	31
15	ALBERTA	1,468	1,434	1,707	1,405	1,415	1,404	1,418
16	IDAHO	23	2	0	0	0	-	0
18	MPC	-	42	96	69	73	69	73
19	SIERRA	267	204	235	212	218	213	216
20	WYO	49	72	120	113	113	112	112
22	BONZ	69	66	69	67	64	63	66
23	UT N	259	123	160	141	144	142	143
24	UT S	387	352	461	399	425	422	414
25	COL E	1,160	583	877	651	684	662	654
26	COL W	200	194	200	198	200	200	200
28	B HILL	103	55	60	52	53	53	52
29	LRS	83	79	83	82	83	83	83
30	JB	261	233	307	301	305	305	303
32	BDVW	17	44	49	48	48	48	48
33	CRSOVRCO	165	118	189	186	186	185	185
Total		23,109	19,216	18,298	18,475	18,443	18,465	18,449

Annual VOM are essentially same in all options

Change in VOM with Added Transmission

Alternative 3 – (\$Millions)

Row	Area Name	No Tx Constraints	Option 1 (Mont & Telsa)	Option 2 (Ut & Tesla)	Option 3 (Ut & Grizzly)	Option 4 (SWIP & Telsa)
1	NEW MEXI	28	11	14	12	12
2	ARIZONA	470	40	96	84	95
3	NEVADA	(232)	(78)	(342)	(377)	(283)
4	WAPA L.C	50	(6)	(2)	(5)	(13)
5	MEXICO-C	10	2	(1)	(1)	1
6	IMPERIAL	(5)	(3)	(3)	(3)	(3)
7	SANDIEGO	(138)	(40)	(48)	(39)	(36)
8	SOCALIF	(561)	(98)	(114)	(87)	(110)
9	LADWP	(121)	4	(22)	(17)	2
10	IPP	2	(1)	1	(0)	2
11	PG AND E	(1,197)	(588)	(505)	(332)	(577)
12	NORTHWES	(222)	(252)	(204)	(283)	(176)
13	B.C.HYDR	(15)	(55)	(49)	(61)	(47)
14	AQUILA	2	(2)	(1)	(3)	(0)
15	ALBERTA	272	(29)	(20)	(30)	(16)
16	IDAHO	(2)	(2)	(2)	(2)	(1)
18	MPC	53	27	30	27	30
19	SIERRA	31	8	14	10	13
20	WYO	48	41	41	40	40
22	BONZ	3	1	(2)	(3)	(0)
23	UT N	37	18	21	19	20
24	UT S	108	47	73	70	62
25	COL E	294	68	101	79	71
26	COL W	7	5	6	6	7
28	B HILL	4	(3)	(2)	(3)	(3)
29	LRS	3	3	3	3	3
30	JB	74	68	72	72	70
32	BDVW	5	4	4	4	4
33	CRSOVRCO	71	68	68	67	67
Total		(918)	(741)	(774)	(751)	(767)

✓ Negative (red) values indicate reduction in fuel cost due to displacement

✓ Positive (black) values indicate increased fuel cost due to higher dispatch

Annual VOM savings are essentially same in all options

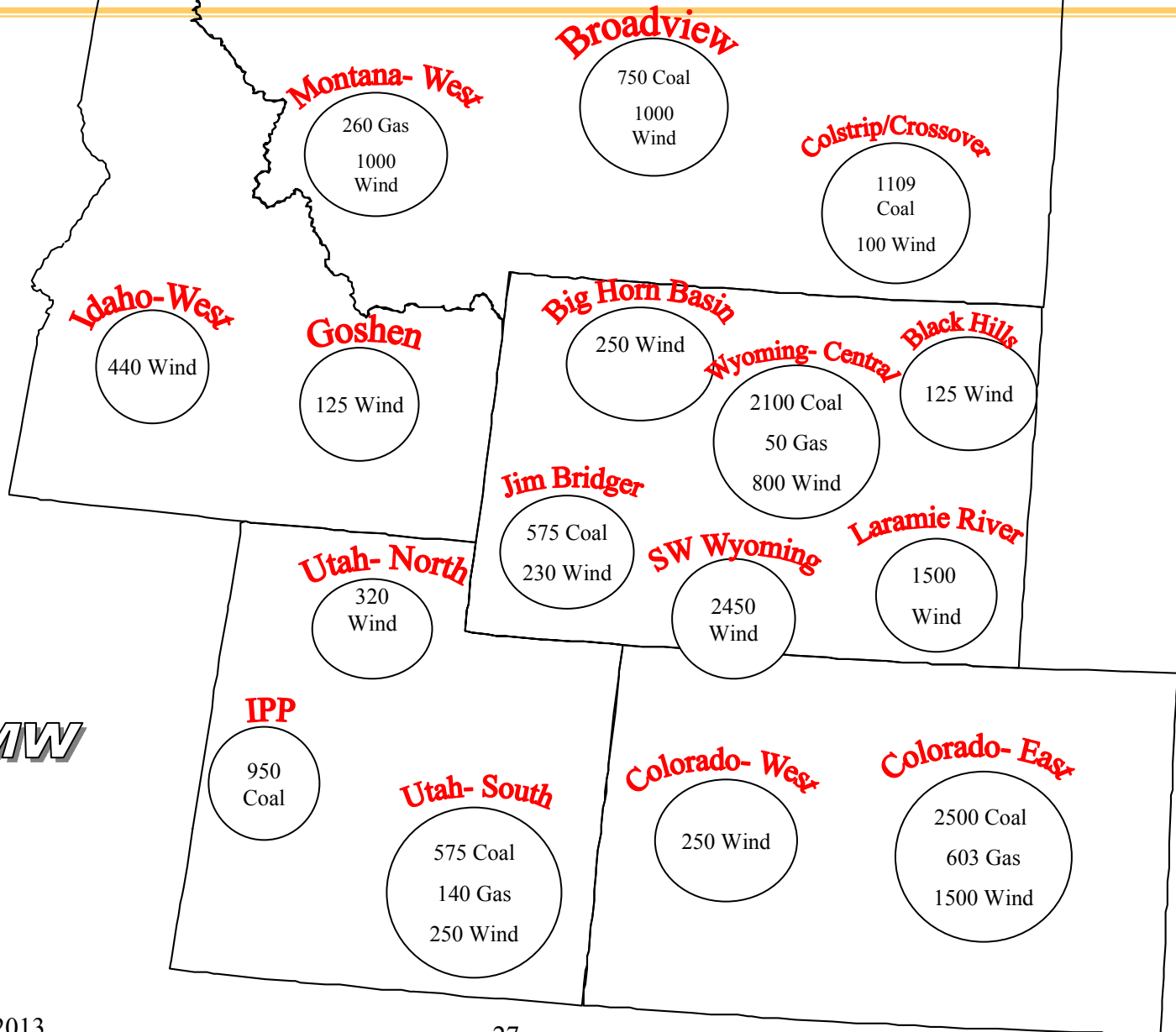
Alternative 4



Rocky Mountain Area Transmission Study

Incremental Resource Additions (MW)

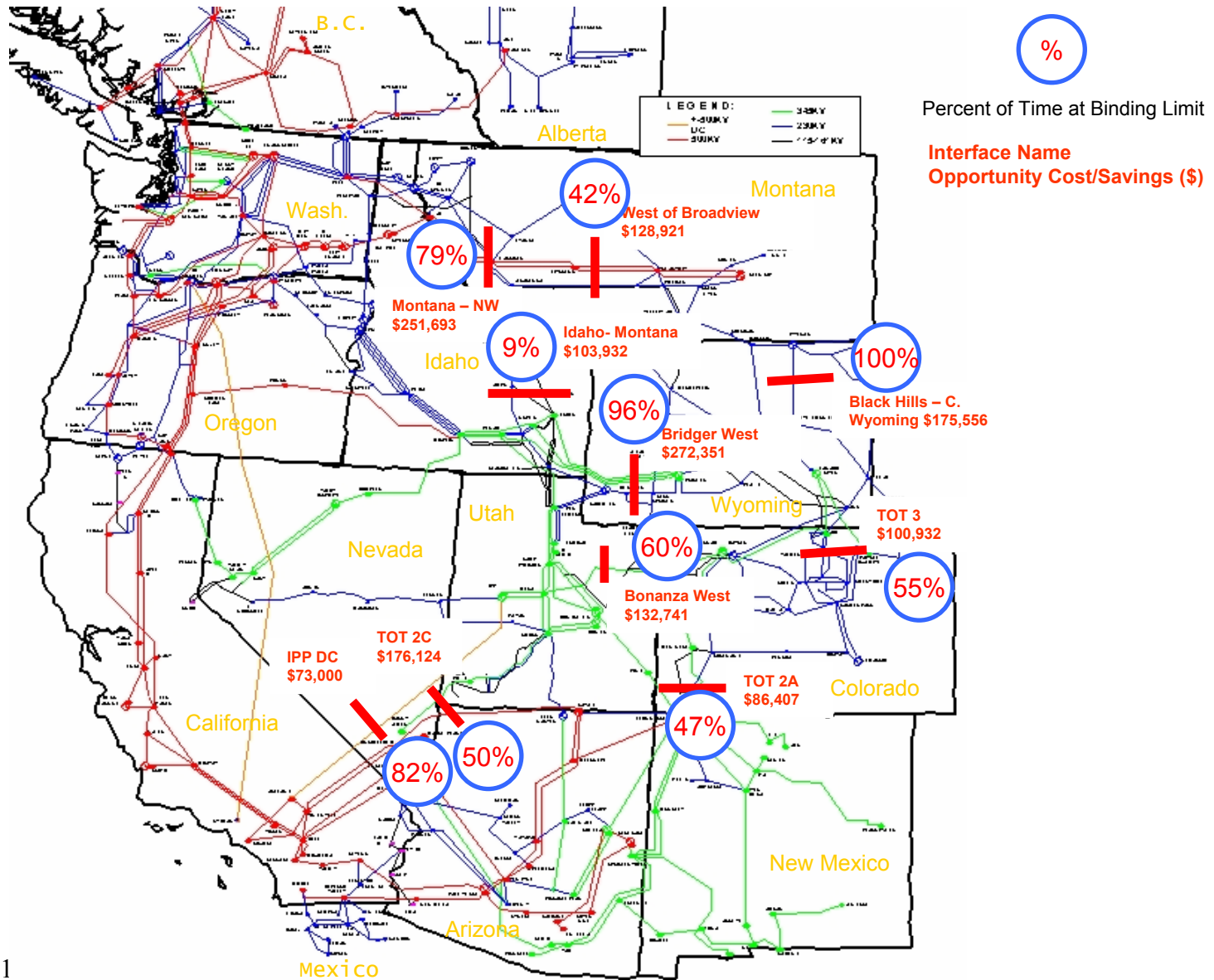
Alternative 4



Congestion if no Transmission is Added

Alternative 4, (Top 10 Paths)

11,700 MW added to Rocky Mtn. States



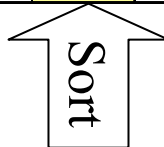
Alternative 4- no transmission additions

This page left blank intentionally

Opportunity Costs with Transmission Solutions

Alternative 4

Row	Interface	Opp. Cost (\$) % Binding		Wyo to SF		Wyo to LA	
		Add Gen/ No Tx		Option 1		Option 2	
1	BRIDGER WEST	272,351	96%	23,870	16%	25,147	16%
2	MONTANA - NORTHWEST	251,693	79%	76,702	43%	82,796	44%
3	TOT 2C	176,124	50%	73,423	57%	40,574	30%
4	Black Hills to C Wyoming	175,566	100%	-	0%	-	0%
5	BONANZA WEST	132,741	60%	80,080	34%	70,004	28%
6	WEST OF BROADVIEW	128,921	42%	25,130	11%	27,111	11%
7	IDAHO - MONTANA	103,923	9%	34,969	26%	33,019	24%
8	TOT 3	100,932	55%	3,260	2%	2,342	2%
9	TOT 2A	86,407	47%	15,220	9%	12,848	8%
10	IPP DC LINE	73,000	82%	42,622	70%	41,884	81%
11	TOT 1A	71,020	60%	20,629	18%	16,177	15%
12	ALBERTA - BRITISH COLUMBIA	53,068	73%	37,994	60%	39,233	62%
13	West of Naughton (E-S&W)	51,847	21%	39,603	25%	28,429	18%
14	WOR -n- El Dor to Lugo	45,071	55%	18,080	47%	8,756	21%
15	North of Miguel	43,210	51%	24,189	53%	18,213	40%
16	TOT 2B2	39,695	28%	28,882	20%	22,663	16%
17	PAVANT, INTRMTN - GONDER 230 KV	33,270	14%	81	0%	402	1%
18	SOUTHWEST OF FOUR CORNERS	29,943	13%	12,662	5%	14,458	7%
19	SOUTHERN NEW MEXICO (NM1)	29,183	45%	33,206	46%	32,280	45%
20	Montana - Southeast	23,285	33%	1,254	2%	1,600	2%
21	Combined 4a, 4b	18,485	24%	551	1%	544	1%
22	TOT 7	18,040	9%	99	1%	40	1%
23	Combined PACI & PDCI	14,931	22%	12,576	17%	18,098	29%
24	COI	14,931	61%	10,374	59%	20,571	78%
25	NW to Canada, East BC	12,121	6%	20,421	15%	19,371	14%
26	TOT 4B	9,122	7%	-	0%	-	0%
27	SW Wyoming to N Utah	7,413	3%	-	0%	-	0%
28	TOT 4A	6,933	6%	224	0%	229	0%
29	PACIFIC DC INTERTIE (PDCI)	6,004	18%	2,696	10%	2,737	11%
30	ARIZONA - CALIFORNIA	4,784	24%	1,203	18%	688	13%
31	NORTHWEST - CANADA	4,655	3%	6,188	4%	7,019	4%
32	CA INDEPENDENT - MEXICO (CFE)	3,646	41%	2,594	37%	2,024	29%
33	PATH C	3,471	4%	-	0%	-	0%
34	Southern CA Imports	3,461	28%	6,680	54%	1,780	20%
35	NORTHERN - SOUTHERN CALIFORN	3,290	18%	3,861	13%	1,020	5%
36	Imp.Valley to Miguel	2,711	11%	5,188	19%	4,271	17%
37	SW Wyoming to Bonanza	2,470	1%	-	0%	-	0%
38	MIDPOINT - SUMMER LAKE	2,398	1%	853	1%	1,373	1%
39	Wyodak DC	N/A	N/A	139,647	95%	144,851	97%
40	Colstrip South 500KV	N/A	N/A	4,944	6%	4,256	3%



Annual VOM Costs with Transmission Solutions

Alternative 4 – (\$Millions)

Row	Area Name	No Added Gen/Tx (a)	Add Gen/ No Tx (b)	Add Gen/ No Tx Constraints (c)	Option 1 Wyo to SF (d)	Option 2 Wyo to LA (e)	Value of Gen Additions Delta (b - a)	VOM Savings with No Tx Constraints (c - b)	Value of Option 1 Tx Wyo to SF	Value of Option 2 Tx Wyo to LA
1	NEW MEXI	515	418	430	420	420	(98)	12	3	3
2	ARIZONA	4,154	3,538	3,829	3,405	3,375	(616)	291	(133)	(162)
3	NEVADA	1,229	1,317	896	1,061	963	88	(421)	(256)	(354)
4	WAPA L.C	564	397	410	366	373	(166)	13	(32)	(24)
5	MEXICO-C	675	865	781	849	814	190	(84)	(16)	(51)
6	IMPERIAL	40	17	9	11	11	(23)	(8)	(6)	(6)
7	SANDIEGO	845	668	450	502	428	(177)	(218)	(165)	(240)
8	SOCALIF	2,623	1,388	682	1,060	890	(1,235)	(706)	(329)	(498)
9	LADWP	743	275	114	227	164	(468)	(161)	(49)	(111)
10	IPP	250	341	344	335	338	91	3	(6)	(4)
11	PG AND E	4,514	3,429	1,780	2,570	3,048	(1,085)	(1,649)	(859)	(382)
12	NORTHWES	2,023	2,184	1,698	1,827	1,816	161	(487)	(358)	(369)
13	B.C.HYDR	417	518	473	439	439	101	(45)	(78)	(78)
14	AQUILA	6	30	33	28	29	24	3	(2)	(2)
15	ALBERTA	1,468	1,421	1,654	1,381	1,385	(47)	232	(40)	(37)
16	IDAHO	23	1	-	-	-	(22)	(1)	(1)	(1)
18	MPC	-	22	85	49	47	22	64	28	26
19	SIERRA	267	203	217	187	191	(64)	14	(16)	(12)
20	WYO	49	51	150	139	139	2	99	88	87
22	BONZ	69	56	69	55	55	(12)	12	(1)	(1)
23	UT N	259	116	146	127	127	(143)	31	11	11
24	UT S	387	347	458	387	392	(39)	110	40	44
25	COL E	1,160	508	988	619	606	(652)	480	111	97
26	COL W	200	153	200	193	194	(48)	48	40	41
28	B HILL	103	41	54	50	50	(63)	13	9	9
29	LRS	83	66	83	82	82	(16)	16	16	16
30	JB	261	169	307	299	297	(92)	138	130	128
32	BDVW	17	47	61	58	58	30	14	11	11
33	CRSOVRCO	165	65	209	183	182	(99)	143	118	116
Total		23,109	18,652	16,609	16,910	16,911	(4,456)	(2,043)	(1,742)	(1,742)

✓ Negative (red) values indicate reduction in fuel cost do to displacement

✓ Positive (black) values indicate increased fuel cost due to higher dispatch

Sensitivities

Sensitivities (applied to Alternative 3 – Option 3)

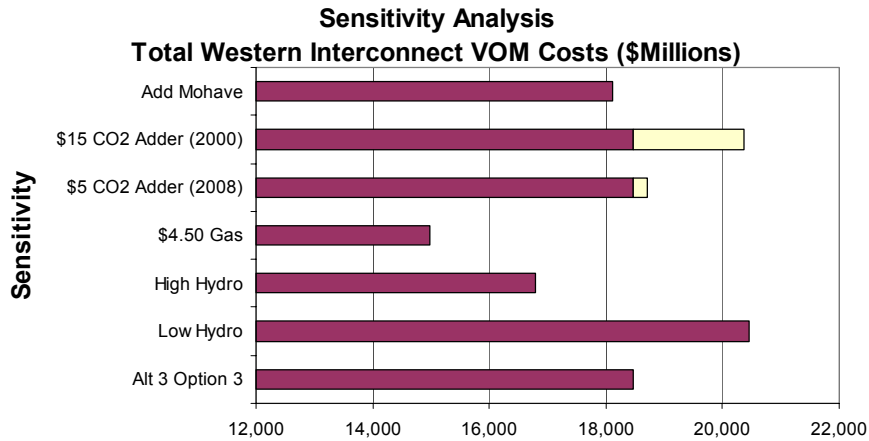
- Hydro (high & low)
- Gas (low: \$4.5)
- CO₂ Adder (\$5 & \$15)
- Add Mohave
- DSM



Rocky Mountain Area Transmission Study

Annual VOM Costs

Sensitivities – (\$Millions)



- \$5 Carbon Adder is applied to incremental CO₂ emissions above 2008 levels
- \$15 Carbon Adder is applied to incremental CO₂ emissions above 2000 levels
- Alt 3- Option 3 (benchmark) is \$6.50 gas, medium hydro, no CO₂ adder and no Mohave

VOM Cost (\$Millions)

Row	Area Name	Alt 3 Option 3	Low Hydro	High Hydro	\$4.50 Gas	Add Mohave
1	NEW MEXI	434	445	427	409	427
2	ARIZONA	3,714	3,880	3,517	3,097	3,515
3	NEVADA	927	967	866	711	517
4	WAPA L.C	418	432	392	316	264
5	MEXICO-C	866	874	852	650	858
6	IMPERIAL	14	20	10	12	15
7	SANDIEGO	654	821	537	462	635
8	SOCALIF	1,318	1,644	1,161	1,004	1,698
9	LADWP	257	288	249	194	253
10	IPP	339	341	339	339	340
11	PG AND E	3,155	3,608	2,678	2,402	3,209
12	NORTHWES	1,908	2,379	1,550	1,504	1,941
13	B.C.HYDR	471	593	388	346	480
14	AQUILA	29	32	25	20	29
15	ALBERTA	1,404	1,452	1,337	1,154	1,402
16	IDAHO	-	0	0	-	-
18	MPC	69	80	61	50	71
19	SIERRA	213	242	196	180	213
20	WYO	112	112	111	109	112
22	BONZ	63	65	62	63	64
23	UT N	142	158	130	127	136
24	UT S	422	433	407	372	420
25	COL E	662	713	631	596	650
26	COL W	200	200	200	200	200
28	B HILL	53	58	50	52	51
29	LRS	83	83	83	83	83
30	JB	305	305	300	305	305
32	BDVW	48	48	48	48	48
33	CRSOVRCO	185	184	184	185	185
Total		18,465	20,454	16,792	14,988	18,118

Delta from Alt 3- Option 3

	Low Hydro	High Hydro	\$4.50 Gas	Add Mohave
	11	(6)	(25)	(7)
	166	(197)	(617)	(199)
	40	(61)	(216)	(410)
	14	(26)	(102)	(154)
	7	(14)	(216)	(8)
	5	(4)	(2)	0
	167	(116)	(192)	(19)
	326	(157)	(314)	380
	31	(8)	(63)	(4)
	2	(1)	(1)	0
	452	(478)	(753)	53
	471	(358)	(404)	32
	122	(82)	(125)	9
	3	(4)	(9)	(0)
	48	(68)	(251)	(2)
	0	0	0	0
	11	(8)	(19)	2
	29	(17)	(34)	(0)
	0	(1)	(3)	0
	2	(1)	(1)	0
	15	(12)	(15)	(6)
	10	(15)	(50)	(2)
	51	(31)	(66)	(12)
	0	(0)	0	0
	5	(2)	(0)	(1)
	0	(0)	0	0
	0	(5)	0	(0)
	0	(0)	(0)	(0)
	(1)	(1)	0	0
Total	1,988	(1,673)	(3,477)	(347)

DSM Sensitivity



Rocky Mountain Area Transmission Study

Change in Loads with DSM

(MW) - Year 2013

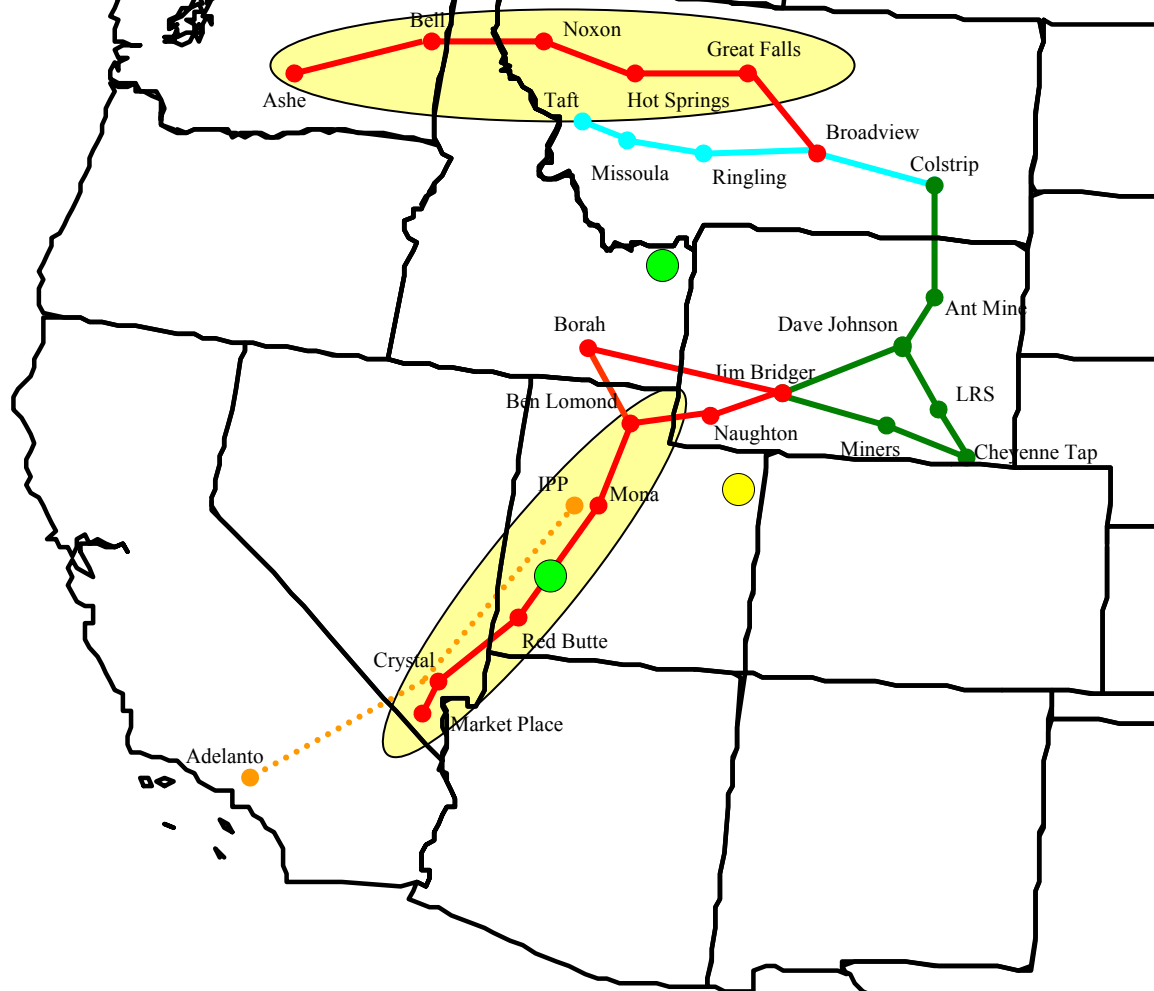
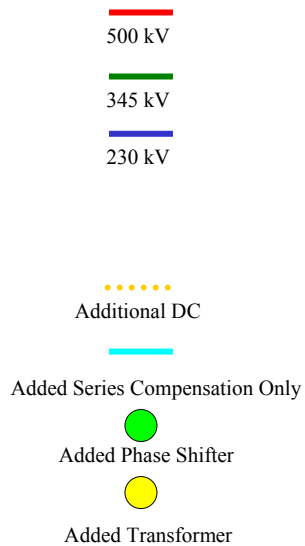
Est. Load After Assumed DSM Factor

Region	Annual Energy MWh	Summer Peak MW	Winter Peak MW	Peak Growth Summer (from 2008)
RMATS	149,196,529	23,803	21,823	100
Az, NM, S. Nv	149,915,758	29,432	21,241	883
California	323,394,364	58,965	45,070	522
Or,Wa, N. Nv	185,403,864	25,610	31,003	753
Canada	134,489,410	16,446	21,831	132
Mexico	19,896,003	3,626	2,600	1,130
Totals	962,295,928	157,882	143,568	3,520

- RMATS load growth from 2008 to 2013 with DSM sensitivity is equivalent to 100 MW
- If generating resources in the 2013 alternatives are added, then 3,900 MW would be exportable
- **Sensitivities:**
 - **DSM Option 1 makes use of 2013 loads applied to 2008 resources and transmission**
 - **DSM Option 2 includes 2013 loads, Alternative 2 resources and DSM amount equivalent 1X Rocky Mountains sub-region load growth. It does not take into account resources that also may be required for planning margin.**

Transmission Additions

DSM Sensitivity- Option 2



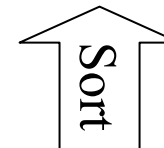
As with Alternative 3, two-500 kV lines are required to export 3,200 MW

* Option 1 requires no new transmission

Change in Opportunity Costs with Tx Solutions

DSM Sensitivities

Interface	Existing Limits		No Added Gen/Tx		Option 1		Option 2	
	Reverse Limit (MW)	Forward Limit (MW)	Opportunity Cost (\$)	% Time at Binding Limit	Opportunity Cost (\$)	% Time at Binding Limit	Opportunity Cost (\$)	% Time at Binding Limit
BRIDGER WEST	N/A	2,200	10,489	16%	284,949	81%	-	0%
Black Hills to C Wyoming	(332)	332	-	0%	218,376	80%	-	0%
TOT 3	N/A	1,424	8,782	10%	199,633	68%	35,762	24%
WEST OF BROADVIEW	N/A	2,573	-	0%	178,097	46%	-	0%
CA INDEPENDENT - MEXICO (CFE)	(800)	408	172,362	55%	177,213	56%	179,521	57%
MONTANA - NORTHWEST	(1,350)	2,200	21	0%	85,139	23%	129	0%
BONANZA WEST	N/A	785	6,073	9%	70,094	42%	73,259	47%
WOR -n- El Dor to Lugo	N/A	2,754	56,394	48%	58,397	46%	70,927	62%
ALBERTA - BRITISH COLUMBIA	(720)	700	56,226	73%	51,777	71%	39,562	65%
TOT 2C	(300)	300	2,878	10%	49,388	27%	1,209	5%
IPP DC LINE	(300)	1,920	9,057	62%	43,033	80%	8,973	40%
SOUTHERN NEW MEXICO (NM1)	(1,048)	1,048	18,965	21%	33,464	42%	30,695	32%
West of Naughton (E-S&W)	N/A	920	-	0%	23,696	10%	-	0%
ARIZONA - CALIFORNIA	N/A	5,700	13,894	43%	22,641	42%	11,907	42%
INYO - CONTROL 115 KV TIE	(56)	56	5,269	3%	20,393	8%	2,348	1%
Montana - Southeast	(450)	600	186	0%	17,241	11%	75,188	28%
COI	(3,675)	4,800	2,325	19%	14,424	57%	10,415	34%
Combined PACI & PDCI	N/A	7,300	7,522	15%	14,325	15%	16,279	21%
NW to Canada, East BC	(400)	400	8,776	6%	13,320	7%	13,076	8%
TOT 1A	N/A	650	879	0%	13,088	10%	6,969	5%
SOUTHWEST OF FOUR CORNERS	N/A	2,325	-	0%	11,285	5%	6,140	3%
PATH C	(1,000)	1,000	5,503	5%	7,381	5%	14,552	8%
TOT 2B2	(300)	265	202	0%	7,351	6%	23	0%
North of Miguel	N/A	2,000	4,860	19%	6,962	18%	5,348	17%
Colstrip South	(500)	500	N/A	N/A	N/A	N/A	14,056	7%



VOM Costs No Generation/ No Tx Solutions

DSM – (\$Millions)

Line	Area	DSM No Gen/Tx Additions (a)	Option 1 (b)	Option 2 (c)	Value of Option 1 (b - c)	Value of Option 2 (c - b)
1	NEW MEXI	449	403	418	(46)	15
2	ARIZONA	3,890	3,532	3,683	(358)	150
3	NEVADA	1,118	1,097	908	(21)	(189)
4	WAPA L.C	533	509	493	(24)	(17)
5	MEXICO-C	660	648	651	(11)	3
6	IMPERIAL	30	27	25	(3)	(2)
7	SANDIEGO	674	582	601	(91)	18
8	SOCALIF	1,859	1,529	1,516	(330)	(12)
9	LADWP	479	366	346	(113)	(20)
10	IPP	250	250	250	(0)	0
11	PG AND E	3,834	3,720	3,320	(114)	(400)
12	NORTHWES	1,855	1,740	1,619	(115)	(121)
13	B.C.HYDR	351	312	267	(39)	(45)
14	AQUILA	0	0	0	(0)	(0)
15	ALBERTA	1,249	1,231	1,211	(17)	(20)
16	IDAHO	3	3	0	0	(3)
18	MPC	0	0	0	0	0
19	SIERRA	172	139	131	(33)	(8)
20	WYO	49	71	76	21	5
22	BONZ	69	67	67	(2)	1
23	UT N	216	151	183	(65)	32
24	UT S	386	431	471	45	40
25	COL E	895	692	802	(203)	111
26	COL W	200	198	200	(2)	1
28	B HILL	80	58	64	(22)	6
29	LRS	83	76	82	(6)	6
30	JB	261	241	307	(20)	66
32	BDVW	17	33	36	15	3
33	CRSOVRCO	165	160	177	(5)	17
Total		19,826	18,267	17,905	(1,559)	(361)

✓ Negative (red) values indicate reduction in fuel cost due to displacement

✓ Positive (black) values indicate increased fuel cost due to higher dispatch

Summary



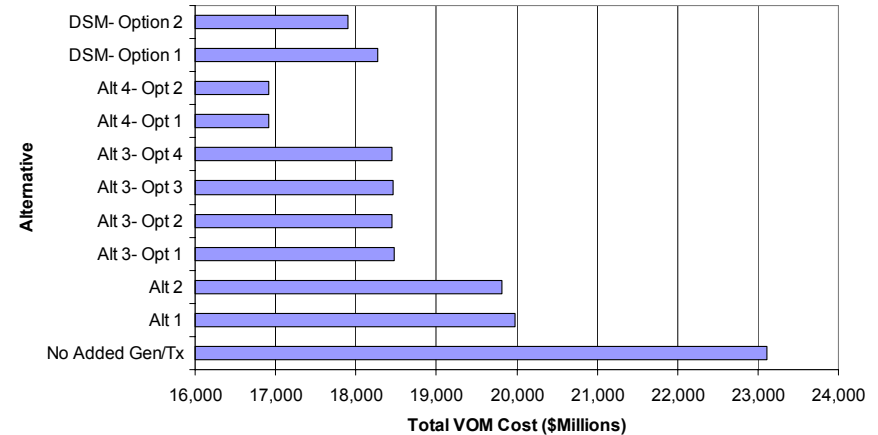
Rocky Mountain Area Transmission Study

Total Annual VOM Costs (\$Millions)

Line	Area Name	No Added Gen/Tx	Alt 1	Alt 2	Alt 3- Opt 1	Alt 3- Opt 2	Alt 3- Opt 3	Alt 3- Opt 4	Alt 4- Opt 1	Alt 4- Opt 2	DSM- Option 1	DSM- Option 2
1	NEW MEXI	515	449	447	433	435	434	434	420	420	403	418
2	ARIZONA	4,154	3,934	3,970	3,669	3,725	3,714	3,725	3,405	3,375	3,532	3,683
3	NEVADA	1,229	1,145	1,241	1,226	962	927	1,020	1,061	963	1,097	908
4	WAPA L.C	564	453	449	416	420	418	409	366	373	509	493
5	MEXICO-C	675	879	879	869	866	866	868	849	814	648	651
6	IMPERIAL	40	18	18	14	14	14	11	11	11	27	25
7	SANDIEGO	845	787	769	653	645	654	657	502	428	582	601
8	SOCALIF	2,623	1,510	1,482	1,307	1,291	1,318	1,296	1,060	890	1,529	1,516
9	LADWP	743	290	307	277	252	257	276	227	164	366	346
10	IPP	250	274	253	338	340	339	341	335	338	250	250
11	PG AND E	4,514	3,315	3,336	2,900	2,983	3,155	2,911	2,570	3,048	3,720	3,320
12	NORTHWES	2,023	2,202	2,203	1,940	1,988	1,908	2,016	1,827	1,816	1,740	1,619
13	B.C.HYDR	417	540	539	477	482	471	485	439	439	312	267
14	AQUILA	6	32	32	30	31	29	31	28	29	0	0
15	ALBERTA	1,468	1,434	1,437	1,405	1,415	1,404	1,418	1,381	1,385	1,231	1,211
16	IDAHO	23	2	3	0	0	-	0	-	-	3	0
18	MPC	-	-	-	69	73	69	73	49	47	-	-
19	SIERRA	267	235	227	212	218	213	216	187	191	139	131
20	WYO	49	65	76	113	113	112	112	139	139	71	76
22	BONZ	69	68	68	67	64	63	66	55	55	67	67
23	UT N	259	162	160	141	144	142	143	127	127	151	183
24	UT S	387	538	413	399	425	422	414	387	392	431	471
25	COL E	1,160	783	650	651	684	662	654	619	606	692	802
26	COL W	200	200	200	198	200	200	200	193	194	198	200
28	B HILL	103	60	59	52	53	53	52	50	50	58	64
29	LRS	83	83	83	82	83	83	83	82	82	76	82
30	JB	261	334	307	301	305	305	303	299	297	241	307
32	BDVW	17	17	36	48	48	48	48	58	58	33	36
33	CRSOVRCO	165	165	172	186	186	185	185	183	182	160	177
Total		23,109	19,974	19,815	18,475	18,443	18,465	18,449	16,910	16,911	18,267	17,905

Total Western Interconnect VOM Costs (\$000)

Savings (\$Millions)	(3,135)	(3,293)	(4,634)	(4,666)	(4,643)	(4,659)	(6,198)	(6,198)	(4,842)	(5,203)
Percent Savings	-13.6%	-14.3%	-20.1%	-20.2%	-20.1%	-20.2%	-26.8%	-26.8%	-21.0%	-22.5%



Delta VOM Savings from Reference Case (No Gen/ No Tx)

(\$Millions)

Line	Area Name	No Added Gen/Tx	Alt 1	Alt 2	Alt 3- Opt 1	Alt 3- Opt 2	Alt 3- Opt 3	Alt 3- Opt 4	Alt 4- Opt 1	Alt 4- Opt 2	DSM- Option 1	DSM- Option 2
1	NEW MEXI	515	(66)	(68)	(82)	(80)	(82)	(81)	(95)	(95)	(112)	(97)
2	ARIZONA	4,154	(220)	(183)	(485)	(428)	(440)	(429)	(749)	(778)	(622)	(471)
3	NEVADA	1,229	(85)	11	(4)	(268)	(302)	(209)	(168)	(266)	(132)	(321)
4	WAPA L.C	564	(110)	(115)	(147)	(144)	(146)	(154)	(198)	(190)	(54)	(71)
5	MEXICO-C	675	204	203	194	191	191	192	174	138	(27)	(24)
6	IMPERIAL	40	(22)	(22)	(26)	(26)	(26)	(26)	(29)	(29)	(13)	(15)
7	SANDIEGO	845	(57)	(75)	(192)	(200)	(191)	(188)	(342)	(417)	(262)	(244)
8	SOCALIF	2,623	(1,113)	(1,141)	(1,315)	(1,331)	(1,304)	(1,327)	(1,563)	(1,732)	(1,094)	(1,107)
9	LADWP	743	(453)	(435)	(465)	(491)	(486)	(467)	(516)	(579)	(377)	(397)
10	IPP	250	24	2	88	90	89	91	85	87	(0)	0
11	PG AND E	4,514	(1,199)	(1,179)	(1,614)	(1,532)	(1,359)	(1,604)	(1,944)	(1,467)	(794)	(1,194)
12	NORTHWES	2,023	179	180	(83)	(35)	(115)	(7)	(197)	(208)	(283)	(404)
13	B.C.HYDR	417	123	122	60	66	54	68	23	22	(105)	(150)
14	AQUILA	6	26	26	23	24	23	25	22	22	(6)	(6)
15	ALBERTA	1,468	(34)	(31)	(63)	(54)	(64)	(50)	(87)	(83)	(237)	(257)
16	IDAHO	23	(21)	(20)	(22)	(23)	(23)	(22)	(23)	(23)	(19)	(22)
18	MPC	-	0	0	69	73	69	73	49	47	0	0
19	SIERRA	267	(31)	(39)	(55)	(49)	(54)	(51)	(80)	(76)	(128)	(136)
20	WYO	49	15	26	64	64	63	63	90	89	21	26
22	BONZ	69	(0)	(0)	(2)	(5)	(5)	(3)	(14)	(13)	(2)	(1)
23	UT N	259	(97)	(98)	(118)	(115)	(116)	(116)	(132)	(132)	(108)	(75)
24	UT S	387	152	26	13	38	36	28	1	5	44	85
25	COL E	1,160	(377)	(510)	(509)	(476)	(498)	(506)	(540)	(554)	(468)	(357)
26	COL W	200	(0)	(0)	(2)	(1)	(1)	(0)	(8)	(6)	(2)	(1)
28	B HILL	103	(43)	(44)	(51)	(50)	(51)	(51)	(54)	(53)	(45)	(39)
29	LRS	83	0	0	(0)	0	0	0	(0)	(0)	(6)	(0)
30	JB	261	72	46	40	43	44	41	37	36	(20)	46
32	BDVW	17	(0)	19	31	31	31	31	41	40	15	18
33	CRSOVRCO	165	(0)	7	21	21	20	21	19	17	(5)	12
Total		23,109	(3,135)	(3,293)	(4,634)	(4,666)	(4,643)	(4,659)	(6,198)	(6,198)	(4,842)	(5,203)

- ✓ Negative (red) values indicate reduction in fuel cost due to displacement
- ✓ Positive (black) values indicate increased fuel cost due to higher dispatch