Appendix D2

2013 Base Case Assumption Consensus Status

#	Assumption	Consensus Status	Assumption Description
1	**Study Period**	✍	**2013 and 2013 (next phase)**
2	**Inflation Rate**	✍	**2.5%**
3	**Operational Costs (Representative)**	✍	**Existing & New Resources (Fuel & Variable O&M)**
4	**2013 Resource Additions**	✍	**Three Scenarios - Gas-fired, Coal-fired, & Renewable**
5	**Transmission Additions**	✍	**As stipulated by the SSG-WI Transmission Sub-group**
6	**LP Dispatch Optimization**	✍	**Based on variable O&M, fuel costs, transmission constraints**
7	**Thermal Plant Lives**	✍	**Plants assumed to remain open**
8	**Hydro Plant Lives**	✍	**All plants operating throughout study**
9	**Transmission Topology**	✍	**As stipulated by the SSG-WI Transmission Sub-group**
10	**Transmission Path Ratings & Nomograms**	✍	**As stipulated by the SSG-WI Transmission Sub-group**
11	**Gas Prices**	✍	**Medium and High Sensitivities**
12	**WECC Region Loads**	✍	**Based on 2002 L&R report**
13	**Average Annual Load Growth**	✍	**Based on 2002 L&R report**
14	**Renewable Resources**	✍	**As agreed to by the SSG-WI Generation Sub-group**
15	**Thermal Plants**	✍	**As agreed to by the SSG-WI Generation Sub-group**
16	**Maintenance Outages**	✍	**Maintenance Outages**
17	**Base year Dollars**	✍	**2003**

Load Assumptions

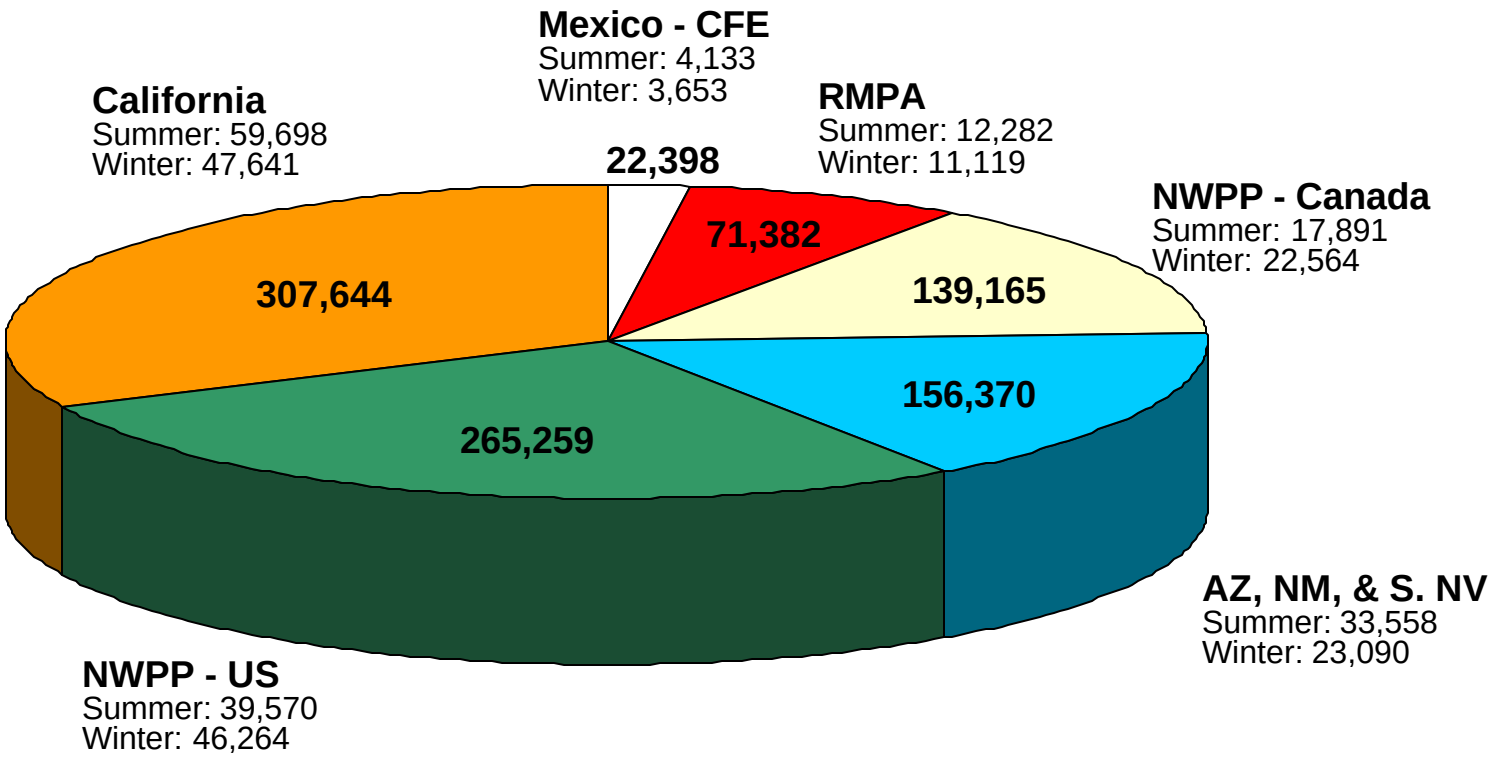
Average Annual Load Growth Rate

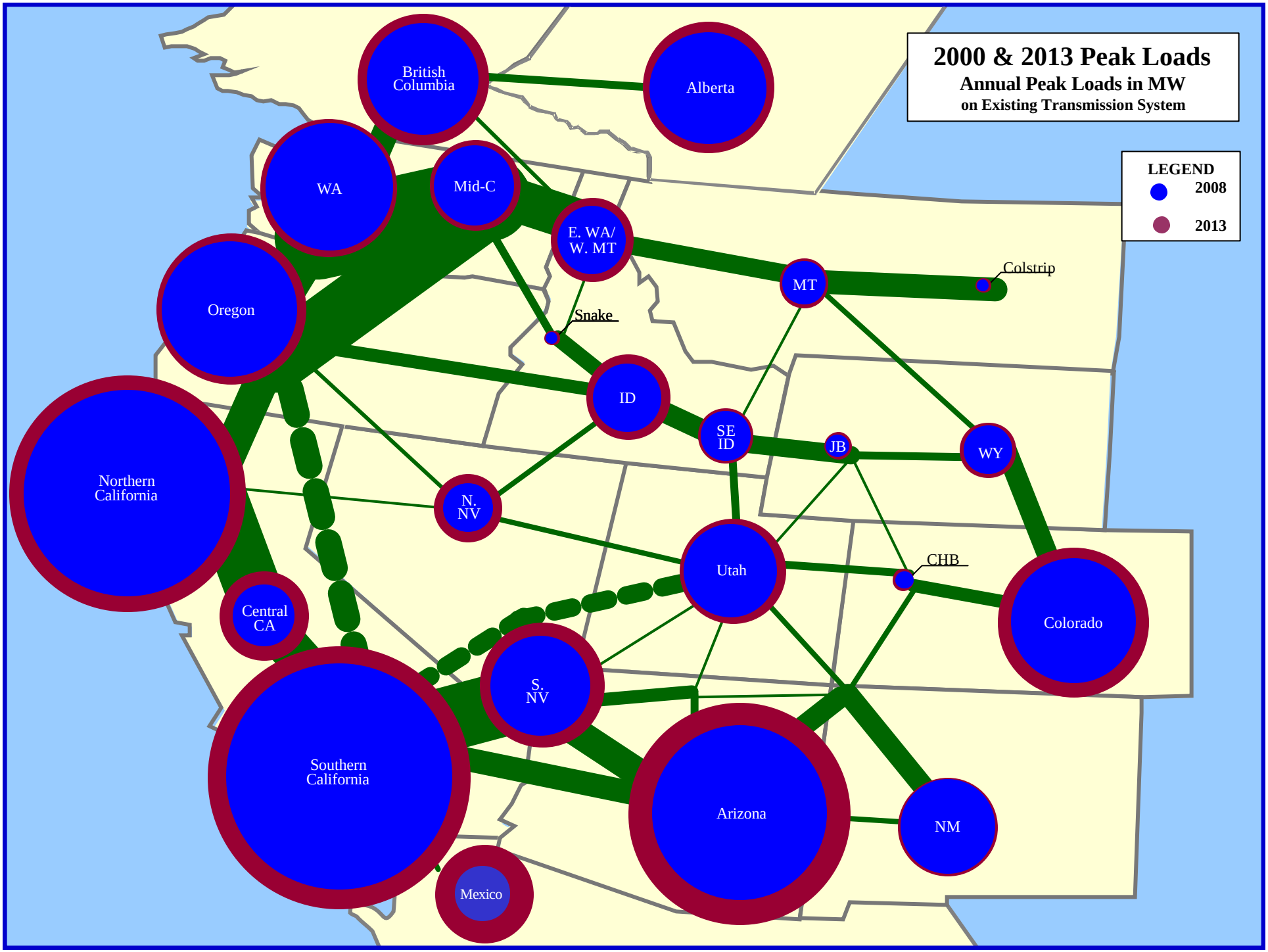
	WECC Total System Growth 2002-2011		
	Smr Peak	Wntr Peak	Energy
Canada	1.6%	1.9%	1.9%
NWPP-US	1.6%	1.4%	1.7%
RMPA	2.6%	2.5%	2.2%
Az-NM-S.Nv	3.0%	2.7%	2.7%
California	1.5%	2.0%	0.9%
Mexico-CFE	8.3%	9.8%	7.5%
Total	2.0%	2.1%	1.8%

Seams Steering Group of the Western Interconnection

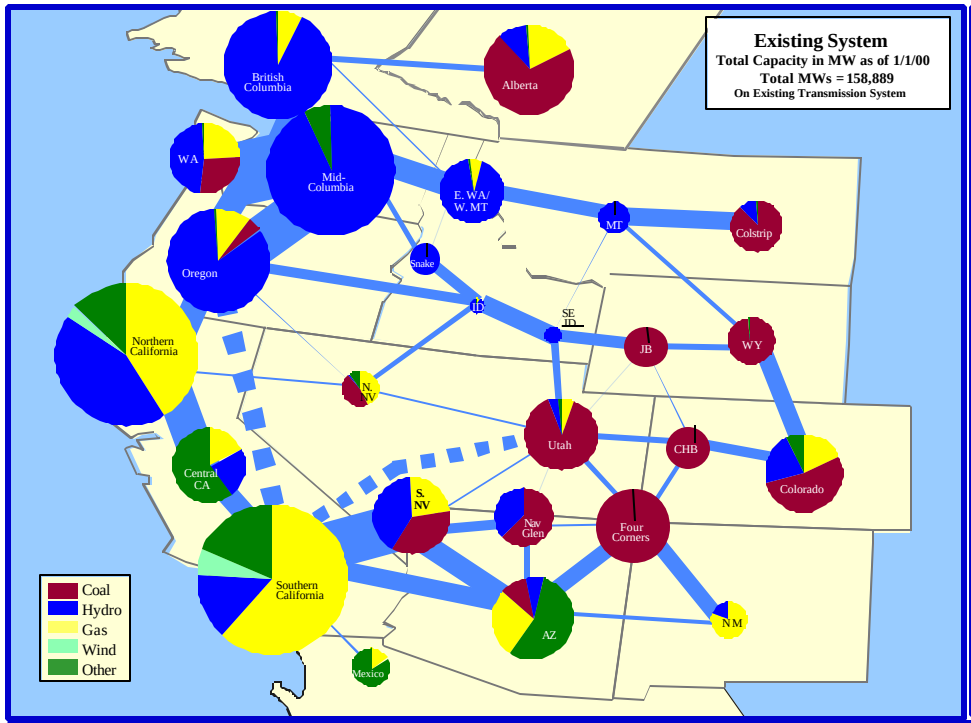
Loads by WECC Region

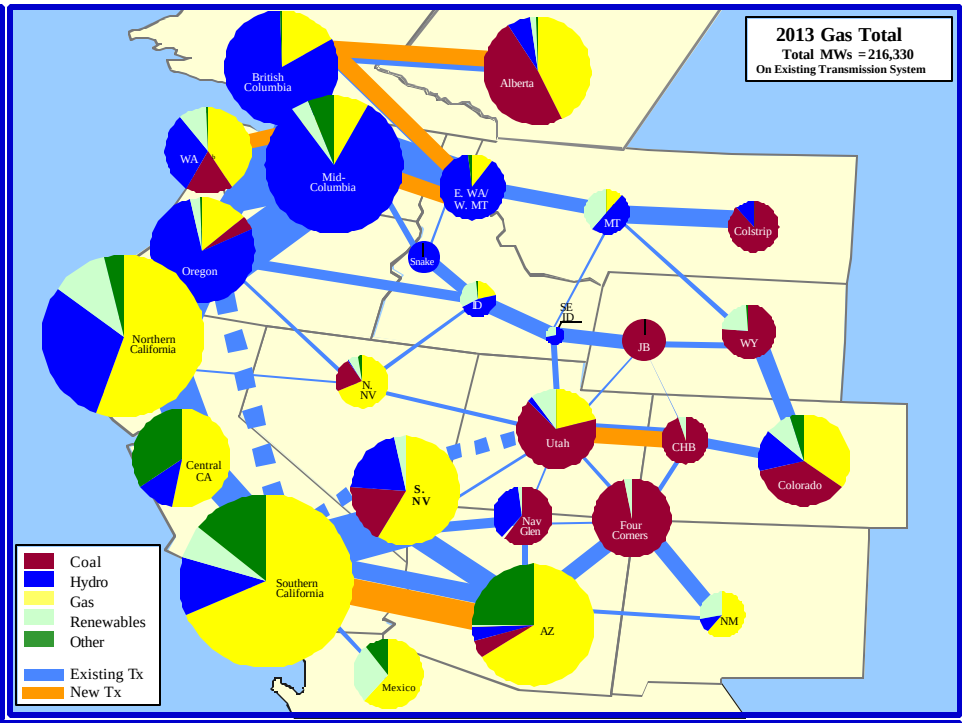
Annual GWh with Summer & Winter Peaks

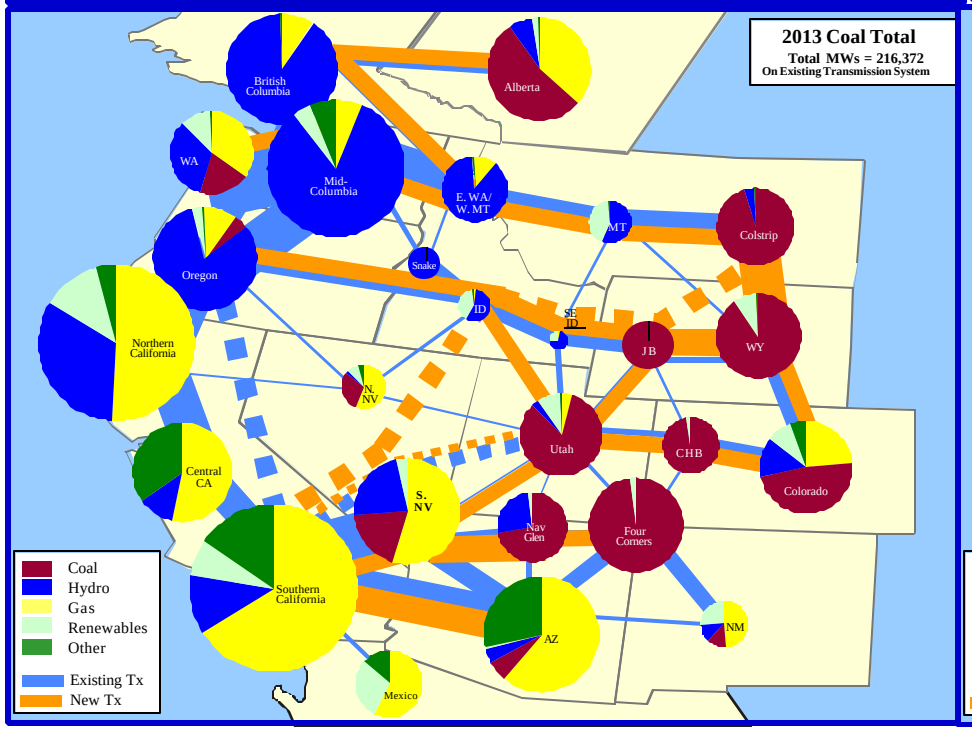


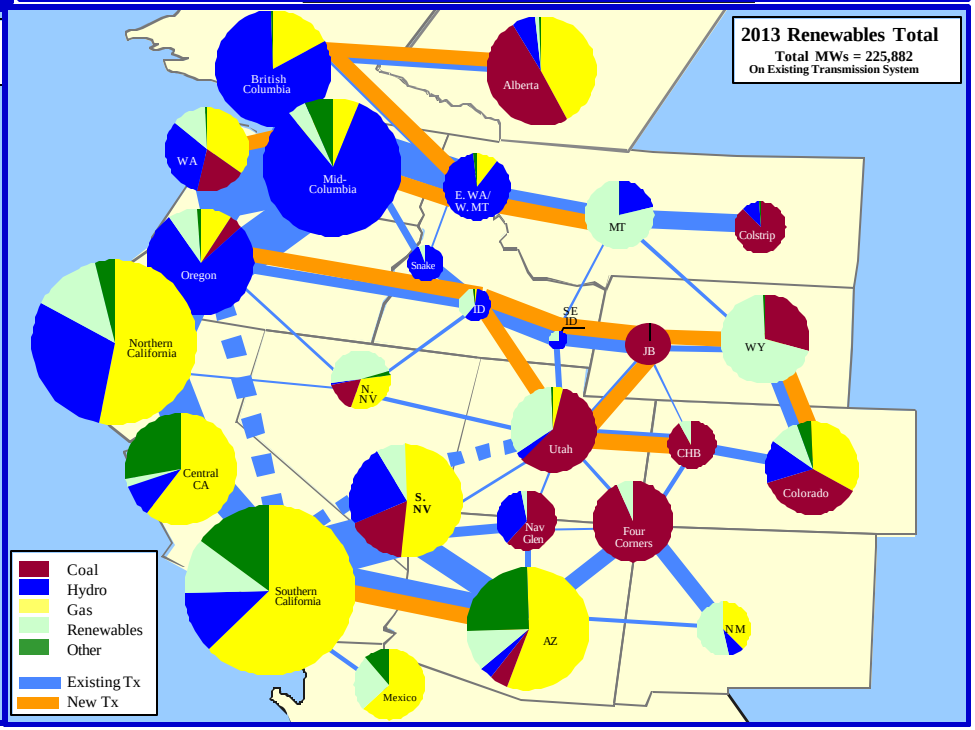

2000 & 2013 Peak Loads
Annual Peak Loads in MW
on Existing Transmission System
LEGEND
2008
2013
British Columbia
Alberta
WA
Mid-C
E. WA/ W. MT
MT
Colstrip
Oregon
Snake
ID
SE ID
JB
WY
Northern California
N. NV
Utah
CHB
Colorado
Central CA
S. NV
Southern California
Arizona
NM
Mexico

Generation Assumptions

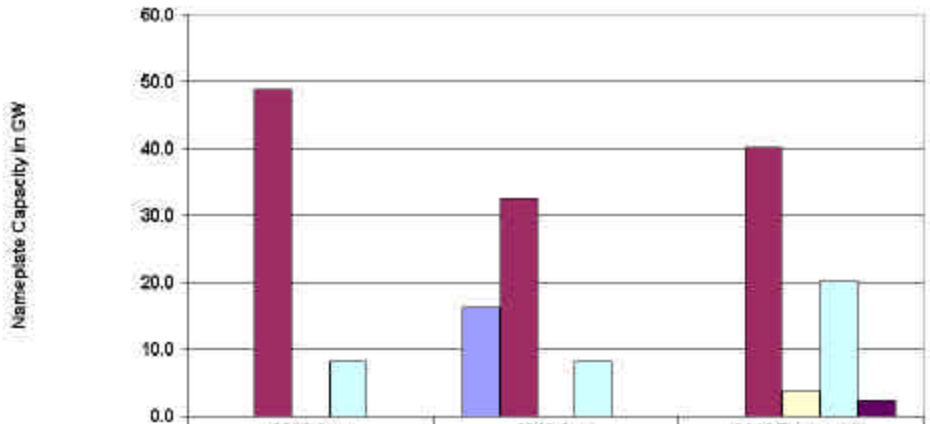

Existing System
Total Capacity in MW as of 1/1/00
Total MWs = 158,889
On Existing Transmission System
British Columbia
Alberta
WA
Mid-Columbia
E. WA/ W. MT
MT
Colstrip
Oregon
Snake
ID
SE ID
JB
WY
Northern California
N. NV
Utah
CHB
Central CA
S. NV
Nav Glen
Four Corners
Colorado
Southern California
AZ
NM
Mexico
Coal
Hydro
Gas
Wind
Other


2013 Gas Total
Total MWs = 216,330
On Existing Transmission System
British Columbia
Alberta
WA
Mid-Columbia
E. WA/ W. MT
MT
Colstrip
Oregon
Snake
ID
SE ID
JB
WY
Northern California
N. NV
Utah
CHB
Central CA
S. NV
Nav Glen
Four Corners
Colorado
Southern California
AZ
NM
Mexico
Coal
Hydro
Gas
Renewables
Other
Existing Tx
New Tx

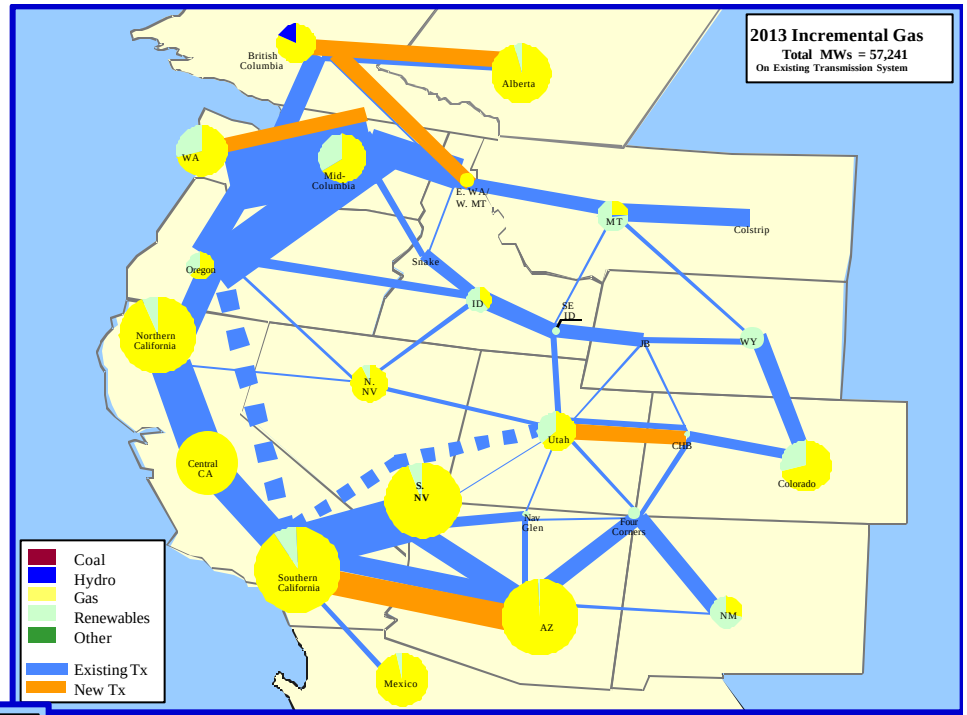

2013 Coal Total
Total MWs = 216,372
On Existing Transmission System
British Columbia
Alberta
WA
Mid-Columbia
E. WA/ W. MT
MT
Colstrip
Oregon
Snake
ID
SE ID
JB
WY
Northern California
N. NV
Utah
CHB
Central CA
S. NV
Nav Glen
Four Corners
Colorado
Southern California
AZ
NM
Mexico
Coal
Hydro
Gas
Renewables
Other
Existing Tx
New Tx

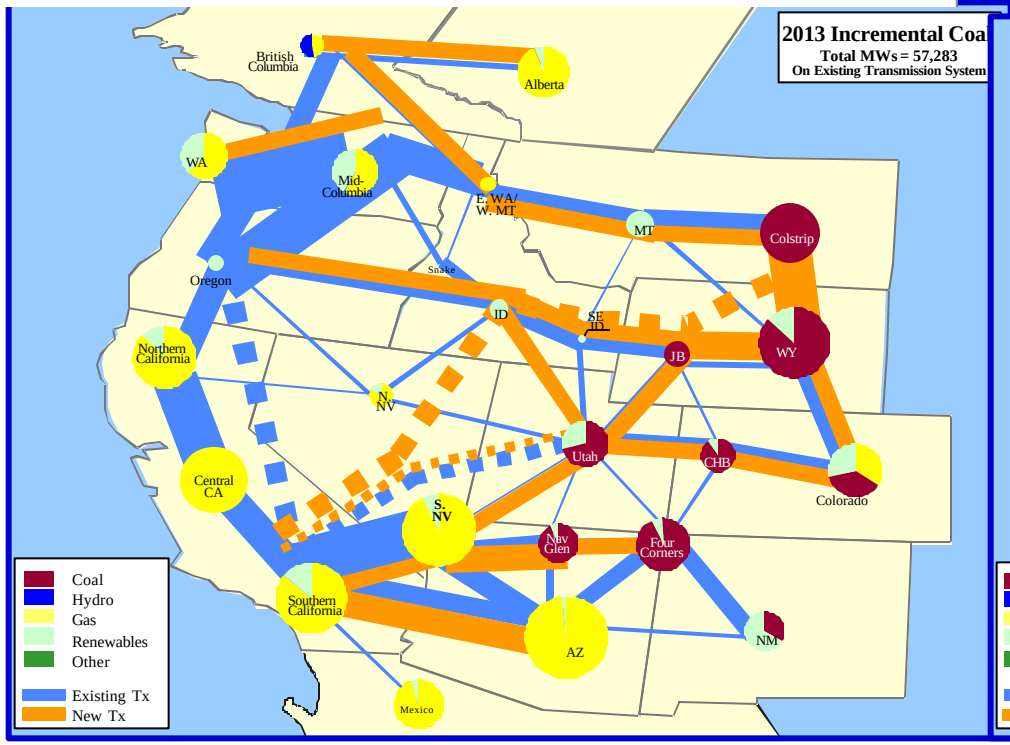

2013 Renewables Total
Total MWs = 225,882
On Existing Transmission System
British Columbia
Alberta
WA
Mid-Columbia
E. WA/ W. MT
MT
Colstrip
Oregon
Snake
ID
SE ID
JB
WY
Northern California
N. NV
Utah
CHB
Central CA
S. NV
Nav Glen
Four Corners
Colorado
Southern California
AZ
NM
Mexico
Coal
Hydro
Gas
Renewables
Other
Existing Tx
New Tx

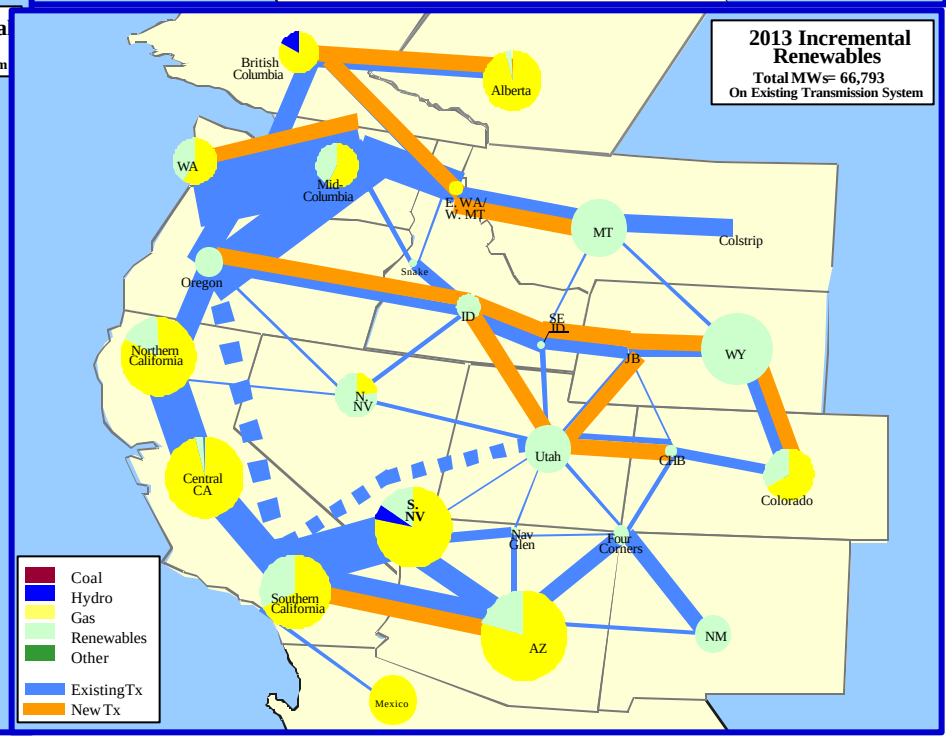
Generation Additions 2000 to 2013



	2013 Gas	2013 Coal	2013 Renewable
Coal	0.0	16.3	0.0
Gas	48.8	32.5	40.1
Geo & Biomass	0.0	0.0	3.8
Wind	8.2	8.2	20.2
Solar	0.0	0.0	2.4

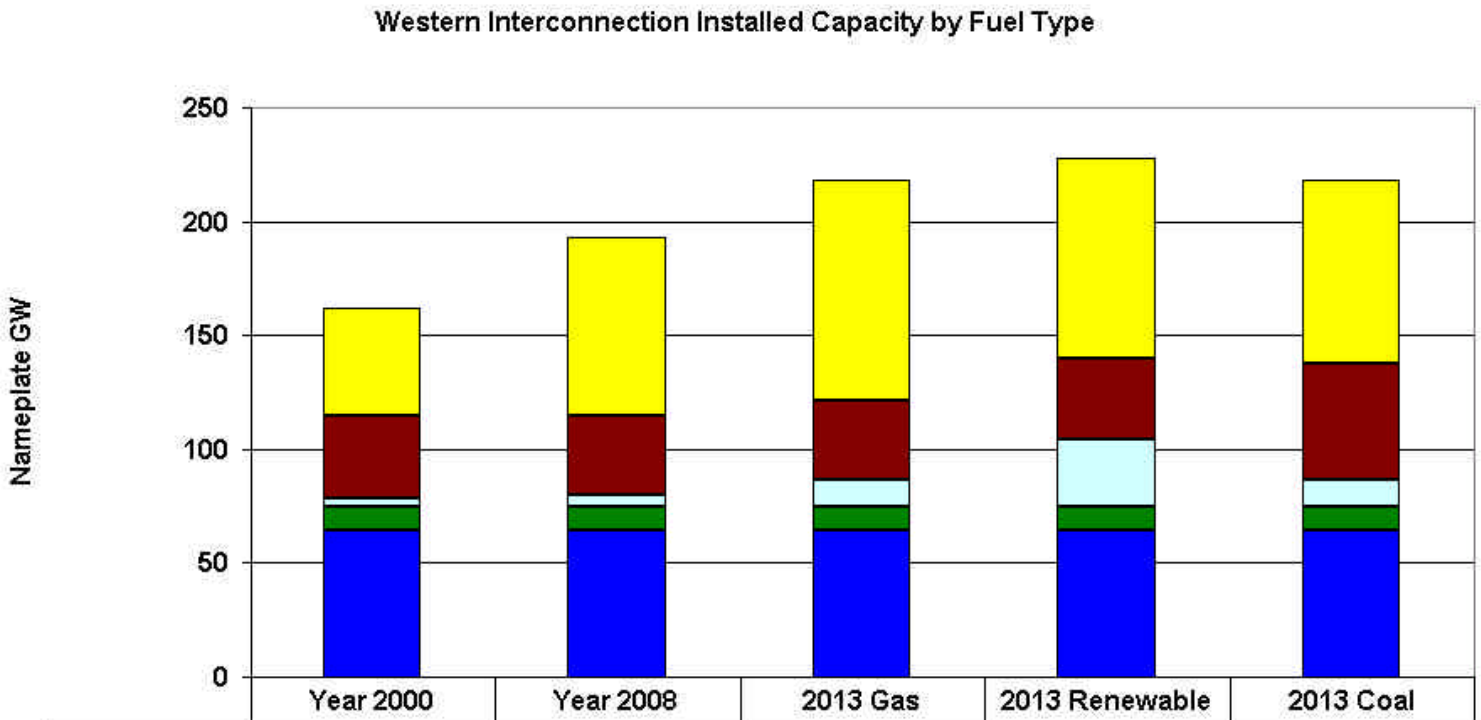






Western Interconnection

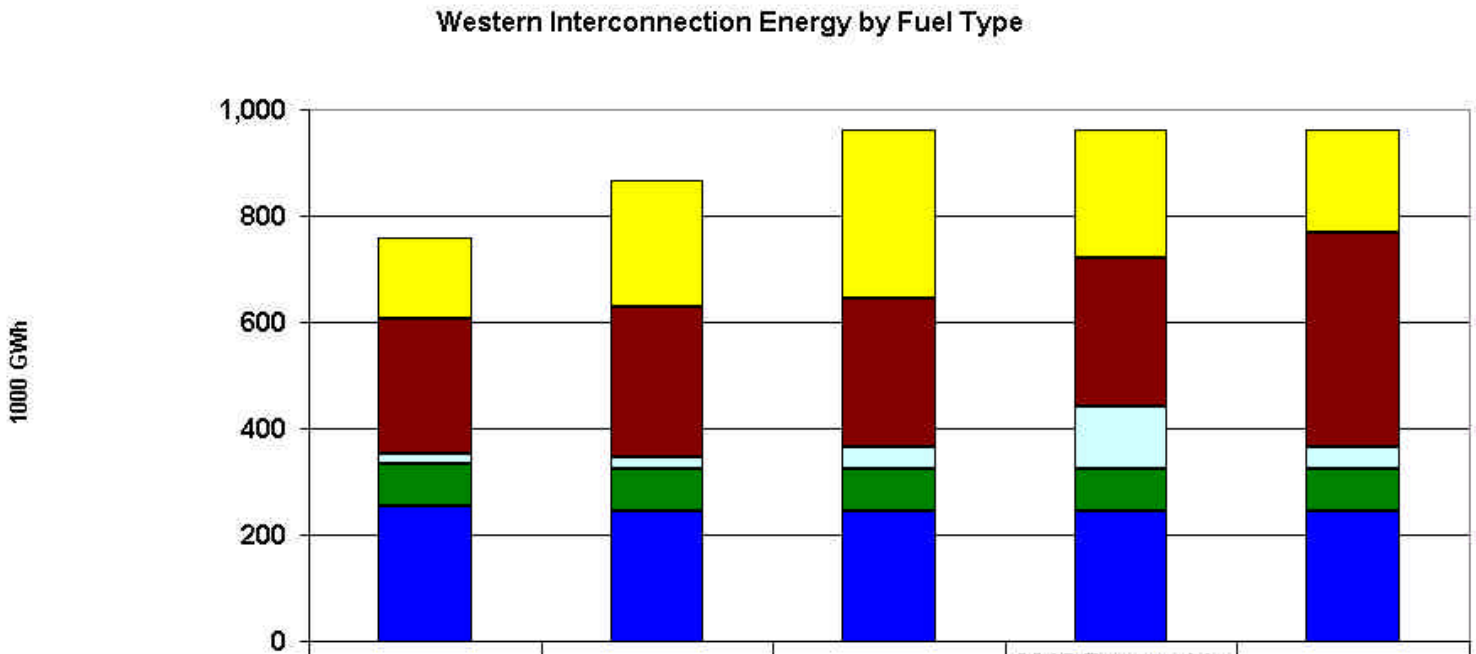
Installed Generation Capacity (GWs)



	Year 2000	Year 2008	2013 Gas	2013 Renewable	2013 Coal
Total GW	162	193	218	228	218
Gas	47	78	96	88	80
Coal	37	35	35	35	52
Renewables	3	5	11	30	11
Other	10	10	10	10	10
Hydro	65	65	65	65	65

Western Interconnection

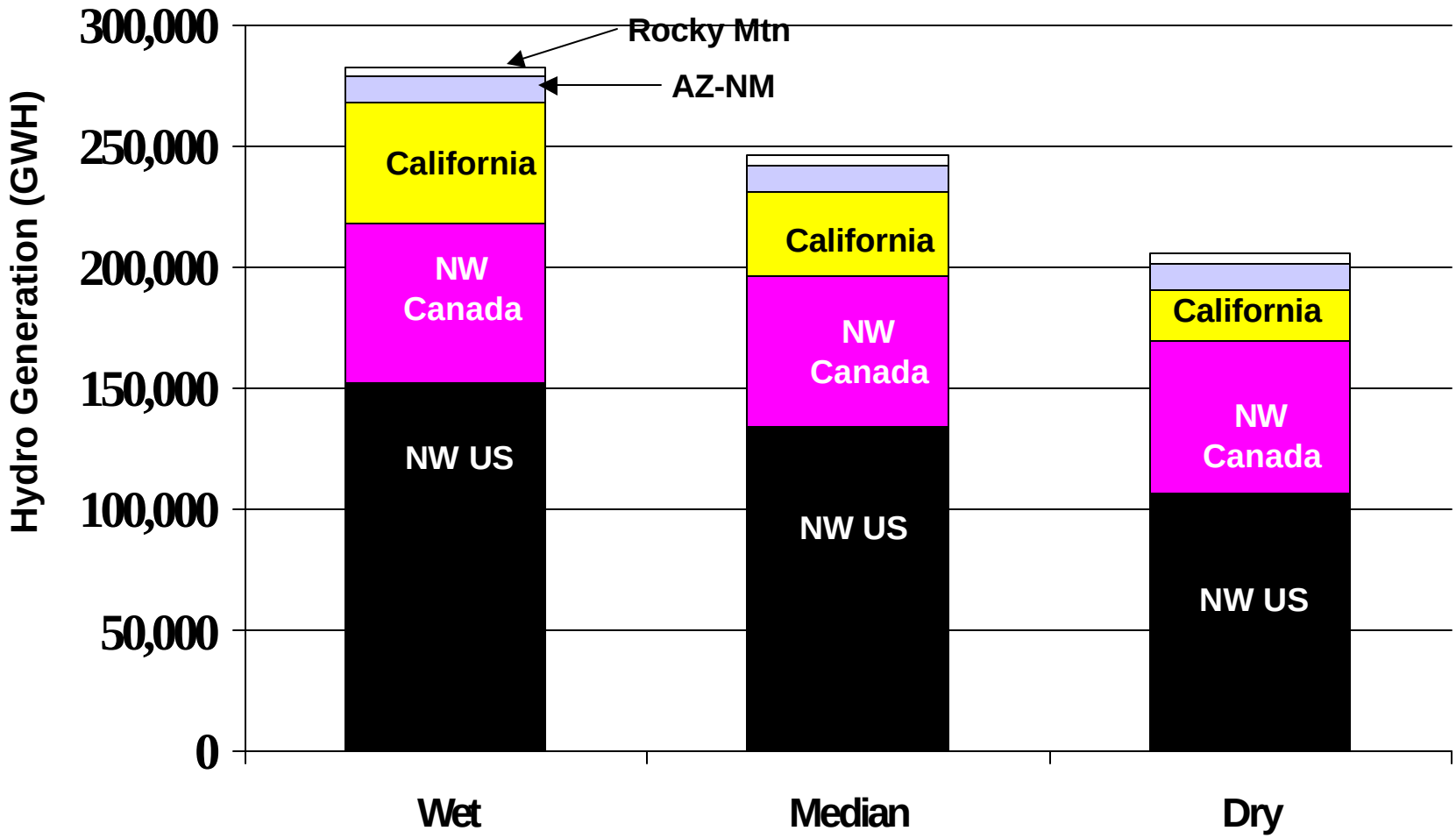
GWh by Energy Source



	2000 Est	2008 AW	2013 Gas AW	2013 Renewable AW	2013 Coal AW
Total GWh in 000	758	865	963	963	963
Gas	153	238	317	244	195
Coal	252	280	280	278	402
Renewables	21	24	42	118	42
Other	78	78	78	78	78
Hydro	255	246	246	246	246

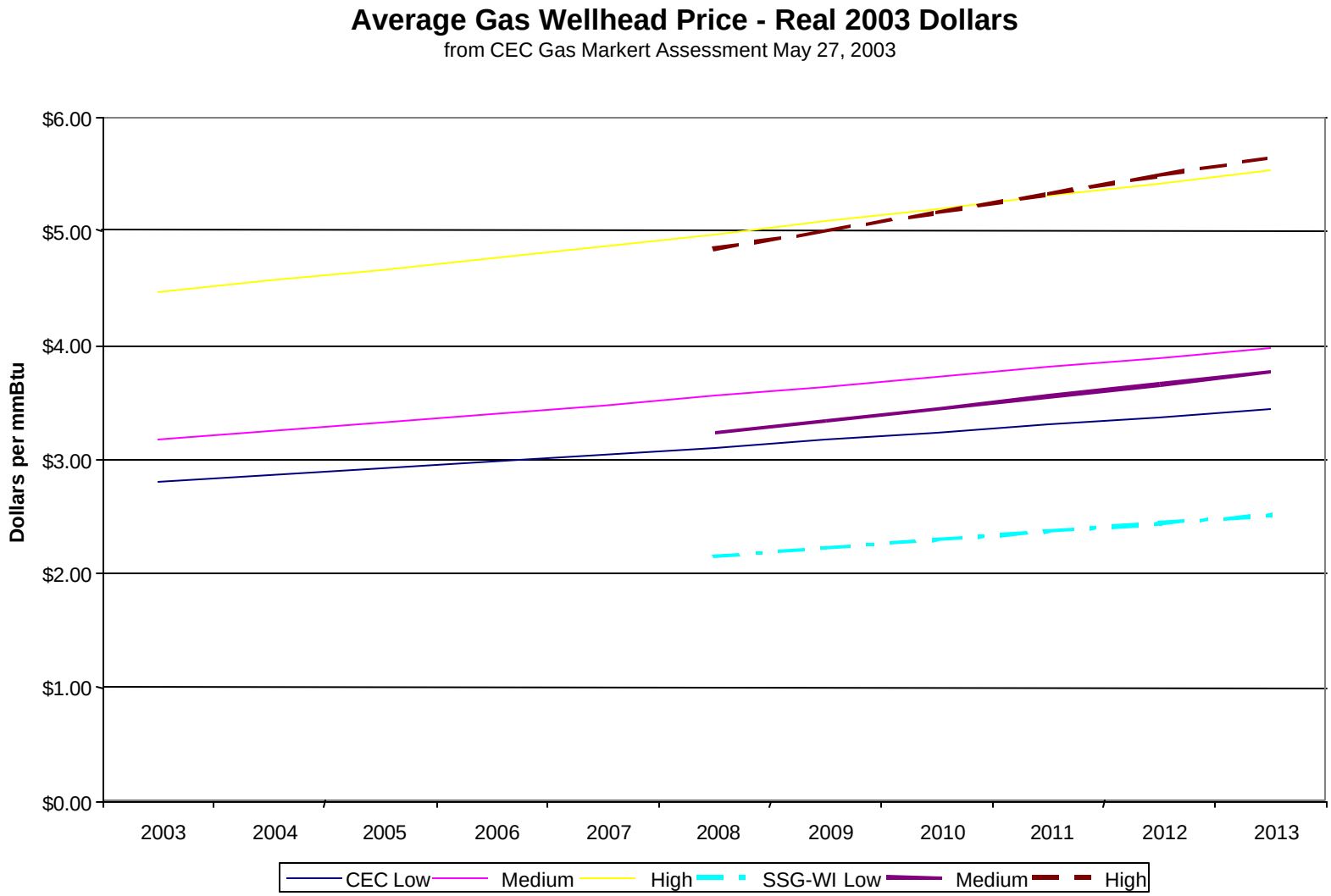
Seams Steering Group of the Western Interconnection

SSG-WI Hydro Modeling

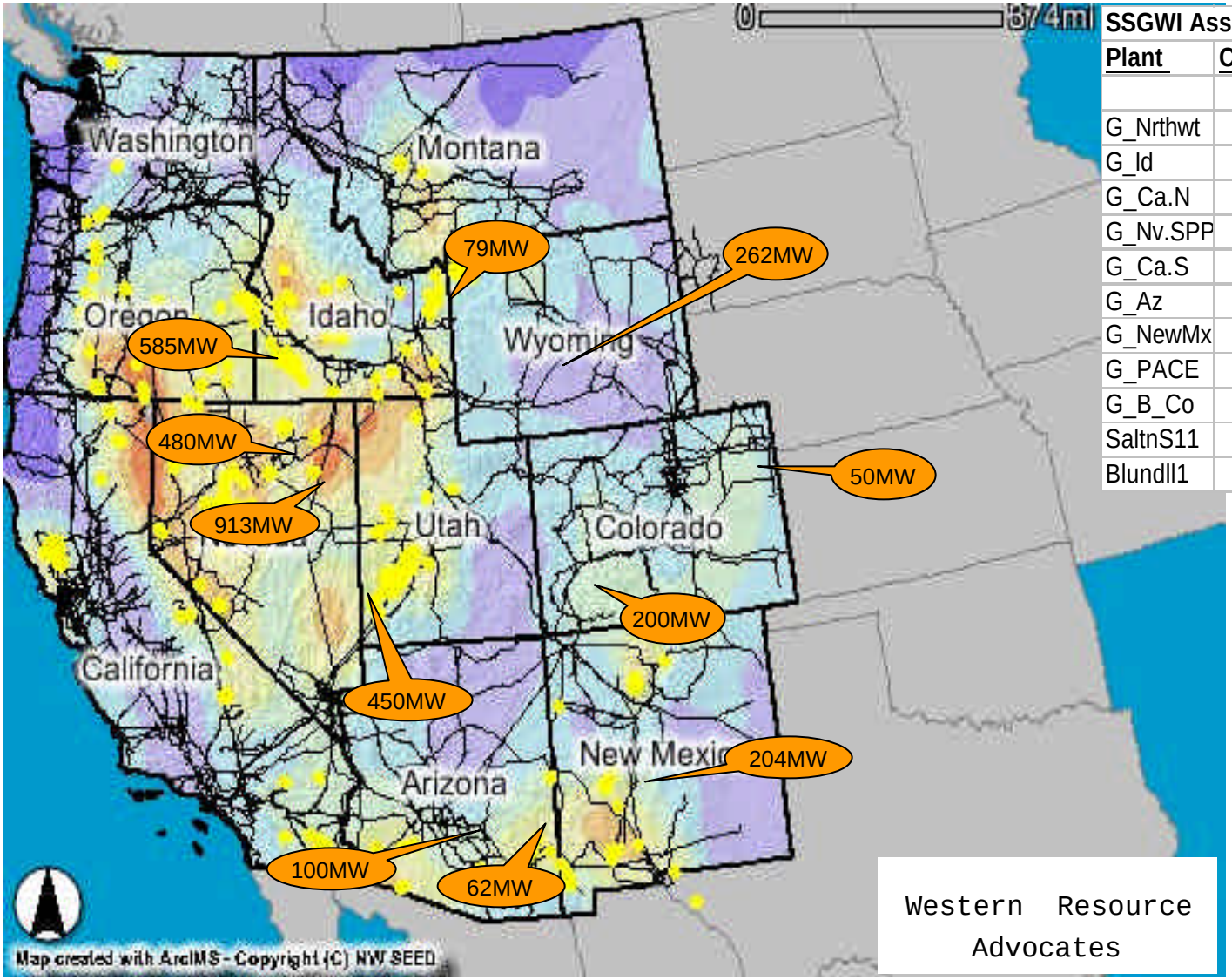


Seams Steering Group of the Western Interconnection

Gas Prices

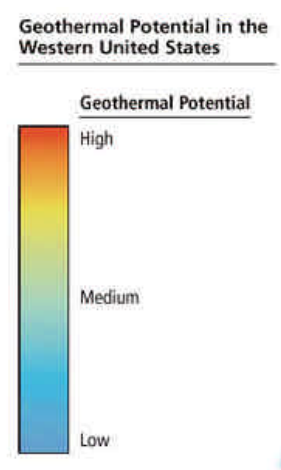


Geothermal

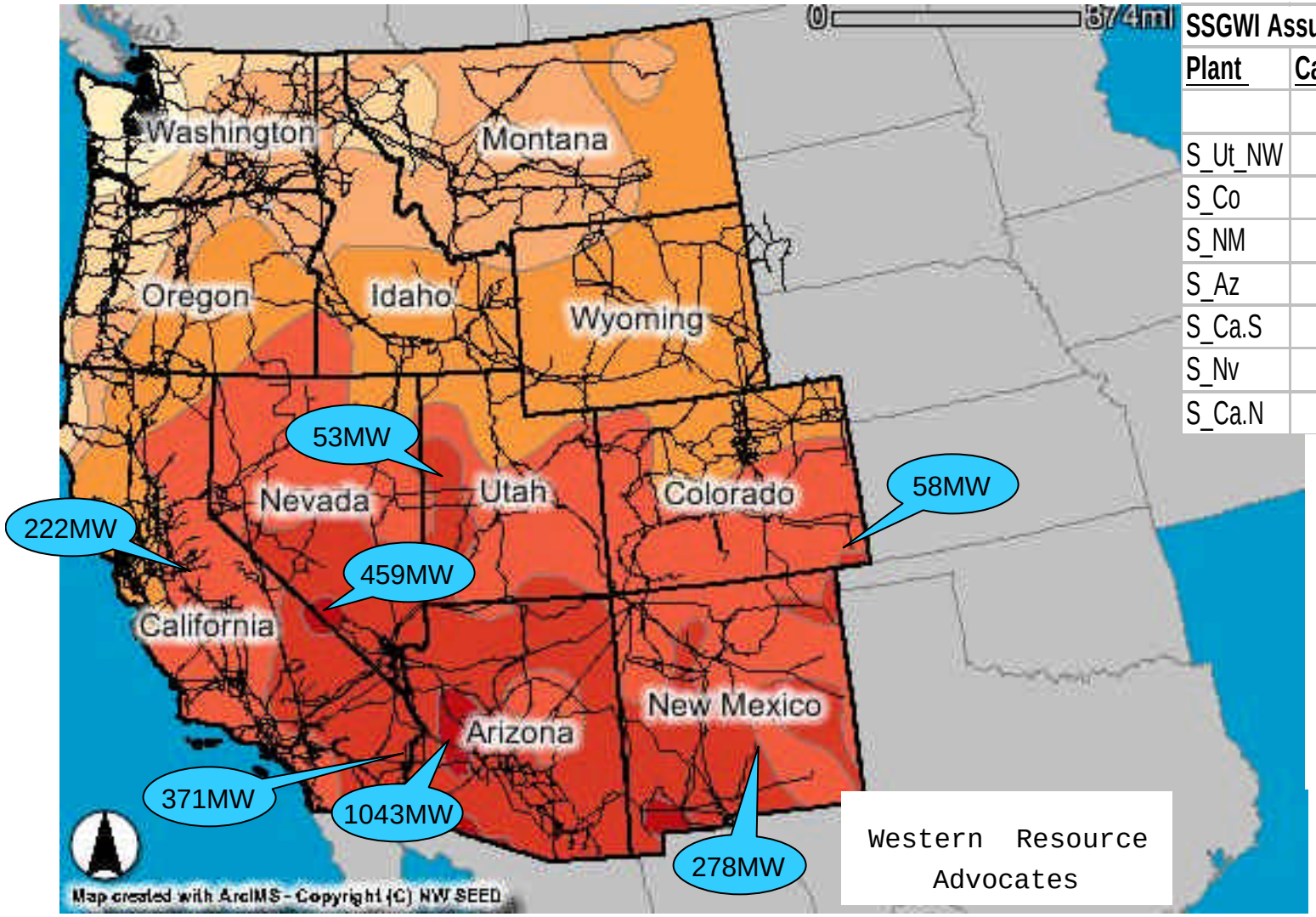


Western Resource Advocates

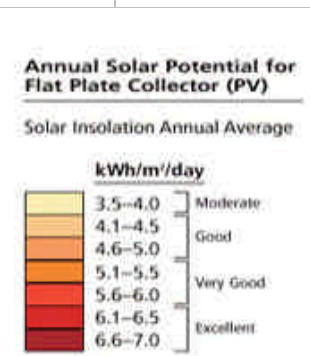
SSGWI Assumed Geothermal & Biomass		
Plant	Capacity	Location
	(MW)	
G_Nrthwt	587	Pondosa 230
G_Id	79	McCall 138
G_Ca.N	450	Carabou 230
G_Nv.SPP	923	Boardertown 345
G_Ca.S	450	Kramer 230
G_Az	462	N.gila 500
G_NewMx	204	Luna 345
G_PACE	267	Soda Springs
G_B_Co	50	Limon
SaltnS11	100	added to Salton Sea
Blundll1	200	added to Blundell



Solar

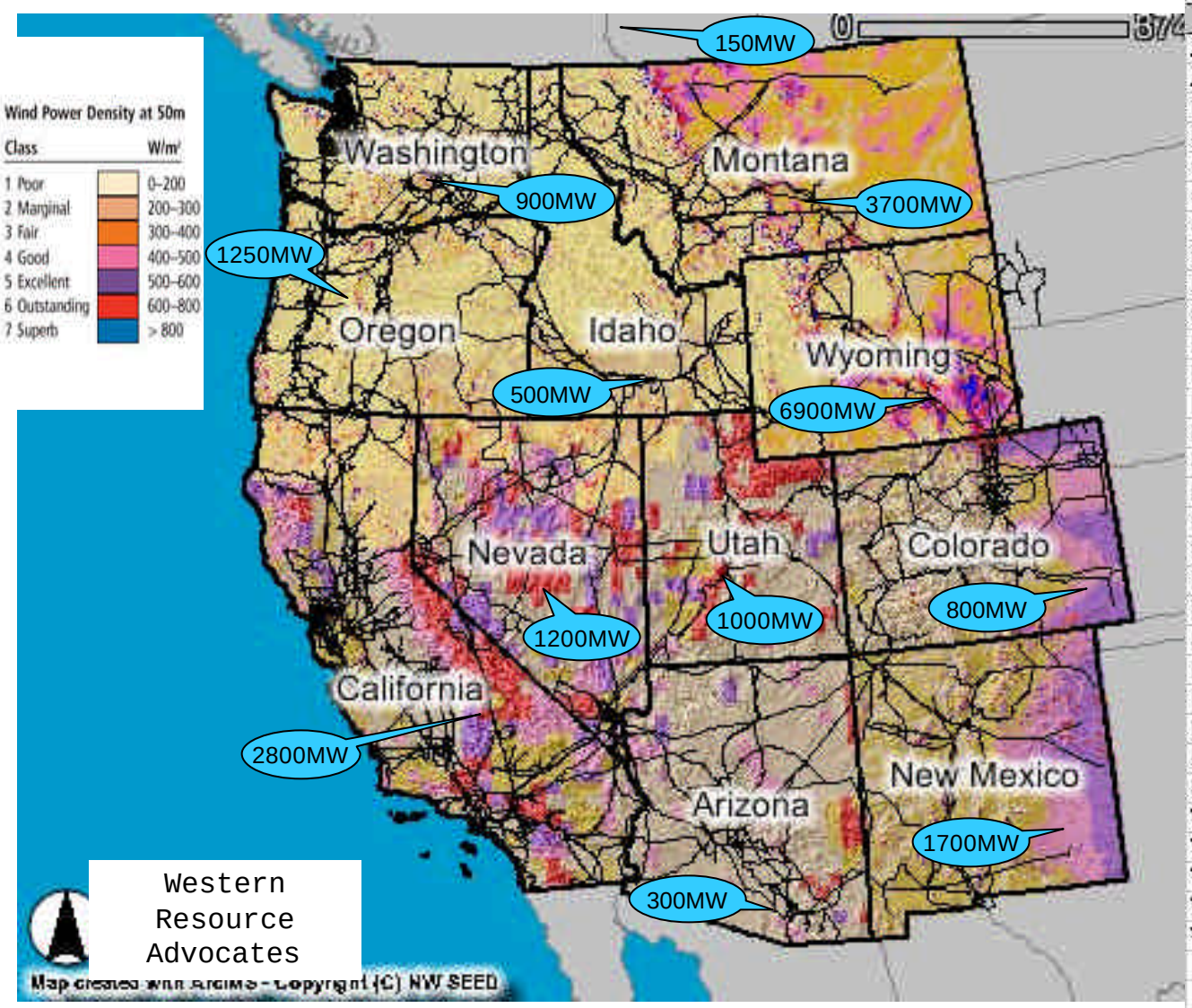


SSGWI Assumed Solar		
Plant	Capacity	Location
	(MW)	
S_Ut_NW	53	Gondor 230
S_Co	58	Vilas 115
S_NM	278	Luna 345
S_Az	1043	Palo Verde 500
S_Ca.S	371	Luz 230
S_Nv	459	Northwest 500
S_Ca.N	222	Wilson 230



Western Resource Advocates

Wind

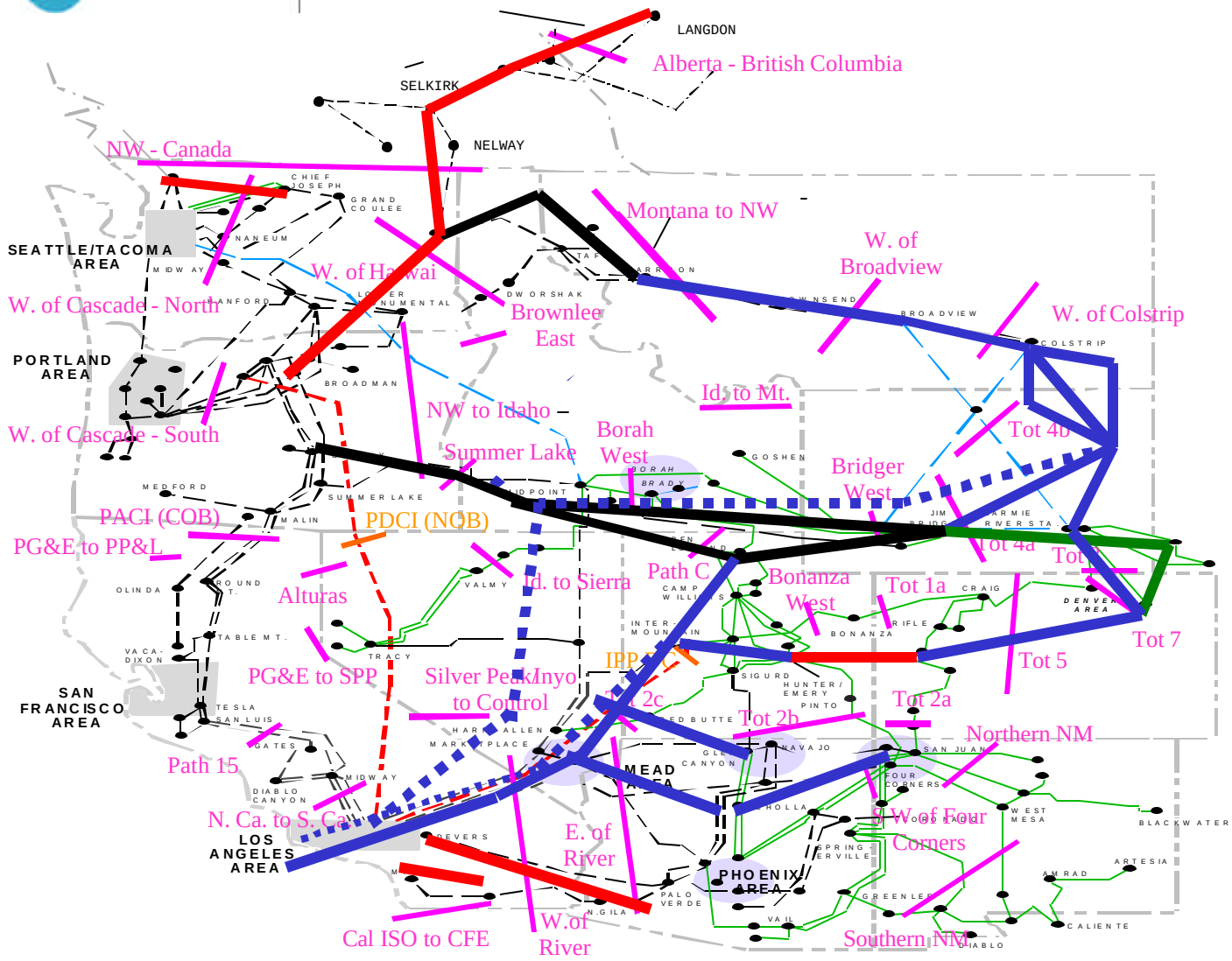


SSG-WI Planning - 2013 Case		
Assumed Wind MW & Locations		
Wind in Renewable Scenario		
State	BusName	MaxMW
AZ	APACHST3	200
AZ	GLENC7-8	100
CA	OMAR	850
CA	DEVERS	350
CA	TESLA	600
CA	VACA-DIX	350
CA	ANTELOPE	650
CN	LANGDON2	150
CO	LAPORTE	400
CO	WALSENBG	400
ID	ADELAIDE	200
ID	MT HOME	200
ID	DON	100
MT	CONRAD	1,400
MT	CLYDE P	2,300
NM	BLACKWTR	1,100
NM	CURECANT	200
NM	SHIPROCK	400
NV	TONOPAH	600
NV	PAHRUMP	600
NW	CARSON	200
NW	MCNARY	650
NW	REDMOND	400
UT	PINTO	100
UT	WASHNGTN	200
UT	SMITHFLD	700
WA	ELLENSBG	500
WA	CUSICK	400
WY	MINERS	2,700
WY	SPENCE	3,000
WY	NAUGHTON	1,200
		21,200

2013 Case Results

Seams Steering Group of the Western Interconnection

Western Interconnect Transmission Paths



Gas Scenario

Coal Scenario

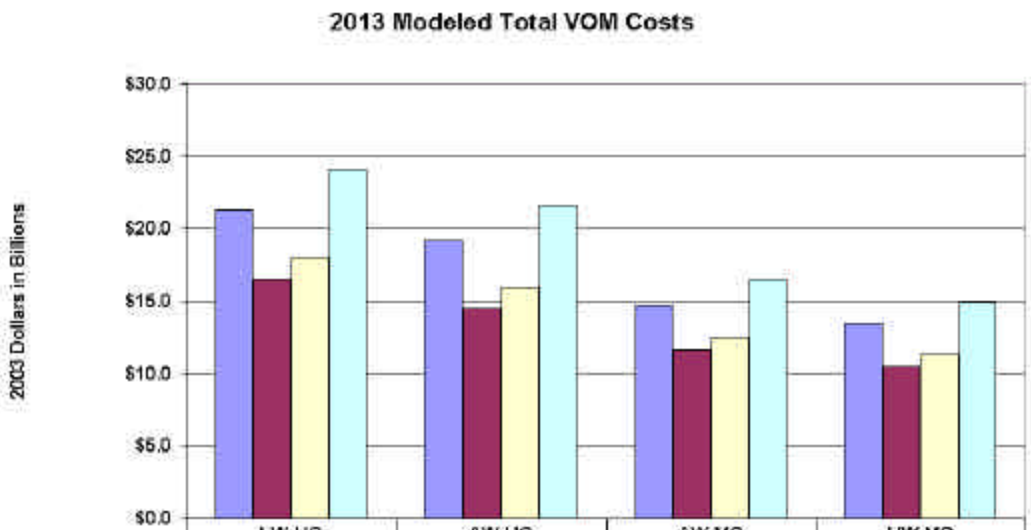
DC

Renewables Scenario

1	Alberta-BC
2	Alberta – Saskatchewan
3	Northwest – Canada
4	West of Cascades – North
5	West of Cascades – South
6	West of Hatwai
7	Blank
8	Montana to Northwest
9	West of Broadview
10	West of Colstrip
11	West of Crossover
12-13	Blank
14	Idaho to Northwest
15	Midway – Los Banos
16	Idaho – Sierra
17	Borah West
18	Idaho – Montana
19	Bridger West
20	Path C
21	Arizona to Calif
23	Four Corners 345/500
24	PG&E – SPP
25	PacifiCorp/PG&E 115 Intercon.
26	Northern – Southern Calif
27	Intermountain Power Project
28	Intermountain – Mona 345 kv
29	Intermountain – Gonder 230 kv
30	TOT 1A
31	TOT 2A
32	Pavant/Intermtn Gonder
33	Bonanza West
34	see paths 78 & 79
35	TOT 2C
36	TOT3
37	TOT 4A
38	TOT 4B
39	TOT 5
40	TOT 7
41	Sylmar to SCE
42	IID – SCE
43	North of San Onofre
44	South of San Onofre
45	SDG&E Comision Fed. de Elect.
46	West of Colorado River (WOR)
47	Southern New Mexico (NM1)
48	Northern New Mexico (NM2)
49	East of the Colrado River
50	Cholla – Pinnacle Peak
51	Southern Navajo
52	Silver Peak – Control 55 kv
53	Billings – Yellowtail
54	Coronado West
55	Brownlee East
56-57	Blank
58	Eldorado – Mead 230 kv Lines
59	WALC Blythe – SCE Blythe

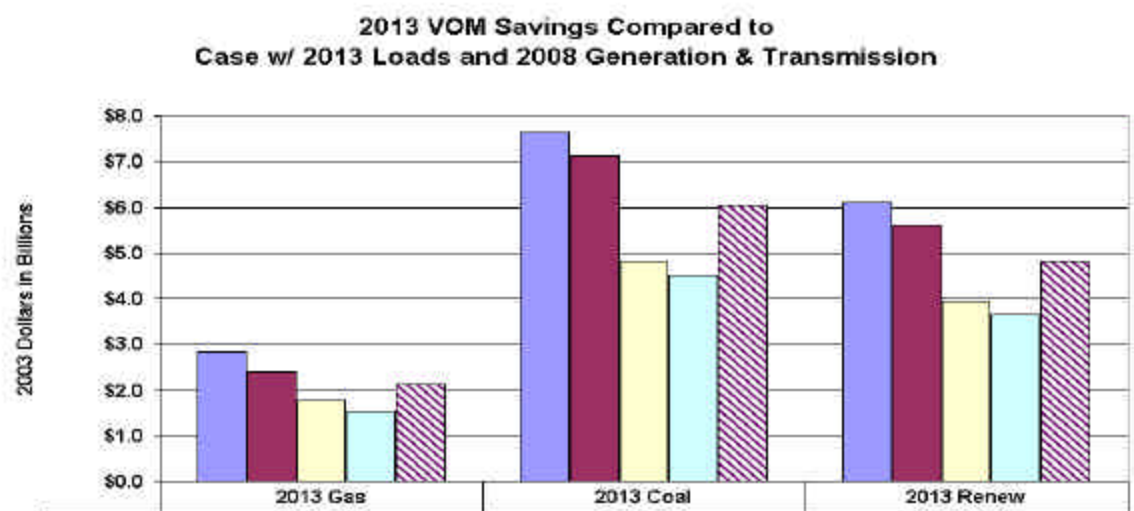
Variable Operating Costs

The model dispatched and estimated VOM for the Gas, Coal, and Renewable Scenarios. In addition a base scenario of no generation or transmission additions was run (2013 loads against 2008 G&T). This allows an estimate of total VOM savings for the three scenarios.



	LW-HG	AW-HG	AW-MG	HW-MG
2013 Gas	$21.3	$19.2	$14.7	$13.4
2013 Coal	$16.5	$14.4	$11.6	$10.4
2013 Renew	$18.0	$16.0	$12.5	$11.3
Ld13, 08 G&T	$24.1	$21.6	$16.5	$14.9

The VOM savings could be compared to the total capital requirements (both generation & transmission) and other considerations (environmental impacts, desired fuel mix, perceived risks, etc) when comparing scenarios.

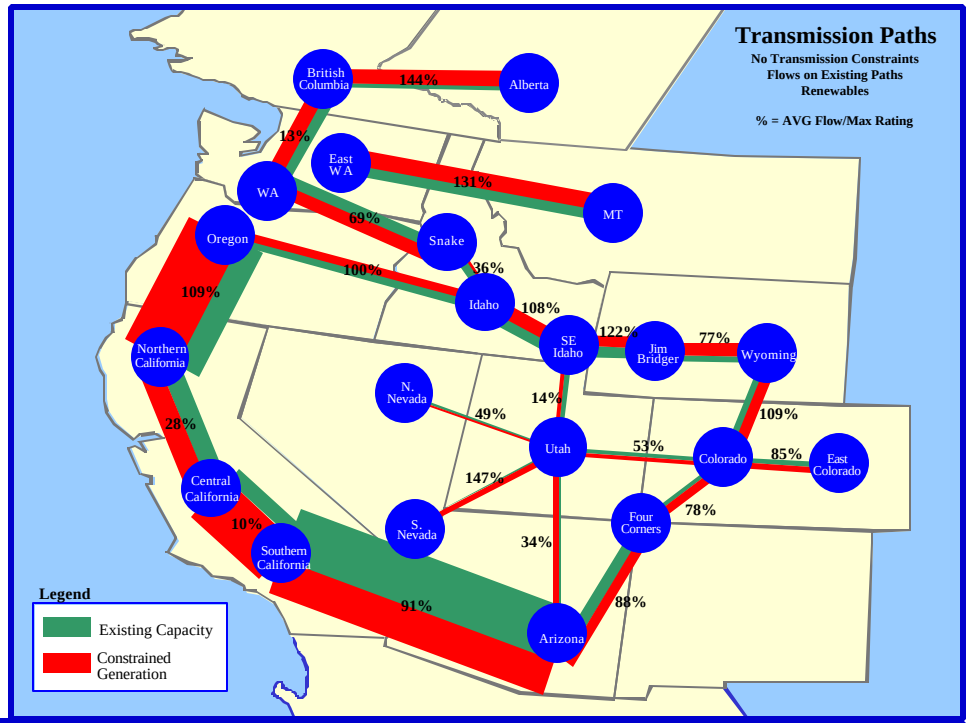


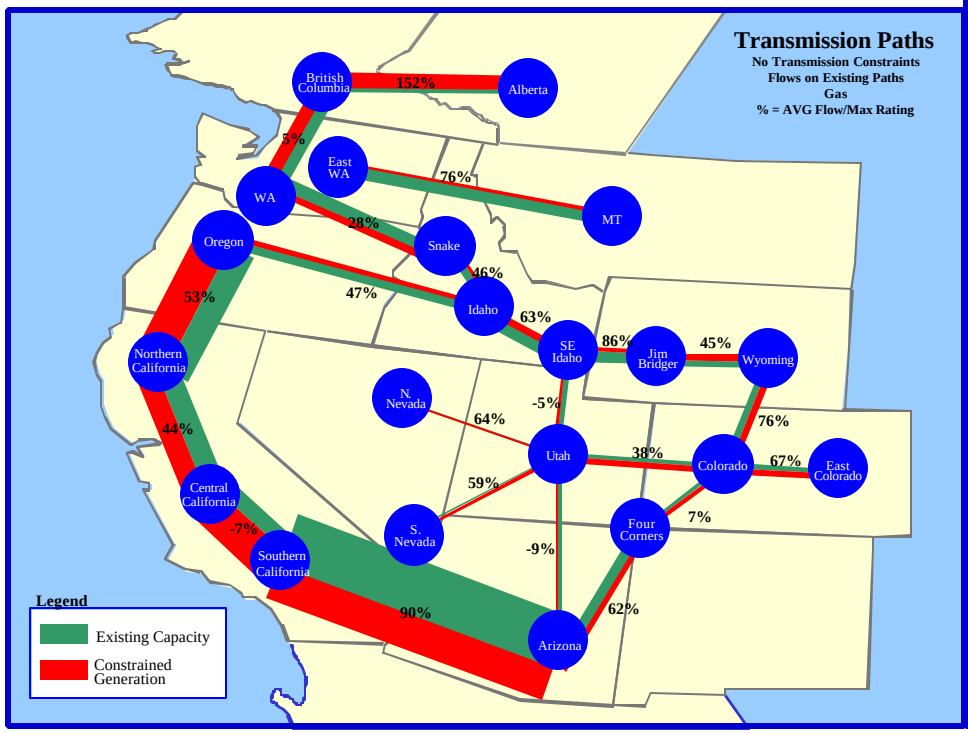
	2013 Gas	2013 Coal	2013 Renew
LW-HG	$2.8	$7.6	$6.1
AW-HG	$2.4	$7.1	$5.6
AW-MG	$1.8	$4.8	$3.9
HW-MG	$1.5	$4.5	$3.7
Average	$2.13	$6.03	$4.83

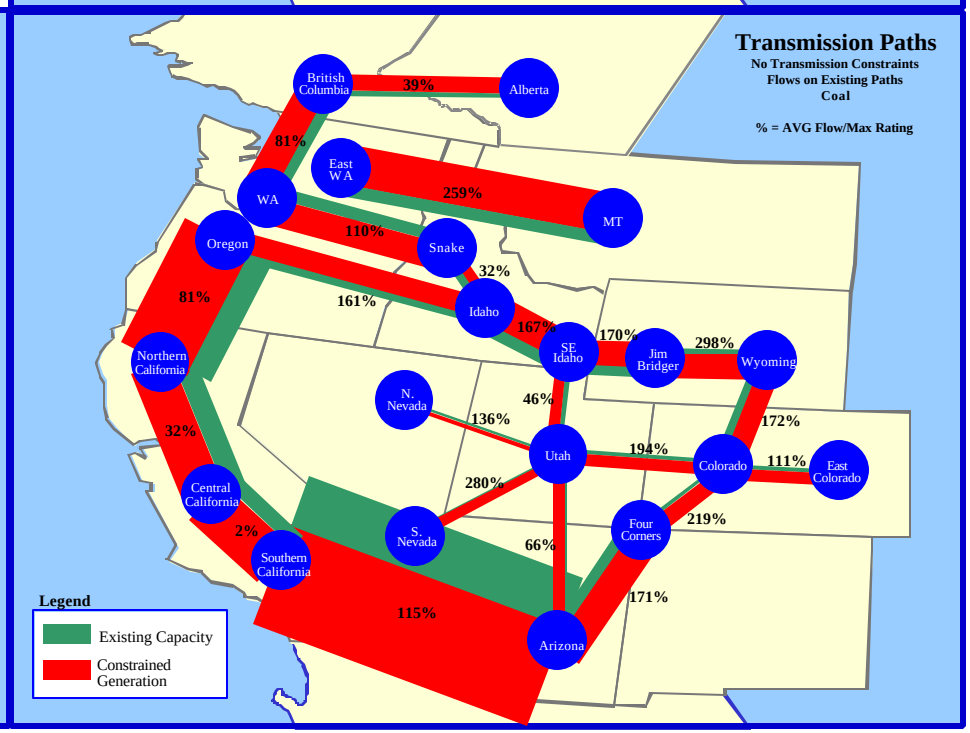
Expansion Value of Interfaces

2013 Resources & Loads running on 2008 Transmission

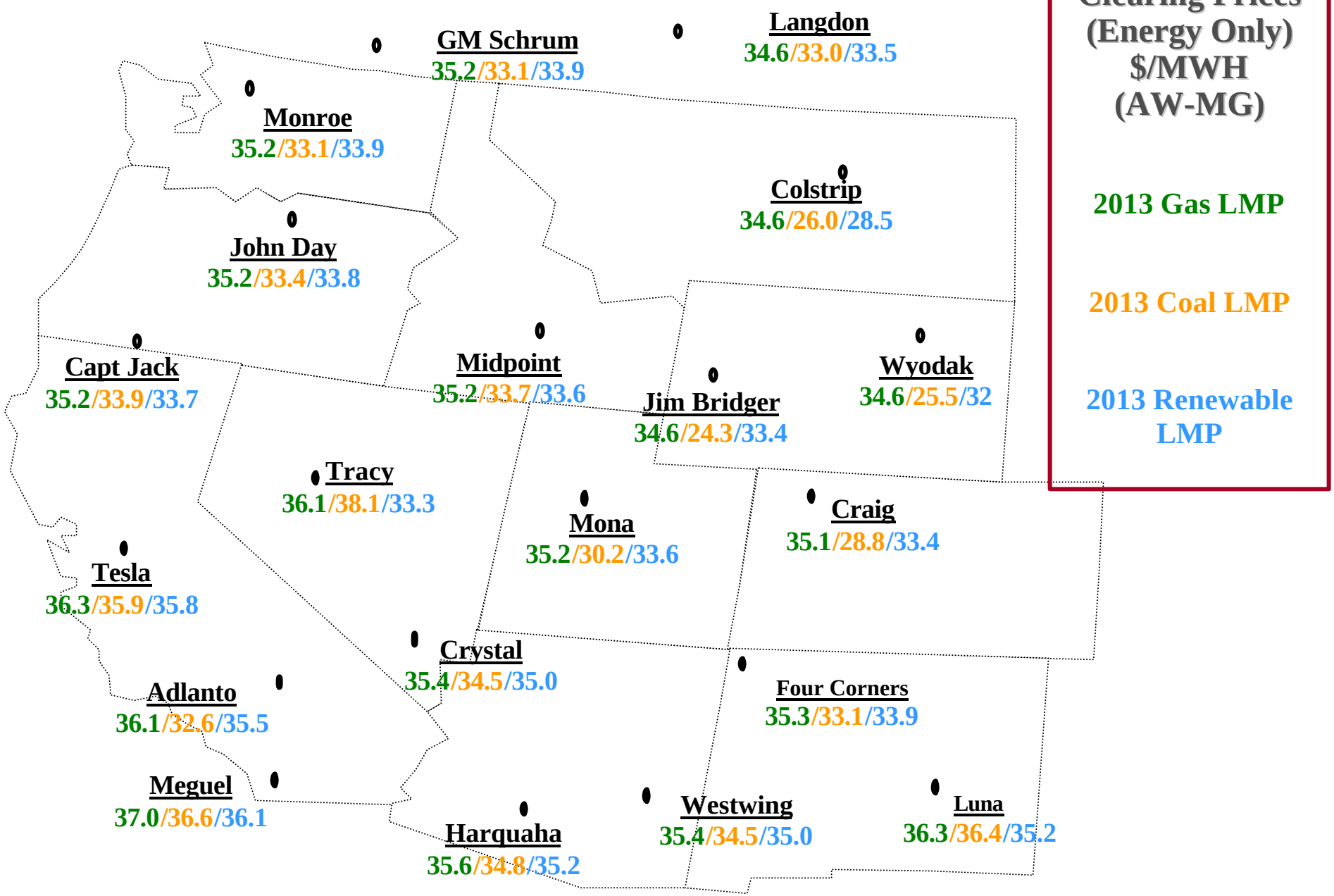
Interface Name	Low Limit	High Limit	Total Expansion Value (2003 $) 2013 Gas Aw-MG	2013 Coal Aw-MG	2013 Renewable Aw-MG	2013 Expansion Rank Gas Aw-MG	Coal Aw-MG	Renewable Aw-MG
ALBERTA - BRITISH COLUMBIA	-720	700	$72,841	$111,745	$79,378	2	5	5
NW to Canada, East BC	-400	400	$95,761	$222,270	$130,338	1	2	3
WOR - PV to Devers	63	1550	$38,684	$3,097	$34,744	3	35	7
WOR - n. El Dorado to Lugo	-732	2754	$31,524	$61,882	$22,468	4	10	11
NORTHWEST - CANADA	-2299	2000	$9,546	$24,470	$10,001	10	15	18
SOUTHERN NEW MEXICO (NM1)	332	1048	$9,405	$55,892	$5,853	11	11	26
CA INDEPENDENT - MEXICO (CFE)	-629	409	$2,706	$28,005	$3,370	17	14	28
BRIDGER WEST	1087	2200	$11,241	$148,719	$117,751	6	4	4
TOT 3	-643	1424	$5,285	$108,647	$167,236	14	7	2
TOT 2C	-300	300	$6,160	$32,726	$20,942	13	13	12
PACI vs PDCI	-4709	7300	$6,347	$7,477	$11,366	12	28	16
North of Miguel	6	2000	$10,880	$15,246	$17,457	9	20	14
ARIZONA - CALIFORNIA	-560	5700	$4,015	$51,322	$1,940	15	12	34
TOT 7	-712	890	$11,142	$110,024	$29,028	7	6	8
BROWNLEE EAST	150	1750	$0	$0	$0	68	68	68
BONANZA WEST	-218	785	$2,064	$8,661	$2,751	30	25	31
COI	-2643	4800	$2,583	$5,952	$8,774	18	28	21

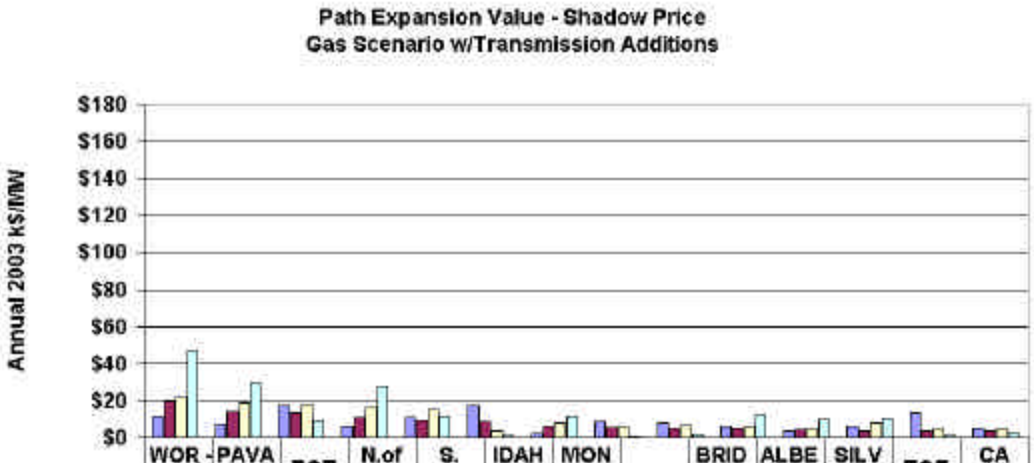






2013 LMP Prices - 2003$





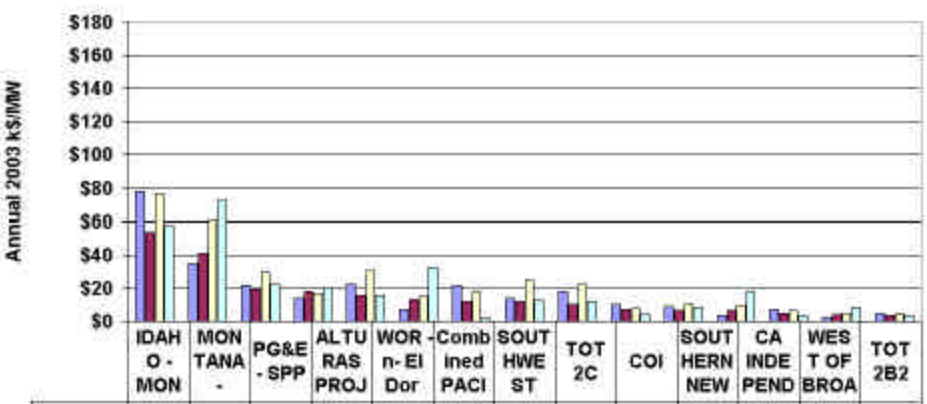
	WOR - En- El Dor	PAVANT, INTR	TOT 7	N.of Miguel	S. NEW MEXI	IDAHO - SIER	MONTANA -	COI	BRIDGER WES	ALBERTA - BRITI	SILVER PEAK	TOT 3	CA INDEPEND
HW-MG	$12	$7	$17	$6	$11	$17	$2	$8	$6	$4	$6	$13	$5
AW-MG	$19	$14	$13	$11	$9	$9	$6	$5	$5	$4	$4	$4	$4
AW-HG	$22	$19	$18	$16	$15	$4	$8	$6	$6	$5	$8	$5	$5
LW-HG	$47	$29	$9	$28	$12	$1	$12	$2	$13	$9	$10	$1	$3

Path Expansion values

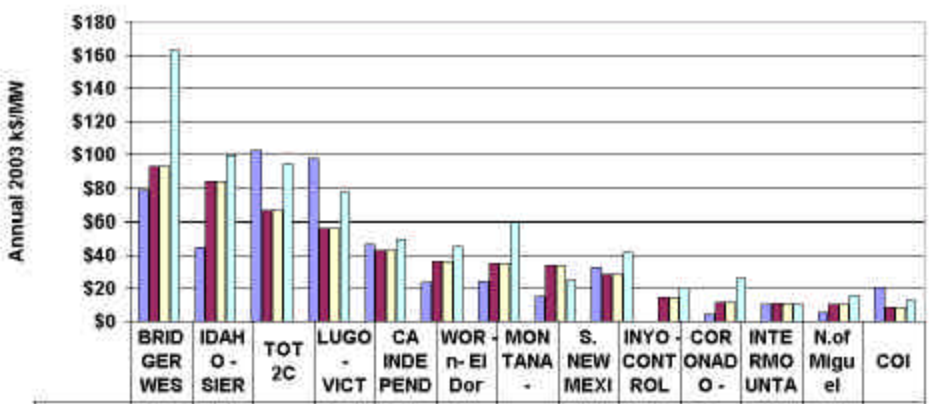
The Gas Scenario has the lowest Expansion Values as the VOM differences between CCCTs in different areas tend to be low.

The Renewable Scenario has more remote low cost generators and higher Expansion Values.

The Coal Scenario has the highest Expansion Values, due to the quantity of remote MWhs trying to move.



	IDAHO - MON	MONTANA -	PG&E - SPP	ALTURAS PROJ	WOR - En- El Dor	Combined PACI	SOUTHWEST	TOT 2C	COI	SOUTHERN NEW	CA INDEPEND	WEST OF BROA	TOT 2B2
HW-MG	$78	$35	$22	$14	$7	$22	$14	$18	$11	$9	$7	$3	$5
AW-MG	$54	$41	$19	$18	$13	$12	$12	$11	$7	$7	$5	$4	$4
AW-HG	$77	$61	$29	$17	$15	$18	$25	$22	$8	$11	$7	$5	$5
LW-HG	$57	$72	$22	$21	$33	$2	$12	$12	$4	$8	$4	$8	$4

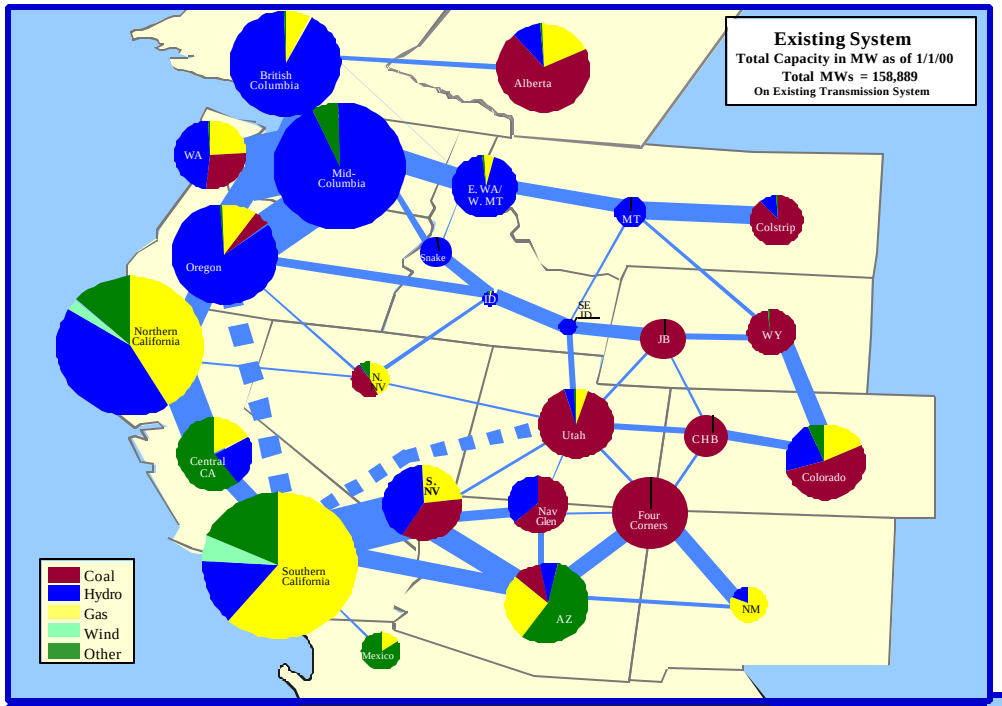


	BRIDGER WES	IDAHO - SIER	TOT 2C	LUGO - VICT	CA INDEPEND	WOR - En- El Dor	MONTANA -	S. NEW MEXI	INYO - CONTROL	CORONADO -	INTERMOUNTA	N.of Miguel	COI
HW-MG	$79	$45	$103	$98	$47	$23	$24	$32	$0	$4	$11	$5	$20
AW-MG	$93	$84	$66	$56	$43	$36	$35	$29	$14	$12	$11	$10	$9
AW-HG	$93	$84	$66	$56	$43	$36	$35	$29	$14	$12	$11	$10	$9
LW-HG	$163	$100	$95	$77	$50	$45	$60	$42	$20	$26	$10	$16	$12

SSG-WI Estimates
Modeled Backstop Generation
MWh by Case

		High Water Medium Gas	Average Water Medium Gas	Average Water High Gas	Low Water High Gas
	2008 Runs	3,330	3,330	4,048	75,430
2013 cases					
	08 Resources	1,157,718	1,169,468	1,431,882	3,110,255
	Gas	0	0	0	0
	Renewable	0	0	0	0
	Coal	10,718	10,718	10,718	11,893

Gas Scenario



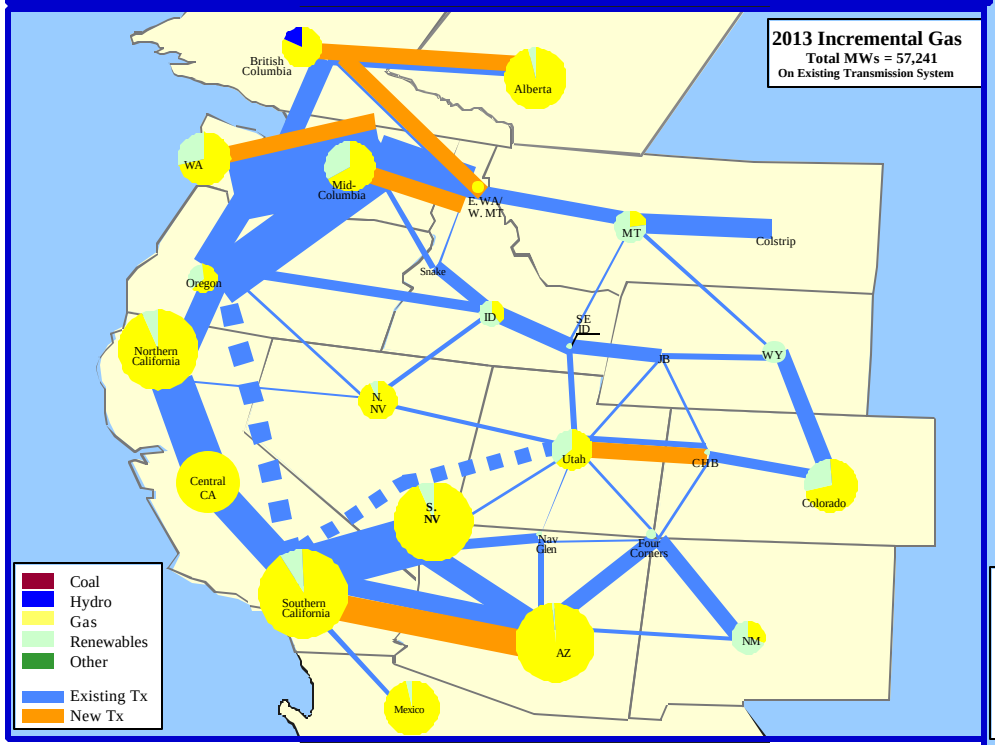
Gas Scenario 2000-2013

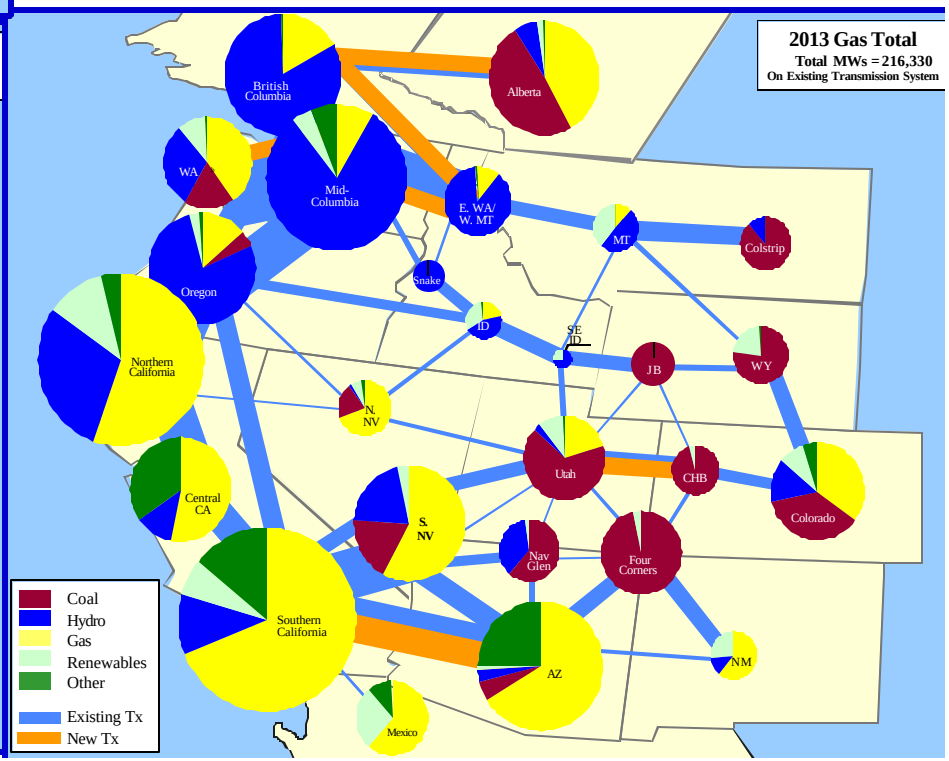
? About 49 GW new gas-fired CCCT

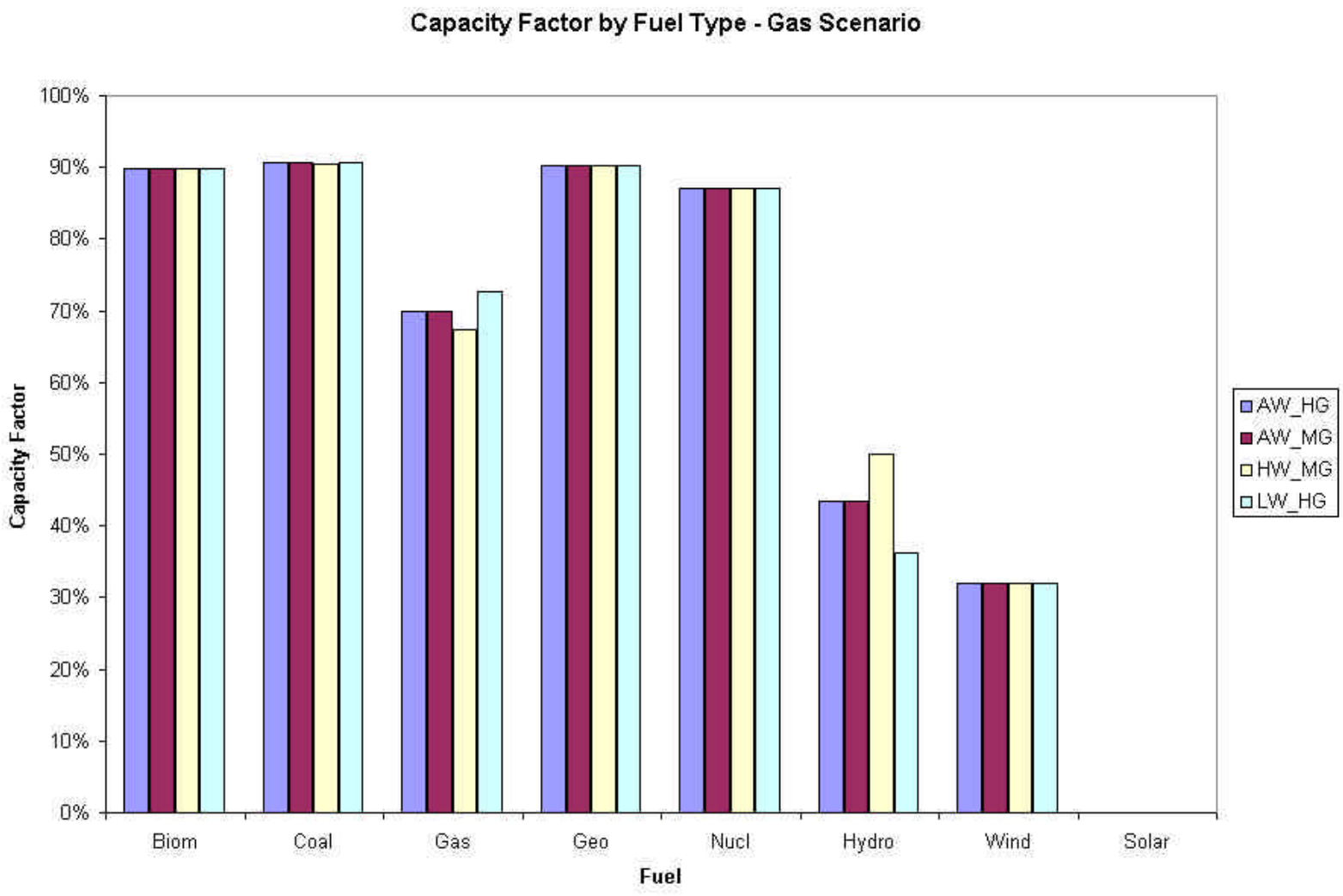
? About 8 GW new Wind plants

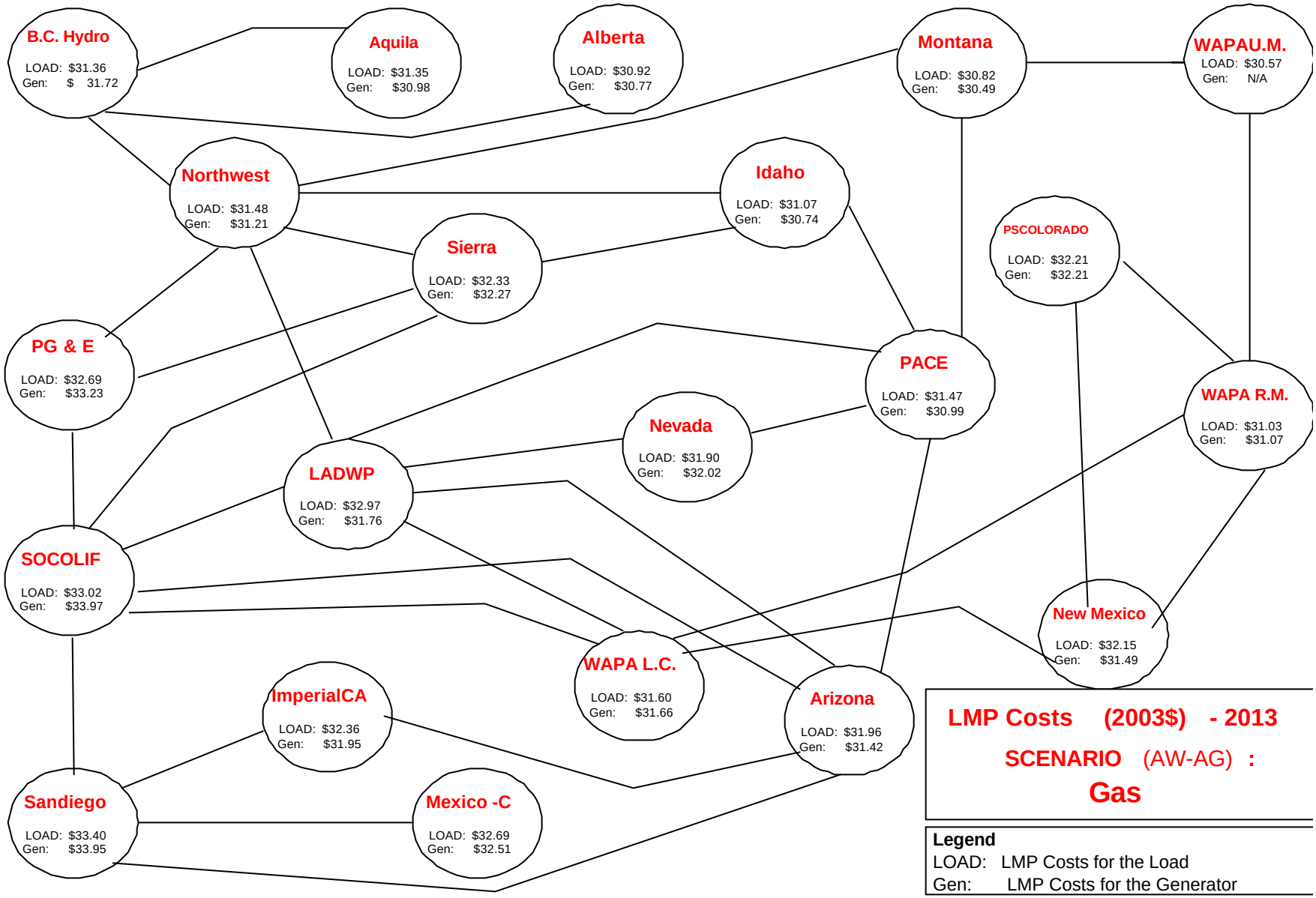
Incremental 2008-2013	Approx. Capital
? 18,300 MW CCCT	~ $600 per kW
? 6,400 MW Wind	~ $1000 per kW
? 1300 Miles of 500 kV line	~ $2 Million per Mile

Circa $20 Billion new capital from 2008 to 2013






Capacity Factor by Fuel Type - Gas Scenario
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Capacity Factor
Biom
Coal
Gas
Geo
Nucl
Hydro
Wind
Solar
Fuel
AW_HG
AW_MG
HW_MG
LW_HG



LMP Costs (2003$) - 2013

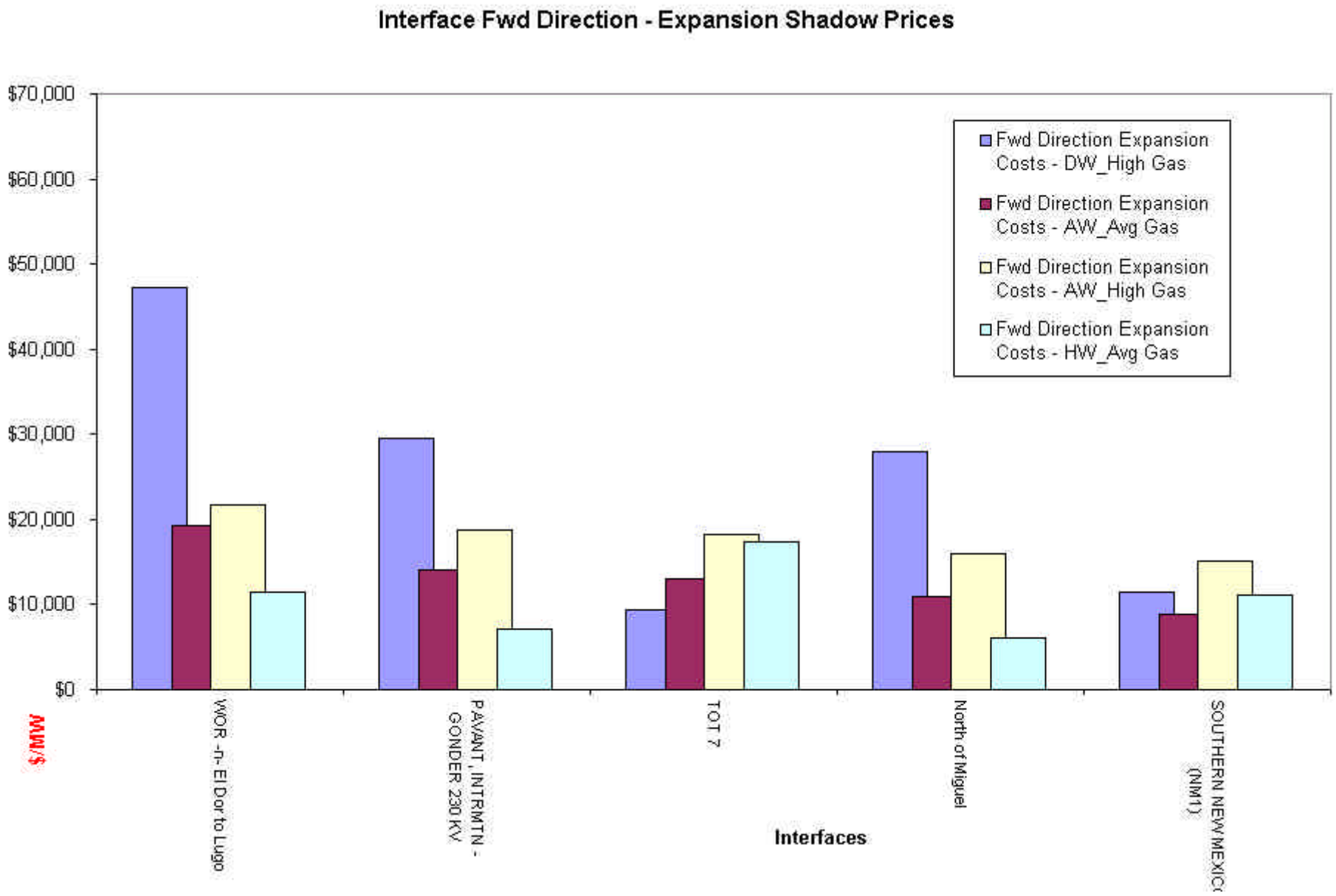
SCENARIO (AW-AG) **:**

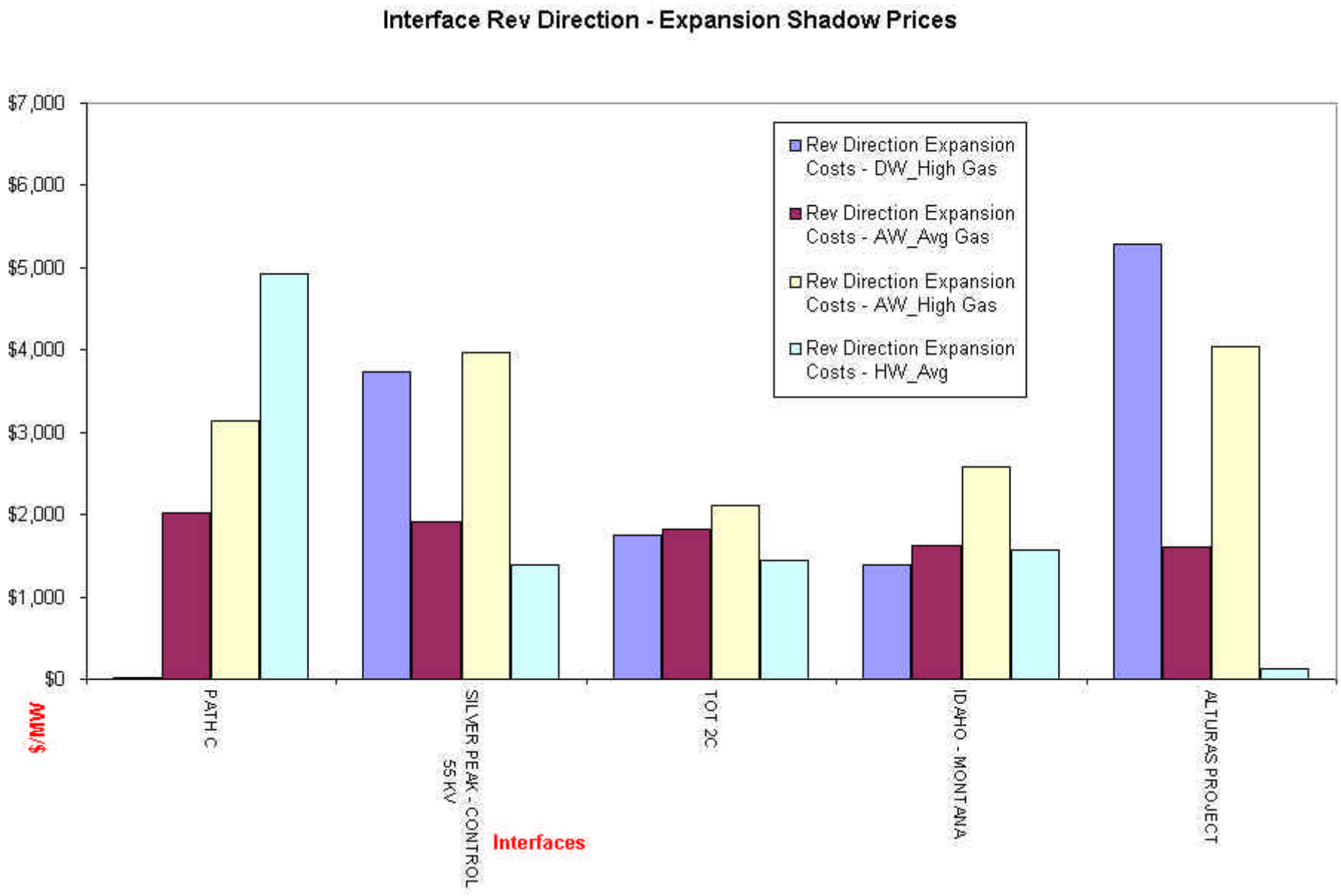
Gas

Legend

LOAD: LMP Costs for the Load

Gen: LMP Costs for the Generator


Interface Fwd Direction - Expansion Shadow Prices
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
$/MW
Fwd Direction Expansion Costs - DW_High Gas
Fwd Direction Expansion Costs - AW_Avg Gas
Fwd Direction Expansion Costs - AW_High Gas
Fwd Direction Expansion Costs - HW_Avg Gas
WOR -n- El Dor to Lugo
PAVANT, INTRMTN - GONDER 230 KV
TOT 7
North of Miguel
SOUTHERN NEW MEXIC (NM1)
Interfaces


Interface Rev Direction - Expansion Shadow Prices
$7,000
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$0
$/MW
Rev Direction Expansion Costs - DW_High Gas
Rev Direction Expansion Costs - AW_Avg Gas
Rev Direction Expansion Costs - AW_High Gas
Rev Direction Expansion Costs - HW_Avg
PATH C
SILVER PEAK - CONTROL 55 KV
TOT 2C
IDAHO - MONTANA
ALTURAS PROJECT
Interfaces

Interfaces	Fwd Direction Expansion/MW Shadow Price			
	Costs - DW_High Gas	Costs - AW_Avg Gas	Costs - AW_High Gas	Costs - HW_Avg Gas
WOR -n- El Dor to Lugo	$47,258	$19,334	$21,715	$11,542
PAVANT, INTRMTN - GONDER 230 KV	$29,447	$14,098	$18,797	$7,151
TOT 7	$9,309	$13,097	$18,240	$17,361
North of Miguel	$27,971	$10,989	$16,057	$6,128
SOUTHERN NEW MEXICO (NM1)	$11,540	$8,937	$15,065	$11,125
IDAHO - SIERRA	$1,237	$8,613	$3,519	$17,354
MONTANA - NORTHWEST	$11,555	$6,013	$8,048	$2,183
Combined PACI & PDCI Limit	$616	$5,371	$5,835	$8,284
COI	$1,747	$4,959	$6,417	$8,045
BRIDGER WEST	$12,949	$4,604	$5,920	$6,209
ALBERTA - BRITISH COLUMBIA	$9,489	$4,419	$4,737	$3,540
TOT 3	$1,152	$3,821	$5,109	$13,260
CA INDEPENDENT - MEXICO (CFE)	$2,332	$3,406	$4,458	$4,906
Southern CA Imports	$890	$2,722	$2,948	$4,139
ARIZONA - CALIFORNIA	$3,298	$2,256	$2,024	$1,791
SILVER PEAK - CONTROL 55 KV	$6,405	$1,988	$4,135	$4,432
NORTHERN - SOUTHERN CALIFORNIA	$498	$1,812	$2,370	$4,244
SOUTHWEST OF FOUR CORNERS	$1,476	$1,698	$1,725	$3,050

Interfaces	Rev Direction Expansion/MW Shadow Price			
	Costs - DW_High Gas	Costs - AW_Avg Gas	Costs - AW_High Gas	Costs - HW_Avg Gas
PATH C	$26	$2,017	$3,135	$4,933
SILVER PEAK - CONTROL 55 KV	$3,734	$1,909	$3,961	$1,387
TOT 2C	$1,752	$1,827	$2,115	$1,450
IDAHO - MONTANA	$1,389	$1,629	$2,580	$1,570
ALTURAS PROJECT	$5,290	$1,611	$4,043	$133
PG&E - SPP	$2,552	$1,375	$2,269	$2,631
TOT 2B2	$2,766	$1,284	$1,274	$742
MIDPOINT - SUMMER LAKE	$25	$482	$452	$606
INYO - CONTROL 115 KV TIE	$235	$472	$188	$516
NW to Canada, East BC	$970	$471	$416	$583
INTERMOUNTAIN - MONA 345 KV	$428	$329	$751	$88
CA INDEPENDENT - MEXICO (CFE)	$609	$153	$312	$110
NORTHERN - SOUTHERN CALIFORNIA	$50	$34	$25	$28
PACIFICORP_PG&E 115 KV INTERCON.	$28	$30	$40	$133
LUGO - VICTORVILLE 500 KV LINE	$6	$6	$7	$2
Tot 2a, 2b, 2c Nomogram	$20	$1	$160	$4
WOR -n- El Dor to Lugo	$0	$0	$0	$0
PAVANT, INTRMTN - GONDER 230 KV	$0	$0	$0	$0

Annual Energy & LMP Costs - WECC Wide

Scenarios	Load GWH	Load K$	Load Avg $/MWh	Gen GWH	Gen K$	Gen Avg $/MWh	Congestion Rent Surplus K$ (Value of CRR)
AW_HG	961,832	49,418,492	51.380	961,834	49,050,661	50.997	$367,933
AW_MG	961,832	34,833,443	36.216	961,833	34,528,380	35.899	$305,098
DW_HG	961,832	52,005,471	54.069	961,831	51,604,194	53.652	$401,223
HW_MG	961,832	33,314,886	34.637	961,835	32,945,670	34.253	$369,319

Annual Energy & LMP Costs - By Area

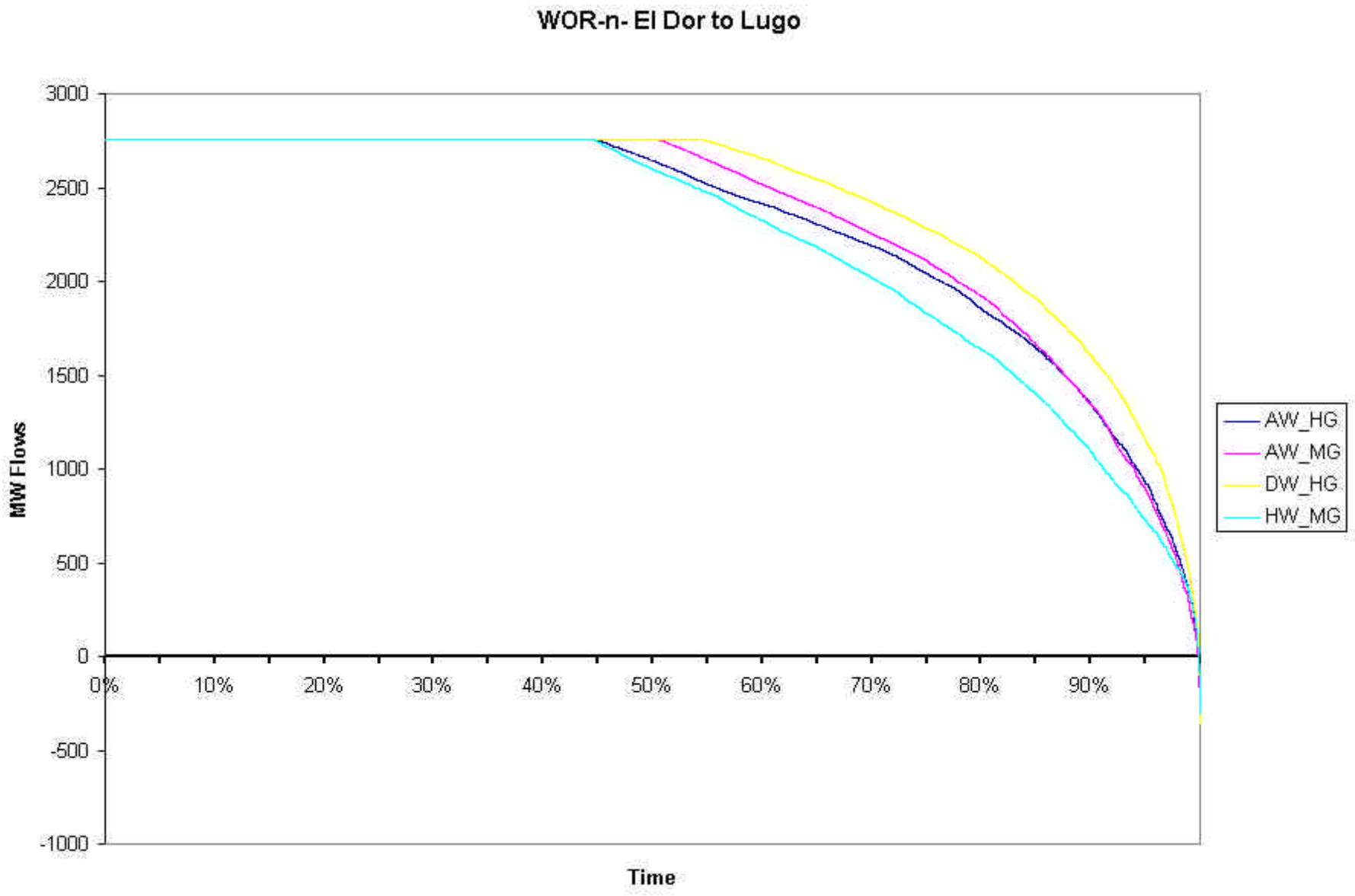
AreaID	Scenarios	Load GWH	Load K$	Load Avg $/MWh	Gen GWH	Gen K$	Gen Avg $/MWh
New Mexico	AW_HG	23,286	$1,208,004	$45.85	19,888	$1,009,596	$44.87
	AW_MG	23,286	$847,070	$32.15	19,881	$708,369	$31.49
	DW_HG	23,286	$1,239,724	$46.52	20,164	$1,052,725	$46.14
	HW_MG	23,286	$824,574	$31.30	19,609	$678,257	$30.57
Arizona	AW_HG	98,160	$5,042,336	$45.40	155,191	$7,850,285	$44.71
	AW_MG	98,160	$3,549,435	$31.96	155,811	$5,538,256	$31.42
	DW_HG	98,160	$5,196,588	$46.79	157,768	$8,205,313	$45.97
	HW_MG	98,160	$3,449,417	$31.06	152,853	$5,290,428	$30.59
NEVADA	AW_HG	32,045	$1,643,188	$45.32	27,698	$1,430,080	$45.63
	AW_MG	32,045	$1,156,606	$31.90	28,811	$1,043,875	$32.02
	DW_HG	32,045	$1,686,704	$46.52	28,627	$1,521,727	$46.98
	HW_MG	32,045	$1,126,224	$31.06	27,748	$976,762	$31.11
WAPA L.C.	AW_HG	2,453	$124,736	$44.94	20,750	$1,056,552	$45.00
	AW_MG	2,453	$87,709	$31.60	20,883	$747,969	$31.66
	DW_HG	2,453	$128,718	$46.38	21,059	$1,099,569	$46.15
	HW_MG	2,453	$85,087	$30.66	20,605	$718,528	$30.82
MEXICO-C	AW_HG	22,347	$1,165,955	$46.12	22,817	$1,183,921	$45.86
	AW_MG	22,347	$826,437	$32.69	22,780	$837,991	$32.51
	DW_HG	22,347	$1,186,473	$46.93	23,483	$1,238,434	$46.61
	HW_MG	22,347	$812,582	$32.14	22,156	$802,100	$32.00
IMPERIAL	AW_HG	4,259	$220,769	$45.82	3,585	$185,187	$45.66
	AW_MG	4,259	$155,915	$32.36	3,529	$127,571	$31.95
	DW_HG	4,259	$229,053	$47.53	3,564	$191,836	$47.57
	HW_MG	4,259	$151,012	$31.34	3,627	$126,860	$30.91
SANDIEGO	AW_HG	22,550	$1,203,847	$47.19	13,947	$748,786	$47.45
	AW_MG	22,550	$852,053	$33.40	12,689	$487,368	$33.95
	DW_HG	22,550	$1,263,241	$49.51	16,035	$893,918	$49.27
	HW_MG	22,550	$820,492	$32.16	11,174	$413,505	$32.71

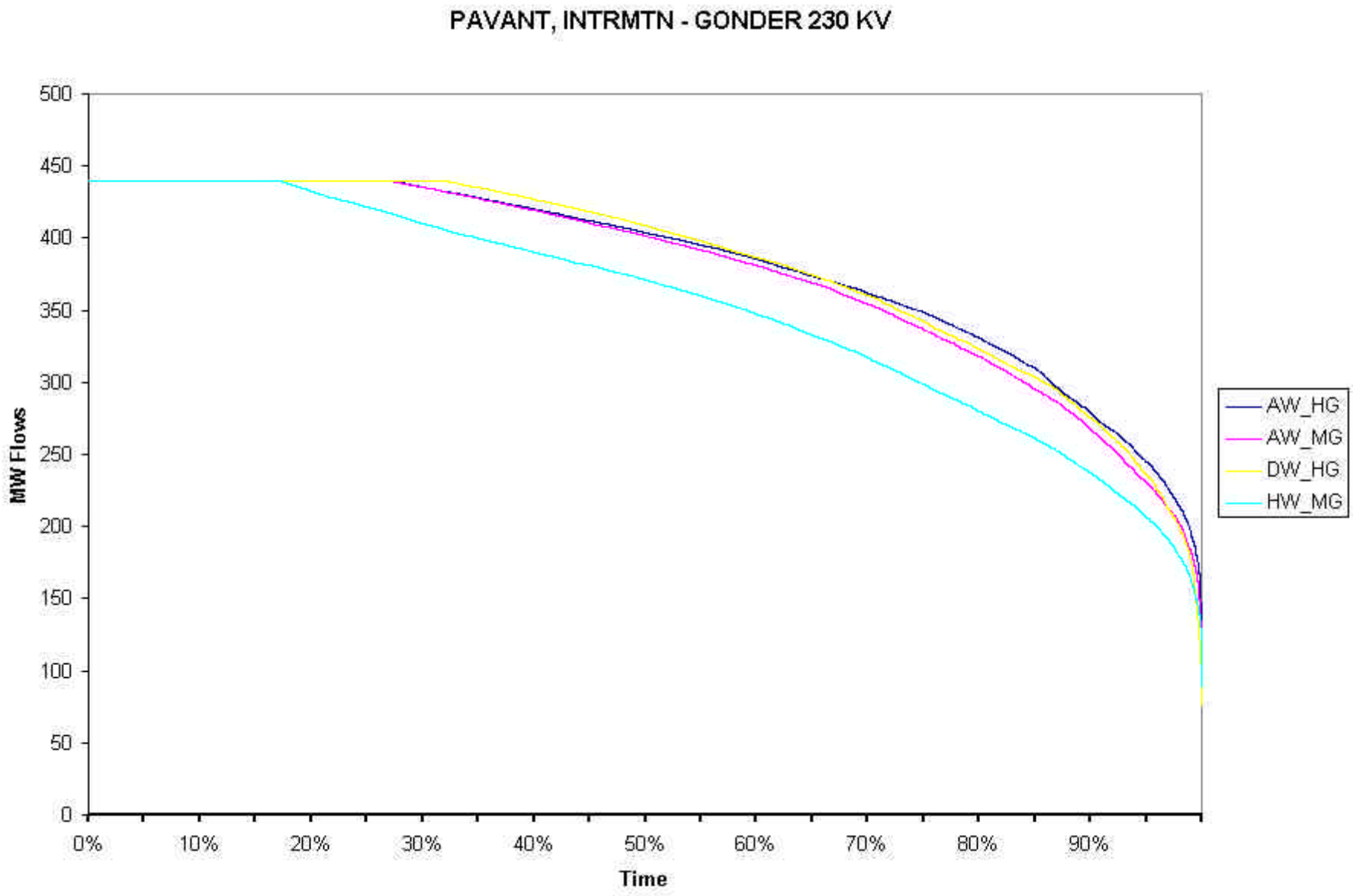
Annual Energy & LMP Costs - By Area

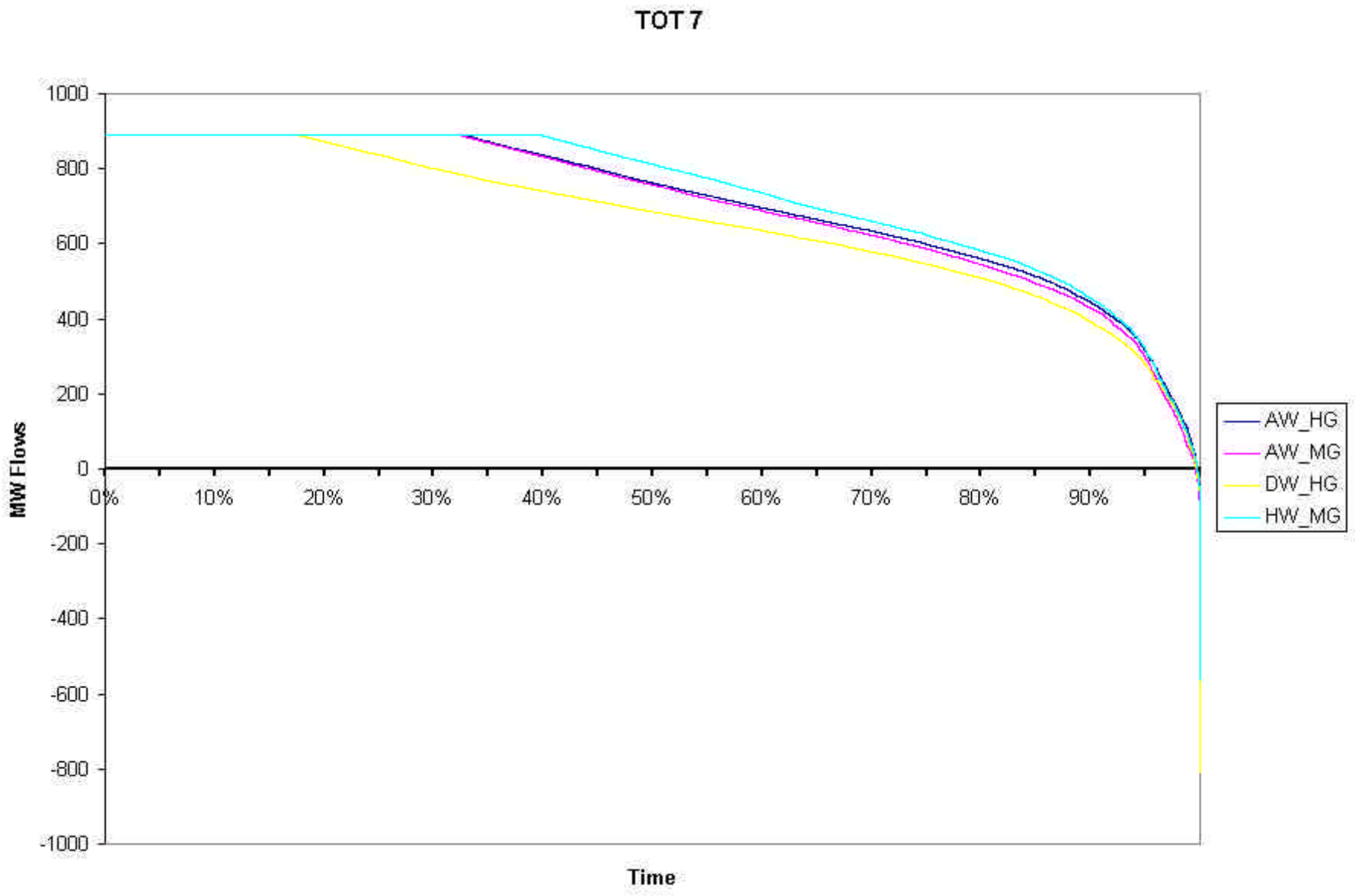
AreaID	Scenarios	Load GWH	Load K$	Load Avg $/MWh	Gen GWH	Gen K$	Gen Avg $/MWh
SOCALIF	AW_HG	108,572	$5,725,087	$46.61	51,018	$2,769,641	$47.98
	AW_MG	108,572	$4,055,983	$33.02	51,518	$1,979,885	$33.97
	DW_HG	108,572	$5,986,356	$48.73	54,215	$3,093,016	$50.42
	HW_MG	108,572	$3,923,472	$31.94	50,094	$1,851,407	$32.67
LADWP	AW_HG	32,468	$1,710,315	$46.56	21,331	$1,085,759	$44.99
	AW_MG	32,468	$1,211,099	$32.97	21,088	$757,772	$31.76
	DW_HG	32,468	$1,782,006	$48.51	22,434	$1,201,350	$47.33
	HW_MG	32,468	$1,173,203	$31.94	20,479	$708,075	$30.56
PG AND E	AW_HG	141,300	$7,389,336	$46.22	108,244	$5,752,620	$46.97
	AW_MG	141,300	$5,225,767	$32.69	108,485	$4,078,516	$33.23
	DW_HG	141,300	$7,805,786	$48.83	107,605	$6,040,989	$49.62
	HW_MG	141,300	$4,975,005	$31.12	109,846	$3,911,659	$31.47
NORTHWEST	AW_HG	179,563	$9,091,503	$44.75	192,353	$9,661,182	$44.39
	AW_MG	179,563	$6,395,941	$31.48	192,047	$6,780,836	$31.21
	DW_HG	179,563	$9,768,606	$48.08	176,513	$9,560,441	$47.87
	HW_MG	179,563	$6,010,883	$29.59	203,163	$6,724,786	$29.26
B.C.HYDR	AW_HG	68,119	$3,436,989	$44.60	61,849	$3,156,510	$45.11
	AW_MG	68,119	$2,417,158	$31.36	61,902	$2,221,783	$31.72
	DW_HG	68,119	$3,685,080	$47.81	65,245	$3,572,725	$48.40
	HW_MG	68,119	$2,271,547	$29.47	63,135	$2,112,238	$29.57
AQUILA	AW_HG	4,344	$219,148	$44.59	5,366	$267,762	$44.10
	AW_MG	4,344	$154,102	$31.35	5,368	$188,160	$30.98
	DW_HG	4,344	$234,873	$47.79	5,028	$269,503	$47.37
	HW_MG	4,344	$144,802	$29.46	5,613	$184,988	$29.13
ALBERTA	AW_HG	66,287	$3,309,890	$44.13	77,488	$3,850,581	$43.92
	AW_MG	66,287	$2,319,139	$30.92	77,642	$2,703,063	$30.77
	DW_HG	66,287	$3,510,976	$46.81	79,276	$4,169,746	$46.49
	HW_MG	66,287	$2,180,990	$29.08	75,233	$2,478,718	$29.12

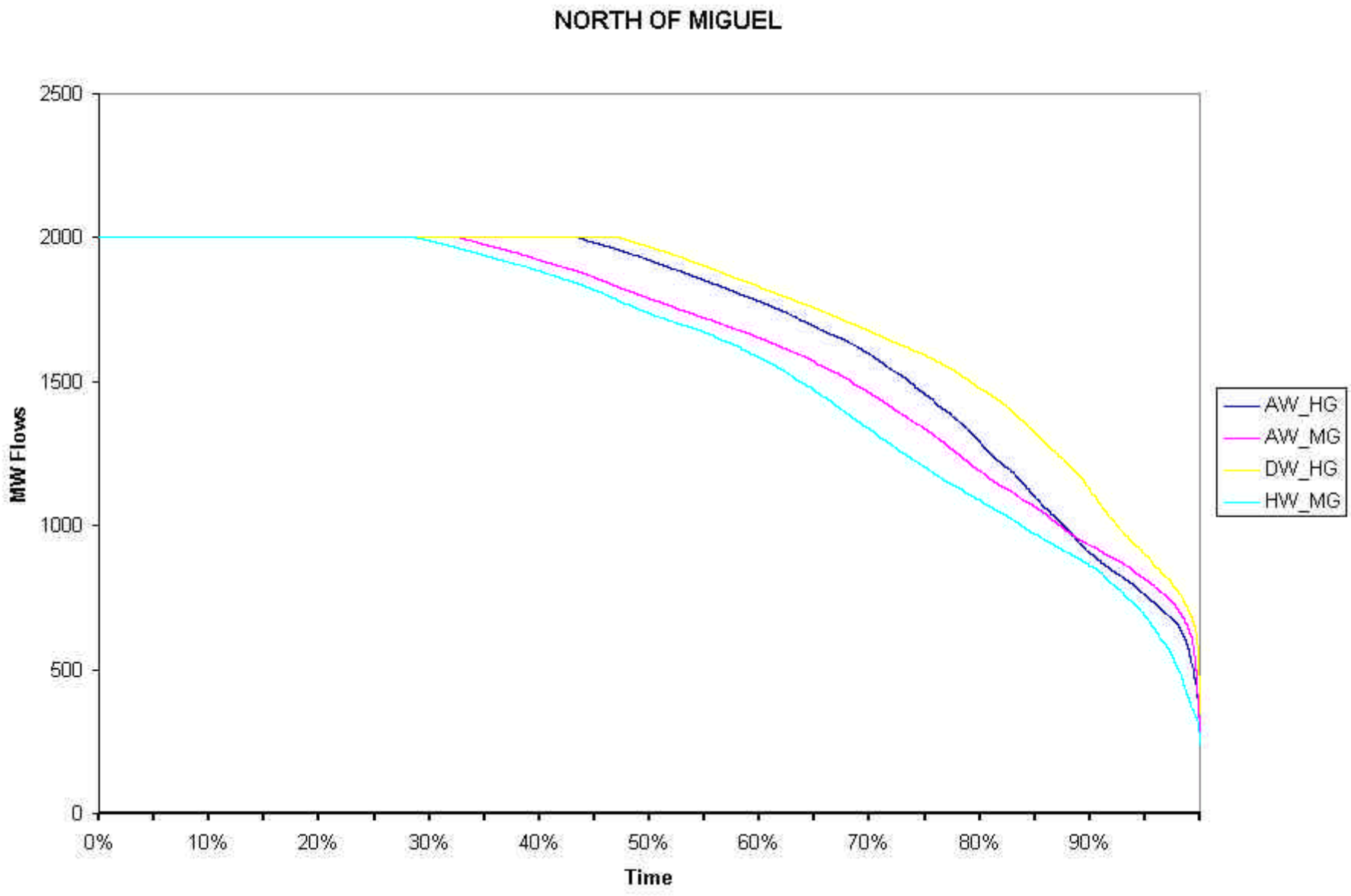
Annual Energy & LMP Costs - By Area

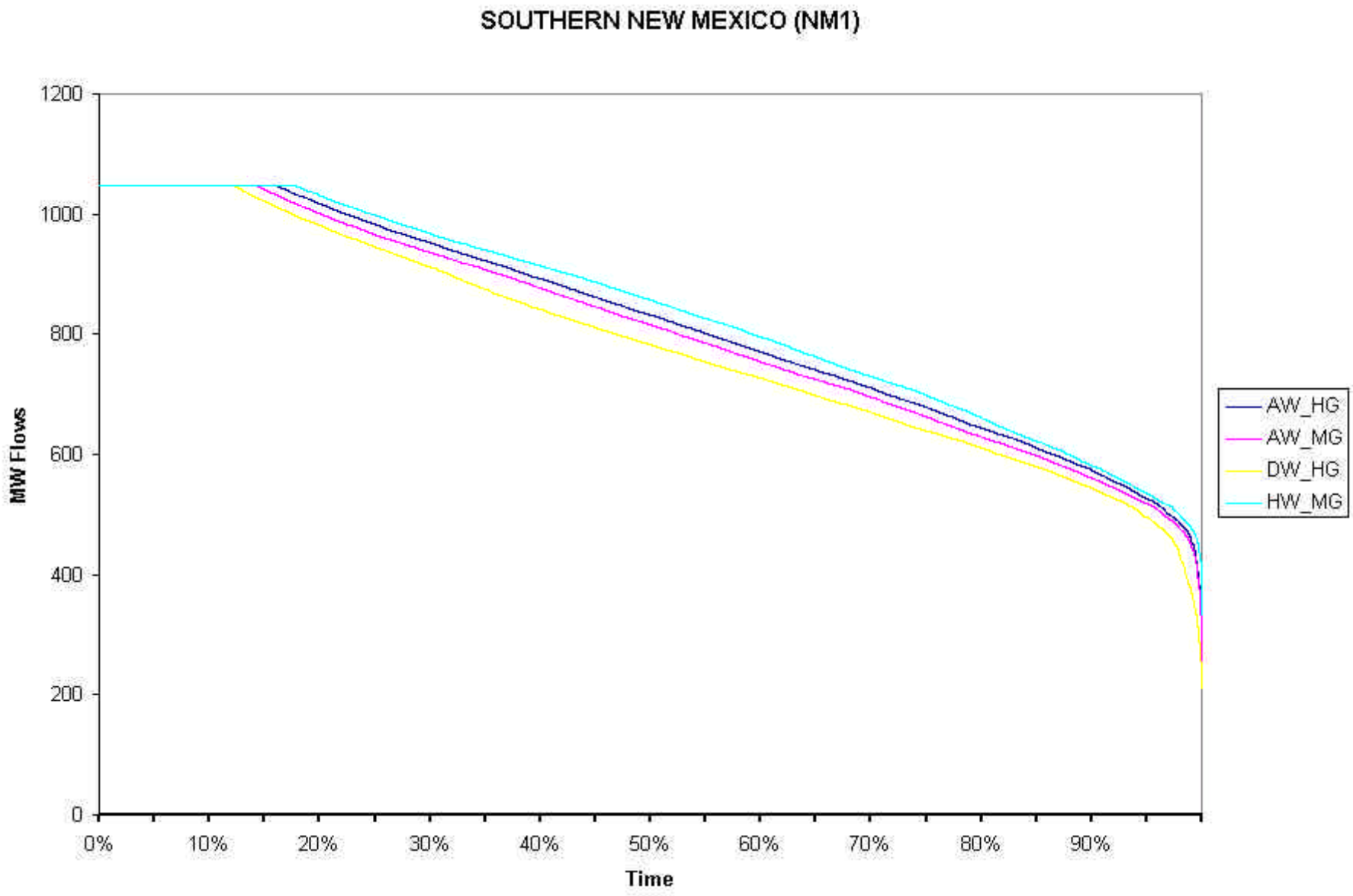
AreaID	Scenarios	Load GWH	Load K$	Load Avg $/MW	Gen GWH	Gen K$	Gen Avg $/MWh
IDAHO	AW_HG	18,412	$921,596	$44.24	29,471	$1,459,981	$43.79
	AW_MG	18,412	$647,285	$31.07	29,469	$1,024,813	$30.74
	DW_HG	18,412	$987,482	$47.40	26,831	$1,402,584	$46.20
	HW_MG	18,412	$608,262	$29.20	28,732	$944,065	$29.04
MONTANA	AW_HG	9,627	$477,721	$43.86	26,683	$1,310,686	$43.42
	AW_MG	9,627	$335,659	$30.82	26,683	$920,609	$30.49
	DW_HG	9,627	$509,419	$46.77	26,672	$1,388,438	$46.01
	HW_MG	9,627	$318,336	$29.23	26,810	$881,550	$29.06
WAPA U.M	AW_HG	1,039	$51,174	$43.53	0	$0	$0.00
	AW_MG	1,039	$35,935	$30.57	0	$0	$0.00
	DW_HG	1,039	$54,447	$46.32	0	$0	$0.00
	HW_MG	1,039	$34,135	$29.04	0	$0	$0.00
SIERRA	AW_HG	13,568	$698,599	$45.51	8,423	$433,275	$45.47
	AW_MG	13,568	$496,297	$32.33	8,463	$309,032	$32.27
	DW_HG	13,568	$741,130	$48.28	9,019	$492,364	$48.25
	HW_MG	13,568	$475,826	$31.00	7,970	$278,583	$30.89
PACE	AW_HG	43,309	$2,193,182	$44.76	46,143	$2,302,104	$44.10
	AW_MG	43,309	$1,542,191	$31.47	45,957	$1,611,598	$30.99
	DW_HG	43,309	$2,298,446	$46.91	46,772	$2,436,835	$46.05
	HW_MG	43,309	$1,478,658	$30.18	45,394	$1,526,555	$29.72
PSCOLORA	AW_HG	45,026	$2,331,417	$45.77	32,827	$1,697,185	$45.70
	AW_MG	45,026	$1,640,642	$32.21	32,184	$1,172,853	$32.21
	DW_HG	45,026	$2,404,758	$47.21	34,202	$1,826,540	$47.20
	HW_MG	45,026	$1,600,878	$31.43	31,291	$1,110,341	$31.36
WAPA R.M	AW_HG	25,098	$1,253,700	$44.15	36,762	$1,838,968	$44.21
	AW_MG	25,098	$881,022	$31.03	36,643	$1,288,061	$31.07
	DW_HG	25,098	$1,305,606	$45.98	37,319	$1,946,142	$46.09
	HW_MG	25,098	$849,501	$29.92	36,303	$1,226,267	$29.86

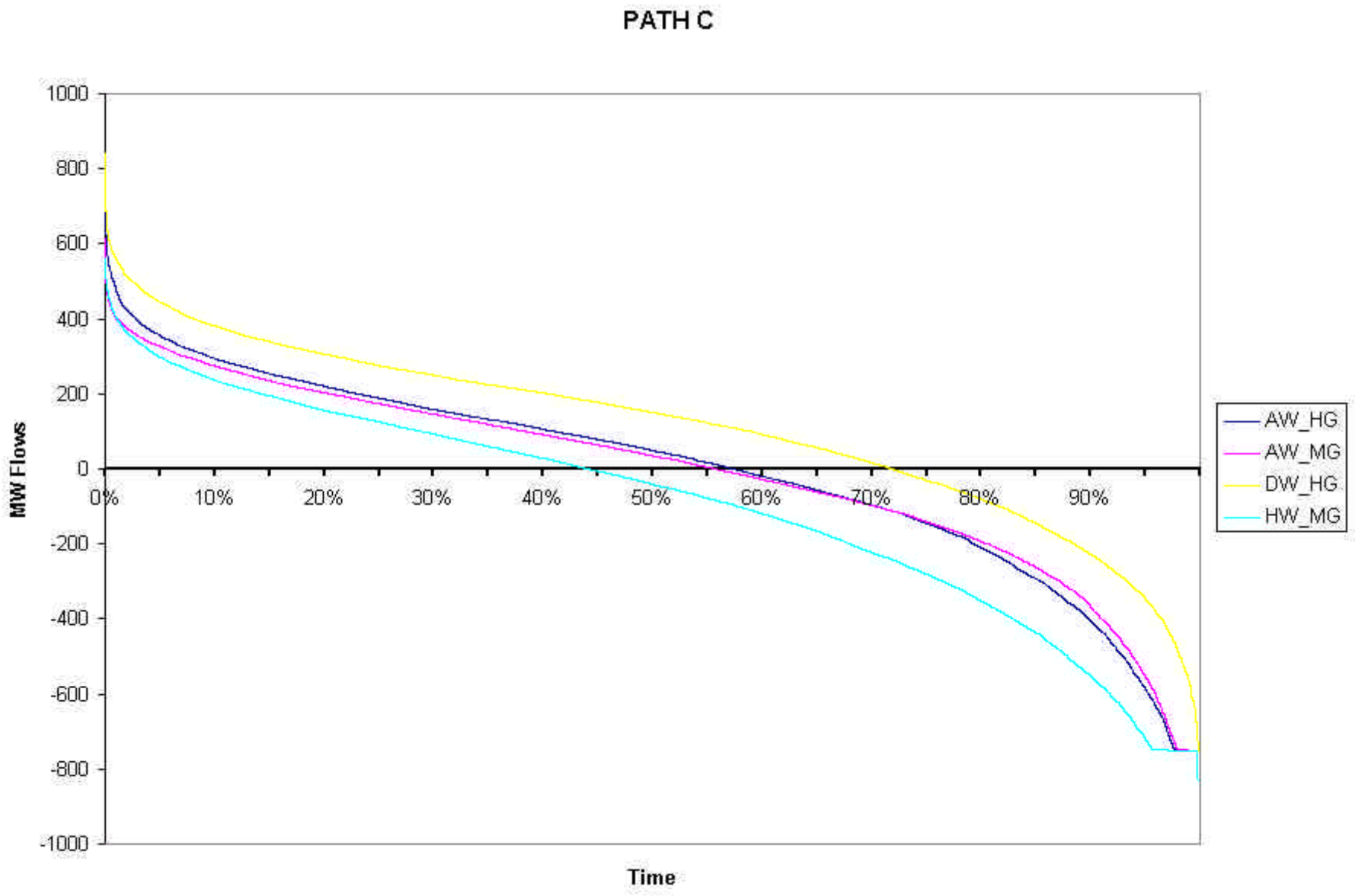

WOR-n- El Dor to Lugo
3000
2500
2000
1500
1000
500
0
-500
-1000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG

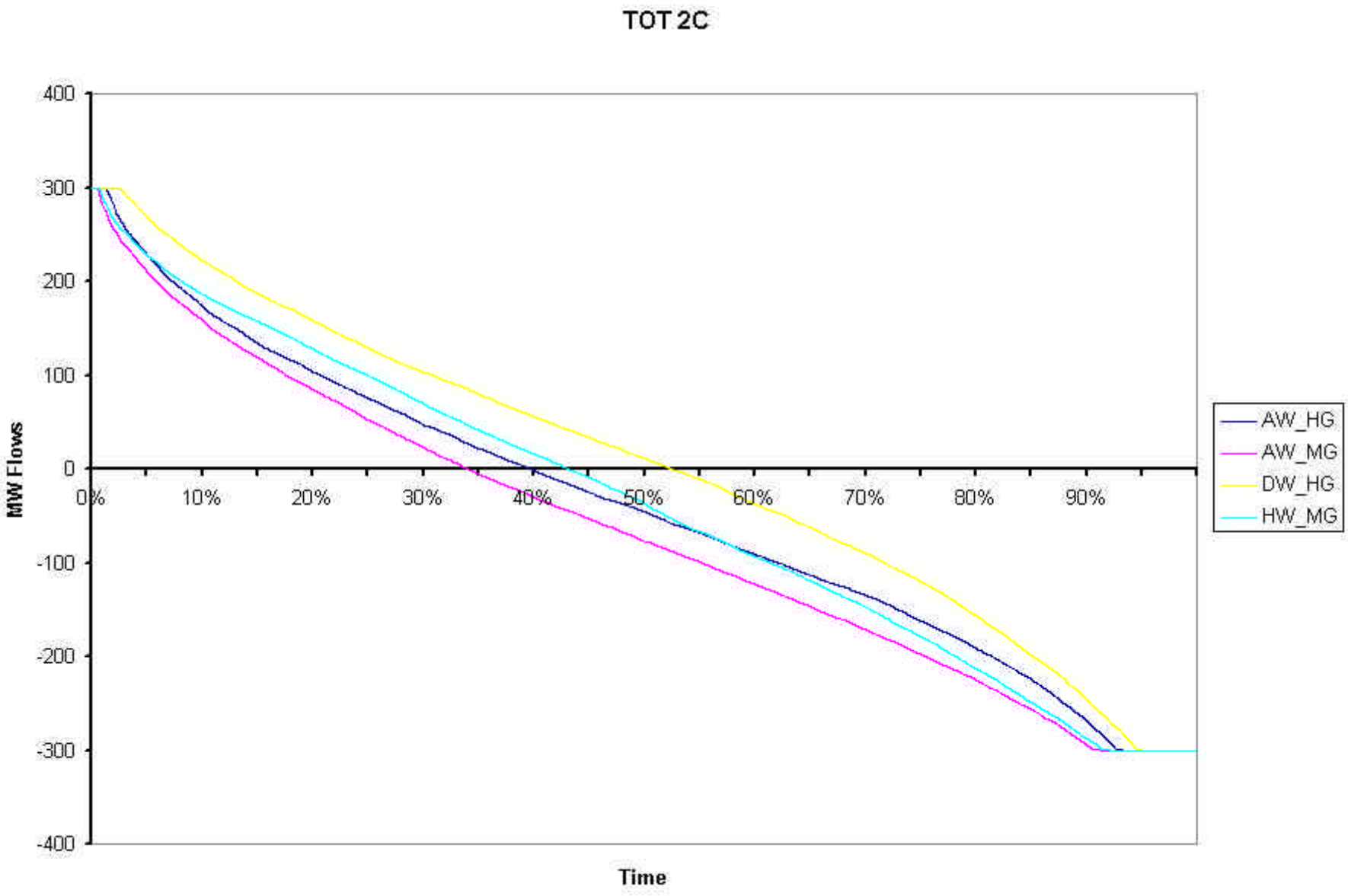

PAVANT, INTRMTN - GONDER 230 KV
MW Flows
500
450
400
350
300
250
200
150
100
50
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG


TOT 7
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG

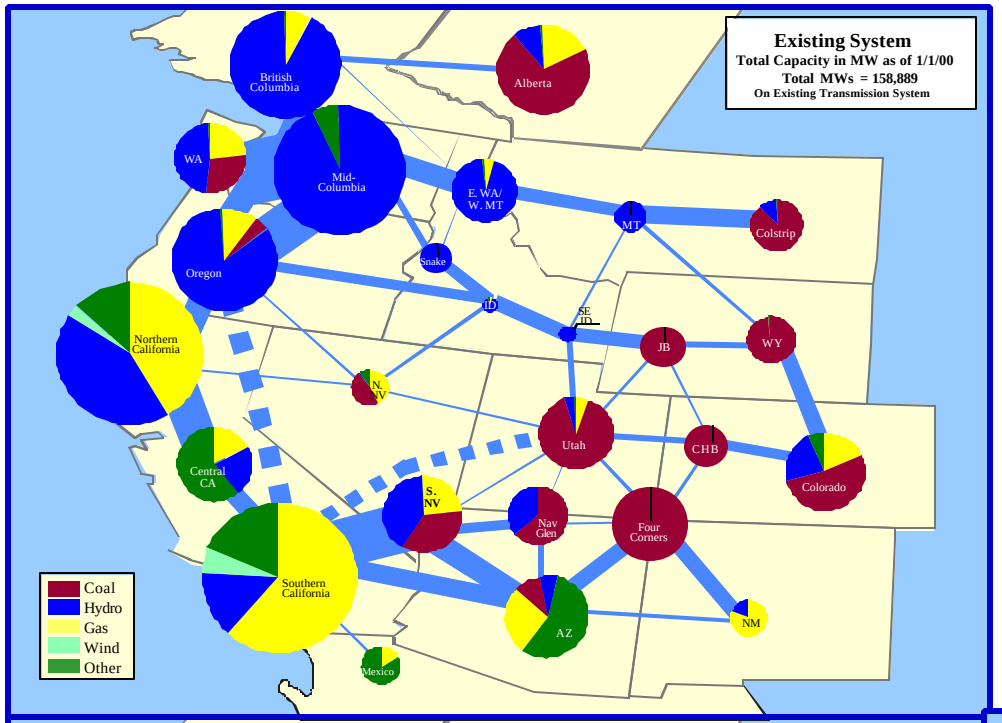

NORTH OF MIGUEL
2500
2000
1500
1000
500
0
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG


SOUTHERN NEW MEXICO (NM1)
1200
1000
800
600
400
200
0
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG


PATH C
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG


TOT 2C
400
300
200
100
0
-100
-200
-300
-400
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG

Coal Scenario

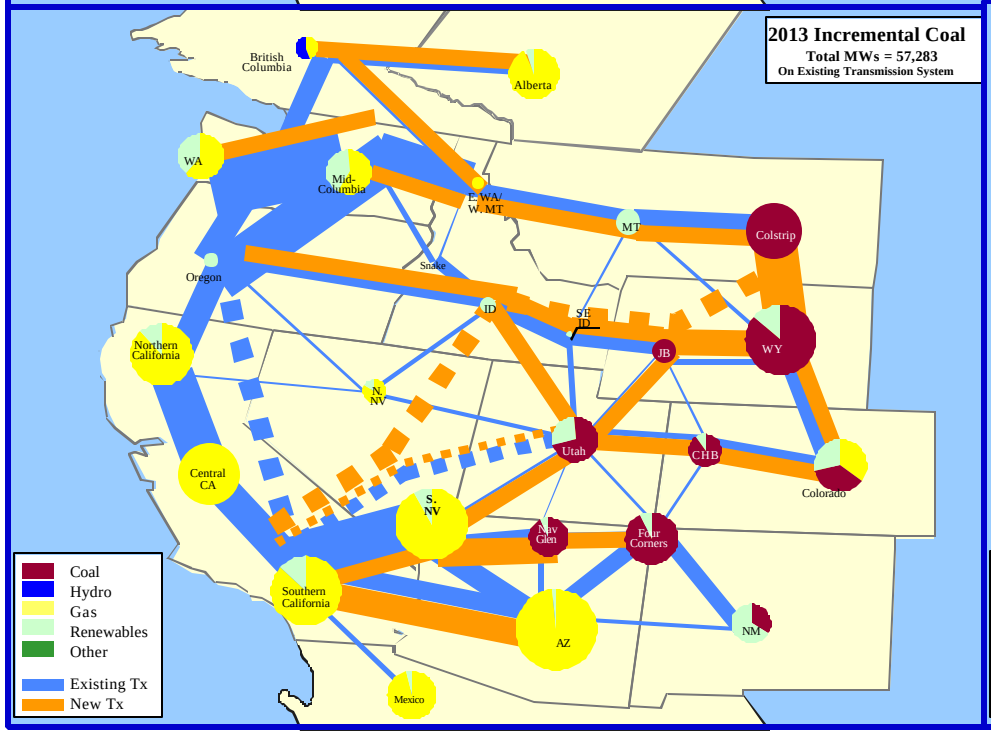


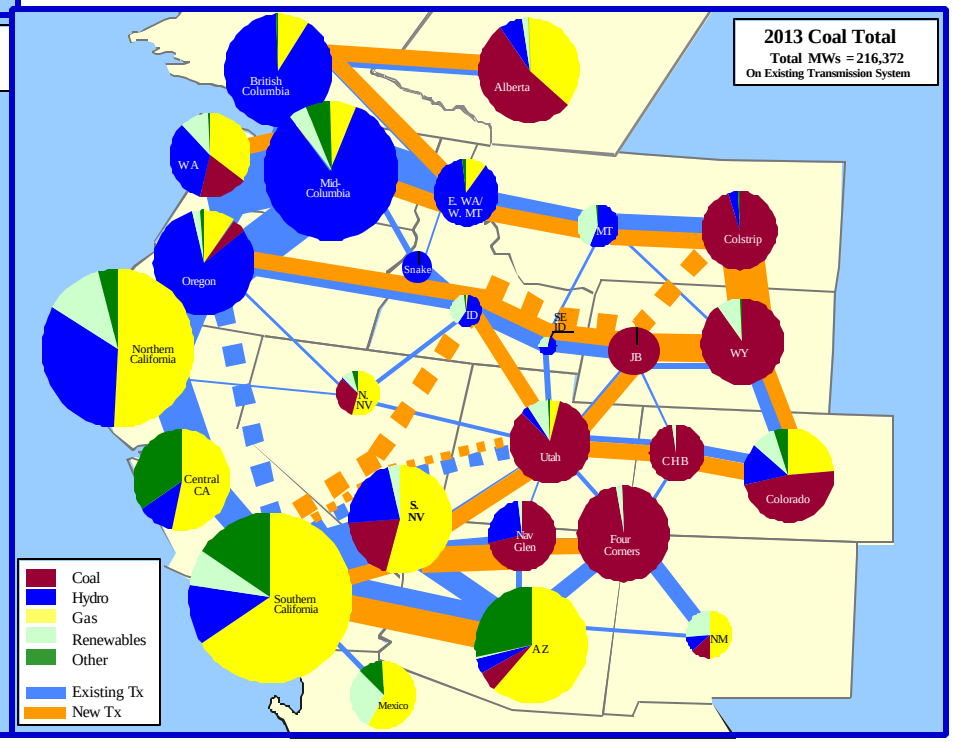
Coal Scenario 2000-2013

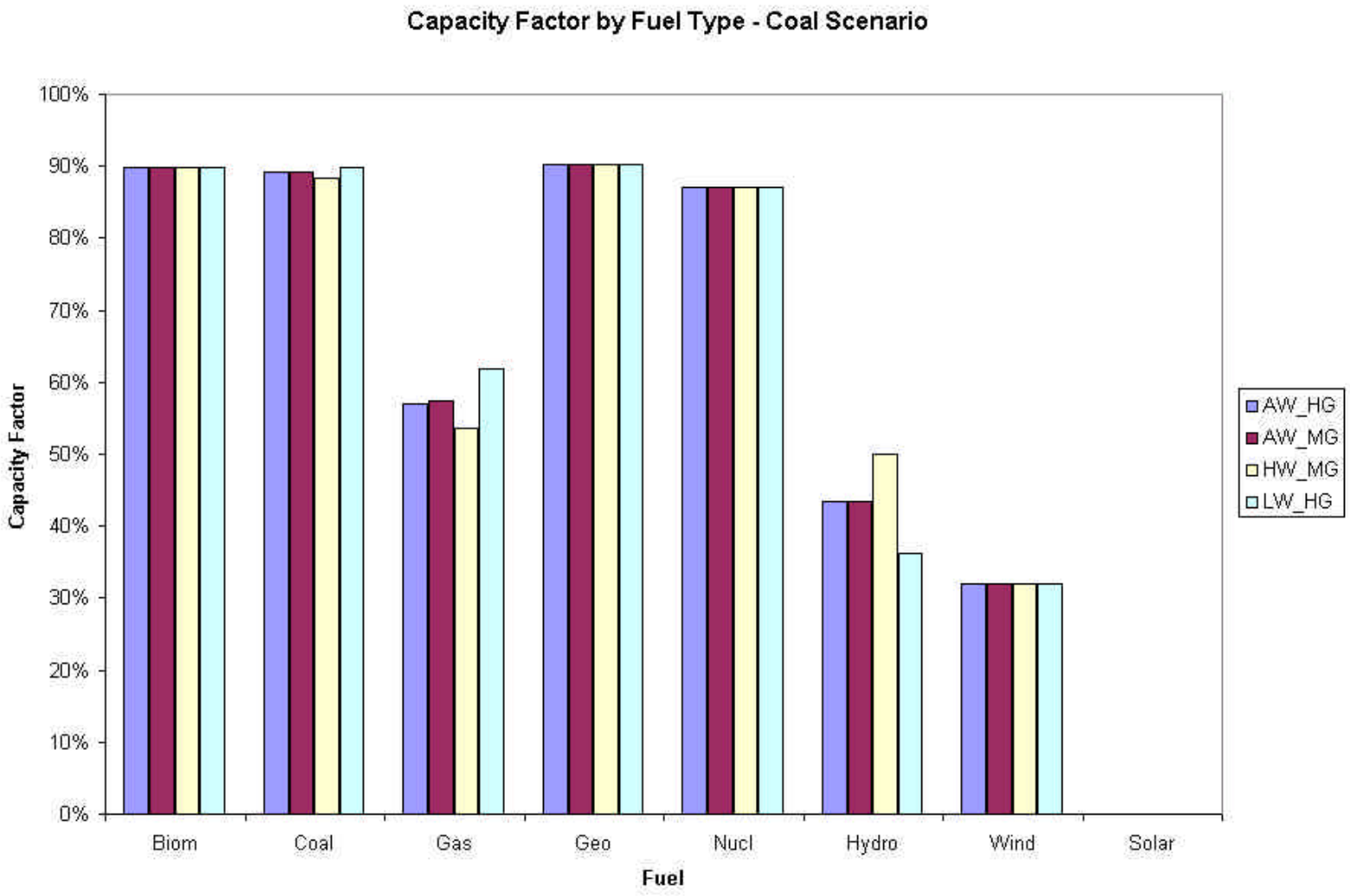
- ? About 33 GW new gas-fired CCCT
- ? About 8 GW new Wind plants
- ? About 16 GW new Coal Plants

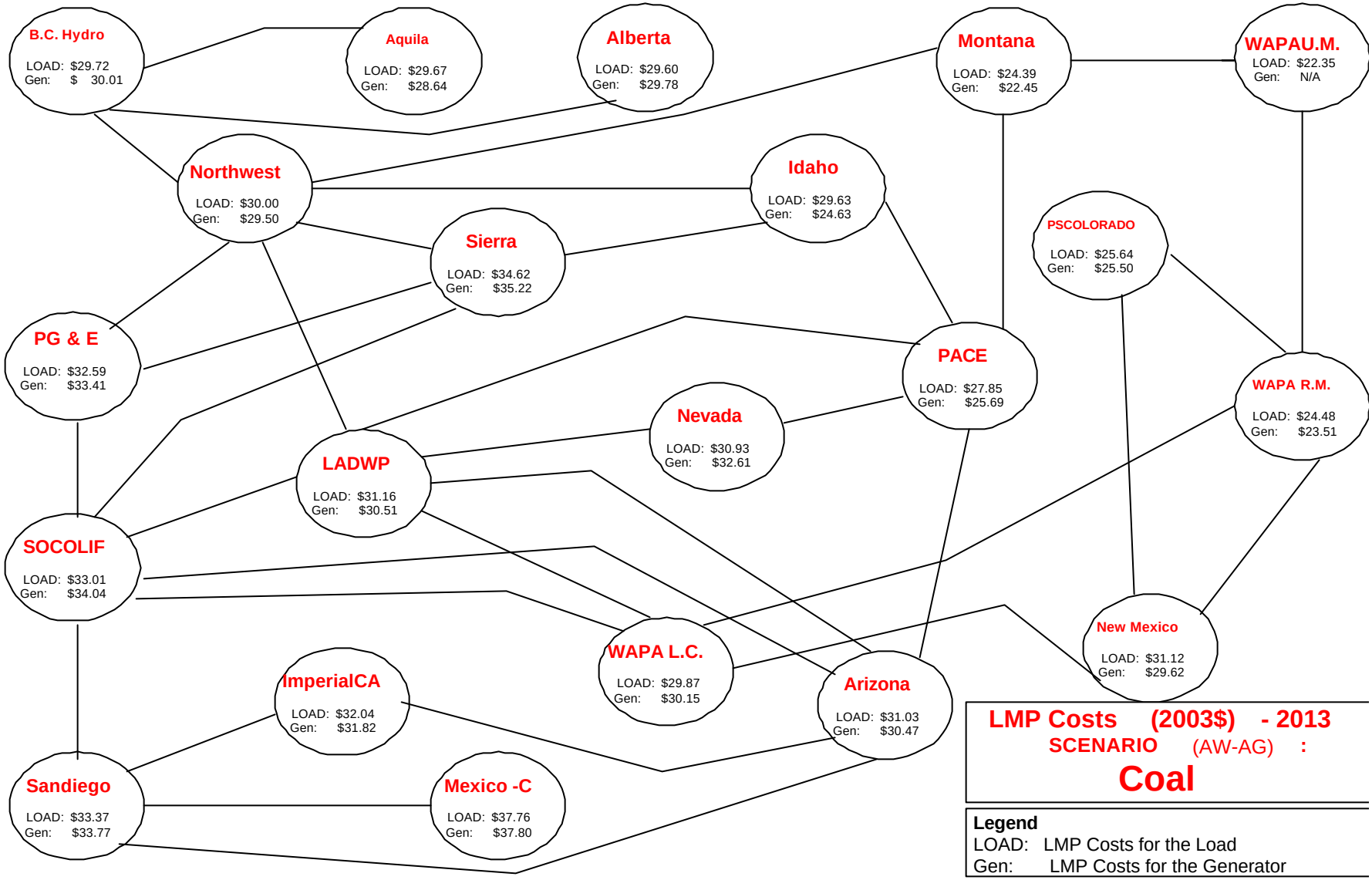
Incremental 2008-2013	Approx. Capital
? 1,900 MW CCCT	~ $600 per kW
? 6,400 MW Wind	~ $1000 per kW
? 16,400 MW new Coal	~ $1400 per kW
? 8,300 Miles of 500 kV line	~ $2 million/mile
? 3000 MW Wyoming-LA new DC Line	~ $3 Billion
? 1000 MW Upgrade to existing DC	~ $1 Billion

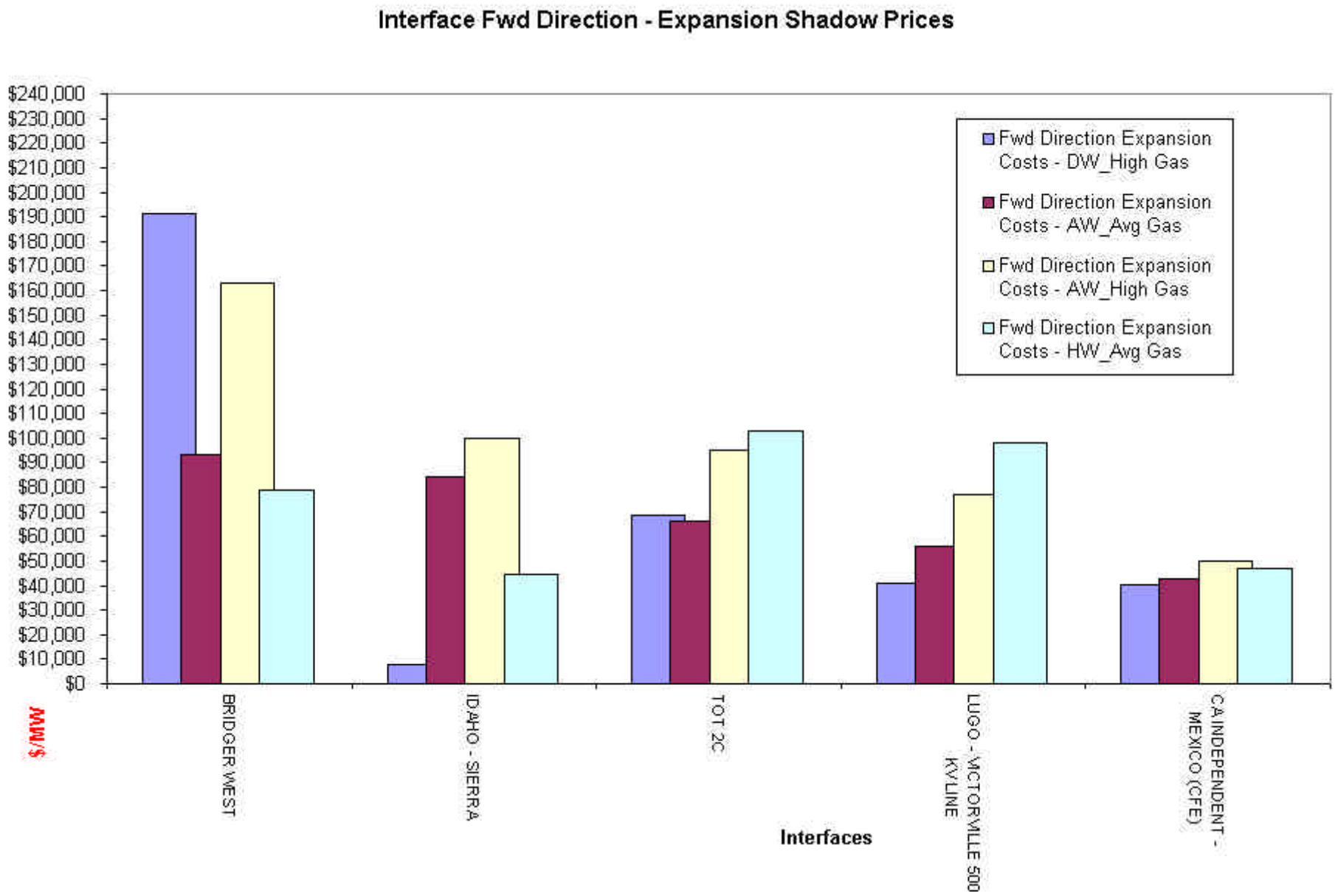
Capital costs would be Circa $47 Billion from 2008 to 2013

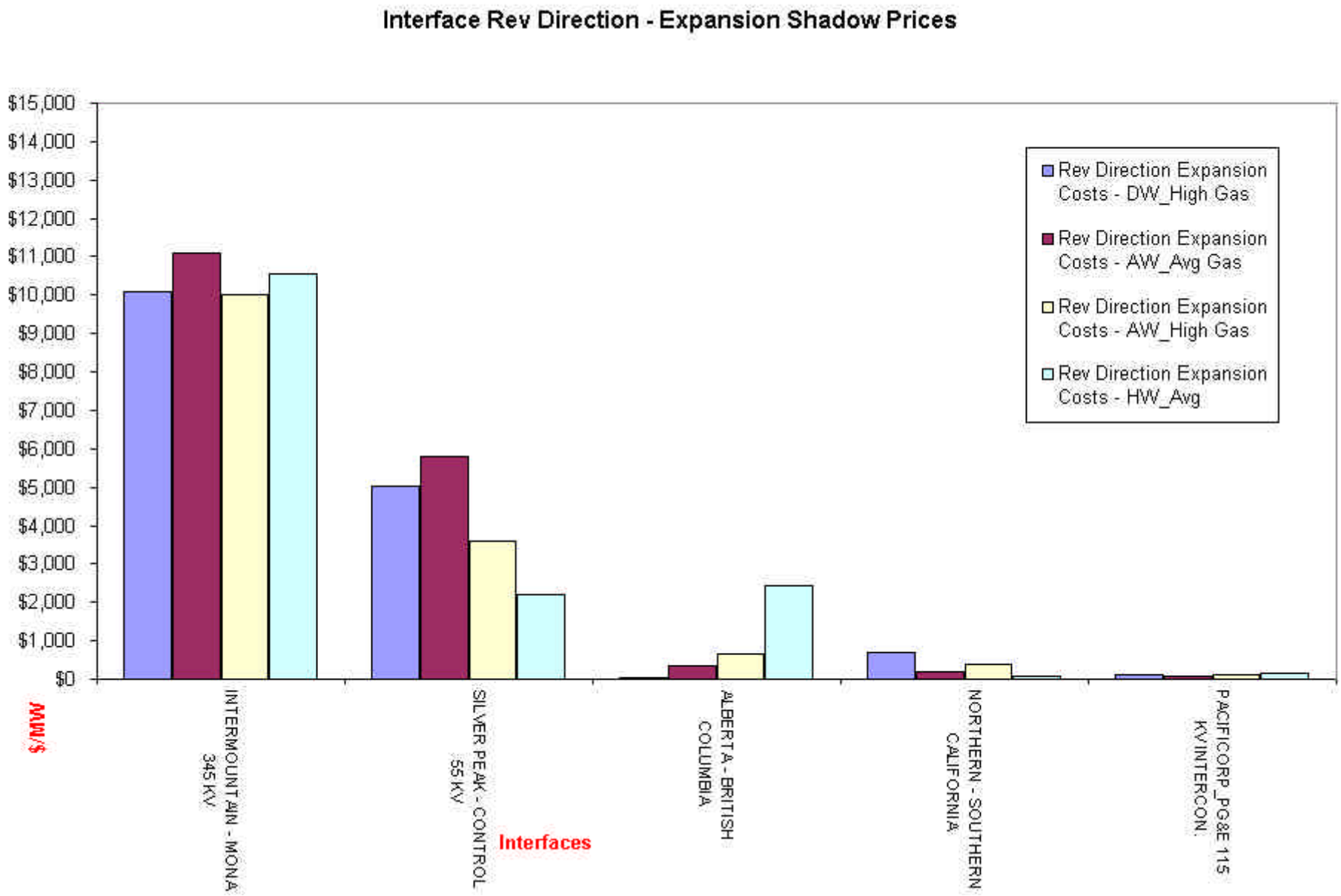





Capacity Factor by Fuel Type - Coal Scenario
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Capacity Factor
Biom
Coal
Gas
Geo
Nucl
Hydro
Wind
Solar
Fuel
AW_HG
AW_MG
HW_MG
LW_HG


B.C. Hydro
LOAD: $29.72
Gen: $ 30.01
Aquila
LOAD: $29.67
Gen: $28.64
Alberta
LOAD: $29.60
Gen: $29.78
Montana
LOAD: $24.39
Gen: $22.45
WAPAU.M.
LOAD: $22.35
Gen: N/A
Northwest
LOAD: $30.00
Gen: $29.50
Idaho
LOAD: $29.63
Gen: $24.63
Sierra
LOAD: $34.62
Gen: $35.22
PSCOLORADO
LOAD: $25.64
Gen: $25.50
PG & E
LOAD: $32.59
Gen: $33.41
PACE
LOAD: $27.85
Gen: $25.69
WAPA R.M.
LOAD: $24.48
Gen: $23.51
Nevada
LOAD: $30.93
Gen: $32.61
LADWP
LOAD: $31.16
Gen: $30.51
SOCOLIF
LOAD: $33.01
Gen: $34.04
New Mexico
LOAD: $31.12
Gen: $29.62
WAPA L.C.
LOAD: $29.87
Gen: $30.15
ImperialCA
LOAD: $32.04
Gen: $31.82
Arizona
LOAD: $31.03
Gen: $30.47
Sandiego
LOAD: $33.37
Gen: $33.77
Mexico -C
LOAD: $37.76
Gen: $37.80
LMP Costs (2003$) - 2013
SCENARIO (AW-AG) :
Coal
Legend
LOAD: LMP Costs for the Load
Gen: LMP Costs for the Generator


Interface Fwd Direction - Expansion Shadow Prices
$240,000
$230,000
$220,000
$210,000
$200,000
$190,000
$180,000
$170,000
$160,000
$150,000
$140,000
$130,000
$120,000
$110,000
$100,000
$90,000
$80,000
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
$/MW
Fwd Direction Expansion Costs - DW_High Gas
Fwd Direction Expansion Costs - AW_Avg Gas
Fwd Direction Expansion Costs - AW_High Gas
Fwd Direction Expansion Costs - HW_Avg Gas
BRIDGER WEST
IDAHO - SIERRA
TOT 2C
LUGO - VICTORVILLE 500 KV LINE
CA INDEPENDENT - MEXICO (CFE)
Interfaces


Interface Rev Direction - Expansion Shadow Prices
$15,000
$14,000
$13,000
$12,000
$11,000
$10,000
$9,000
$8,000
$7,000
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$0
$/MW
Rev Direction Expansion Costs - DW_High Gas
Rev Direction Expansion Costs - AW_Avg Gas
Rev Direction Expansion Costs - AW_High Gas
Rev Direction Expansion Costs - HW_Avg
INTERMOUNTAIN - MONA 345 KV
SILVER PEAK - CONTROL 55 KV
ALBERTA - BRITISH COLUMBIA
NORTHERN - SOUTHERN CALIFORNIA
PACIFICORP_PG&E 115 KV INTERCON.
Interfaces

Interfaces	Fwd Direction Expansion/MW Shadow Price			
	Costs - LW_High Gas	Costs - AW_Avg Gas	Costs - AW_High Gas	Costs - HW_Avg Gas
BRIDGER WEST	$191,351	$93,260	$163,110	$78,710
IDAHO - SIERRA	$8,085	$83,979	$99,587	$44,629
TOT 2C	$68,729	$66,400	$94,762	$102,763
LUGO - VICTORVILLE 500 KV LINE	$41,070	$56,084	$77,157	$97,900
CA INDEPENDENT - MEXICO (CFE)	$40,093	$42,616	$49,714	$46,751
WOR -n- El Dor to Lugo	$90,474	$36,293	$45,080	$23,404
MONTANA - NORTHWEST	$95,378	$35,055	$60,074	$23,969
PAVANT, INTRMTN - GONDER 230 KV	$4,898	$33,954	$24,962	$15,228
SOUTHERN NEW MEXICO (NM1)	$34,408	$28,628	$41,515	$32,437
INYO - CONTROL 115 KV TIE	$17,862	$14,472	$19,644	$0
CORONADO - SILVER KING - KYRENE	$26,428	$11,554	$26,131	$3,939
North of Miguel	$23,777	$10,265	$15,514	$5,420
COI	$3,999	$8,534	$12,455	$20,363
TOT 4A	$4,943	$5,595	$5,500	$6,106
TOT 3	$797	$5,037	$6,456	$13,111
Southern CA Imports	$1,007	$3,402	$4,180	$4,283
PACI vs PDCI	$11	$3,387	$5,321	$533
PG&E - SPP	$89	$2,715	$9,039	$4,058

Interfaces	Rev Direction Expansion/MW Shadow Price			
	Costs - LW_High Gas	Costs - AW_Avg Gas	Costs - AW_High Gas	Costs - HW_Avg Gas
INTERMOUNTAIN - MONA 345 KV	$10,086	$11,090	$10,018	$10,550
SILVER PEAK - CONTROL 55 KV	$5,041	$5,795	$3,607	$2,188
ALBERTA - BRITISH COLUMBIA	$20	$331	$674	$2,444
NORTHERN - SOUTHERN CALIFORNIA	$682	$194	$384	$95
PACIFICORP_PG&E 115 KV INTERCON.	$118	$60	$97	$164
ALTURAS PROJECT	$0	$13	$0	$0
NW to Canada, East BC	$0	$4	$0	$0
BRIDGER WEST	$0	$0	$0	$0
IDAHO - SIERRA	$0	$0	$0	$0
TOT 2C	$0	$0	$0	$0
LUGO - VICTORVILLE 500 KV LINE	$0	$0	$0	$0
CA INDEPENDENT - MEXICO (CFE)	$17	$0	$4	$2
WOR -n- El Dor to Lugo	$0	$0	$0	$0
MONTANA - NORTHWEST	$0	$0	$0	$0
PAVANT, INTRMTN - GONDER 230 KV	$0	$0	$0	$0
SOUTHERN NEW MEXICO (NM1)	$0	$0	$0	$0
INYO - CONTROL 115 KV TIE	$0	$0	$0	$0
CORONADO - SILVER KING - KYRENE	$0	$0	$0	$0

Annual Energy & LMP Costs - WECC Wide							
Scenarios	Load GWH	Load K$	Load Avg $/MWh	Gen GWH	Gen K$	Gen Avg $/MWh	Congestion Rent Surplus K$ (Value of CRR)
AW_HG	961,832	47,082,034	48.950	961,834	44,653,726	46.426	$2,428,401
AW_MG	961,832	33,398,521	34.724	961,835	31,868,240	33.133	$1,530,380
DW_HG	961,832	50,930,633	52.952	961,834	48,339,961	50.258	$2,590,772
HW_MG	961,832	31,154,014	32.390	961,833	29,580,850	30.755	$1,573,194

Annual Energy & LMP Costs - By Area

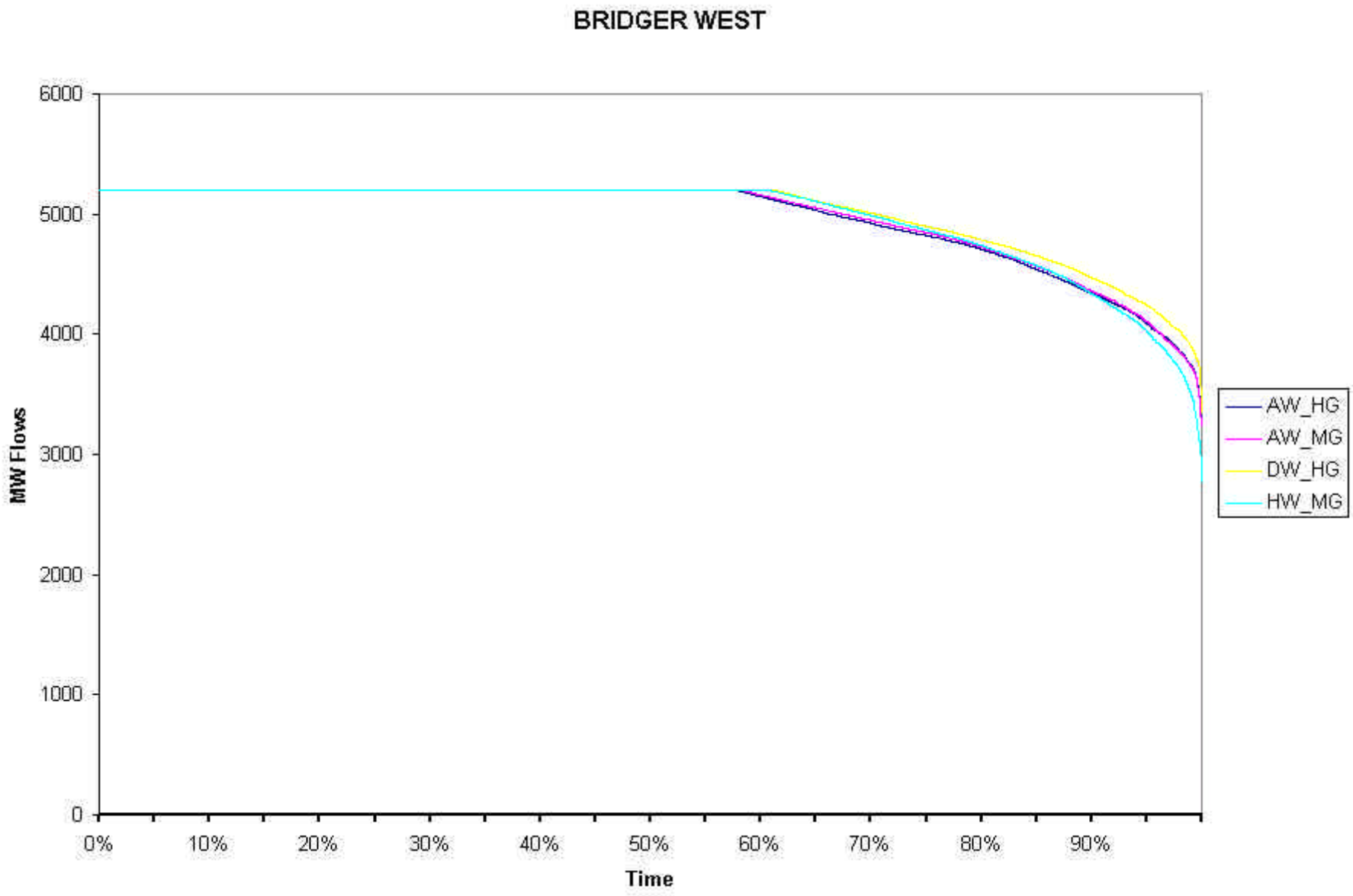
AreaID	Scenarios	Load GWH	Load K$	Load Avg $/MWh	Gen GWH	Gen K$	Gen Avg $/MWh
New Mexico	AW_HG	23,286	$1,150,242	$43.66	19,930	$932,954	$41.37
	AW_MG	23,286	$820,008	$31.12	19,974	$669,472	$29.62
	DW_HG	23,286	$1,198,780	$45.64	20,386	$998,575	$43.29
	HW_MG	23,286	$790,890	$30.02	19,634	$630,089	$28.36
Arizona	AW_HG	98,160	$4,876,677	$43.91	150,278	$7,315,199	$43.02
	AW_MG	98,160	$3,445,622	$31.03	152,375	$5,253,201	$30.47
	DW_HG	98,160	$5,102,258	$45.94	154,873	$7,868,250	$44.90
	HW_MG	98,160	$3,327,402	$29.96	148,806	$4,964,439	$29.49
NEVADA	AW_HG	32,045	$1,589,569	$43.84	15,546	$811,777	$46.15
	AW_MG	32,045	$1,121,424	$30.93	14,932	$550,983	$32.61
	DW_HG	32,045	$1,654,753	$45.64	16,837	$916,653	$48.12
	HW_MG	32,045	$1,085,007	$29.93	13,513	$478,666	$31.31
WAPA L.C.	AW_HG	2,453	$116,753	$42.07	31,672	$1,520,533	$42.43
	AW_MG	2,453	$82,901	$29.87	32,048	$1,093,059	$30.15
	DW_HG	2,453	$122,585	$44.17	32,220	$1,618,185	$44.39
	HW_MG	2,453	$79,241	$28.55	31,418	$1,029,666	$28.97
MEXICO-C	AW_HG	22,347	$1,304,114	$51.58	20,308	$1,180,130	$51.36
	AW_MG	22,347	$954,627	$37.76	19,749	$844,554	$37.80
	DW_HG	22,347	$1,322,507	$52.31	20,758	$1,219,325	$51.92
	HW_MG	22,347	$947,821	$37.49	19,626	$833,574	$37.54
IMPERIAL	AW_HG	4,259	$218,135	$45.27	3,541	$181,429	$45.29
	AW_MG	4,259	$154,411	$32.04	3,482	$125,370	$31.82
	DW_HG	4,259	$229,425	$47.61	3,539	$191,878	$47.92
	HW_MG	4,259	$149,936	$31.12	3,619	$126,153	$30.81
SANDIEGO	AW_HG	22,550	$1,202,672	$47.14	9,967	$531,802	$47.16
	AW_MG	22,550	$851,275	$33.37	8,976	$342,912	$33.77
	DW_HG	22,550	$1,270,245	$49.79	11,398	$625,930	$48.54
	HW_MG	22,550	$820,328	$32.15	8,348	$309,745	$32.79

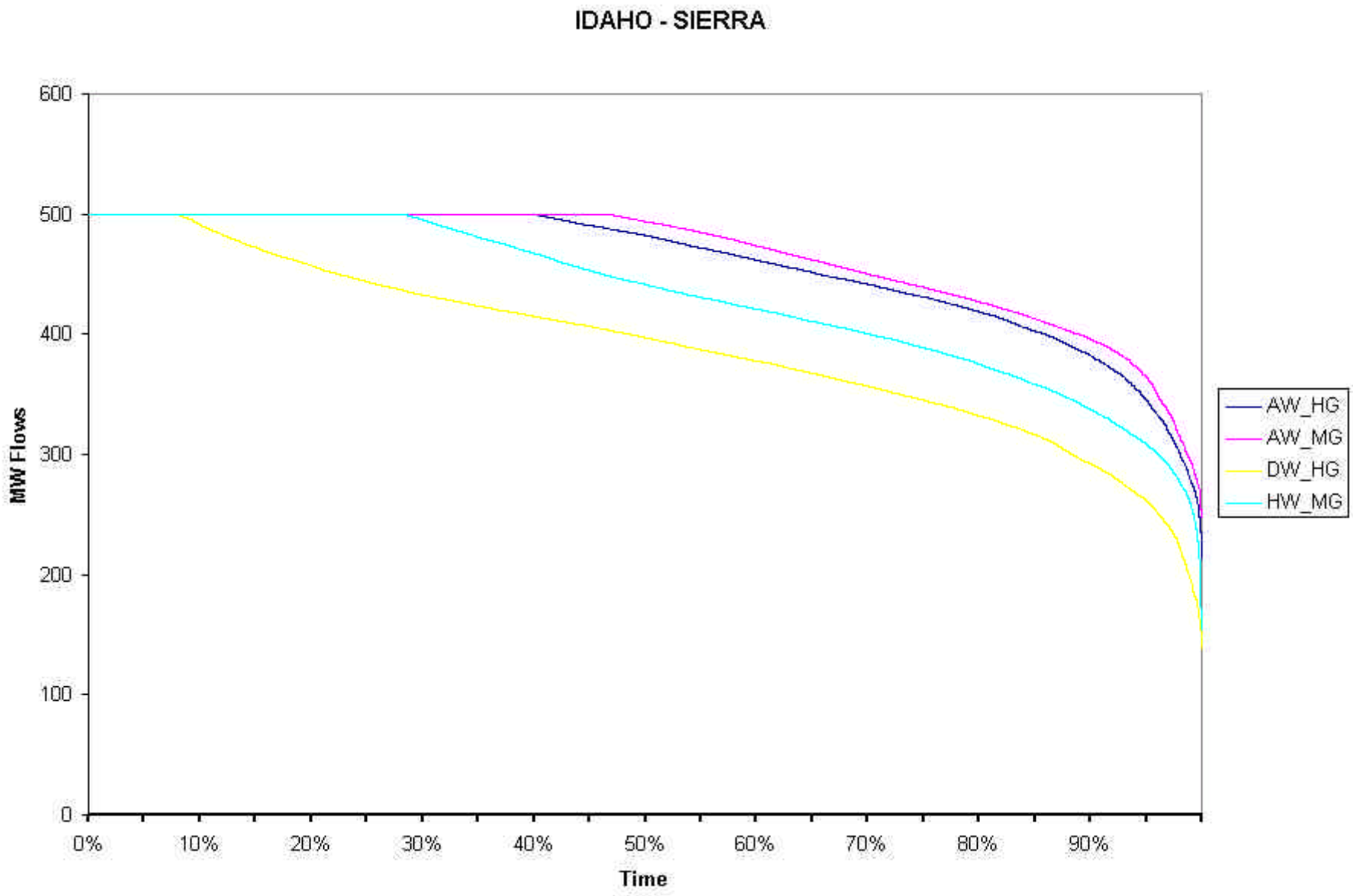
Annual Energy & LMP Costs - By Area

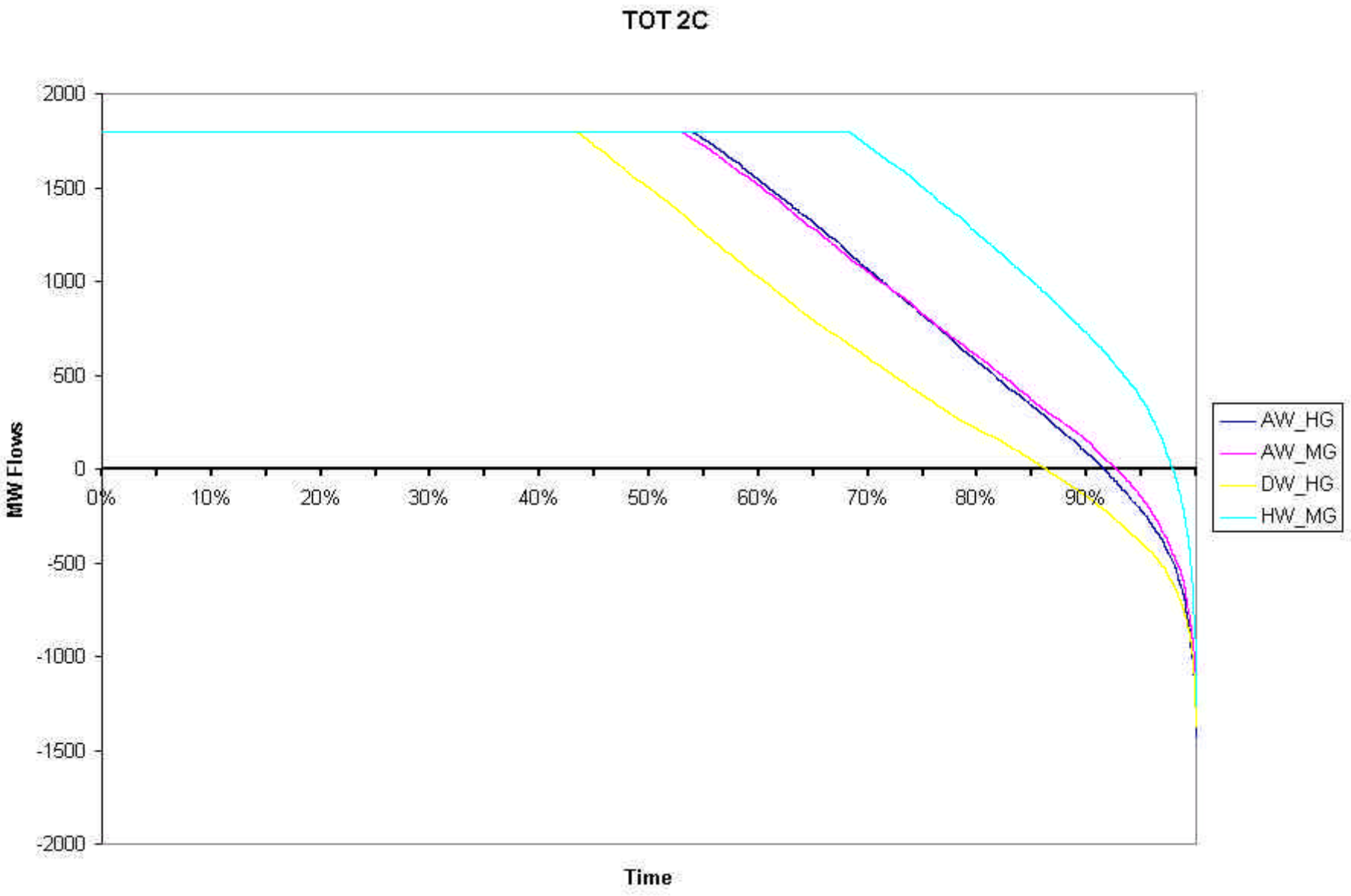
AreaID	Scenarios	Load GWH	Load K$	Load Avg $/MWh	Gen GWH	Gen K$	Gen Avg $/MWh
SOCALIF	AW_HG	108,572	$5,714,806	$46.52	43,208	$2,348,607	$48.04
	AW_MG	108,572	$4,055,349	$33.01	43,607	$1,679,359	$34.04
	DW_HG	108,572	$6,049,098	$49.24	46,828	$2,710,086	$51.15
	HW_MG	108,572	$3,913,595	$31.86	44,343	$1,638,192	$32.65
LADWP	AW_HG	32,468	$1,618,132	$44.05	16,152	$780,968	$42.74
	AW_MG	32,468	$1,144,570	$31.16	15,772	$544,387	$30.51
	DW_HG	32,468	$1,754,324	$47.76	18,312	$943,008	$45.52
	HW_MG	32,468	$1,050,040	$28.58	12,946	$411,124	$28.07
PG AND E	AW_HG	141,300	$7,377,412	$46.15	98,040	$5,252,313	$47.35
	AW_MG	141,300	$5,210,005	$32.59	96,407	$3,643,919	$33.41
	DW_HG	141,300	$7,928,227	$49.59	96,008	$5,532,844	$50.94
	HW_MG	141,300	$4,926,013	$30.81	99,777	$3,554,008	$31.48
NORTHWEST	AW_HG	179,563	$8,637,222	$42.51	172,075	$8,116,063	$41.69
	AW_MG	179,563	$6,095,688	$30.00	172,620	$5,760,794	$29.50
	DW_HG	179,563	$9,684,879	$47.67	154,568	$8,327,967	$47.62
	HW_MG	179,563	$5,491,076	$27.03	183,937	$5,470,515	$26.29
B.C.HYDR	AW_HG	68,119	$3,246,206	$42.12	59,205	$2,850,947	$42.56
	AW_MG	68,119	$2,290,500	$29.72	59,395	$2,016,754	$30.01
	DW_HG	68,119	$3,654,691	$47.42	60,943	$3,278,916	$47.55
	HW_MG	68,119	$2,069,608	$26.85	61,567	$1,865,888	$26.79
AQUILA	AW_HG	4,344	$206,741	$42.06	4,663	$213,377	$40.44
	AW_MG	4,344	$145,824	$29.67	4,663	$151,109	$28.64
	DW_HG	4,344	$232,971	$47.40	4,230	$221,283	$46.24
	HW_MG	4,344	$131,863	$26.83	4,981	$145,695	$25.85
ALBERTA	AW_HG	66,287	$3,147,673	$41.97	66,595	$3,185,002	$42.27
	AW_MG	66,287	$2,219,888	$29.60	67,498	$2,273,897	$29.78
	DW_HG	66,287	$3,536,087	$47.15	70,720	$3,773,518	$47.16
	HW_MG	66,287	$2,020,423	$26.94	63,799	$1,972,058	$27.32

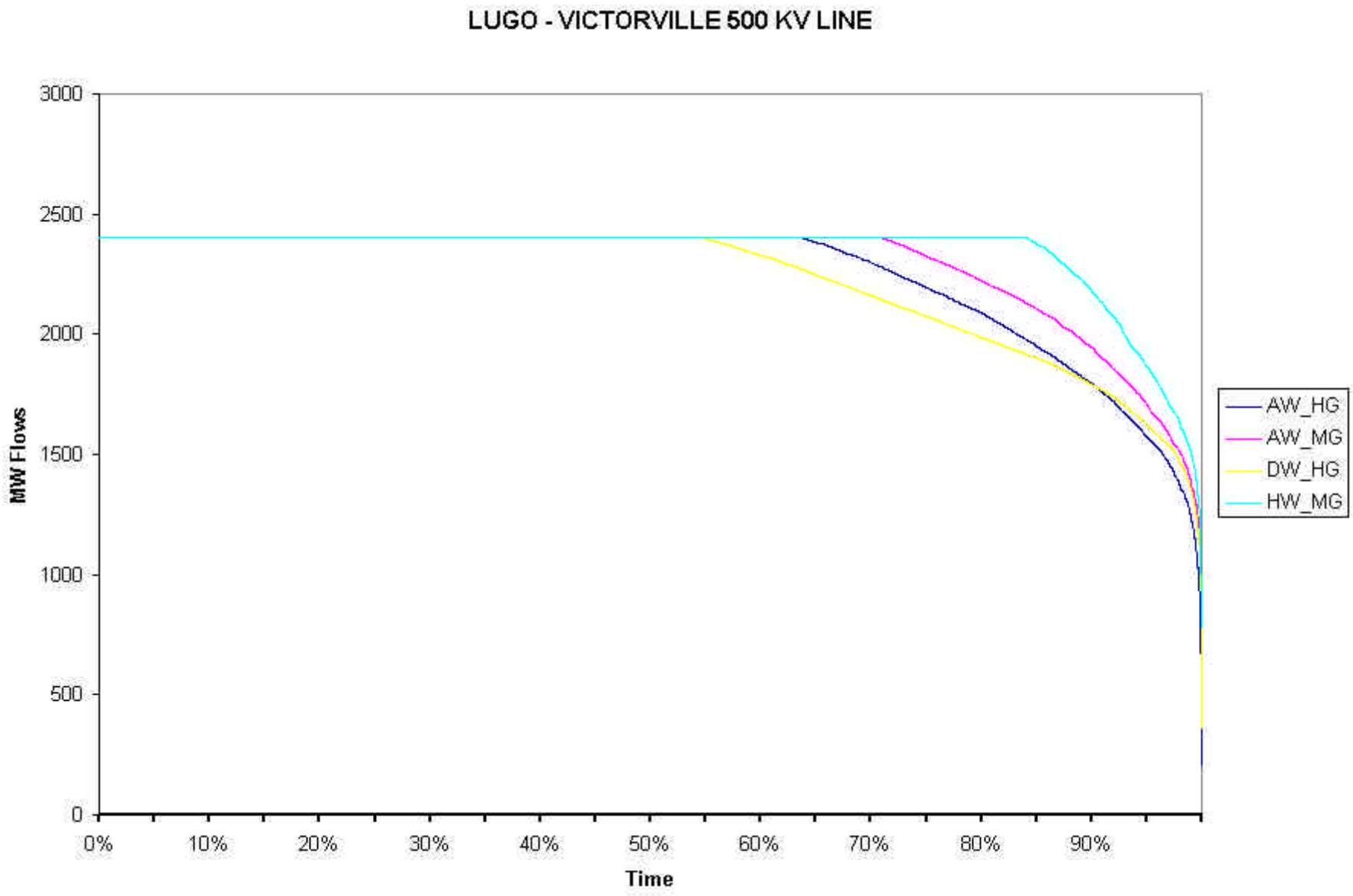
Annual Energy & LMP Costs - By Area

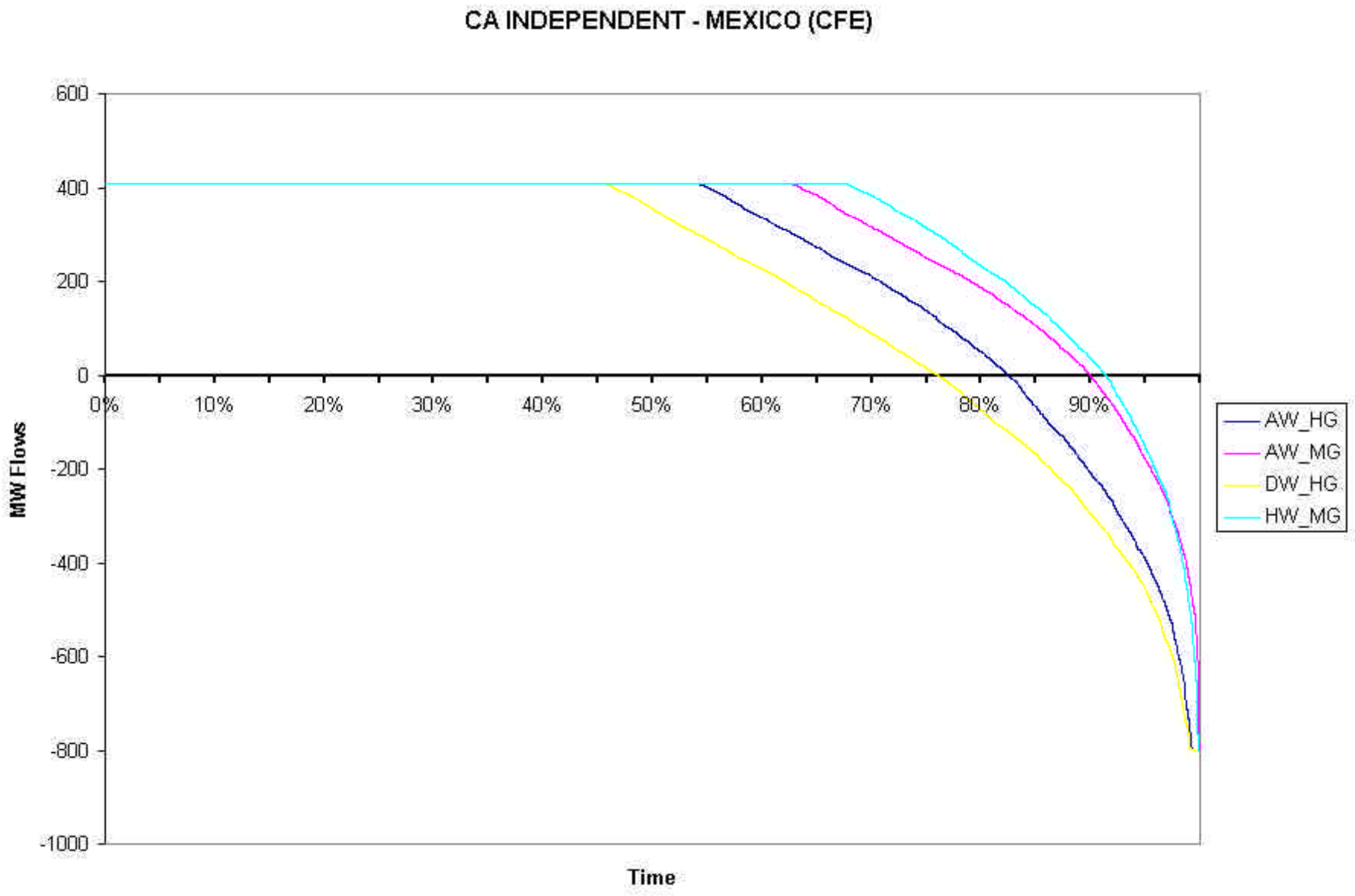
AreaID	Scenarios	Load GWH	Load K$	Load Avg $/MW	Gen GWH	Gen K$	Gen Avg $/MWh
IDAHO	AW_HG	18,412	$877,390	$42.12	30,234	$1,137,098	$33.24
	AW_MG	18,412	$617,207	$29.63	29,914	$833,726	$24.63
	DW_HG	18,412	$989,721	$47.51	27,835	$1,118,689	$35.52
	HW_MG	18,412	$551,519	$26.48	28,924	$732,827	$22.39
MONTANA	AW_HG	9,627	$360,765	$33.12	52,524	$1,790,828	$30.14
	AW_MG	9,627	$265,639	$24.39	52,864	$1,342,896	$22.45
	DW_HG	9,627	$383,332	$35.19	52,252	$1,911,460	$32.33
	HW_MG	9,627	$243,328	$22.34	53,040	$1,230,135	$20.50
WAPA U.M	AW_HG	1,039	$35,156	$29.91	0	$0	$0.00
	AW_MG	1,039	$26,271	$22.35	0	$0	$0.00
	DW_HG	1,039	$38,957	$33.14	0	$0	$0.00
	HW_MG	1,039	$23,457	$19.95	0	$0	$0.00
SIERRA	AW_HG	13,568	$734,597	$47.85	6,301	$345,456	$48.46
	AW_MG	13,568	$531,484	$34.62	6,340	$252,626	$35.22
	DW_HG	13,568	$732,602	$47.72	6,271	$340,614	$48.01
	HW_MG	13,568	$462,222	$30.11	5,363	$183,446	$30.23
PACE	AW_HG	43,309	$1,924,096	$39.27	54,362	$2,198,915	$35.75
	AW_MG	43,309	$1,364,633	$27.85	54,279	$1,577,478	$25.69
	DW_HG	43,309	$2,112,156	$43.11	55,174	$2,431,332	$38.95
	HW_MG	43,309	$1,219,388	$24.89	53,277	$1,389,609	$23.05
PSCOLORA	AW_HG	45,026	$1,795,996	$35.26	29,807	$1,177,414	$34.91
	AW_MG	45,026	$1,306,033	$25.64	29,744	$858,027	$25.50
	DW_HG	45,026	$1,917,167	$37.63	30,544	$1,284,855	$37.18
	HW_MG	45,026	$1,211,118	$23.77	28,773	$769,695	$23.64
WAPA R.M	AW_HG	25,098	$947,681	$33.37	77,426	$2,782,914	$31.77
	AW_MG	25,098	$695,160	$24.48	77,196	$2,053,716	$23.51
	DW_HG	25,098	$1,015,869	$35.77	78,138	$3,026,595	$34.24
	HW_MG	25,098	$639,736	$22.53	76,142	$1,845,325	$21.42

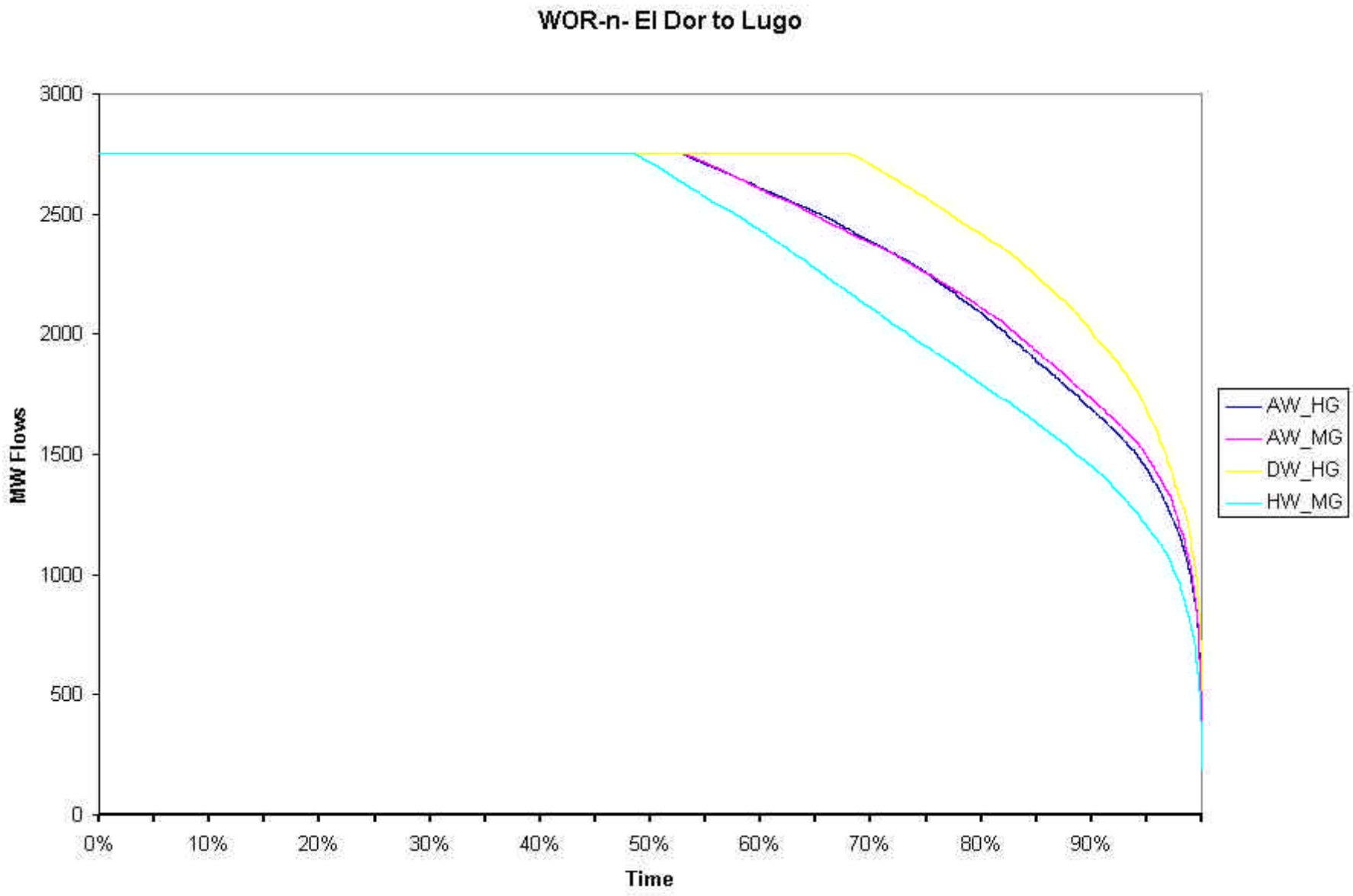

BRIDGER WEST
6000
5000
4000
3000
2000
1000
0
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG

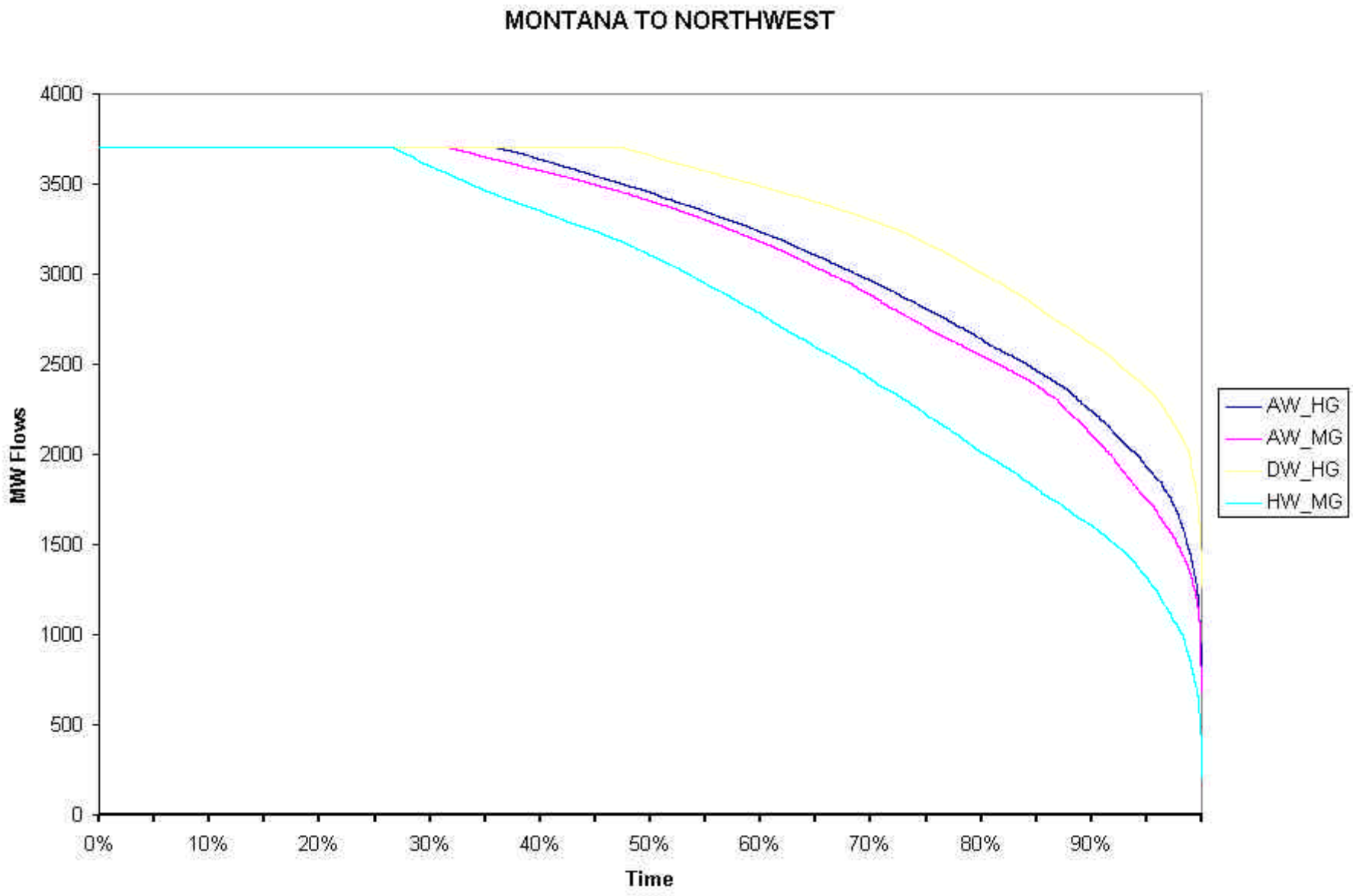

IDAHO - SIERRA
600
500
400
300
200
100
0
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG

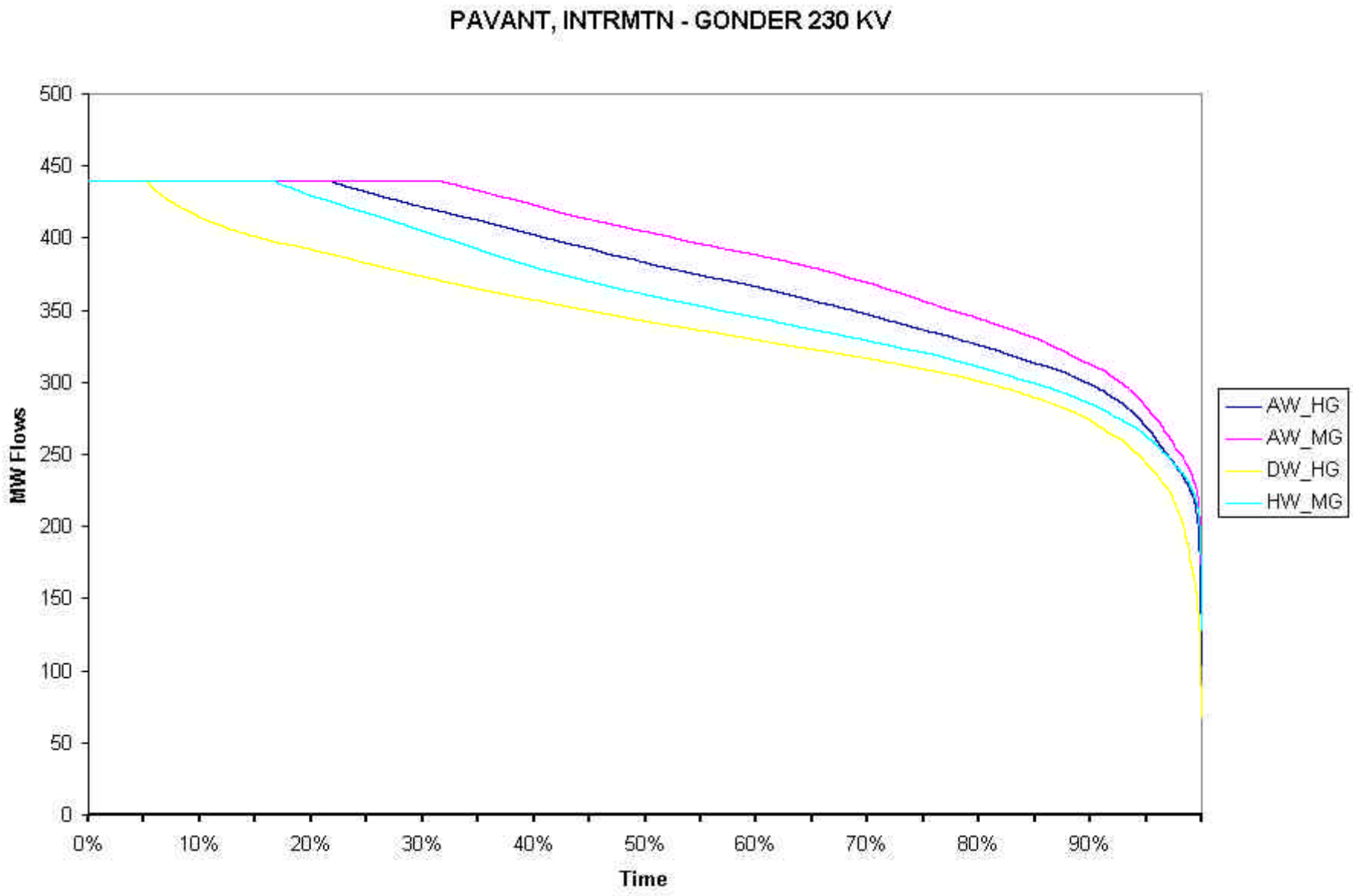

TOT 2C
2000
1500
1000
500
0
-500
-1000
-1500
-2000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG

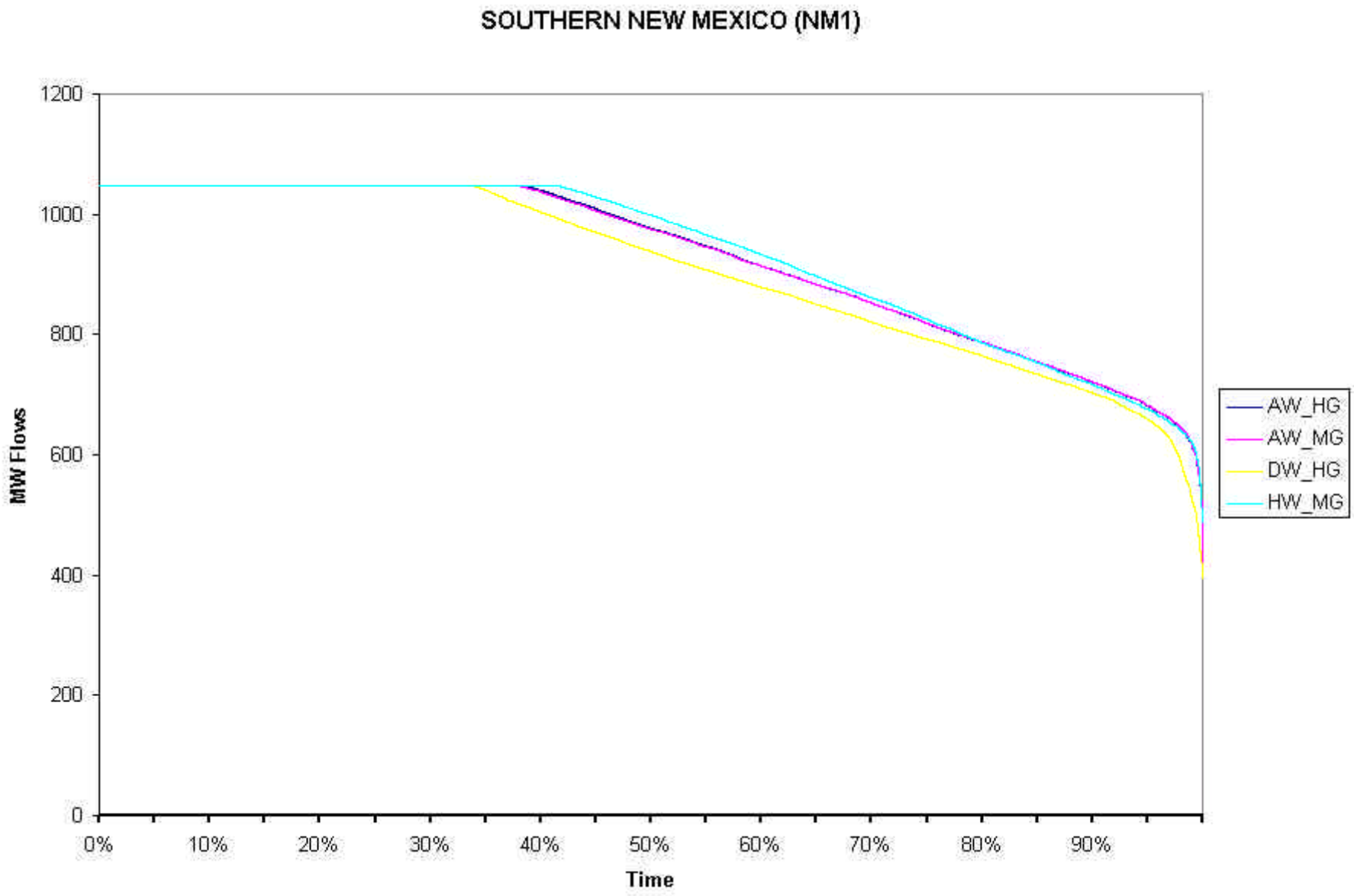

LUGO - VICTORVILLE 500 KV LINE
3000
2500
2000
1500
1000
500
0
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG

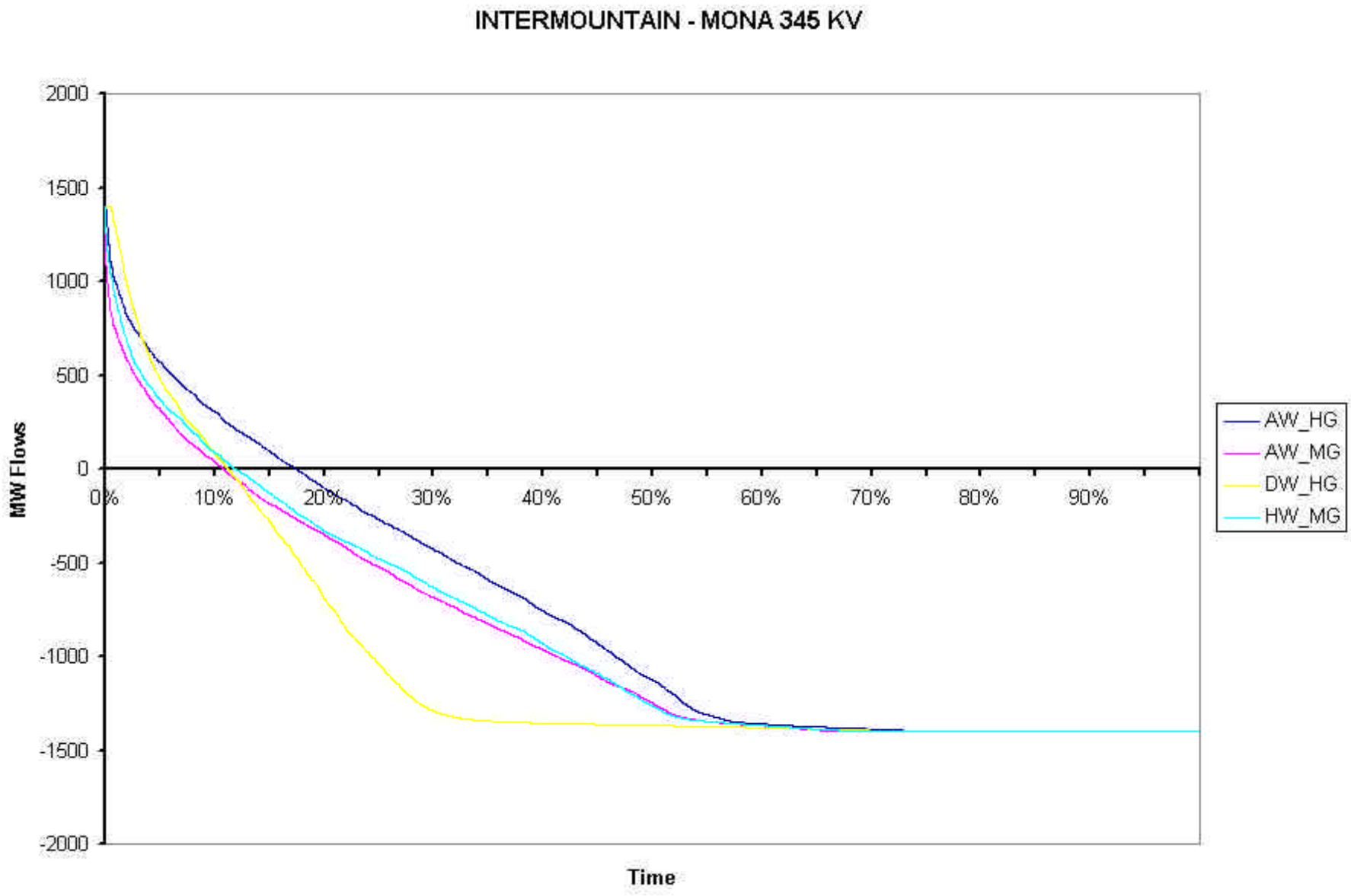

CA INDEPENDENT - MEXICO (CFE)
600
400
200
0
-200
-400
-600
-800
-1000
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
MW Flows
Time
AW_HG
AW_MG
DW_HG
HW_MG


WOR-n- El Dor to Lugo
3000
2500
2000
1500
1000
500
0
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG

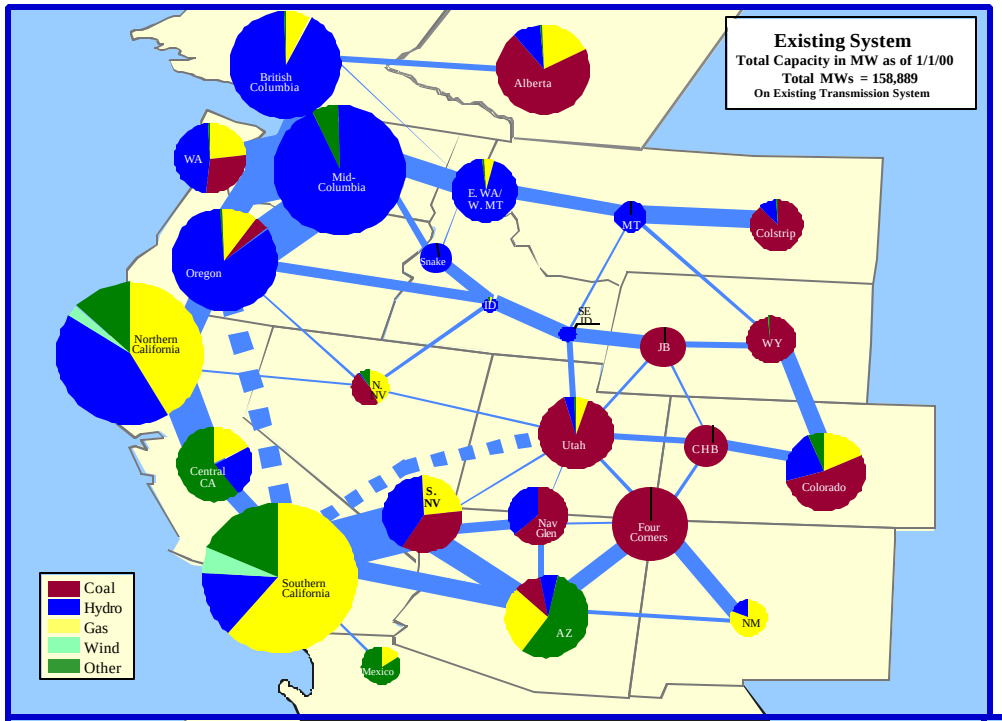

MONTANA TO NORTHWEST
4000
3500
3000
2500
2000
1500
1000
500
0
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG


PAVANT, INTRMTN - GONDER 230 KV
MW Flows
500
450
400
350
300
250
200
150
100
50
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG


SOUTHERN NEW MEXICO (NM1)
1200
1000
800
600
400
200
0
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG


INTERMOUNTAIN - MONA 345 KV
2000
1500
1000
500
0
-500
-1000
-1500
-2000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG

Renewable Scenario

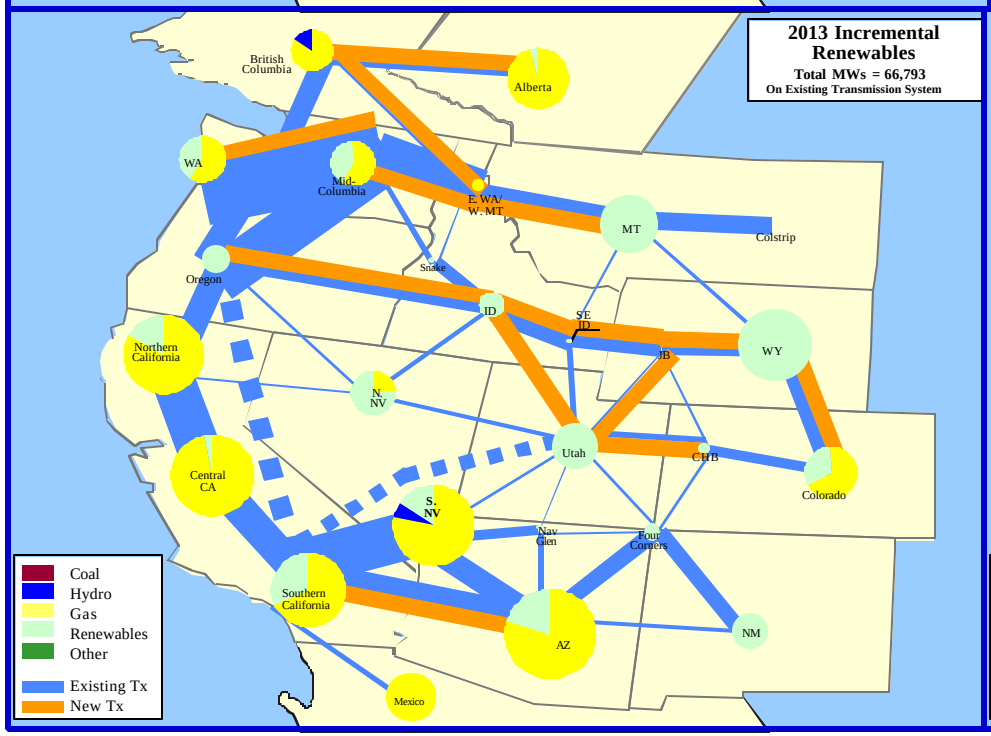


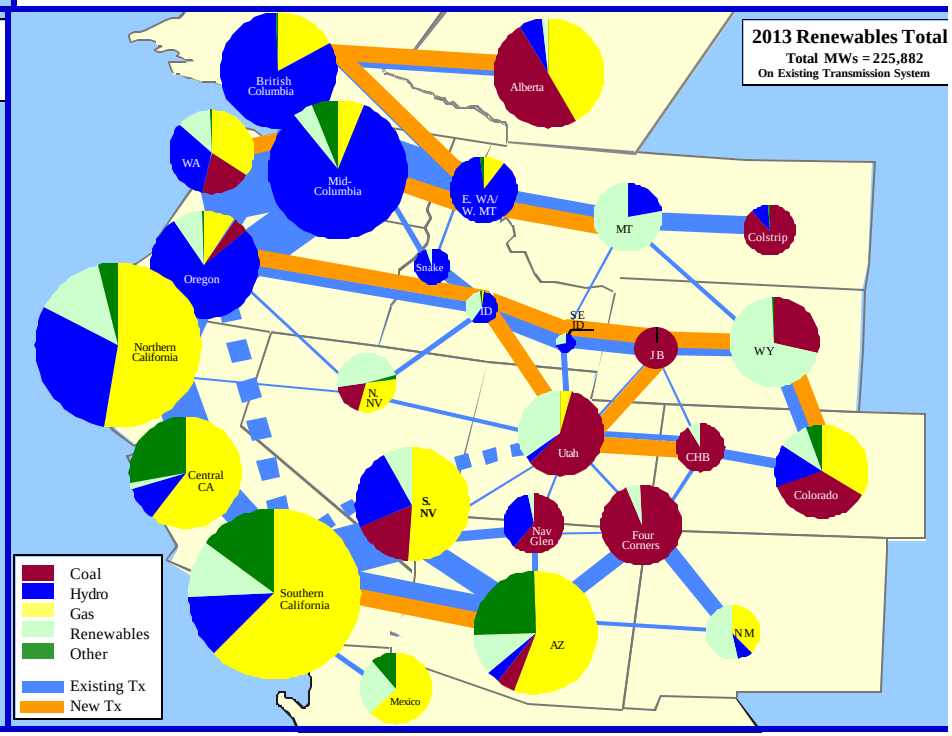
Renewable Scenario 2000-2013

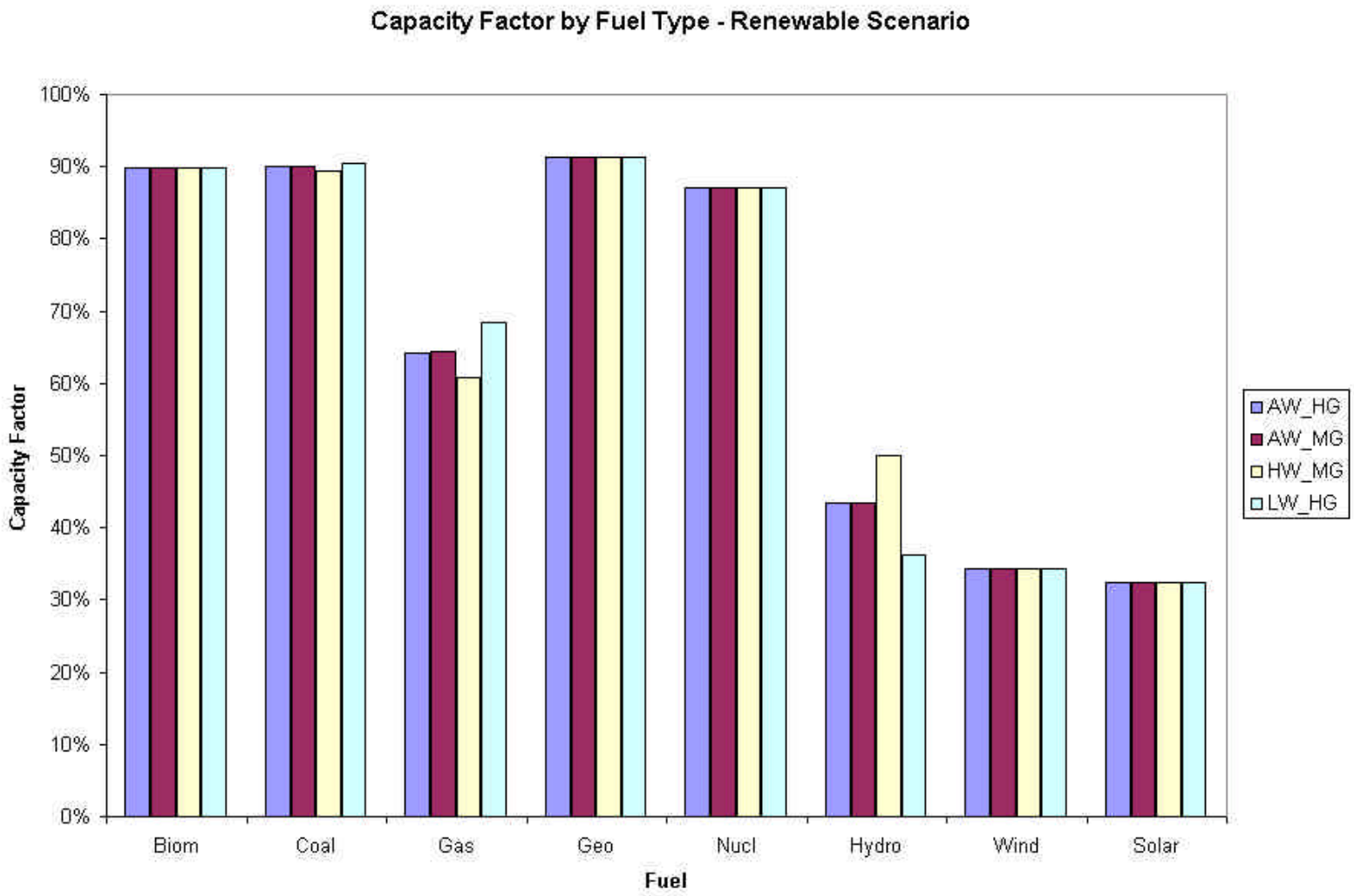
- ? About 40 GW new gas-fired CCCT
- ? About 20 GW new Wind plants
- ? About 4 GW new Geothermal and Biomass Plants
- ? About 2 GW new solar (Central & rooftop PV, & thermal)

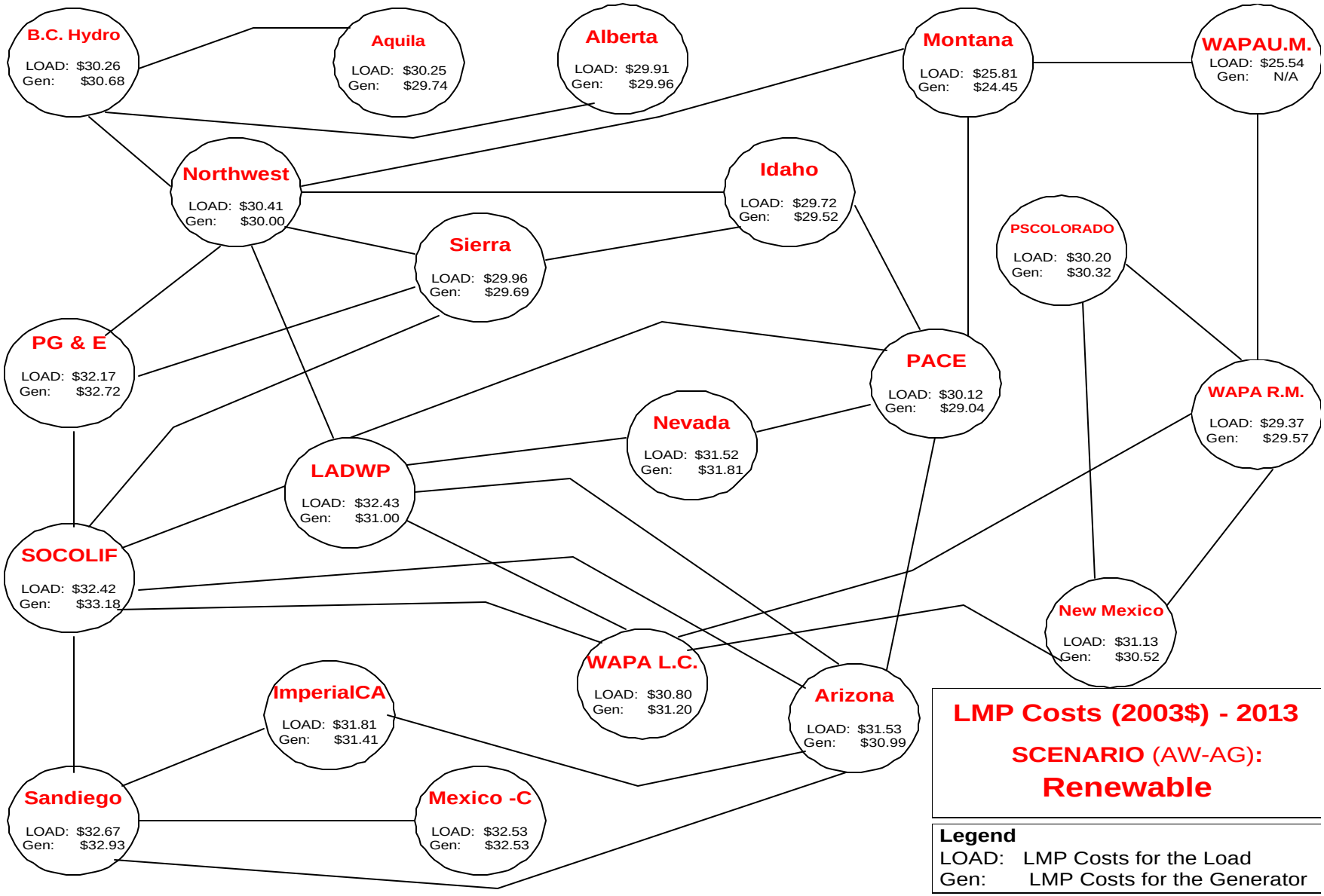
Incremental 2008-2013	Approx. Capital
? 9,500 MW CCCT	~ $600 per kW
? 18,500 MW Wind	~ $1000 per kW
? 3800 MW Geothermal & Biomass	~ $2000 per kW
? 2400 MW Solar	~ $2000 per kW
3800 Miles of 500 kV line	~ $2 Million/Mile

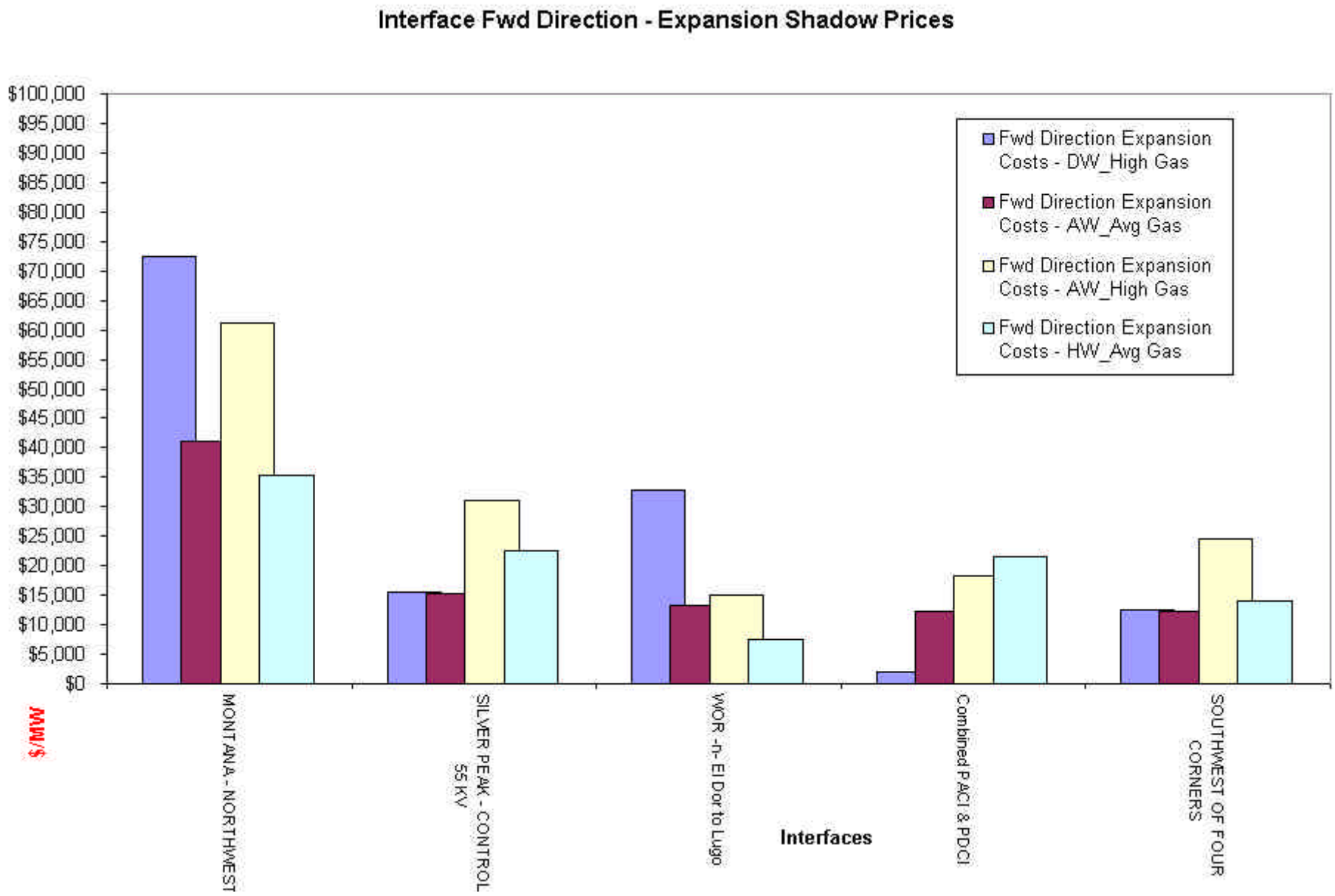
Capital costs would be Circa $43 Billion from 2008 to 2013

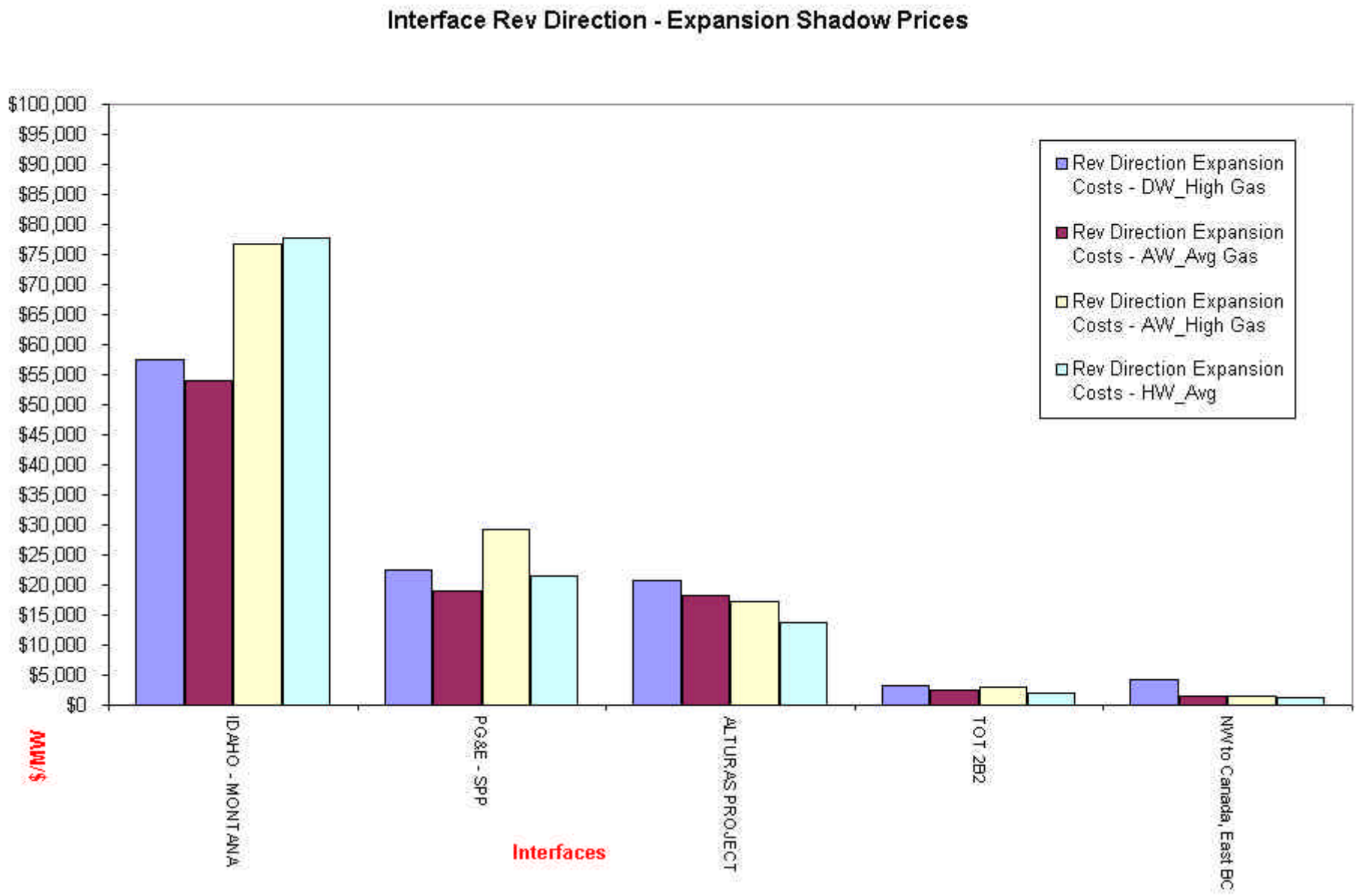





Capacity Factor by Fuel Type - Renewable Scenario
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Capacity Factor
Biom
Coal
Gas
Geo
Nucl
Hydro
Wind
Solar
Fuel
AW_HG
AW_MG
HW_MG
LW_HG


B.C. Hydro
LOAD: $30.26
Gen: $30.68
Aquila
LOAD: $30.25
Gen: $29.74
Alberta
LOAD: $29.91
Gen: $29.96
Montana
LOAD: $25.81
Gen: $24.45
WAPAU.M.
LOAD: $25.54
Gen: N/A
Northwest
LOAD: $30.41
Gen: $30.00
Idaho
LOAD: $29.72
Gen: $29.52
Sierra
LOAD: $29.96
Gen: $29.69
PSCOLORADO
LOAD: $30.20
Gen: $30.32
PG & E
LOAD: $32.17
Gen: $32.72
PACE
LOAD: $30.12
Gen: $29.04
WAPA R.M.
LOAD: $29.37
Gen: $29.57
Nevada
LOAD: $31.52
Gen: $31.81
LADWP
LOAD: $32.43
Gen: $31.00
SOCOLIF
LOAD: $32.42
Gen: $33.18
New Mexico
LOAD: $31.13
Gen: $30.52
WAPA L.C.
LOAD: $30.80
Gen: $31.20
ImperialCA
LOAD: $31.81
Gen: $31.41
Arizona
LOAD: $31.53
Gen: $30.99
Sandiego
LOAD: $32.67
Gen: $32.93
Mexico -C
LOAD: $32.53
Gen: $32.53
LMP Costs (2003$) - 2013
SCENARIO (AW-AG):
Renewable
Legend
LOAD: LMP Costs for the Load
Gen: LMP Costs for the Generator


Interface Fwd Direction - Expansion Shadow Prices
$100,000
$95,000
$90,000
$85,000
$80,000
$75,000
$70,000
$65,000
$60,000
$55,000
$50,000
$45,000
$40,000
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
$/MW
Fwd Direction Expansion Costs - DW_High Gas
Fwd Direction Expansion Costs - AW_Avg Gas
Fwd Direction Expansion Costs - AW_High Gas
Fwd Direction Expansion Costs - HW_Avg Gas
MONTANA - NORTHWEST
SILVER PEAK - CONTROL 55 KV
WOR -n- El Dor to Lugo
Combined PACI & PDCI
SOUTHWEST OF FOUR CORNERS
Interfaces


Interface Rev Direction - Expansion Shadow Prices
$100,000
$95,000
$90,000
$85,000
$80,000
$75,000
$70,000
$65,000
$60,000
$55,000
$50,000
$45,000
$40,000
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
$/MW
Rev Direction Expansion Costs - DW_High Gas
Rev Direction Expansion Costs - AW_Avg Gas
Rev Direction Expansion Costs - AW_High Gas
Rev Direction Expansion Costs - HW_Avg
IDAHO - MONTANA
PG&E - SPP
ALTURAS PROJECT
TOT 2B2
NW to Canada, East BC
Interfaces

Interfaces	Fwd Direction Expansion/MW Shadow Price			
	Costs - LW_High Gas	Costs - AW_Avg Gas	Costs - AW_High Gas	Costs - HW_Avg Gas
MONTANA - NORTHWEST	$72,346	$41,086	$61,030	$35,231
SILVER PEAK - CONTROL 55 KV	$15,605	$15,371	$30,972	$22,486
WOR -n- El Dor to Lugo	$32,825	$13,221	$14,938	$7,429
Combined PACI & PDCI	$1,990	$12,311	$18,386	$21,661
SOUTHWEST OF FOUR CORNERS	$12,408	$12,172	$24,556	$14,090
TOT 2C	$11,038	$10,127	$21,742	$17,864
COI	$4,042	$7,368	$8,093	$10,519
SOUTHERN NEW MEXICO (NM1)	$8,201	$6,689	$10,693	$9,029
North of Miguel	$17,995	$6,378	$9,451	$3,696
CA INDEPENDENT - MEXICO (CFE)	$3,068	$4,788	$6,461	$7,011
WEST OF BROADVIEW	$8,156	$4,044	$4,960	$2,557
Southern CA Imports	$1,199	$3,327	$3,603	$5,849
ALBERTA - BRITISH COLUMBIA	$6,777	$2,975	$3,415	$2,385
TOT 2B1	$3,093	$2,005	$2,458	$1,704
NORTHERN - SOUTHERN CALIFORNIA	$470	$1,629	$2,108	$3,292
TOT 3	$374	$1,544	$2,388	$5,745
Combined 4a, 4b	$3,138	$1,349	$1,847	$759
TOT 2B2	$305	$1,124	$1,564	$3,007

Interfaces	Rev Direction Expansion/MW Shadow Price			
	Costs - LW_High Gas	Costs - AW_Avg Gas	Costs - AW_High Gas	Costs - HW_Avg Gas
IDAHO - MONTANA	$57,404	$53,930	$76,866	$77,811
PG&E - SPP	$22,400	$19,033	$29,369	$21,398
ALTURAS PROJECT	$20,678	$18,294	$17,134	$13,732
TOT 2B2	$3,332	$2,382	$3,077	$2,062
NW to Canada, East BC	$4,189	$1,465	$1,625	$1,152
TOT 2B1	$0	$642	$1,086	$2,399
INYO - CONTROL 115 KV TIE	$213	$500	$963	$1,743
Tot 2a, 2b, 2c Nomogram	$739	$411	$599	$392
TOT 2C	$1,099	$398	$593	$77
BILLINGS - YELLOWTAIL	$978	$394	$387	$270
SILVER PEAK - CONTROL 55 KV	$270	$200	$89	$0
INTERMOUNTAIN - MONA 345 KV	$5	$119	$102	$576
CA INDEPENDENT - MEXICO (CFE)	$818	$65	$107	$33
NORTHERN - SOUTHERN CALIFORNIA	$169	$55	$72	$18
PACIFICORP_PG&E 115 KV INTERCON.	$47	$53	$55	$125
LUGO - VICTORVILLE 500 KV LINE	$5	$4	$7	$3
TOT 2B	$0	$2	$0	$2
North of Miguel	$0	$0	$0	$0

Annual Energy & LMP Costs - WECC Wide

Scenarios	Load GWH	Load K$	Load Avg $/MWh	Gen GWH	Gen K$	Gen Avg $/MWh	Congestion Rent Surplus K$ (Value of CRR)
AW_HG	961,832	47,904,678	49.806	961,833	47,126,640	48.997	$778,087
AW_MG	961,832	33,814,914	35.157	961,835	33,271,463	34.592	$543,554
DW_HG	961,832	51,043,478	53.069	961,832	50,387,266	52.387	$656,211
HW_MG	961,832	32,082,424	33.356	961,833	31,405,026	32.651	$677,431

Annual Energy & LMP Costs - By Area

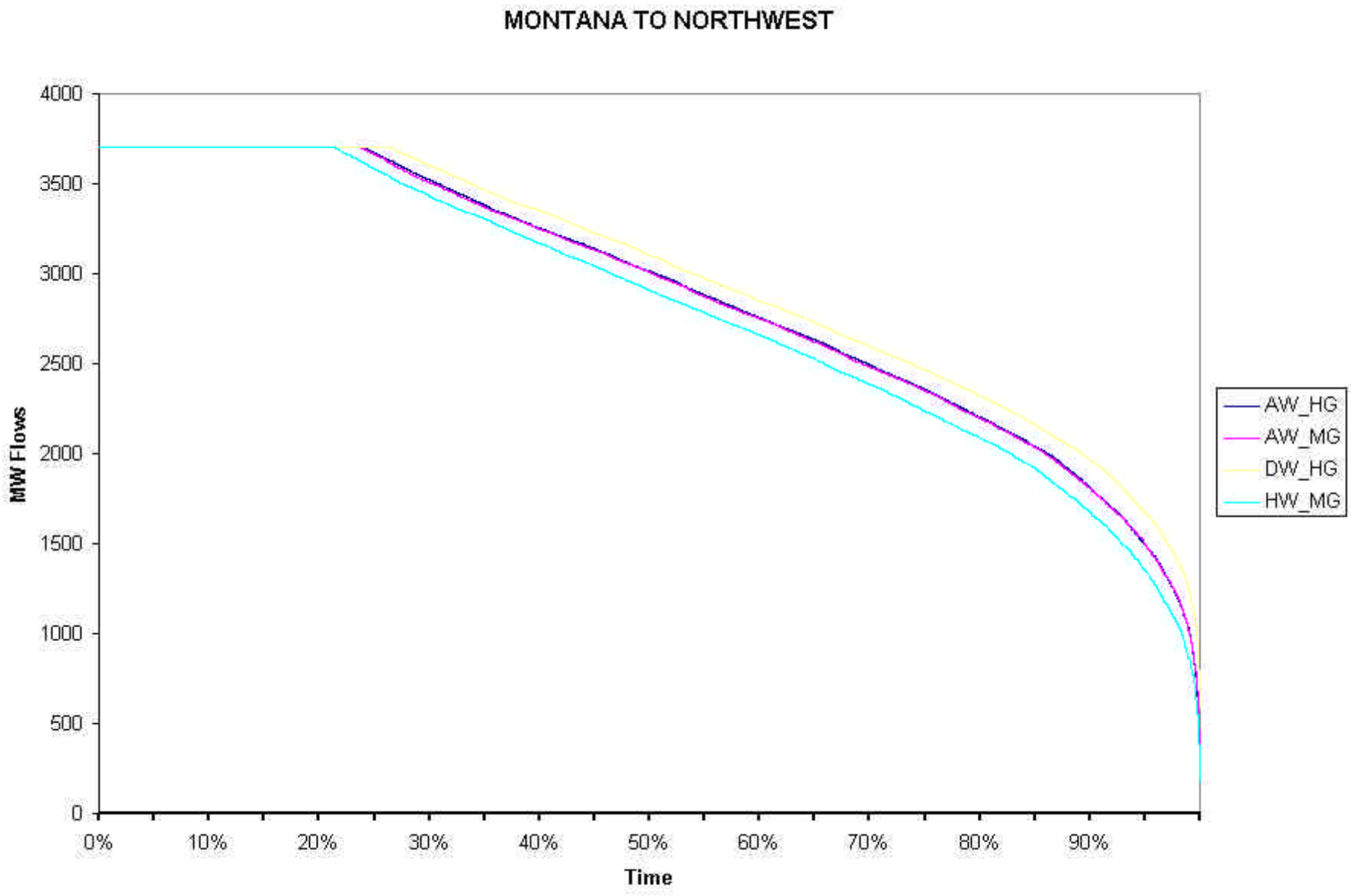
AreaID	Scenarios	Load GWH	Load K$	Load Avg $/MWh	Gen GWH	Gen K$	Gen Avg $/MWh
New Mexico	AW_HG	23,286	$1,159,751	$44.02	21,226	$1,031,939	$42.97
	AW_MG	23,286	$820,211	$31.13	21,159	$730,647	$30.52
	DW_HG	23,286	$1,218,142	$46.36	21,785	$1,115,695	$45.27
	HW_MG	23,286	$790,293	$30.00	20,836	$690,638	$29.30
Arizona	AW_HG	98,160	$4,971,294	$44.76	143,090	$7,126,450	$44.02
	AW_MG	98,160	$3,501,650	$31.53	145,452	$5,100,629	$30.99
	DW_HG	98,160	$5,173,676	$46.58	147,359	$7,630,119	$45.77
	HW_MG	98,160	$3,381,869	$30.45	141,394	$4,801,824	$30.02
NEVADA	AW_HG	32,045	$1,624,071	$44.79	26,563	$1,359,930	$45.25
	AW_MG	32,045	$1,142,657	$31.52	26,840	$966,015	$31.81
	DW_HG	32,045	$1,680,931	$46.36	27,894	$1,481,113	$46.93
	HW_MG	32,045	$1,107,370	$30.54	25,228	$878,914	$30.79
WAPA L.C.	AW_HG	2,453	$120,925	$43.57	20,718	$1,040,346	$44.38
	AW_MG	2,453	$85,474	$30.80	21,185	$747,826	$31.20
	DW_HG	2,453	$127,201	$45.83	21,346	$1,109,112	$45.92
	HW_MG	2,453	$82,162	$29.60	20,485	$701,277	$30.26
MEXICO-C	AW_HG	22,347	$1,161,629	$45.94	21,761	$1,129,678	$45.88
	AW_MG	22,347	$822,565	$32.53	21,496	$791,116	$32.53
	DW_HG	22,347	$1,186,389	$46.92	22,467	$1,190,085	$46.82
	HW_MG	22,347	$809,667	$32.02	21,044	$762,974	$32.05
IMPERIAL	AW_HG	4,259	$217,309	$45.10	4,318	$219,024	$44.83
	AW_MG	4,259	$153,278	$31.81	4,259	$151,395	$31.42
	DW_HG	4,259	$226,787	$47.06	4,326	$229,624	$46.91
	HW_MG	4,259	$147,698	$30.65	4,324	$148,290	$30.31
SANDIEGO	AW_HG	22,550	$1,178,766	$46.20	12,525	$655,255	$46.24
	AW_MG	22,550	$833,587	$32.67	11,620	$432,869	$32.93
	DW_HG	22,550	$1,238,422	$48.54	14,149	$773,448	$48.32
	HW_MG	22,550	$806,509	$31.61	10,711	$386,187	$31.87

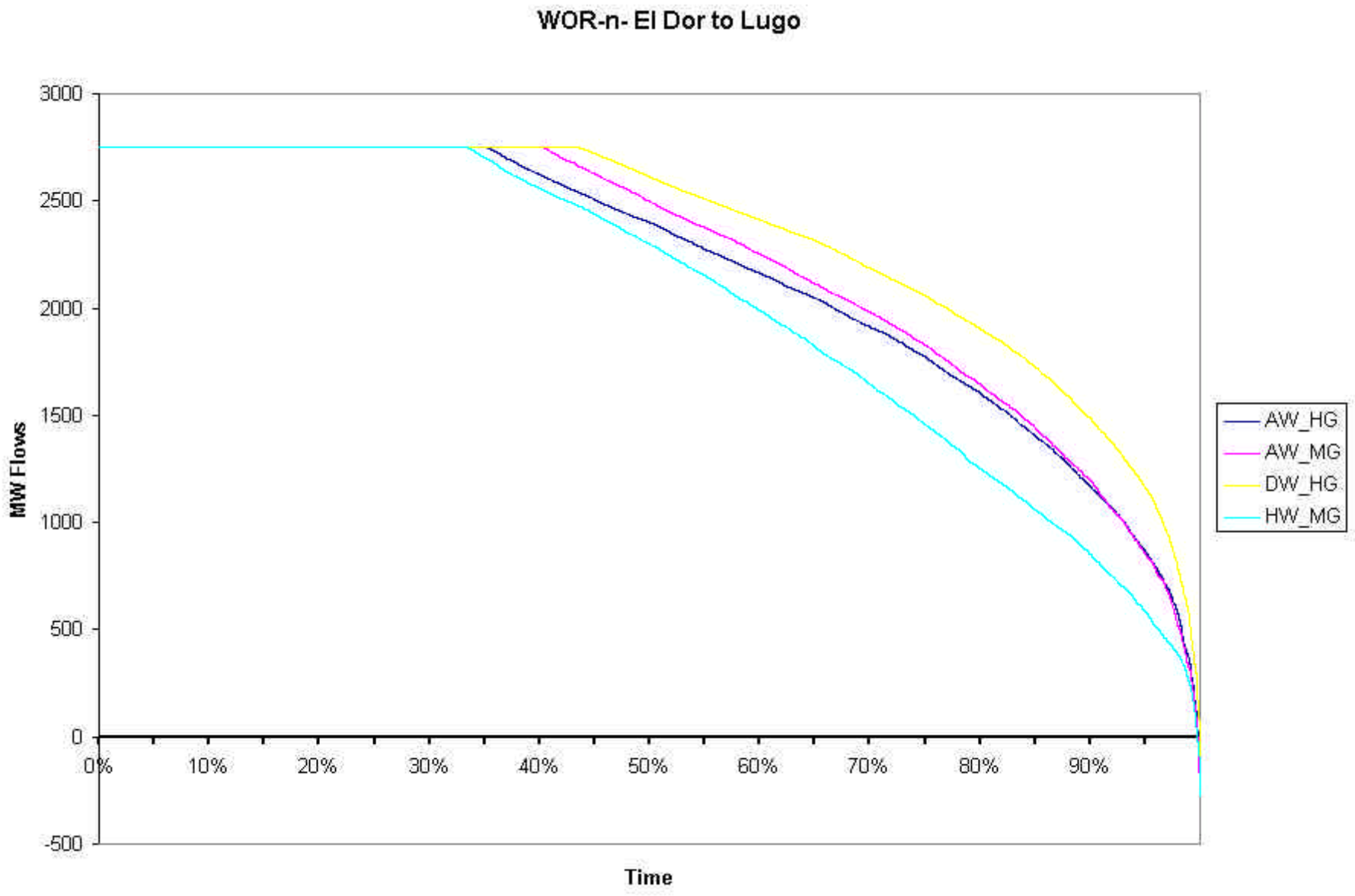
Annual Energy & LMP Costs - By Area

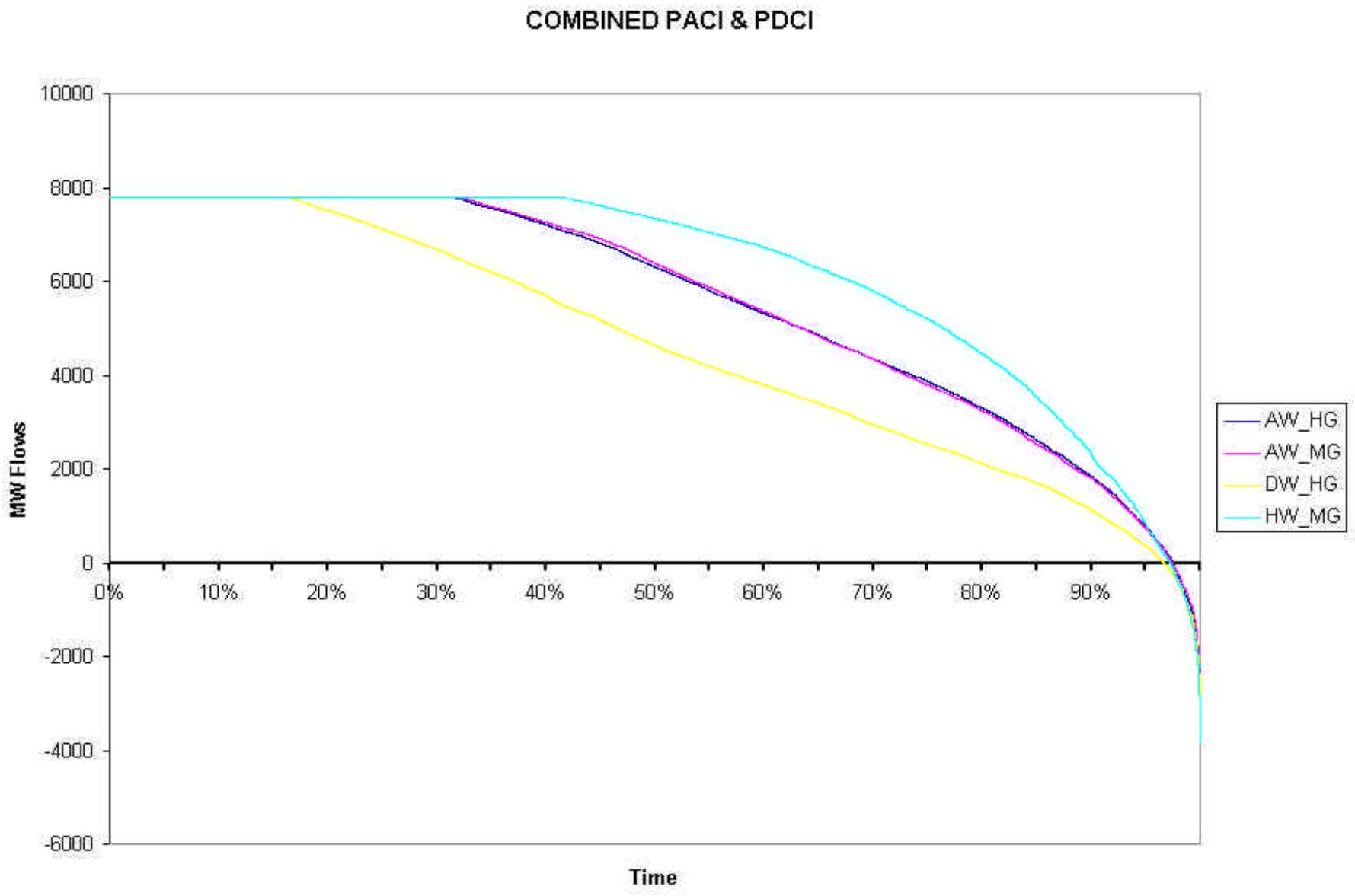
AreaID	Scenarios	Load GWH	Load K$	Load Avg $/MWh	Gen GWH	Gen K$	Gen Avg $/MWh
SOCALIF	AW_HG	108,572	$5,626,428	$45.80	51,452	$2,728,949	$46.88
	AW_MG	108,572	$3,982,046	$32.42	51,539	$1,934,940	$33.18
	DW_HG	108,572	$5,883,220	$47.89	53,993	$3,014,443	$49.35
	HW_MG	108,572	$3,862,900	$31.45	50,826	$1,838,825	$31.98
LADWP	AW_HG	32,468	$1,683,497	$45.83	23,077	$1,141,169	$43.71
	AW_MG	32,468	$1,191,125	$32.43	22,463	$787,783	$31.00
	DW_HG	32,468	$1,755,407	$47.79	24,108	$1,273,790	$46.70
	HW_MG	32,468	$1,157,306	$31.50	21,677	$726,863	$29.64
PG AND E	AW_HG	141,300	$7,277,265	$45.52	104,506	$5,472,312	$46.28
	AW_MG	141,300	$5,143,014	$32.17	103,884	$3,845,698	$32.72
	DW_HG	141,300	$7,672,830	$47.99	102,634	$5,680,349	$48.92
	HW_MG	141,300	$4,919,736	$30.77	106,413	$3,745,004	$31.11
NORTHWEST	AW_HG	179,563	$8,766,031	$43.15	180,890	$8,702,626	$42.52
	AW_MG	179,563	$6,177,213	$30.41	180,772	$6,135,551	$30.00
	DW_HG	179,563	$9,584,936	$47.18	163,443	$8,705,666	$47.08
	HW_MG	179,563	$5,705,067	$28.08	192,279	$5,976,782	$27.47
B.C.HYDR	AW_HG	68,119	$3,309,482	$42.94	61,408	$3,029,594	$43.61
	AW_MG	68,119	$2,332,020	$30.26	61,100	$2,120,579	$30.68
	DW_HG	68,119	$3,616,445	$46.92	64,588	$3,466,292	$47.43
	HW_MG	68,119	$2,160,257	$28.03	62,578	$1,987,955	$28.08
AQUILA	AW_HG	4,344	$211,045	$42.94	5,295	$252,657	$42.17
	AW_MG	4,344	$148,673	$30.25	5,296	$178,214	$29.74
	DW_HG	4,344	$230,401	$46.88	4,990	$262,375	$46.47
	HW_MG	4,344	$137,840	$28.05	5,529	$172,262	$27.54
ALBERTA	AW_HG	66,287	$3,189,975	$42.53	75,349	$3,637,086	$42.66
	AW_MG	66,287	$2,243,119	$29.91	75,575	$2,561,532	$29.96
	DW_HG	66,287	$3,462,433	$46.17	78,657	$4,082,102	$45.87
	HW_MG	66,287	$2,082,386	$27.77	72,321	$2,301,064	$28.12

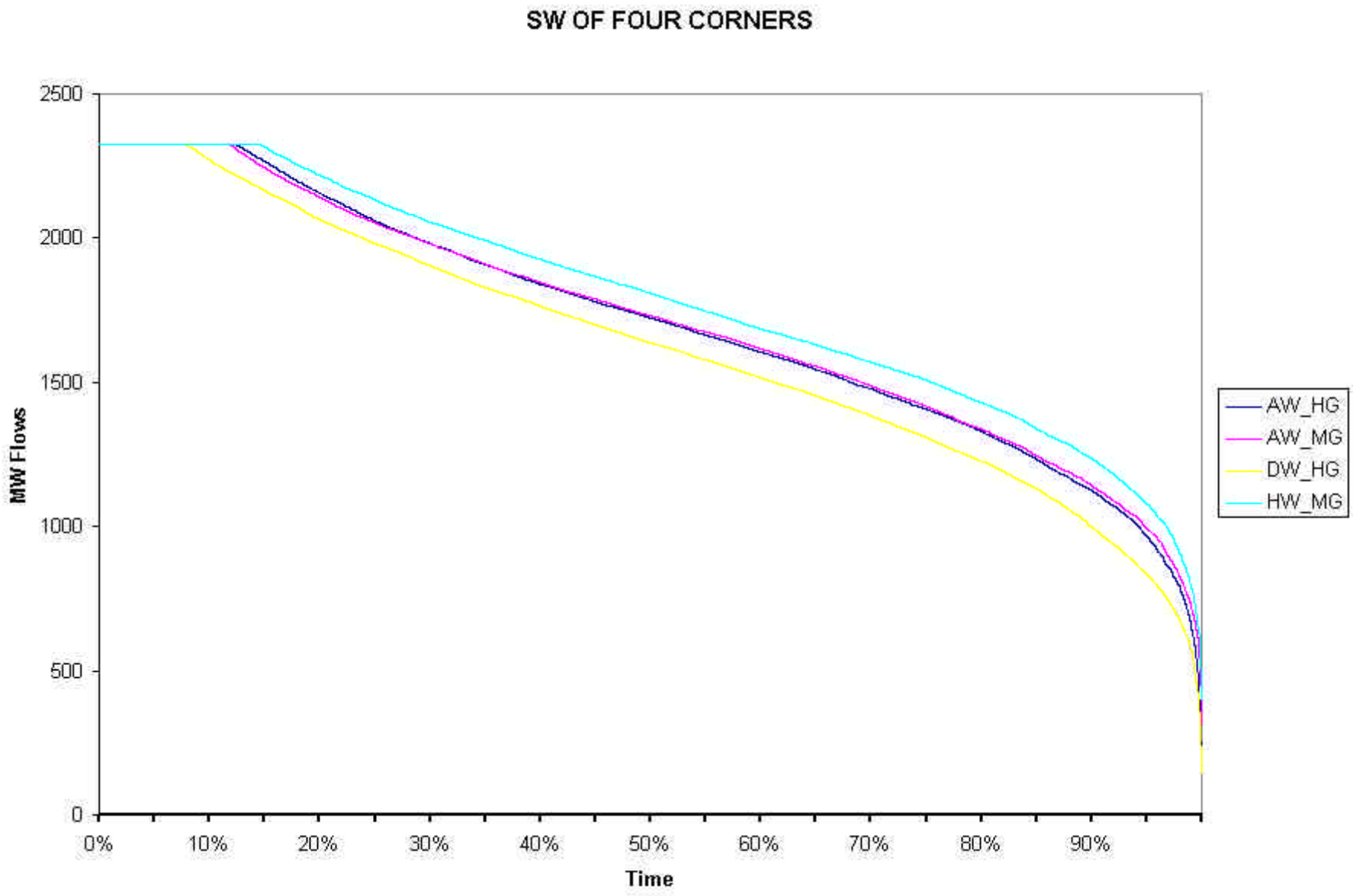
Annual Energy & LMP Costs - By Area

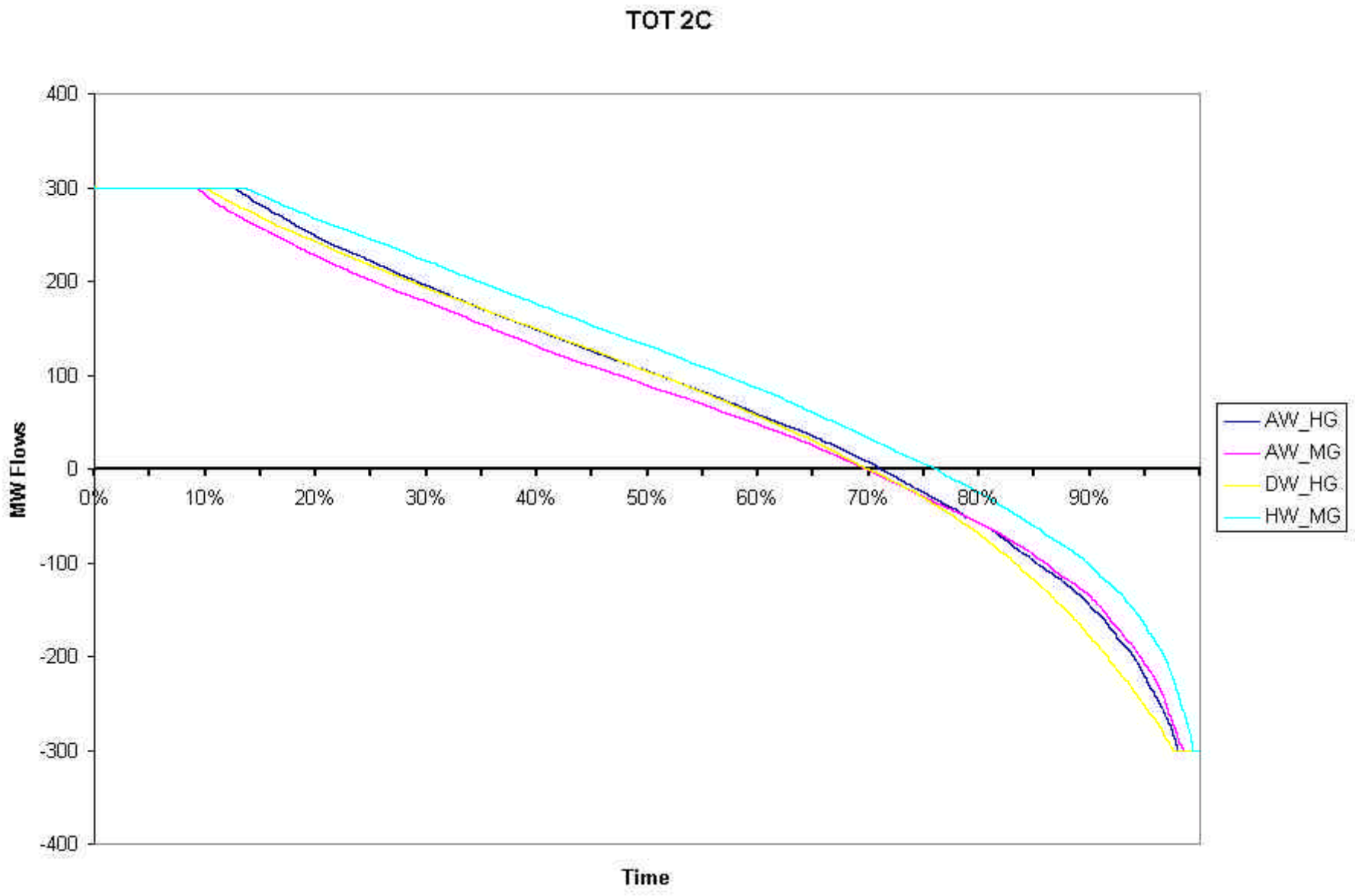
AreaID	Scenarios	Load GWH	Load K$	Load Avg $/MW	Gen GWH	Gen K$	Gen Avg $/MWh
IDAHO	AW_HG	18,412	$876,030	$42.05	28,401	$1,341,074	$41.73
	AW_MG	18,412	$619,042	$29.72	28,410	$948,861	$29.52
	DW_HG	18,412	$962,528	$46.21	25,767	$1,325,200	$45.46
	HW_MG	18,412	$573,024	$27.51	27,554	$862,203	$27.66
MONTANA	AW_HG	9,627	$395,892	$36.35	33,683	$1,307,610	$34.31
	AW_MG	9,627	$281,168	$25.81	33,628	$930,152	$24.45
	DW_HG	9,627	$431,293	$39.60	33,570	$1,408,064	$37.07
	HW_MG	9,627	$259,172	$23.79	33,781	$867,192	$22.69
WAPA U.M	AW_HG	1,039	$42,185	$35.89	0	$0	$0.00
	AW_MG	1,039	$30,017	$25.54	0	$0	$0.00
	DW_HG	1,039	$46,039	$39.16	0	$0	$0.00
	HW_MG	1,039	$27,688	$23.55	0	$0	$0.00
SIERRA	AW_HG	13,568	$651,881	$42.47	13,248	$631,316	$42.12
	AW_MG	13,568	$459,972	$29.96	13,230	$444,344	$29.69
	DW_HG	13,568	$705,378	$45.95	13,635	$701,223	$45.46
	HW_MG	13,568	$431,548	$28.11	12,884	$408,004	$27.99
PACE	AW_HG	43,309	$2,087,263	$42.60	68,813	$3,189,906	$40.97
	AW_MG	43,309	$1,475,922	$30.12	68,810	$2,261,113	$29.04
	DW_HG	43,309	$2,247,762	$45.87	69,240	$3,461,047	$44.18
	HW_MG	43,309	$1,386,393	$28.29	68,384	$2,110,373	$27.28
PSCOLORA	AW_HG	45,026	$2,176,484	$42.72	28,393	$1,376,121	$42.84
	AW_MG	45,026	$1,538,287	$30.20	28,007	$960,617	$30.32
	DW_HG	45,026	$2,330,073	$45.74	30,076	$1,559,247	$45.82
	HW_MG	45,026	$1,463,263	$28.72	26,921	$876,596	$28.78
WAPA R.M	AW_HG	25,098	$1,177,472	$41.47	37,117	$1,753,597	$41.76
	AW_MG	25,098	$833,873	$29.37	37,110	$1,241,582	$29.57
	DW_HG	25,098	$1,263,184	$44.48	37,805	$1,918,274	$44.85
	HW_MG	25,098	$790,275	$27.83	36,664	$1,161,800	$28.01

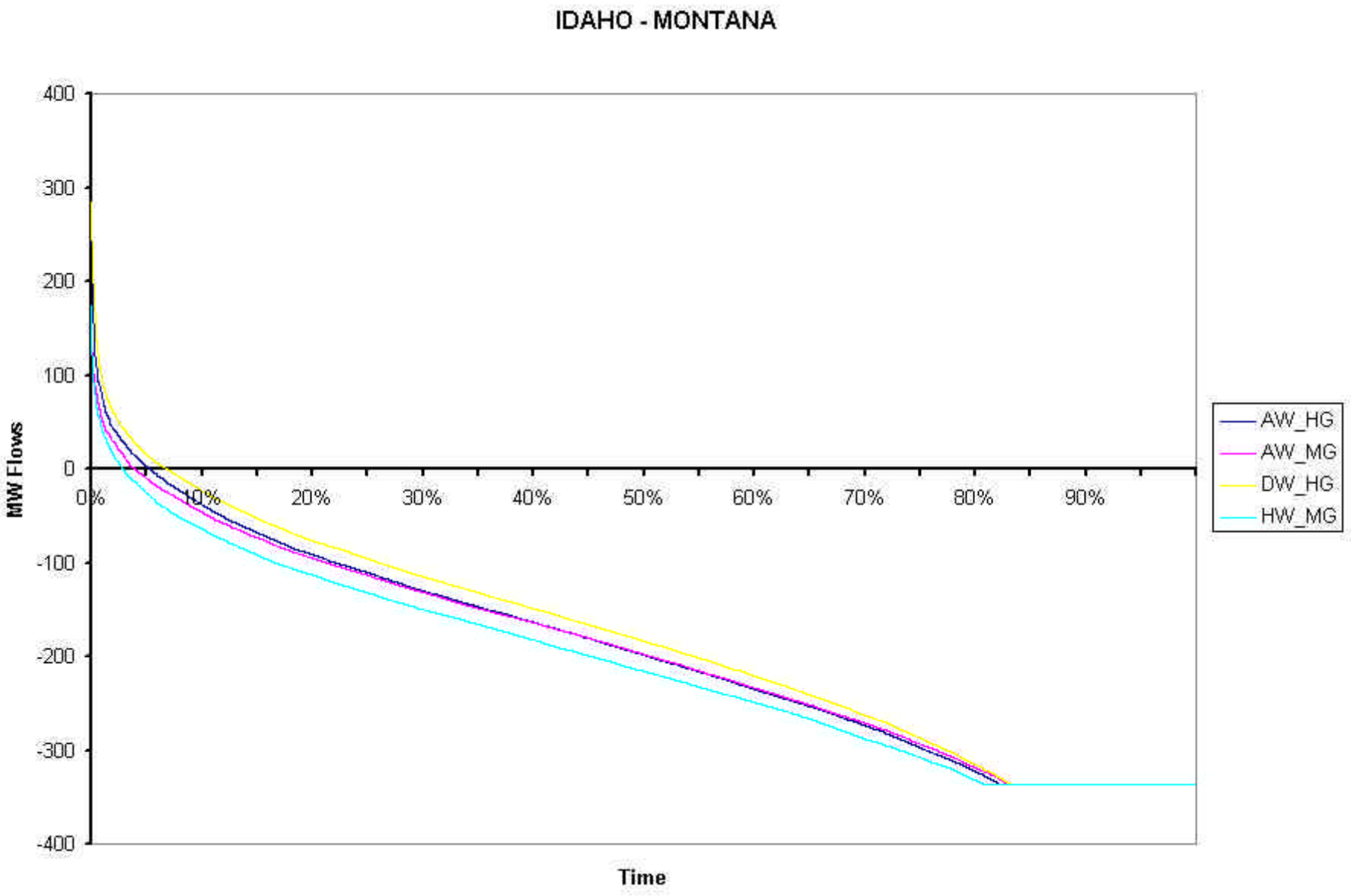

MONTANA TO NORTHWEST
MW Flows
4000
3500
3000
2500
2000
1500
1000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG

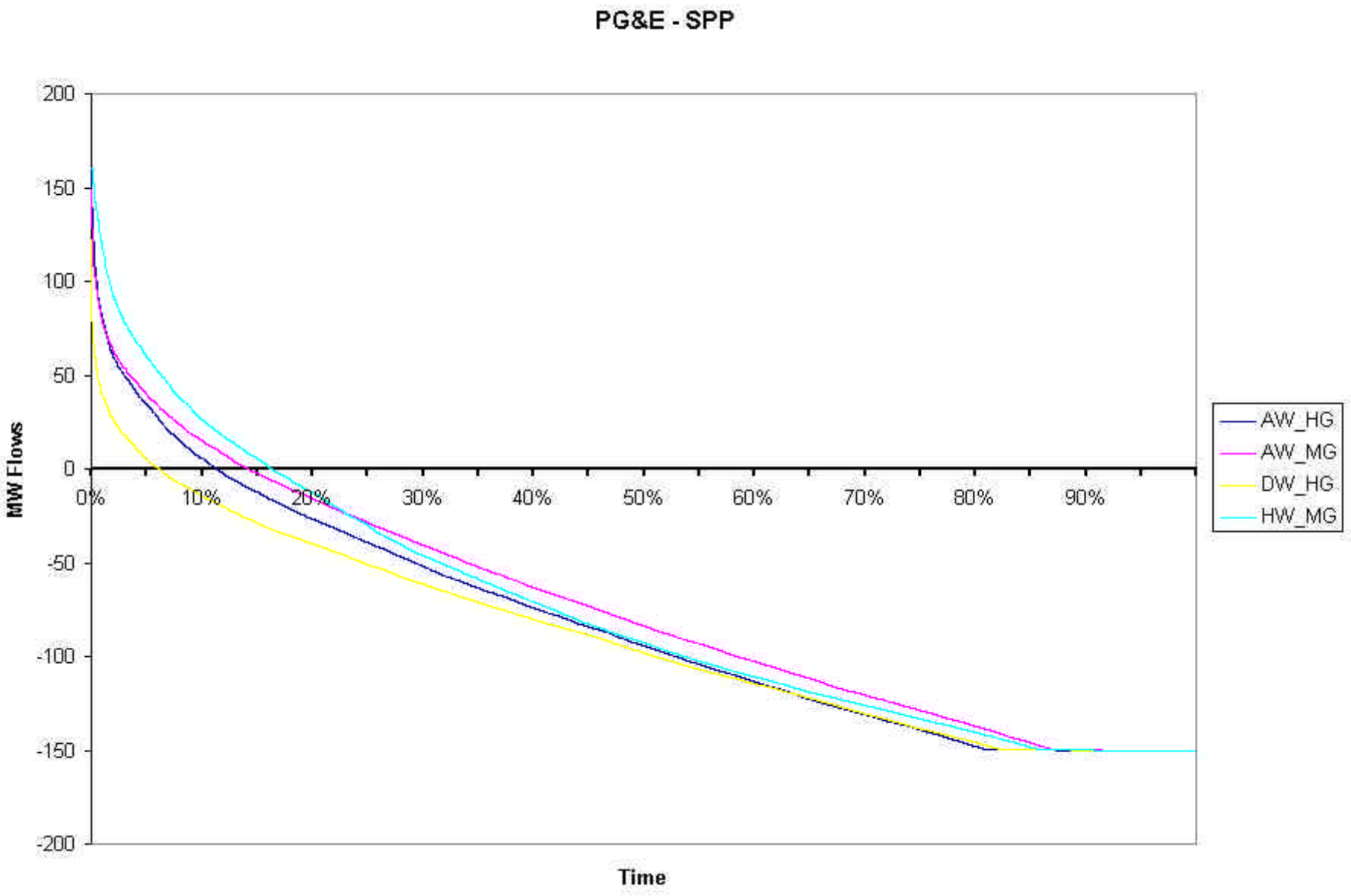

WOR-n- El Dor to Lugo
3000
2500
2000
1500
1000
500
0
-500
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG

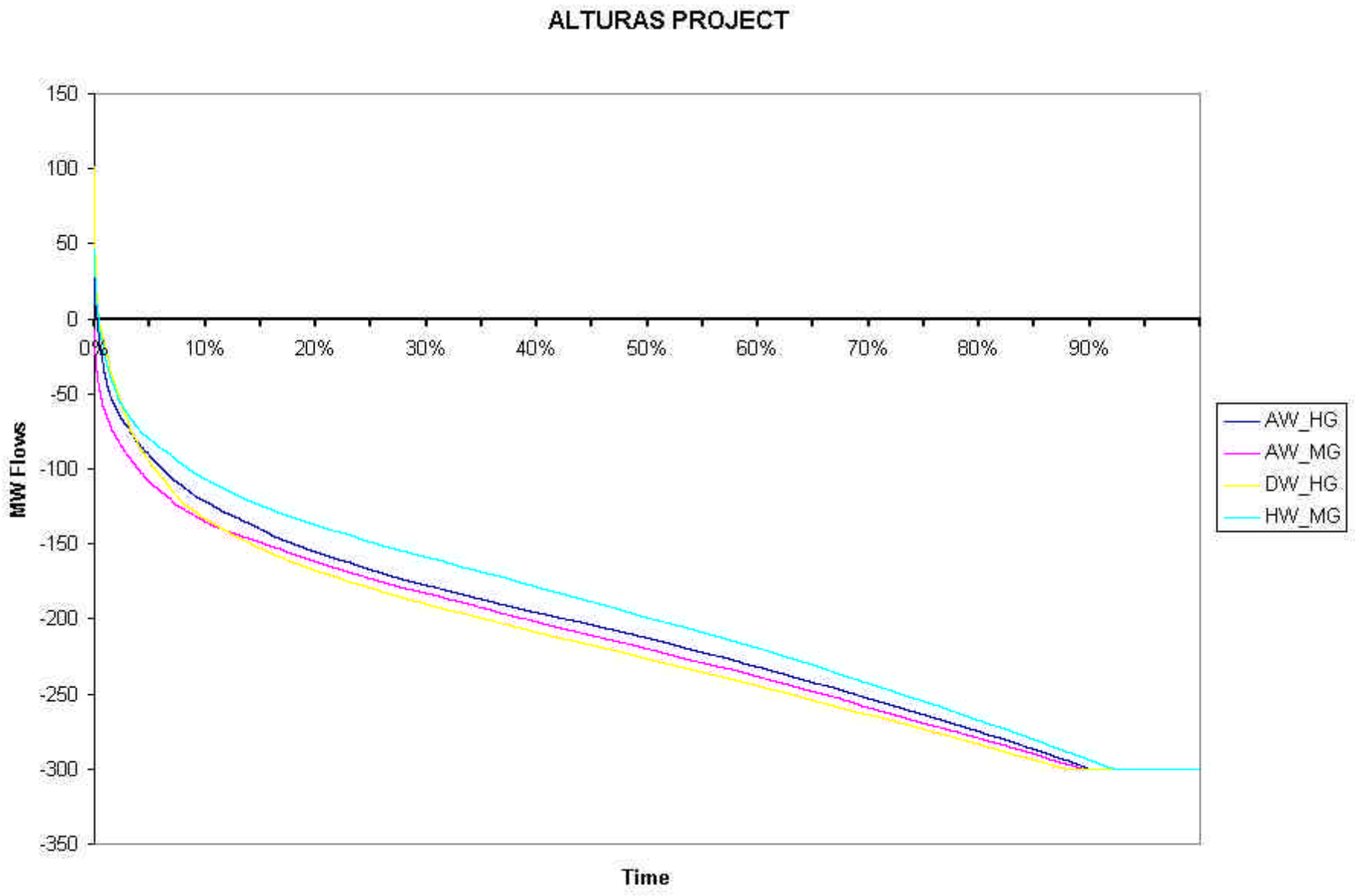

COMBINED PACI & PDCI
10000
8000
6000
4000
2000
0
-2000
-4000
-6000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG


SW OF FOUR CORNERS
2500
2000
1500
1000
500
0
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG


TOT 2C
400
300
200
100
0
-100
-200
-300
-400
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG


IDAHO - MONTANA
400
300
200
100
0
-100
-200
-300
-400
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG


PG&E - SPP
200
150
100
50
0
-50
-100
-150
-200
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_MG
DW_HG
HW_MG


ALTURAS PROJECT
150
100
50
0
-50
-100
-150
-200
-250
-300
-350
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
MW Flows
Time
AW_HG
AW_MG
DW_HG
HW_MG

Economic Analysis

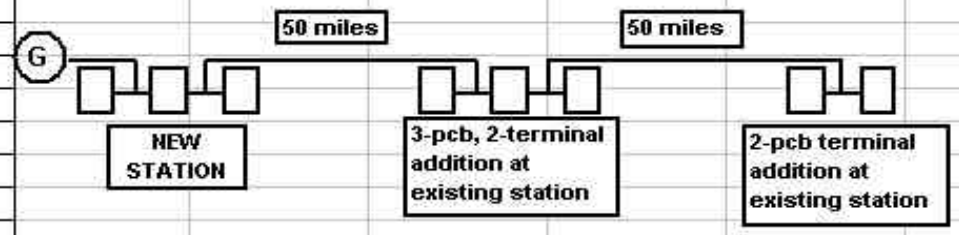
Seams Steering Group of the Western Interconnection

Caveat: For discussion purposes only and not to be construed as final.

Transmission Cost Estimate

			Miles				
	Initial Cost	Cost/mile	100	150	200	250	300
500kV sc steel, 3-deschutes		$1,000,000	$100,000,000	$150,000,000	$200,000,000	$250,000,000	$300,000,000
Land		$250,000	$25,000,000	$37,500,000	$50,000,000	$62,500,000	$75,000,000
Environmental (NEPA)		$10,000	$1,000,000	$1,500,000	$2,000,000	$2,500,000	$3,000,000
Fiber		$50,000	$5,000,000	$7,500,000	$10,000,000	$12,500,000	$15,000,000
New 3-PCB 500 kV station at generator	$8,000,000		$8,000,000	$8,000,000	$8,000,000	$8,000,000	$8,000,000
3-PCB, 2-terminal addition at intermediate sub	$3,750,000		$3,750,000	$7,500,000	$11,250,000	$15,000,000	$18,750,000
2-PCB terminal addition at existing sub	$2,500,000		$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000
RAS & Communications	$5,000,000	$500,000	$5,000,000	$5,500,000	$6,000,000	$6,500,000	$7,000,000
400 mvar Shunt Capacitor Addition	$3,500,000		$3,500,000	$3,500,000	$7,000,000	$7,000,000	$10,500,000
	Total Direct Cost		$153,750,000	$223,500,000	$296,750,000	$366,500,000	$439,750,000
	Corporate OH - 30%		$46,125,000	$67,050,000	$89,025,000	$109,950,000	$131,925,000
	Total Costs with OH		**$199,875,000**	**$290,550,000**	**$385,775,000**	**$476,450,000**	**$571,675,000**
	Total Costs/Mile with OH		**$1,998,750**	**$1,937,000**	**$1,928,875**	**$1,905,800**	**$1,905,583**

Assumptions
Typical line segment length 50 miles between stations
New 3-PCB substation at generation.
3-breaker, 2 terminal addition at intermediate stations
2-breaker terminal addition at existing substation
Varied terrain & ownership
400mvar shunt cap addition per 100 miles of line



SSGwi

Seams Steering Group of the Western Interconnection

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Which is the appropriate cash flow to consider?

Loads priced at bus LMP

Savings from total operating costs

Net load savings, generation revenue change less VOM savings

	Gas	Coal	Renewables
Load Savings - LMP Value (K$)			
AW_HG	$9,836,290	$12,172,748	$11,350,104
AW_MG	$7,609,243	$9,044,165	$8,627,772
LW_HG	$10,682,561	$11,757,399	$11,644,554
HW_MG	$7,062,133	$9,223,005	$8,294,595
VOM Savings (K$)			
AW_HG	$2,398,114	$7,129,701	$5,604,018
AW_MG	$1,769,452	$4,827,911	$3,944,986
LW_HG	$2,826,323	$7,647,678	$6,104,086
HW_MG	$1,530,542	$4,499,287	$3,653,070
Net Benefit - LMP & VOM Values (K$)			
AW_HG	$2,728,446	$5,399,556	$5,524,142
AW_MG	$2,067,967	$3,901,208	$4,005,113
LW_HG	$3,169,672	$5,801,633	$6,192,500
HW_MG	$1,869,947	$3,634,744	$3,684,292
Generation (cash flow contribution?)			
Capital Costs	**($20,084,800,000)**	**($47,254,000,000)**	**($43,472,400,000)**
Transmission	($2,640,000,000)	($16,744,000,000)	($6,708,000,000)
Generation	($17,444,800,000)	($30,510,000,000)	($36,764,400,000)
Payback (yrs) **Which of the above casflow should be used?)**			
Load Savings			
AW_HG	2.04	3.88	3.83
AW_MG	2.64	5.22	5.04
LW_HG	1.88	4.02	3.73
HW_MG	2.84	5.12	5.24
VOM Savings			
AW_HG	8.38	6.63	7.76
AW_MG	11.35	9.79	11.02
LW_HG	7.11	6.18	7.12
HW_MG	13.12	10.50	11.90
Net Benefit			
AW_HG	7.36	8.75	7.87
AW_MG	9.71	12.11	10.85
LW_HG	6.34	8.14	7.02
HW_MG	10.74	13.00	11.80