Appendix D1

SSG-WI Transmission Study

August 21, 2003

Scenarios Included in Study

2008 Simulation

↓

Generation Under Construction

↓

6 Gas/Hydro Sensitivities

	High Hydro	Average Hydro	Low Hydro
High Gas		†	†
Average Gas	†	†	
Low Gas	†	†	

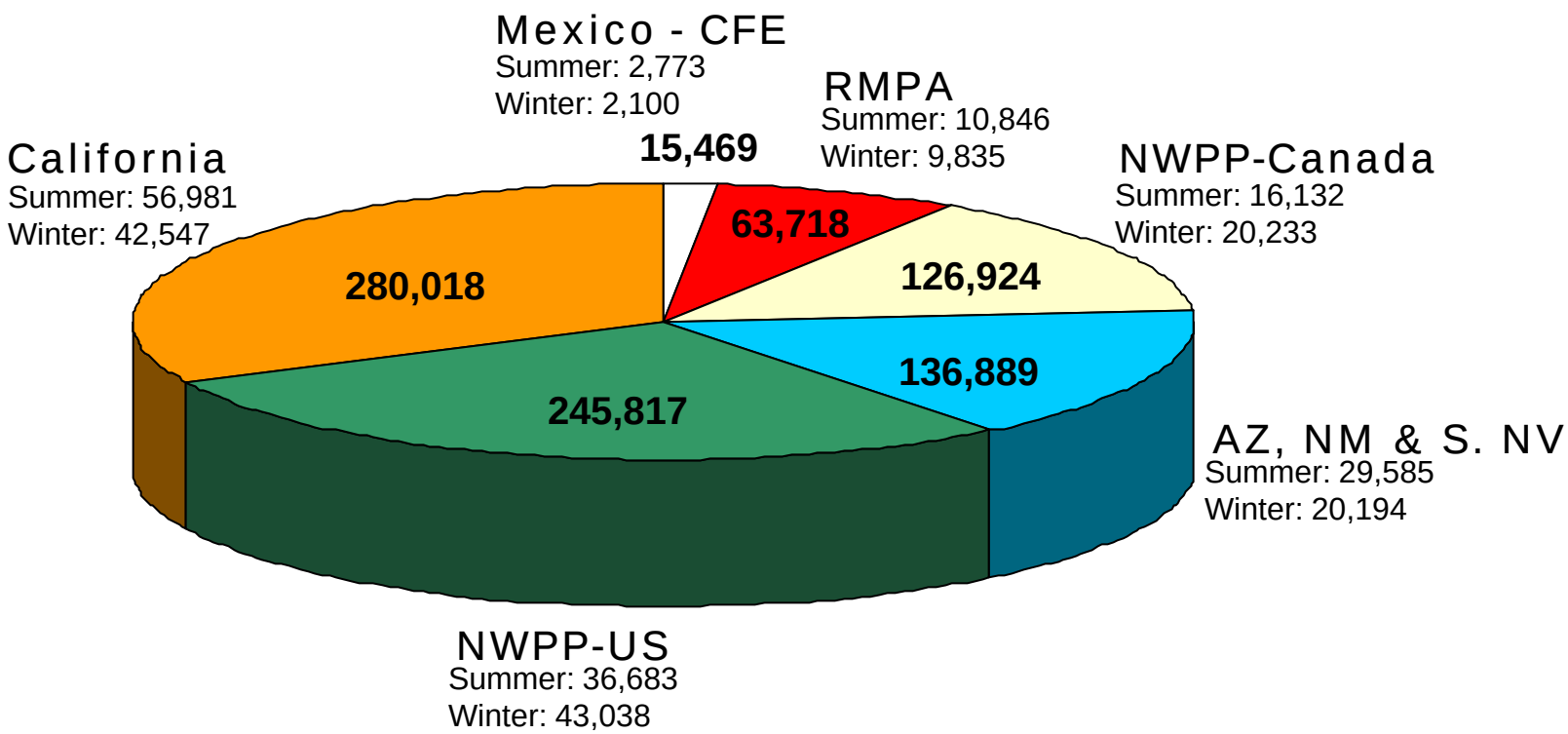
Optional

Base Case Assumption 2008

#	Assumption	Consensus Status	Assumption Description
1	**Study Period**	✍	**2008 and 2013 (next phase)**
2	**Inflation Rate**	✍	**2.5%**
3	**Operational Costs (Representative)**	✍	**Existing & New Resources (Fuel & Variable O&M)**
4	**2008 Resource Additions**	✍	**Includes (35,458 MW) plants online between 1/1/00 and 1/1/04 plus (3,235) on line by 7/1/05; total 38,693MW**
5	**Transmission Additions**	✍	**Starts with WECC 2008 LS case, modified per operator requests.**
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**	✍	**Starts with WECC 2008 LS case, modified per operator requests.**
10	**Transmission Path Ratings & Nomograms**	✍	**WECC Path Rating Catalogue (Spring 2003), modified per Operator request.**
11	**Gas Prices**	✍	**High, Medium, Low based on SSG-WI assessment of forecasts**
12	**WECC Region Loads**	✍	**WECC 2002 Regional Forecasts with modifications**
13	**Average Annual Load Growth**	✍	**WECC 2002 Regional Forecasts with modifications**
16	**Renewable Resources**	✍	**Incremental wind additions (2000 – 2004)**
17	**Thermal Plants**	✍	**Base plants on line by 1/1/00**
18	**Maintenance Outages**	✍	**Numbers based on the TCA cost benefit study for RTO west**

Loads by WECC Region

Annual GWh with Summer & Winter Peaks



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%

Total Resources - 2008 (MW)

	Coal	Geo & Bio	Wind	Solar	New CCCT Gas Fire HtRt <7500	Older Gas	Nuclear	Other	Hydro & PS	Total Area
Model Areas										
ALBERTA	5,898	0	150	0	2,441	1,712	0	41	843	**11,085**
AQUILA	0	0	0	0	0	0	0	0	590	**590**
ARIZONA	7,351	0	0	0	6,558	3,208	3,733	0	462	**21,312**
B.C.HYDR	0	0	0	0	250	2,000	0	60	10,031	**12,341**
IDAHO	2,110	0	0	0	0	0	0	0	1,792	**3,902**
IMPERIAL	0	283	0	0	78	295	0	50	50	**756**
LADWP	1,710	0	0	0	574	2,801	0	0	1,260	**6,345**
MEXICO-C	0	675	0	0	1,100	953	0	0	0	**2,728**
MONTANA	2,311	0	0	0	0	0	0	39	573	**2,923**
NEVADA	595	0	0	0	3,022	1,128	0	0	0	**4,745**
NEW MEXI	1,885	0	200	0	0	1,125	0	0	82	**3,292**
NORTHWES	1,938	0	650	0	4,354	1,935	1,170	272	31,980	**42,299**
PACE	4,612	23	150	0	0	580	0	53	518	**5,936**
PG AND E	90	985	400	0	7,474	8,062	2,192	275	9,252	**28,730**
PSCOLORA	2,607	0	200	0	913	3,020	0	0	521	**7,261**
SANDIEGO	0	0	0	0	764	2,242	0	0	0	**3,006**
SIERRA	532	47	0	0	0	1,010	0	100	16	**1,705**
SOCALIF	1,677	56	1,050	0	2,678	10,237	2,167	0	2,040	**19,905**
WAPA L.C	0	0	0	0	2,227	0	0	0	3,379	**5,606**
WAPA R.M	3,546	0	0	0	480	1,037	0	0	1,225	**6,288**
WAPA U.M	0	0	0	0	0	0	0	0	0	**0**
Total By type	**36,862**	**2,069**	**2,800**	**0**	**32,913**	**41,345**	**9,262**	**890**	**64,614**	**190,755**
2000 Base	36,571	2,069	1,200	0	3,045	41,345	9,262	890	64,614	**158,996**
Additions by Type	291	0	1,600	0	29,868	0	0	0	0	31,759

Thermal Plant by Technology

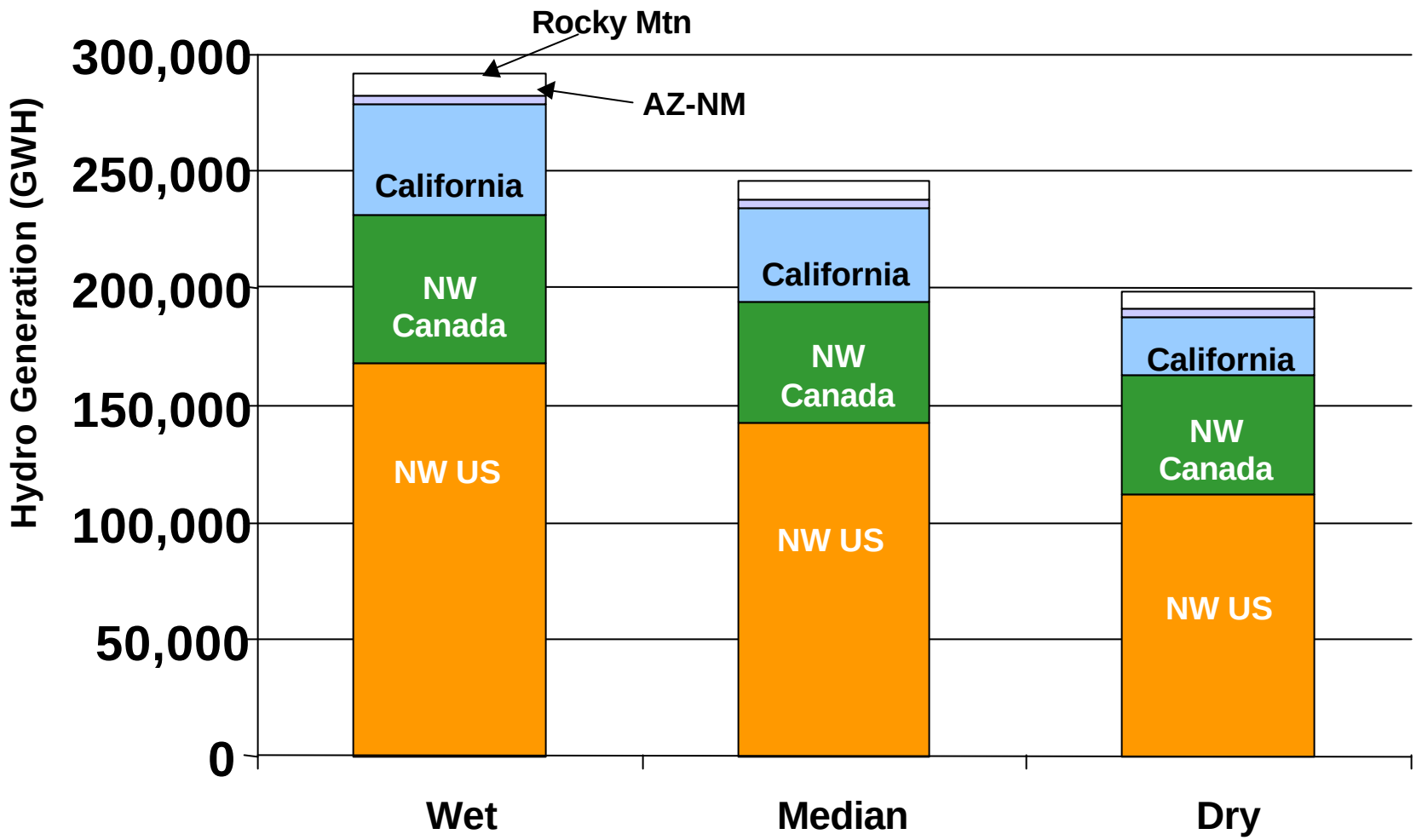
	Nuclear	Coal	Geothermal	New CCCT Gas Fire	Older CCCT Gas (or Oil)	"Good" SCCT/ST	HHR SCCT/ST	Other	Total Area
				HtRt <7500	ca. 9300	9500-10500	> 10500		
Model Areas									
ALBERTA	0	5,898	0	2,441	0	1,417	295	41	**10,092**
AQUILA	0	0	0	0	0	0	0	0	**0**
ARIZONA	3,733	5,311	0	7,568	776	877	1,555	0	**19,820**
B.C.HYDR	0	0	0	250	0	1,000	1,000	60	**2,310**
IDAHO	0	2,110	0	0	0	0	0	0	**2,110**
IMPERIAL	0	0	283	78	295	0	0	50	**706**
LADWP	0	1,710	0	574	0	2,370	431	0	**5,085**
MEXICO-C	0	0	675	1,100	428	465	60	0	**2,728**
MONTANA	0	2,311	0	0	0	0	0	39	**2,350**
NEVADA	0	595	0	3,022	298	603	227	0	**4,745**
NEW MEXI	0	1,885	0	0	0	713	412	0	**3,010**
NORTHWES	1,170	1,938	0	4,354	495	812	628	272	**9,669**
PACE	0	4,612	23	0	0	345	235	53	**5,268**
PG AND E	2,192	90	985	7,474	372	6,222	1,468	275	**19,078**
PSCOLORA	0	1,938	0	913	19	3,392	278	0	**6,540**
SANDIEGO	0	0	0	764	65	1,788	539	0	**3,156**
SIERRA	0	532	47	0	20	978	12	100	**1,689**
SOCALIF	2,167	97	56	2,303	1,176	6,294	2,767	0	**14,860**
WAPA L.C	0	0	0	1,710	0	0	0	0	**1,710**
WAPA R.M	0	3,546	0	480	116	778	143	0	**5,063**
WAPA U.M	0	0	0	0	0	0	0	0	**0**
Total By type	**9,262**	**32,573**	**2,069**	**33,031**	**4,060**	**28,054**	**10,050**	**890**	**119,989**

Resource Addition since 1/1/2000

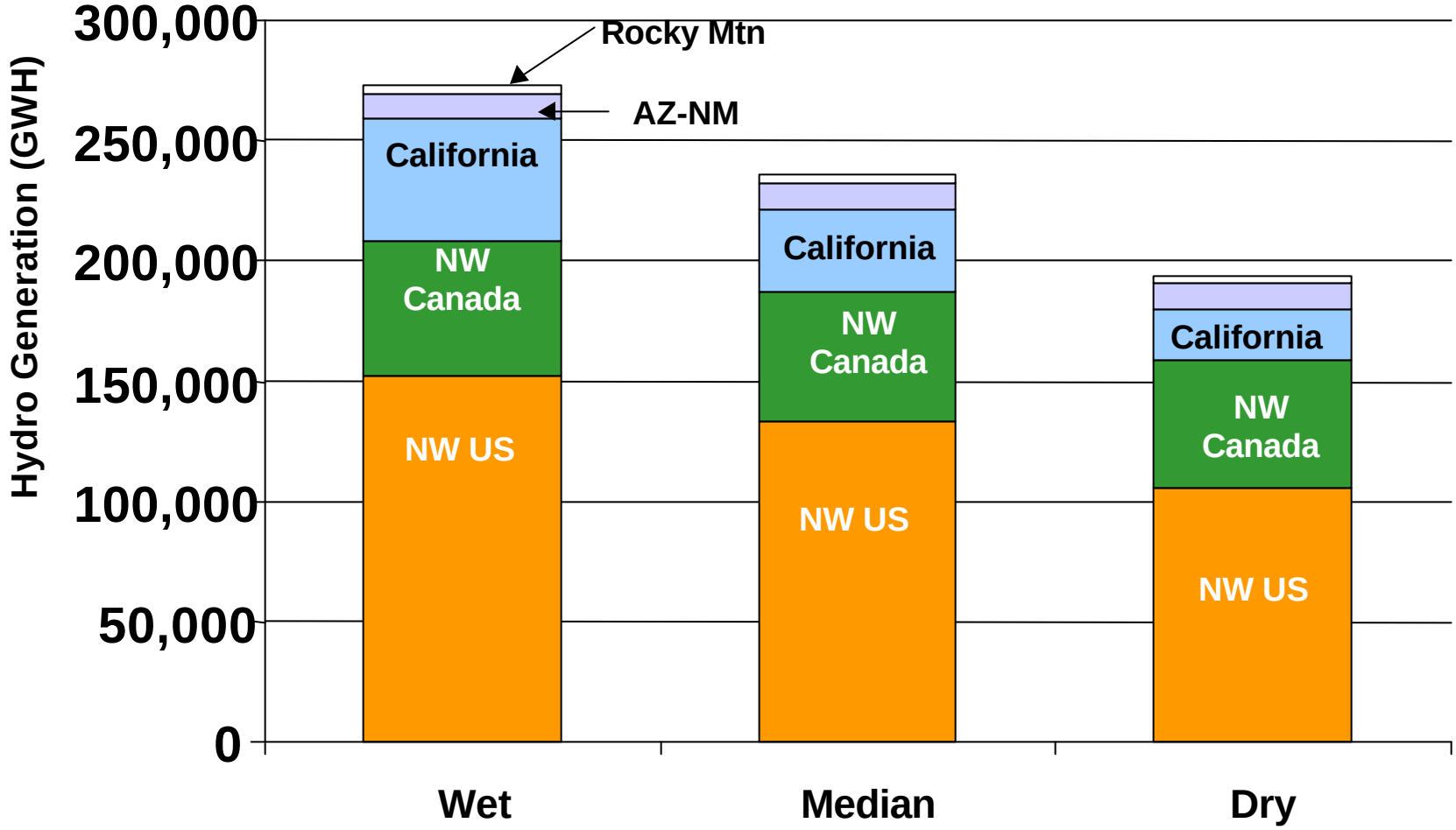
Facility	Location	Technology	Fuel Type	# of Units	Output (MW)	Est Online Date
On or before 1/1/04					**35,458**	**1/1/2004**
Silver Hawk	Nevada	Combined	Gas	0	570	5/1/2004
Pastoria Phase 2	California	Combined	Gas	0	500	6/1/2004
Grande Prairie	Canada - Alberta		WoodWaste	0	25	6/1/2004
Metcalf Energy Center	California	Combined	Gas	2-2-1	600	12/1/2004
Otay Mesa	California	Combined	Gas	2-2-2	510	12/1/2004
Sundance Upgrade II	Canada - Alberta		Coal	0	100	12/1/2004
Contra Costa	California	Combined	Gas	2-2-1	530	6/1/2005
Genesee Phase 3	Canada - Alberta		Coal	1	400	7/1/2005
Total Conventional Thermal Additions					**38,693**	

Sum of Output (MW)	Fuel Type					
Technology	Coal	FO2	Gas	Geothermal	Woodwaste	Grand Total
Biomass					10	10
Cogeneration		20	876			896
Combined			25,022			25,022
Combustion			132			132
Geothermal				112		112
Simple			3,958			3,958
(blank)	1,014		7,465	59	25	8,563
Grand Total	1,014	20	37,453	171	35	38,693

WGA Hydro Modeling



SSG-WI Hydro Modeling



Hydro Modeling

- Algorithm used for hydro shaping is a mix of peak shaving and "pseudo" run of the river
  - The run-of-river hydro energy was modeled as base energy
  - Dispatchable "monthly" hydro energy dispatched to shave peak load
  - Hydro stations are scheduled one at a time over the horizon of the week, subject to hourly constraints for minimum and maximum generation, and weekly constraints for ramp rates, and total energy
- Peak Shaving is common to many Production Cost Models

Renewable Resources

2008 Wind

Name	Area	MW
Thch_Wd1	SOCALIF	400
SnGrgnWd	SOCALIF	350
AltmntWD	PG AND E	200
SolanoWd	PG AND E	200
Thch_Wd2	SOCALIF	300
NM_Wind	NEW MEXI	200
NW_Wind	NORTHWES	650
Wy_Wind	PACE	150
Albrt_Wd	ALBERTA	150
CO_Wind	PSCOLORA	200
	Total MW	2,800

Maintenance Outages

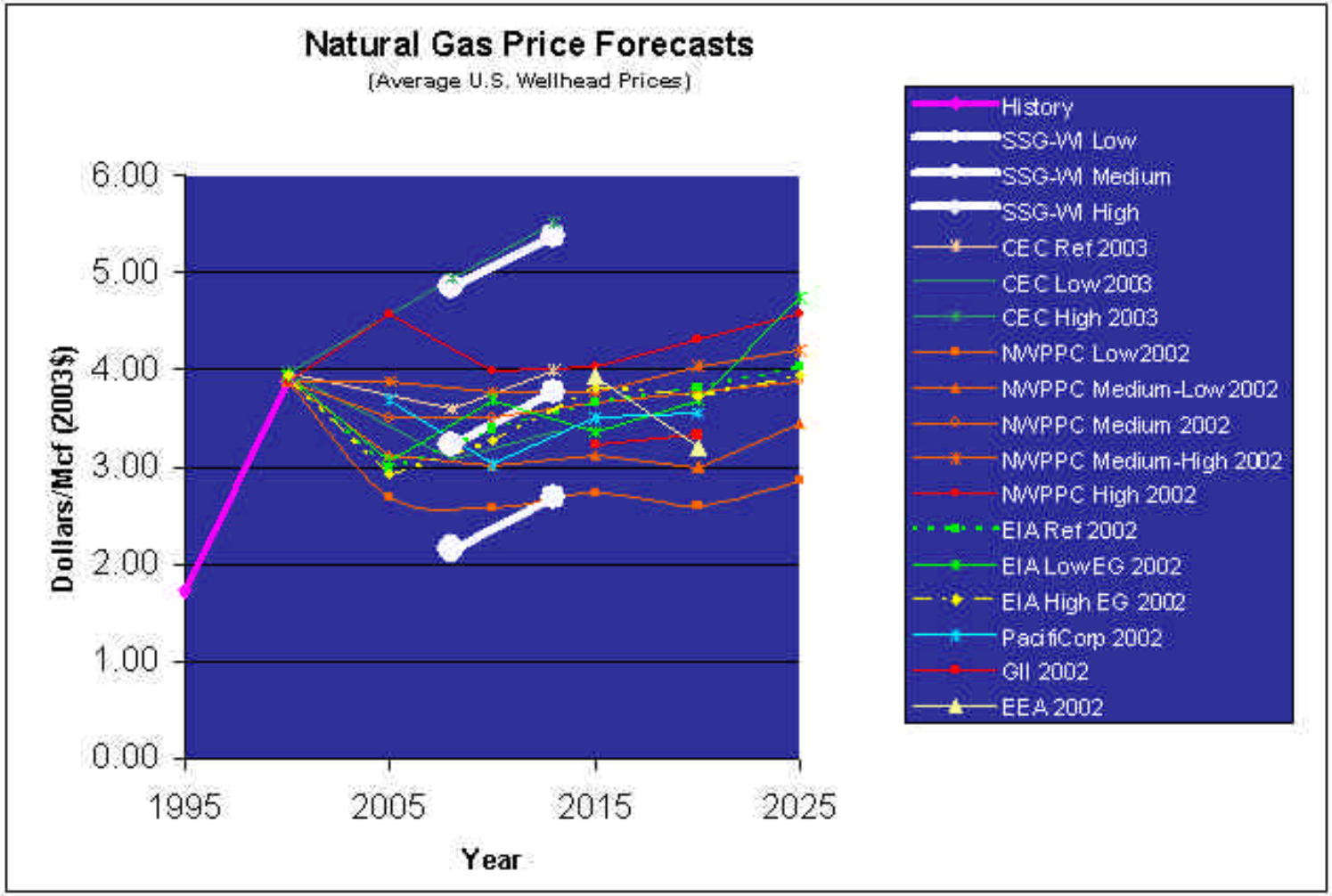
- Used the values from the old TCA report (% year, very approximately)

Unit Type	%
Combined Cycle	7%
CT	7%
Coal Plant	10%
Steam Oil/Gas	10%
Nuclear	12%
Geothermal	10%

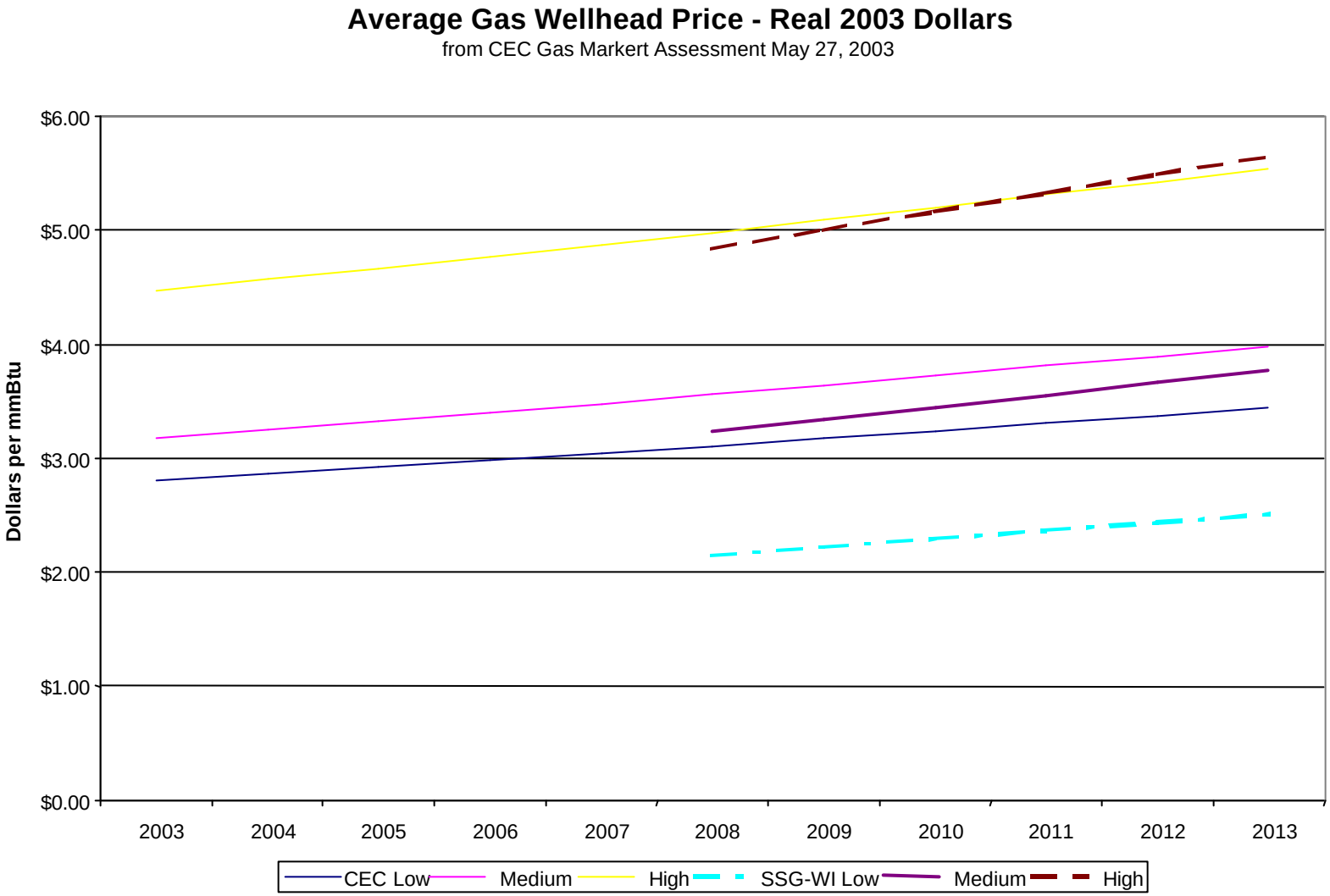
Burner Tip Gas Prices

Burner Tip Gas Prices		2008 National Wellhead Price		
Real 2003 Dollars		Low	Medium	High
	$/mmbtu	$2.15	$3.23	$4.85
	4% Fuel	$0.09	$0.14	$0.21
Wellhead & Fuel		$2.25	$3.37	$5.05
Area	Delivery & Basis			
NEW MEXICO	$0.20	$2.45	$3.57	$5.26
ARIZONA	$0.29	$2.54	$3.66	$5.35
NEVADA	$0.30	$2.55	$3.67	$5.36
WAPA L.C.	$0.29	$2.54	$3.66	$5.35
MEXICO-CFE	$0.58	$2.83	$3.95	$5.64
IMPERIALCA	$0.30	$2.55	$3.67	$5.36
SANDIEGO	$0.54	$2.79	$3.91	$5.59
SOCALIF	$0.58	$2.83	$3.95	$5.64
LADWP	$0.63	$2.87	$4.00	$5.68
PG AND E	$0.54	$2.79	$3.91	$5.59
NORTHWEST	$0.28	$2.53	$3.65	$5.33
B.C.HYDRO	-$0.12	$2.13	$3.25	$4.94
AQUILA	-$0.25	$2.00	$3.12	$4.81
ALBERTA	-$0.36	$1.89	$3.01	$4.70
IDAHO	$0.08	$2.32	$3.45	$5.13
MONTANA	$0.05	$2.30	$3.42	$5.11
WAPA U.M.	$0.05	$2.30	$3.42	$5.11
SIERRA	$0.44	$2.69	$3.81	$5.50
PACE	$0.08	$2.32	$3.45	$5.13
PSCOLORADO	$0.24	$2.48	$3.61	$5.29
WAPA R.M.	$0.24	$2.48	$3.61	$5.29
Eastside PNW	$0.08	$2.32	$3.45	$5.13
Highest Priced Region		$2.87	$4.00	$5.68
Lowest Priced Region		$1.89	$3.01	$4.70

Gas Prices

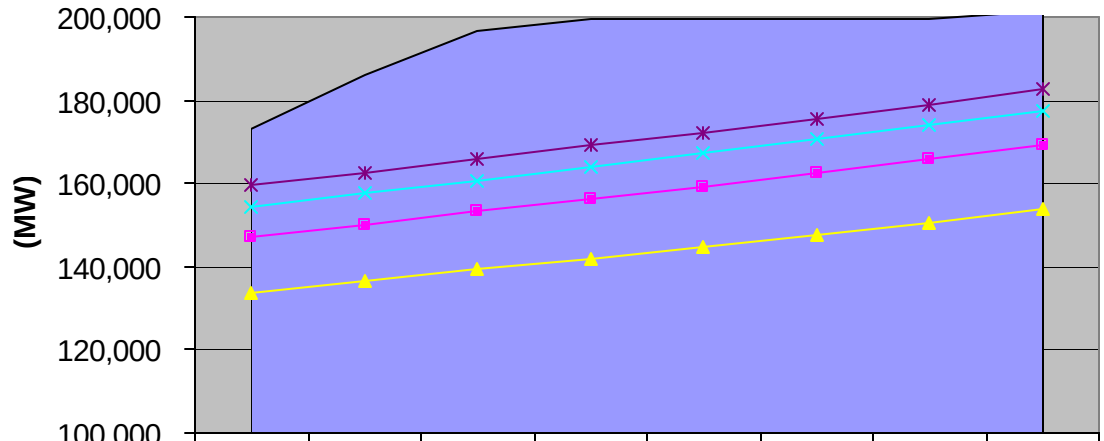

Natural Gas Price Forecasts
(Average U.S. Wellhead Prices)
Dollars/Mcf (2003$)
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1995
2005
2015
2025
Year
History
SSG-WI Low
SSG-WI Medium
SSG-WI High
CEC Ref 2003
CEC Low 2003
CEC High 2003
NWPPC Low 2002
NWPPC Medium-Low 2002
NWPPC Medium 2002
NWPPC Medium-High 2002
NWPPC High 2002
EIA Ref 2002
EIA Low EG 2002
EIA High EG 2002
PacifiCorp 2002
GII 2002
EEA 2002

Updated Gas Prices



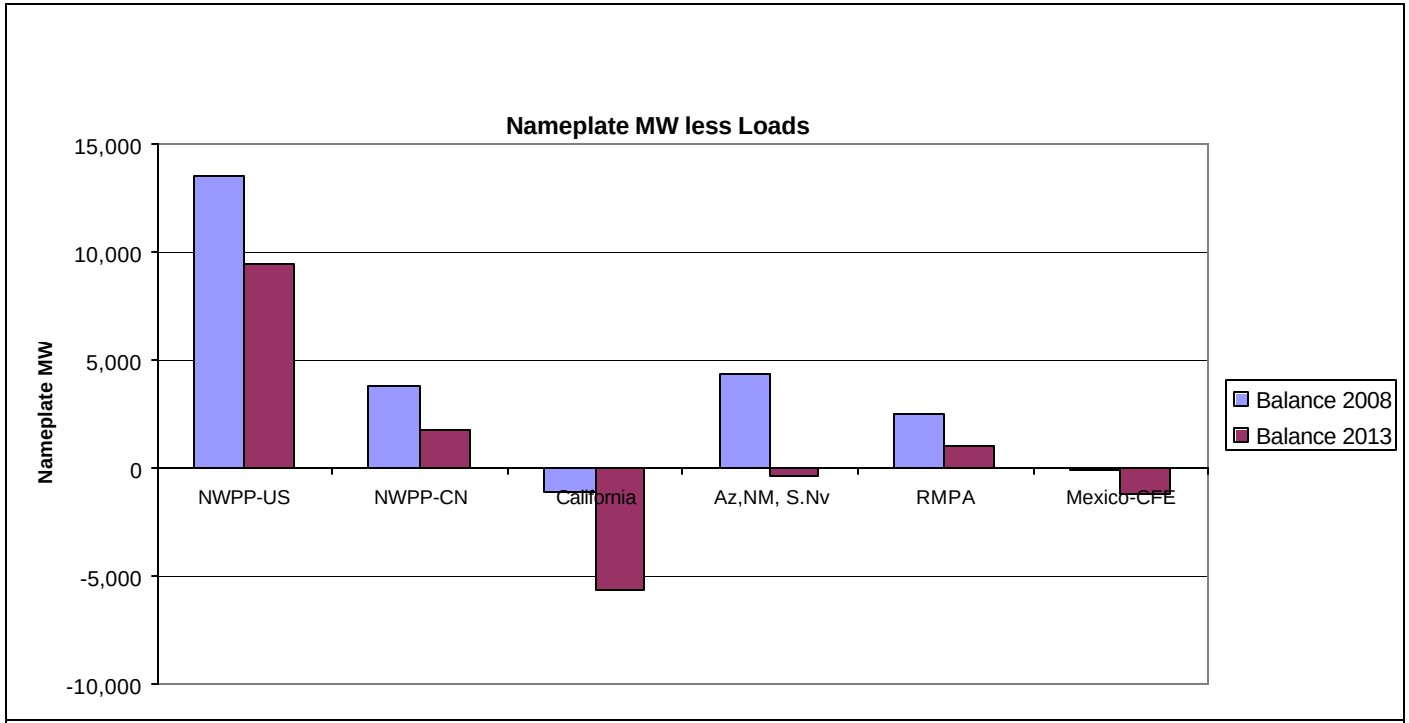
Loads & Resources

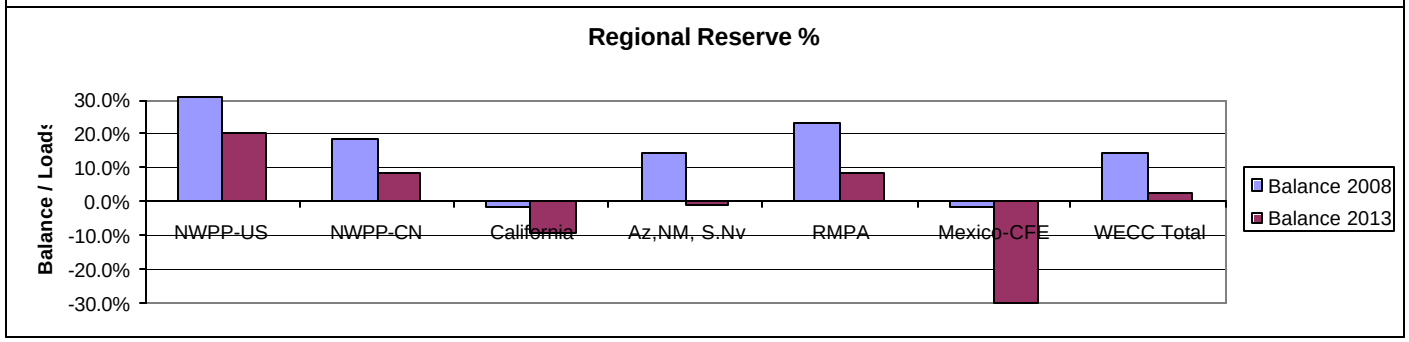
WECC Total
(L: WECC 2002-L&R Report; R: SSG-WI modified)
(without Hydro-capacity derate)



	2002	2003	2004	2005	2006	2007	2008	2009
Resources	173,104	185,920	196,848	199,388	199,388	199,388	199,388	201,588
Plus 5,000 MW Maintenance	159,557	162,649	165,802	169,018	172,298	175,644	179,057	182,538
Pk & 10% Op Res	147,198	150,142	153,144	156,207	159,331	162,518	165,768	169,084
Plus 5% FOR	154,557.48	157,648.63	160,801.60	164,017.63	167,297.99	170,643.95	174,056.83	177,537.96
Summer Pk	133,816	136,492	139,222	142,007	144,847	147,744	150,699	153,713

Position by Region of Plant Location

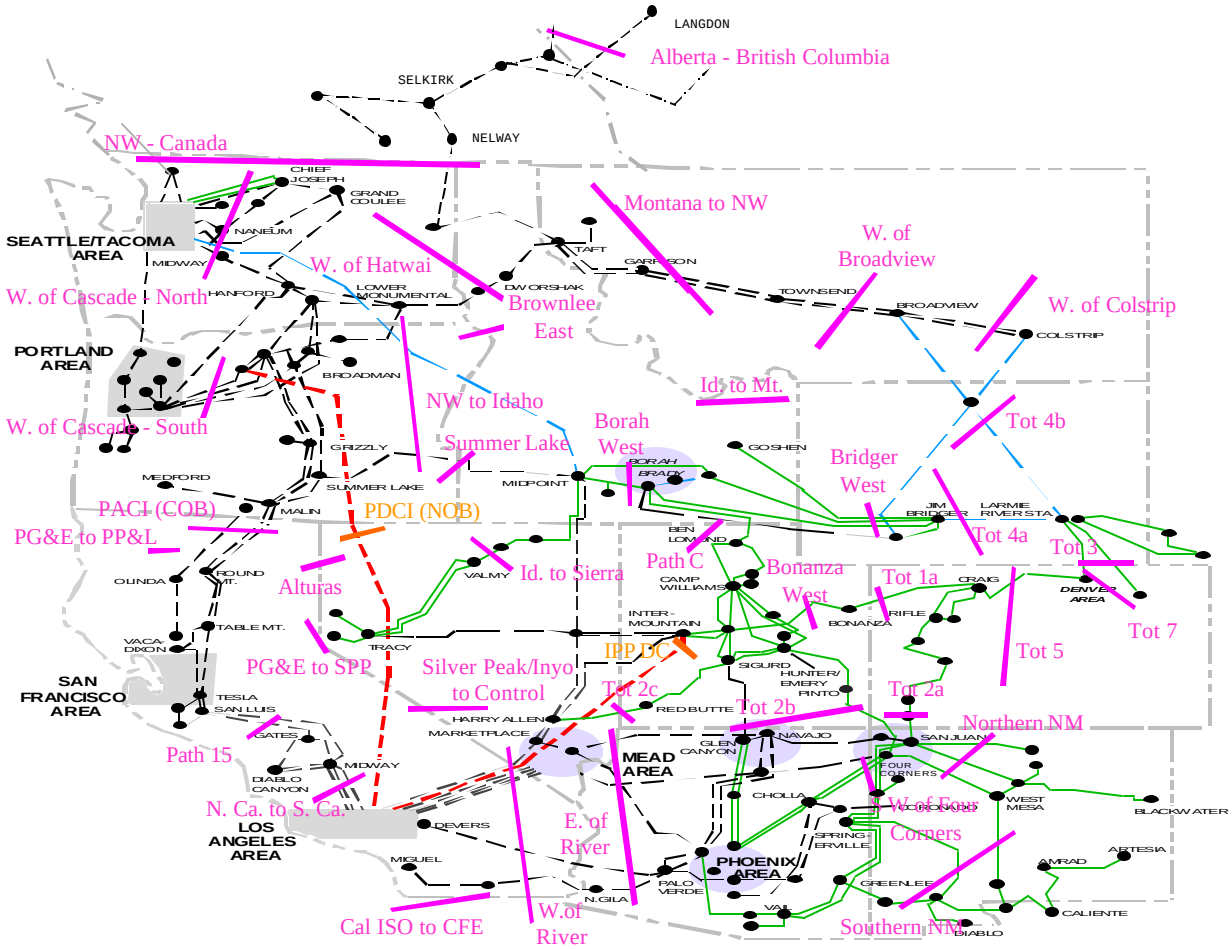




Transmission Topology

- Using the WECC 2008 LS case for system definition
- Using the most recent path rating catalog (2/03) for capacity numbers
- Using modeling Nomograms reflecting system constraints

Western Interconnect Transmission Paths



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

2008 Base Case Results

Results Summary

- Existing WECC Transmission Costs
  - WECC 2008 case shows some bottle-necked inexpensive resources - ~$110 million VOM savings
- Resource Development
  - New resources are mostly gas-fired CCCTs
  - Capacity by fuel type is shifting toward gas, the % change in energy is greater than the rate of capacity increase
- Total VOM Cost Estimates
  - More sensitive to gas price sensitivity as opposed to the gas price scenario than hydro scenario
  - In 2008, for every $1/MMbtu change in gas price, fuel costs in the Western Interconnection change ~$2 billion

Scenarios Result Summary

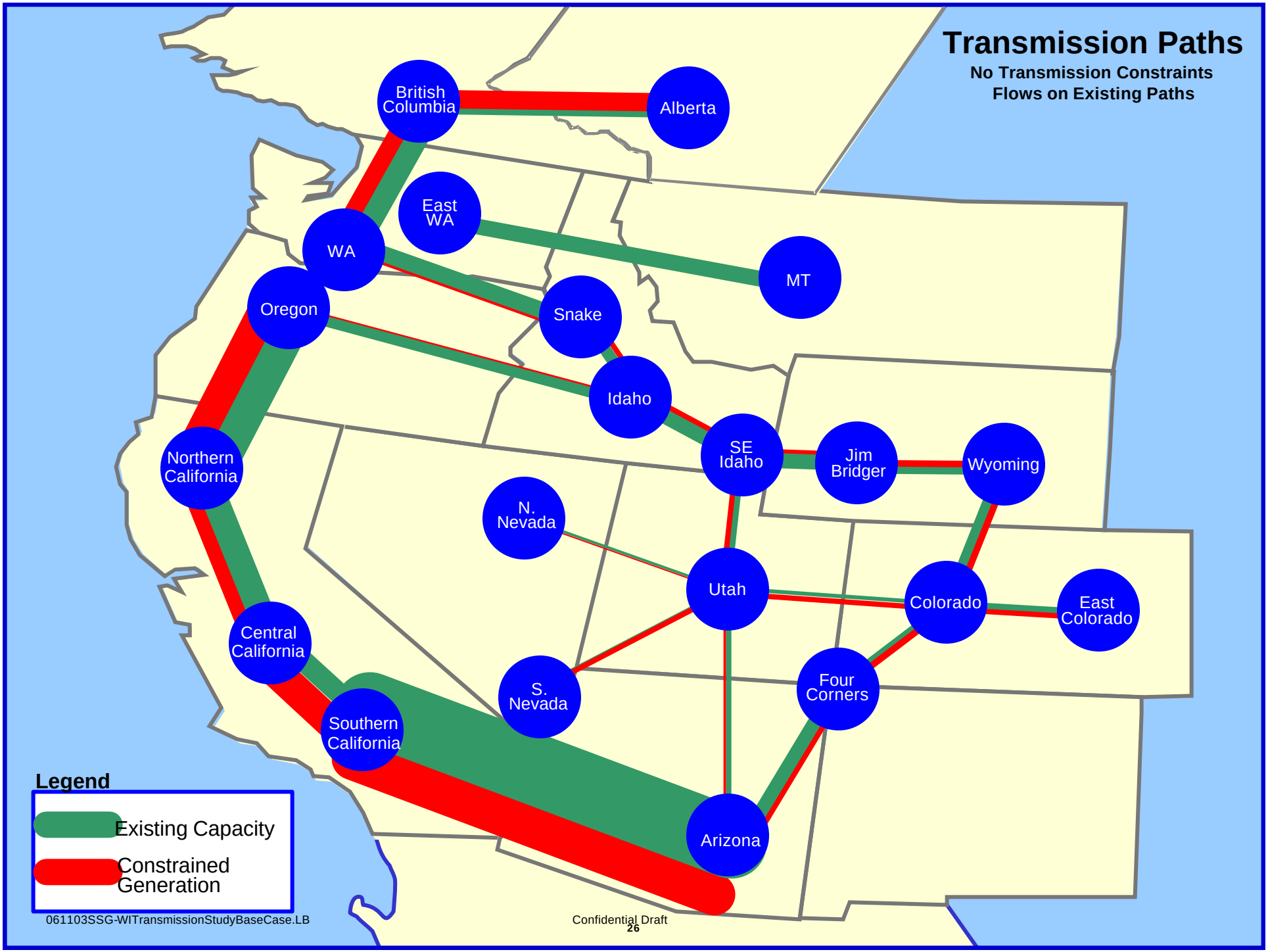
- Determined that Gas has to make-up the difference for Hydro

- Defined the boundaries of usage and their associated costs; specific path usage profile vary depending on:
  - Hydro conditions
  - Gas price sensitivities
  - Location of expected loads and resources

Hydro Results

- LMP differences get muted when looking across varying hydro sensitivities
  - Program just looks at variable costs
  - Does not factor in costs associated with bid behavior

- Plants peak shaving algorithm will spend a considerable percentage of this modeled hours at the minimum output level
  - Hydro regulation min & max MW may be inappropriate; typically not used for many hours of actual hydro operation
  - Peak shaving may underestimate the use of thermal peakers, lowering peak hour LMP estimates


Transmission Paths
No Transmission Constraints
Flows on Existing Paths
British Columbia
Alberta
East WA
WA
MT
Oregon
Snake
Idaho
SE Idaho
Jim Bridger
Wyoming
Northern California
N. Nevada
Utah
Colorado
East Colorado
Central California
S. Nevada
Four Corners
Southern California
Arizona
Legend
Existing Capacity
Constrained Generation
061103SSG-WITransmissionStudyBaseCase.LB
Confidential Draft

Estimated Annual Average LMP - (2003 $)

Estimated Annual Average LMP - 2008 Gas Cases							
	Water Gas Case Average LMP	High Low $22.74	High Medium $30.20	Medium Low $23.85	Medium Medium $32.67	Medium High $46.14	Low High $49.63
Bus LMP less Scenario Average LMP	**Area**						
DEVERS	SOCALIF	$2.45	$3.39	$2.40	$2.94	$3.63	$3.75
VINCENT	SOCALIF	$1.92	$2.94	$1.70	$2.15	$2.65	$2.16
CTY-230	MEXICO-C	$2.80	$4.01	$1.96	$2.06	$1.24	($0.58)
LOSBANOS	PG AND E	$1.30	$2.15	$1.43	$1.80	$2.21	$2.16
TESLA	PG AND E	$1.30	$2.15	$1.43	$1.80	$2.21	$1.99
OLINDA	PG AND E	$1.30	$2.15	$1.34	$1.71	$2.12	$1.90
VICTORVL	LADWP	$1.56	$2.59	$1.34	$1.62	$1.95	$1.10
MIGUEL	SANDIEGO	$1.65	$2.86	$0.99	$1.35	$1.68	$0.13
NILAND	IMPERIAL	$1.03	$1.80	$0.81	$1.00	$1.15	$0.40
WAN230	AQUILA	$1.92	($0.06)	$0.37	$0.56	$0.80	$3.93
MCA500	B.C.HYDR	$1.12	($0.41)	$0.37	$0.47	$0.62	$3.14
ELCENTRO	IMPERIAL	$0.68	$1.44	$0.28	$0.38	$0.27	($0.93)
GONDER	SIERRA	$0.32	$0.38	$0.28	$0.38	$0.27	$0.40
ING500	B.C.HYDR	$0.85	($0.50)	$0.37	$0.38	$0.53	$2.96
MALIN	NORTHWES	($0.03)	($0.68)	$0.37	$0.38	$0.36	$1.72
ALVEY	NORTHWES	($0.12)	($0.68)	$0.37	$0.29	$0.36	$1.63
CHIEF JO	NORTHWES	($0.12)	($0.77)	$0.37	$0.29	$0.27	$1.63
JOHN DAY	NORTHWES	($0.12)	($0.68)	$0.37	$0.29	$0.36	$1.63
FTLUPTON	PSCOLORA	$0.94	$1.80	$0.28	$0.20	$0.18	($1.64)
COLSTRP	MONTANA	($0.47)	($1.03)	$0.19	$0.03	($0.18)	($0.05)
ROSEBUD	WAPA U.M	($0.56)	($1.12)	$0.11	($0.06)	($0.35)	($0.22)
MONA	PACE	$0.06	$0.12	($0.07)	($0.15)	($0.35)	($0.84)
H ALLEN	NEVADA	$0.24	$0.91	($0.25)	($0.24)	($0.44)	($2.08)
MARKETPL	LADWP	$0.32	$1.00	($0.16)	($0.24)	($0.35)	($1.99)
MEAD	WAPA L.C	$0.24	$0.91	($0.25)	($0.33)	($0.44)	($2.17)
AULT	WAPA R.M	$0.24	$0.38	($0.07)	($0.41)	($0.62)	($1.99)
CRAIG	WAPA R.M	$0.06	$0.29	($0.16)	($0.41)	($0.71)	($1.99)
WESTMESA	NEW MEXI	($0.03)	$0.47	($0.51)	($0.77)	($1.15)	($2.79)
MOENKOPI	ARIZONA	$0.06	$0.56	($0.51)	($0.86)	($1.15)	($2.96)
BRIDGER	IDAHO	($0.65)	($1.30)	($0.34)	($1.03)	($1.15)	($2.26)
HASSYAMP	ARIZONA	($0.29)	$0.29	($0.87)	($1.12)	($1.50)	($3.49)
PALOVRDE	ARIZONA	($0.29)	$0.29	($0.87)	($1.12)	($1.50)	($3.49)
LANGDON2	ALBERTA	($4.18)	($3.95)	($5.11)	($5.10)	($5.30)	($7.47)
RUTH LK1	ALBERTA	($4.18)	($3.95)	($5.11)	($5.10)	($5.30)	($7.47)

Shadow Prices - (2003 $)

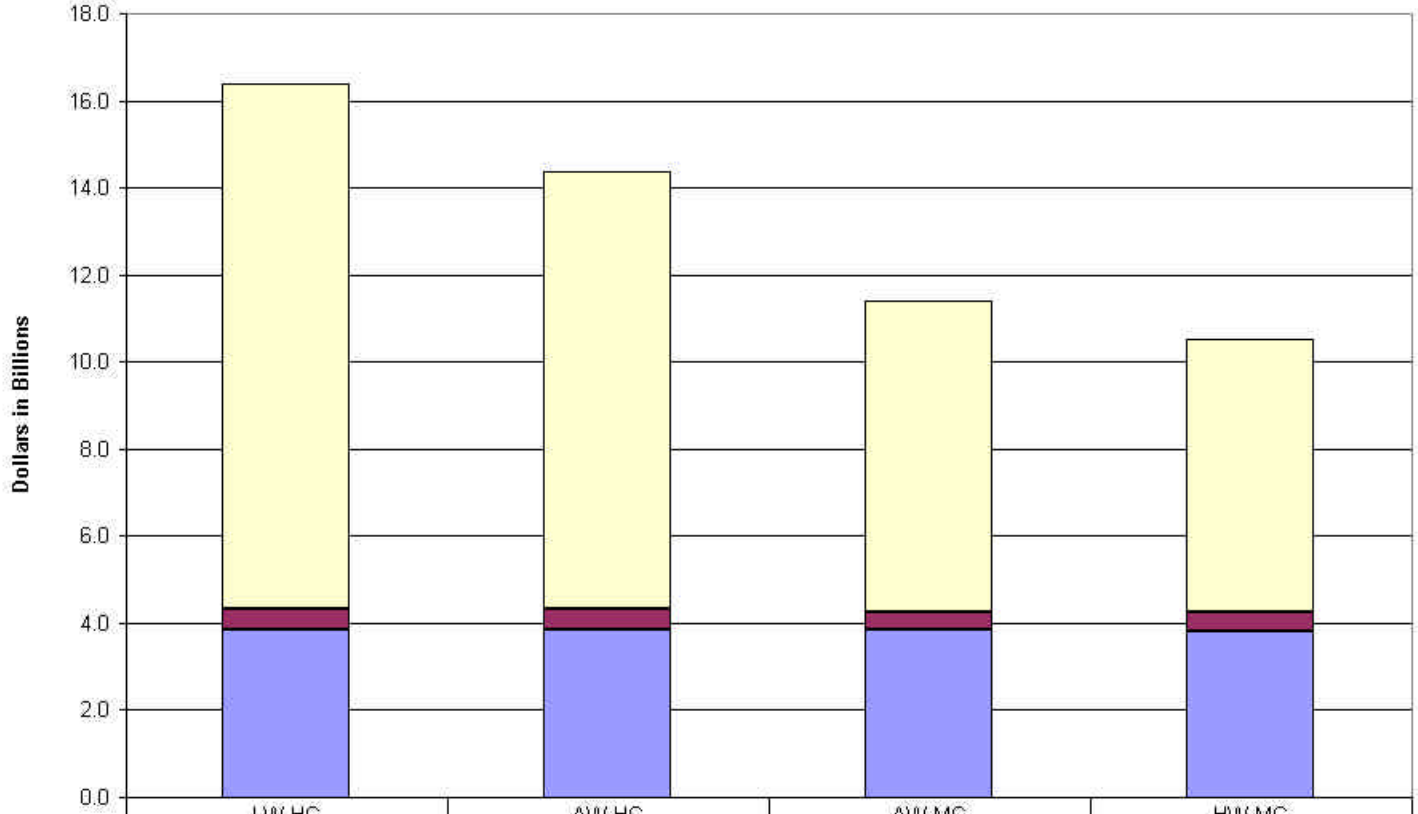
Interfaces	Fwd Direction Expansion/MW Shadow Price					
	Costs - AW_Low Gas	Costs - AW_Avg Gas	Costs - AW_High Gas	Costs - HW_Low Gas	Costs - LW_High Gas	Costs - HW_Avg Gas
WOR - PV to Devers	$47,973	$53,362	$70,412	$37,072	$100,032	$40,892
ALBERTA - BRITISH COLUMBIA	$48,631	$49,414	$53,498	$51,079	$77,457	$53,905
WOR -n- El Dor to Lugo	$25,033	$31,844	$40,559	$18,152	$61,004	$23,361
SOUTHERN NEW MEXICO (NM1)	$10,729	$16,203	$23,479	$12,875	$19,688	$19,515
CA INDEPENDENT - MEXICO (CFE)	$13,281	$13,260	$6,488	$14,909	$4,257	$16,517
BRIDGER WEST	$5,841	$12,624	$12,386	$5,398	$25,526	$11,992
TOT 3	$8,227	$9,931	$13,035	$17,907	$1,412	$26,441
PACI vs PDCI	$5,452	$8,382	$10,705	$8,557	$139	$14,975
TOT 7	$4,909	$7,386	$10,401	$9,767	$4,640	$15,276
NW to Canada, East BC ★	$635	$5,882	$11,633	$43,032	$659	$69,201
North of Miguel	$3,216	$5,086	$8,722	$2,636	$8,595	$4,037
ARIZONA - CALIFORNIA	$1,345	$4,289	$4,818	$759	$5,672	$2,821
COI	$2,655	$3,626	$4,309	$3,377	$189	$5,571
BONANZA WEST	$1,387	$2,723	$3,030	$955	$4,288	$1,818
TOT 2C	$3,871	$2,444	$2,277	$6,008	$1,344	$1,312
Southern CA Imports	$1,968	$2,232	$2,729	$3,249	$363	$4,059
BROWNLEE EAST	$1,239	$1,759	$2,975	$1,372	$0	$1,842
Imp.Valley to Miguel	$1,314	$1,627	$1,276	$3,172	$389	$3,664

	Rev Direction Expansion/MW Shadow Price					
	Costs - AW_Low Gas	Costs - AW_Avg Gas	Costs - AW_High Gas	Costs - HW_Low Gas	Costs - LW_High Gas	Costs - HW_Avg Gas
WOR - PV to Devers	$0	$0	$0	$0	$0	$0
ALBERTA - BRITISH COLUMBIA	$654	$606	$555	$1,610	$145	$1,967
WOR -n- El Dor to Lugo	$0	$0	$0	$0	$0	$0
SOUTHERN NEW MEXICO (NM1)	$0	$0	$0	$0	$0	$0
CA INDEPENDENT - MEXICO (CFE)	$0	$0	$0	$0	$0	$0
BRIDGER WEST	$0	$0	$0	$0	$0	$0
TOT 3	$0	$0	$0	$0	$0	$0
PACI vs PDCI	$0	$0	$0	$0	$0	$0
TOT 7	$0	$0	$0	$0	$0	$0
NW to Canada, East BC	$27	$42	$42	$62	$233	$51
North of Miguel	$0	$0	$0	$0	$0	$0
ARIZONA - CALIFORNIA	$0	$0	$0	$0	$0	$0
COI	$0	$0	$0	$0	$0	$0
BONANZA WEST	$0	$0	$0	$0	$0	$0
TOT 2C	$1,664	$5,243	$1,392	$3,692	$2,235	$4,979
Southern CA Imports	$0	$0	$0	$0	$0	$0
BROWNLEE EAST	$0	$0	$0	$0	$0	$0
Imp.Valley to Miguel	$0	$0	$0	$0	$0	$0

★ Powerflow (data source) modeled Nelway phase shifter at a fixed angle.
The same restriction of action may apply to other phase shifters and control devices.

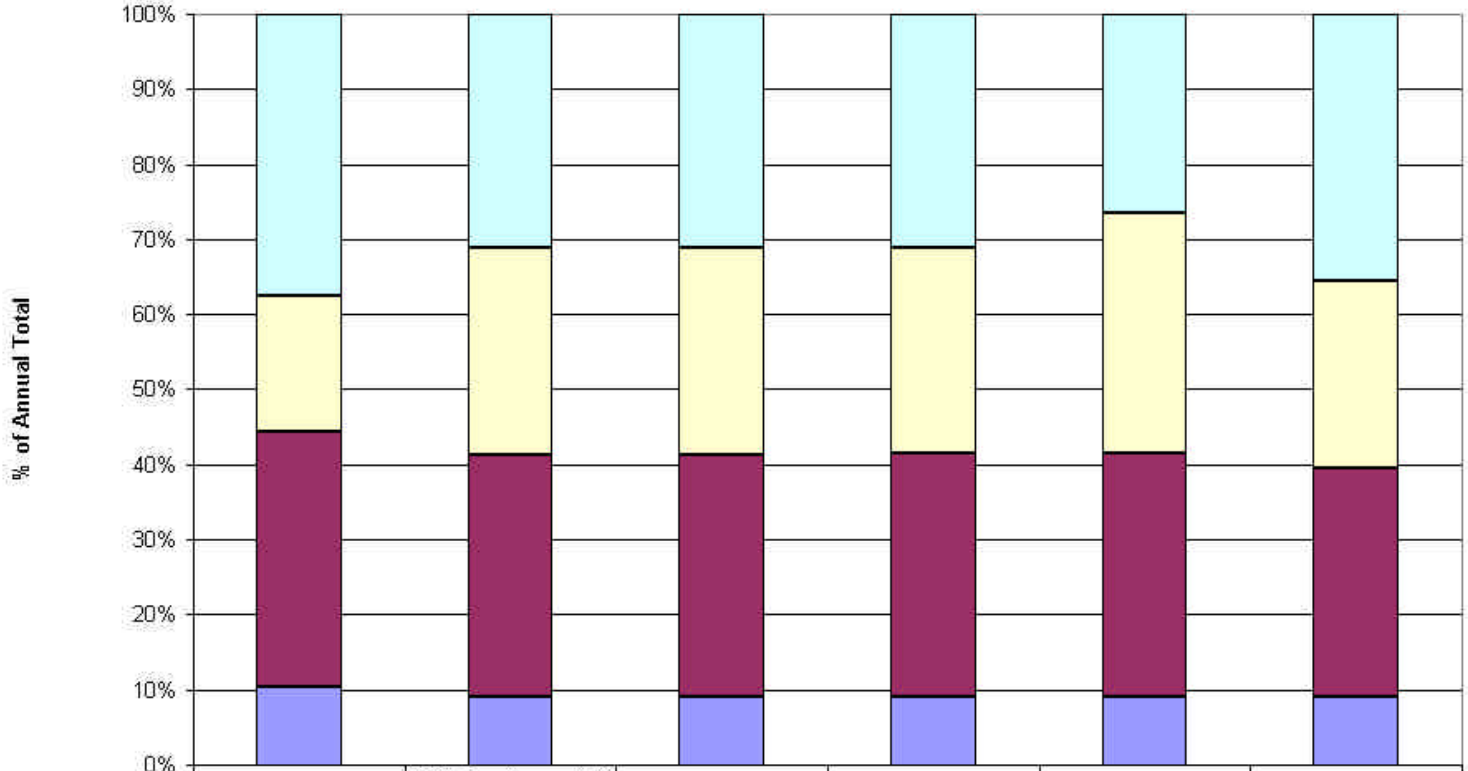
Western Interconnect Total Variable Costs -2008

(in 2003 Dollars)



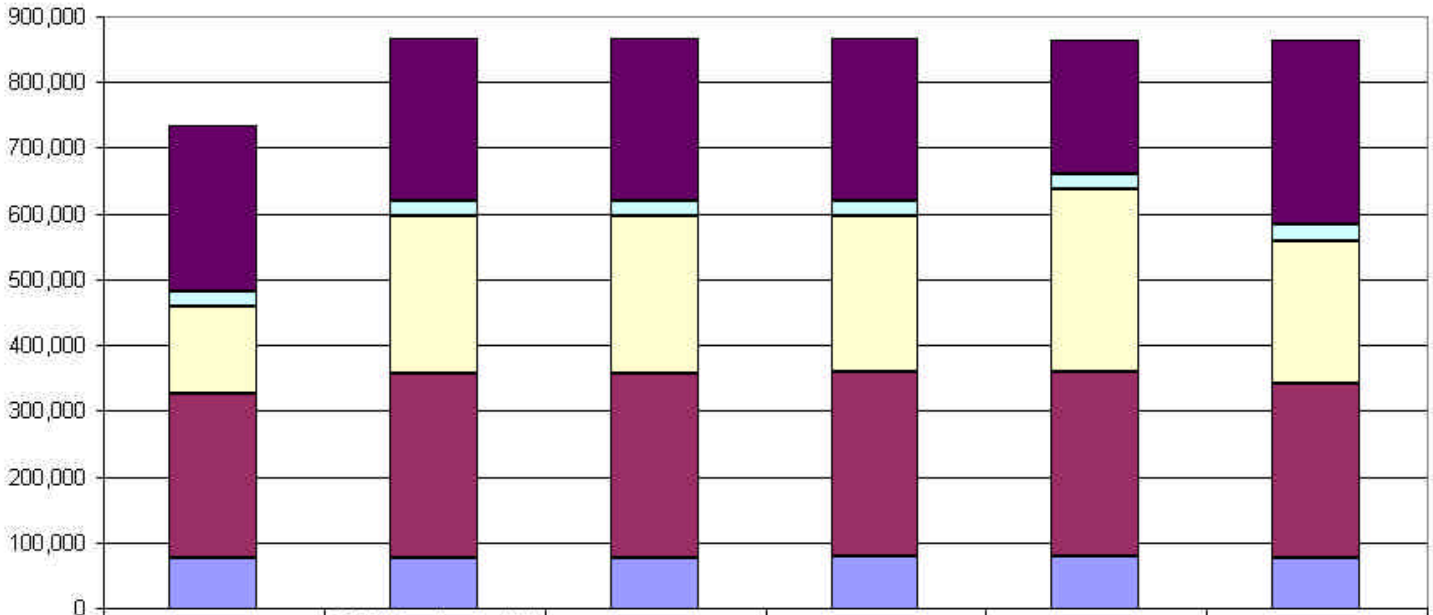
	LW-HG	AW-HG	AW-MG	HW-MG
Gas	12.1	10.1	7.1	6.3
Other	0.5	0.5	0.4	0.4
Coal	3.8	3.8	3.8	3.8

Western Interconnection % Energy by Fuel Source



	1998 Expected MWh	2008 One Area - AW MG	2008 AW MG	2008 AW HG	2008 LW HG	2008 HW MG
Renewables	37.5%	31.2%	31.2%	31.2%	26.5%	35.5%
Gas	18.1%	27.5%	27.5%	27.3%	32.0%	25.1%
Coal	34.1%	32.3%	32.3%	32.3%	32.4%	30.5%
Other	10.3%	9.0%	9.0%	9.1%	9.1%	9.0%

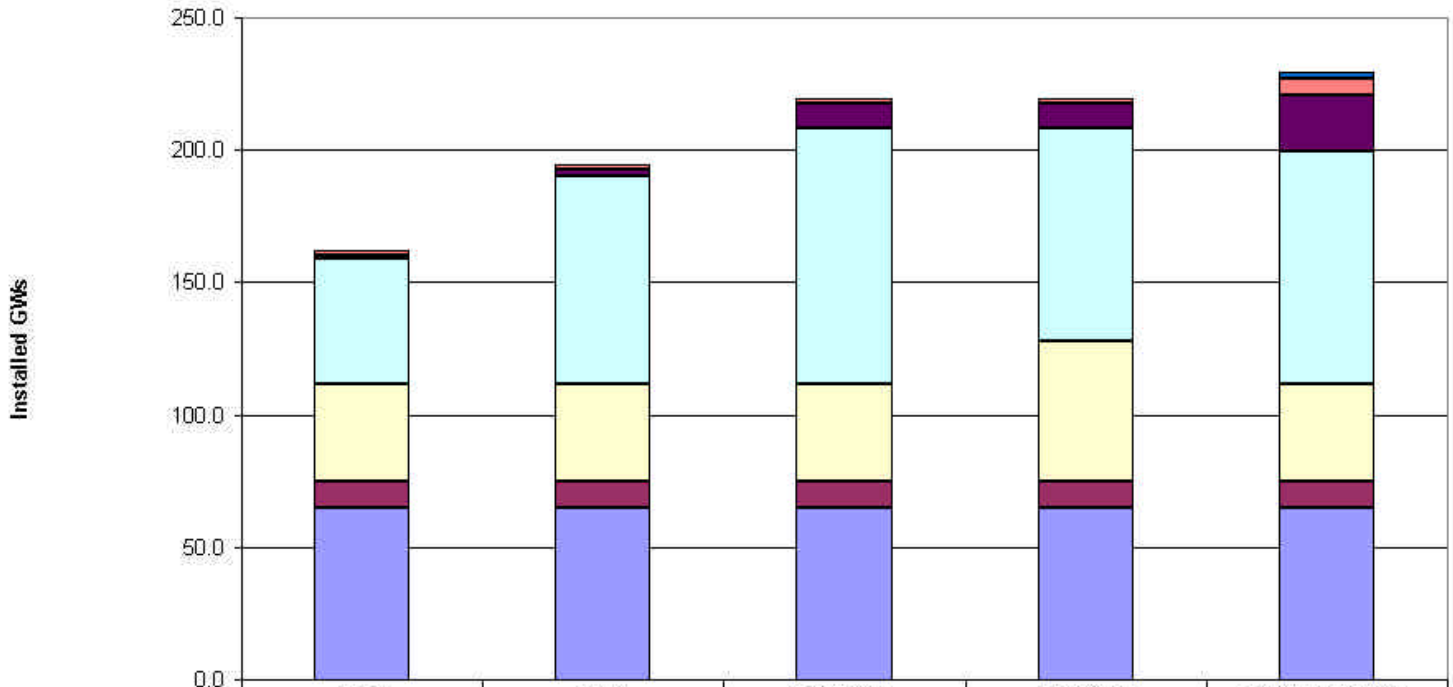
Western Interconnection GWh by Energy Source



	1998 Expected MWh	2008 One Area - AW MG	2008 AW MG	2008 AW HG	2008 LW HG	2008 HW MG
Hydro	251,658	246,090	246,090	246,090	204,875	282,607
Renewables	23,889	24,244	24,244	24,244	24,244	24,243
Gas	132,593	237,737	237,925	236,614	277,095	217,044
Coal	249,972	280,024	279,813	279,965	280,038	263,924
Other	75,905	77,613	77,634	78,787	79,012	77,619

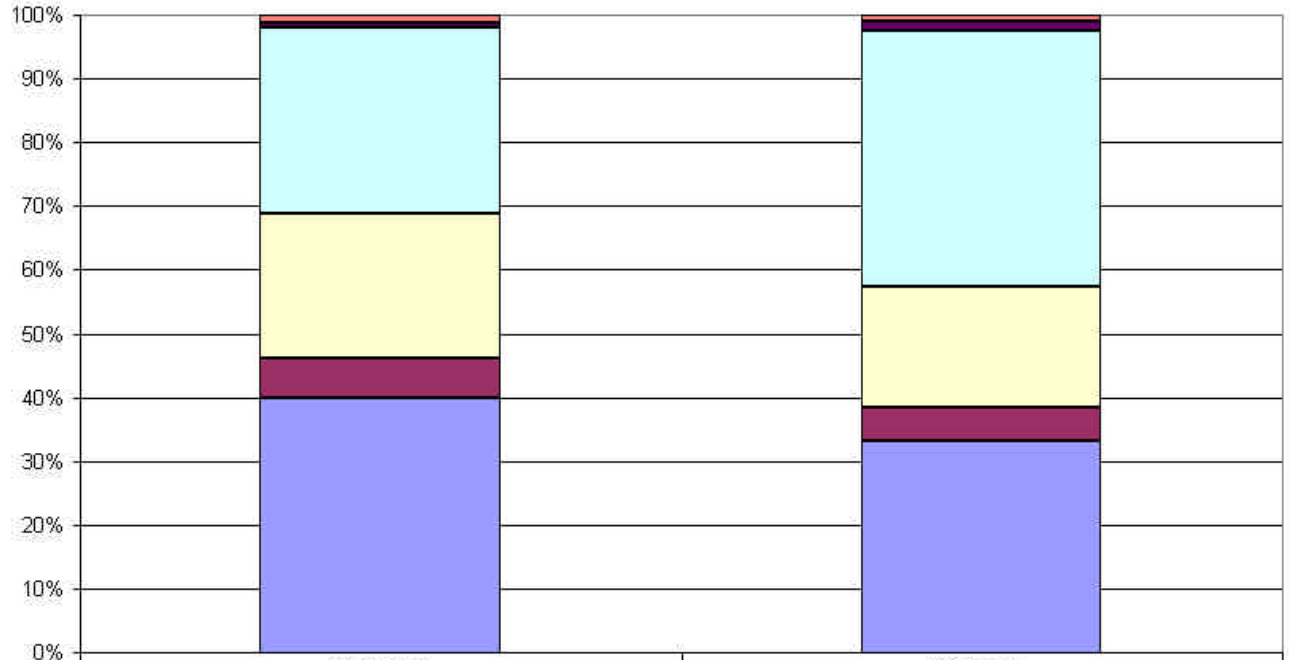
GWh

Installed Generation Capacity - Western Interconnection



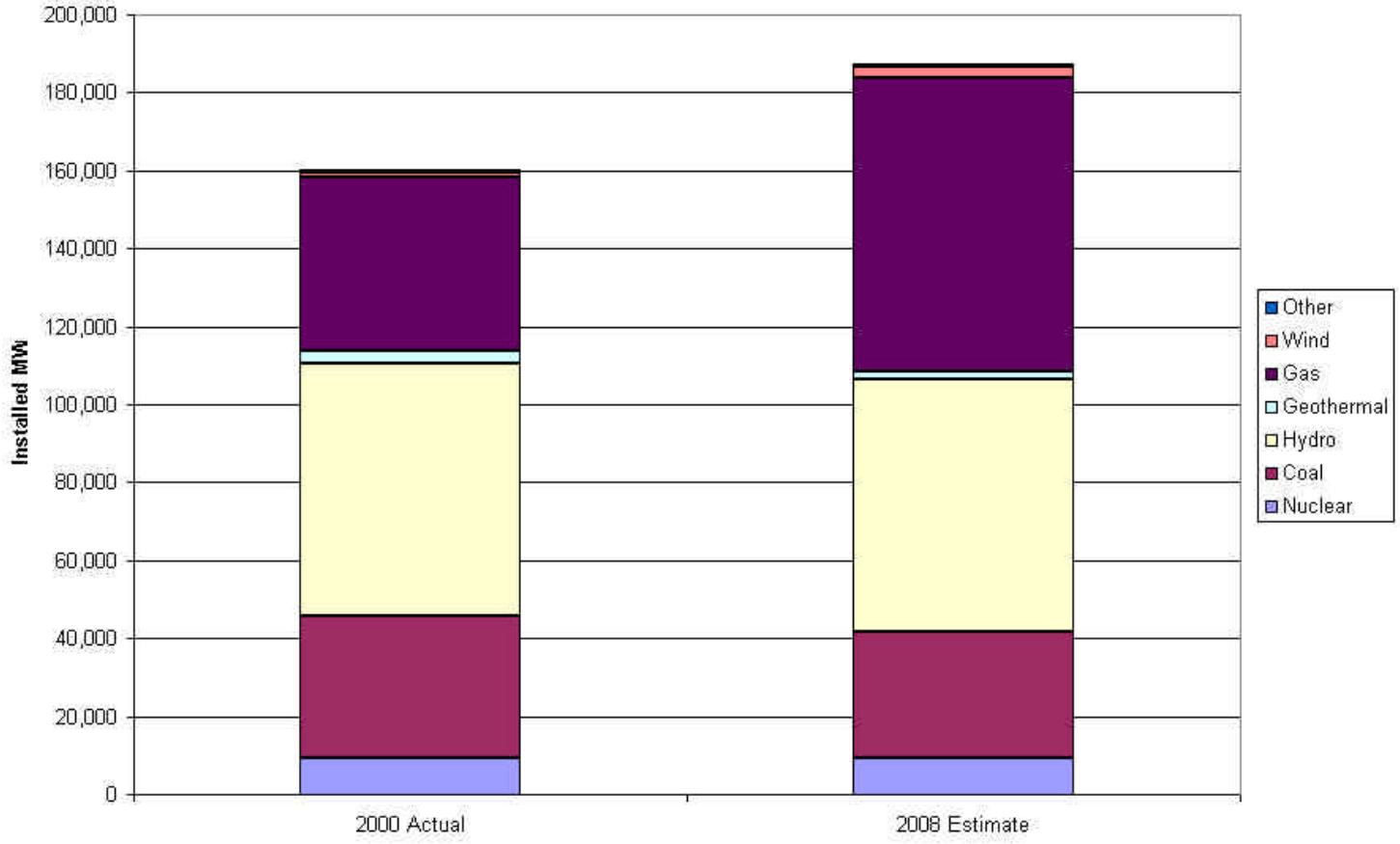
	2000	2008	2013 Gas	2013 Coal	2013 Renewable
Solar	0.0	0.0	0.0	0.0	2.5
Geo & Biomass *	2.1	2.1	2.1	2.1	5.8
Wind *	1.2	2.8	9.4	9.4	21.4
Gas	47.4	78.3	96.5	80.2	87.8
Coal	36.6	36.9	36.9	53.2	36.9
Nuclear &Other	10.2	10.2	10.2	10.2	10.2
Hydro	64.6	64.6	64.6	64.6	64.6

Capacity by Fuel Type

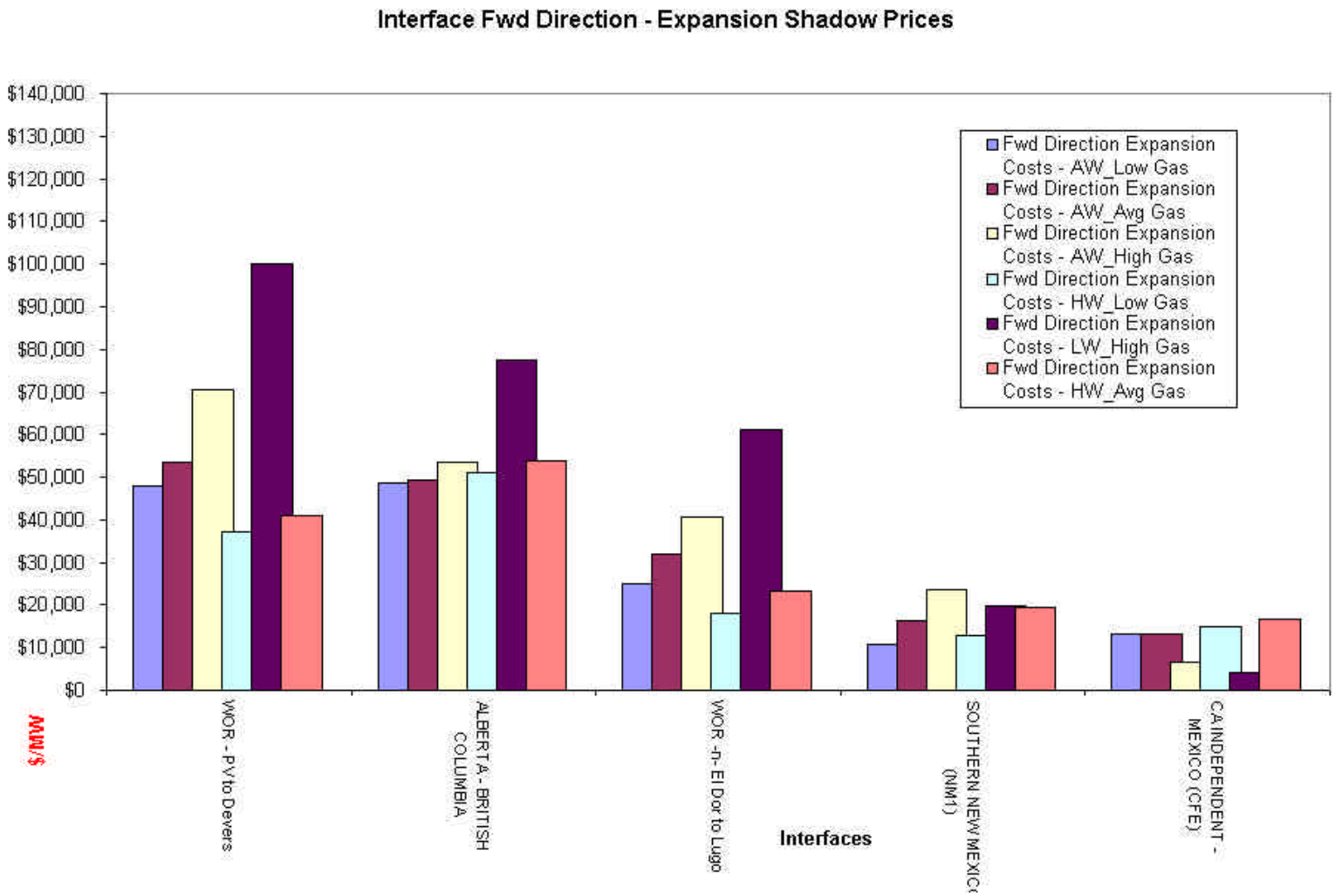


	Year 2000	Year 2008
Solar	0.0%	0.0%
Geo & Biomass *	1.3%	1.1%
Wind *	0.7%	1.4%
Gas	29.3%	40.2%
Coal	22.6%	18.9%
Nuclear &Other	6.3%	5.2%
Hydro	39.9%	33.2%

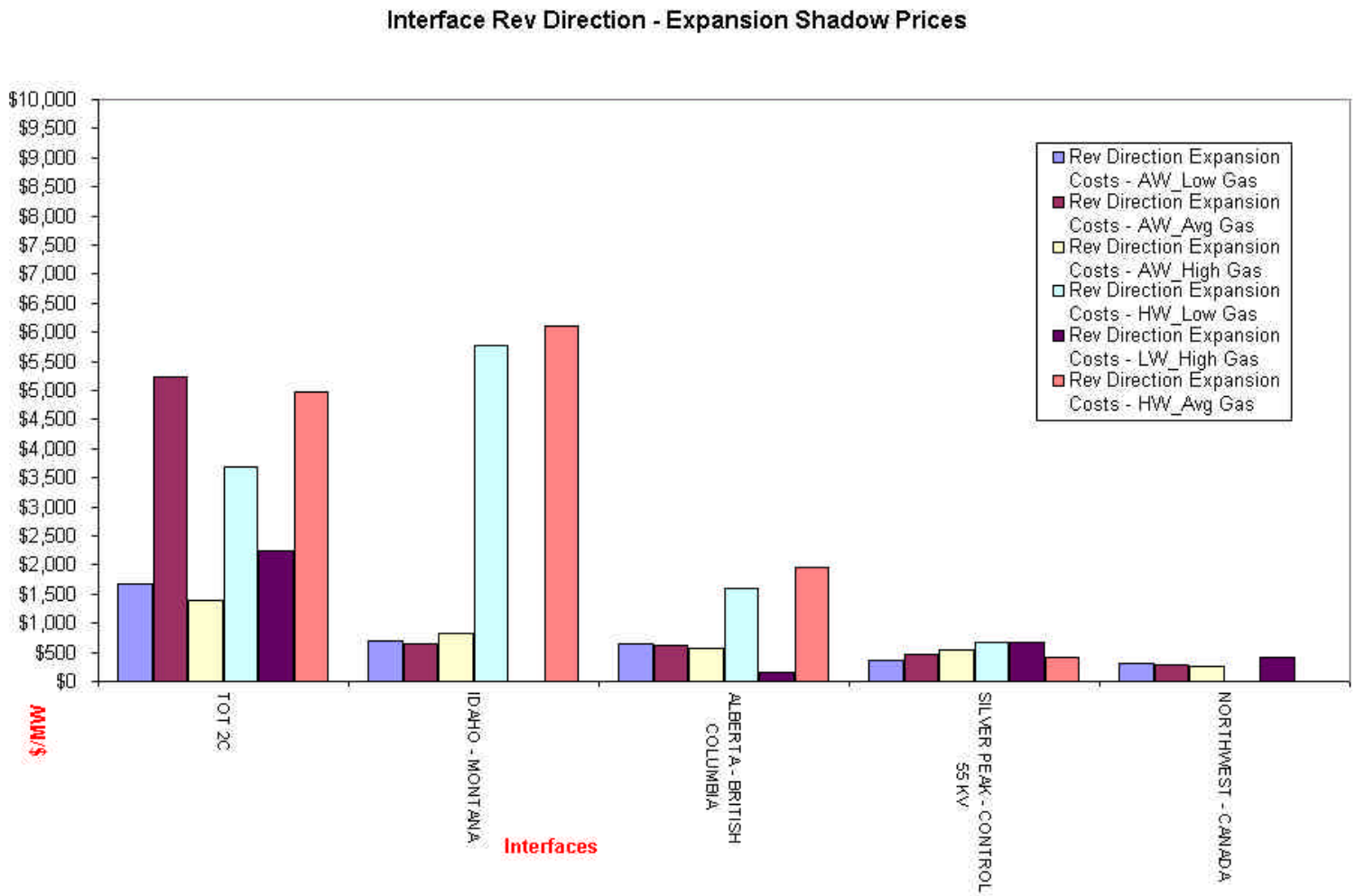
Capacity by Fuel Type



Interface Forward Direction Expansion Value - 2003$



Interface Reverse Direction Expansion Value - 2003$



Annual Energy & LMP Costs - 2003$

Annual Energy & LMP Costs - WECC Wide						
Scenarios	Load GWH	Load K$	Load Avg $/MWh	Gen GWH	Gen K$	Gen Avg $/MWh
AW_HG	864,271	$41,026,898	$47.47	864,271	$40,429,678	$46.78
AW_LG	864,271	$21,633,377	$25.03	864,269	$21,235,547	$24.57
AW_MG	864,271	$29,114,297	$33.69	864,268	$28,645,372	$33.14
DW_HG	864,271	$43,354,000	$50.16	864,273	$42,758,912	$49.47
HW_LG	864,271	$19,997,395	$23.14	864,274	$19,584,911	$22.66
HW_MG	864,271	$27,236,550	$31.51	864,273	$26,646,388	$30.83

Annual Energy & LMP Costs - 2003$

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	21,086	$997,478	$47.31	16,957	$771,879	$45.52
	AW_LG	21,086	$518,174	$24.57	9,386	$245,533	$26.16
	AW_MG	21,086	$706,321	$33.50	17,012	$549,165	$32.28
	DW_HG	21,086	$1,027,077	$48.77	17,206	$810,242	$47.09
	HW_LG	21,086	$501,007	$23.76	8,160	$204,983	$25.12
	HW_MG	21,086	$684,835	$32.48	16,563	$517,310	$31.23
Arizona	AW_HG	86,607	$4,005,058	$46.24	134,145	$6,089,479	$45.39
	AW_LG	86,607	$2,085,727	$24.08	138,512	$3,256,090	$23.51
	AW_MG	86,607	$2,838,471	$32.77	133,979	$4,303,947	$32.12
	DW_HG	86,607	$4,146,655	$47.88	136,389	$6,377,559	$46.76
	HW_LG	86,607	$2,005,349	$23.15	135,315	$3,068,883	$22.68
	HW_MG	86,607	$2,735,309	$31.58	130,616	$4,054,221	$31.04
NEVADA	AW_HG	26,616	$1,250,291	$46.98	23,431	$1,100,004	$46.95
	AW_LG	26,616	$652,974	$24.53	25,623	$620,373	$24.21
	AW_MG	26,616	$887,885	$33.36	23,618	$785,801	$33.27
	DW_HG	26,616	$1,298,168	$48.77	25,067	$1,212,678	$48.38
	HW_LG	26,616	$625,495	$23.50	24,502	$569,715	$23.25
	HW_MG	26,616	$852,117	$32.02	22,289	$714,747	$32.07
WAPA L.C.	AW_HG	2,219	$101,887	$45.92	20,214	$934,206	$46.22
	AW_LG	2,219	$53,137	$23.95	21,258	$508,515	$23.92
	AW_MG	2,219	$72,198	$32.54	20,186	$661,982	$32.79
	DW_HG	2,219	$105,537	$47.56	20,537	$978,169	$47.63
	HW_LG	2,219	$50,857	$22.92	21,015	$483,041	$22.99
	HW_MG	2,219	$69,337	$31.25	19,522	$618,458	$31.68
MEXICO-C	AW_HG	15,431	$749,175	$48.55	13,618	$662,274	$48.63
	AW_LG	15,431	$417,485	$27.05	13,392	$359,792	$26.87
	AW_MG	15,431	$555,536	$36.00	13,327	$477,024	$35.79
	DW_HG	15,431	$771,172	$49.98	14,307	$715,450	$50.01
	HW_LG	15,431	$409,786	$26.56	13,128	$346,558	$26.40
	HW_MG	15,431	$546,925	$35.44	13,165	$464,165	$35.26
IMPERIAL	AW_HG	3,859	$188,416	$48.82	3,804	$186,785	$49.10
	AW_LG	3,859	$99,661	$25.83	3,600	$93,379	$25.94
	AW_MG	3,859	$134,440	$34.84	3,594	$125,018	$34.79
	DW_HG	3,859	$198,324	$51.39	3,795	$196,425	$51.76
	HW_LG	3,859	$93,880	$24.33	3,679	$88,760	$24.13
	HW_MG	3,859	$127,614	$33.07	3,667	$120,115	$32.76
SANDIEGO	AW_HG	20,352	$1,015,703	$49.91	9,559	$472,438	$49.42
	AW_LG	20,352	$536,361	$26.35	8,454	$227,767	$26.94
	AW_MG	20,352	$724,721	$35.61	8,982	$322,283	$35.88
	DW_HG	20,352	$1,058,428	$52.01	11,084	$569,146	$51.35
	HW_LG	20,352	$512,782	$25.20	7,032	$183,006	$26.02
	HW_MG	20,352	$697,395	$34.27	7,772	$272,575	$35.07

Annual Energy & LMP Costs - 2003$

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	98,088	$4,914,444	$50.10	53,920	$2,775,530	$51.47
	AW_LG	98,088	$2,614,664	$26.66	56,591	$1,545,932	$27.32
	AW_MG	98,088	$3,511,572	$35.80	54,765	$2,012,005	$36.74
	DW_HG	98,088	$5,165,000	$52.66	61,483	$3,320,012	$54.00
	HW_LG	98,088	$2,462,629	$25.11	50,858	$1,309,313	$25.74
	HW_MG	98,088	$3,344,285	$34.09	51,040	$1,785,681	$34.99
LADWP	AW_HG	29,321	$1,452,360	$49.53	18,528	$887,812	$47.92
	AW_LG	29,321	$769,582	$26.25	19,631	$498,177	$25.38
	AW_MG	29,321	$1,036,703	$35.36	18,948	$646,898	$34.14
	DW_HG	29,321	$1,519,057	$51.81	20,664	$1,059,395	$51.27
	HW_LG	29,321	$728,937	$24.86	17,545	$414,171	$23.61
	HW_MG	29,321	$991,062	$33.80	17,473	$552,891	$31.64
PG AND E	AW_HG	127,670	$6,341,000	$49.67	102,513	$5,175,921	$50.49
	AW_LG	127,670	$3,363,530	$26.35	104,483	$2,801,404	$26.81
	AW_MG	127,670	$4,525,178	$35.44	101,796	$3,672,844	$36.08
	DW_HG	127,670	$6,707,743	$52.54	103,121	$5,496,253	$53.30
	HW_LG	127,670	$3,100,000	$24.28	103,992	$2,566,904	$24.68
	HW_MG	127,670	$4,229,071	$33.13	104,921	$3,529,570	$33.64
NORTHWEST	AW_HG	165,795	$7,866,615	$47.45	179,441	$8,373,156	$46.66
	AW_LG	165,795	$4,183,394	$25.23	181,598	$4,489,232	$24.72
	AW_MG	165,795	$5,588,209	$33.71	179,781	$5,955,551	$33.13
	DW_HG	165,795	$8,547,368	$51.55	161,333	$8,265,630	$51.23
	HW_LG	165,795	$3,721,841	$22.45	190,689	$4,175,341	$21.90
	HW_MG	165,795	$5,022,015	$30.29	190,556	$5,599,223	$29.38
B.C.HYDR	AW_HG	62,147	$2,936,562	$47.25	61,352	$2,930,242	$47.76
	AW_LG	62,147	$1,639,677	$26.38	53,350	$1,408,300	$26.40
	AW_MG	62,147	$2,081,646	$33.50	61,403	$2,079,052	$33.86
	DW_HG	62,147	$3,168,707	$50.99	63,187	$3,244,126	$51.34
	HW_LG	62,147	$1,385,347	$22.29	63,479	$1,420,567	$22.38
	HW_MG	62,147	$1,878,093	$30.22	63,192	$1,920,408	$30.39
AQUILA	AW_HG	3,963	$187,771	$47.38	4,664	$216,991	$46.52
	AW_LG	3,963	$106,435	$26.86	4,663	$125,017	$26.81
	AW_MG	3,963	$132,989	$33.56	4,663	$153,241	$32.86
	DW_HG	3,963	$202,037	$50.98	4,238	$214,853	$50.70
	HW_LG	3,963	$88,590	$22.35	4,981	$108,691	$21.82
	HW_MG	3,963	$120,592	$30.43	4,981	$147,873	$29.69
ALBERTA	AW_HG	60,454	$2,482,268	$41.06	65,596	$2,685,202	$40.94
	AW_LG	60,454	$1,152,782	$19.07	66,181	$1,256,551	$18.99
	AW_MG	60,454	$1,678,465	$27.76	65,681	$1,816,688	$27.66
	DW_HG	60,454	$2,531,353	$41.87	65,995	$2,754,695	$41.74
	HW_LG	60,454	$1,099,966	$18.20	65,088	$1,180,532	$18.14
	HW_MG	60,454	$1,601,650	$26.49	64,073	$1,695,831	$26.47

Annual Energy & LMP Costs - 2003$

Annual Energy & LMP Costs - By Area							
AreaID	Scenarios	Load GWH	Load K$	Load Avg $/MWh	Gen GWH	Gen K$	Gen Avg $/MWh
IDAHO	AW_HG	17,253	$800,381	$46.39	25,989	$1,174,261	$45.18
	AW_LG	17,253	$423,661	$24.56	26,004	$621,011	$23.88
	AW_MG	17,253	$568,560	$32.95	25,981	$828,636	$31.89
	DW_HG	17,253	$871,071	$50.49	23,278	$1,117,724	$48.02
	HW_LG	17,253	$381,248	$22.10	25,350	$550,487	$21.72
	HW_MG	17,253	$511,436	$29.64	25,327	$734,105	$28.99
MONTANA	AW_HG	11,914	$545,689	$45.80	22,227	$1,019,296	$45.86
	AW_LG	11,914	$288,231	$24.19	22,227	$539,967	$24.29
	AW_MG	11,914	$387,626	$32.54	22,227	$726,290	$32.68
	DW_HG	11,914	$592,282	$49.71	22,179	$1,094,238	$49.34
	HW_LG	11,914	$257,682	$21.63	22,434	$487,507	$21.73
	HW_MG	11,914	$345,485	$29.00	22,447	$654,495	$29.16
WAPA U.M	AW_HG	929	$42,936	$46.22	0	$0	$0.00
	AW_LG	929	$22,656	$24.39	0	$0	$0.00
	AW_MG	929	$30,460	$32.79	0	$0	$0.00
	DW_HG	929	$46,781	$50.36	1	$110	$109.60
	HW_LG	929	$20,246	$21.79	0	$0	$0.00
	HW_MG	929	$27,190	$29.27	0	$0	$0.00
SIERRA	AW_HG	11,736	$555,289	$47.31	5,940	$280,986	$47.30
	AW_LG	11,736	$294,247	$25.07	5,880	$148,952	$25.33
	AW_MG	11,736	$395,839	$33.73	5,961	$201,295	$33.77
	DW_HG	11,736	$595,268	$50.72	6,491	$333,079	$51.31
	HW_LG	11,736	$271,821	$23.16	5,079	$119,278	$23.48
	HW_MG	11,736	$364,459	$31.05	5,409	$169,187	$31.28
PACE	AW_HG	36,234	$1,670,114	$46.09	40,156	$1,825,432	$45.46
	AW_LG	36,234	$879,104	$24.26	39,879	$955,864	$23.97
	AW_MG	36,234	$1,186,102	$32.73	40,211	$1,297,067	$32.26
	DW_HG	36,234	$1,773,283	$48.94	40,451	$1,948,178	$48.16
	HW_LG	36,234	$813,194	$22.44	39,335	$872,212	$22.17
	HW_MG	36,234	$1,097,358	$30.29	39,857	$1,187,747	$29.80
PSCOLORA	AW_HG	40,200	$1,901,958	$47.31	27,784	$1,304,130	$46.94
	AW_LG	40,200	$995,746	$24.77	28,487	$699,430	$24.55
	AW_MG	40,200	$1,347,917	$33.53	27,722	$923,375	$33.31
	DW_HG	40,200	$1,960,829	$48.78	28,517	$1,383,487	$48.51
	HW_LG	40,200	$962,763	$23.95	28,098	$666,528	$23.72
	HW_MG	40,200	$1,310,135	$32.59	27,384	$886,004	$32.35
WAPA R.M	AW_HG	22,397	$1,021,502	$45.61	34,433	$1,563,656	$45.41
	AW_LG	22,397	$536,150	$23.94	35,070	$834,261	$23.79
	AW_MG	22,397	$723,462	$32.30	34,431	$1,107,209	$32.16
	DW_HG	22,397	$1,067,862	$47.68	34,950	$1,667,463	$47.71
	HW_LG	22,397	$503,975	$22.50	34,515	$768,434	$22.26
	HW_MG	22,397	$680,187	$30.37	34,019	$1,021,782	$30.04

INTERFACE FLOWS SUMMARY

AVERAGE FLOWS

			Fwd	Rev	Avg	Fwd	Rev	Avg	Fwd	Rev	Avg	Fwd	Rev	Avg	Fwd	Rev	Avg	Fwd	Rev	Avg
Name	Rev Limit	Fwd Limit	AW_MG	AW_MG	AW_MG	AW_LG	AW_LG	AW_LG	AW_HG	AW_HG	AW_HG	HW_MG	HW_MG	HW_MG	HW_LG	HW_LG	HW_LG	DW_HG	DW_HG	DW_HG
ALBERTA - BRITISH COLUMBIA	-720	700	640	-280	597	674	-330	654	636	-276	587	615	-464	413	633	-428	529	664	-269	633
ALBERTA - SASKATCHEWAN	-150	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NORTHWEST - CANADA	-3150	2000	702	-1133	-592	965	-948	270	716	-1124	-576	680	-1271	-649	575	-1359	-797	479	-1138	-783
WEST OF CASCADES - NORTH	-10500	10500	4568	0	4568	5035	0	5035	4594	0	4594	4809	0	4809	4710	0	4710	4153	0	4153
WEST OF CASCADES - SOUTH	-7000	7000	3430	0	3430	3536	0	3536	3412	0	3412	3416	0	3416	3431	0	3431	3515	0	3515
WEST OF HATWAI	-9999	4000	725	-229	558	677	-239	450	745	-213	619	664	-183	562	643	-216	521	676	-191	499
MONTANA - NORTHWEST	-1350	2200	1128	-20	1127	1129	-25	1122	1198	-19	1197	1037	-119	985	998	-124	938	1299	0	1299
WEST OF BROADVIEW	-9999	2573	1941	0	1941	1931	0	1931	2018	0	2018	1810	0	1810	1783	0	1783	2076	0	2076
WEST OF COLSTRIP	-9999	2598	1890	0	1890	1890	0	1890	1890	0	1890	1890	0	1890	1889	0	1889	1890	0	1890
WEST OF CROSSOVER	-9999	2598	1940	0	1940	1885	0	1885	2165	0	2165	1834	0	1834	1818	0	1818	2162	0	2162
IDAHO - NORTHWEST	-1200	2400	639	-322	493	565	-289	411	650	-320	486	539	-358	326	438	-355	173	539	-256	404
MIDWAY - LOS BANOS	-9999	3900	2564	-502	2442	2534	-437	2443	2649	-609	2504	2099	-871	1570	1995	-693	1675	3179	-134	3176
IDAHO - SIERRA	-360	500	286	0	286	286	-13	286	275	0	275	318	0	318	356	0	356	220	-40	216
BORAH WEST	-9999	2307	1517	0	1517	1435	0	1435	1499	0	1499	1440	0	1440	1326	0	1326	1668	0	1668
IDAHO - MONTANA	-337	337	50	-120	-66	50	-122	-61	48	-123	-73	53	-145	-103	44	-158	-123	57	-69	-23
BRIDGER WEST	-9999	2200	1896	0	1896	1887	0	1887	1871	0	1871	1860	0	1860	1833	0	1833	1952	0	1952
PATH C	-1000	1000	196	-210	32	147	-215	-35	211	-231	33	197	-271	-46	130	-304	-153	251	-151	170
ARIZONA - CALIFORNIA	-9999	5700	5064	-136	5058	4933	-142	4927	5022	-156	5015	4905	-49	4903	4715	-39	4713	5107	-129	5106
SOUTHWEST OF FOUR CORNERS	-9999	2325	1349	-71	1339	822	-109	808	1324	-80	1315	1408	0	1408	819	-146	796	1282	-33	1279
FOUR CORNERS 345_500	-840	840	315	-172	180	107	-209	-120	318	-175	170	313	-152	197	109	-240	-155	308	-150	169
PG&E - SPP	-150	160	47	-63	-14	57	-47	18	49	-72	-21	58	-72	-27	51	-56	-7	61	-32	28
PACIFICORP_PG&E 115 KV INTERCON	-30	80	74	-26	41	73	-26	34	74	-25	41	73	-26	32	72	-26	35	75	-20	56
NORTHERN - SOUTHERN CALIFORNIA	-3000	3400	1425	-1187	-164	1427	-1061	-44	1460	-1210	-218	1804	-1177	467	1645	-1073	407	1048	-1163	-626
IPP DC LINE	-1400	1920	1800	-235	1799	1856	-213	1852	1814	-259	1813	1711	-181	1708	1743	-262	1741	1868	-281	1864
INTERMOUNTAIN - MONA 345 KV	-1200	1400	561	-483	-400	336	-488	-438	553	-502	-410	649	-484	-315	518	-531	-378	459	-503	-463
INTERMOUNTAIN - GONDER 230 KV	-9999	250	159	-12	159	143	-10	143	155	-19	155	160	0	160	149	0	149	156	-11	156
TOT 1A	-9999	650	342	-110	280	356	-99	313	344	-115	278	312	-147	225	332	-137	264	373	-103	347
TOT 2A	-9999	690	253	-241	57	351	-254	158	257	-255	33	299	-216	130	376	-225	224	247	-237	5
PAVANT, INTRMTN - GONDER 230 KV	-235	440	304	-23	304	278	-9	277	299	-33	299	300	0	300	281	0	281	307	0	307
BONANZA WEST	-9999	785	523	-25	521	528	-24	526	521	-50	516	497	-95	482	491	-73	481	559	-53	557
TOT 2B	-850	780	242	-288	-83	212	-308	-45	249	-318	-103	304	-256	48	277	-244	74	163	-323	-192
TOT 2C	-300	300	146	-156	12	167	-152	37	132	-143	-1	136	-162	-10	170	-160	36	110	-142	-42
TOT 3	-9999	1424	983	-69	980	968	-74	967	950	-64	946	1071	-350	1071	1070	-238	1070	869	-91	866
TOT 4A	-9999	810	241	-68	227	254	-69	243	209	-62	187	257	-71	243	267	-71	255	245	-91	233
TOT 4B	-9999	680	282	-64	257	281	-67	248	348	-61	325	236	-107	141	225	-119	118	379	-20	377
TOT 5	-9999	1675	887	-185	864	753	-238	729	907	-211	889	866	-140	845	744	-210	712	877	-240	848
TOT 7	-9999	890	623	-101	617	581	-78	574	610	-86	603	670	-83	668	632	-63	630	558	-101	547
SYLMAR - SCE	-1200	1200	15	-21	4	15	-19	6	16	-20	5	13	-22	-2	13	-21	-1	18	-16	11
IID - SCE	-9999	600	288	-73	272	288	-74	272	297	-60	284	279	-71	261	280	-75	263	305	-54	295
NORTH OF SAN ONOFRE	-9999	2440	1163	-88	1162	1167	-108	1166	1207	-214	1206	1056	-242	1046	1040	-241	1030	1355	0	1355
SOUTH OF SAN ONOFRE	-9999	2200	497	-133	466	490	-145	462	473	-152	427	581	-157	570	593	-211	584	380	-148	294
CA INDEPENDENT - MEXICO (CFE)	-800	408	313	-135	240	308	-141	233	279	-131	207	324	-122	259	324	-120	263	257	-166	128
WEST OF COLORADO RIVER (WOR)	-10118	10118	6657	-763	6594	6837	-822	6776	6607	-825	6553	6200	-711	6131	6377	-681	6316	6940	-526	6903

INTERFACE FLOWS SUMMARY

AVERAGE FLOWS

			Fwd	Rev	Avg	Fwd	Rev	Avg	Fwd	Rev	Avg	Fwd	Rev	Avg	Fwd	Rev	Avg	Fwd	Rev	Avg
Name	Rev Limit	Fwd Limit	AW_MG	AW_MG	AW_MG	AW_LG	AW_LG	AW_LG	AW_HG	AW_HG	AW_HG	HW_MG	HW_MG	HW_MG	HW_LG	HW_LG	HW_LG	DW_HG	DW_HG	DW_HG
SOUTHERN NEW MEXICO (NM1)	-1048	1048	889	0	889	882	0	882	895	0	895	911	0	911	909	0	909	872	0	872
NORTHERN NEW MEXICO (NM2)	-1450	1665	633	0	633	612	-16	612	636	0	636	623	0	623	613	-27	612	639	0	639
EAST OF COLORADO RIVER (EOR)	-9999	7550	5737	-335	5725	5584	-342	5573	5706	-313	5691	5511	-177	5502	5287	-217	5278	5858	-92	5850
CHOLLA - PINNACLE PEAK	-9999	1200	713	0	713	489	0	489	706	0	706	737	0	737	478	-29	477	688	0	688
SOUTHERN NAVAJO	-9999	2264	333	-203	168	334	-200	73	333	-199	152	397	-160	276	371	-164	187	274	-187	46
SILVER PEAK - CONTROL 55 KV	-17	17	6	-7	-1	7	-7	-1	6	-7	-1	7	-7	0	7	-7	1	6	-8	-3
BILLINGS - YELLOWTAIL	-400	400	137	-148	-48	111	-177	-93	143	-73	100	143	-148	-23	148	-140	-13	124	-80	40
CORONADO - SILVER KING - KYRENE	-9999	1100	556	-32	555	352	-108	337	553	-38	551	564	-111	557	332	-185	292	546	-21	546
BROWNLEE EAST	-9999	1750	881	0	881	877	0	877	881	0	881	931	0	931	975	0	975	649	-29	649
ELDORADO - MEAD 230 KV LINES	-1140	1140	93	-126	-49	89	-128	-65	94	-125	-49	107	-122	-21	93	-124	-42	82	-126	-71
EAGLE MTN 230_161 KV - BLYTHE 16	-168	72	7	-115	-114	3	-116	-116	11	-117	-116	9	-112	-107	11	-113	-112	0	-121	-121
INYO - CONTROL 115 KV TIE	-56	56	5	-22	-20	4	-25	-24	6	-22	-19	6	-21	-19	7	-21	-18	6	-26	-23
LUGO - VICTORVILLE 500 KV LINE	-900	2400	1239	-102	1218	1128	-78	1101	1251	-86	1231	1248	-100	1232	1275	-88	1268	1051	-85	973
ELDORADO - MCCULLOUGH 500 KV	-2598	2598	59	-643	-634	60	-711	-706	64	-647	-634	91	-590	-548	60	-680	-666	40	-657	-654
PERKINS - MEAD - MARKETPLACE 500	-9999	1300	686	-224	652	681	-227	649	695	-217	663	622	-203	576	600	-204	554	761	-204	742
MARKETPLACE - ADELANTO	-1200	1200	606	-156	577	633	-160	604	604	-145	575	540	-136	502	544	-143	511	687	-127	670
PACIFIC DC INTERTIE (PDCI)	-3100	3100	1533	-1956	-951	1809	-1890	-359	1448	-1958	-1077	1441	-2131	-1618	1542	-2075	-1517	1852	-1482	272
COI	-3675	4800	2999	-552	2859	2938	-498	2710	2890	-571	2742	3469	-654	3170	3548	-908	3234	2411	-533	2251
NORTH OF JOHN DAY	-8600	8600	2435	-163	2397	2141	-305	1922	2454	-175	2425	3203	-109	3171	3267	-130	3219	1674	-423	1495
MIDPOINT - SUMMER LAKE	-400	1500	631	-125	592	544	-113	506	631	-131	586	601	-156	534	500	-148	425	604	-105	581
ALTURAS PROJECT	-300	300	88	-29	82	91	-24	86	114	-34	107	135	-14	131	130	-11	130	63	-31	45
CRYSTAL - ALLEN	-9999	950	89	-82	4	75	-104	-37	82	-75	11	97	-66	37	83	-95	-18	85	-71	0
TOT 2B1	-600	560	153	-197	-78	138	-202	-29	154	-217	-91	192	-175	6	181	-159	51	97	-221	-149
TOT 2B2	-300	265	94	-92	-5	75	-107	-16	97	-102	-12	118	-82	42	97	-86	23	70	-102	-43
Albuquerque Sum with caps	-9999	9999	106	0	106	107	-3	107	106	0	106	107	0	107	107	0	107	106	-8	106
Albuquerque Sum without caps	-9999	9999	443	0	443	441	0	441	442	0	442	444	0	444	442	0	442	441	0	441
Southern CA Imports	-15200	15200	12299	-44	12298	11509	-340	11496	12497	-37	12496	13521	-24	13520	13466	0	13466	9993	-28	9992
WOR - PV to Devers	-9999	1550	1415	0	1415	1441	0	1441	1420	0	1420	1339	0	1339	1367	0	1367	1470	0	1470
WOR - N Gila	-9999	1331	822	-164	809	881	-158	867	769	-183	755	857	-154	850	930	-136	923	685	-211	651
WOR - IID230	-600	600	288	-73	272	288	-74	272	297	-60	284	279	-71	261	280	-75	263	305	-54	295
WOR -n- Mc-Vic	-9999	2592	1236	-263	1193	1286	-284	1244	1232	-250	1190	1103	-243	1049	1119	-244	1071	1388	-205	1363
WOR -n- El Dor to Lugo	-9999	2754	2339	-201	2328	2357	-207	2348	2338	-208	2329	2146	-194	2131	2193	-163	2180	2456	-61	2454
Path 15 Borah W Summer	-9999	9999	1078	-25	1078	1034	-14	1033	1075	-11	1075	958	-65	949	900	-77	897	1235	0	1235
Combined 4a, 4b	-9999	1096	529	-68	500	537	-64	508	554	-63	525	467	-107	402	463	-113	391	632	-75	626
Combined PACI & PDCI	-9999	7300	4261	-1031	3727	4046	-1286	2983	4249	-1076	3713	5118	-1089	4657	5075	-1072	4622	3069	-1092	1934
Tot 2a, 2b, 2c Nomogram	-1600	1570	551	-647	-15	709	-665	150	560	-676	-71	677	-604	167	790	-573	334	476	-652	-229
EOR - HASSYAMP- N GILA	-9999	1273	984	-19	983	1035	-26	1035	929	-47	927	1012	0	1012	1073	0	1073	848	-108	840
WOR - N GILA - IMPRLVLY	-9999	1273	913	-75	909	965	-72	961	861	-96	855	941	-42	940	1005	-40	1003	780	-147	765
Imp Valley to Miguel	-9999	1560	1282	0	1282	1277	0	1277	1276	0	1276	1271	0	1271	1291	0	1291	1242	0	1242
NW to Canada, East BC	-400	400	147	-127	42	231	-133	157	147	-126	41	180	-131	41	158	-136	40	106	-128	-45
North of Miguel	-9999	2000	1412	-61	1410	1403	-47	1402	1475	-62	1473	1362	-129	1349	1356	-115	1348	1531	-60	1530

SSG-WI Transmission Study
2008 Base Case Validation

Scenario Results Summary

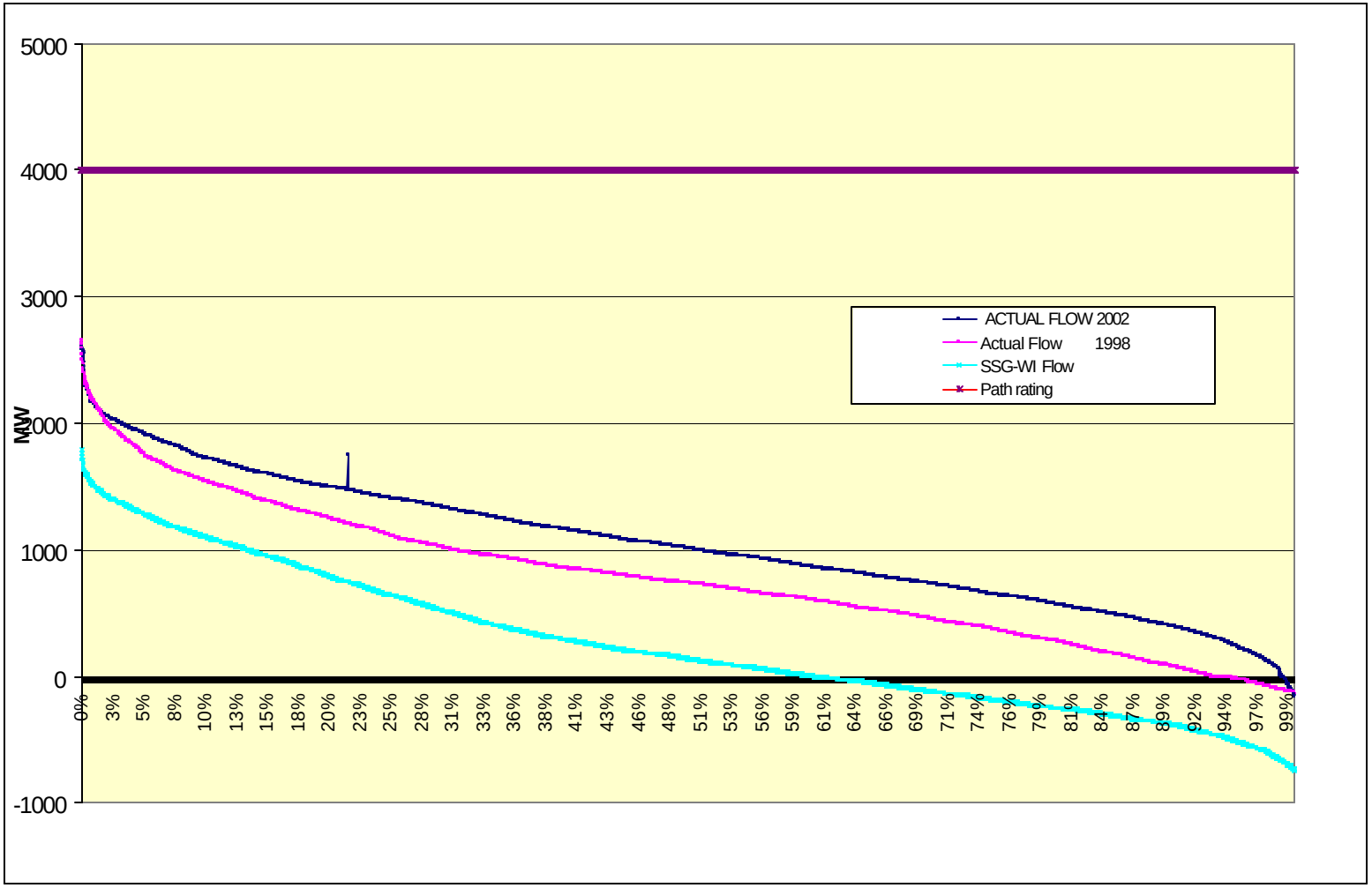
- This is a relative comparison, basically looking for matching trends with consideration given to:
  - COUGER Market Symulator models a single control area
  - Comparing the SSG-WI 2008 case to 2002 actual (different load levels; considerable new resource additions; varied transmission topology)
    - Paths Duration Flow comparison "Actual to SSG-WI 2008 Base Case" were created to test the validity of the model

- "Idaho to PNW" and "Montana to PNW" compared incredibly close
  - profile of resources hasn't changed much for those areas. Consistently, we've improved on the"West of Hatwai" path.
    - Issue - Area Load Level; sensitivity runs with reduced DSI loads in Montana showed direct impact to the "WHO" flows
    - Total energy level in Canada also provided for a direct impact

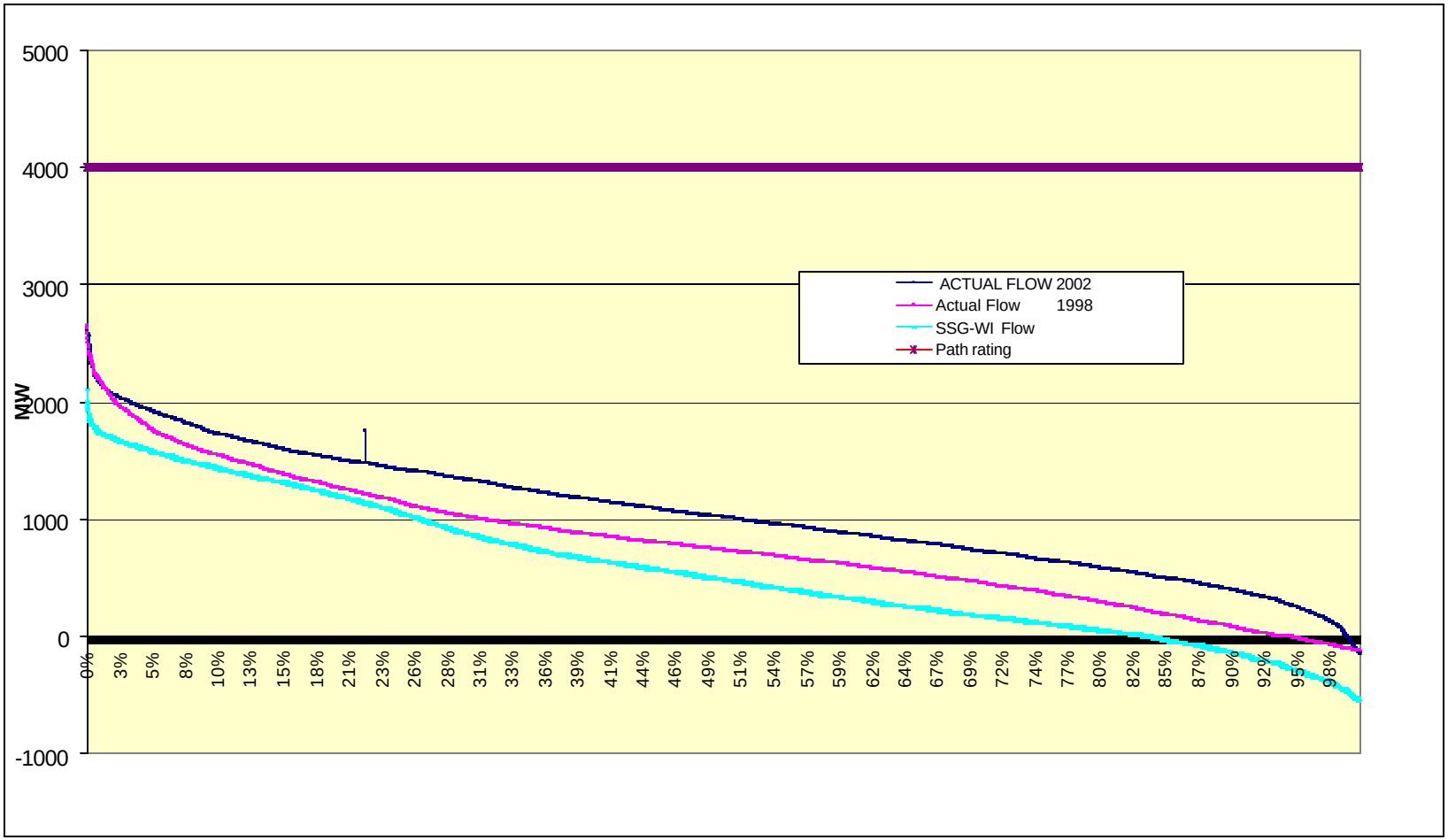
Scenario Results Summary (continued)

- "EOR " and "SCIT - CAISO confirmed the SSG-WI result to be consistent with what they are seeing
  - Thousands of MWs were added in Arizona & Nevada
- "TOT2" discrepancy has to do with reversed economics caused by the glut of generation in Arizona
- Path 26 compared favorably
- COI Deviation is due to the fair amount of gas added in the Northwest, attempting to move south

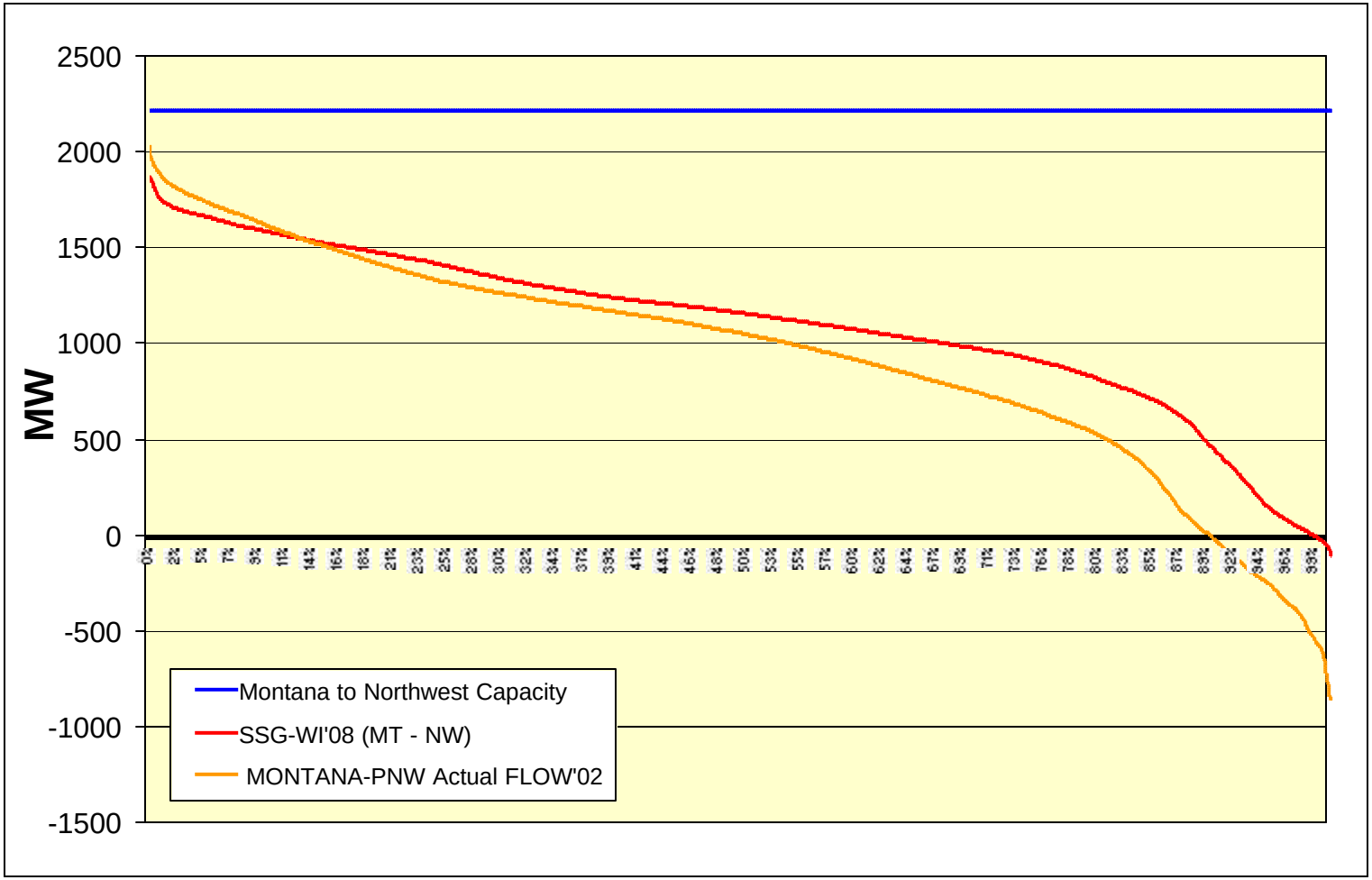
West of Hatwai (Old)



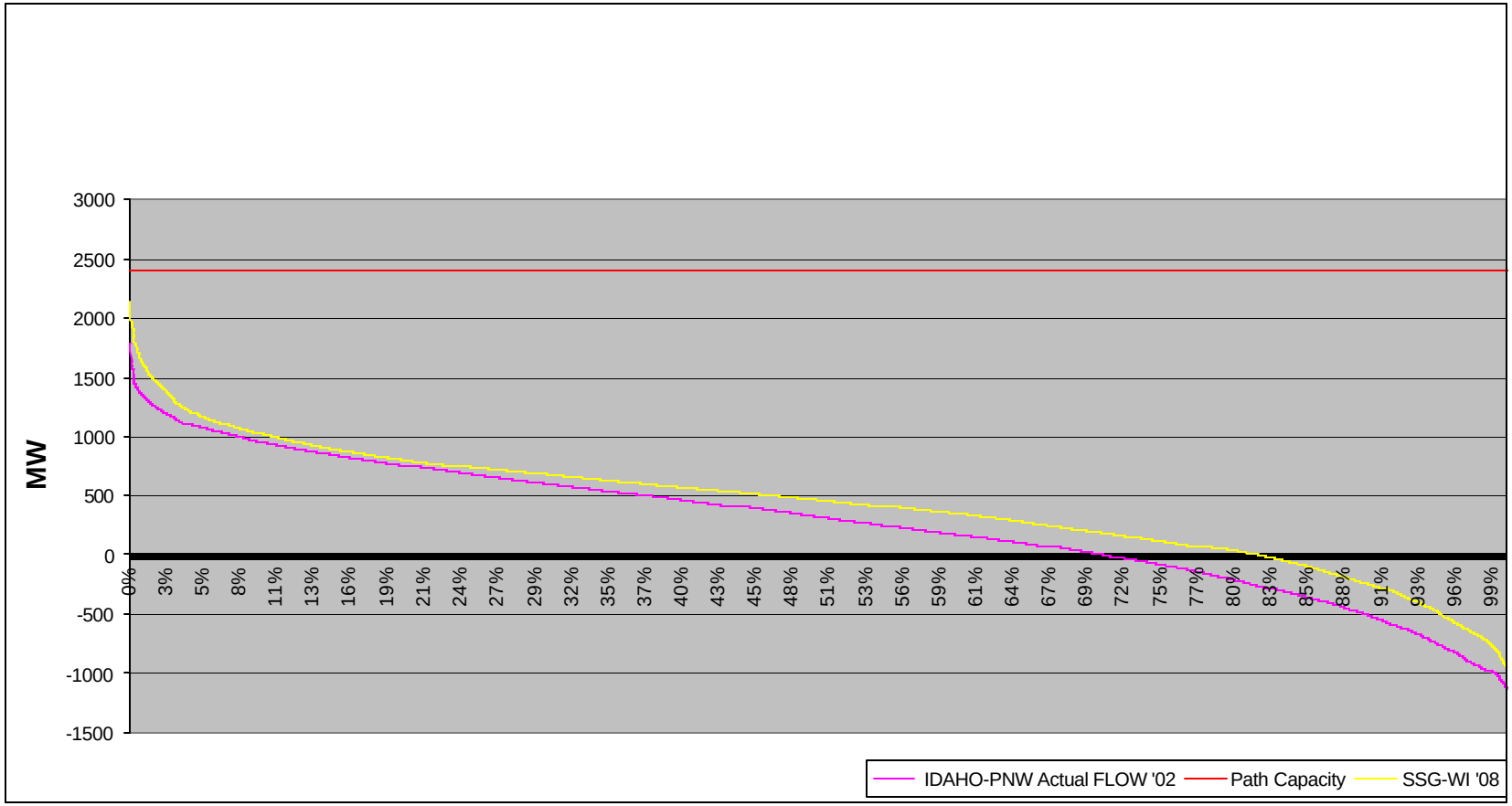
West of Hatwai (New)



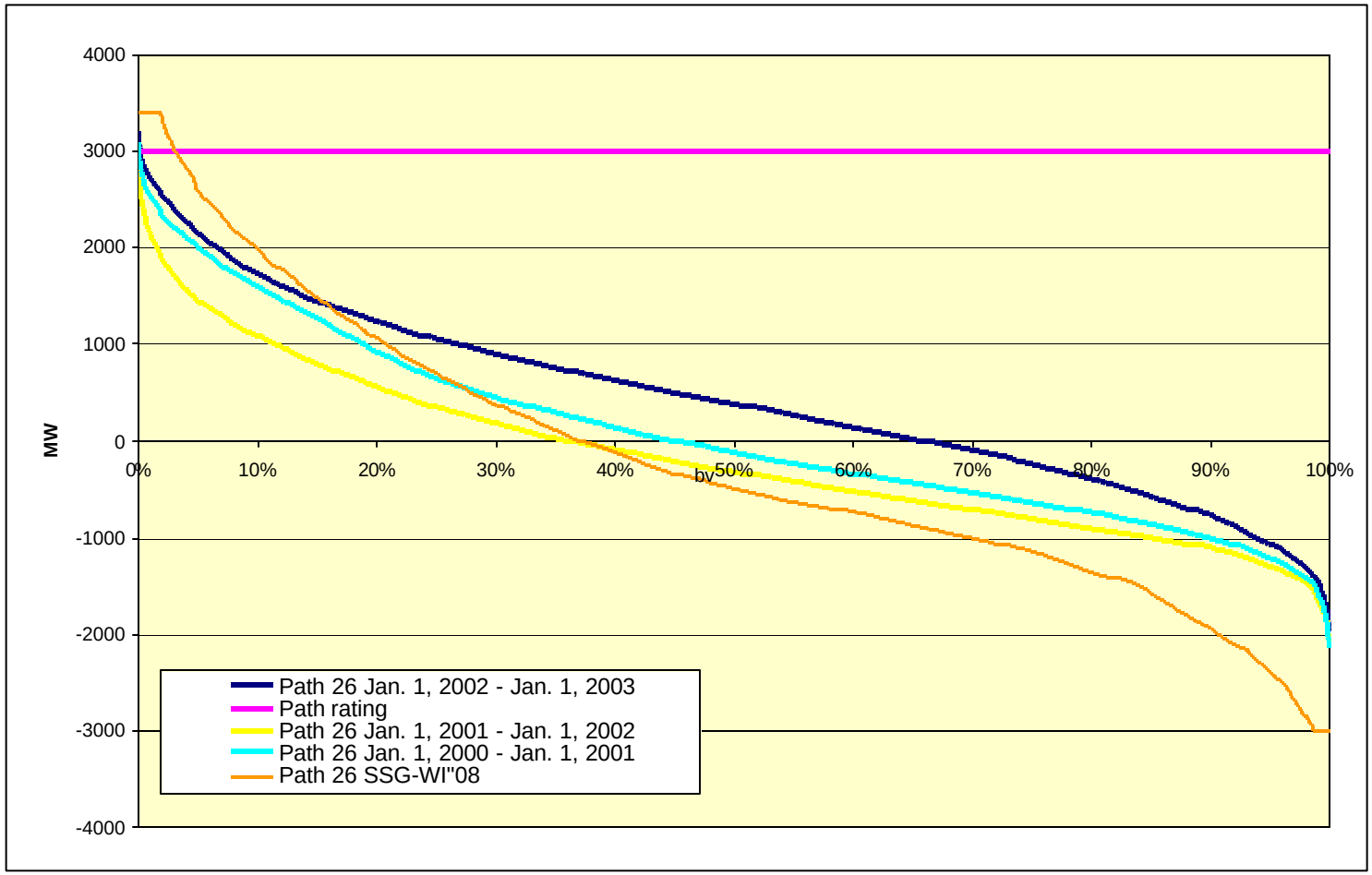
Montana to PNW Cut Plane



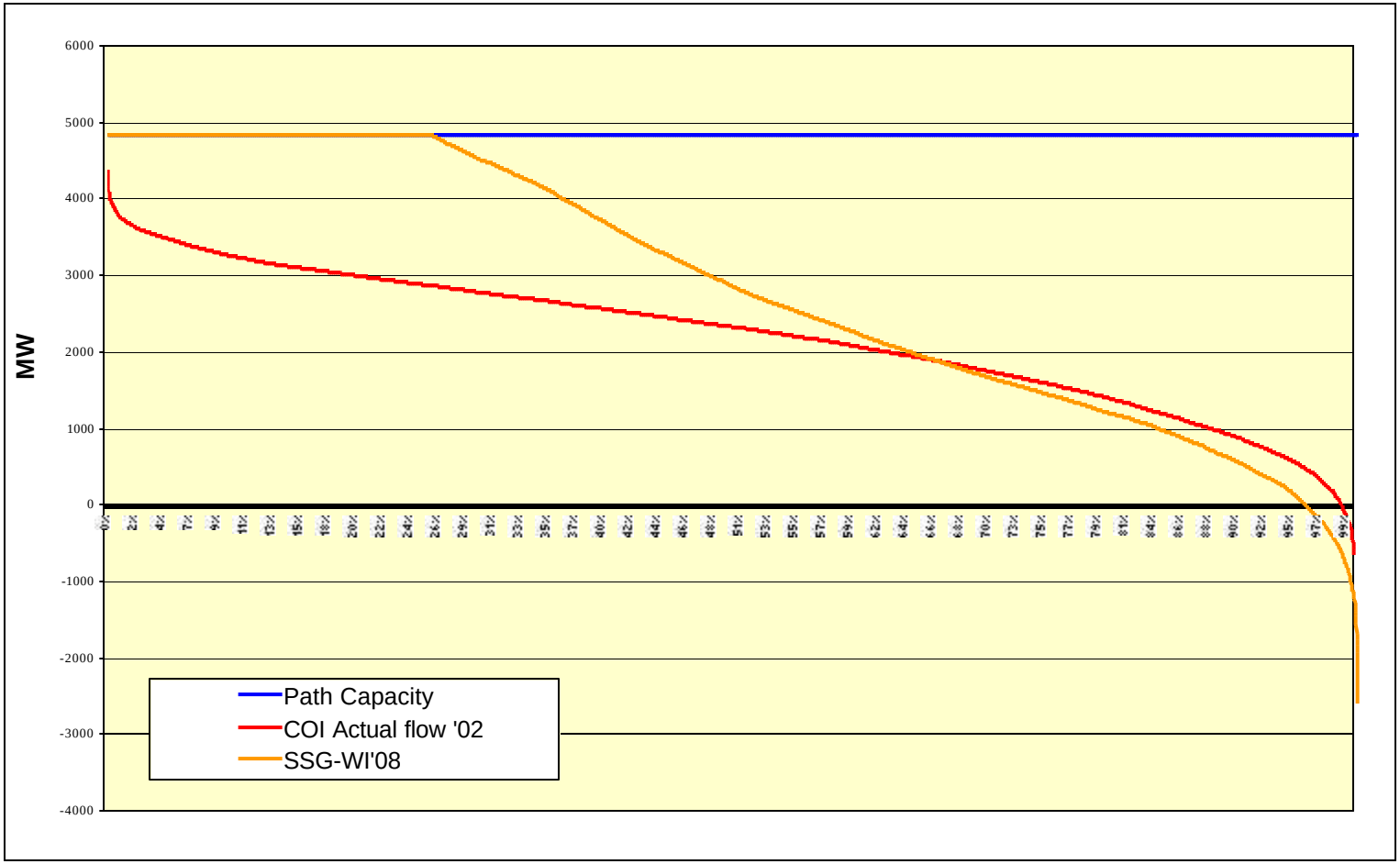
Idaho to PNW Cut Plane



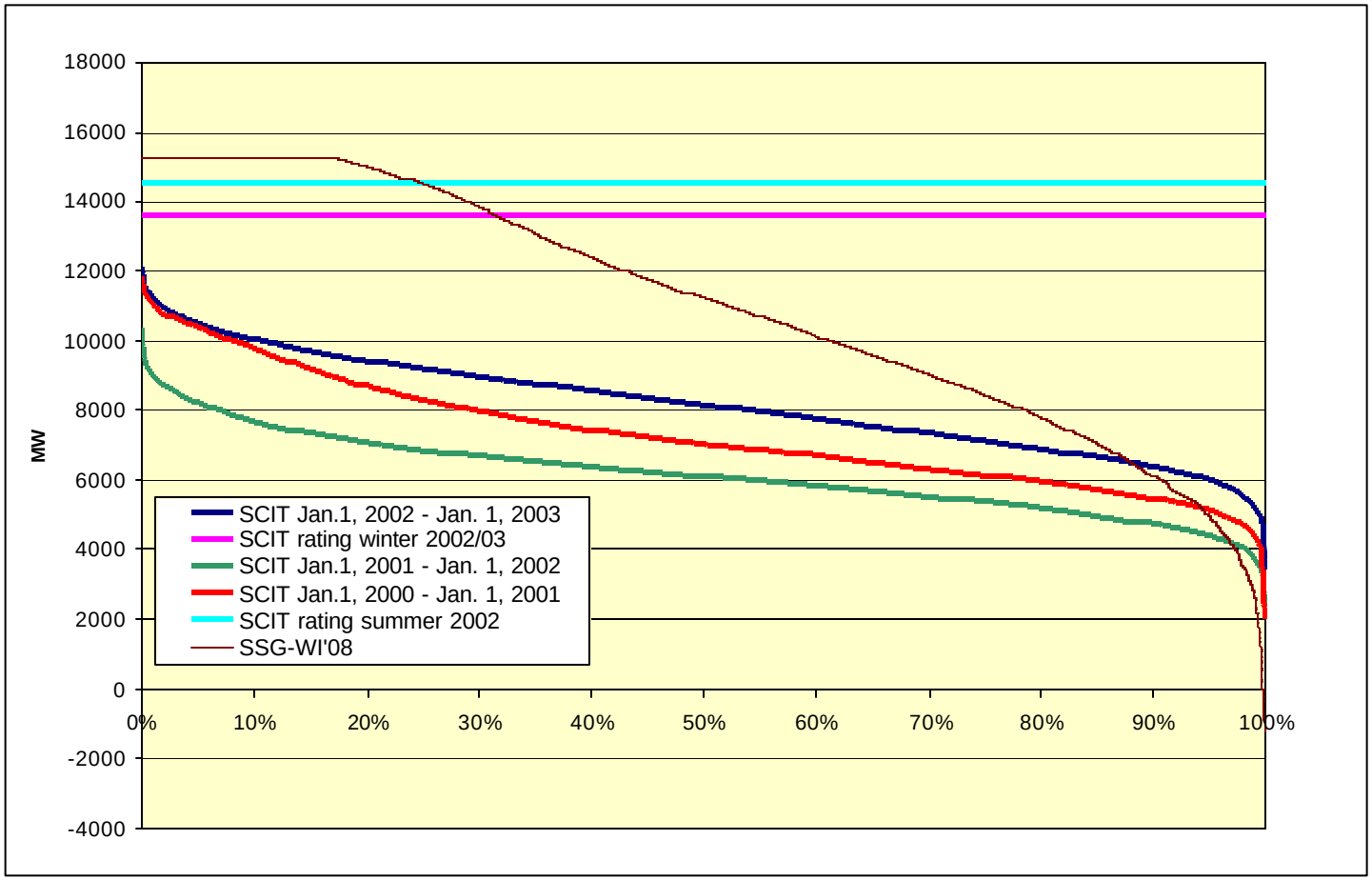
Path 26


4000
3000
2000
1000
0
-1000
-2000
-3000
-4000
MW
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Path 26 Jan. 1, 2002 - Jan. 1, 2003
Path rating
Path 26 Jan. 1, 2001 - Jan. 1, 2002
Path 26 Jan. 1, 2000 - Jan. 1, 2001
Path 26 SSG-WI"08

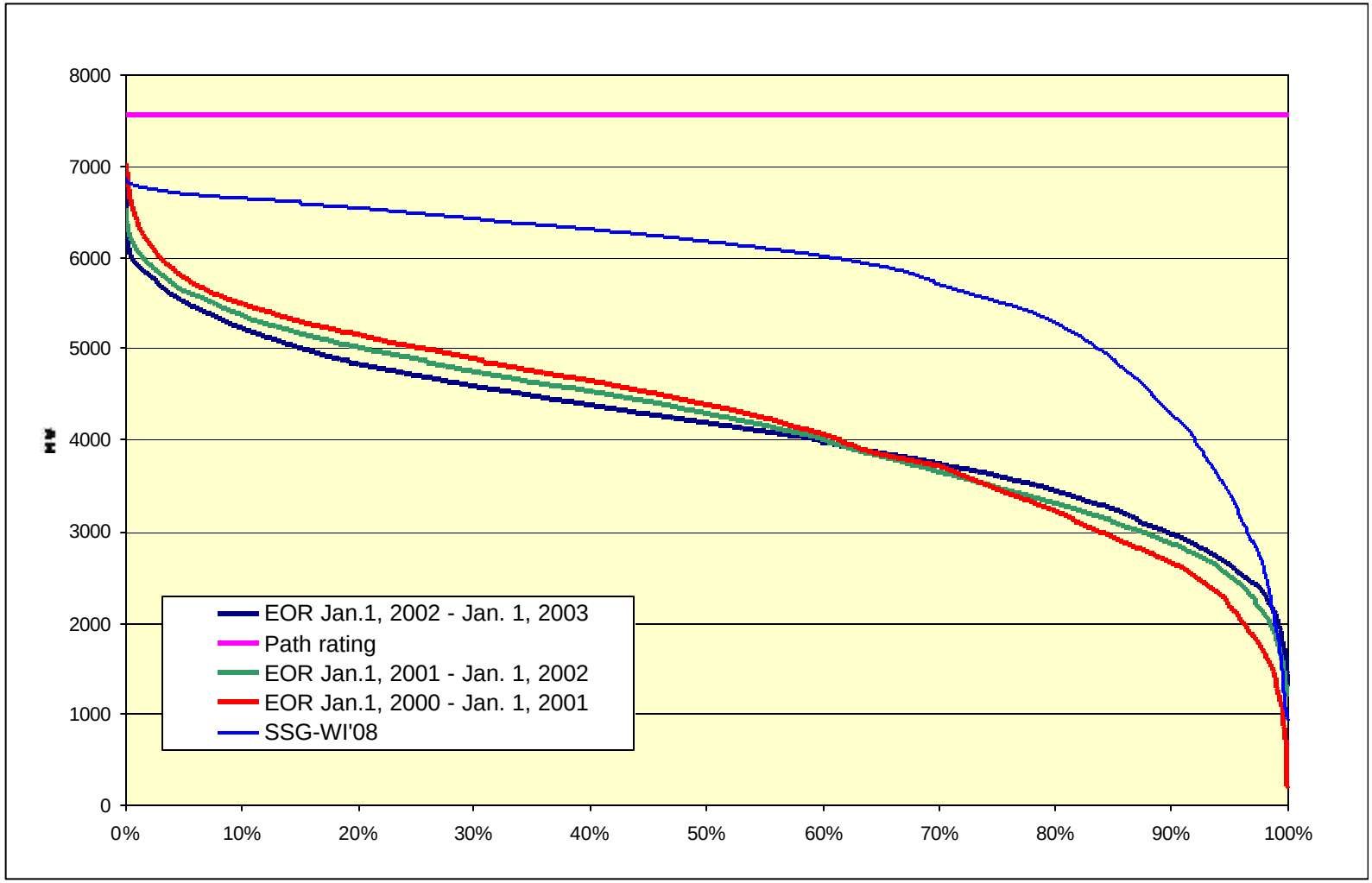
COI


MW
6000
5000
4000
3000
2000
1000
0
-1000
-2000
-3000
-4000
Path Capacity
COI Actual flow '02
SSG-WI'08

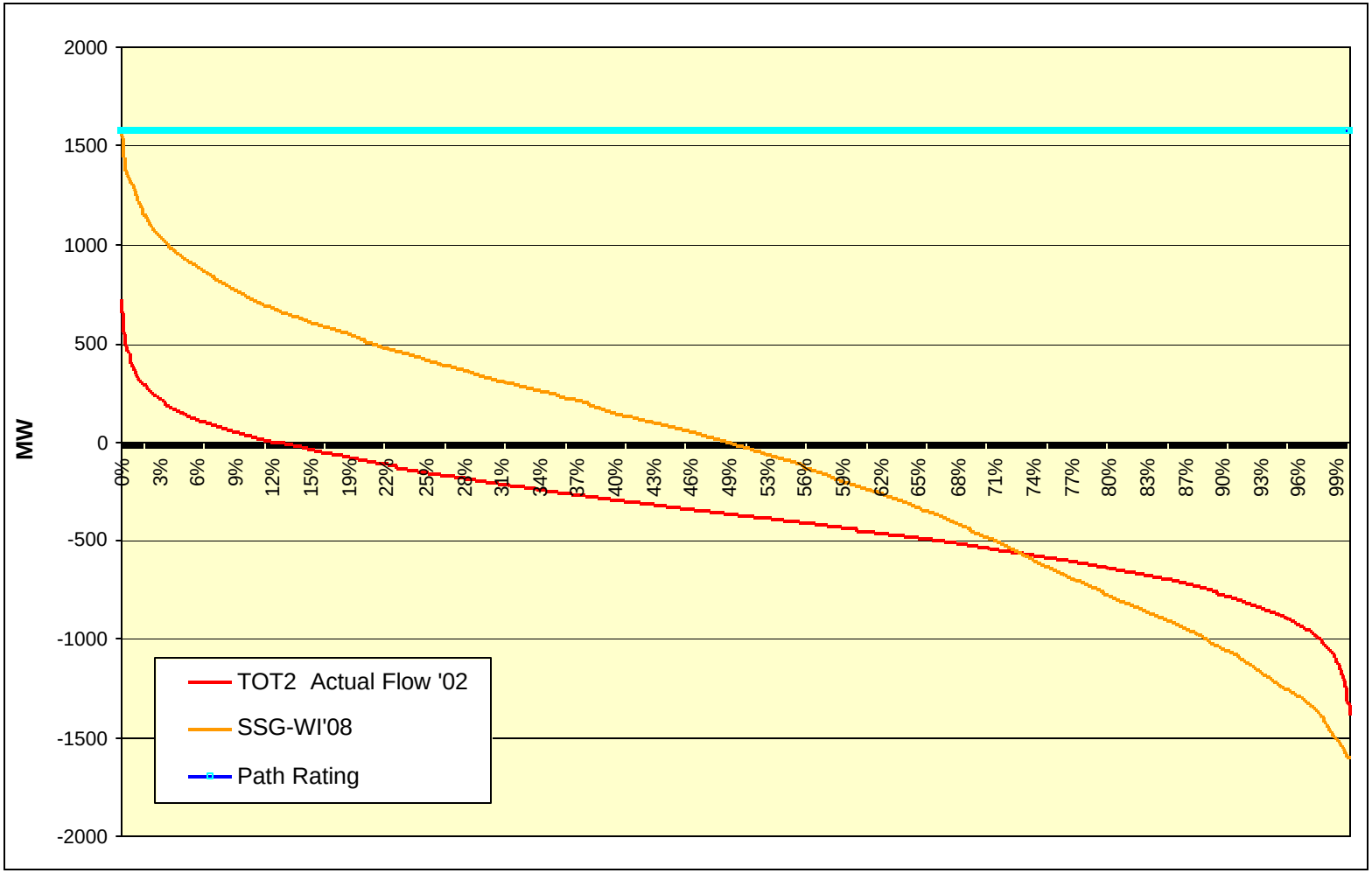
SCIT


18000
16000
14000
12000
10000
8000
6000
4000
2000
0
-2000
-4000
MW
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
SCIT Jan.1, 2002 - Jan. 1, 2003
SCIT rating winter 2002/03
SCIT Jan.1, 2001 - Jan. 1, 2002
SCIT Jan.1, 2000 - Jan. 1, 2001
SCIT rating summer 2002
SSG-WI'08

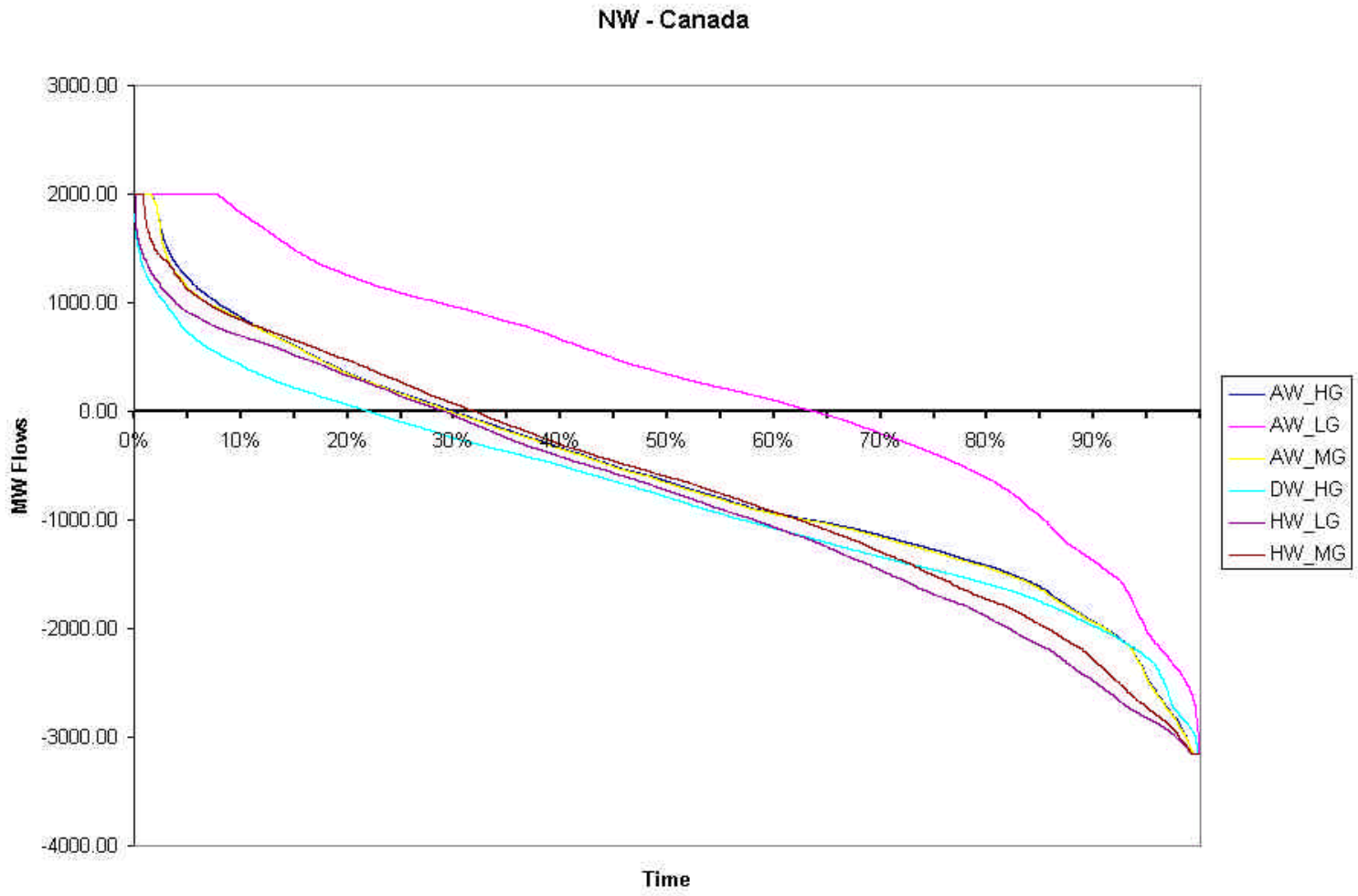
East of River



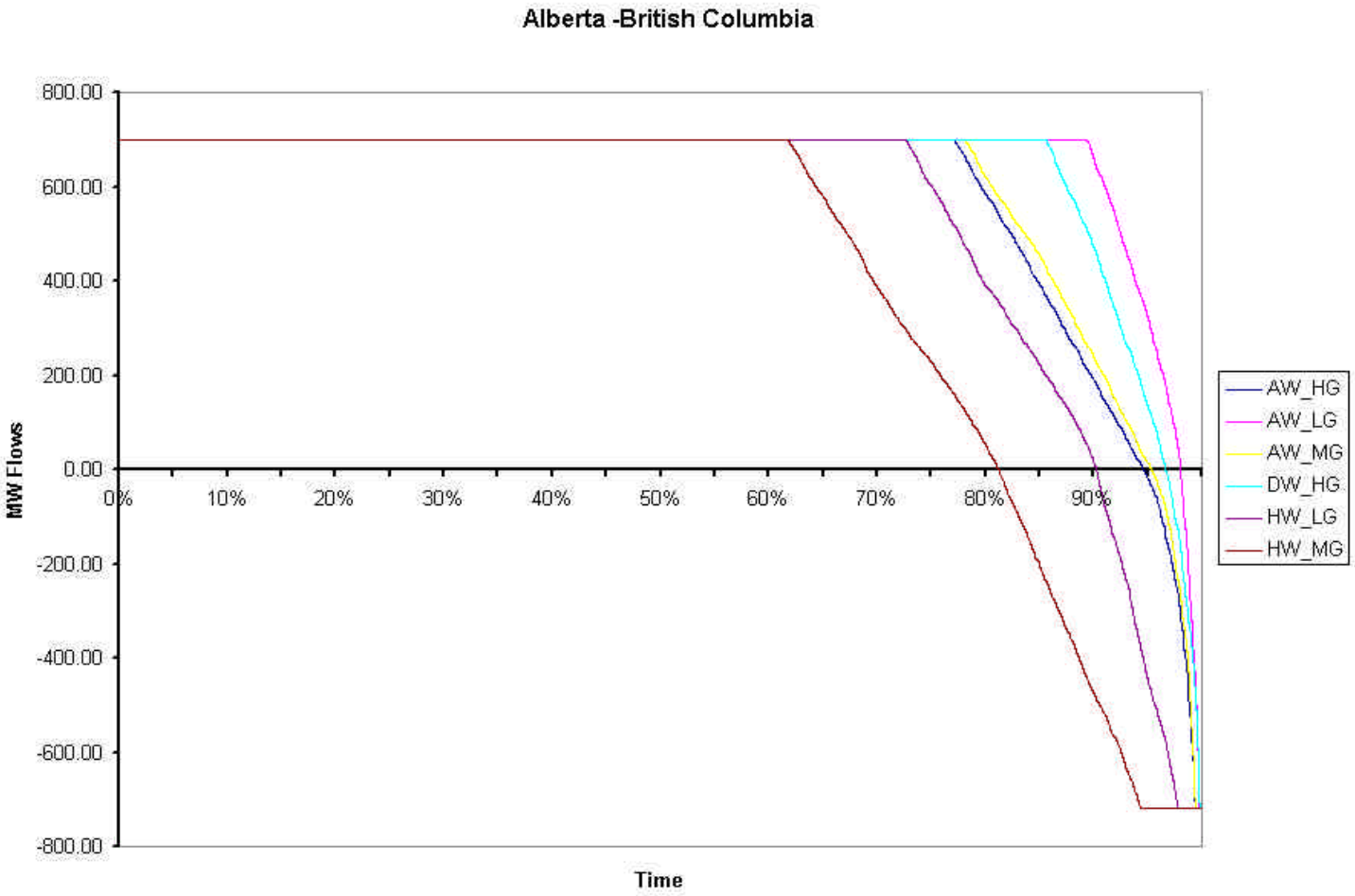
TOT2 (A+B+C)

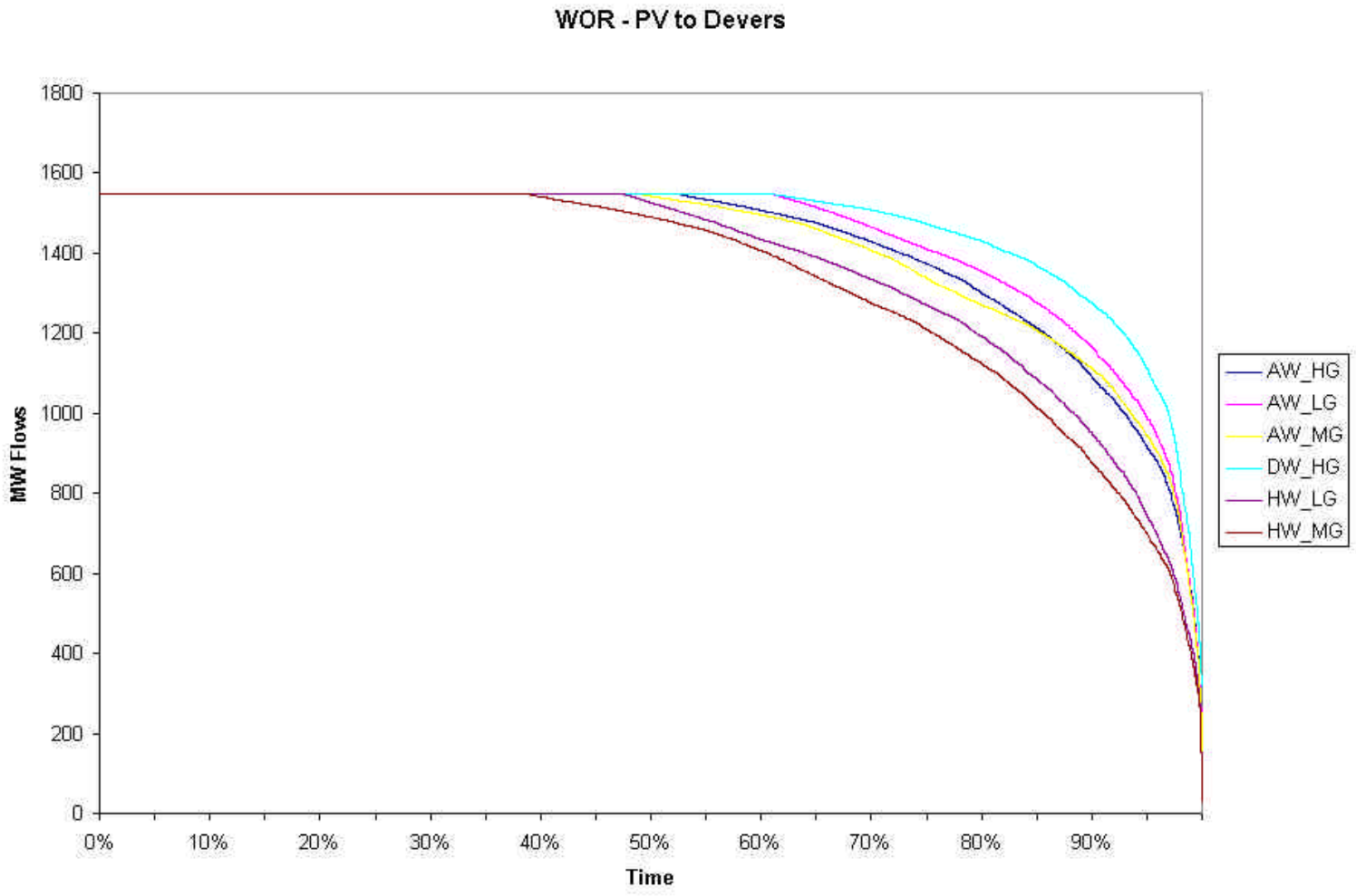

2000
1500
1000
500
0
-500
-1000
-1500
-2000
MW
0%
3%
6%
9%
12%
15%
19%
22%
25%
28%
31%
34%
37%
40%
43%
46%
49%
53%
56%
59%
62%
65%
68%
71%
74%
77%
80%
83%
87%
90%
93%
96%
99%
TOT2 Actual Flow '02
SSG-WI'08
Path Rating

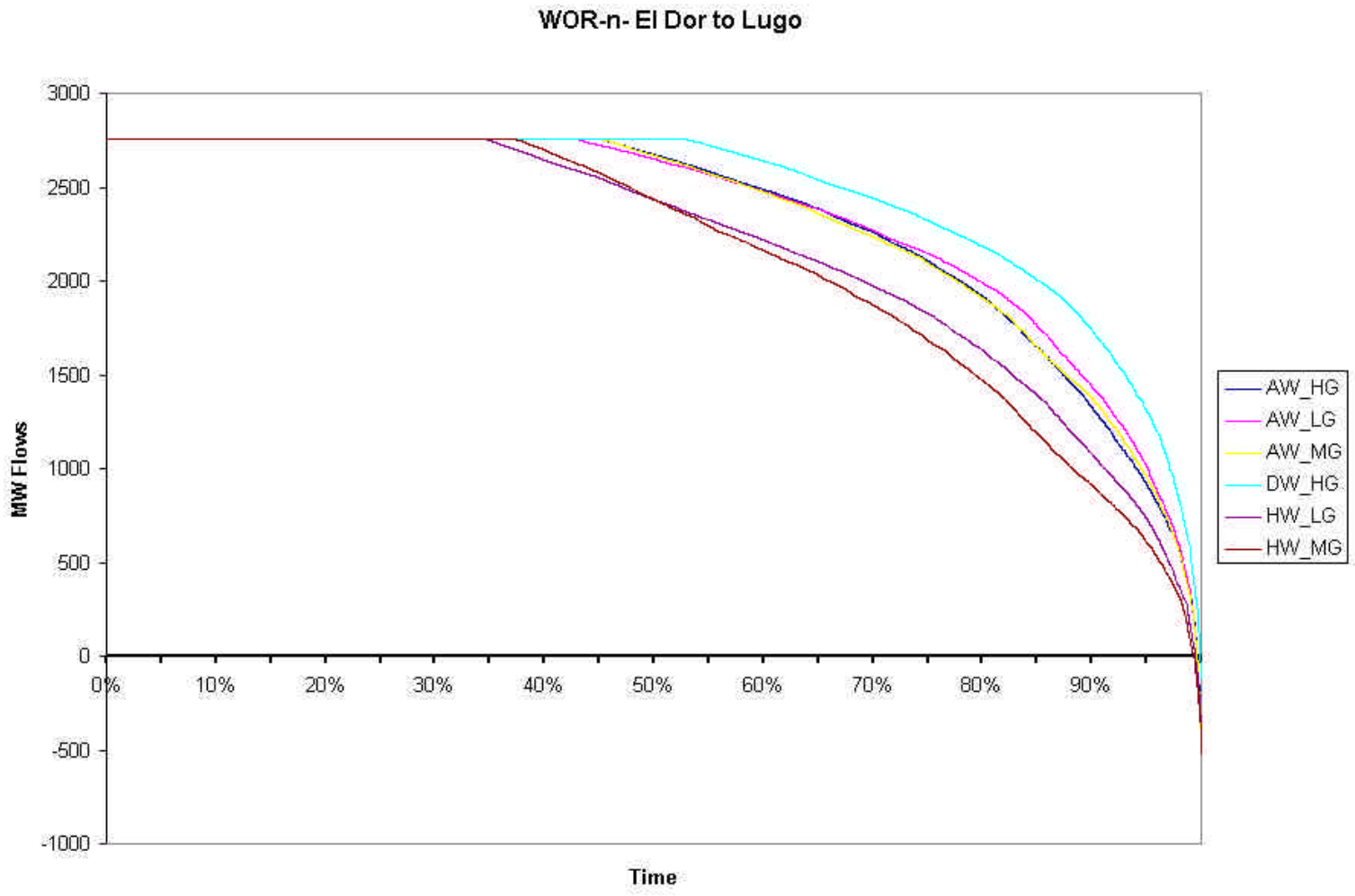
NW - Canada

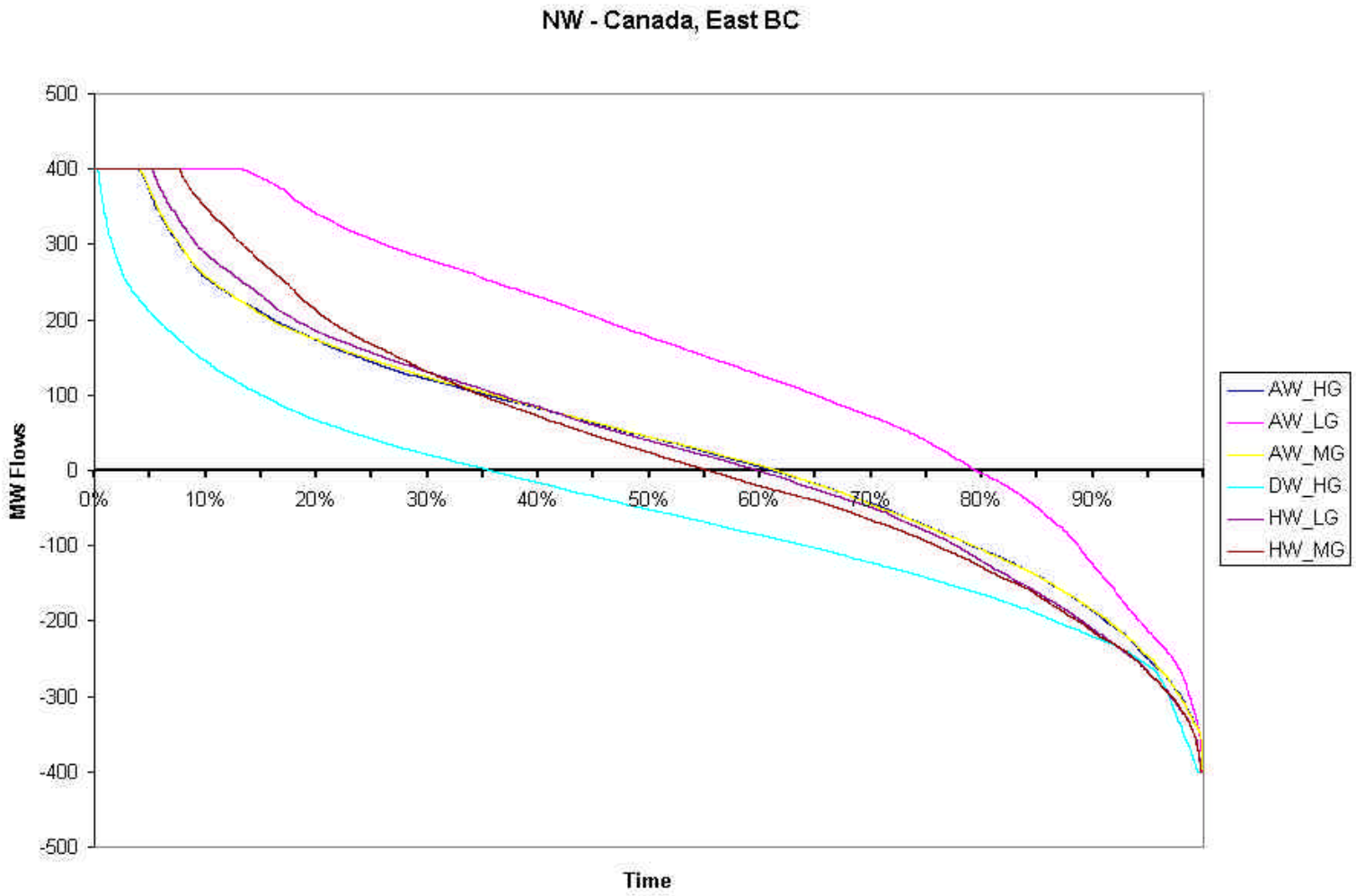

NW - Canada
3000.00
2000.00
1000.00
0.00
-1000.00
-2000.00
-3000.00
-4000.00
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

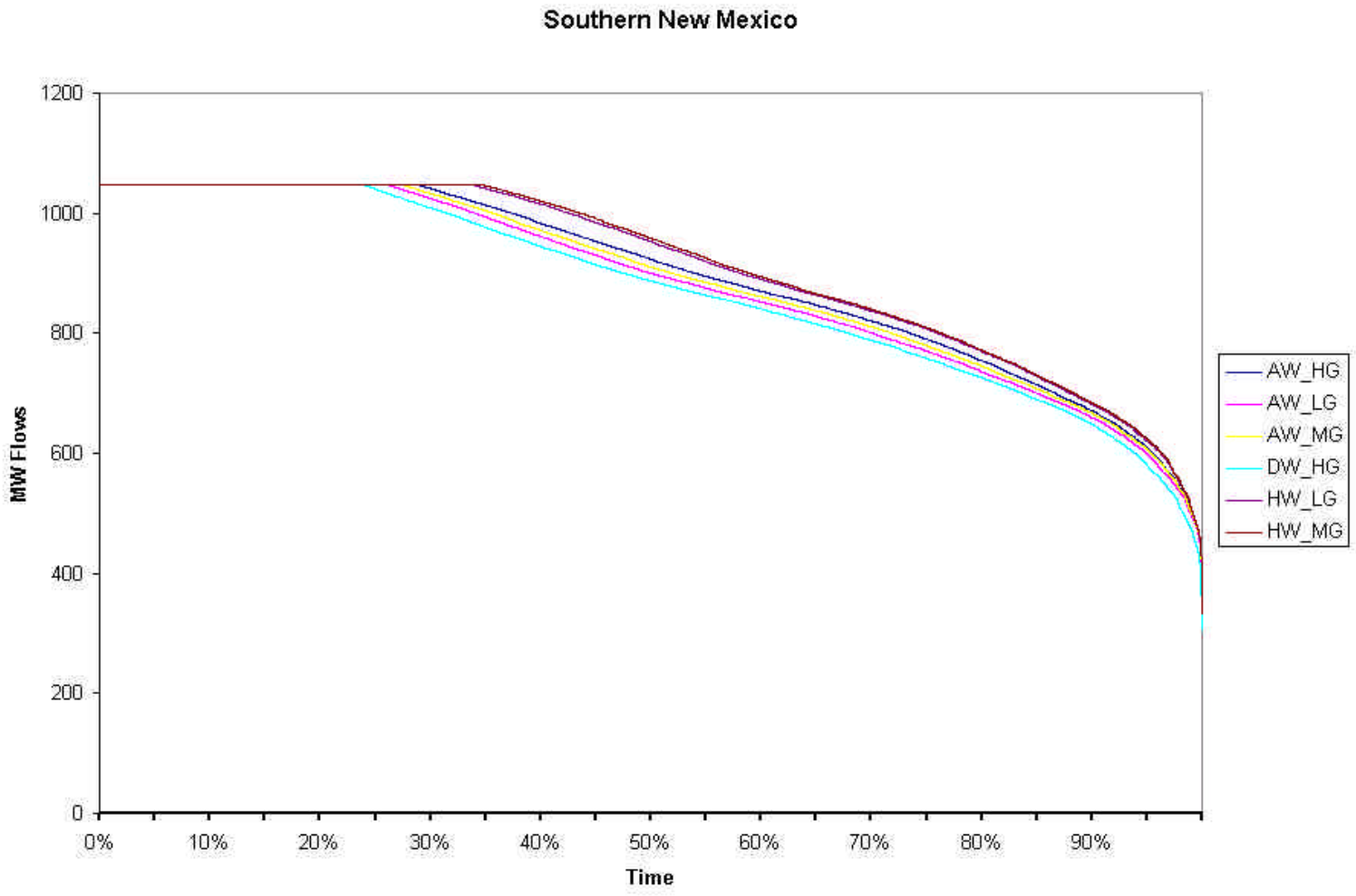
Alberta - British Columbia

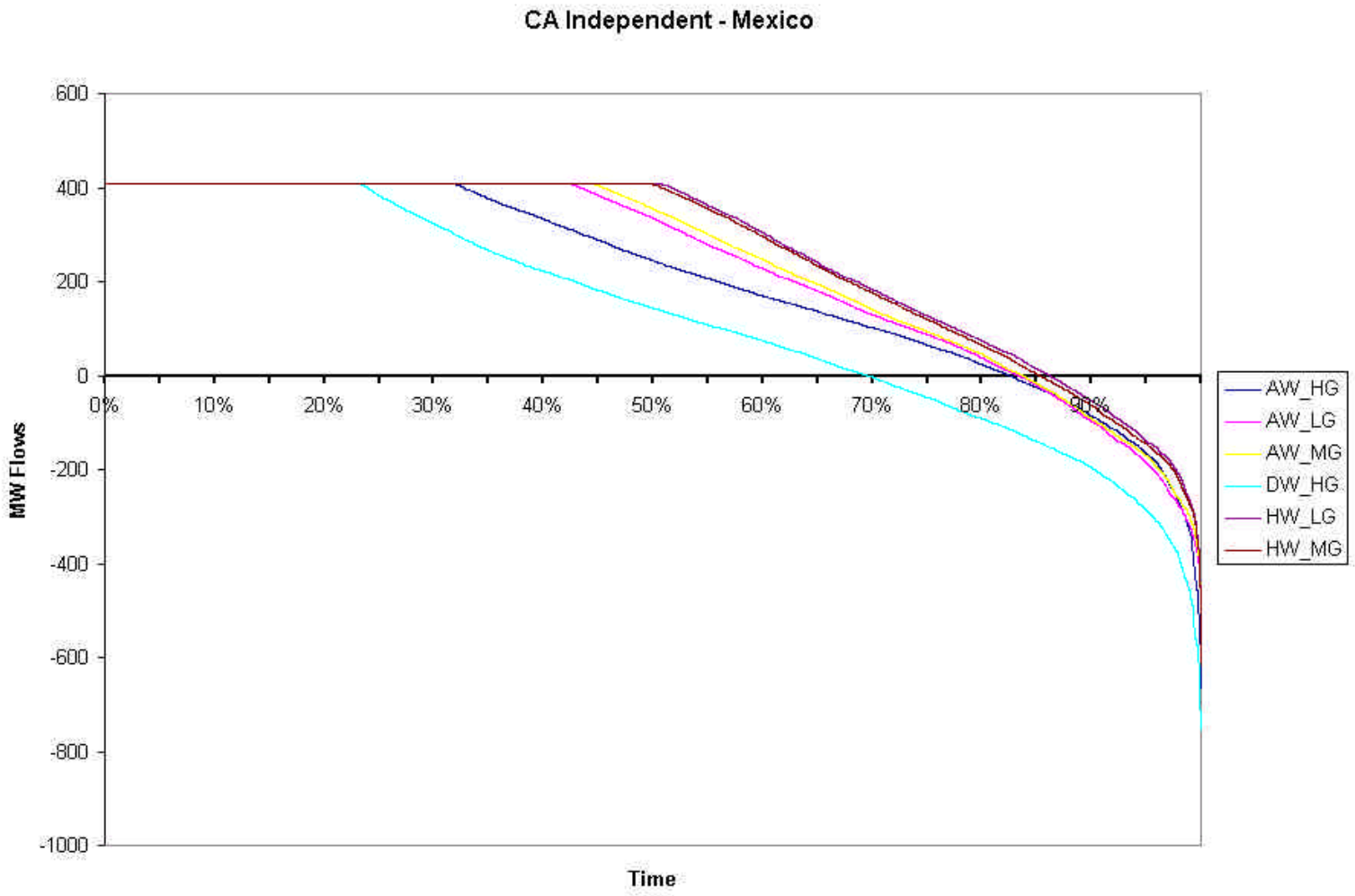


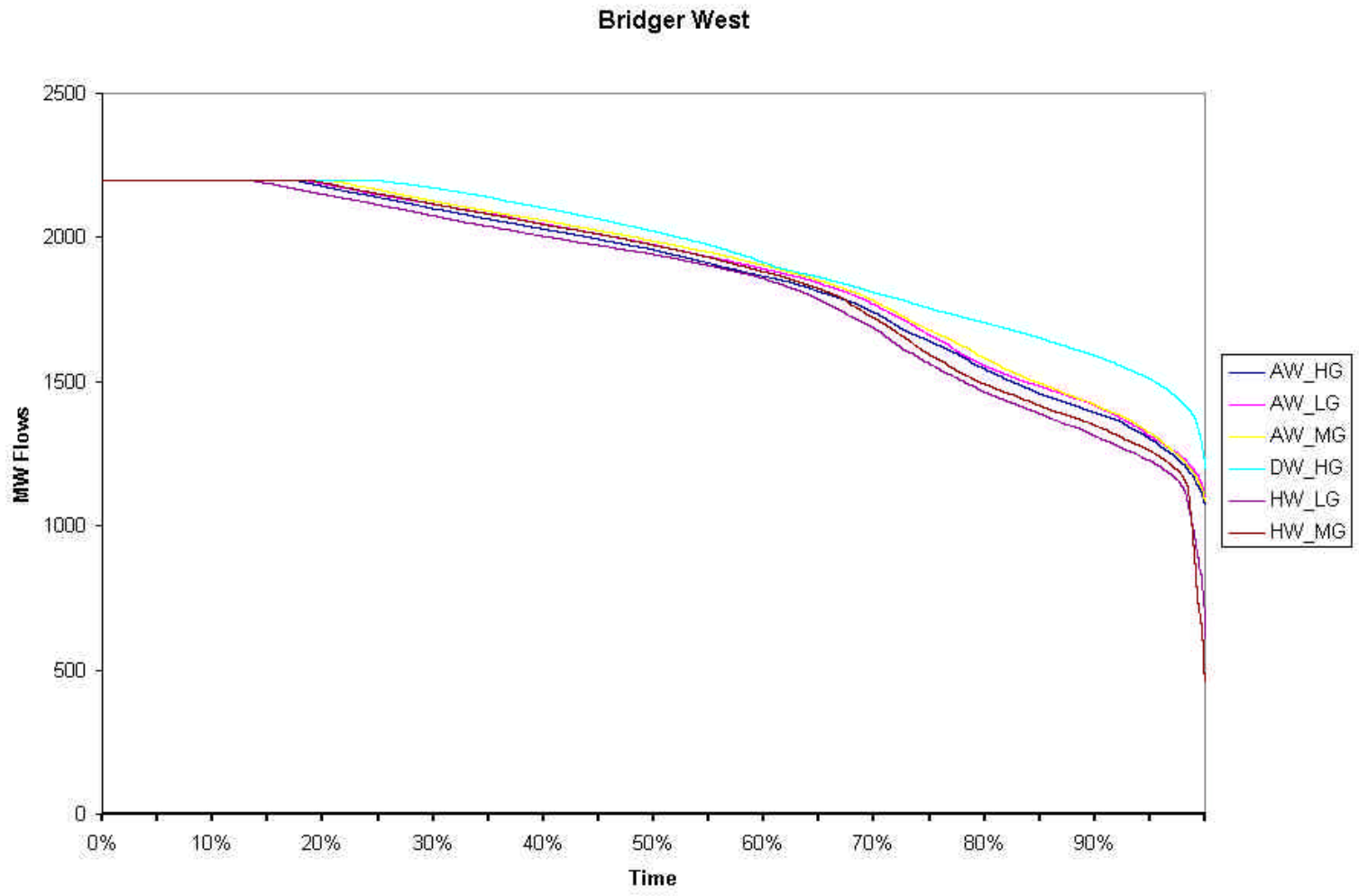

WOR - PV to Devers
MW Flows
1800
1600
1400
1200
1000
800
600
400
200
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

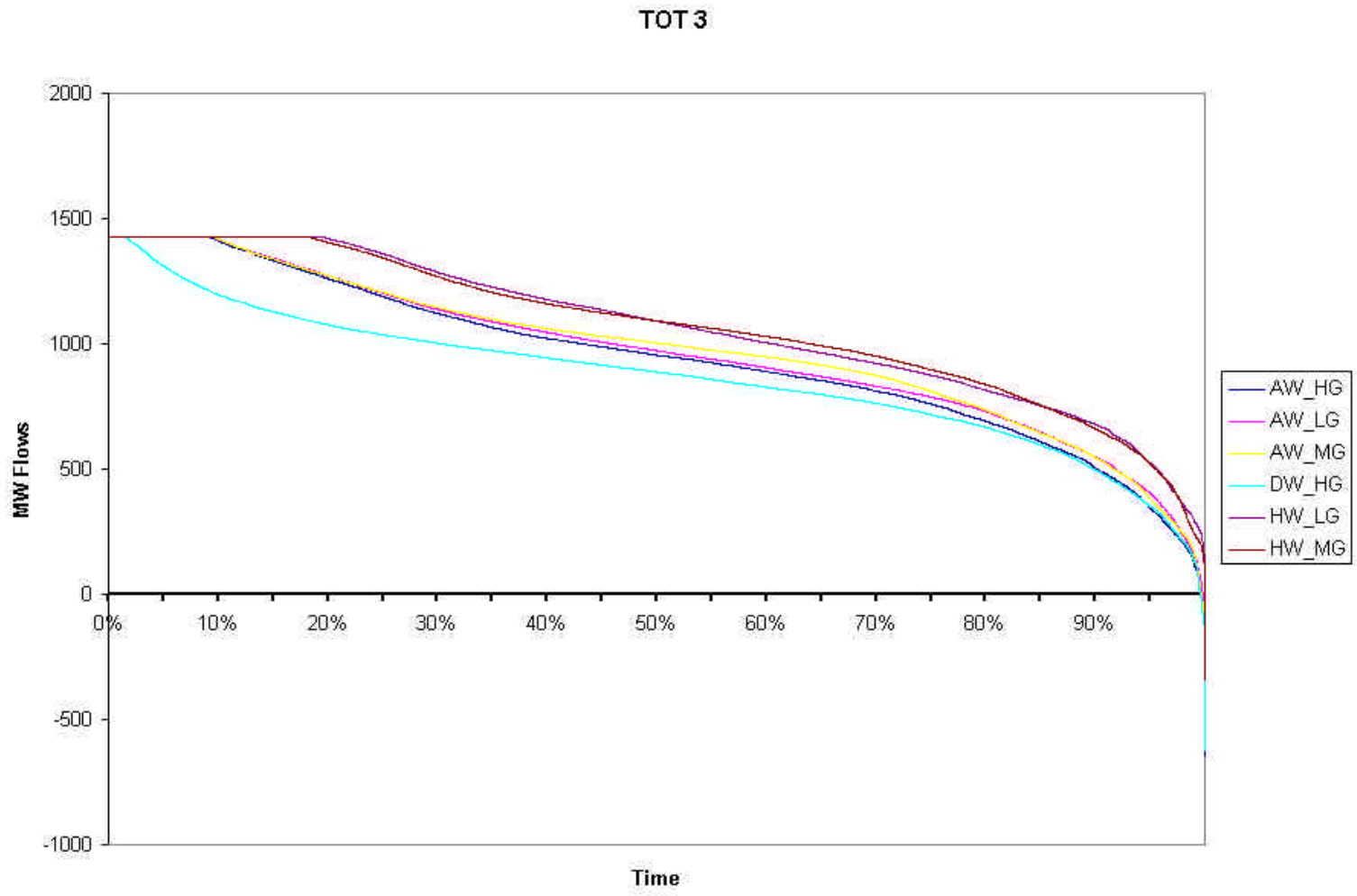

WOR-n- El Dor to Lugo
3000
2500
2000
1500
1000
500
0
-500
-1000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

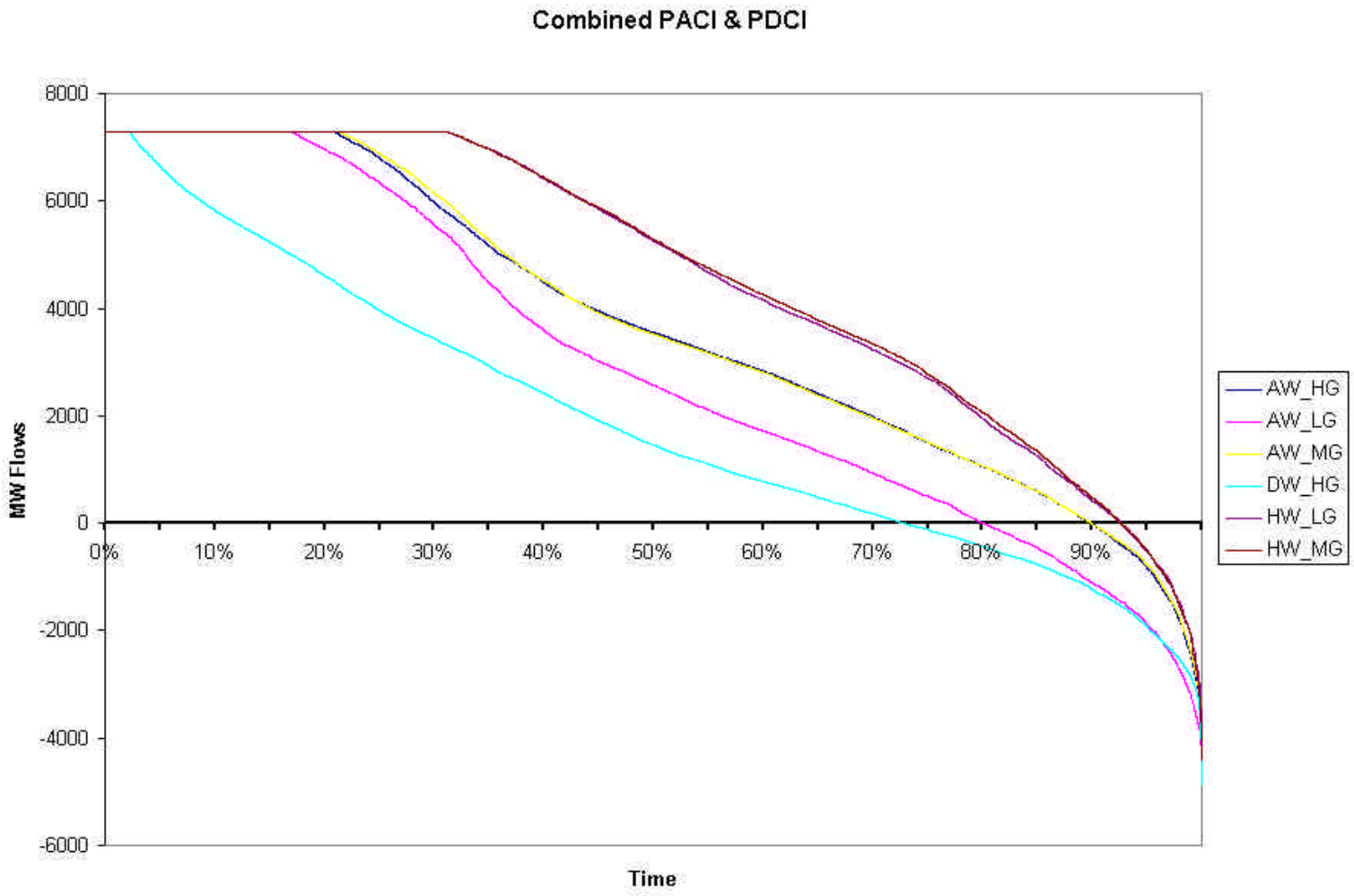

NW - Canada, East BC
500
400
300
200
100
0
-100
-200
-300
-400
-500
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

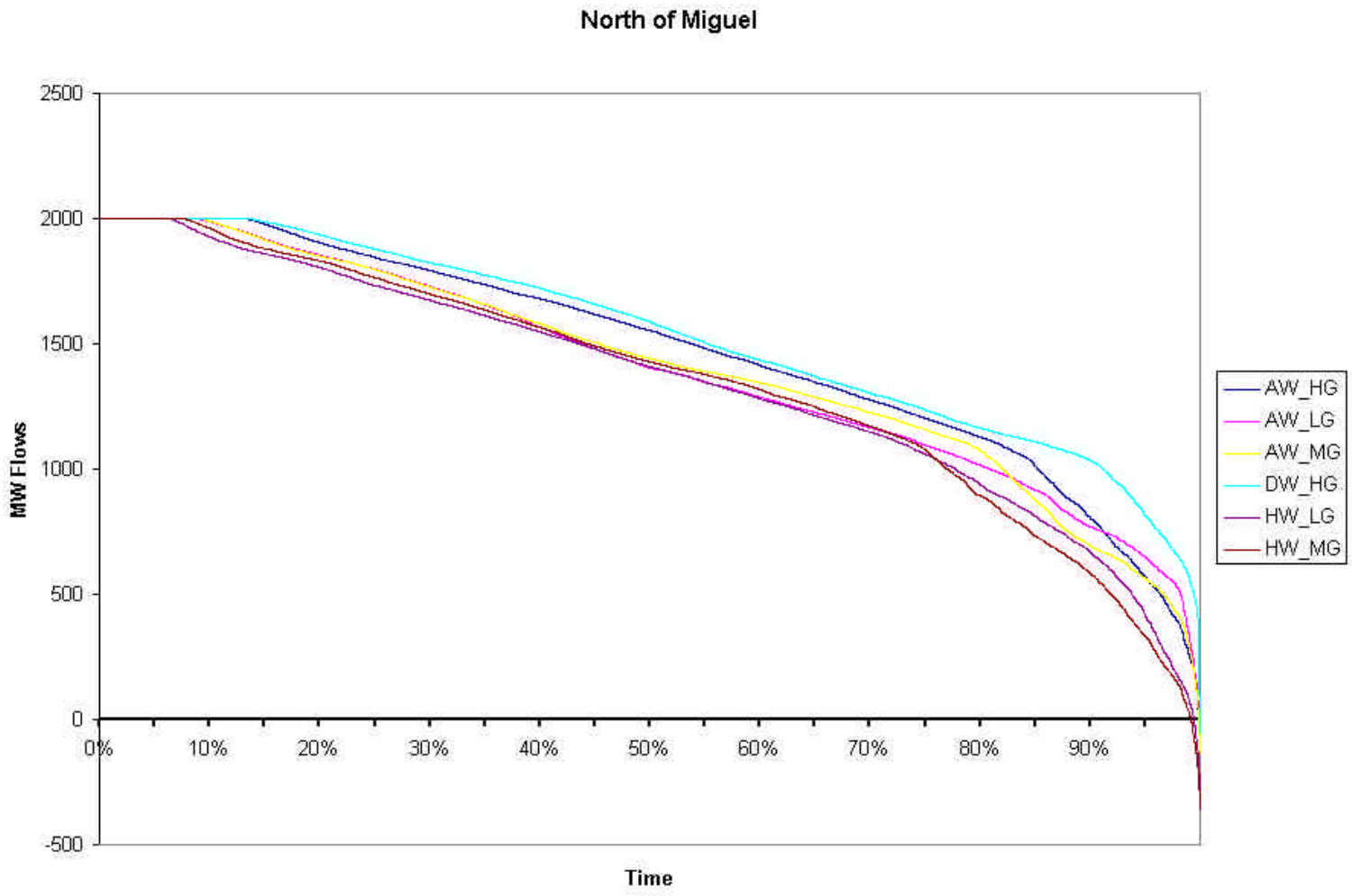

Southern New Mexico
1200
1000
800
600
400
200
0
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

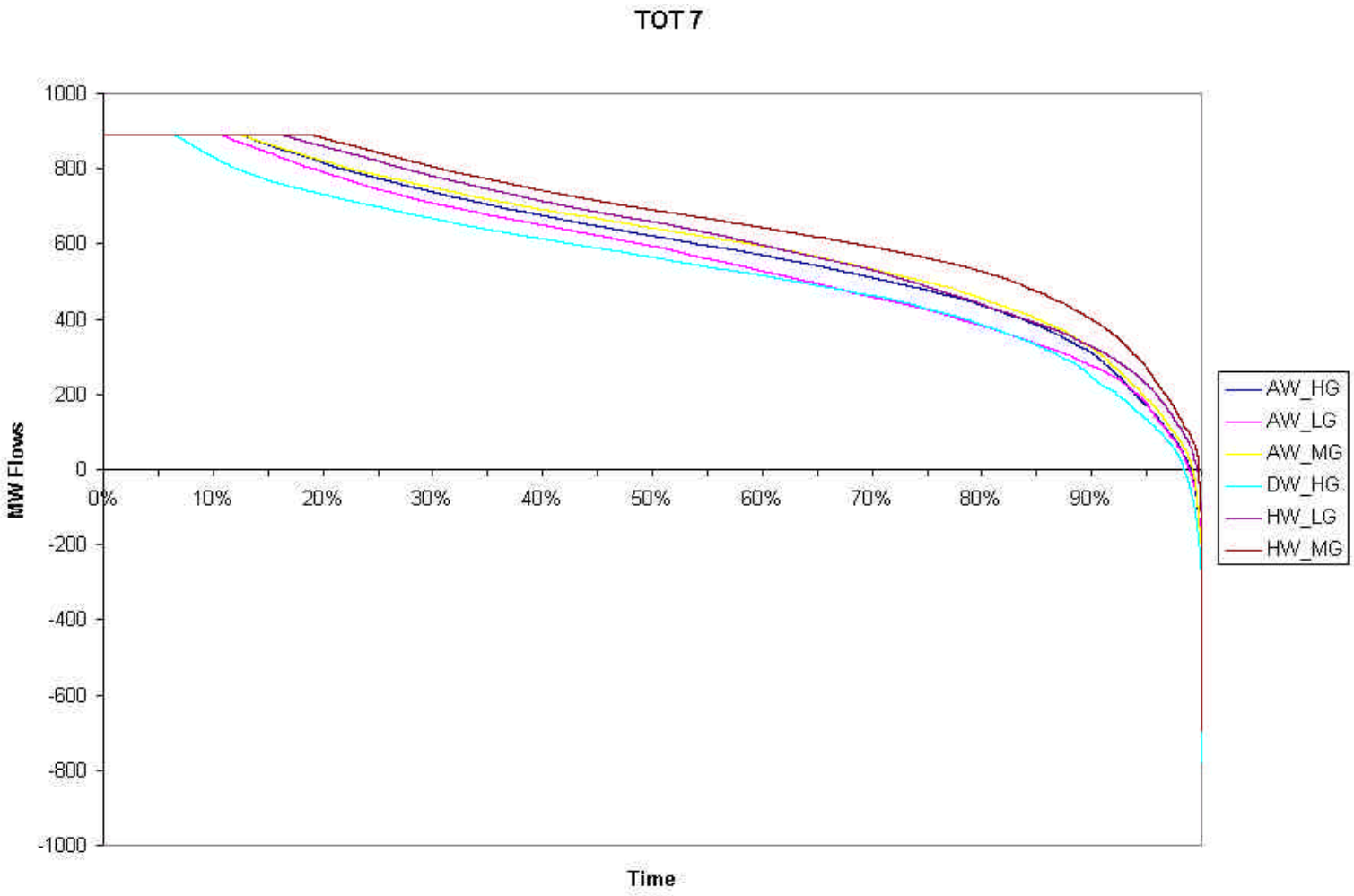

CA Independent - Mexico
600
400
200
0
-200
-400
-600
-800
-1000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

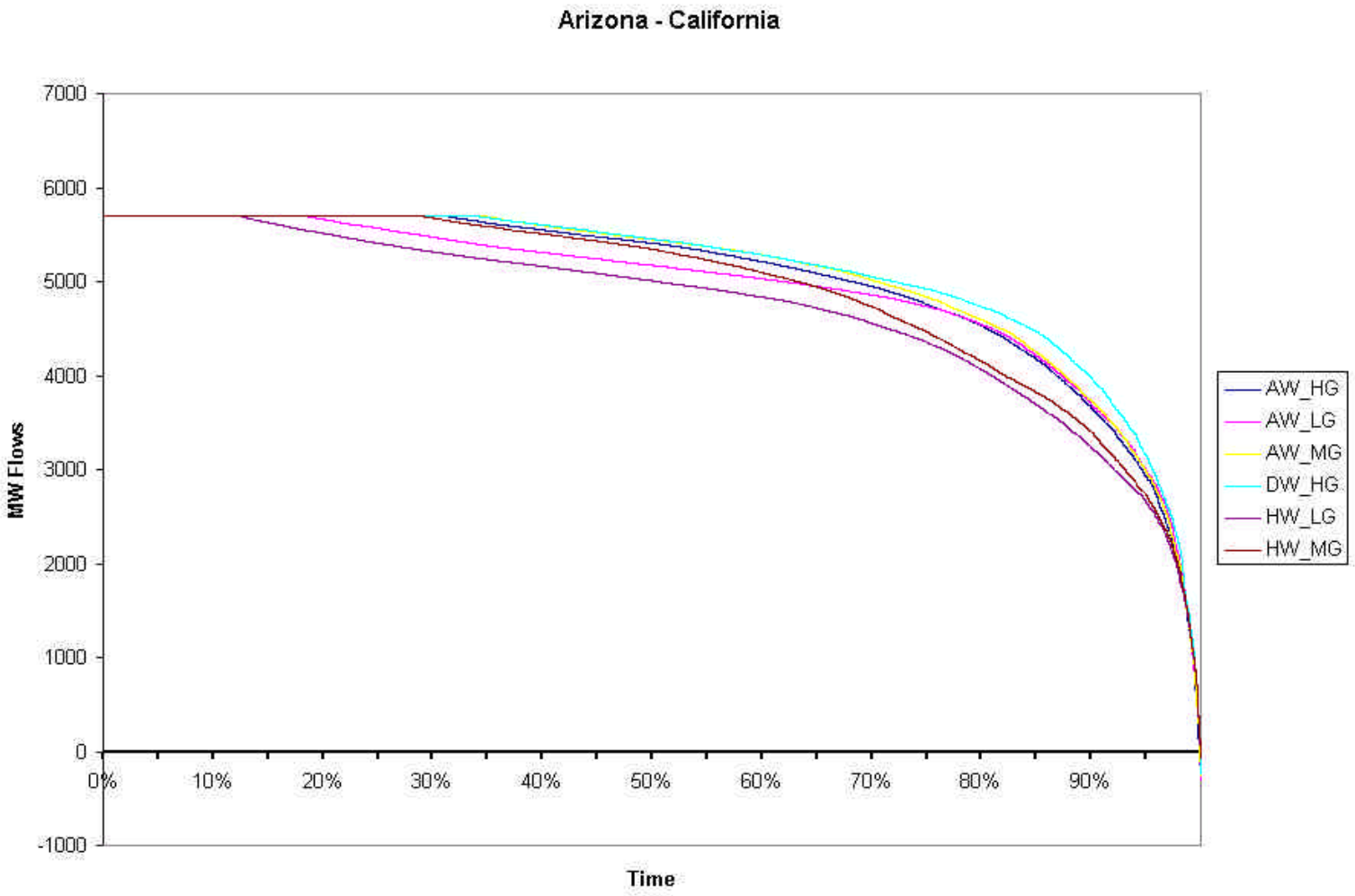

Bridger West
2500
2000
1500
1000
500
0
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

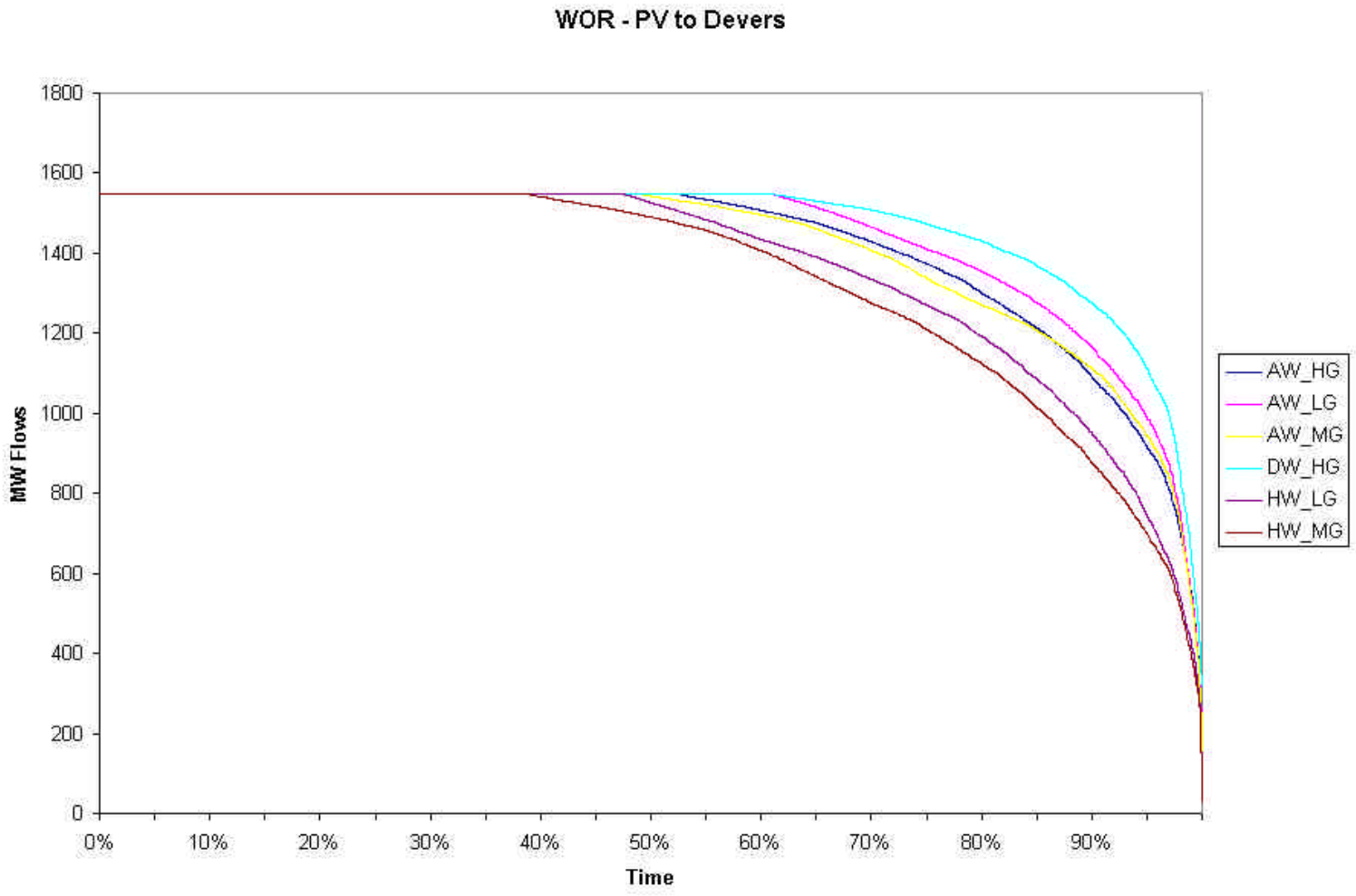

TOT 3
2000
1500
1000
500
0
-500
-1000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

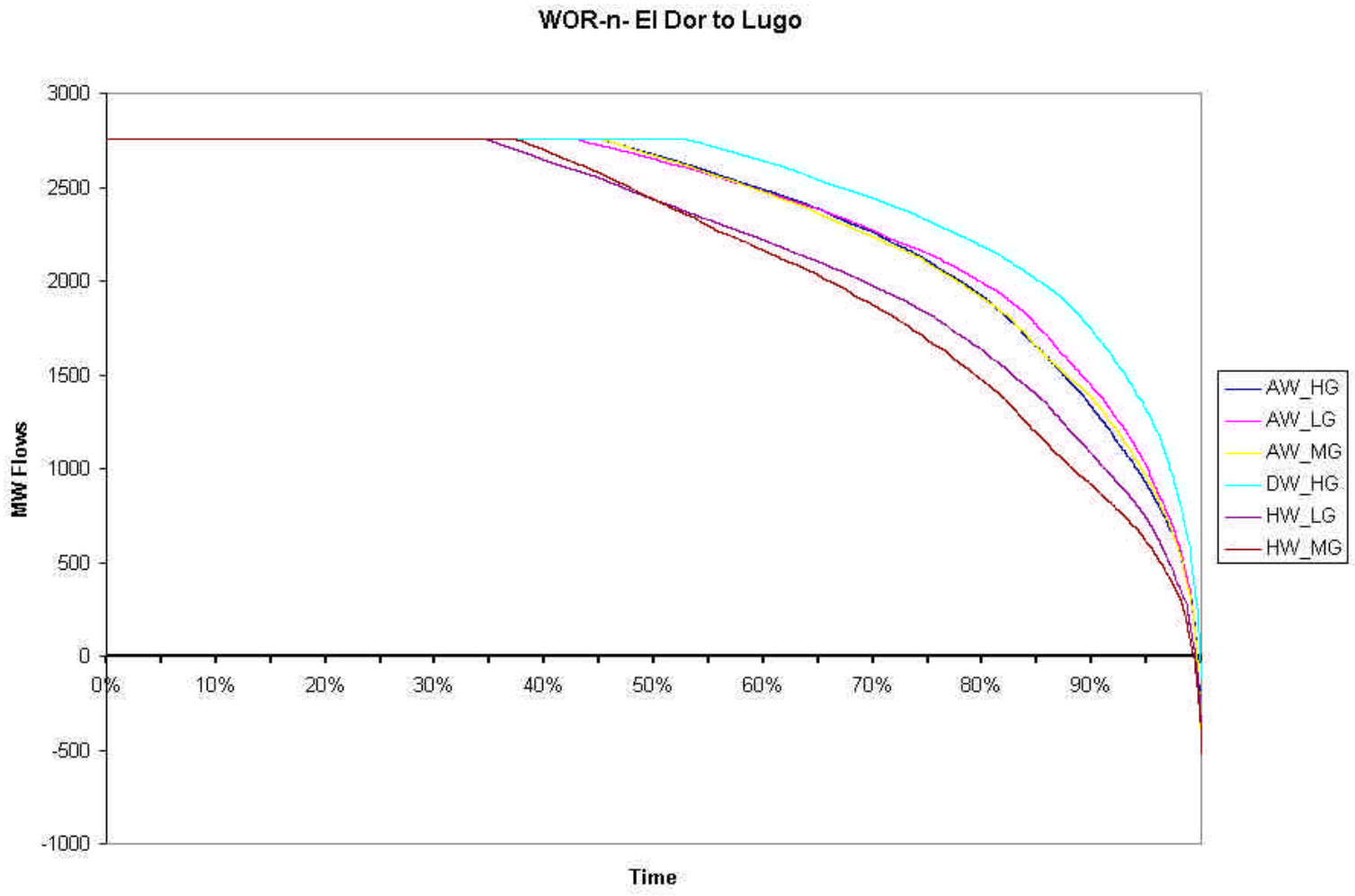

Combined PACI & PDCI
8000
6000
4000
2000
0
-2000
-4000
-6000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

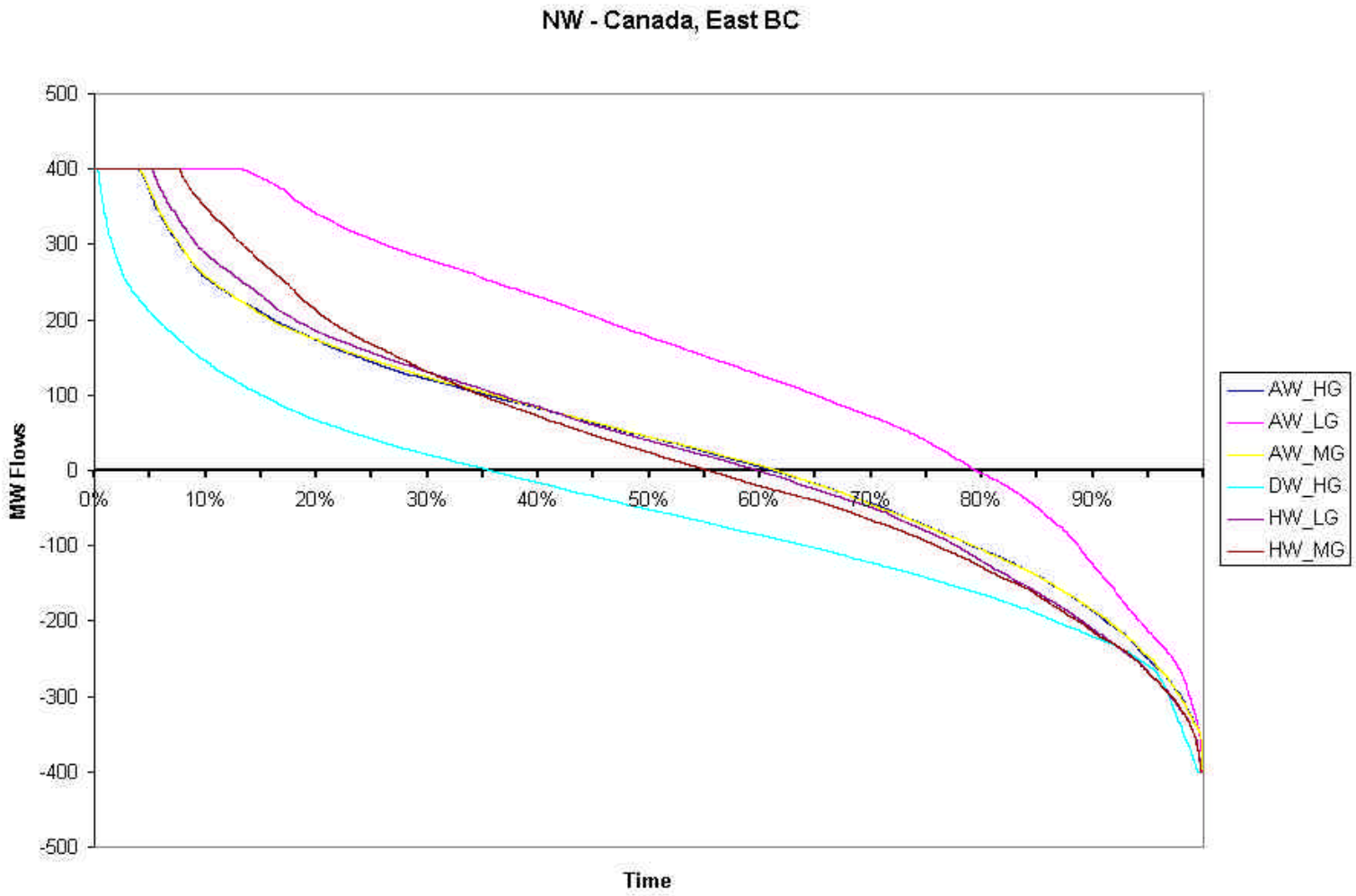

North of Miguel
2500
2000
1500
1000
500
0
-500
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

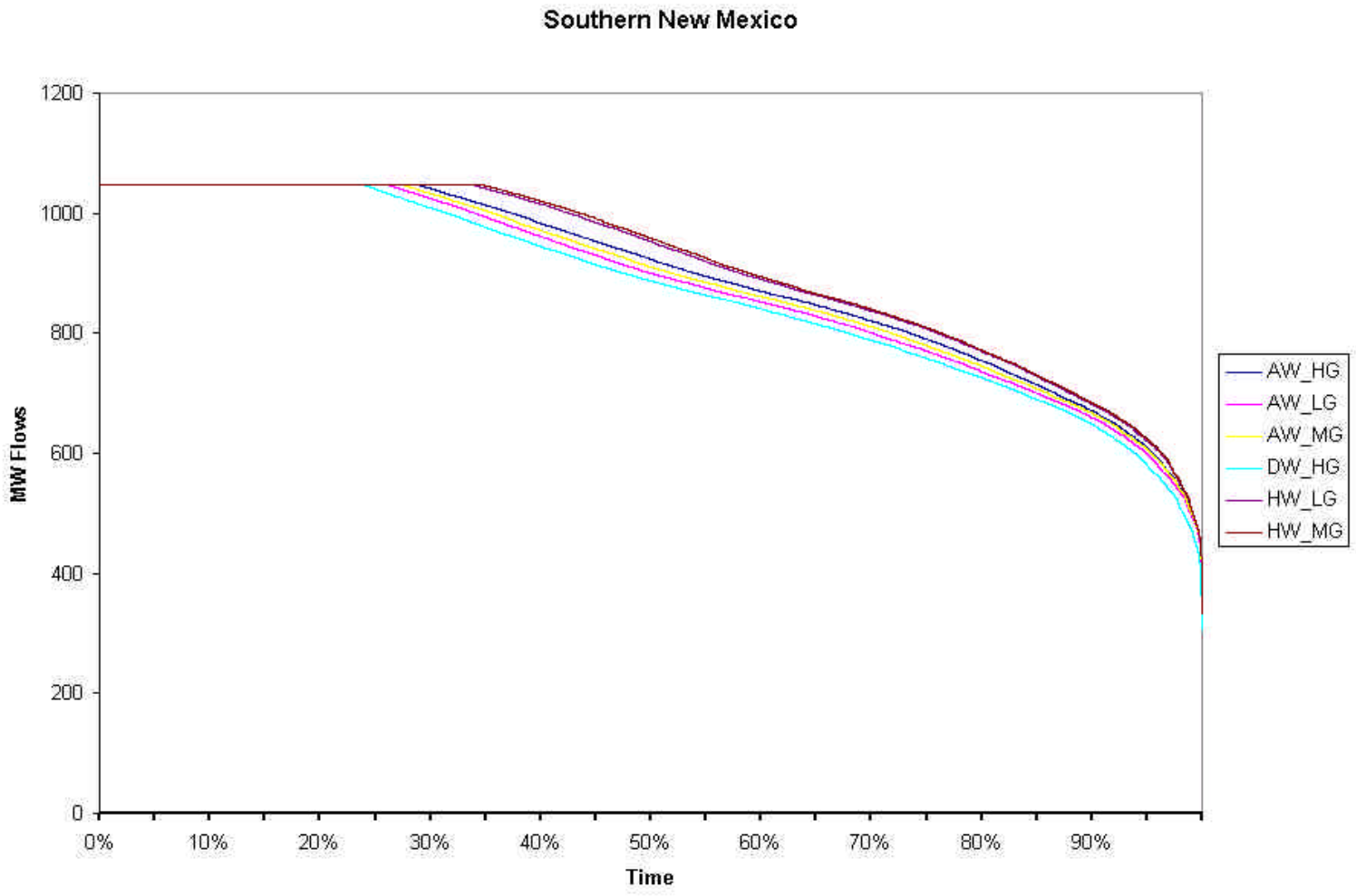

TOT 7
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

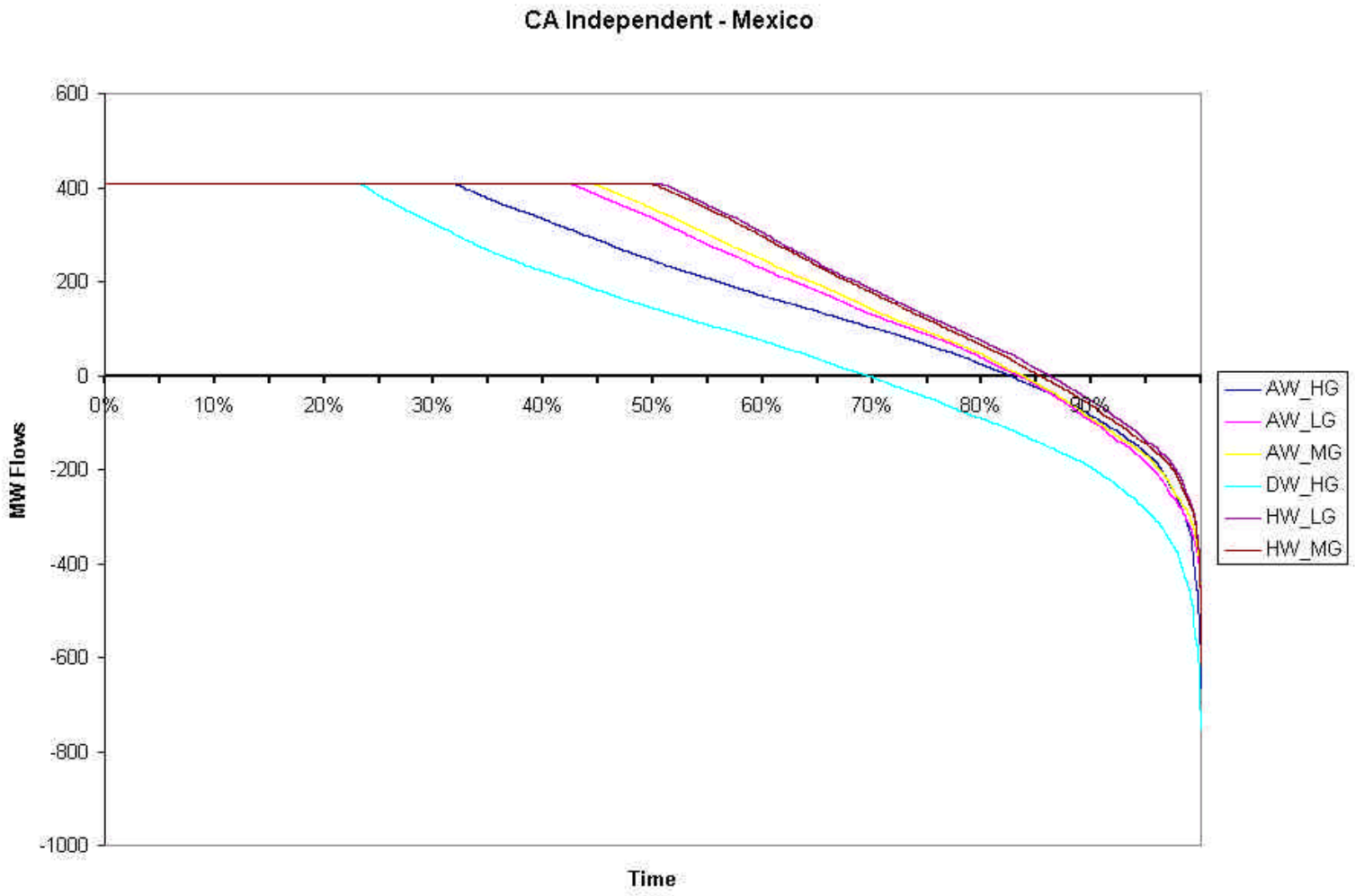

Arizona - California
7000
6000
5000
4000
3000
2000
1000
0
-1000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

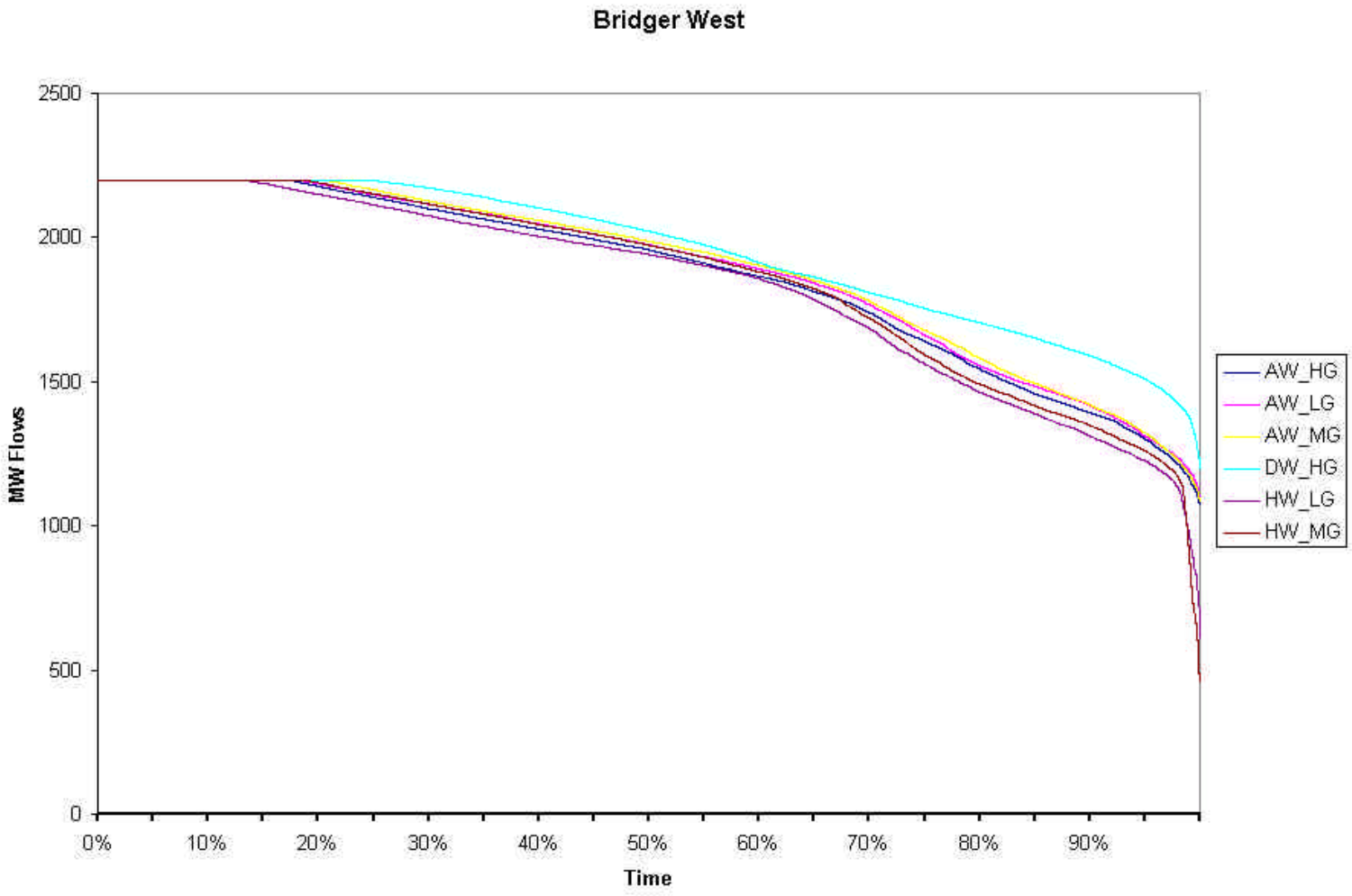

WOR - PV to Devers
MW Flows
1800
1600
1400
1200
1000
800
600
400
200
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

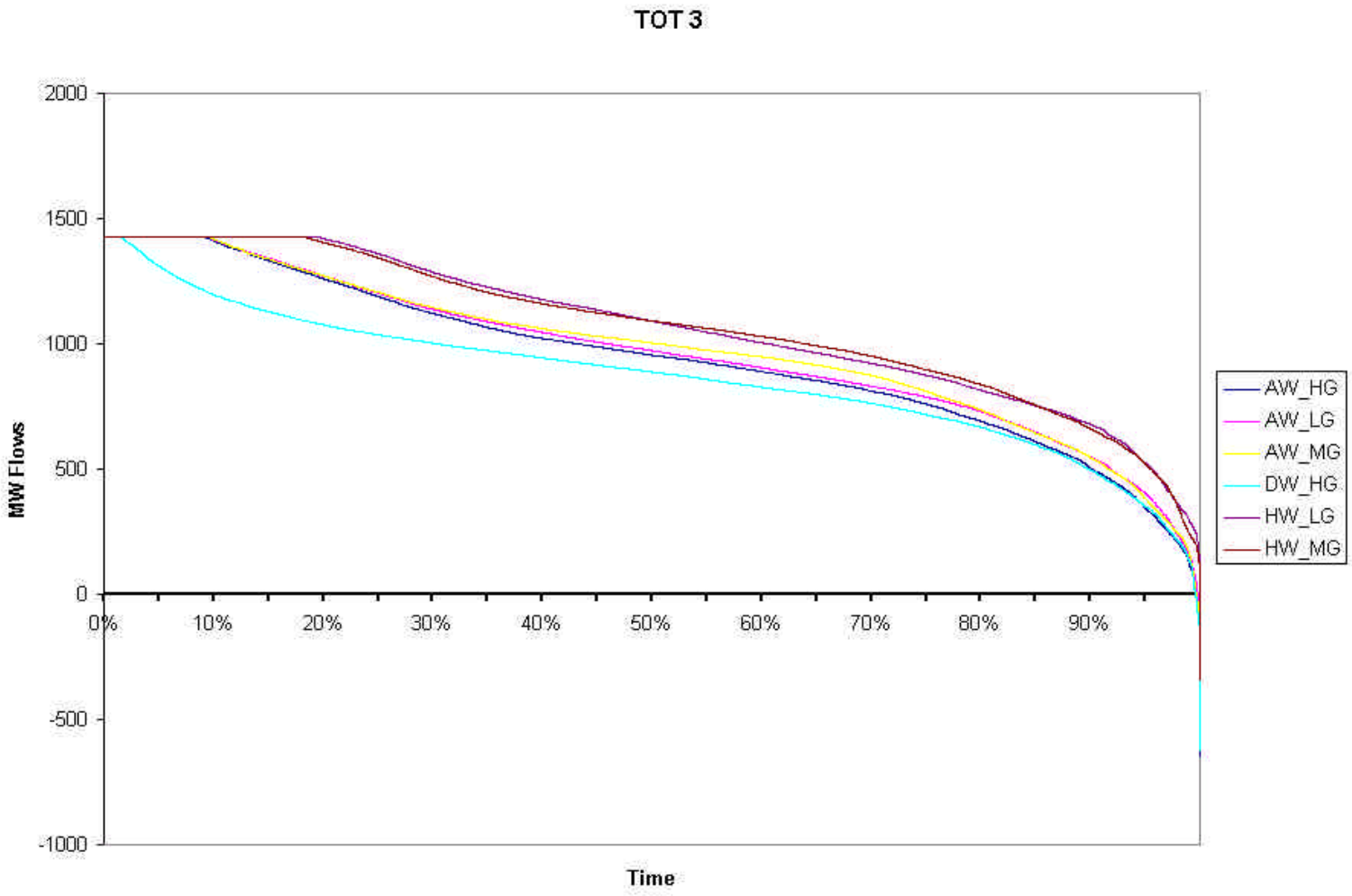

WOR-n- El Dor to Lugo
3000
2500
2000
1500
1000
500
0
-500
-1000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

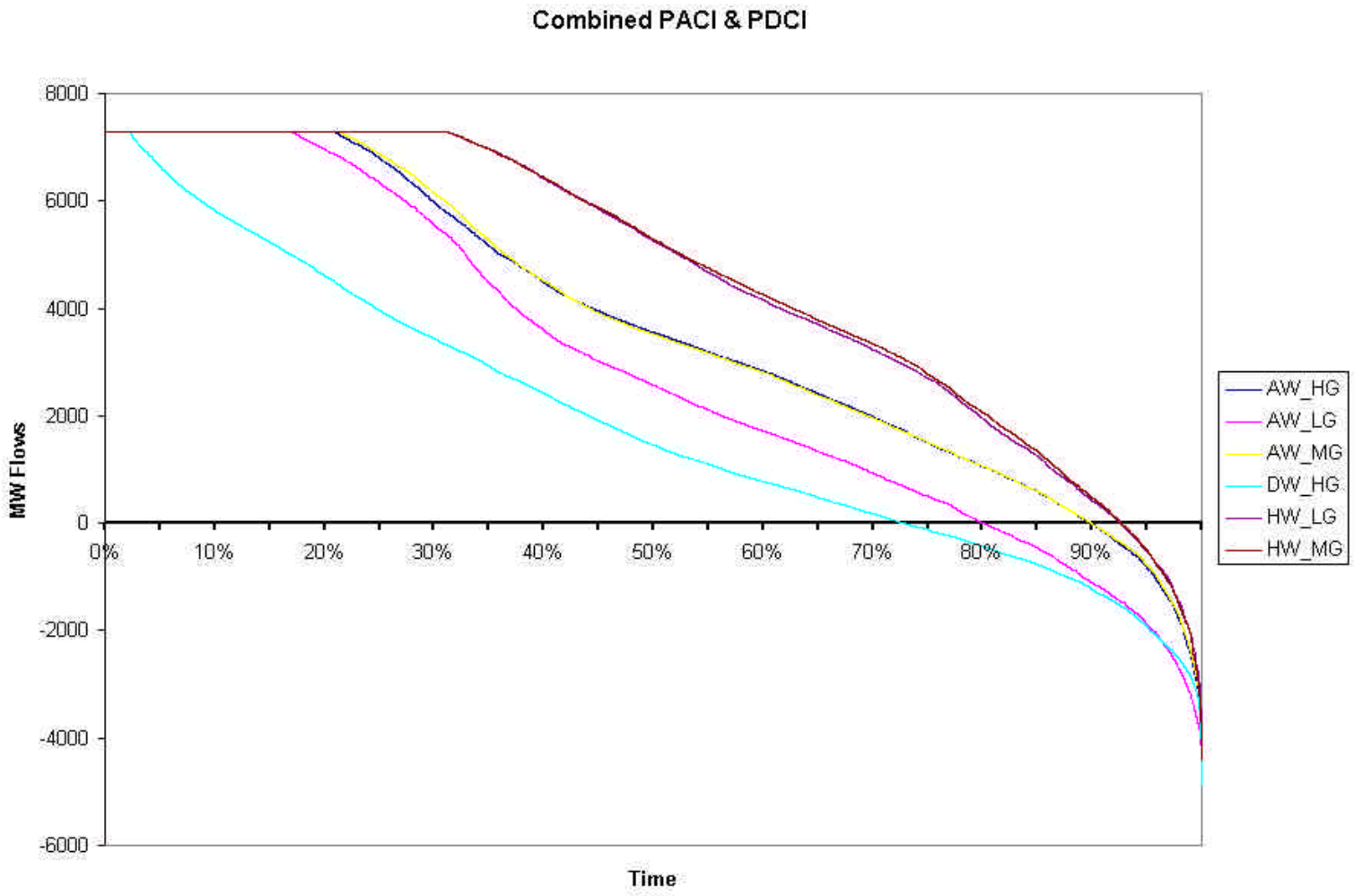

NW - Canada, East BC
500
400
300
200
100
0
-100
-200
-300
-400
-500
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

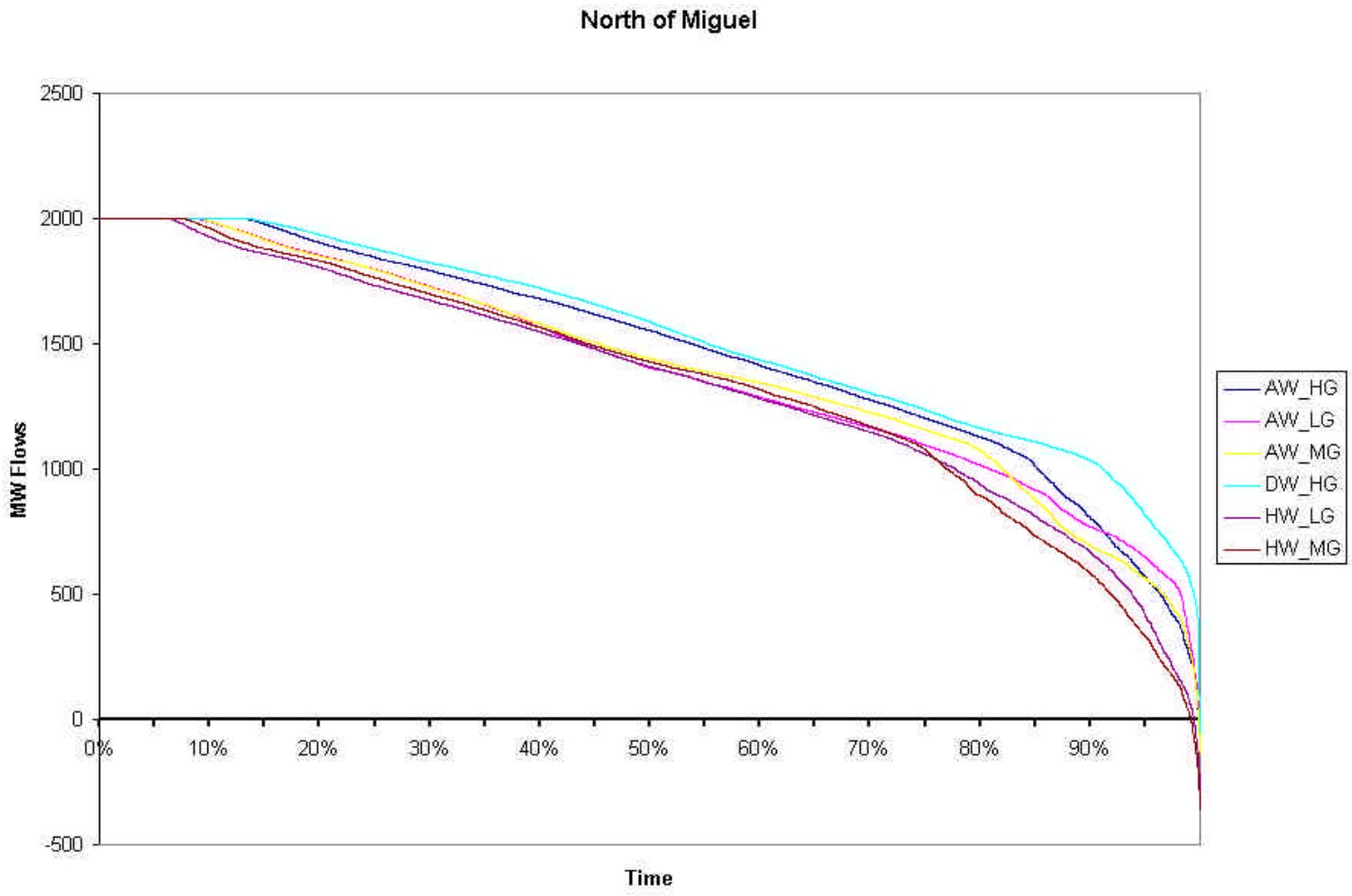

Southern New Mexico
1200
1000
800
600
400
200
0
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

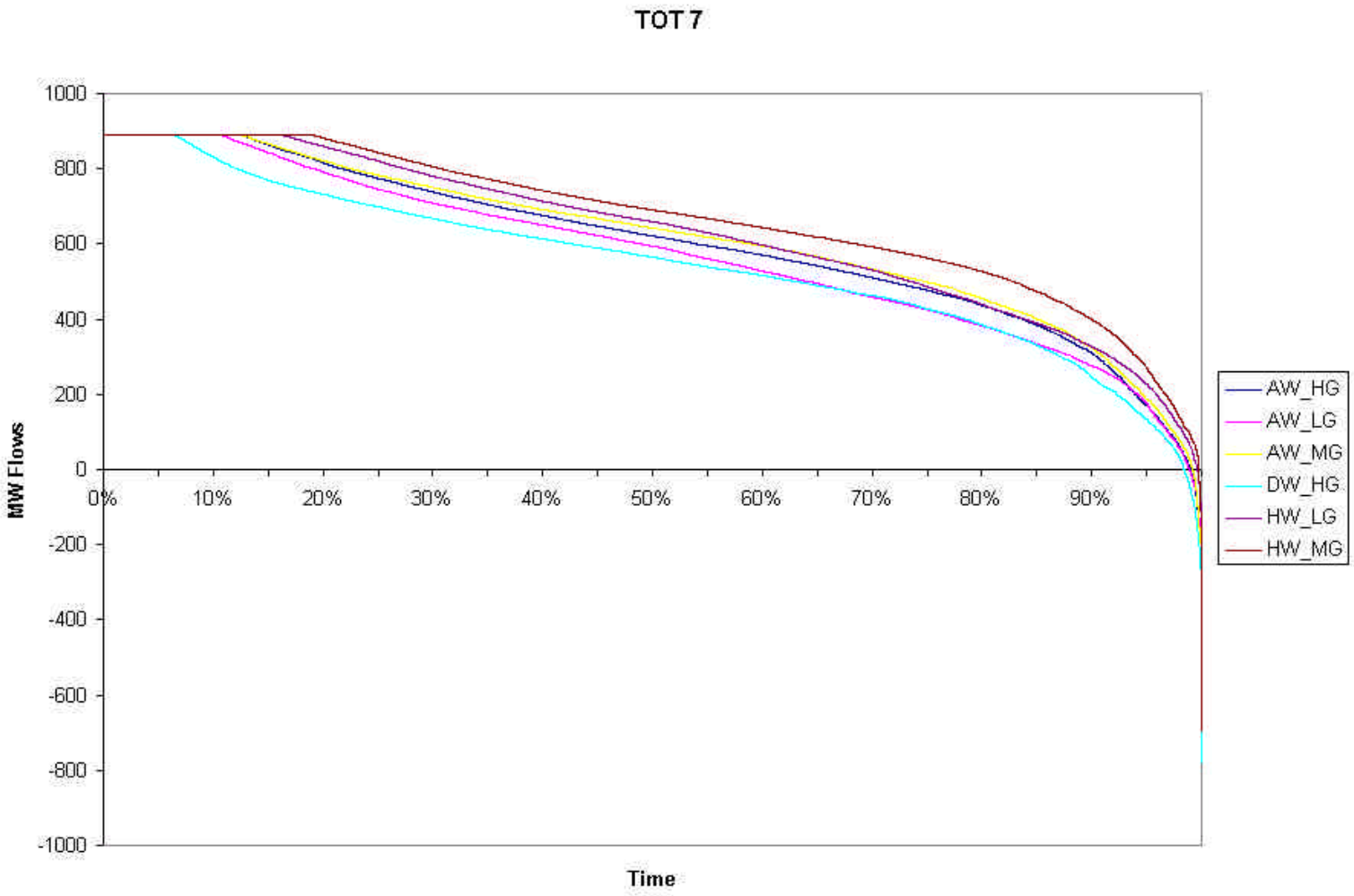

CA Independent - Mexico
600
400
200
0
-200
-400
-600
-800
-1000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

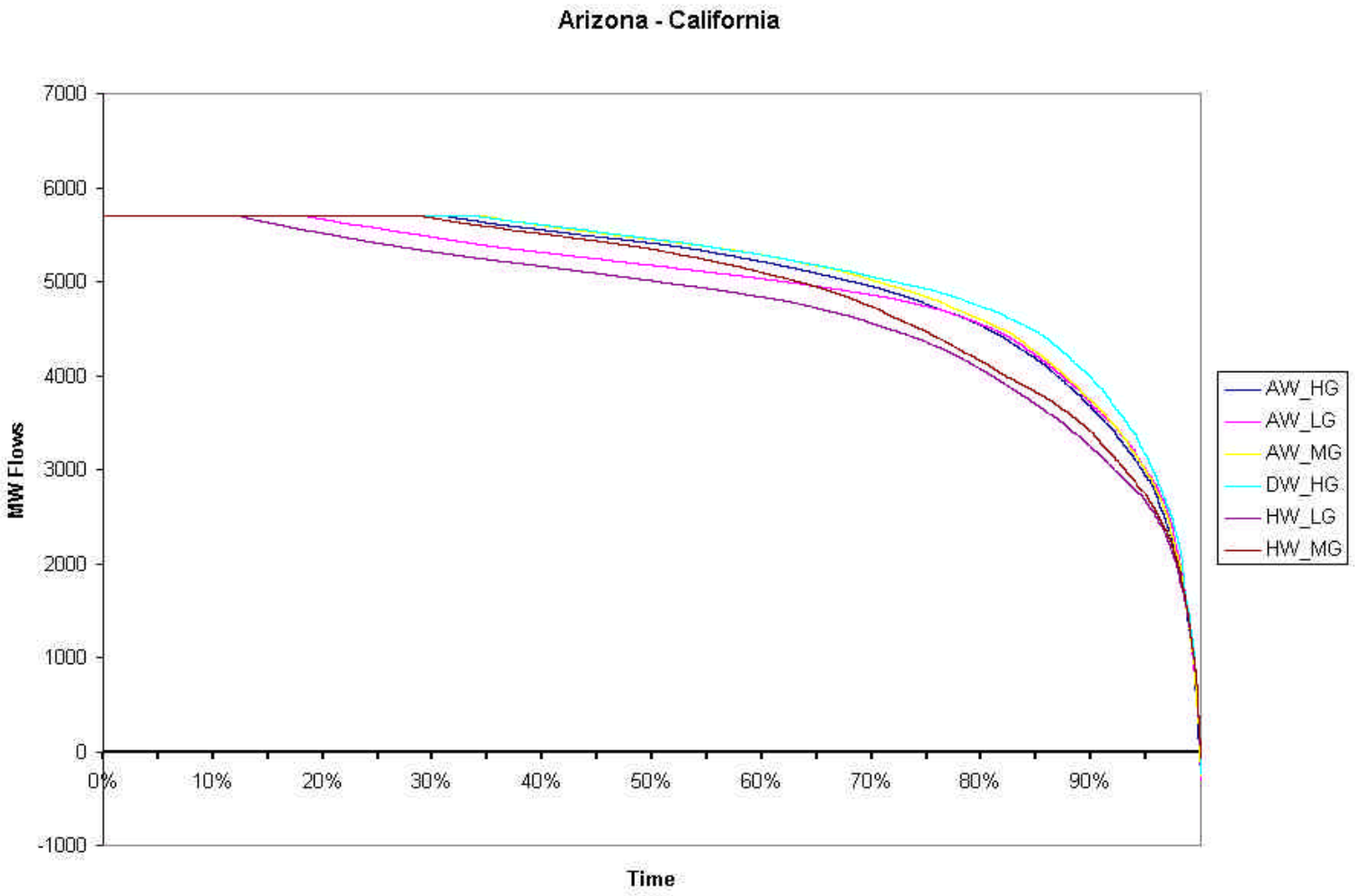

Bridger West
2500
2000
1500
1000
500
0
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG


TOT 3
2000
1500
1000
500
0
-500
-1000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG


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

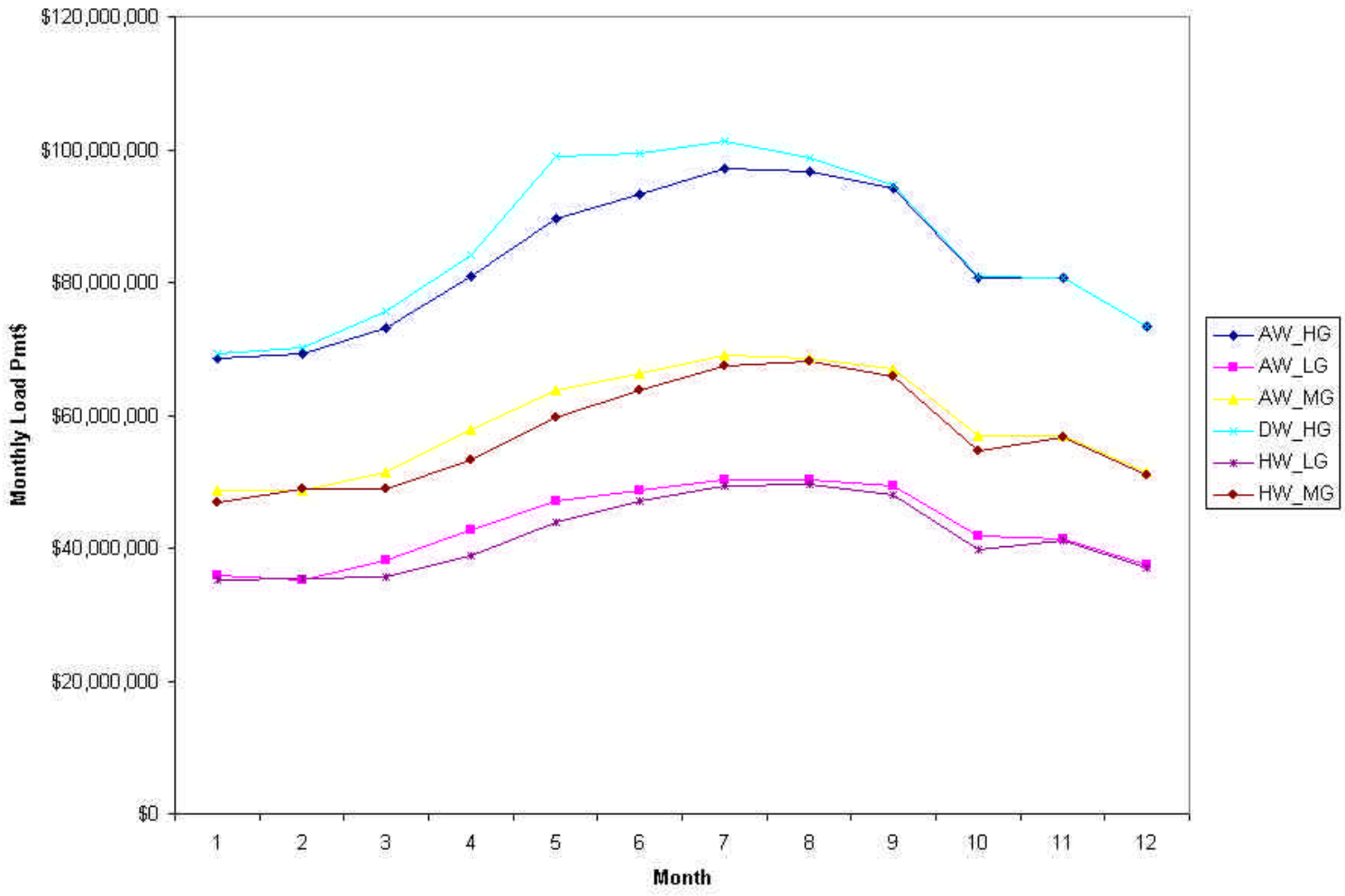

North of Miguel
2500
2000
1500
1000
500
0
-500
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG


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_LG
AW_MG
DW_HG
HW_LG
HW_MG

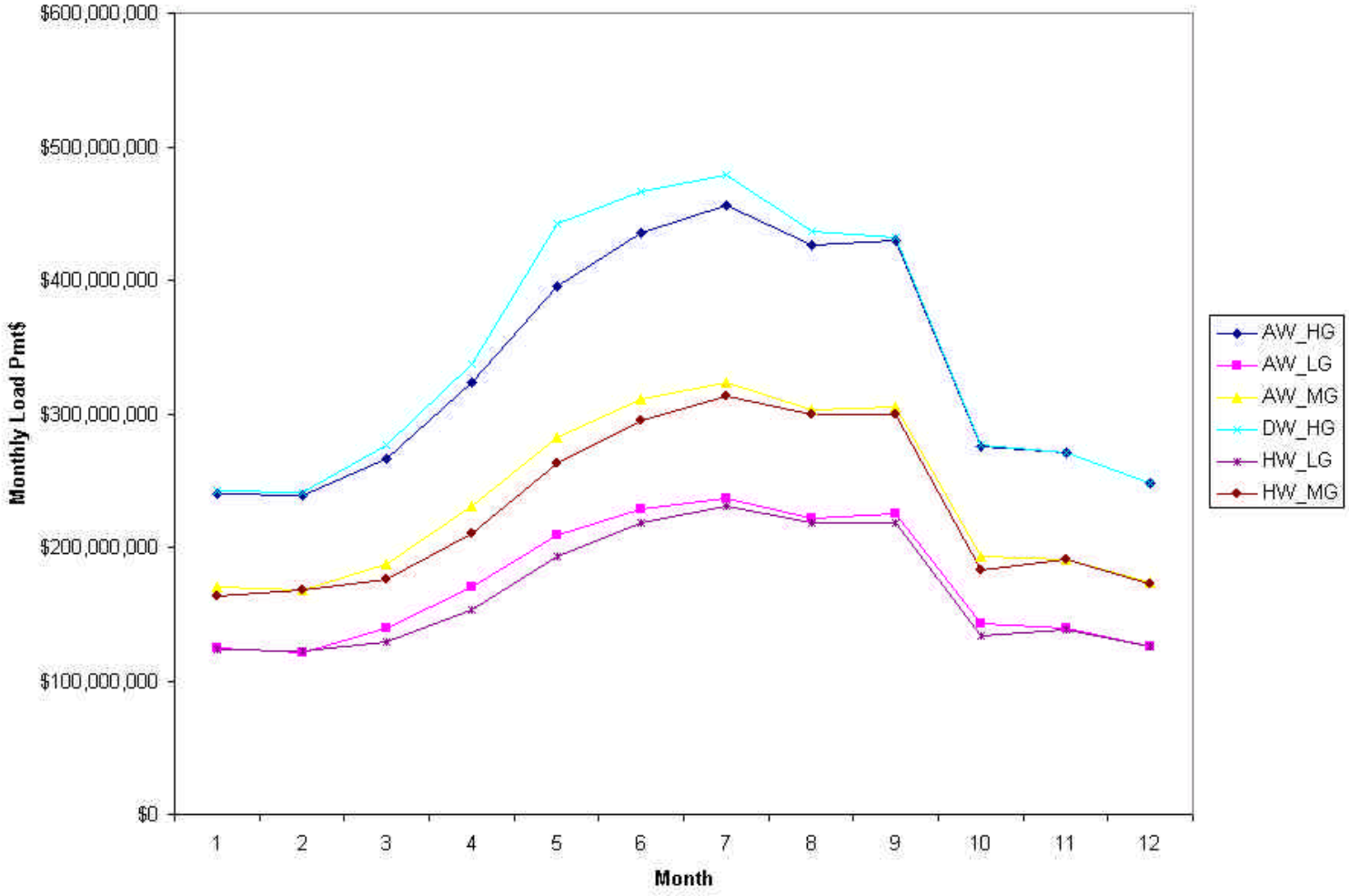

Arizona - California
7000
6000
5000
4000
3000
2000
1000
0
-1000
MW Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Time
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

LOAD

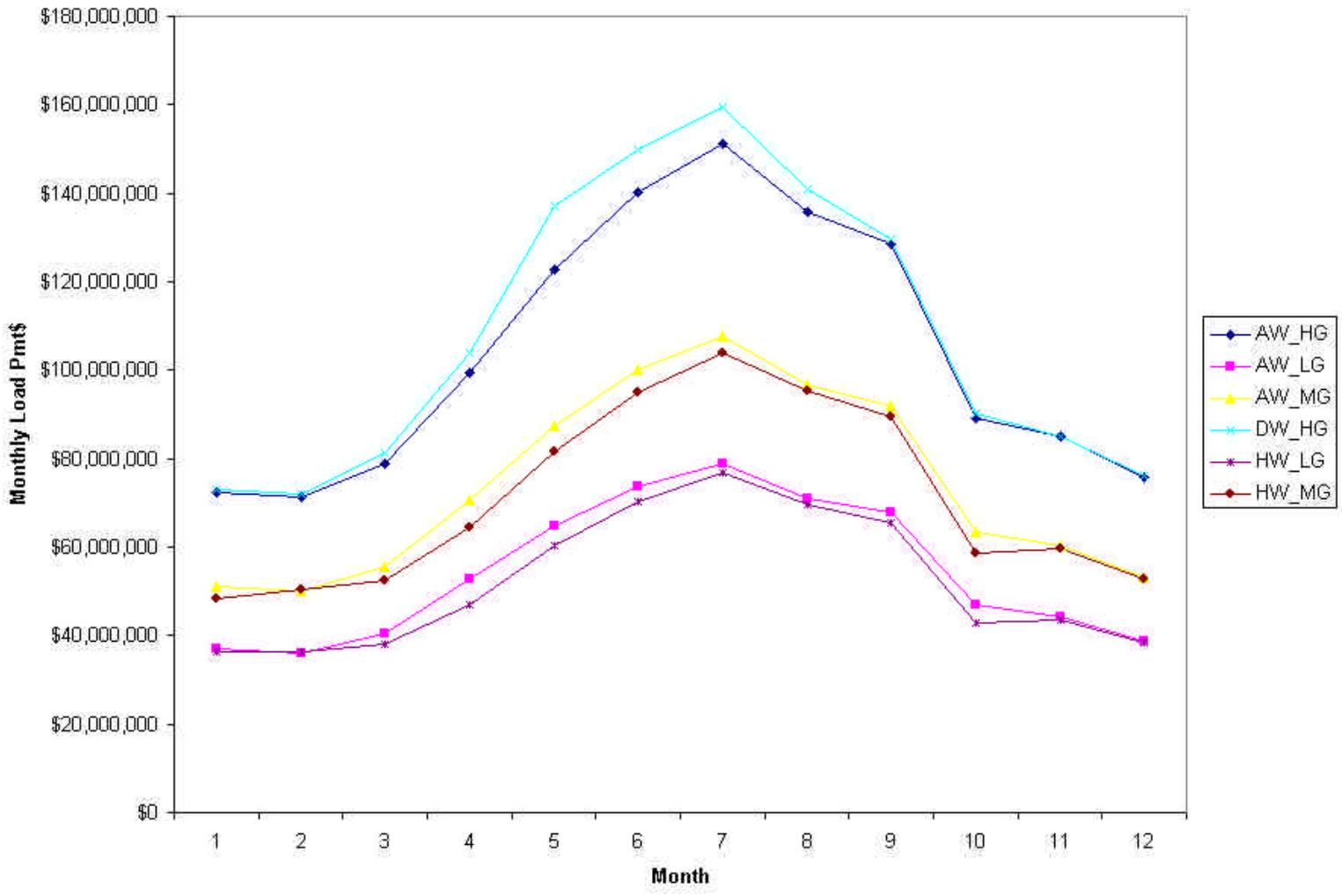
New Mexico - Load



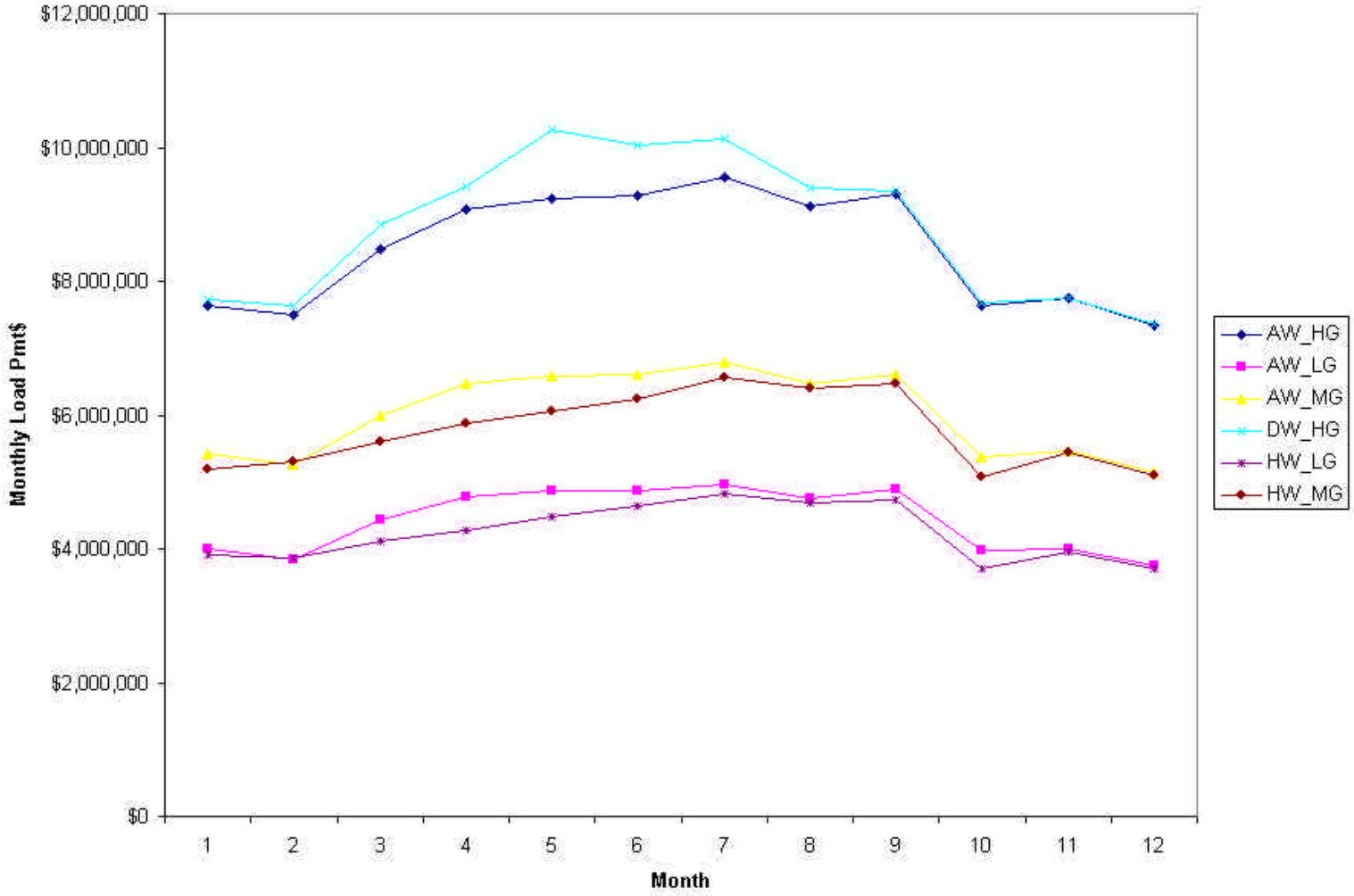
Arizona - Load



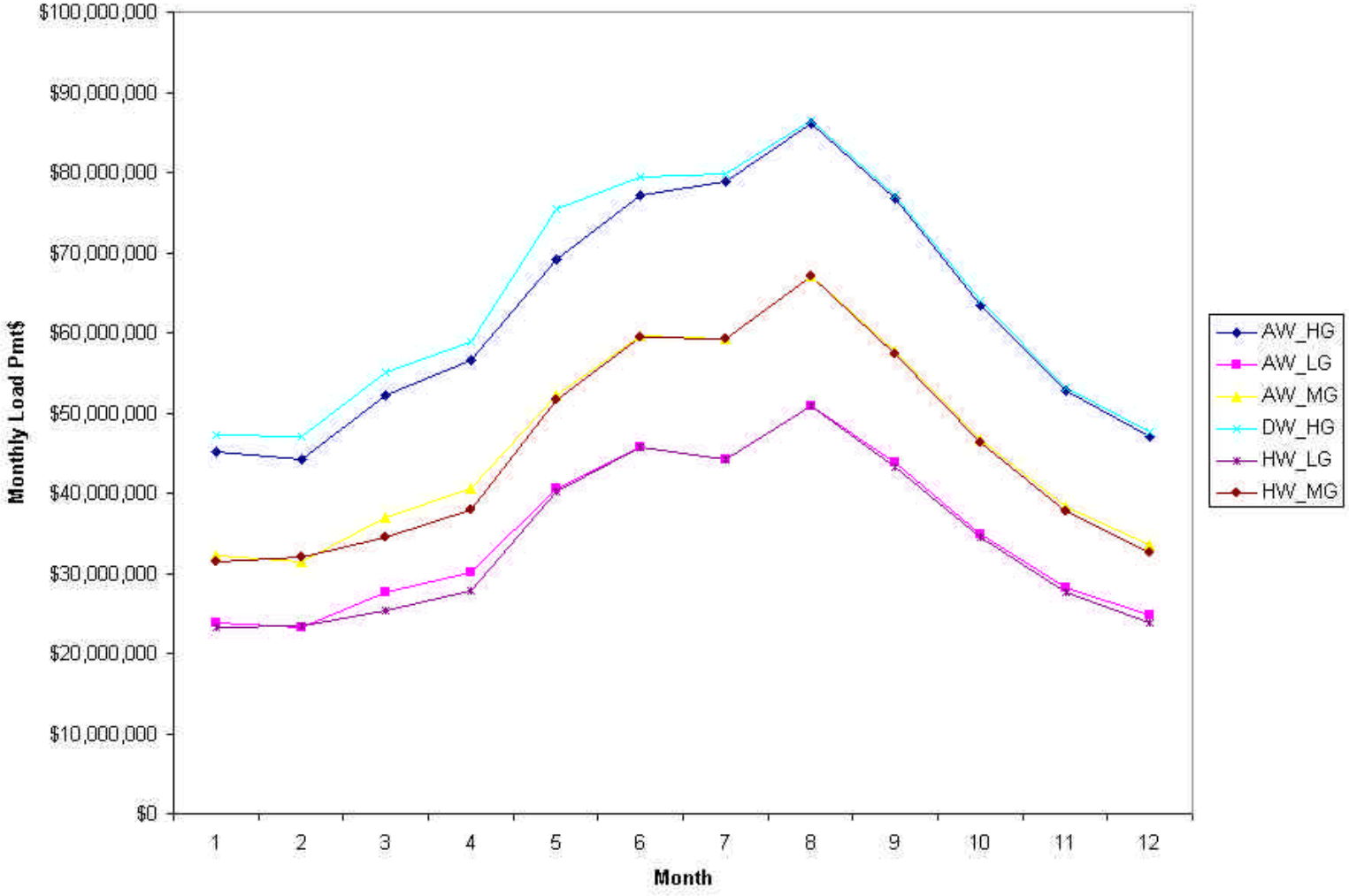
Nevada - Load


$180,000,000
$160,000,000
$140,000,000
$120,000,000
$100,000,000
$80,000,000
$60,000,000
$40,000,000
$20,000,000
$0
Monthly Load Pmt$
1
2
3
4
5
6
7
8
9
10
11
12
Month
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

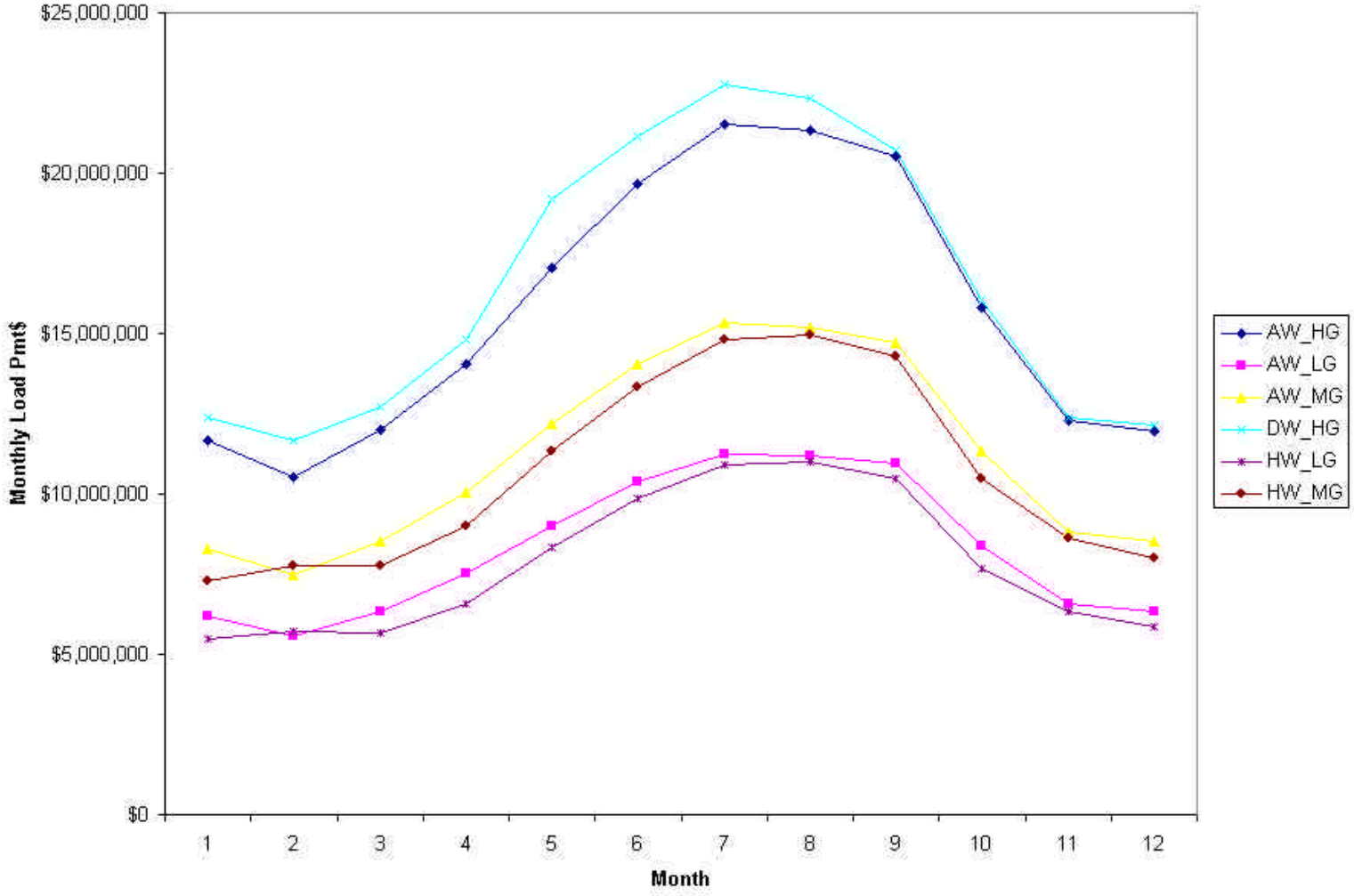
WAPA LC - Load


$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$0
Monthly Load Pmt$
1
2
3
4
5
6
7
8
9
10
11
12
Month
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

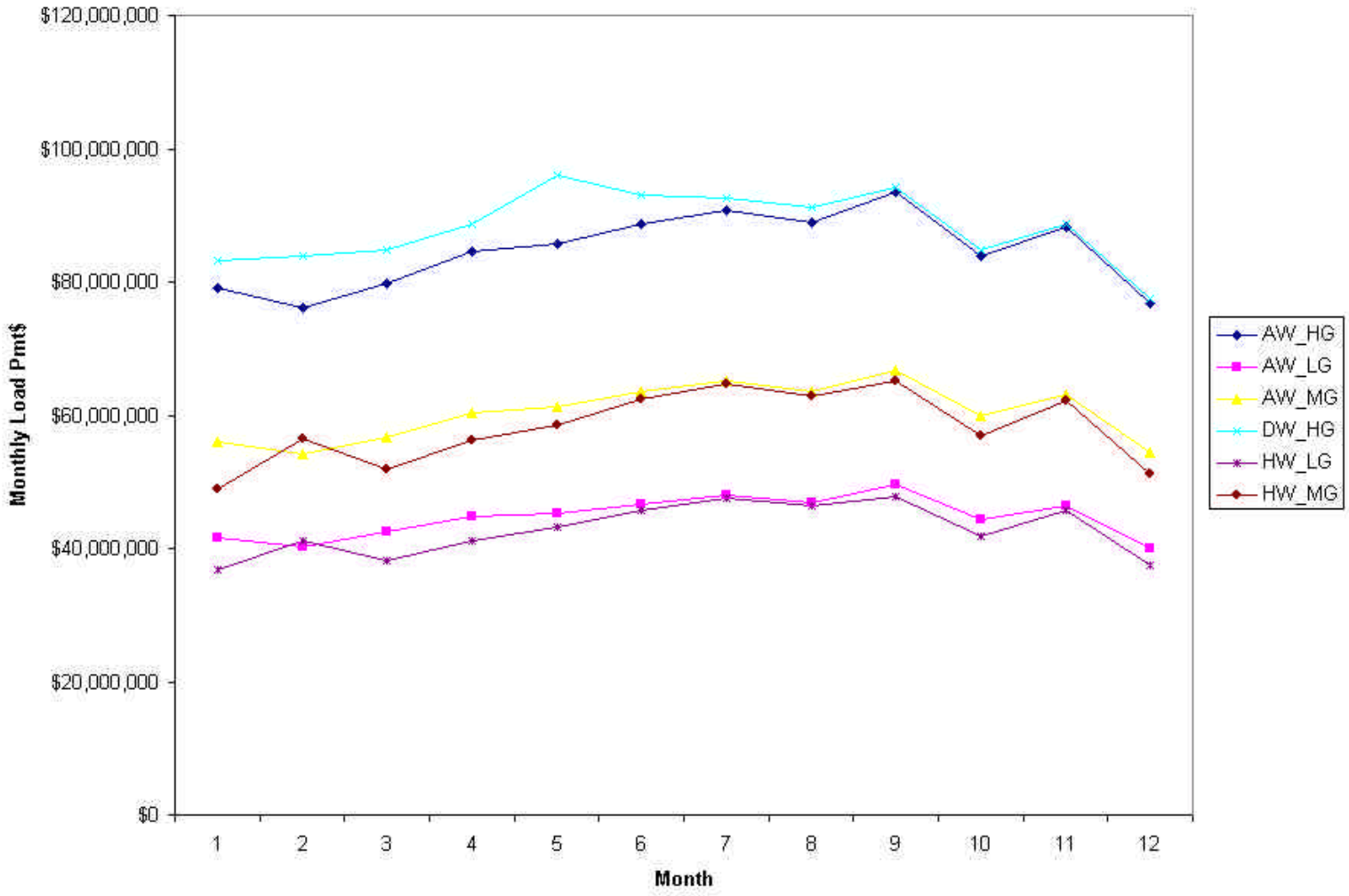
Mexico-C Load



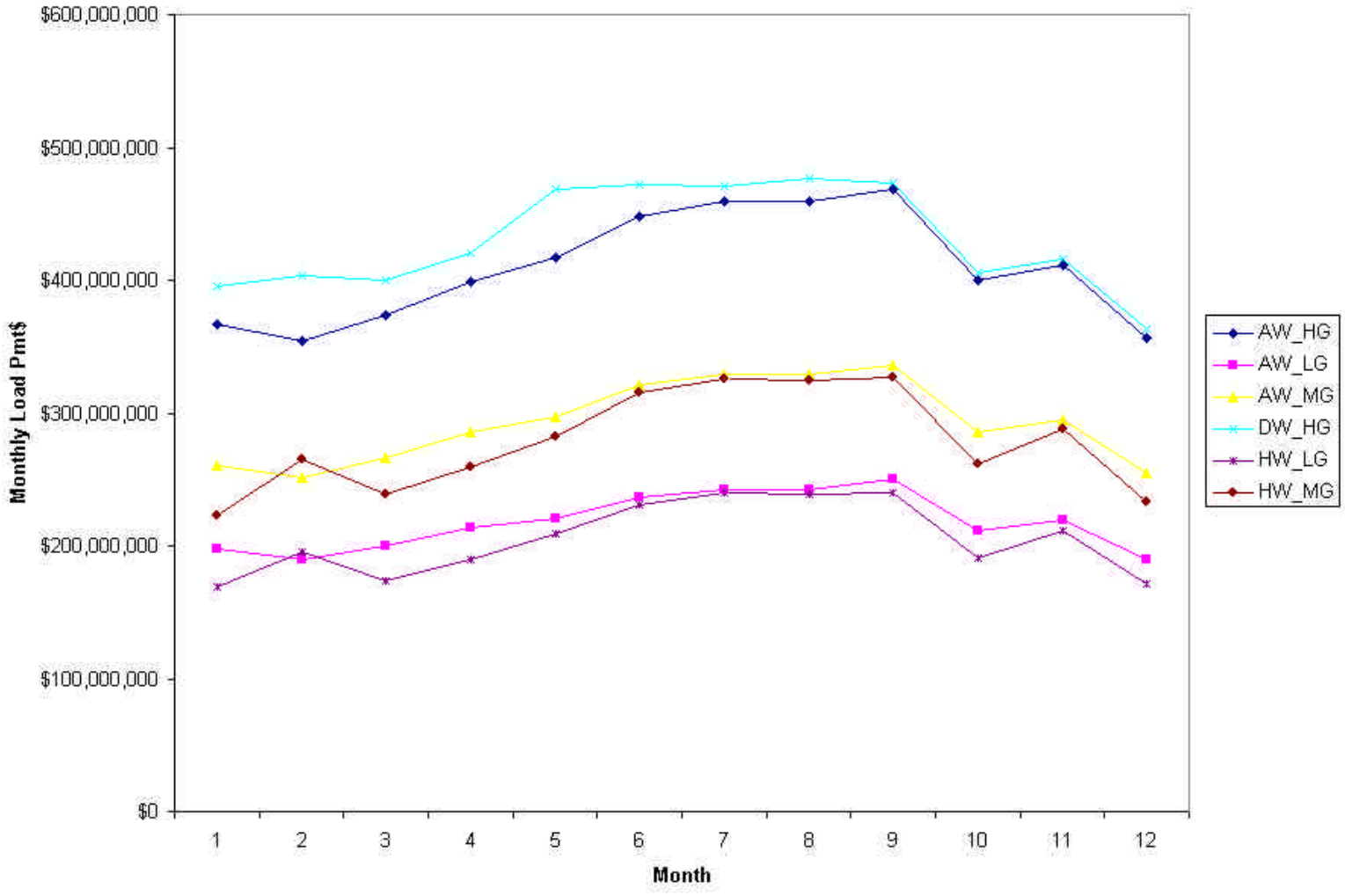
Imperial - Load



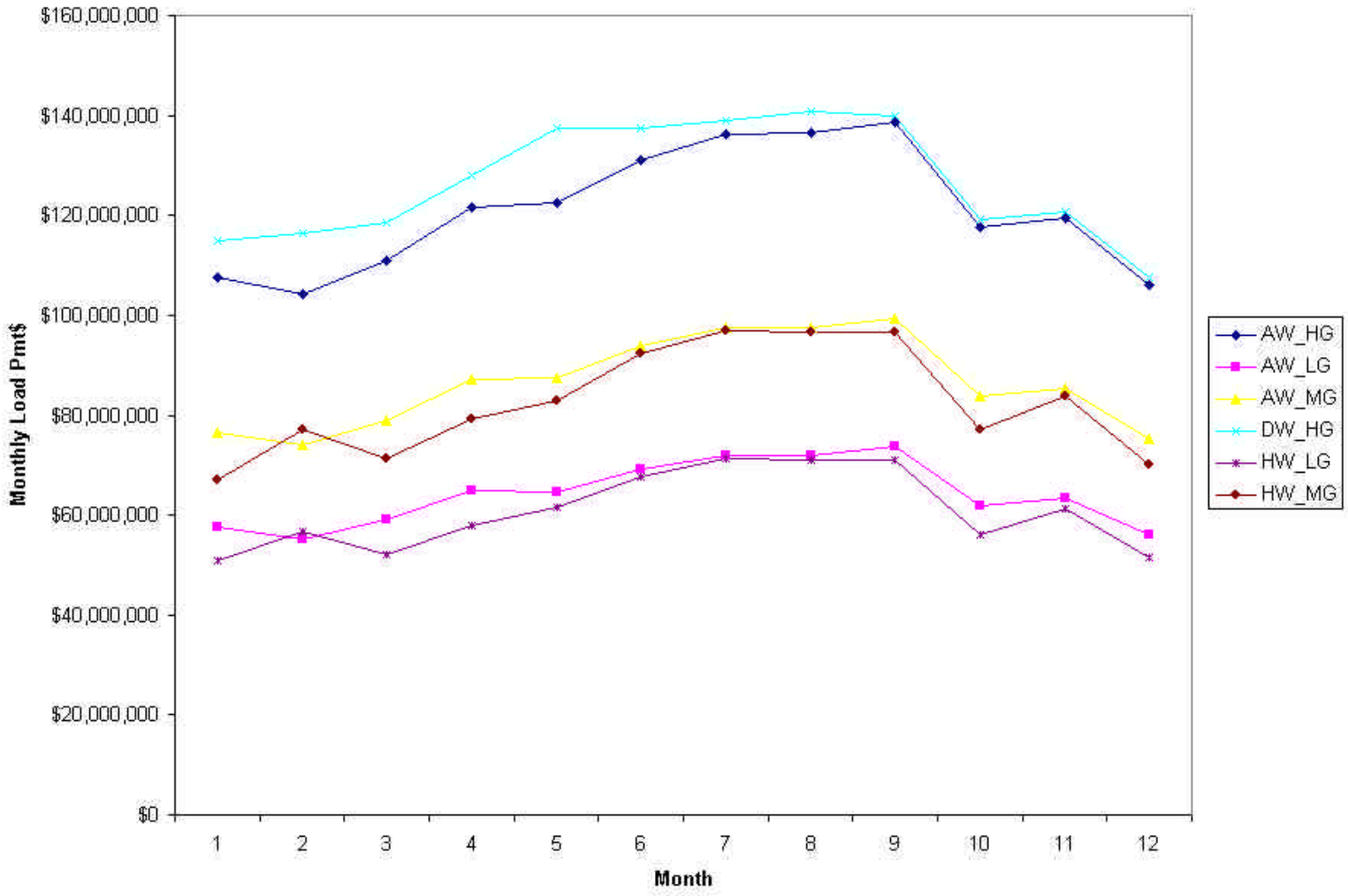
San Diego - Load



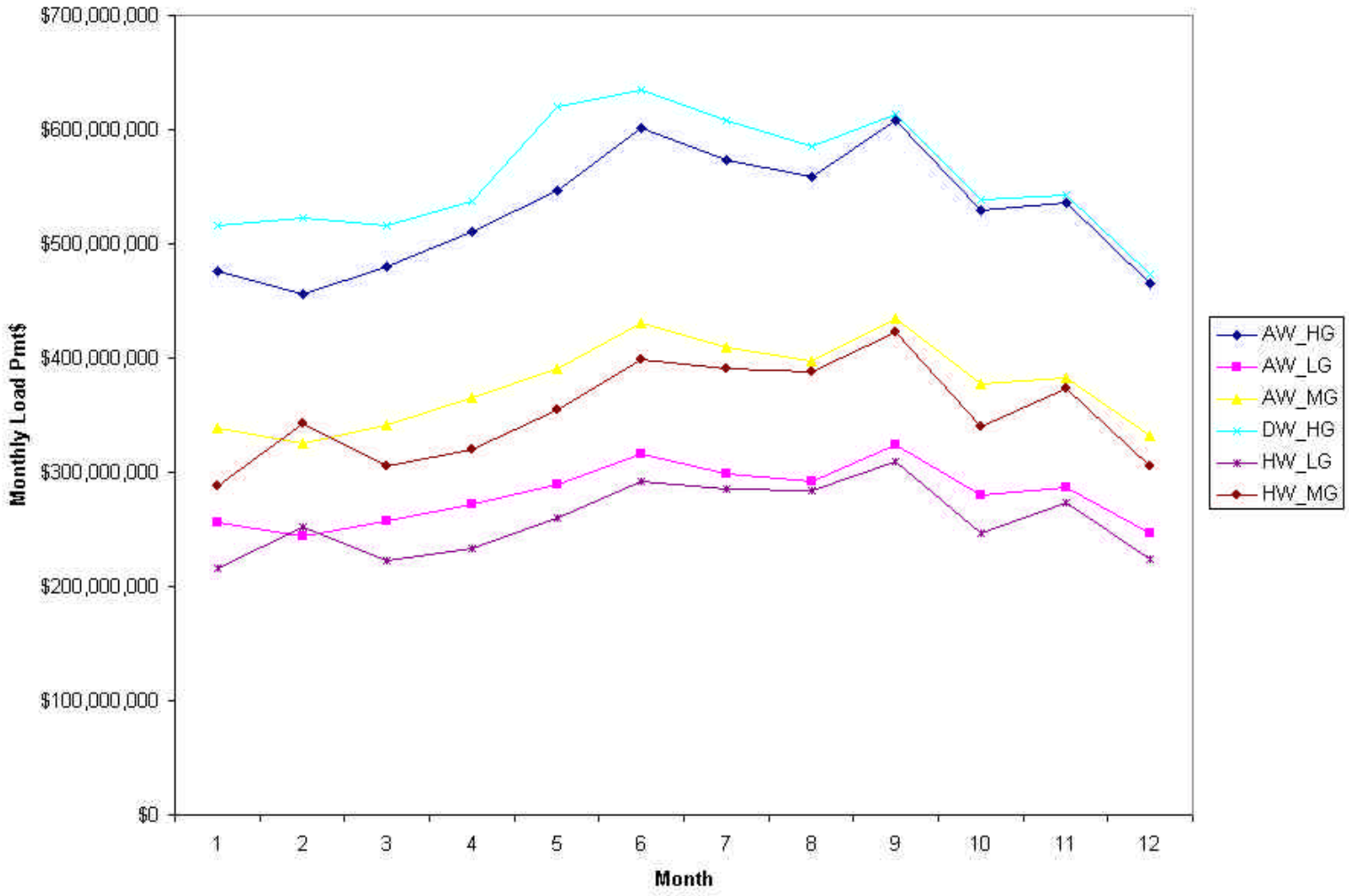
SOCALIF - Load



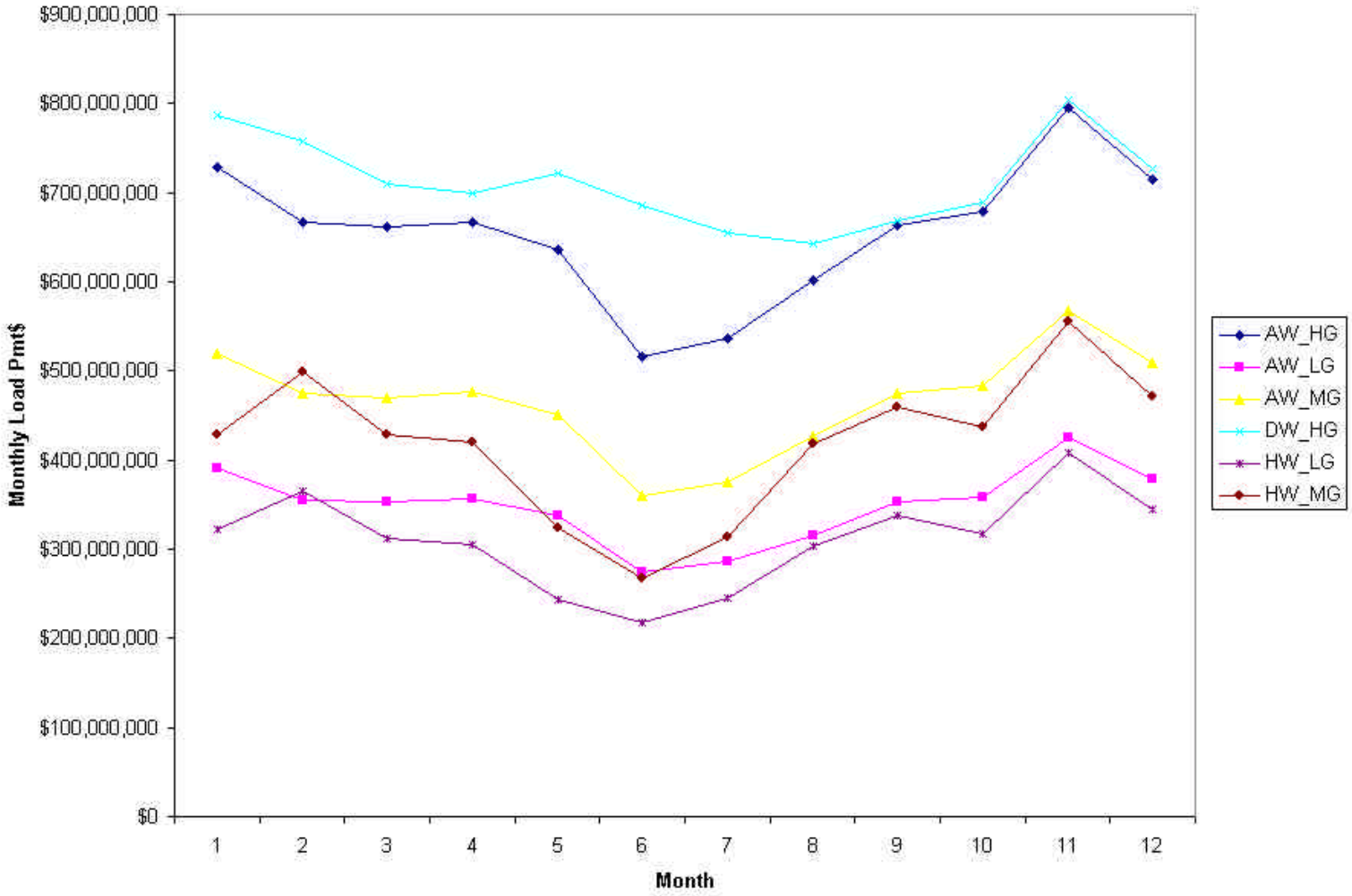
LADWP - Load


$160,000,000
$140,000,000
$120,000,000
$100,000,000
$80,000,000
$60,000,000
$40,000,000
$20,000,000
$0
Monthly Load Pmt$
1
2
3
4
5
6
7
8
9
10
11
12
Month
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

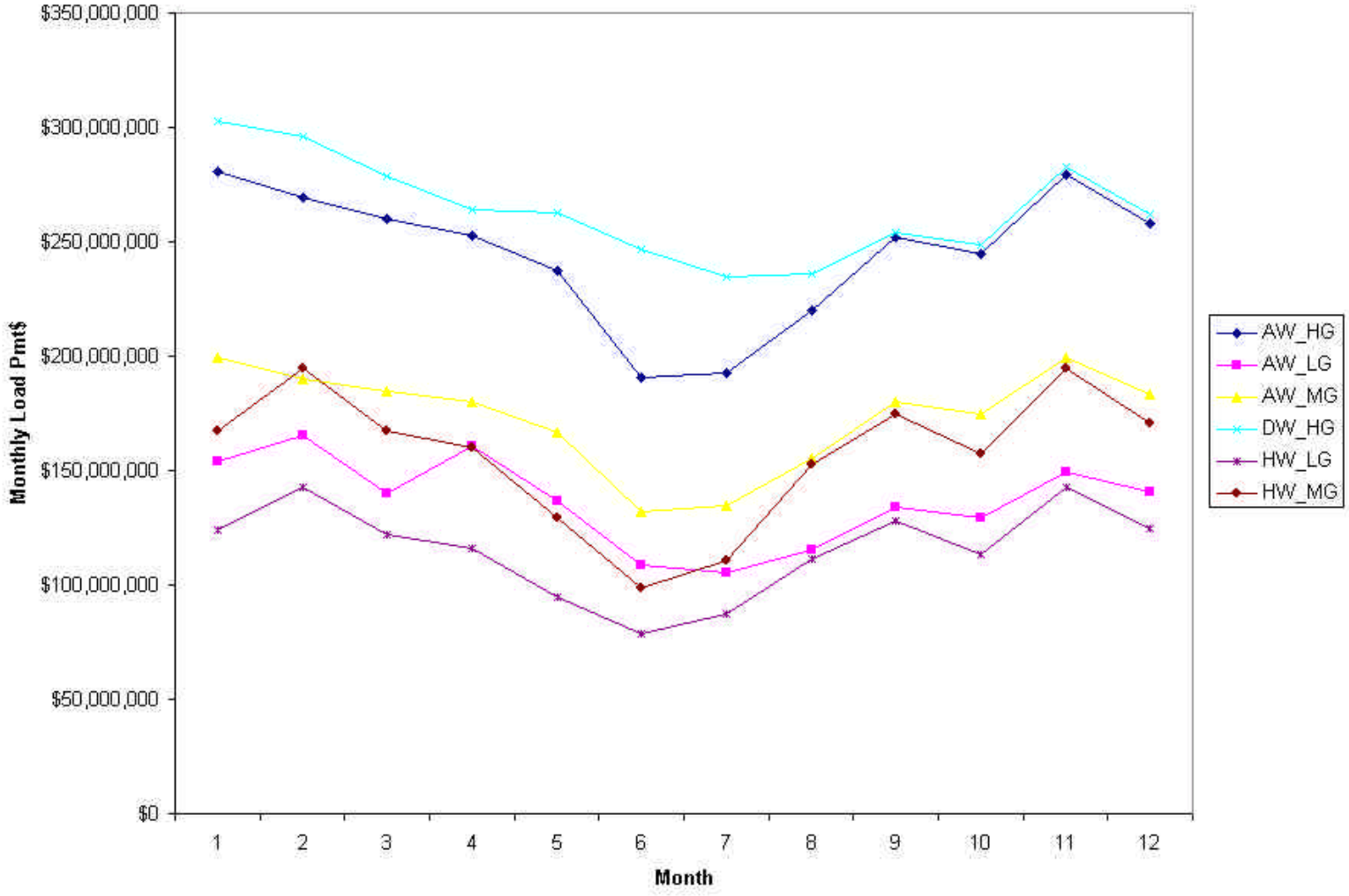
PG & E - Load


$700,000,000
$600,000,000
$500,000,000
$400,000,000
$300,000,000
$200,000,000
$100,000,000
$0
Monthly Load Pmt$
1
2
3
4
5
6
7
8
9
10
11
12
Month
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

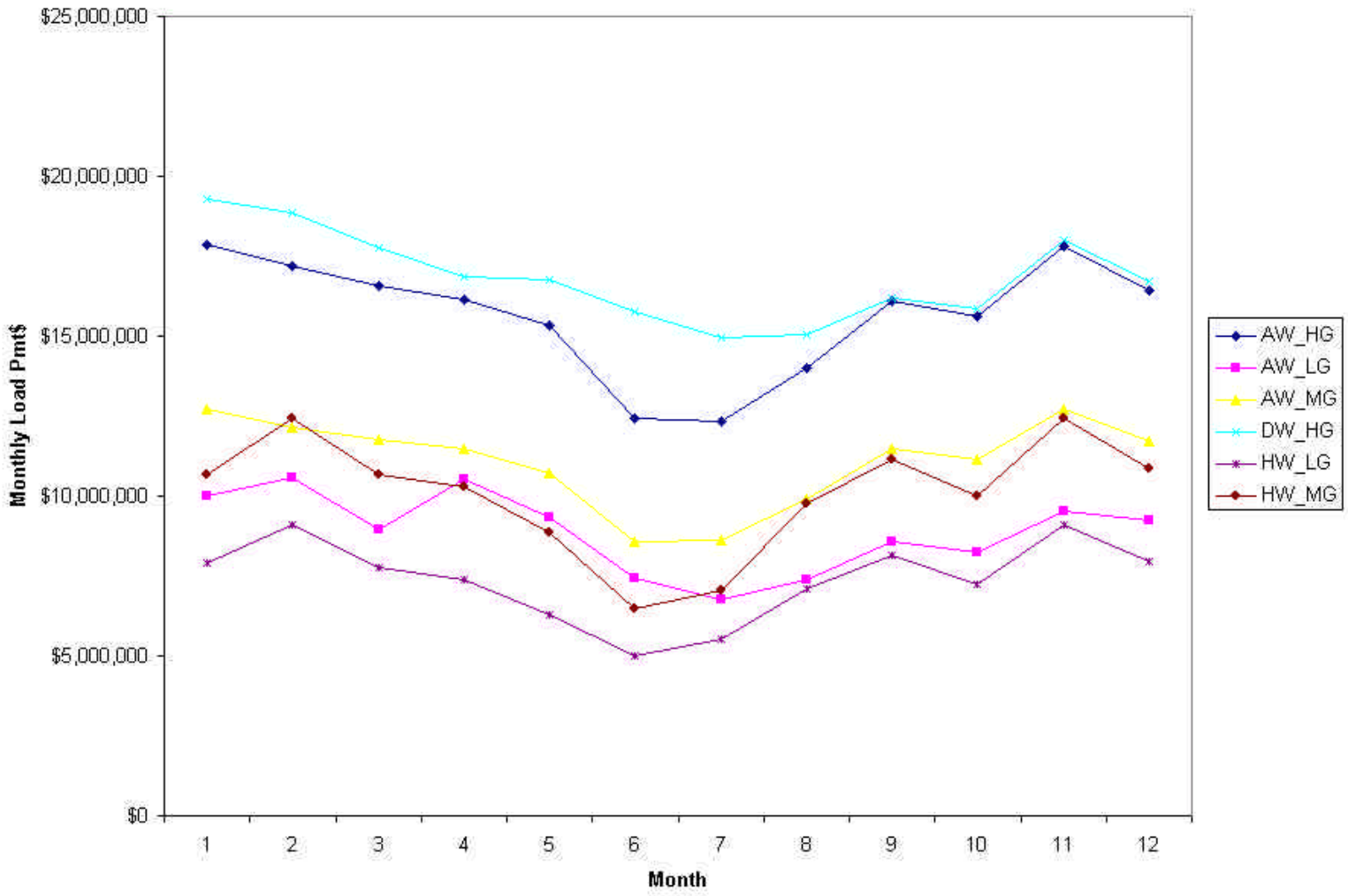
North West - Load



BCHydr - Load


$350,000,000
$300,000,000
$250,000,000
$200,000,000
$150,000,000
$100,000,000
$50,000,000
$0
Monthly Load Pmt$
1
2
3
4
5
6
7
8
9
10
11
12
Month
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

Aquila - Load


$25,000,000
$20,000,000
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$10,000,000
$5,000,000
$0
Monthly Load Pmt$
1
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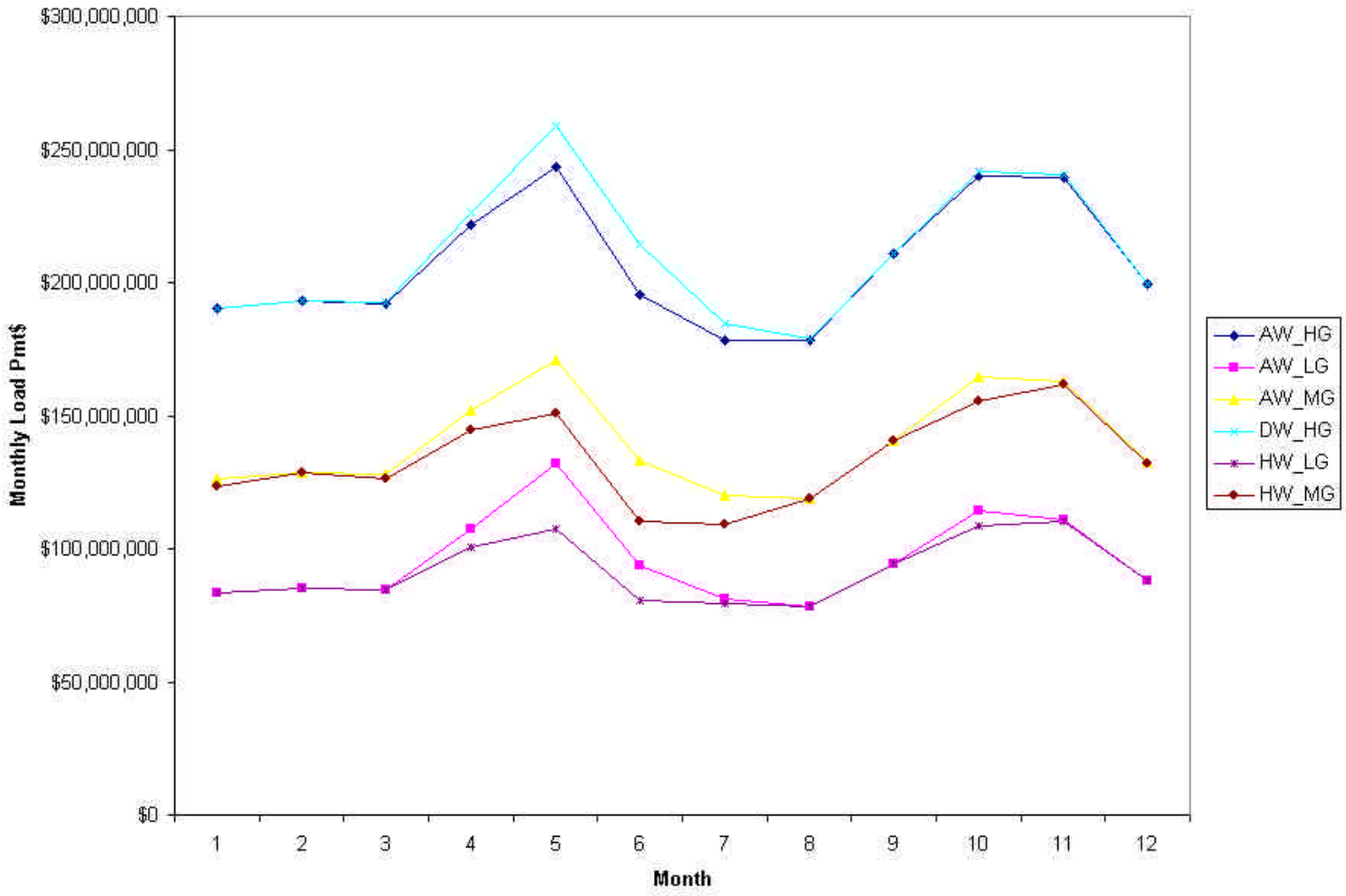
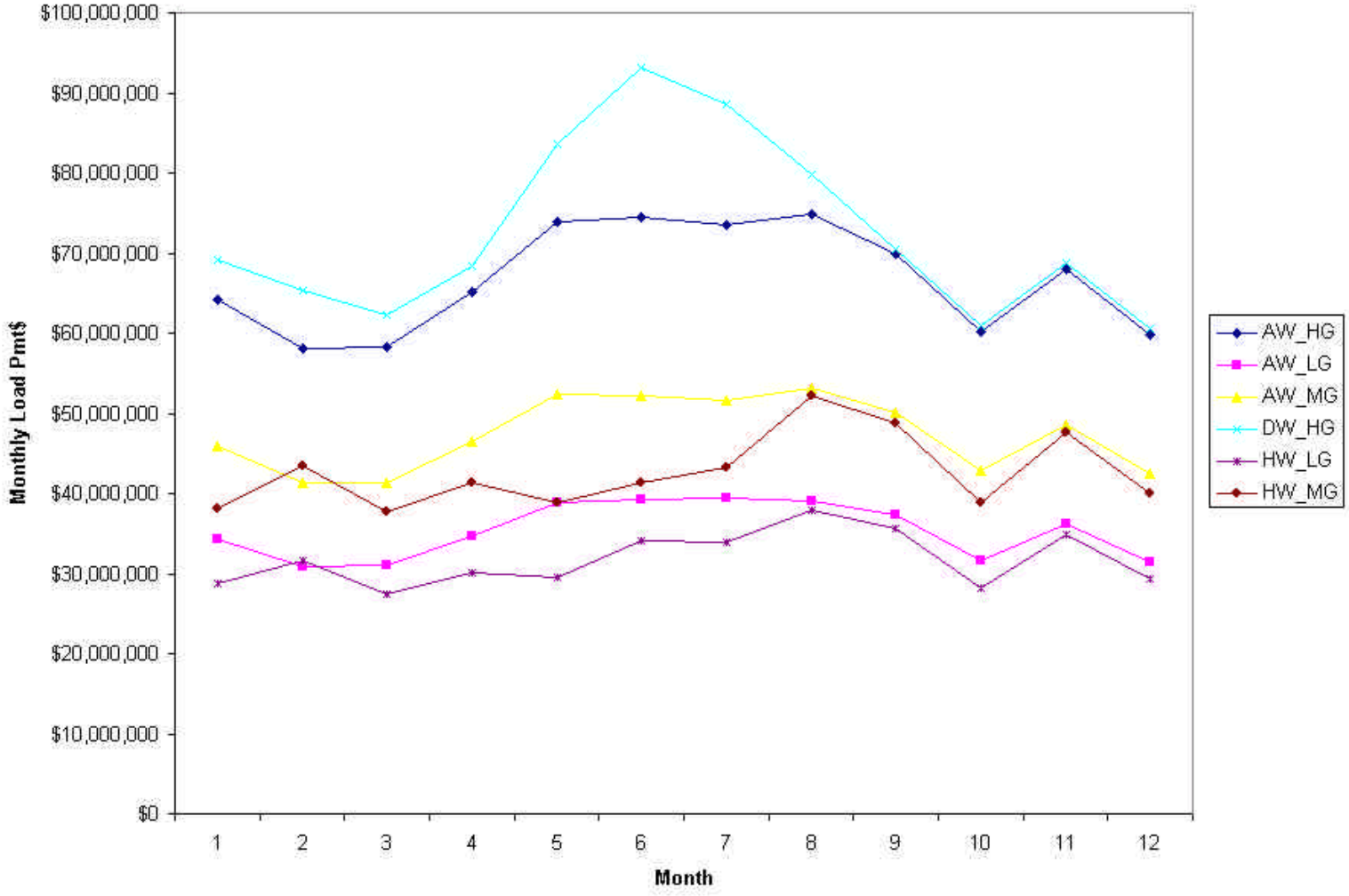
10
11
12
Month
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

Alberta - Load



Idaho - Load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$50,000,000
$40,000,000
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$20,000,000
$10,000,000
$0
Monthly Load Pmt$
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7
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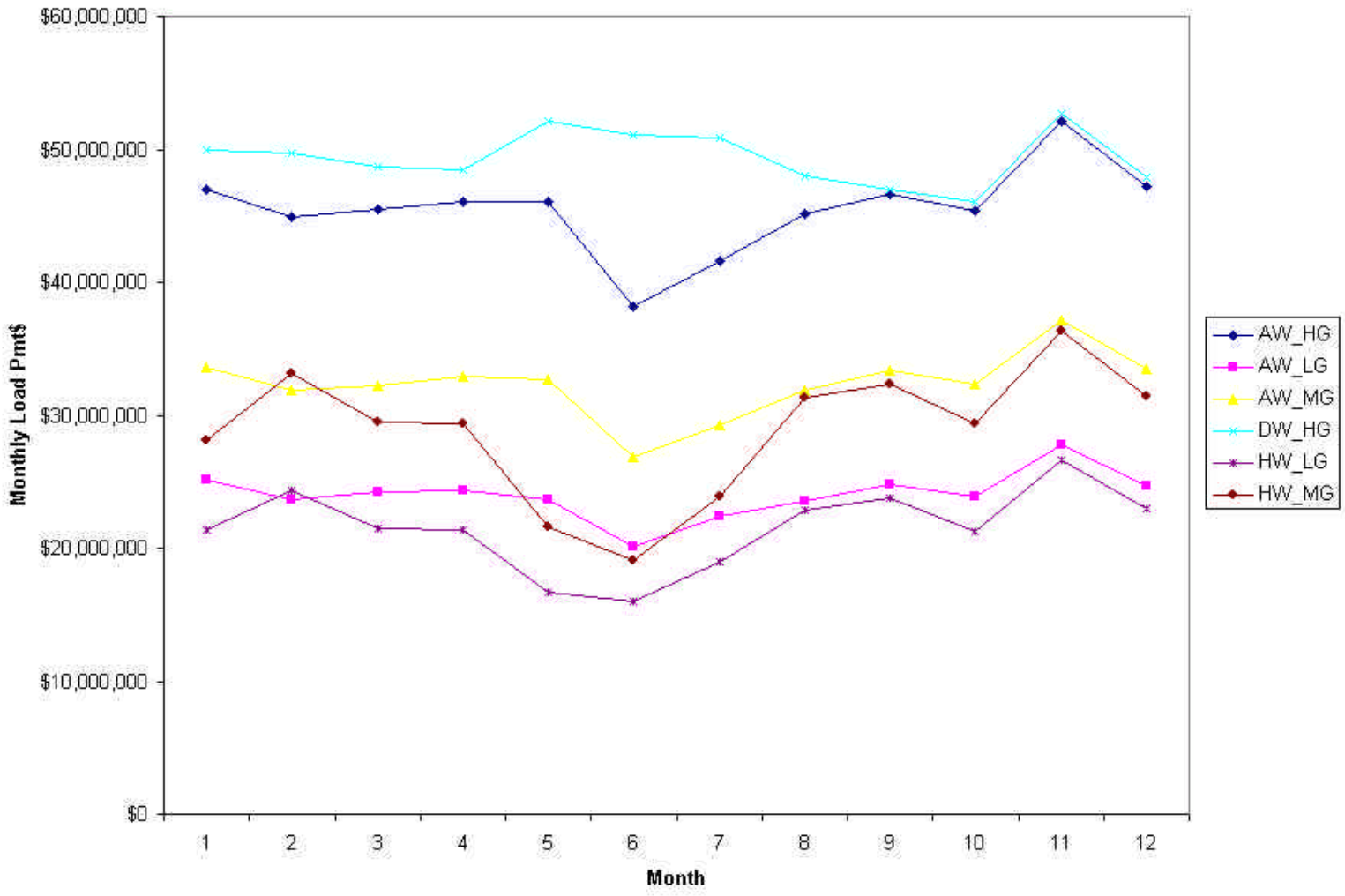
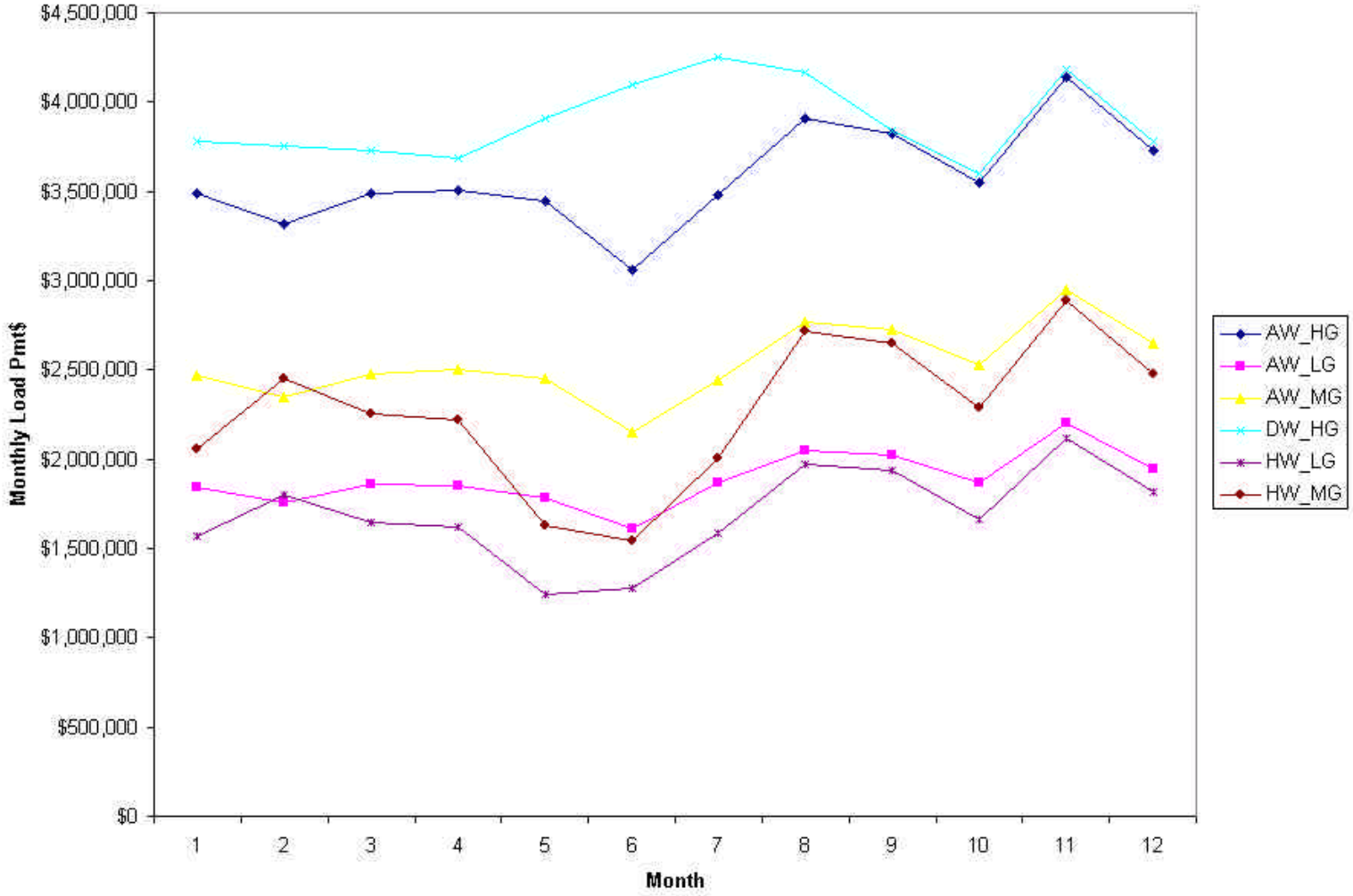
10
11
12
Month
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

Montana - Load



WAPA UM - Load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$0
Monthly Load Pmt$
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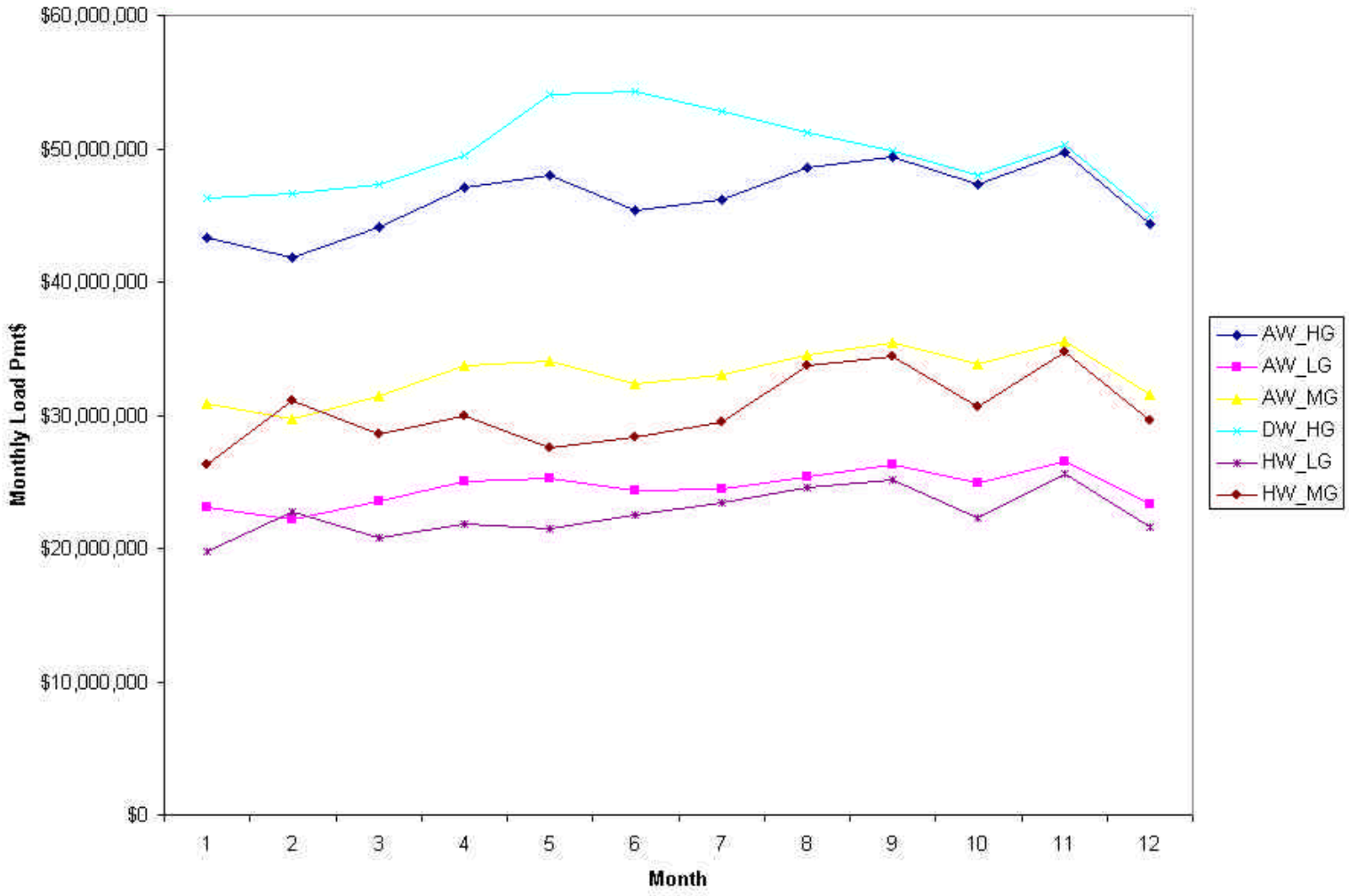
12
Month
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

Sierra - Load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$10,000,000
$0
Monthly Load Pmt$
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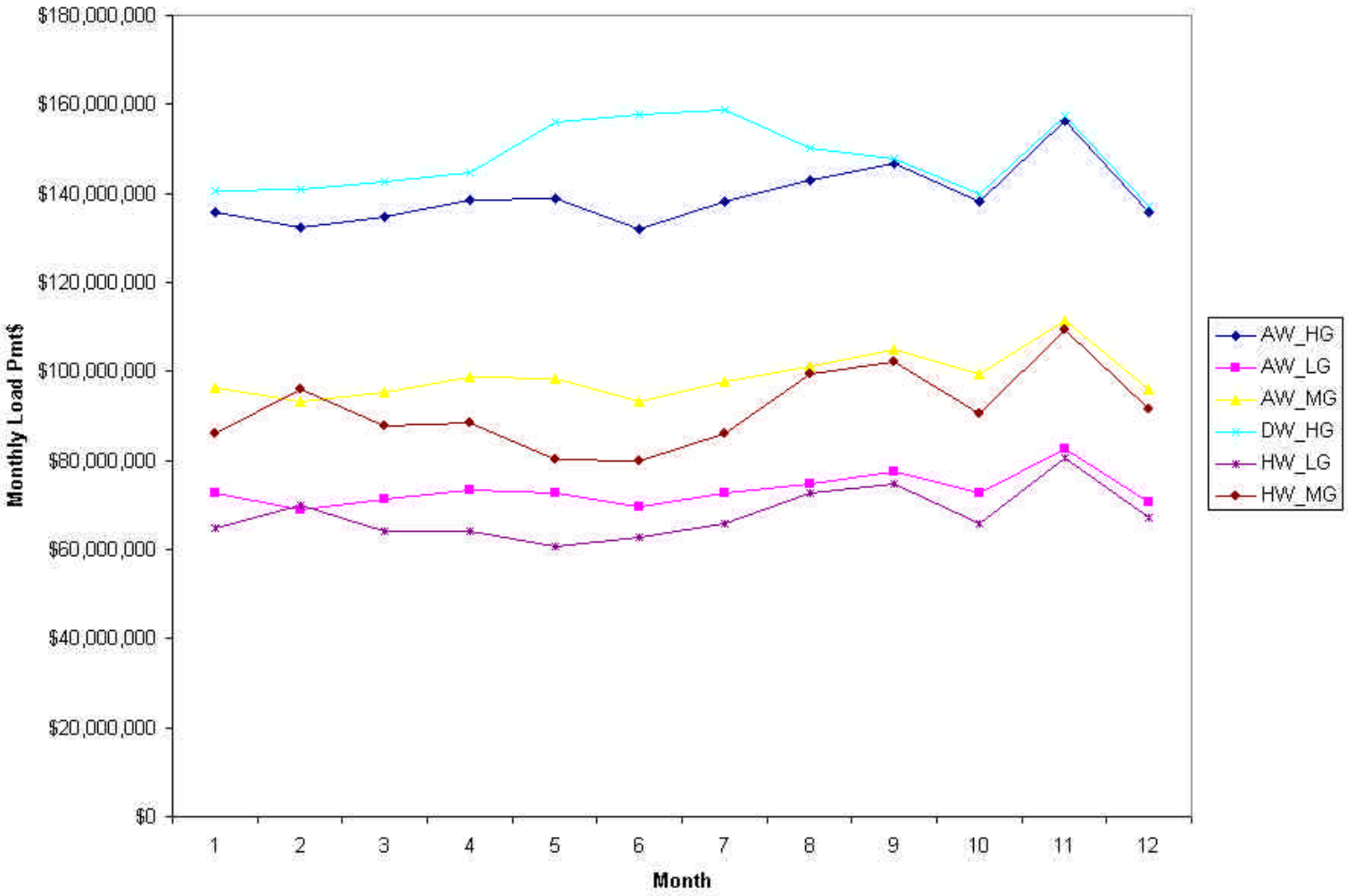
12
Month
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

PACE - Load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$20,000,000
$0
Monthly Load Pmt$
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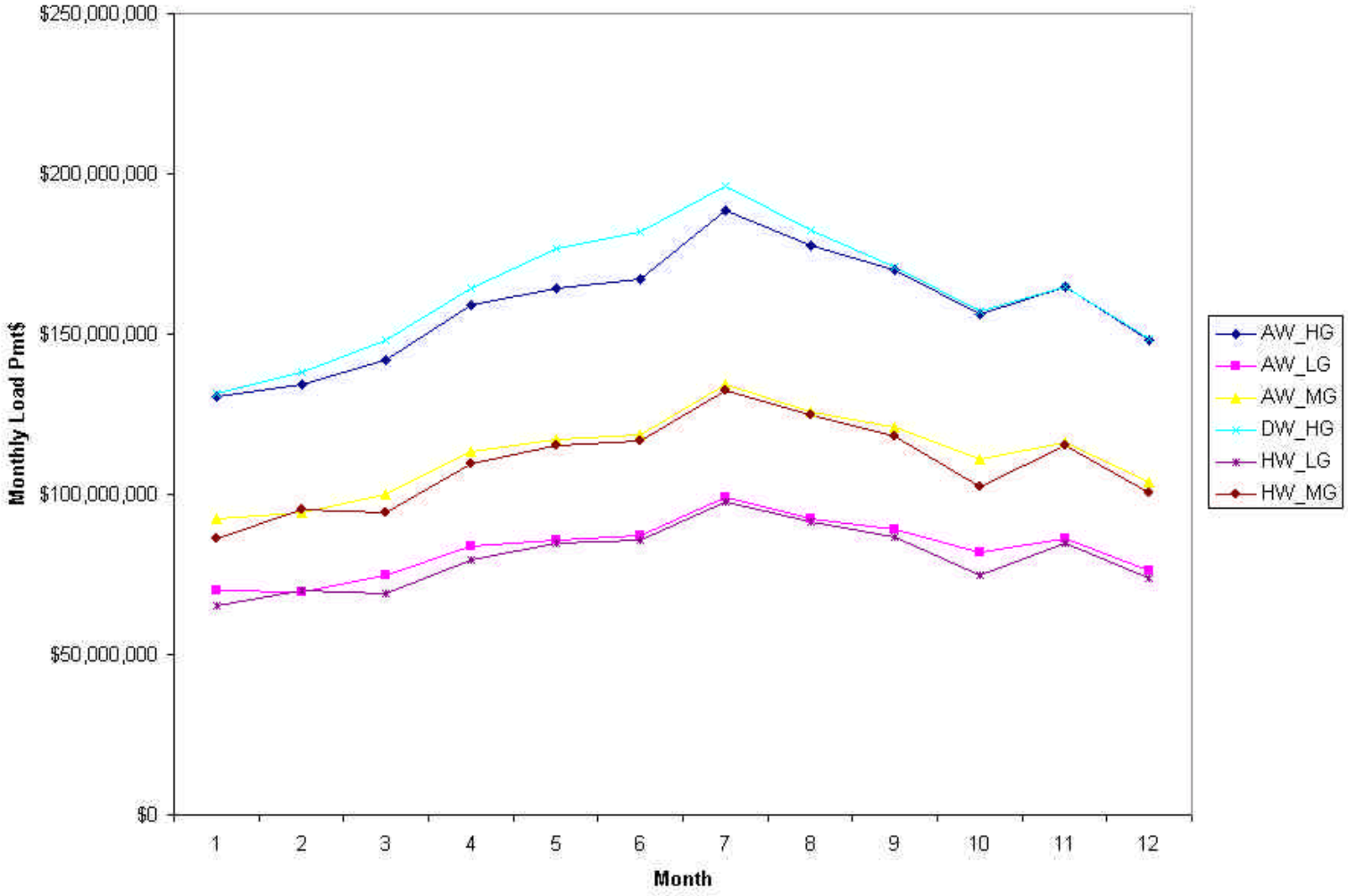
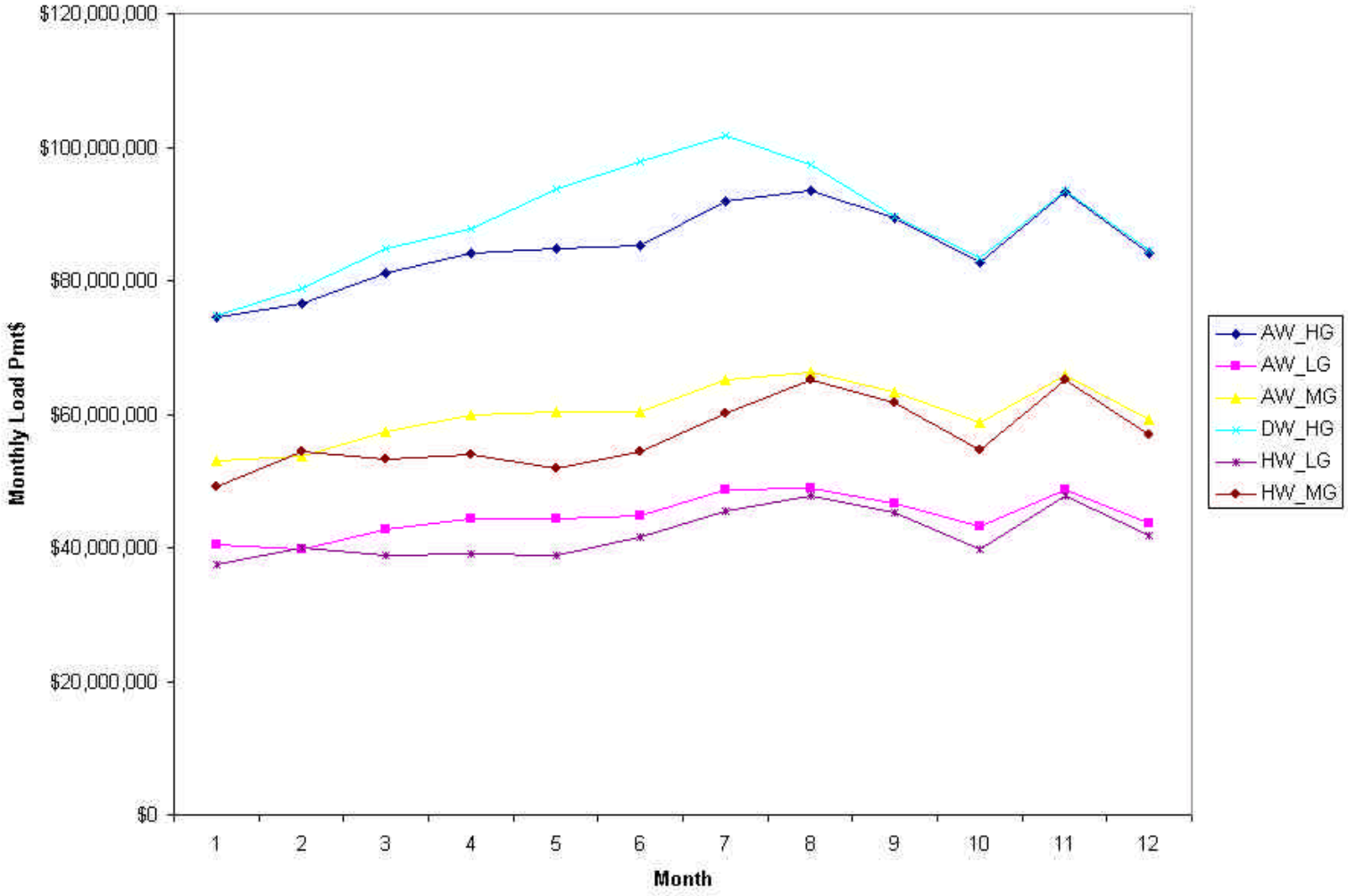
Month
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

PSColorado - Load



WAPA RM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$80,000,000
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$0
Monthly Load Pmt$
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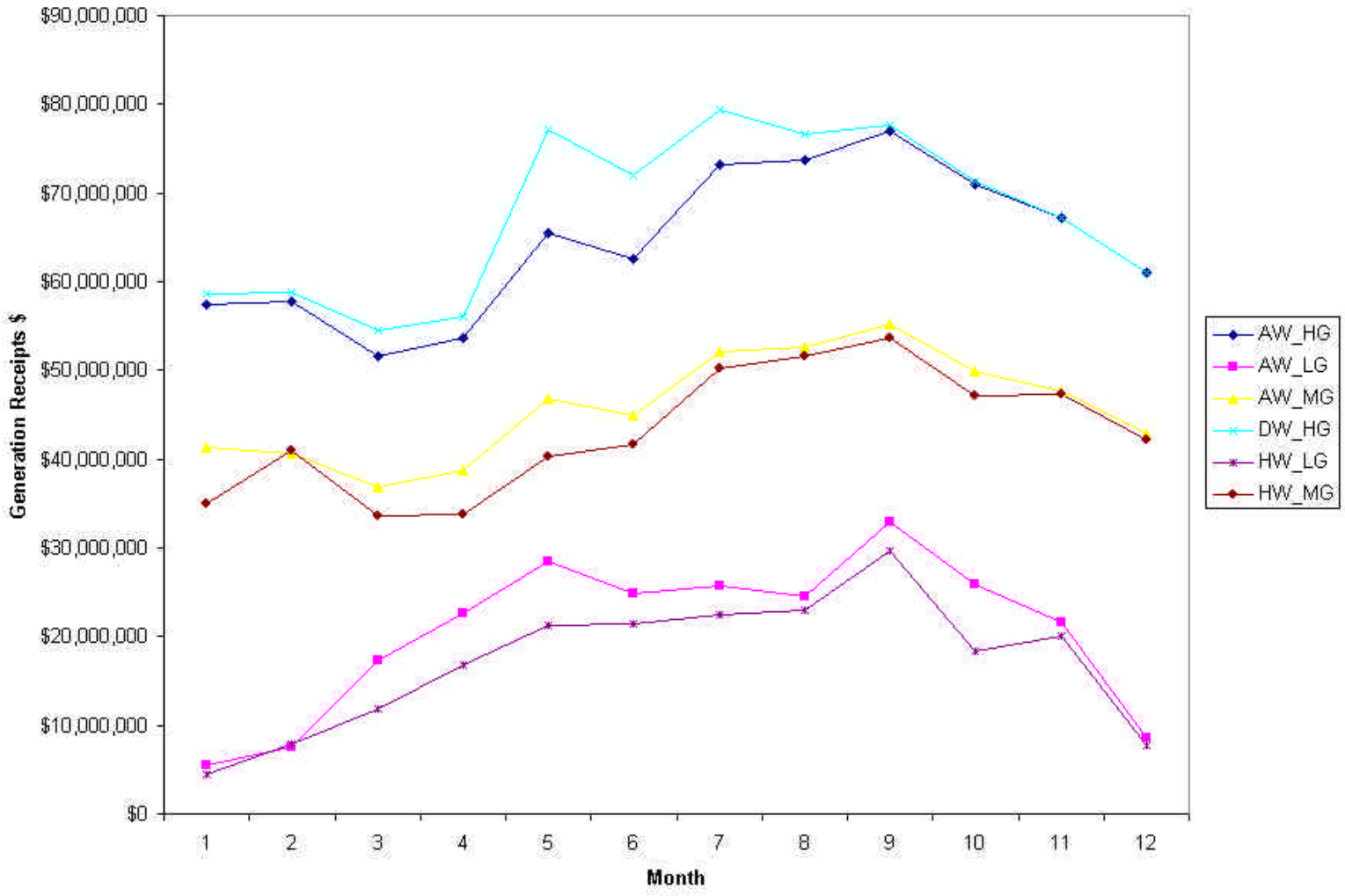
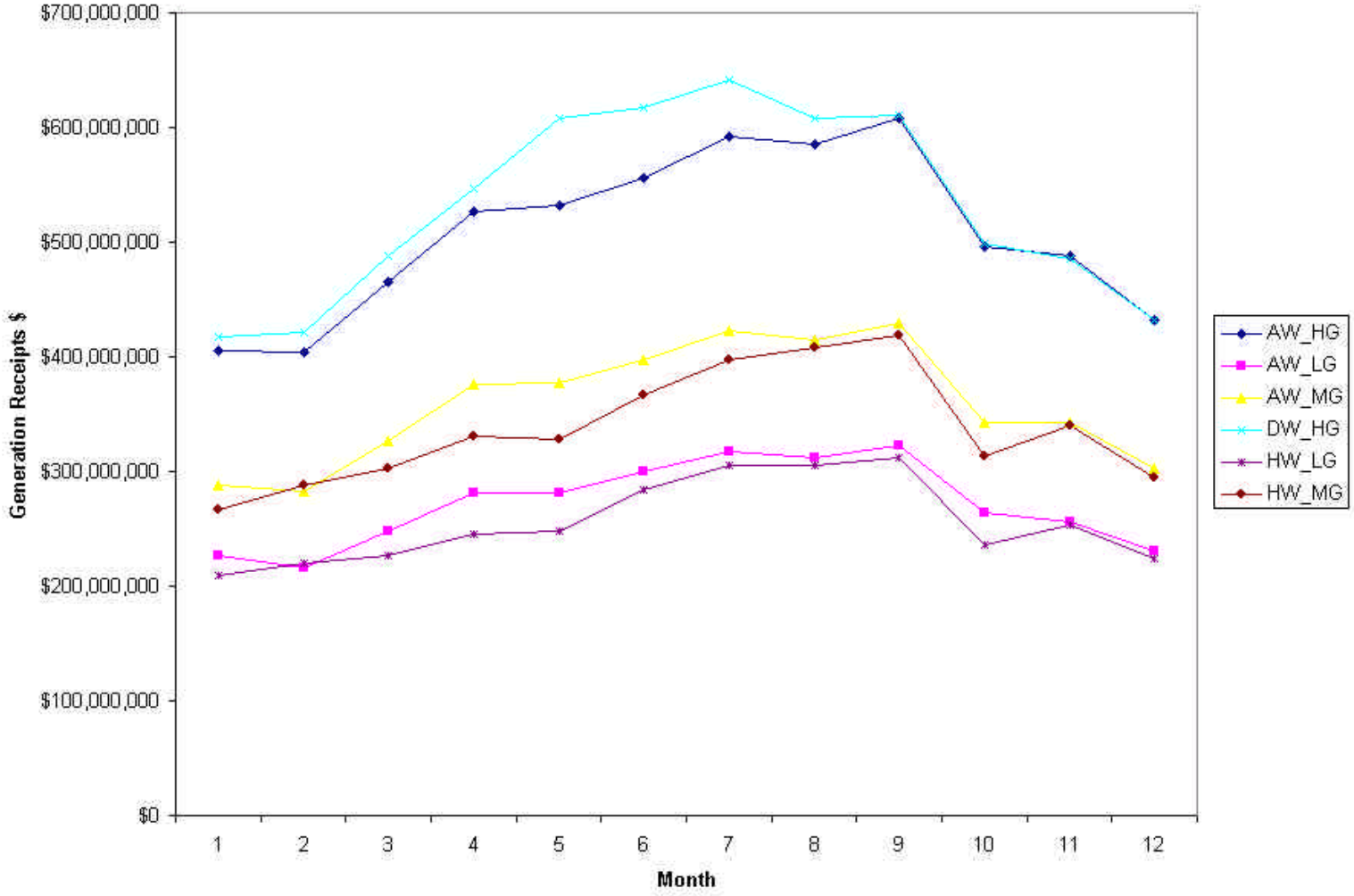
Month
AW_HG
AW_LG
AW_MG
DW_HG
HW_LG
HW_MG

Generation

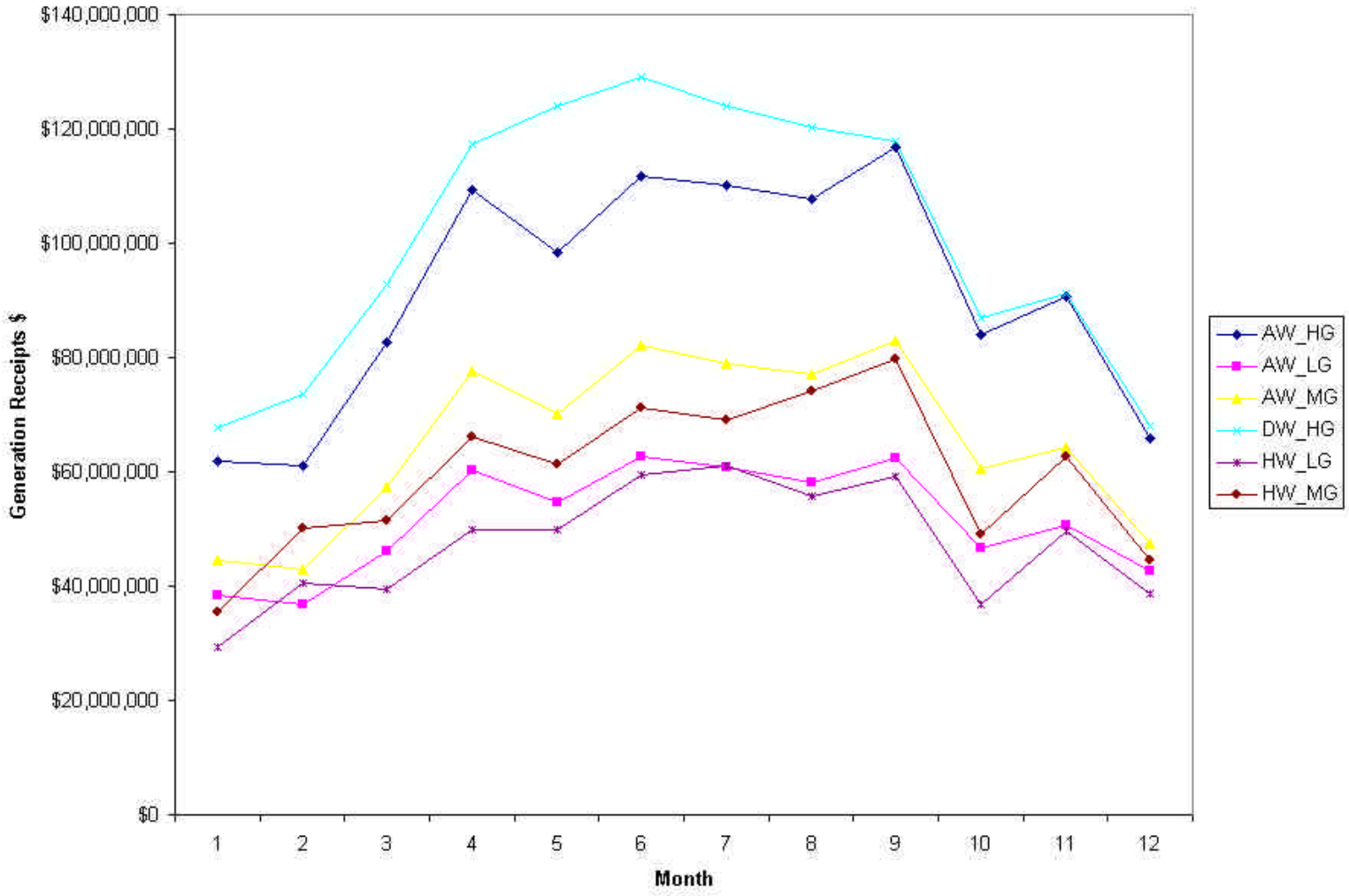
New Mexico - Generation



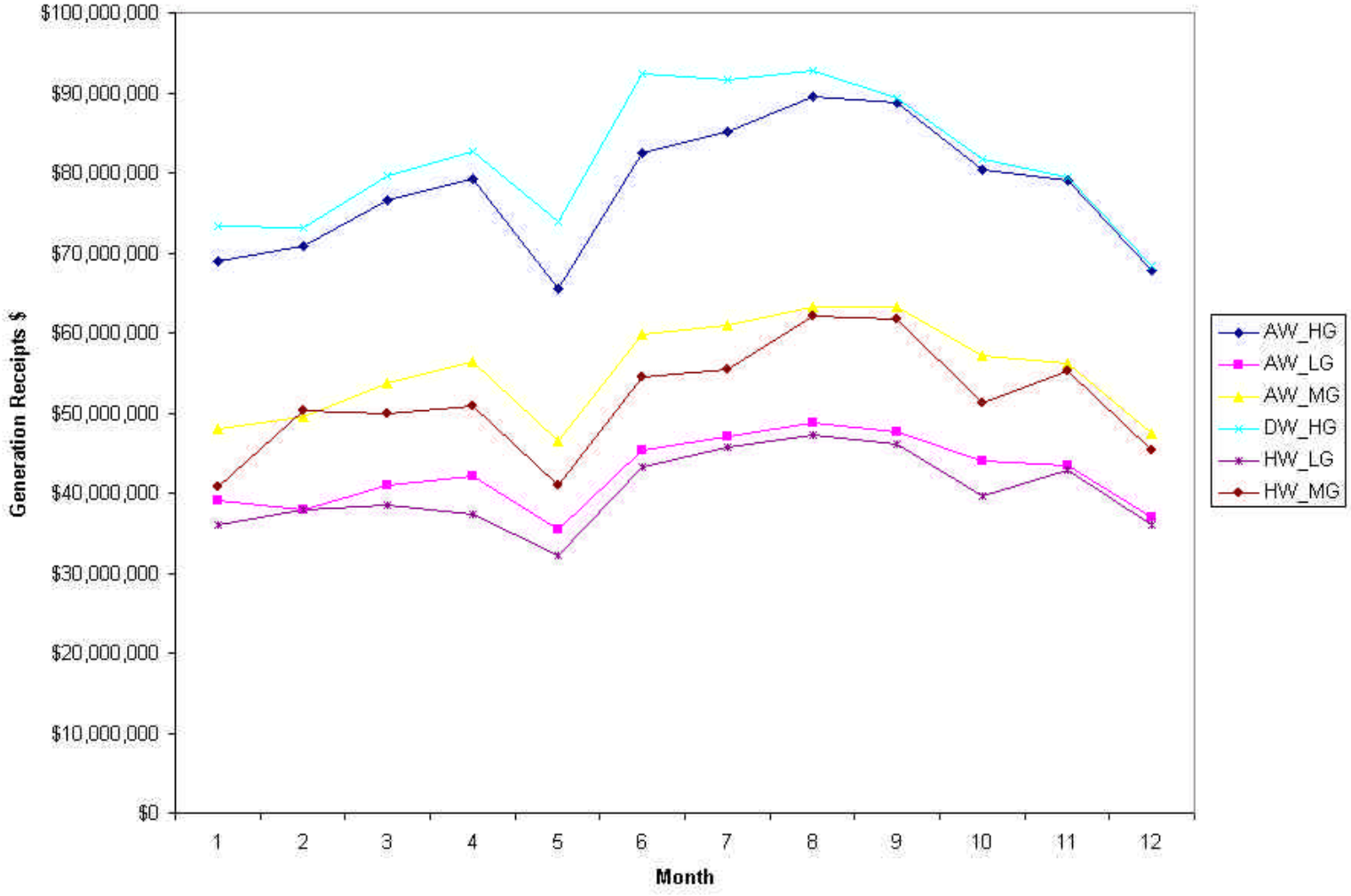
Arizona - Generation



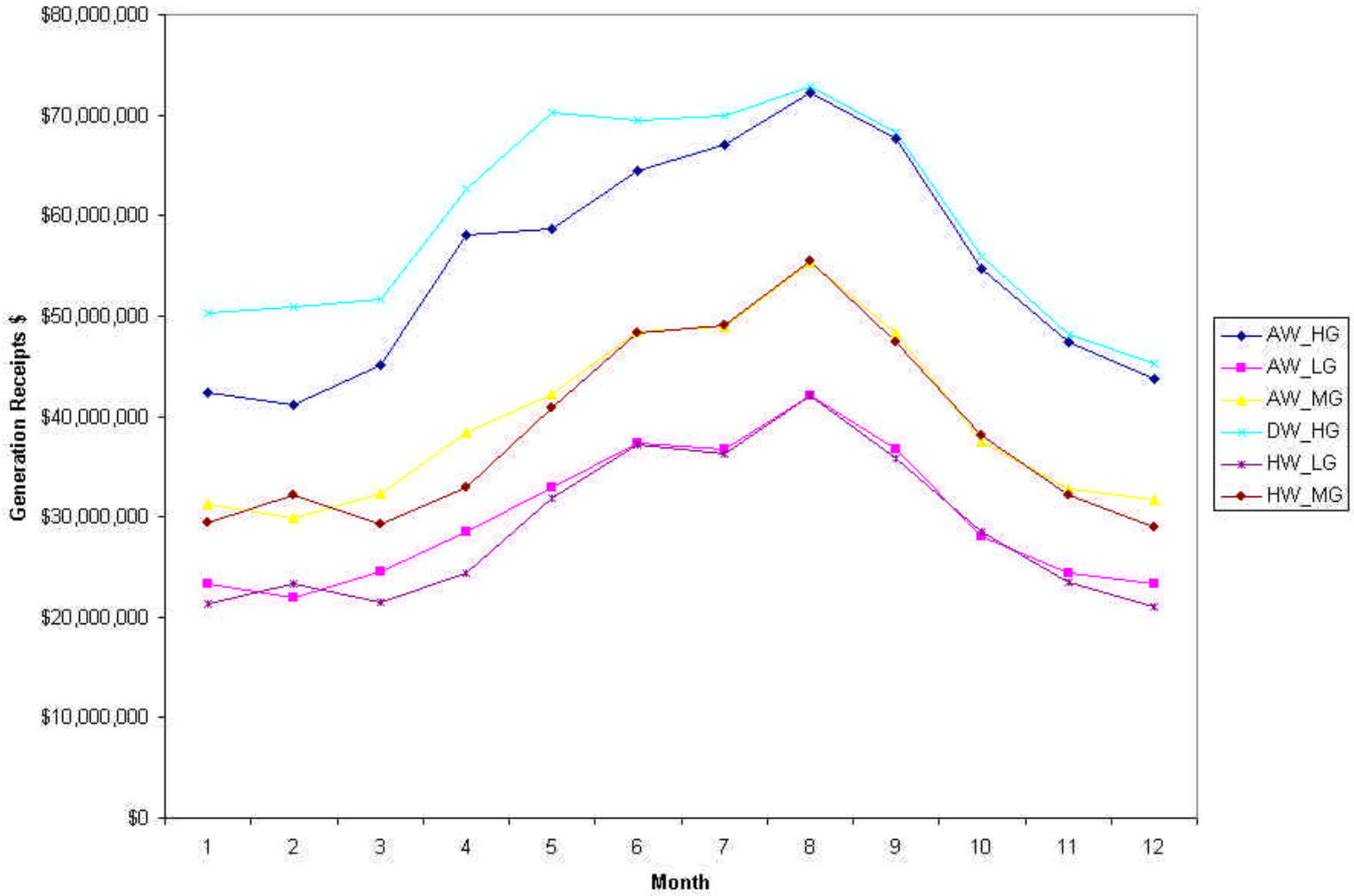
Nevada - Generation



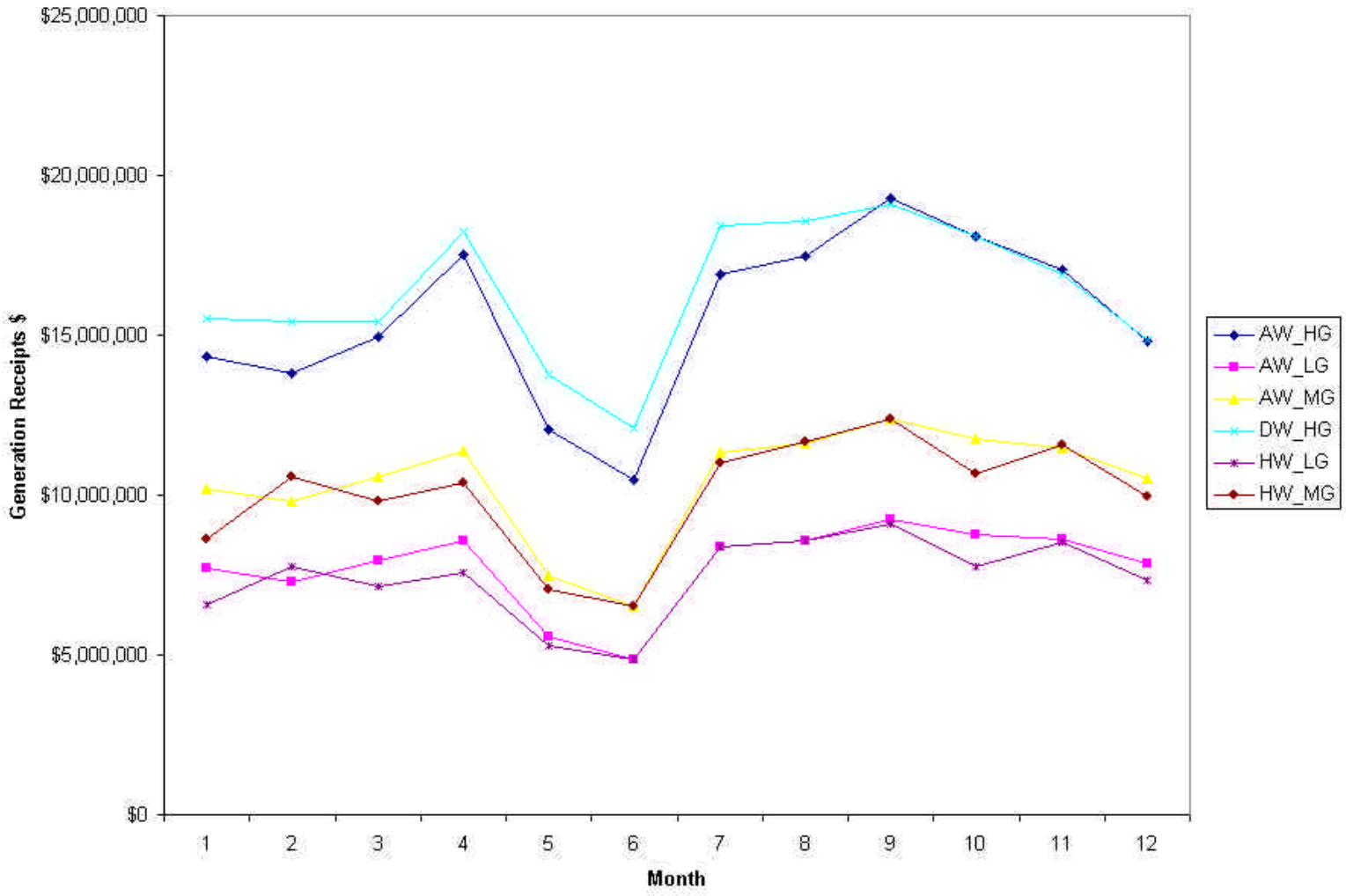
WAPA LC - Generation



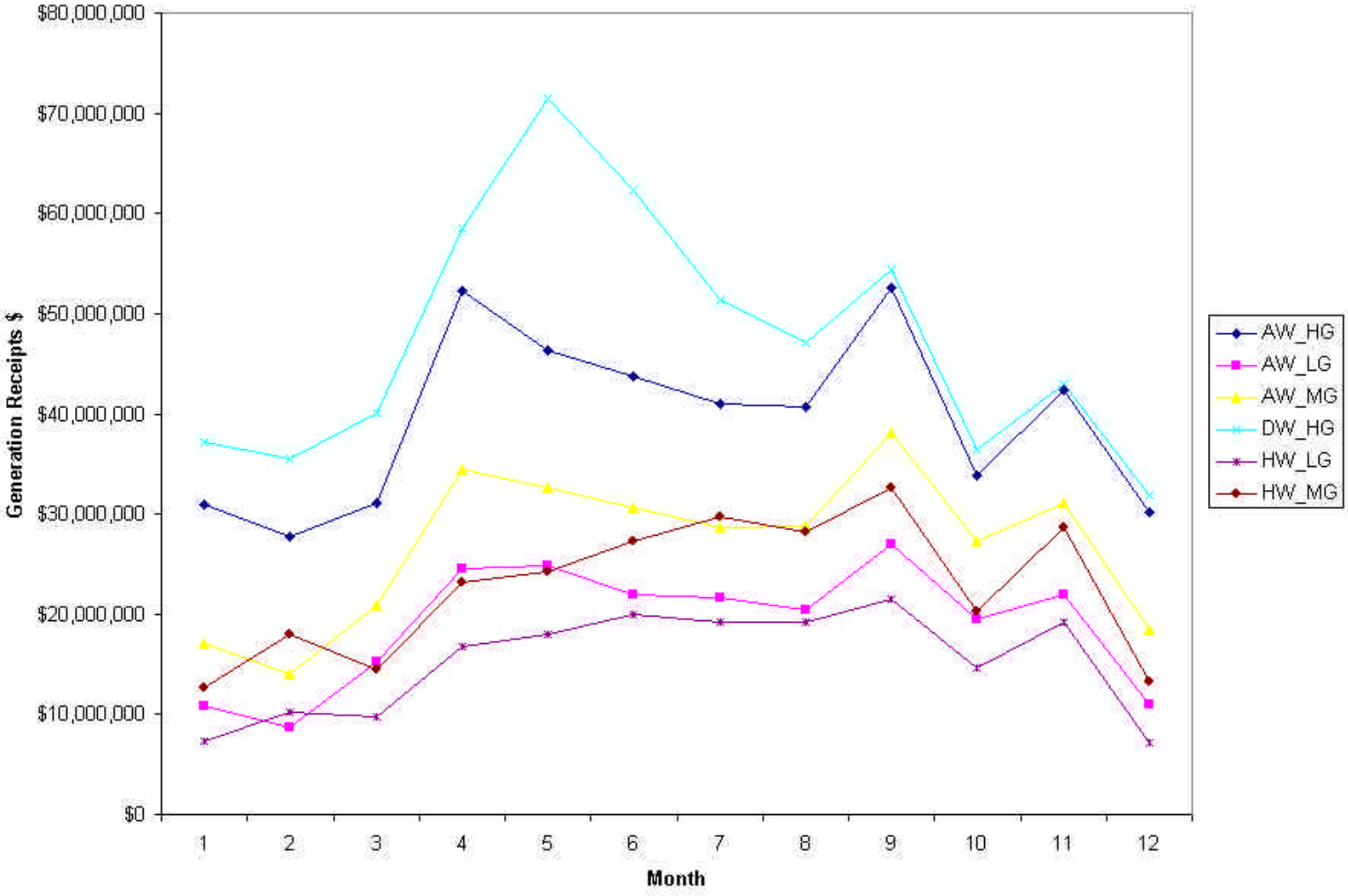
Mexico-C Generation



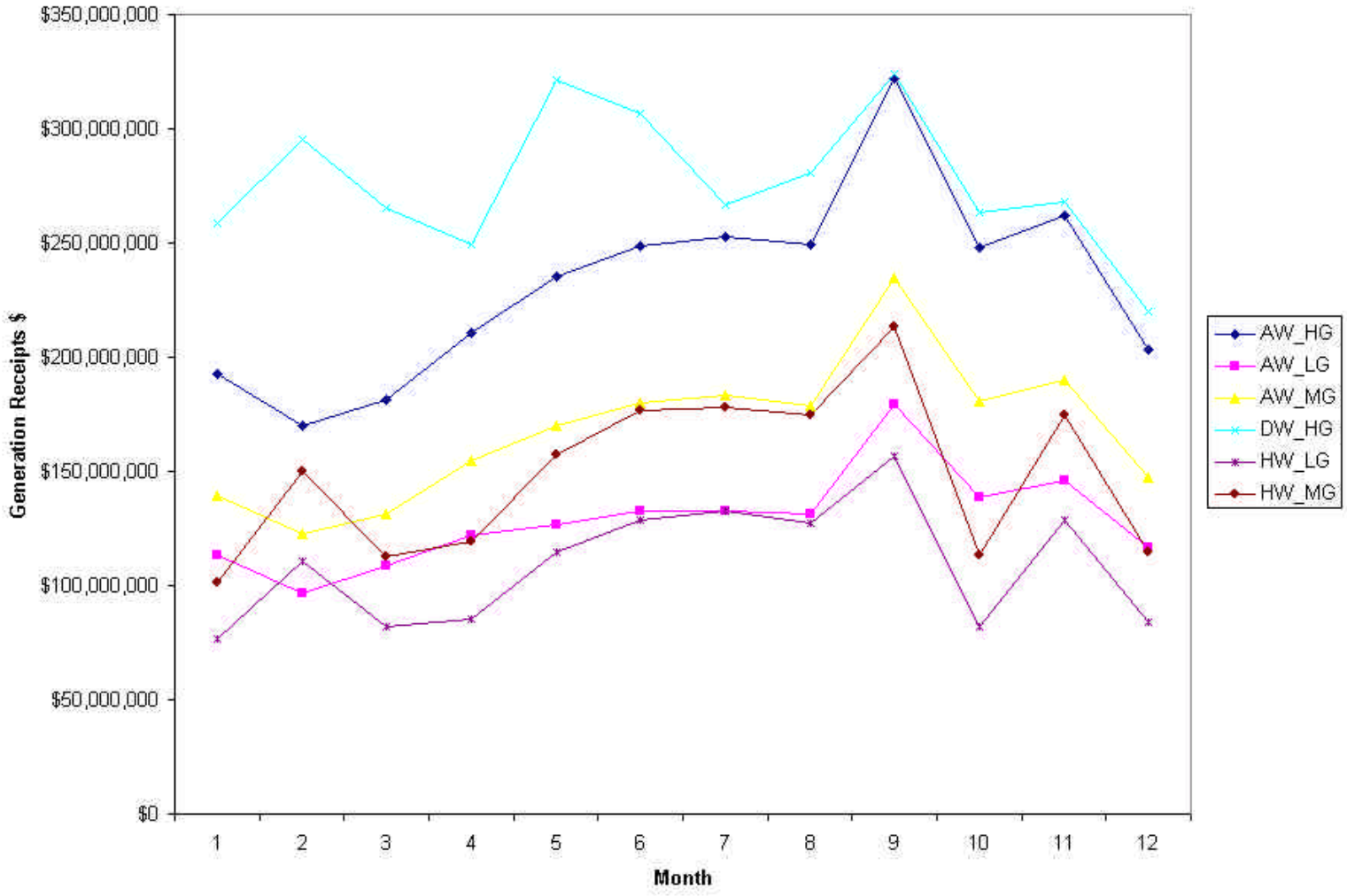
Imperial - Generation



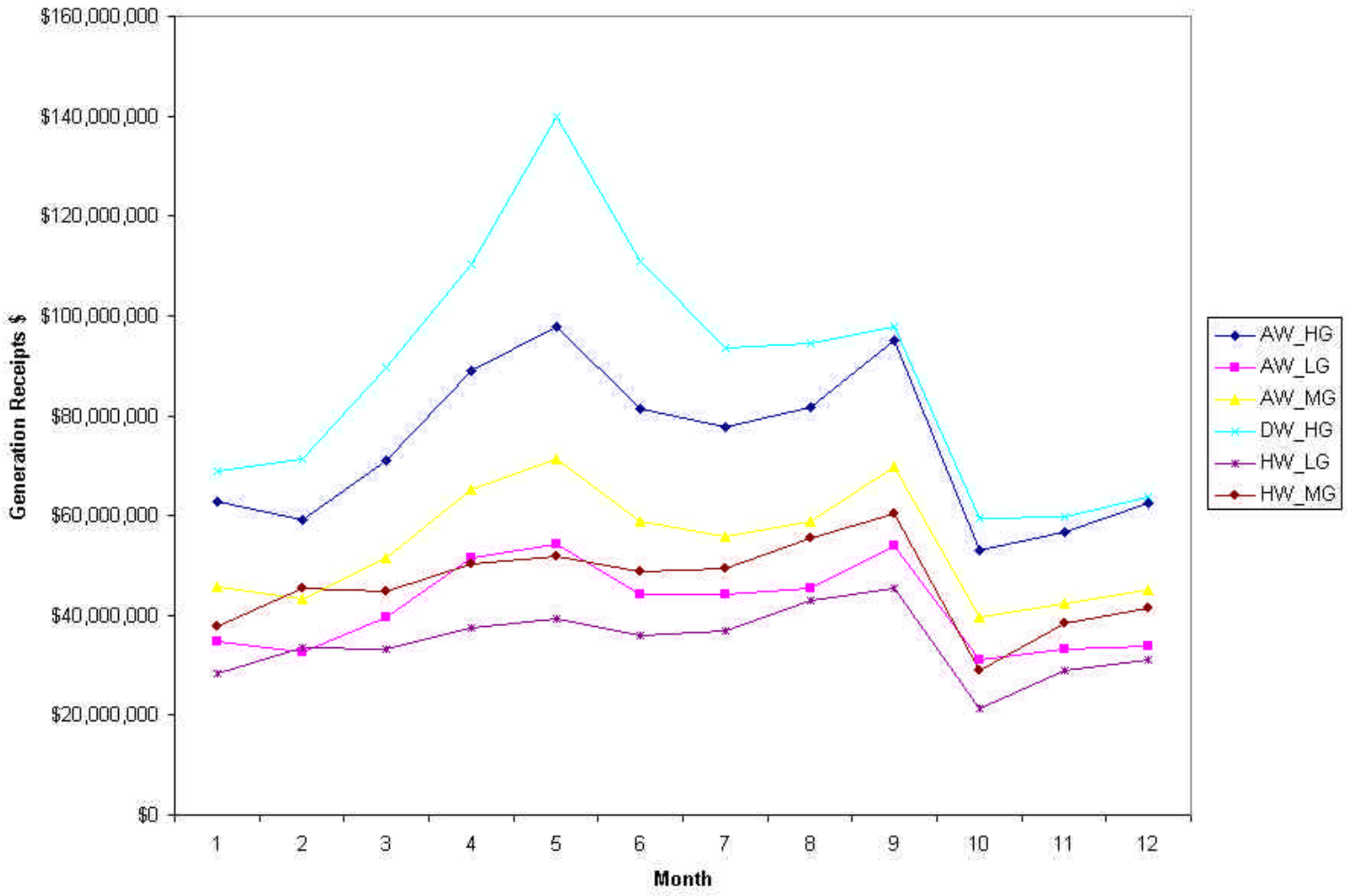
San Diego - Generation



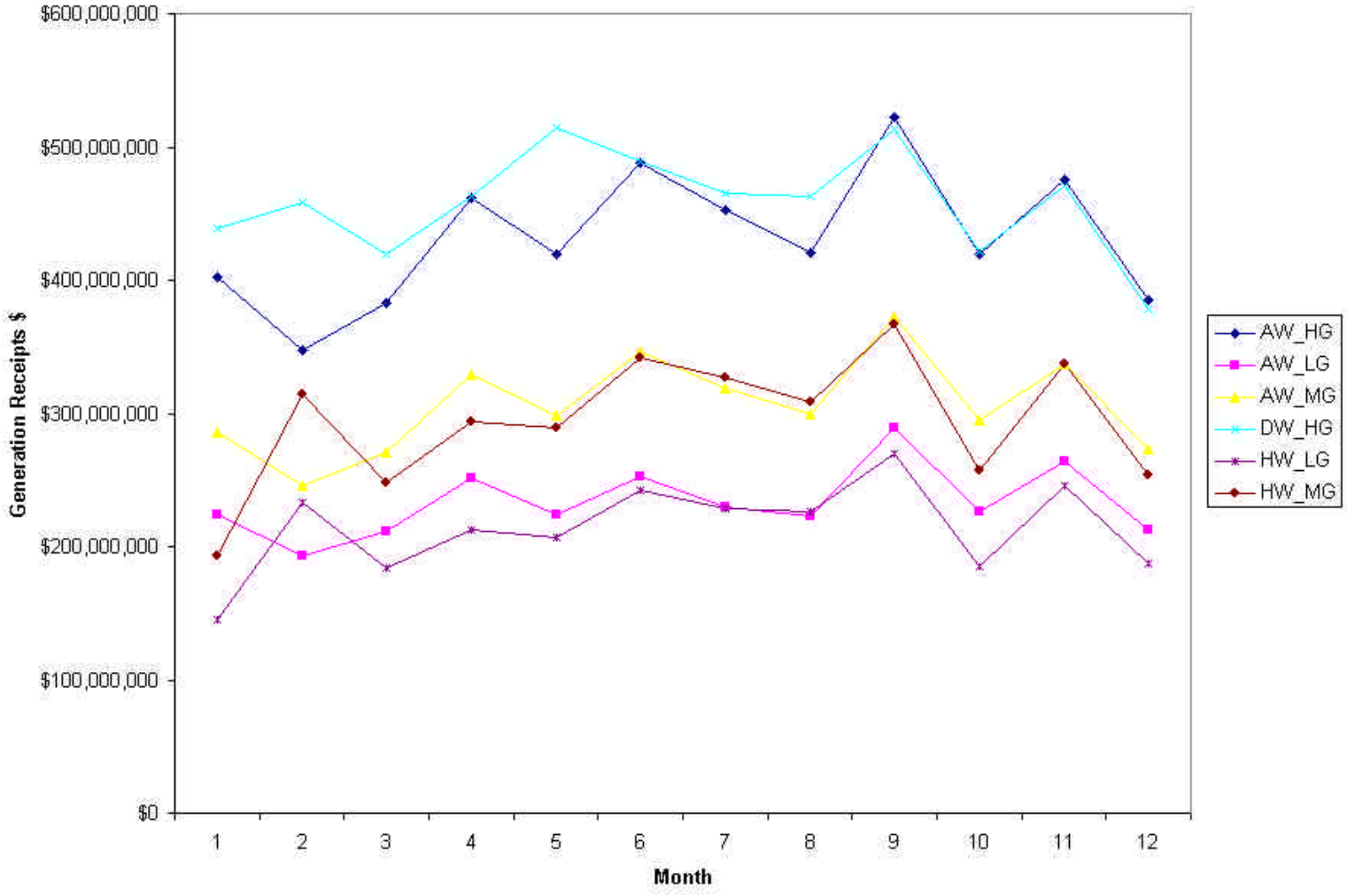
SOCALIF - Generation



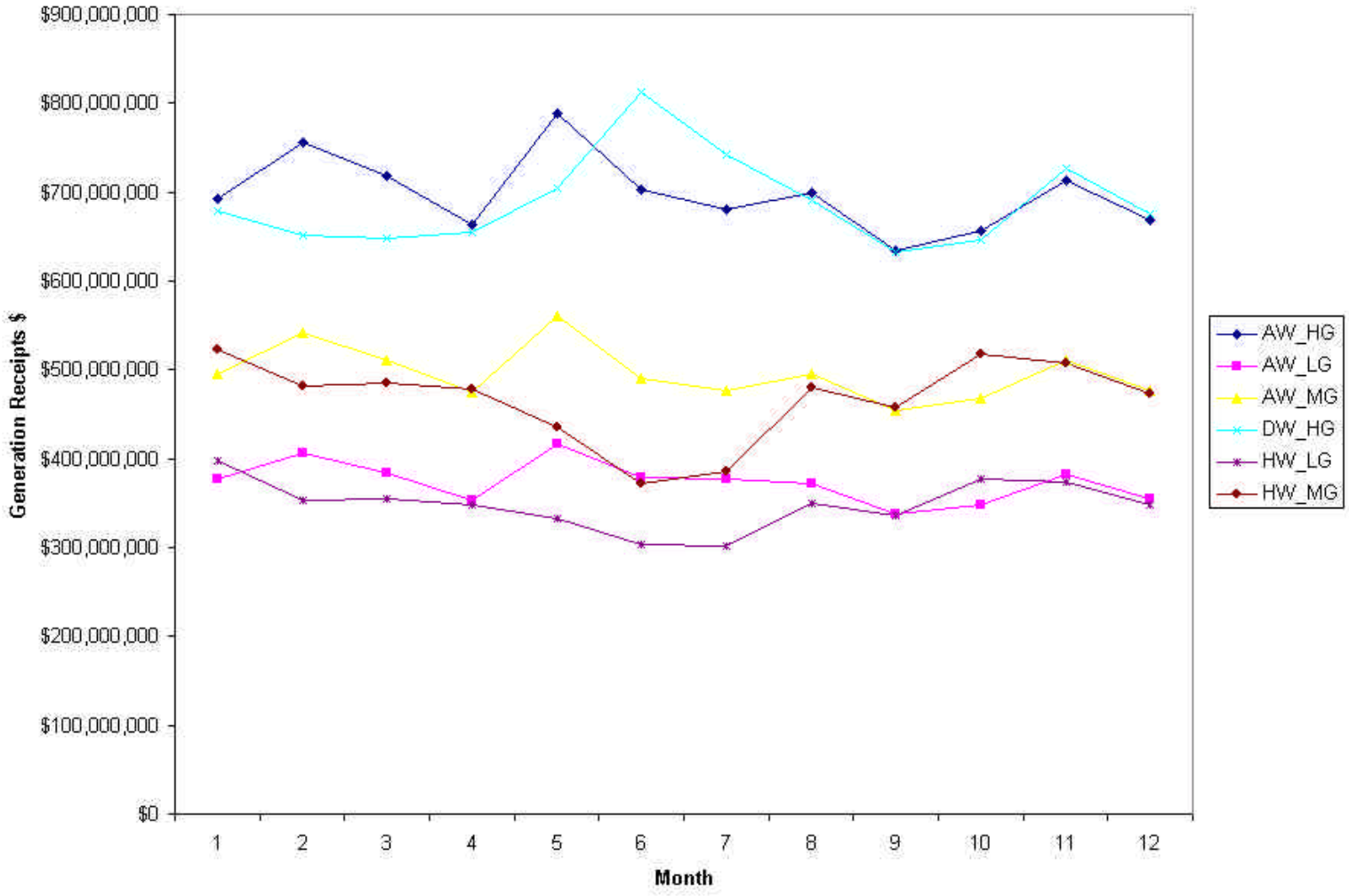
LADWP - Generation



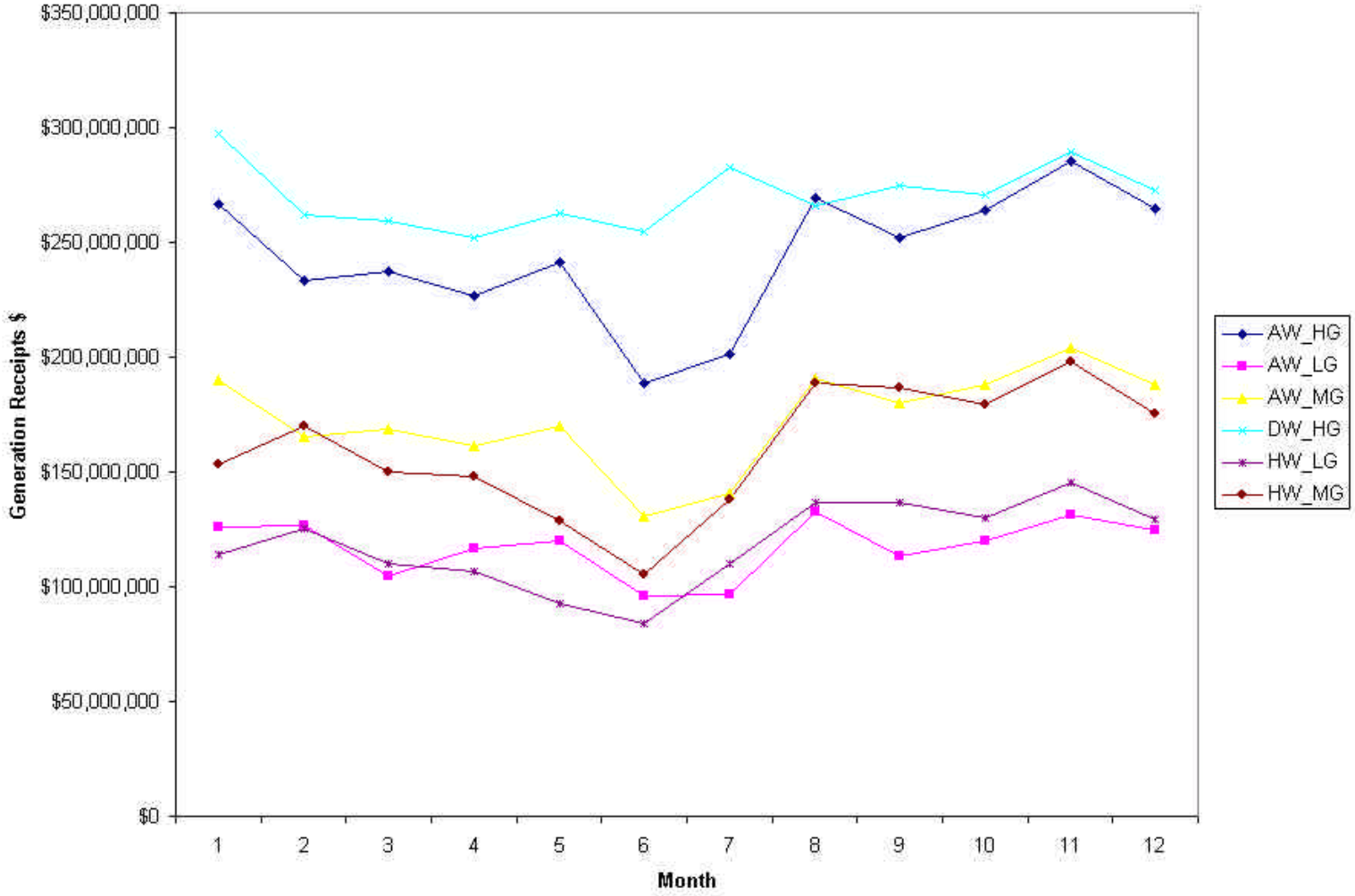
PG & E - Generation



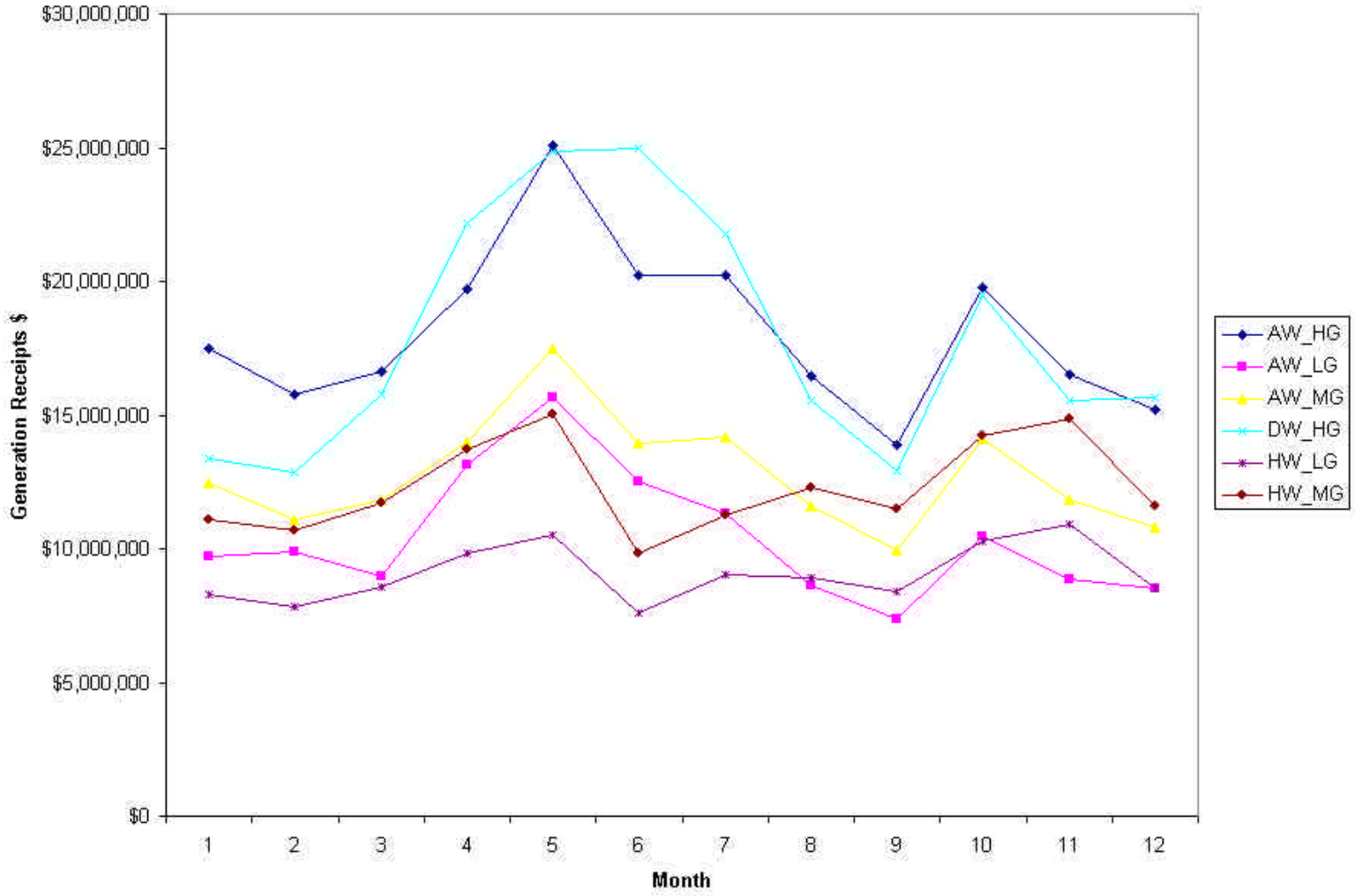
North West - Generation



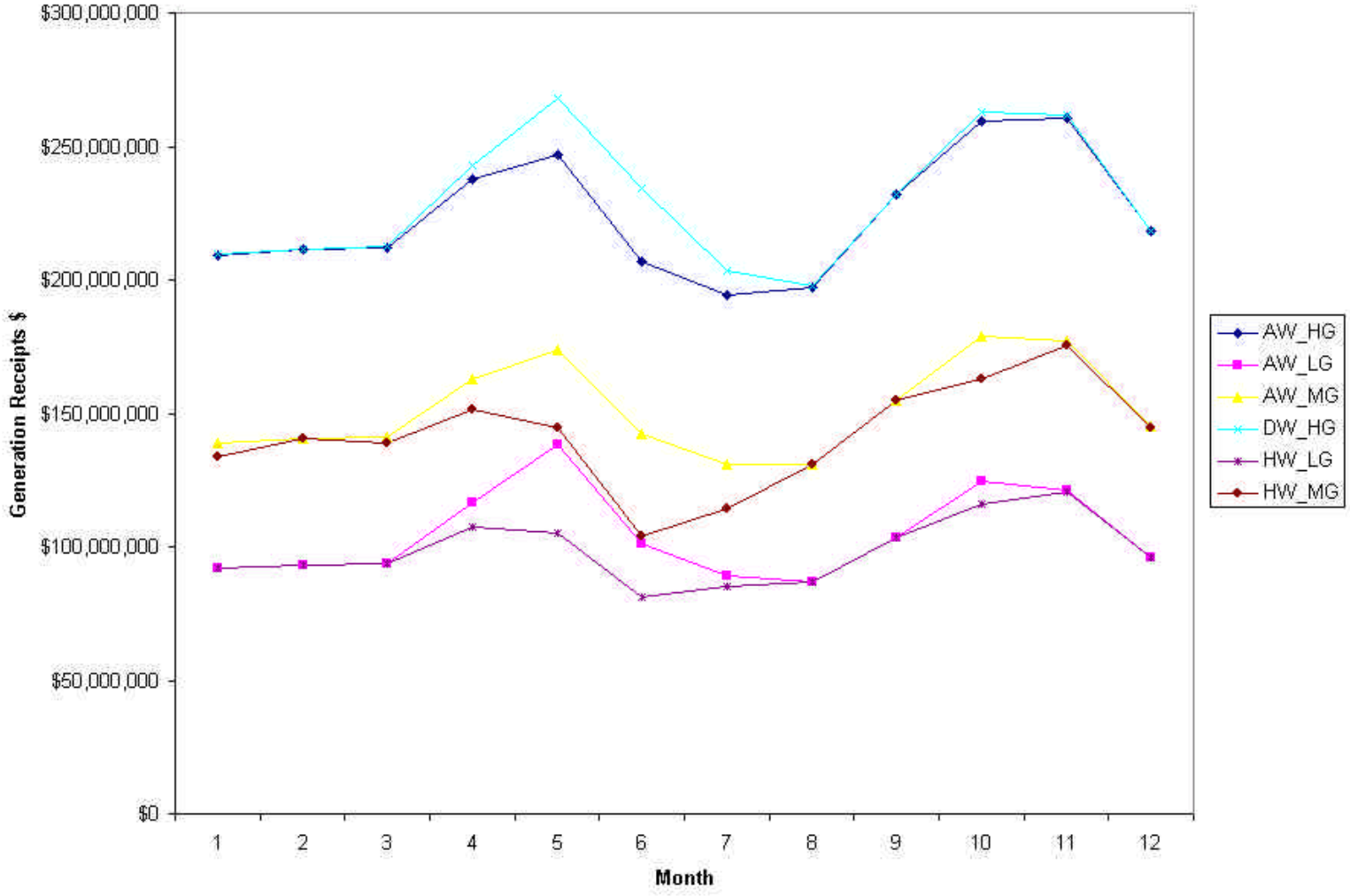
BCHydr - Generation



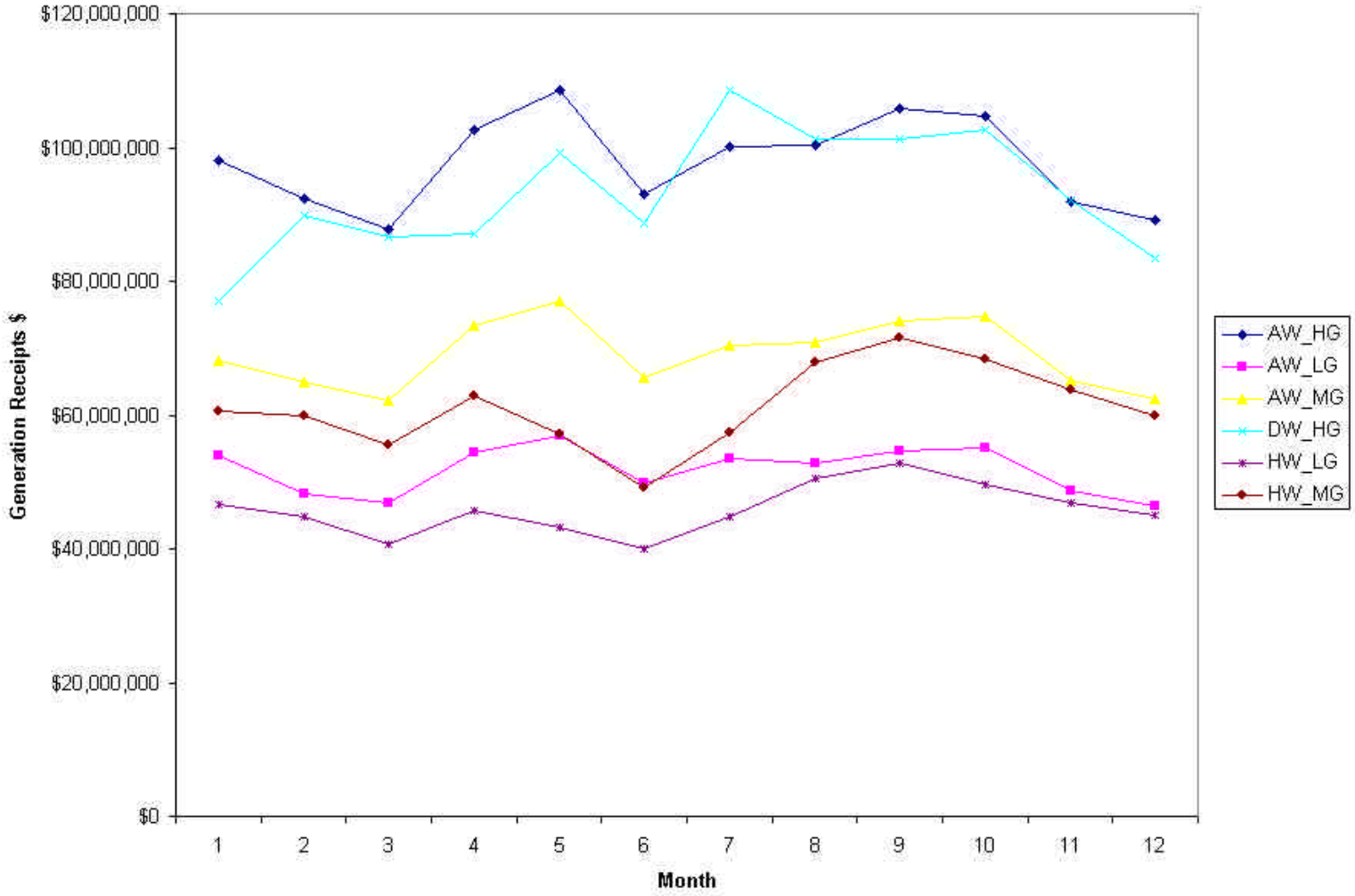
Aquila - Generation



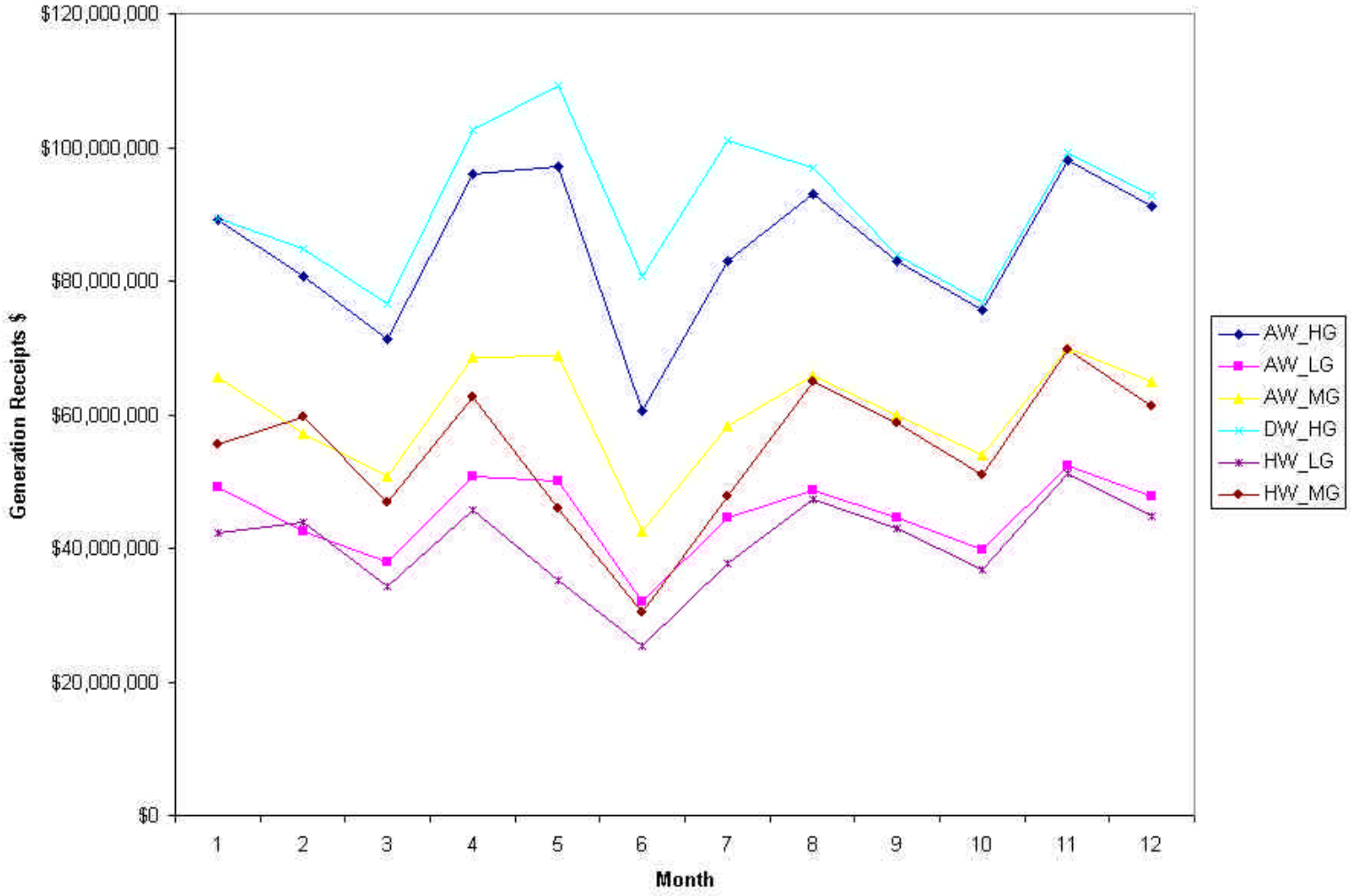
Alberta - Generation



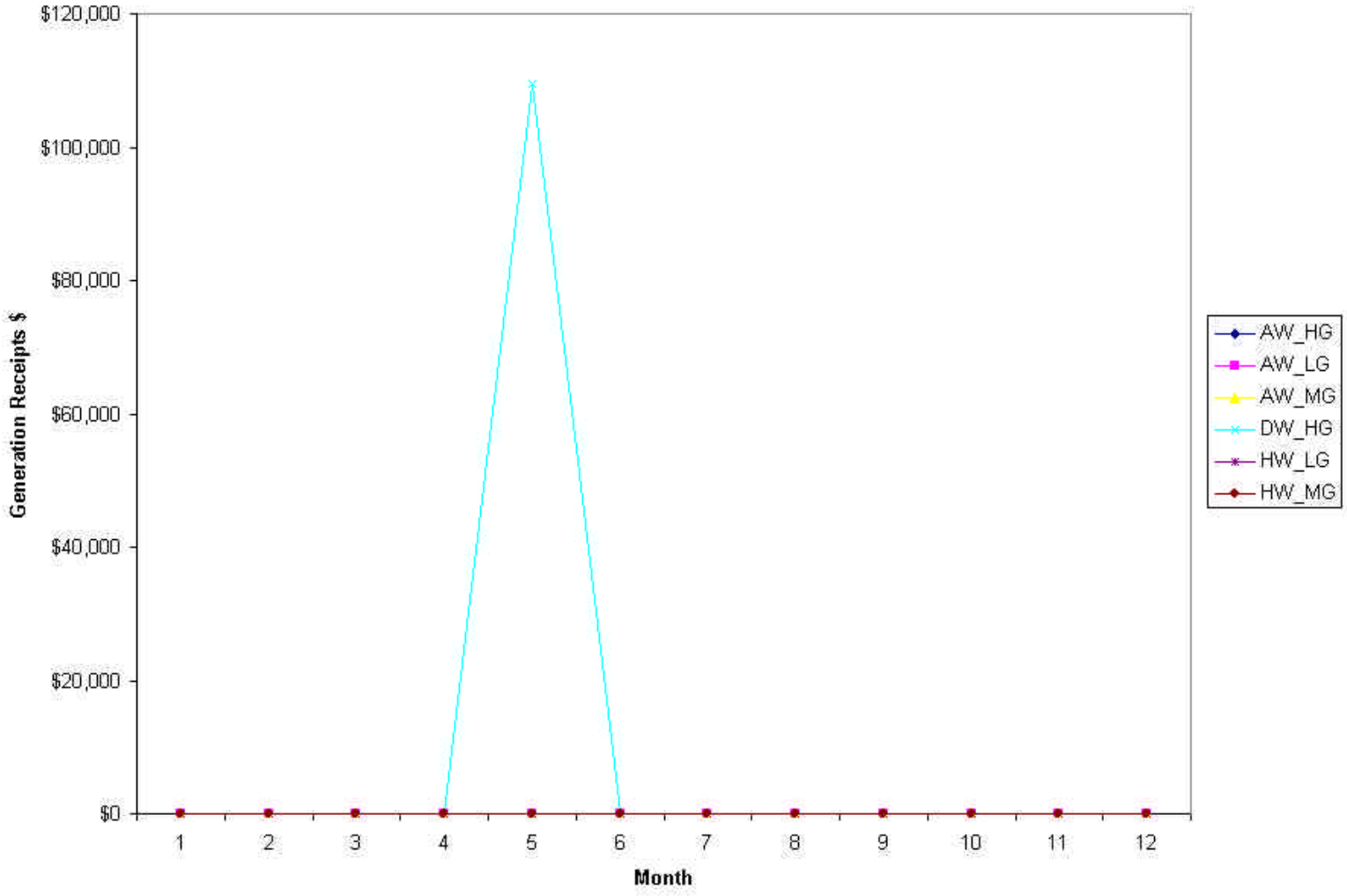
Idaho - Generation



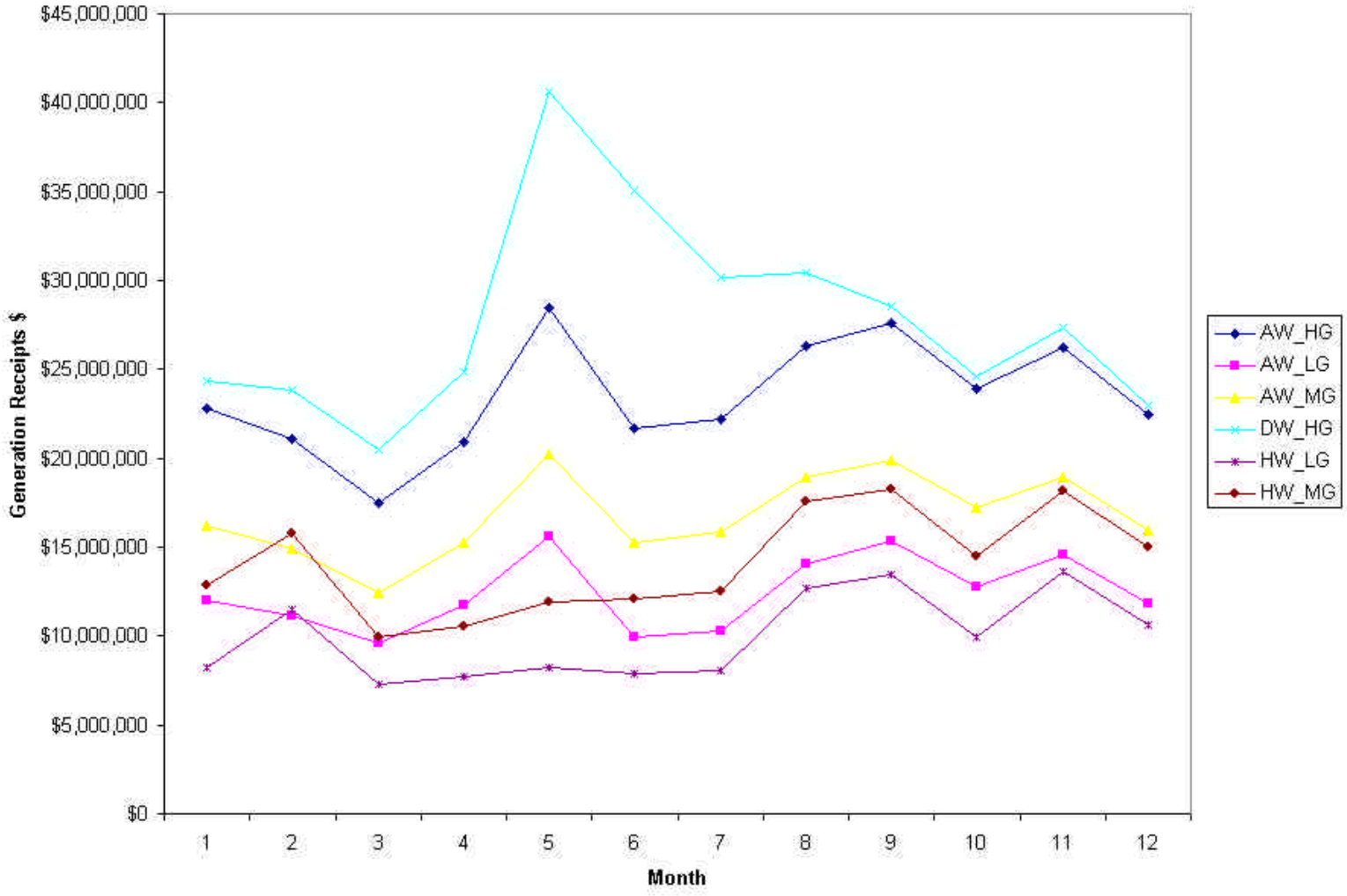
Montana - Generation



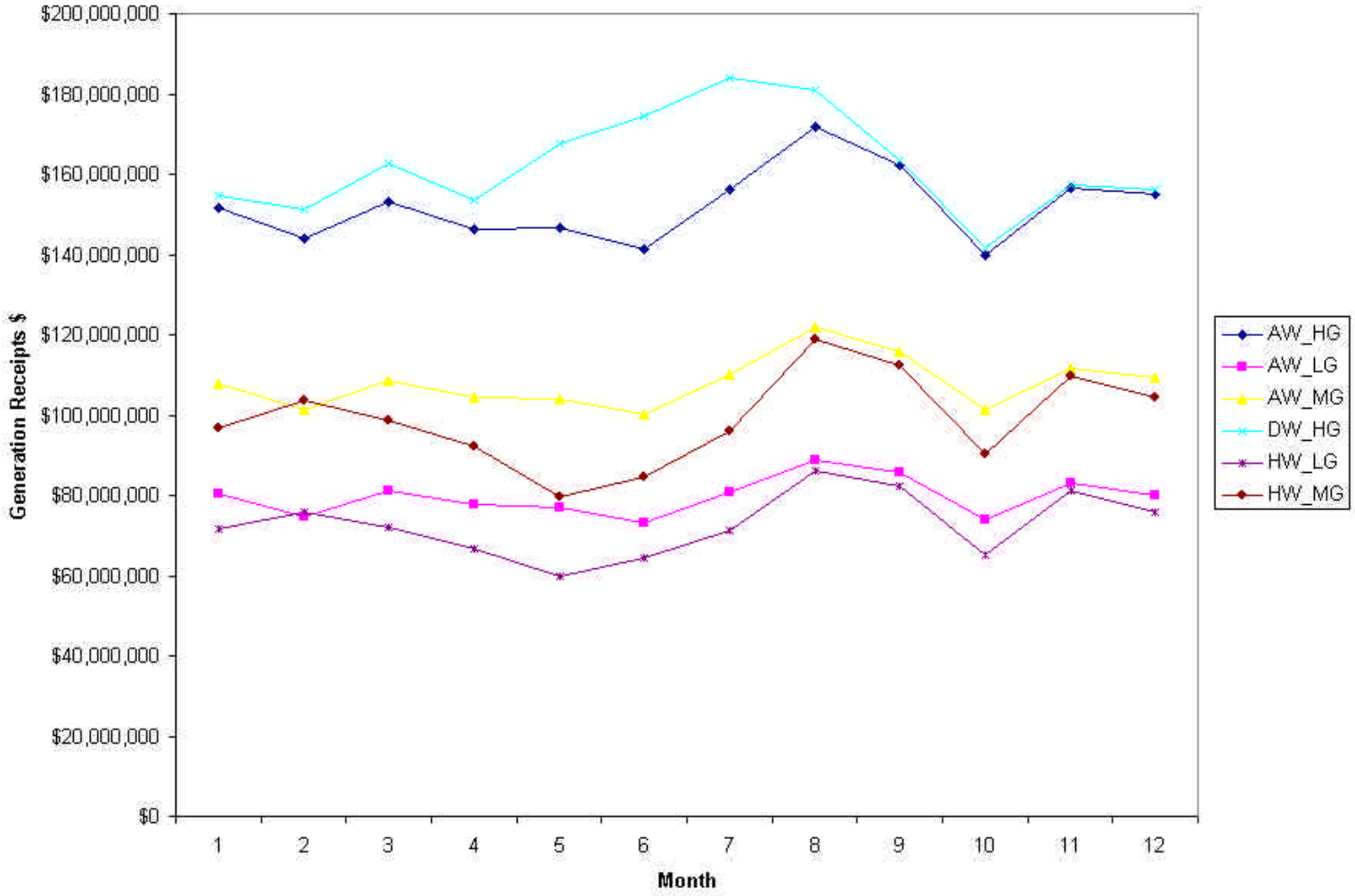
WAPA UM - Generation



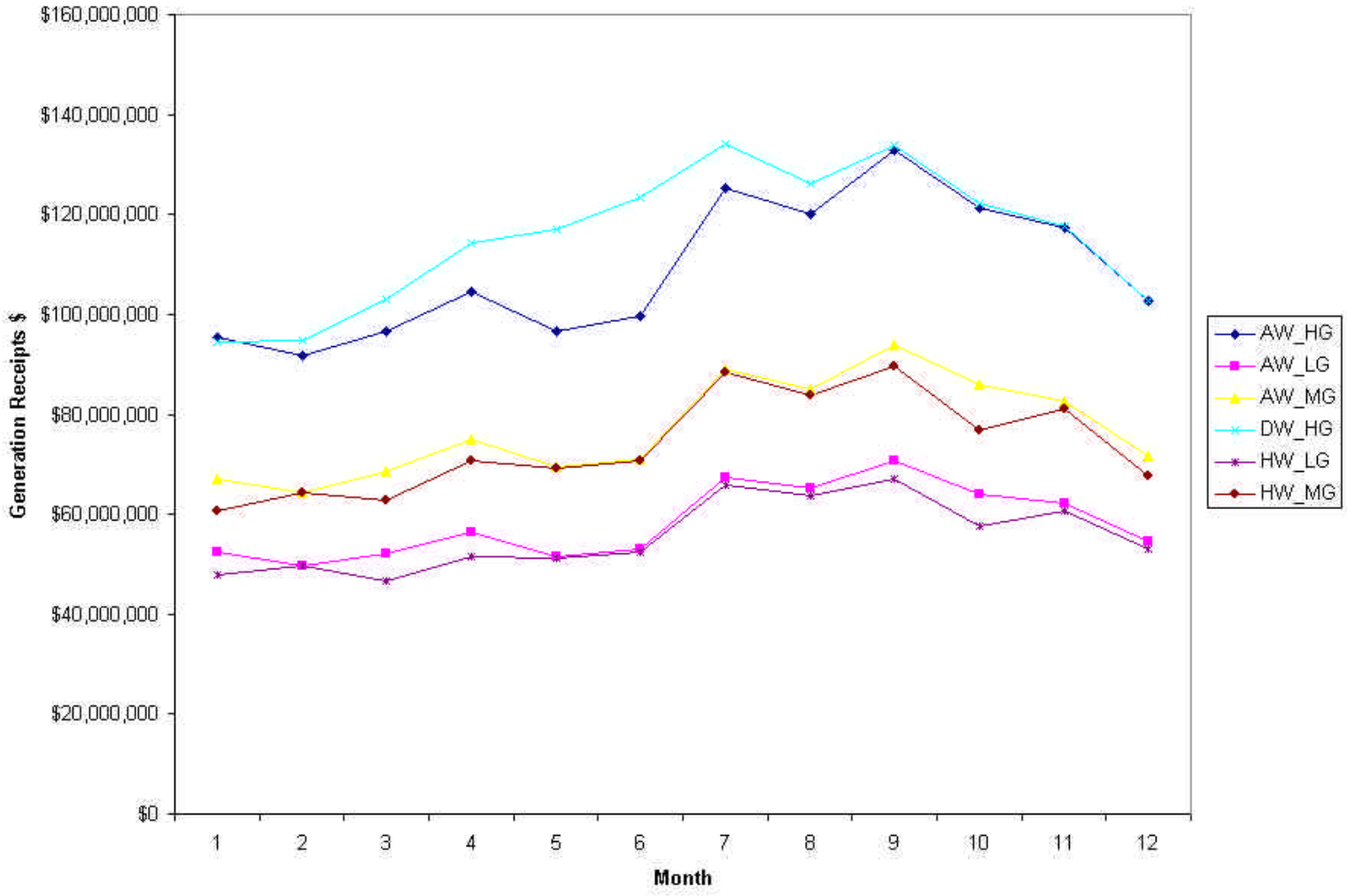
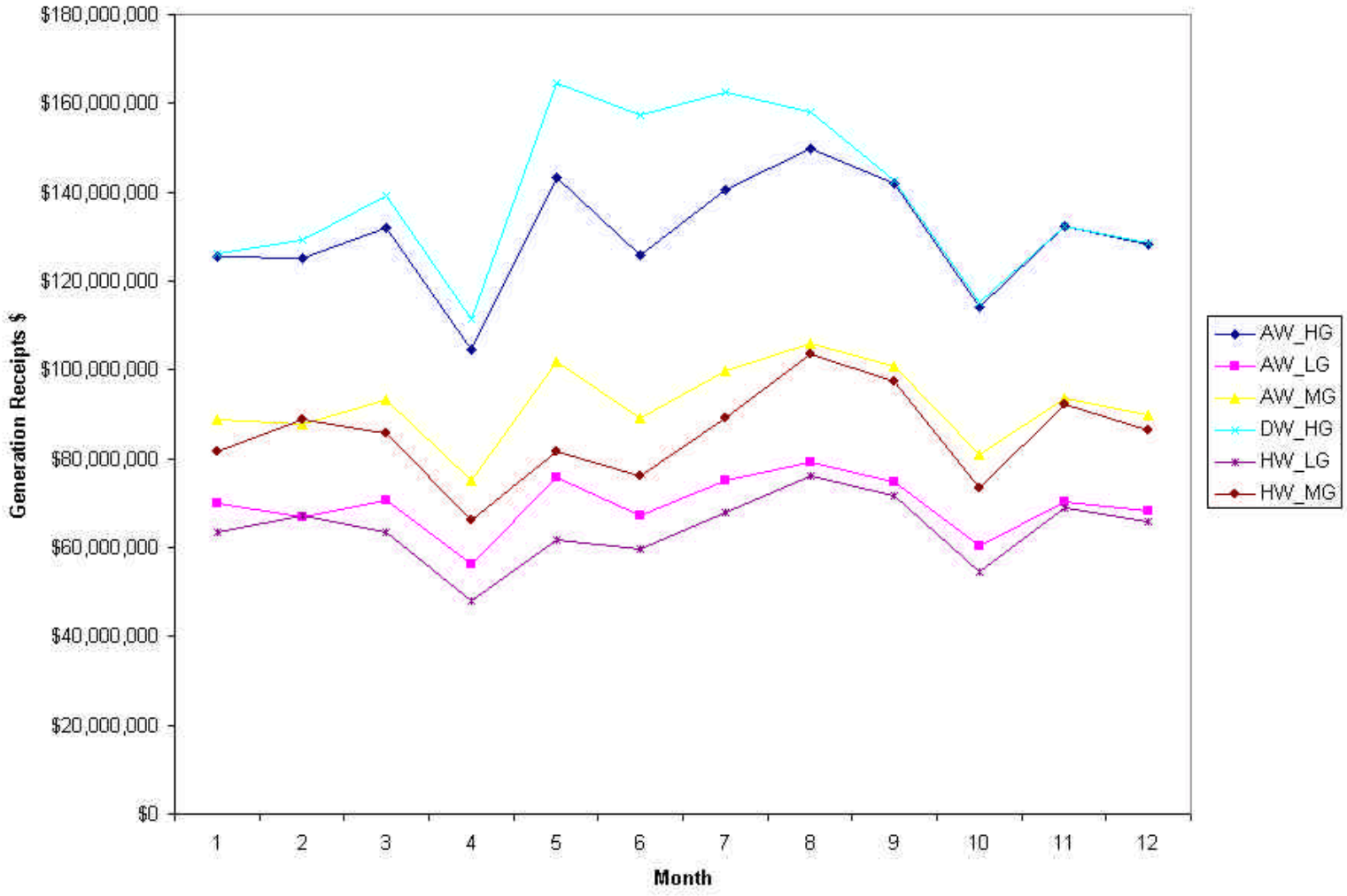
Sierra - Generation



PACE - Generation



PSColorado - Generation



WAPA RM - Generation