SSG-WI 2015
"Do Nothing" Case

Seams Steering Group of the Western Interconnection

September 14, 2005

"Do Nothing" Case

- **2008 System**
  - No resources or transmission addition beyond 2008 Base Case
- **Loads**
  - WECC 2005 Load Forecast with some exceptions:
    - Extrapolated RMATS 2008 to 2015 levels, using recently approved RMATS annual growth rates
    - Applied the Council's loads for the two NW bubbles
    - Used CAISO estimates for the two PG&E bubbles
- **$5 Gas at HH escalated to 2015, using 2.5% annual inflation factor**

Results

All analysis were conducted with transmission wheeling charges & line loss calculation, except as marked

- L&R
- Production Costs
- Congestion & Congestion Costs

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Western Interconnect 2015 Loads

2015 REFERENCE CASE GV LOAD OUTPUTS					
Non-Coincident Peaks			178	157	178
			Summer MW	Winter MW	Annual Peak
Loads		Energy	July-August	Dec-Jan	
CALIF	IMPERIAL	4,212,853	1,188	479	1,188
CALIF	LADWP	38,263,622	6,151	5,376	6,374
CALIF	MEXICO-C	15,278,309	3,174	2,152	3,209
CALIF	PG&E_BAY	59,710,491	11,529	9,682	11,529
CALIF	PG&E_VLY	91,876,375	19,764	13,994	20,641
CALIF	SANDIEGO	26,373,742	4,767	4,479	5,328
CALIF	SOCALIF	154,981,255	25,909	24,714	28,233
		390,696,647	72,482	60,876	76,502
AZNMNV	ARIZONA	104,761,363	22,626	15,193	22,626
AZNMNV	NEVADA	29,345,063	7,276	3,641	7,276
AZNMNV	NEW MEXI	27,245,829	4,730	4,058	4,730
AZNMNV	WAPA L.C	1,590,558	252	249	252
		162,942,813	34,884	23,141	34,884
CANADA	ALBERTA	77,291,024	10,729	11,224	11,224
CANADA	B.C.HYDR	74,158,654	9,418	12,457	12,457
		151,449,678	20,147	23,681	23,681
NWPP	NW_EAST	74,310,418	11,271	12,355	12,355
NWPP	NW_WEST	107,629,258	15,976	17,913	17,913
		181,939,676	27,247	30,268	30,268
RMPP	B HILL	6,588,033	971	954	971
RMPP	BHB	3,694,876	457	505	505
RMPP	BONZ	1,242,519	237	176	237
RMPP	COL E	62,135,752	10,698	9,505	10,698
RMPP	COL W	6,440,916	951	993	993
RMPP	IDAHO	18,631,253	3,857	2,910	3,857
RMPP	IPP	1	-	1	1
RMPP	JB	1	-	1	1
RMPP	KGB	6,826,547	1,425	1,079	1,425
RMPP	LRS	3,996,419	581	567	581
RMPP	MONTANA	10,807,641	1,692	1,701	1,701
RMPP	SIERRA	11,728,356	1,995	1,642	1,995
RMPP	SW WYO	4,553,686	629	540	704
RMPP	UT N	42,173,365	8,013	5,368	8,013
RMPP	UT S	6,057,463	1,189	819	1,189
RMPP	WYO	2,454,944	362	311	410
RMPP	YLW TL	1	1	1	1
		187,331,773	33,058	27,073	33,282

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Western Interconnect 2008 Resources

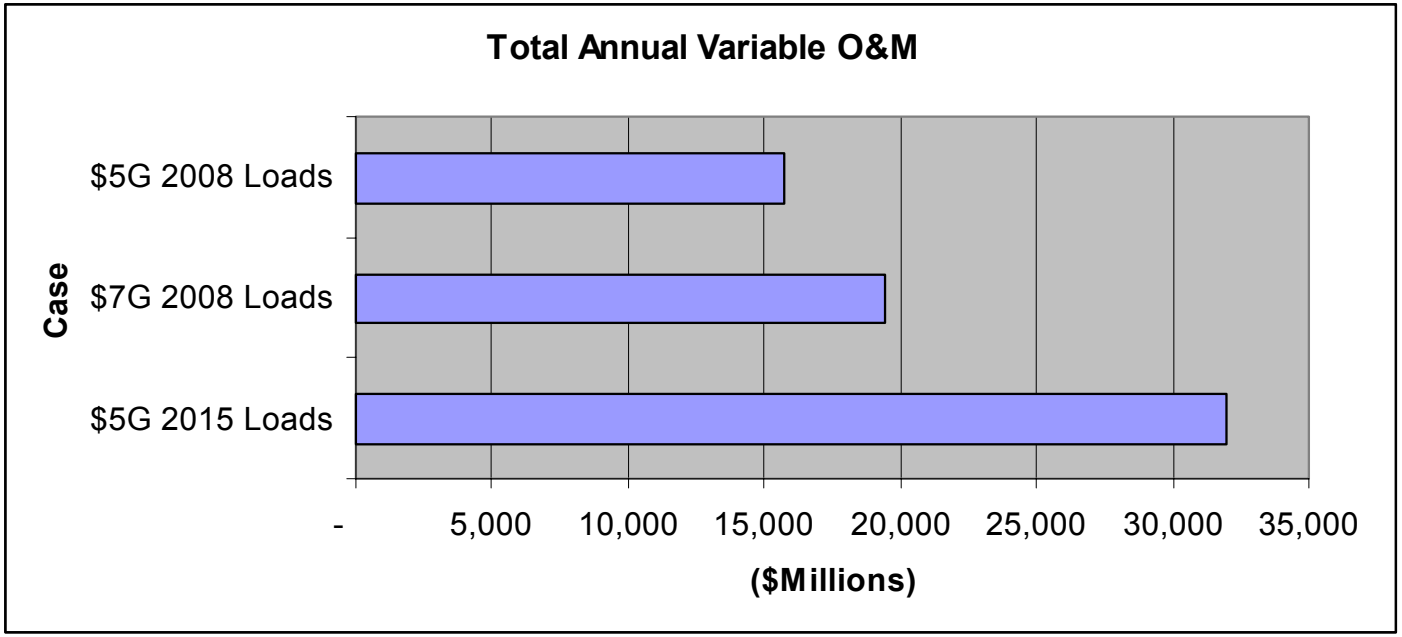
206 MW Total Installed Capacity Net of Station Service

Area Name	Total MW	Bio	Coal	Gas	Geo	Hydro	Nuclear	Oil	Petrol. Coke	Ref	Solar	*** Wind	Wood
IMPERIAL	**1,541**	275		307	692	176		32		55		4	
LADWP	**5,926**			4,899		1,003						24	
MEXICO-C	**3,313**			2,175	699			439					
PG&E_BAY	**6,899**	112	20	5,726				860	80			102	
PG&E_VLY	**23,570**	99	50	11,723	20	8,579	2,190	174	101	64		249	323
SANDIEGO	**4,609**			4,561				48					
SOCALIF	**18,532**	37	108	14,080		1,315	2,150	50	74	33	213	294	178
CALIF Total	**64,390**	522	178	43,470	1,411	11,073	4,340	1,603	255	152	213	673	501
ARIZONA	**23,097**		7,779	10,808		233	4,137	140					
NEVADA	**7,582**		605	6,800				177					
NEW MEXI	**4,280**		2,037	2,161		14		20				48	
WAPA L.C	**5,939**			2,197		3,742							
AZNMNV Total	**40,897**	0	10,421	21,966	0	3,989	4,137	337	0	0	0	48	
ALBERTA	**11,859**	29	5,380	4,904		1,493						21	33
B.C.HYDR	**11,995**			1,639		10,356							
CANADA Total	**23,854**	29	5,380	6,543	0	11,849	0	0	0	0	0	21	33
NW_EAST	**32,920**			3,628		27,639	1,160	24		23		339	107
NW_WEST	**11,113**	37	1,966	3,758		5,067		74		15		18	178
NWPP Total	**44,033**	37	1,966	7,386	0	32,706	1,160	98	0	38	0	356	285
B HILL	**1,020**		522	317		139		42					
BHB	**0**												
BONZ	**468**		468										
COL E	**8,708**		3,517	4,287		744		120				40	
COL W	**2,294**		1,904	104		286							
IDAHO	**2,257**			135		2,088						34	
IPP	**1,847**		1,847										
JB	**2,128**		2,128										
KGB	**272**		15			244						13	
LRS	**1,628**		1,107	300		221							
MONTANA	**3,714**	12	2,511	376		700			65			49	
SIERRA	**1,835**		565	1,206	30							11	23
SW WYO	**181**					160						21	
UT N	**2,458**		929	1,445		84							
UT S	**2,911**		2,274	613	24								
WYO	**775**		775										
YLW TL	**288**					288							
RMPP Total	**32,782**	12	18,562	8,784	54	4,953	0	162	65	0	0	167	23
	205,956	600	36,506	88,148	1,465	64,569	9,637	2,200	320	190	213	1,266	842

*** Wind discounted to 20% of nameplate

Variable O&M doubled with 2015 loads applied to the 2008 system

Western Interconnect



VOM = Fuel+ fixed VOM +Start up Cost

Total Annual VOM by Area

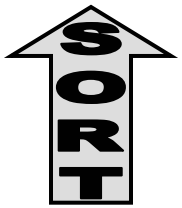
($Millions)

ID	Area	$5G 2008 Loads	$7G 2008 Loads	$5G 2015 Loads
1	NEW MEXI	325	334	684
2	ALBERTA	1,508	1,753	2,777
3	IDAHO	11	13	39
4	MONTANA	220	232	303
5	SIERRA	230	275	471
6	NW_EAST	815	1,106	1,331
7	NW_WEST	1,142	1,461	1,880
8	PG&E_VLY	2,211	2,985	4,423
9	PG&E_BAY	1,261	1,645	2,406
10	B HILL	51	51	94
11	BHB	-	-	-
12	ARIZONA	1,609	1,625	3,407
13	BONZ	45	45	48
14	COL E	612	742	1,306
15	COL W	219	226	256
16	IPP	216	216	232
17	JB	227	227	243
18	KGB	2	2	2
19	LRS	68	68	90
20	SW WYO	-	-	-
21	UT N	295	375	548
22	UT S	352	411	496
23	NEVADA	657	852	1,462
24	WYO	48	48	52
25	WAPA L.C	159	236	590
26	YLW TL	-	-	-
27	MEXICO-C	302	434	816
28	IMPERIAL	110	138	175
29	SANDIEGO	514	665	1,258
30	SOCALIF	1,454	1,934	4,332
31	LADWP	735	989	1,393
32	B.C.HYDR	297	380	820
	Total	15,696	19,471	31,934

Opportunity Costs – 2008 Loads

Savings if capacity on congested paths increase by 1 MW

Interface Name	Forward Limit (MW)	Reverse Limit (MW)	Rank			Congestion Cost (k$) (Shadow Price X Path Flow)		
			$4 Gas	$5 Gas	$7 Gas	$4 Gas	$5 Gas	$7 Gas
IPP DC LINE	1920	-1400	1	1	1	7,476	9,696	12,347
PATH C	775	-850	2	2	2	5,831	6,037	6,086
Navajo - Crystal	1411	-1411	3	3	4	3,992	3,509	4,168
BONANZA WEST	785		4	4	3	2,661	3,158	5,715
CORONADO - SILVER KING - KYRENE	1100		8	5	5	1,364	2,167	3,232
NORTHWEST - CANADA	2000	-2800	7	6	6	1,484	1,955	2,780
ALBERTA - BRITISH COLUMBIA	700	-720	5	7	8	1,949	1,899	2,097
FOUR CORNERS 345_500	840	-840	6	8	7	1,515	1,644	2,379
SOUTHWEST OF FOUR CORNERS	2325		9	9	9	550	835	945
TOT 2C	300	-300	11	10	10	364	595	857
BRIDGER WEST	2100		10	11	11	503	360	645
TOT 1A	650		13	12	13	217	186	201
PACIFICORP_PG&E 115 KV INTERCON.	80	-45	14	13	14	151	152	157
El Centro Bank	215	-215	15	14	15	115	127	157



Opportunity Costs – 2015 Loads

Savings if capacity on congested paths increase by 1 MW

Interface Name	Congestion Cost (k$)	Interface Name	Congestion Cost (k$)
NORTHWEST - CANADA	221,602	NW to Canada East BC	6,325
MONTANA - NORTHWEST	148,455	TOT 4B	6,307
COI	122,719	TOT 2B1	6,258
SOUTHWEST OF FOUR CORNERS	102,852	IPP DC LINE	6,234
PATH C	95,163	FOUR CORNERS 345_500	5,905
BRIDGER WEST	82,468	MIDPOINT - SUMMER LAKE	4,921
CORONADO - SILVER KING - KYRENE	74,722	ALBERTA - BRITISH COLUMBIA	4,875
WOR -n- El Dor to Lugo	71,134	South of Lugo	4,759
PACIFIC DC INTERTIE (PDCI)	70,313	PV West	4,509
Jojoba - Kyrene	68,692	Pinto - 4 Corners PS	4,503
TOT 1A	65,298	TOT 2A	3,850
BONANZA WEST	64,981	TOT 3	3,251
INTERMOUNTAIN - MONA 345 KV	58,812	Mohave - Lugo	3,143
CHOLLA - PINNACLE PEAK	58,548	BORAH WEST	3,010
NORTH OF SAN ONOFRE	47,306	PACIFICORP_PG&E 115 KV INTERCON.	2,818
MIDWAY - LOS BANOS	45,124	Tot 2a 2b 2c Nomogram	2,572
NORTHERN NEW MEXICO (NM2)	33,061	El Centro Bank	2,556
WOR	25,429	Path 26	2,535
Navajo - Crystal	23,249	HA-Red Butte PS	2,159
SOUTHERN NEW MEXICO (NM1)	20,026	TOT 2B	1,449
MARKETPLACE - ADELANTO	15,419	INTERMOUNTAIN - GONDER 230 KV	969
TOT 2C	13,653	TOT 4A	929
IDAHO - NORTHWEST	10,974	PG&E - SPP	872
IID - SCE	10,439	Peacock - Mead	851
IDAHO - SIERRA	10,326	WEST OF BROADVIEW	844
PV to Devers	9,752	WOR - IID230	709
WOR -n- Mc-Vic	8,148	ALTURAS PROJECT	161
Path 45	7,325	Imperial Valley - La Rosita	141
BROWNLEE EAST	7,166	Crystal - H Allen230 kV PS	130
		LUGO - VICTORVILLE 500 KV LINE	124

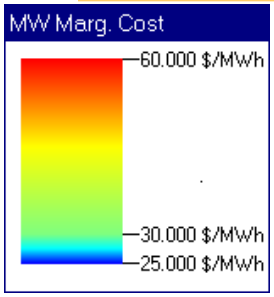
Transmission Congestion via Locational Marginal Prices (LMPs)

Seams Steering Group of the Western Interconnection

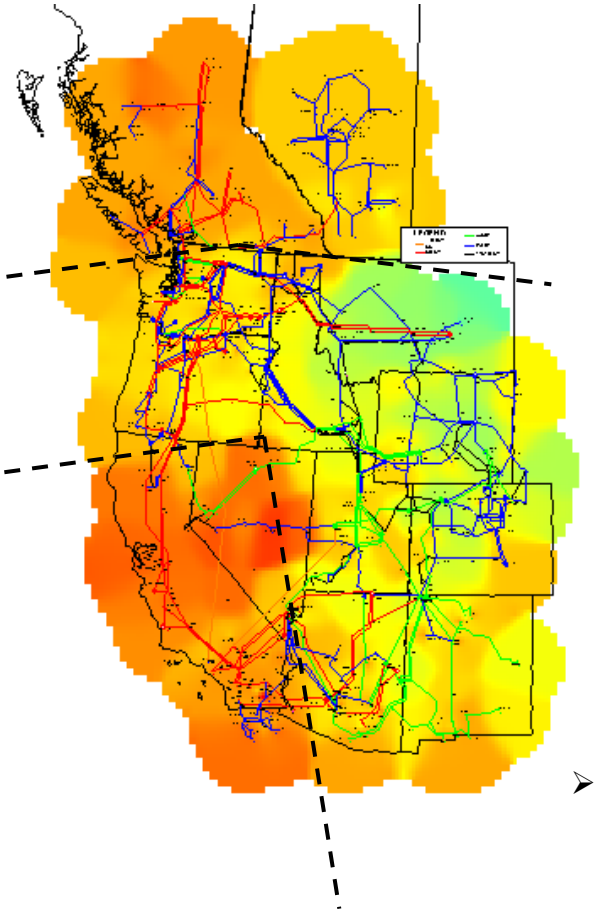
Congestion Prices

Average for January 24, 2008

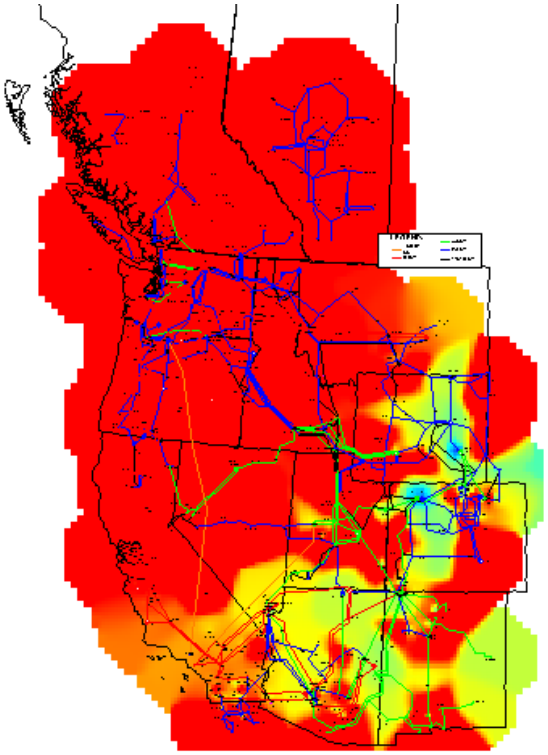
$5 Gas



2008



2015

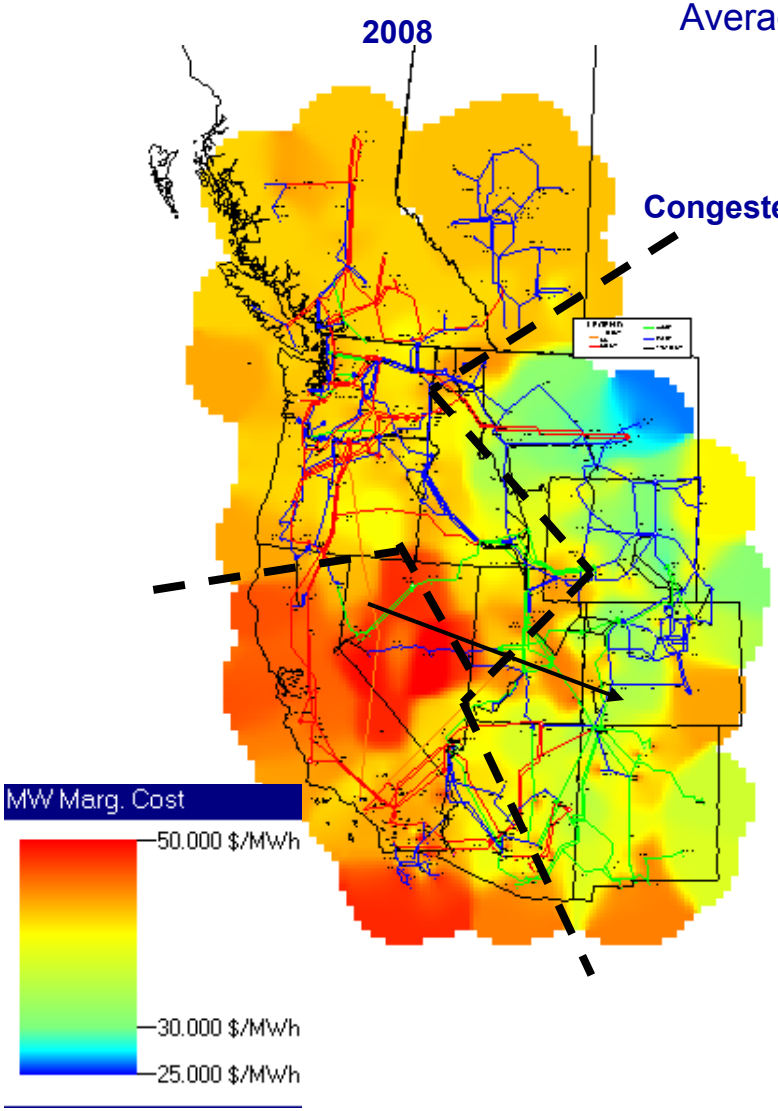


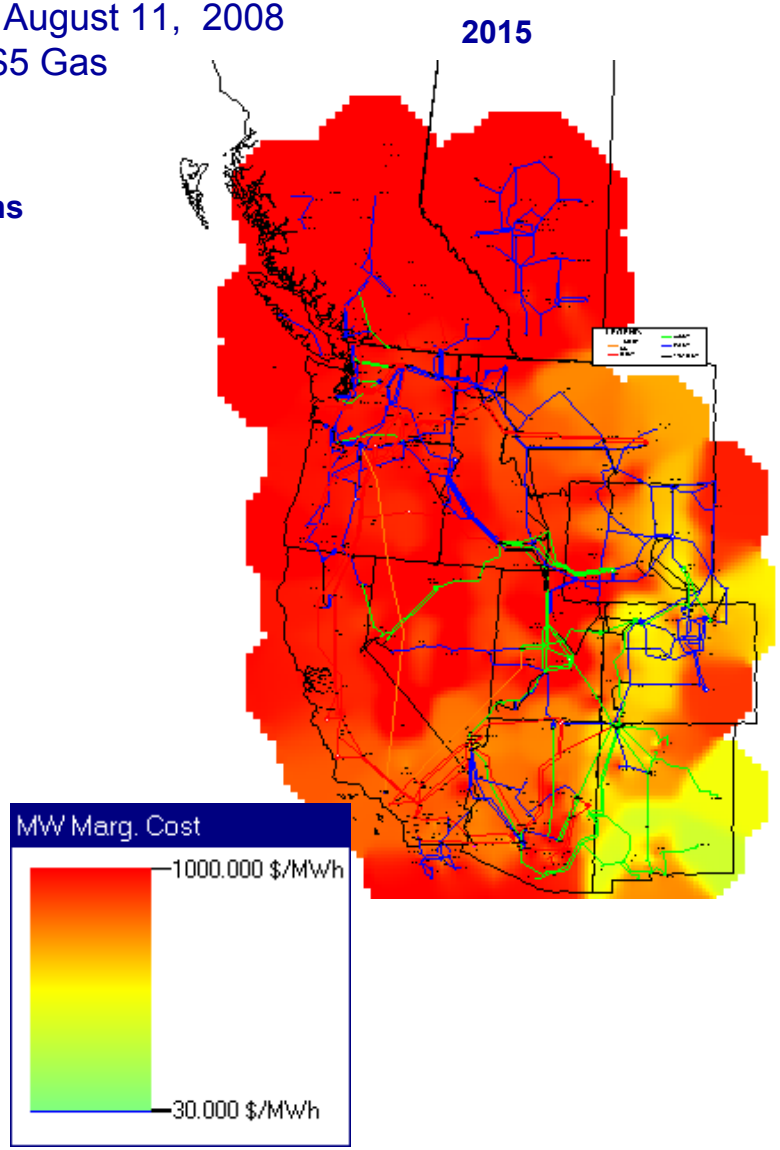
Congested paths

- Contour maps can help identify transmission expansion
- Difference in colors indicate congestion
- Congestion can be caused by transmission constraints and by transmission losses
- A typical Winter and Summer day were chosen.

Congestion Prices

Average for August 11, 2008
$5 Gas





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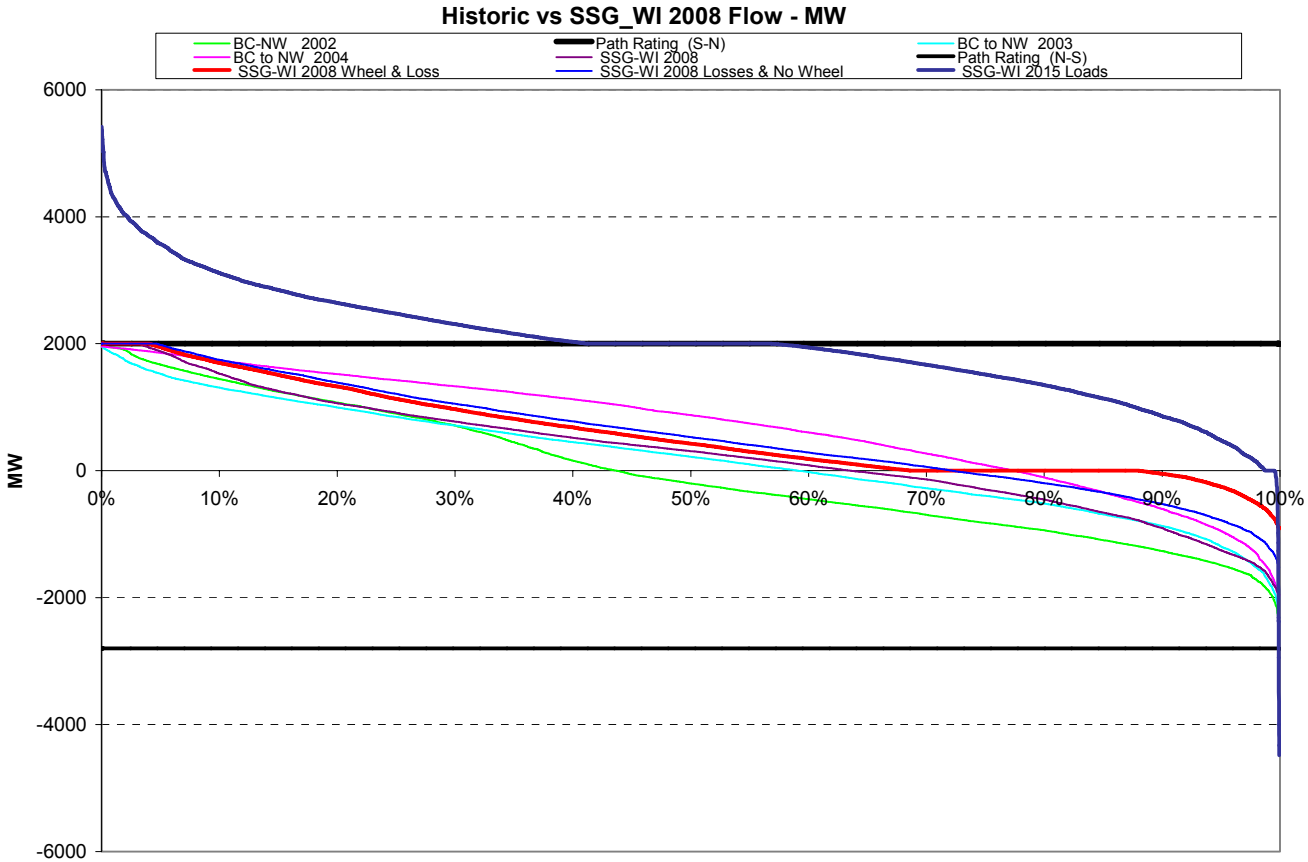
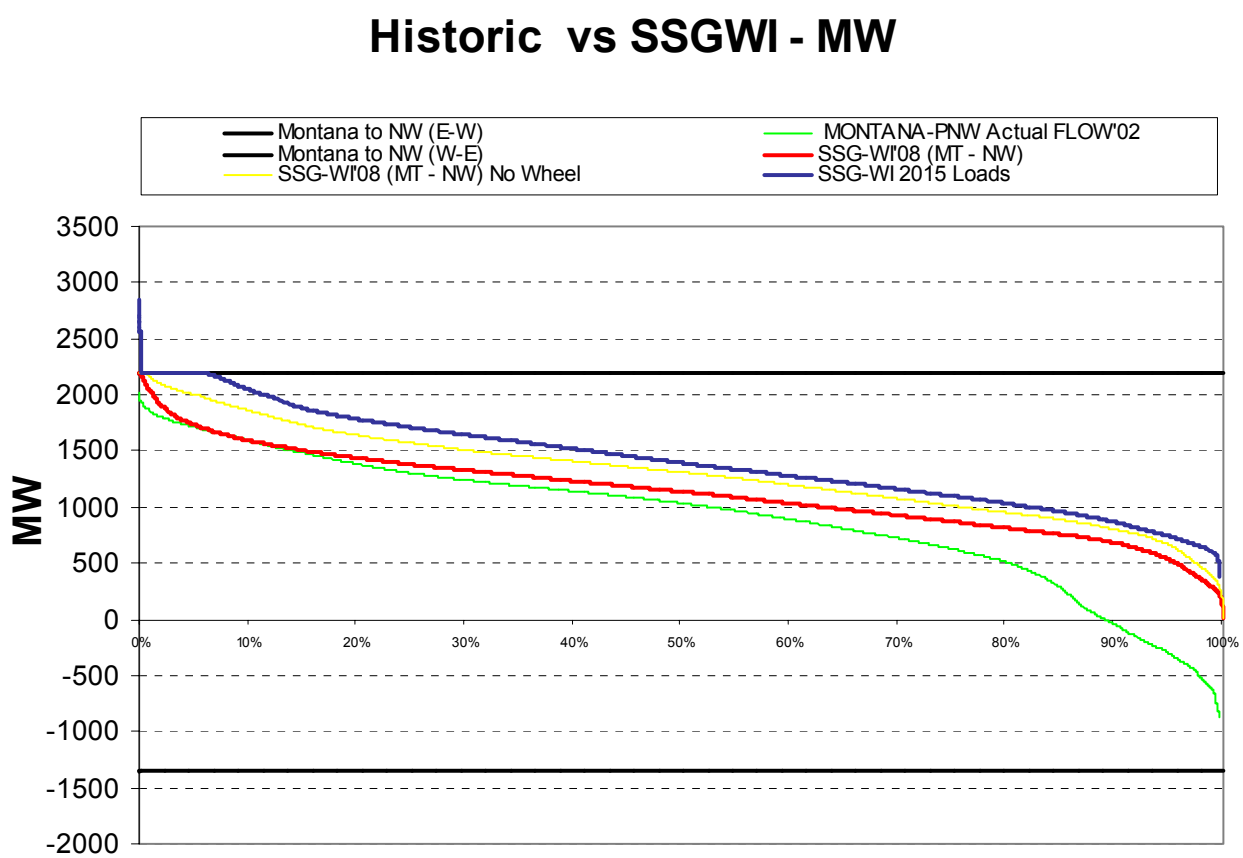
Benchmarking

Seams Steering Group of the Western Interconnection

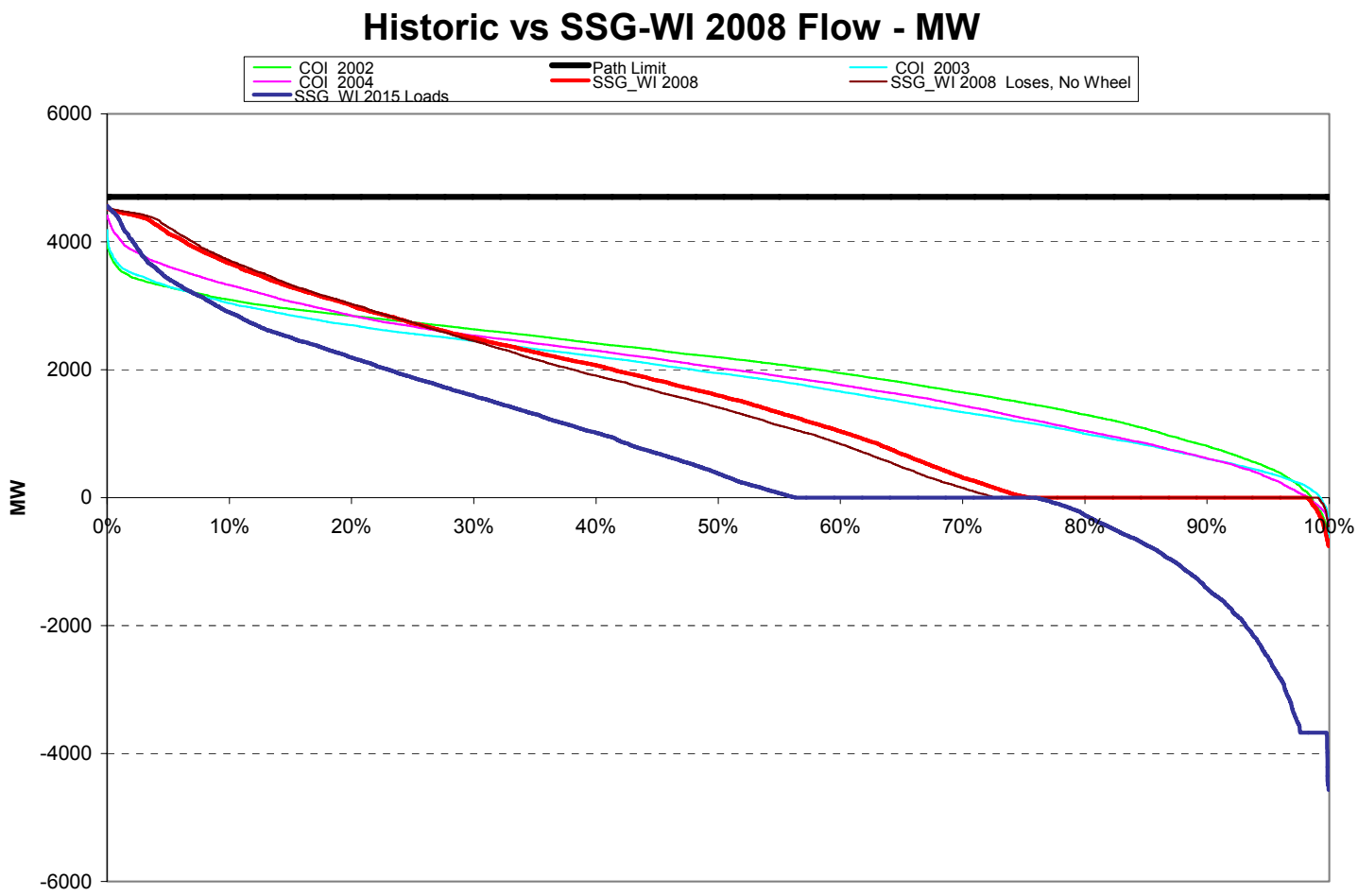
Canada to Northwest



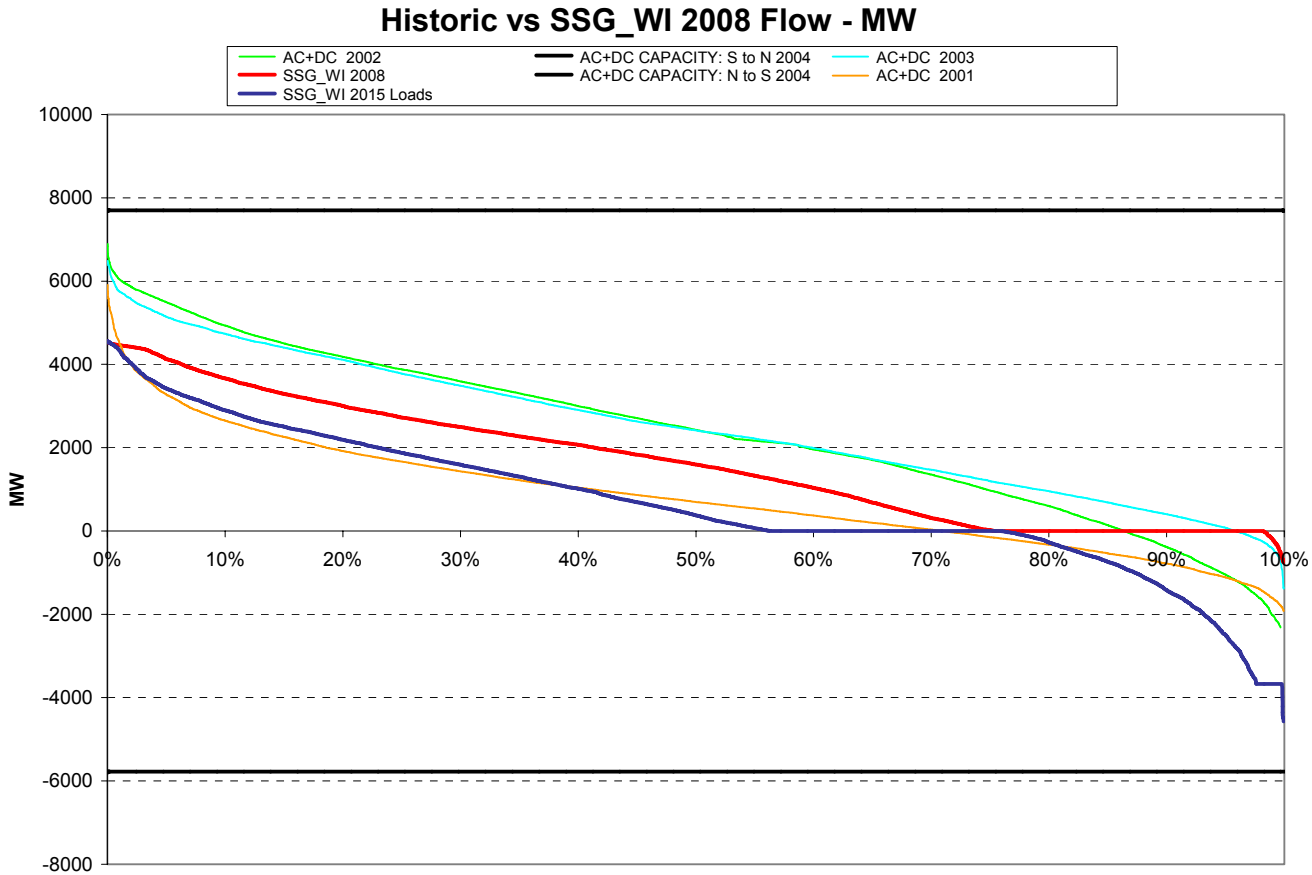
Montana to PNW Duration Curve



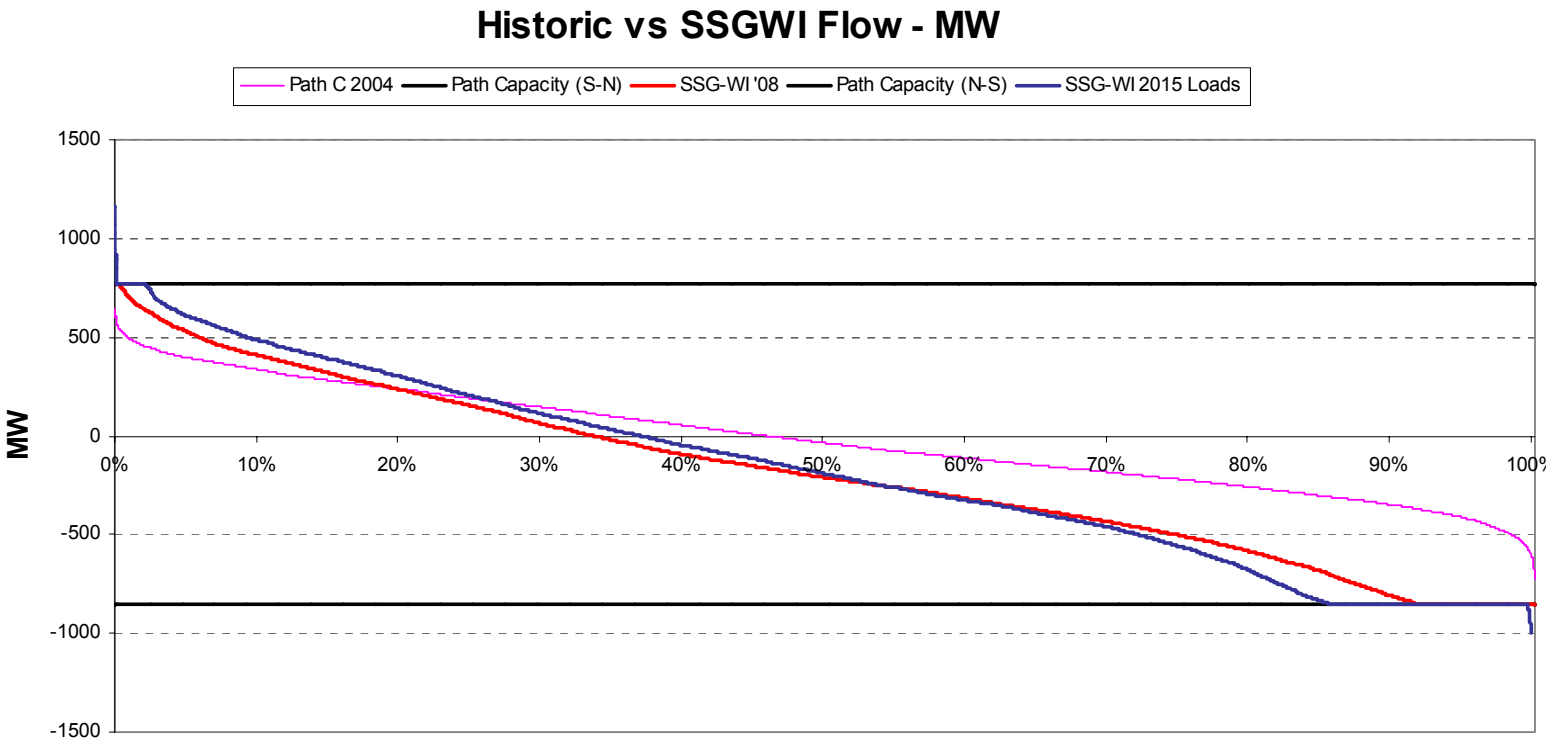
COI


Historic vs SSG-WI 2008 Flow - MW
COI 2002
COI 2004
SSG_WI 2015 Loads
Path Limit
SSG_WI 2008
COI 2003
SSG_WI 2008 Loses, No Wheel
MW
6000
4000
2000
0
-2000
-4000
-6000
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

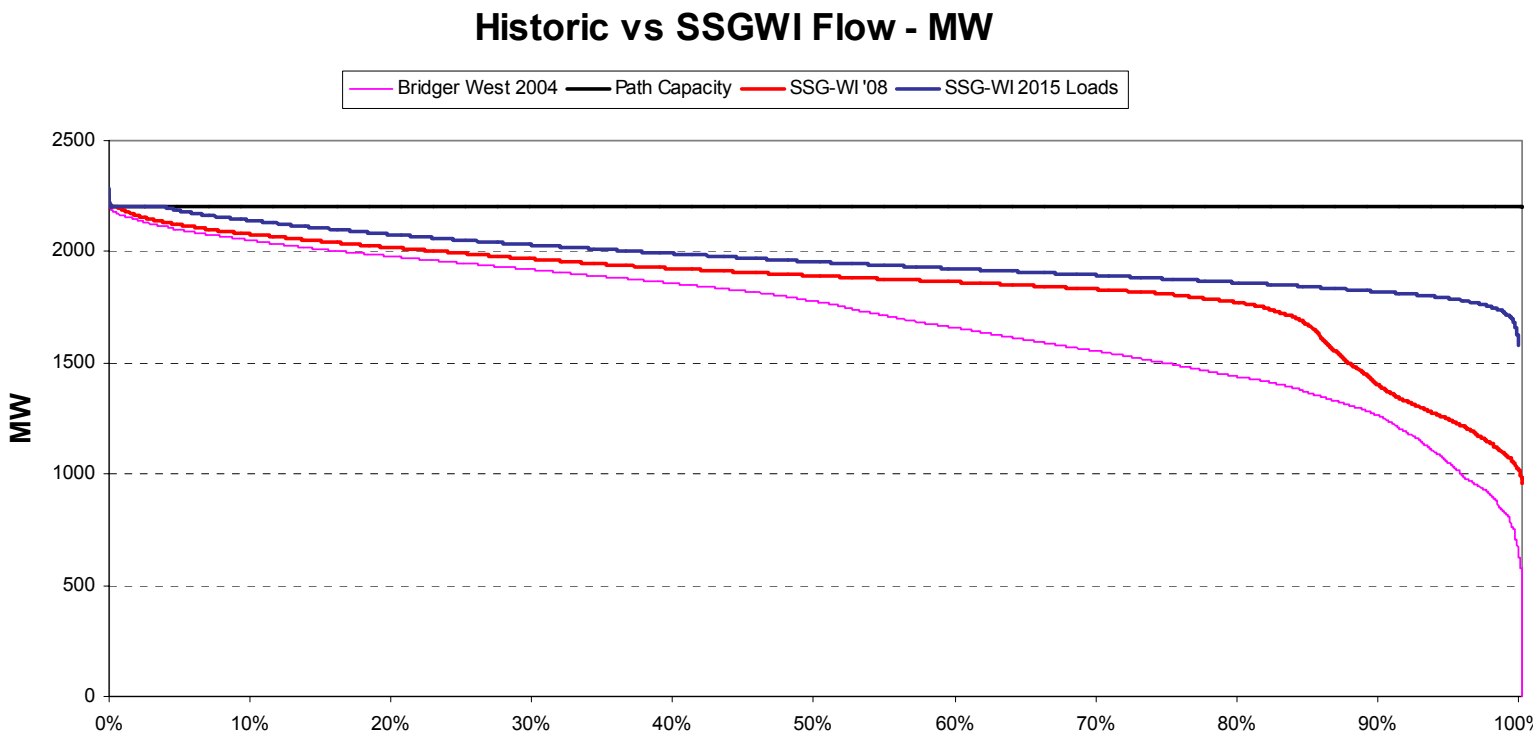
COI + PDCI Duration Curve



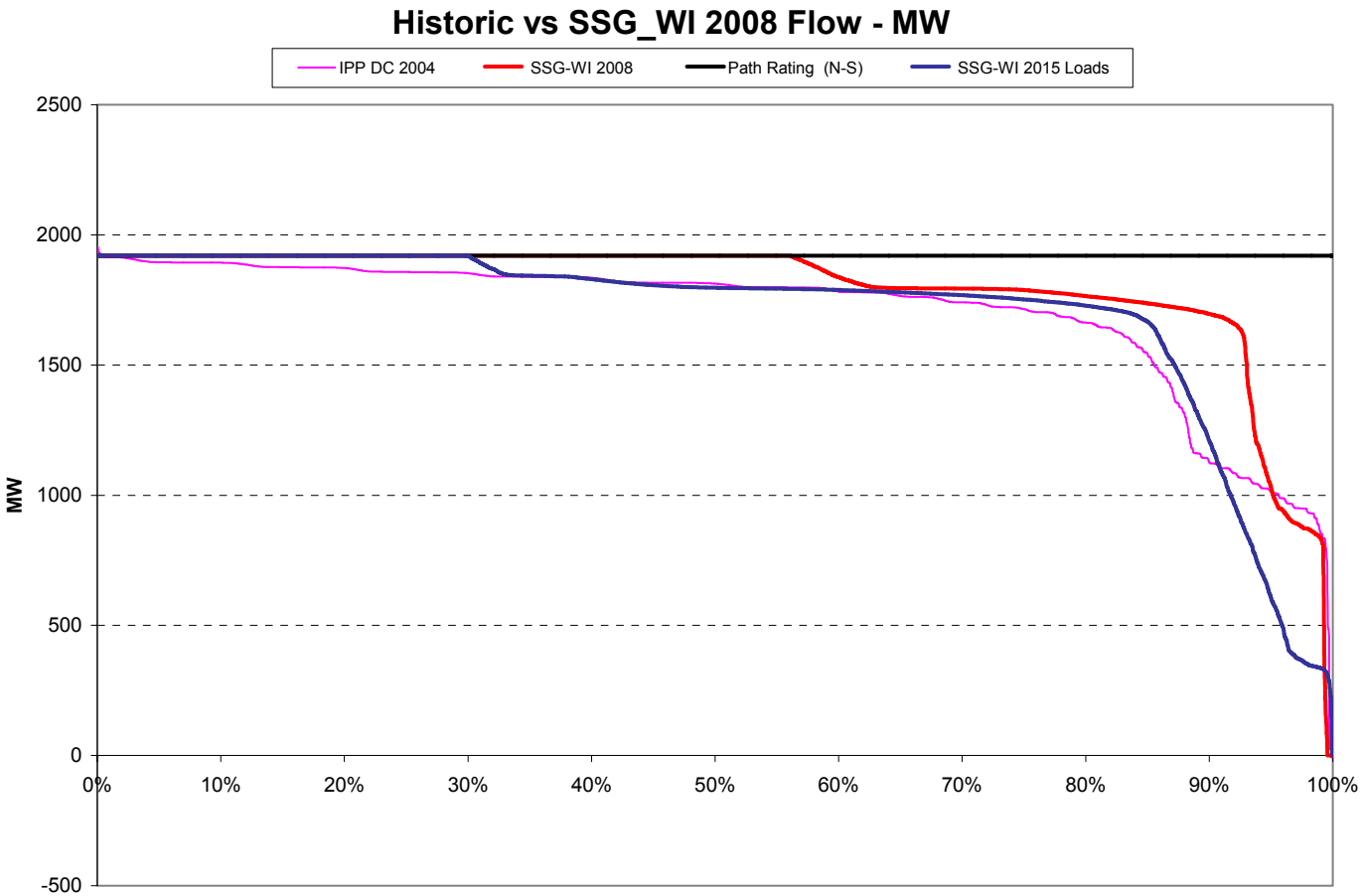
Path C


Historic vs SSGWI Flow - MW
Path C 2004
Path Capacity (S-N)
SSG-WI '08
Path Capacity (N-S)
SSG-WI 2015 Loads
MW
1500
1000
500
0
-500
-1000
-1500
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

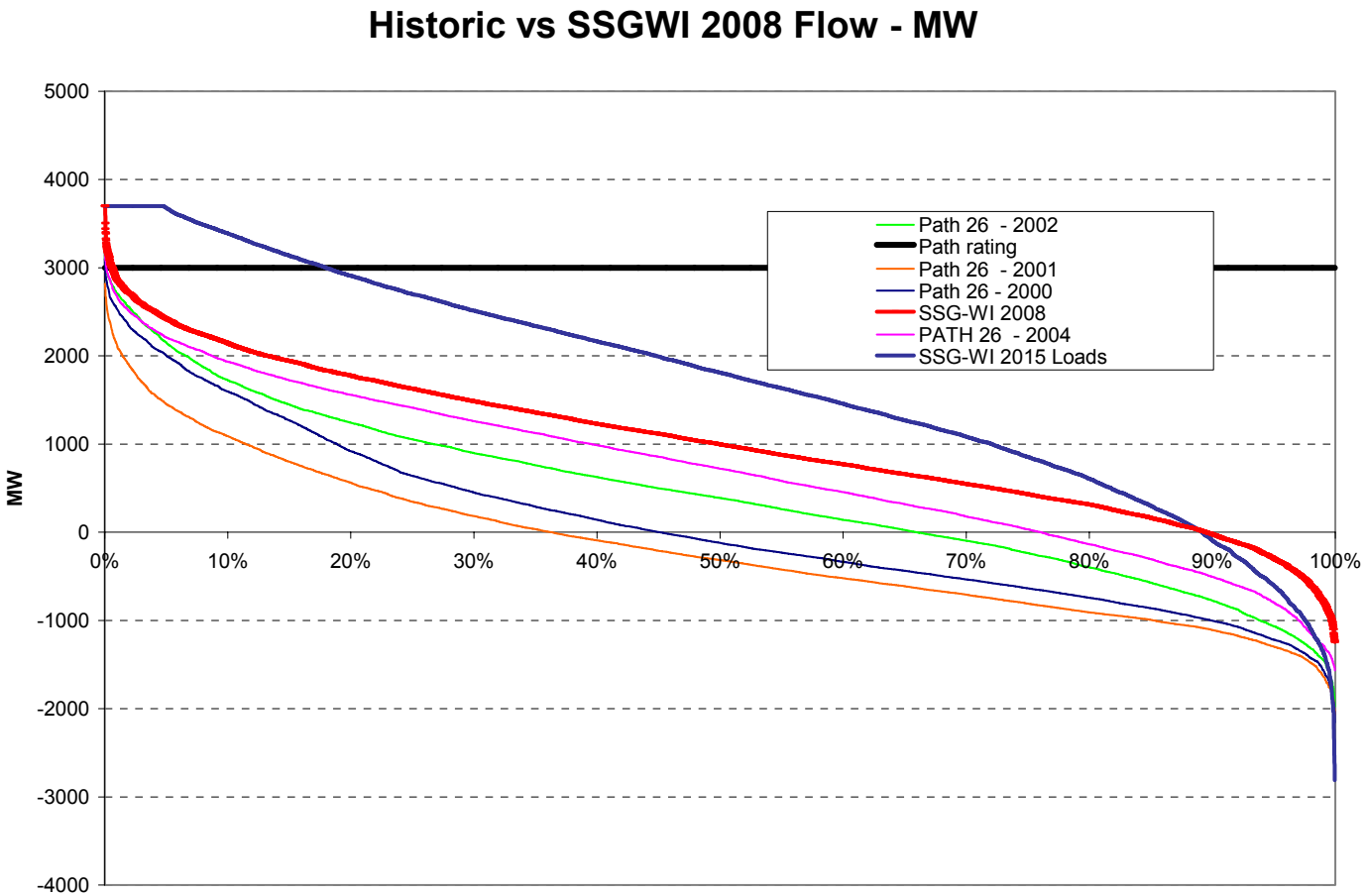
Bridger West



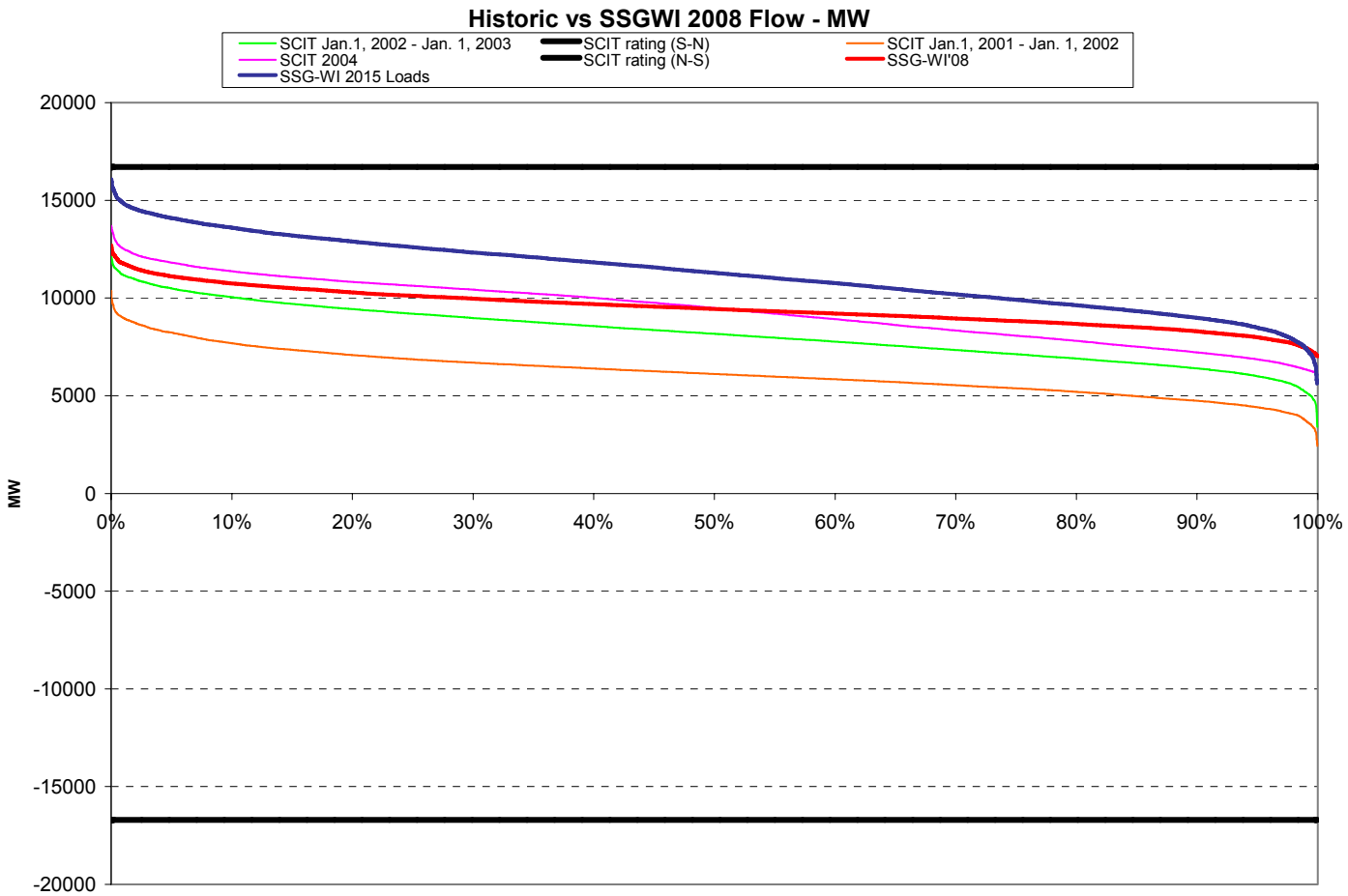
IPP DC


Historic vs SSG_WI 2008 Flow - MW
IPP DC 2004
SSG-WI 2008
Path Rating (N-S)
SSG-WI 2015 Loads
MW
2500
2000
1500
1000
500
0
-500
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

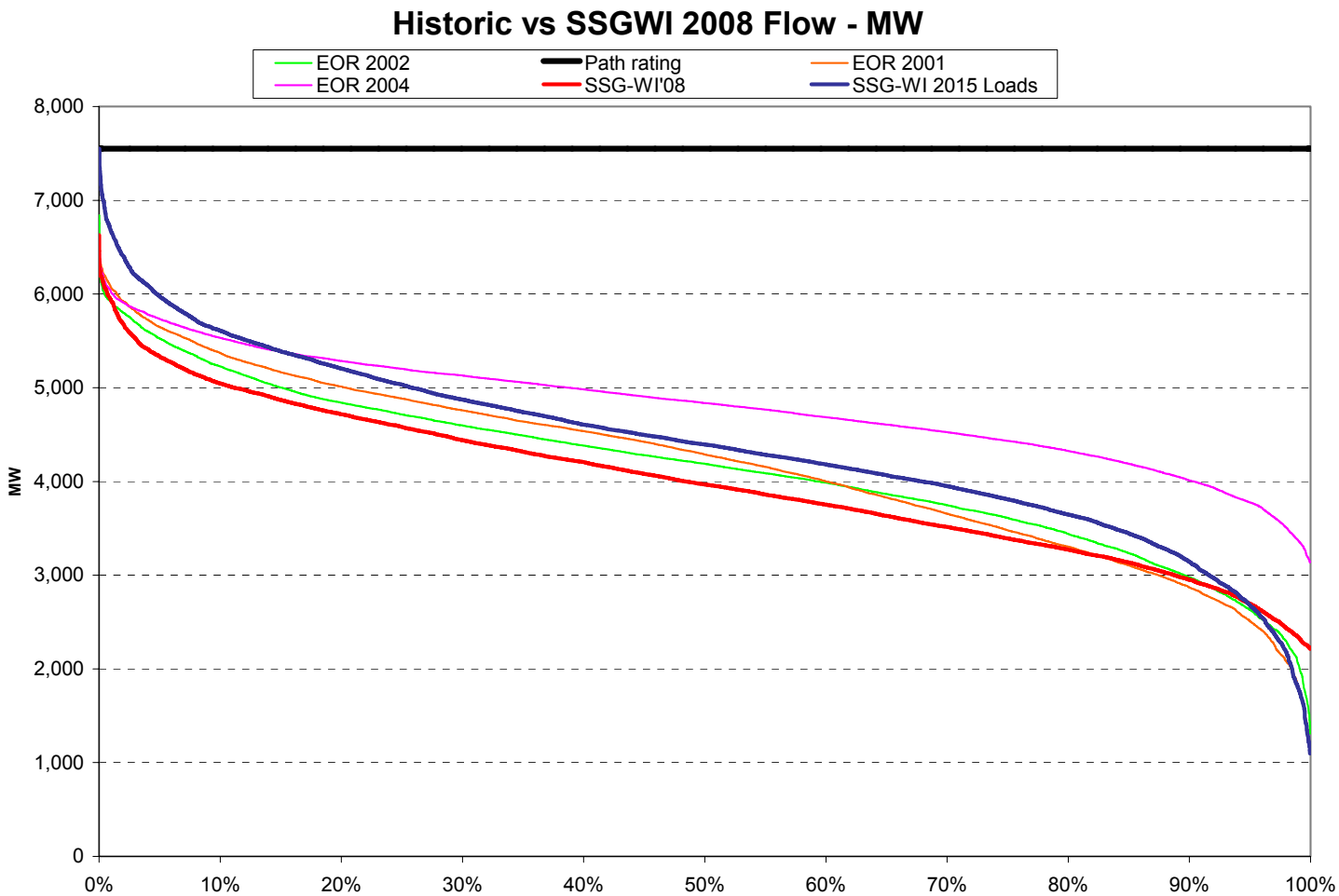
Path 26 Duration Curve



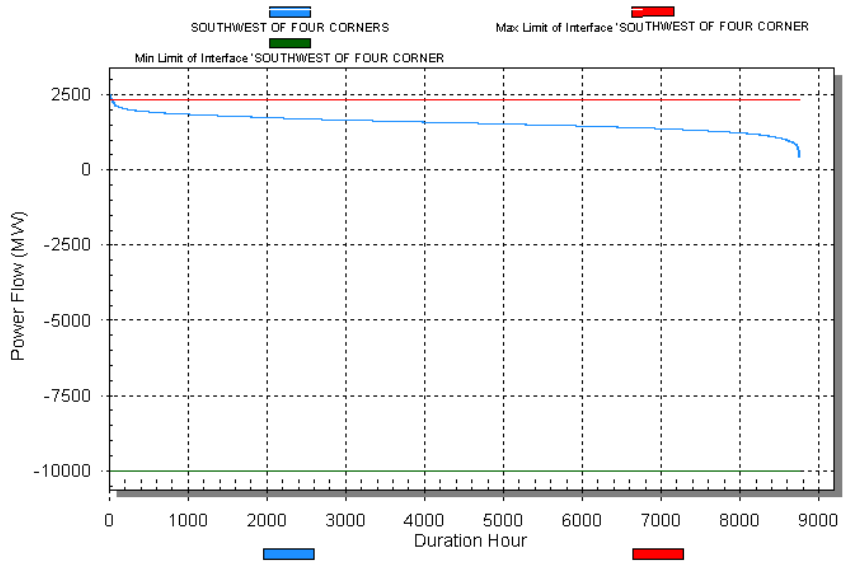
SCIT Duration Curve

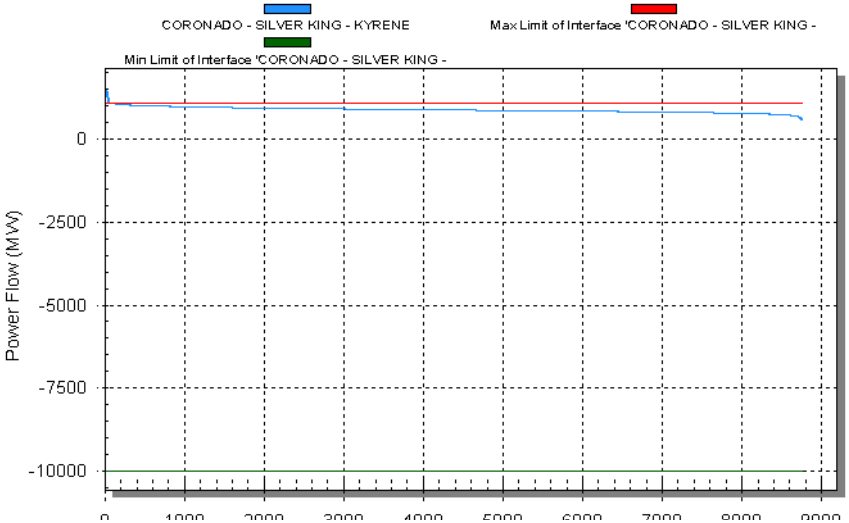


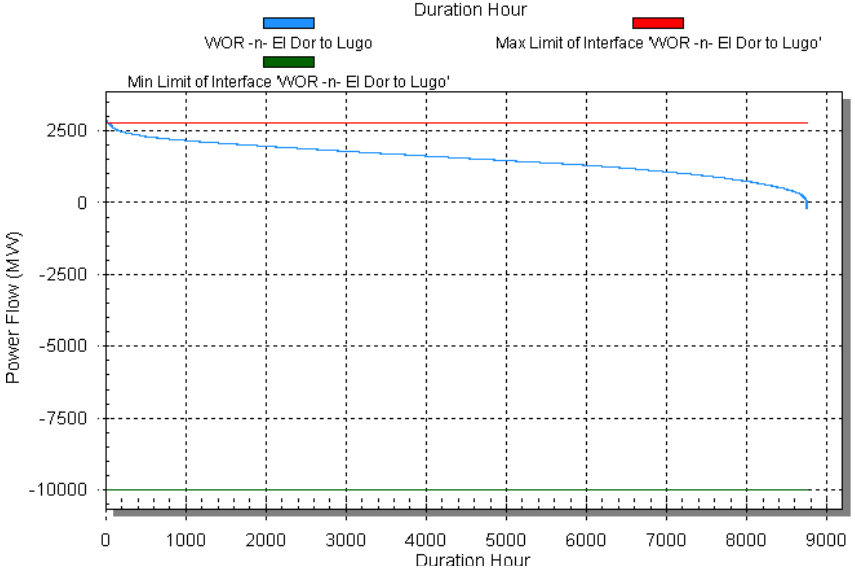
East of the River Duration Curve

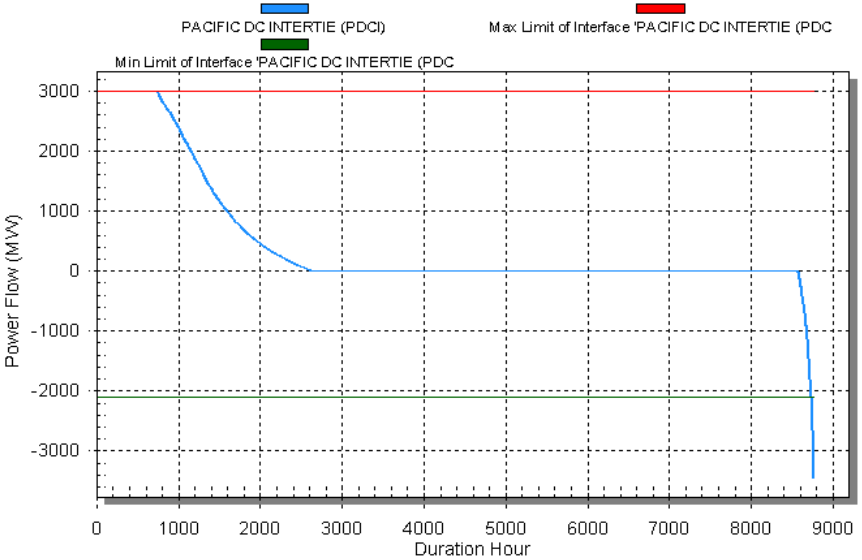


Congested Paths



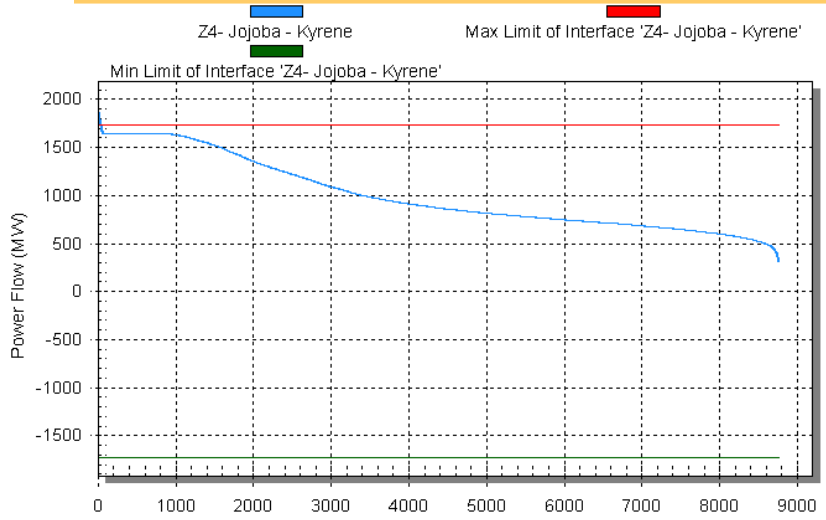


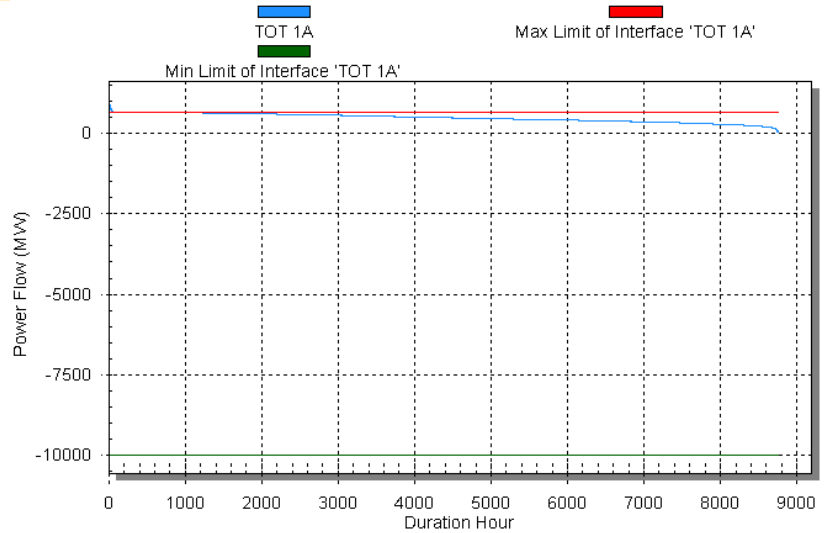


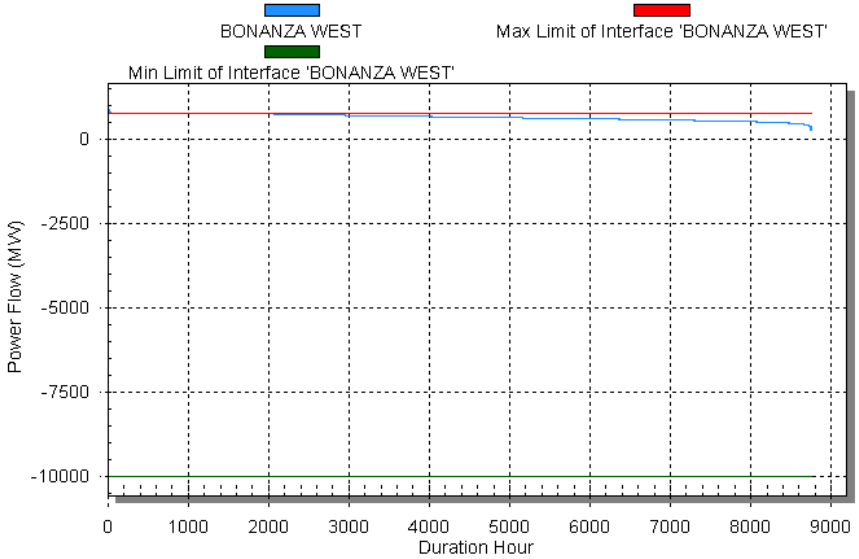


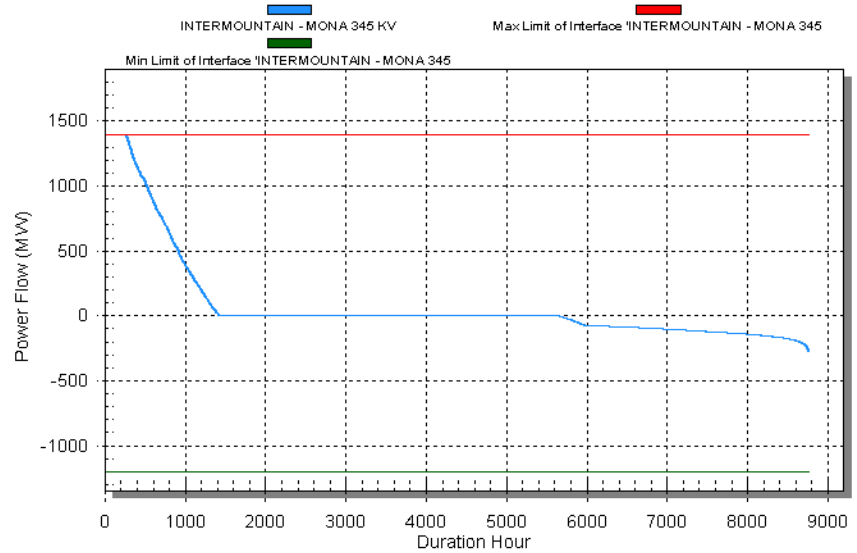
2015 "Do Nothing Case"

Congested Paths









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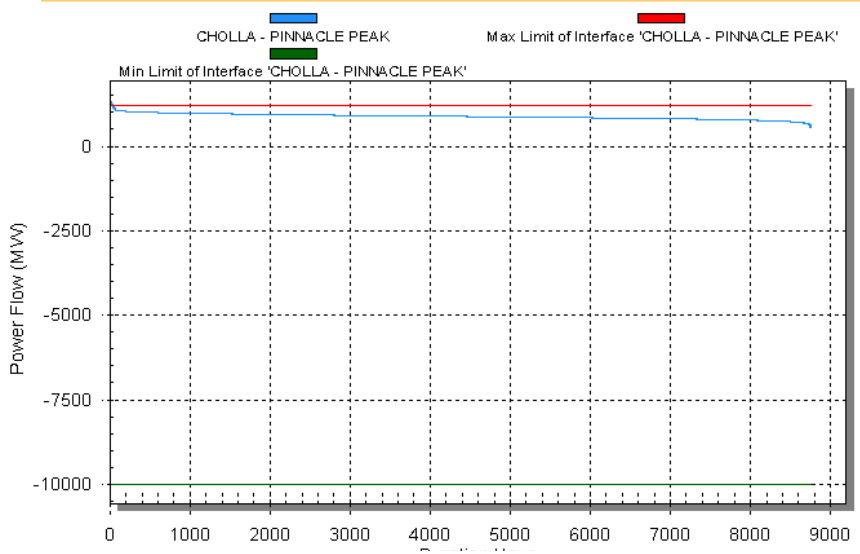
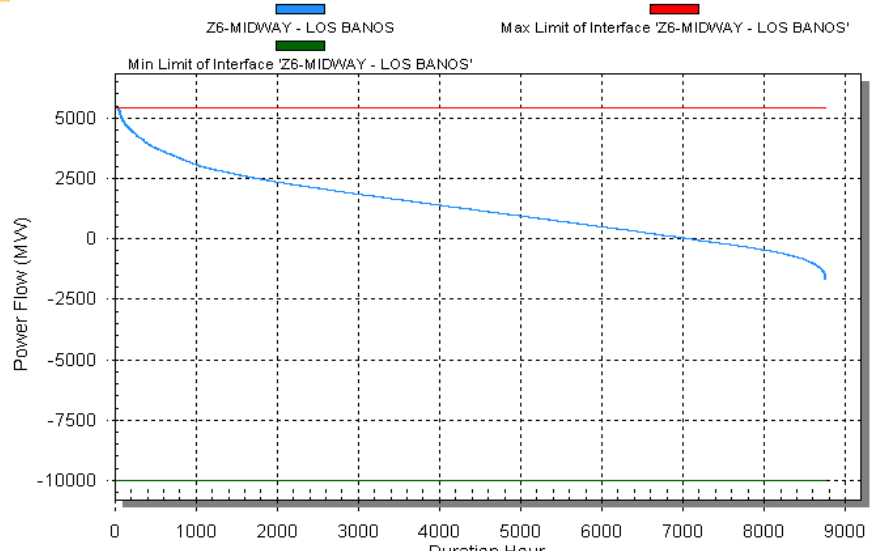
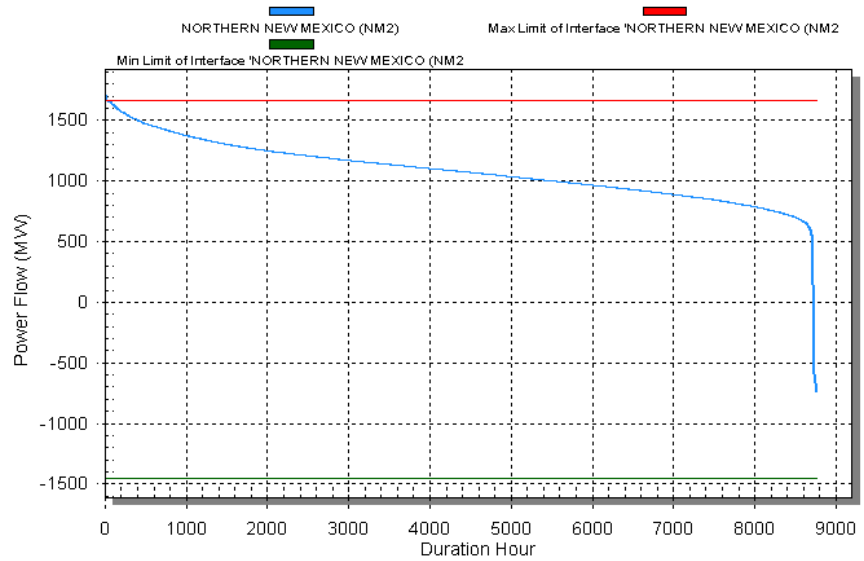
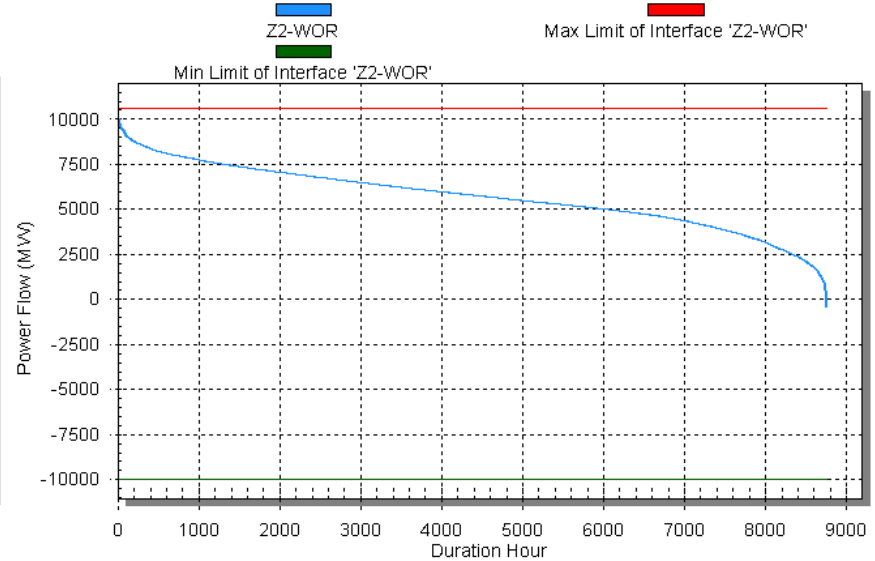
Congested Paths

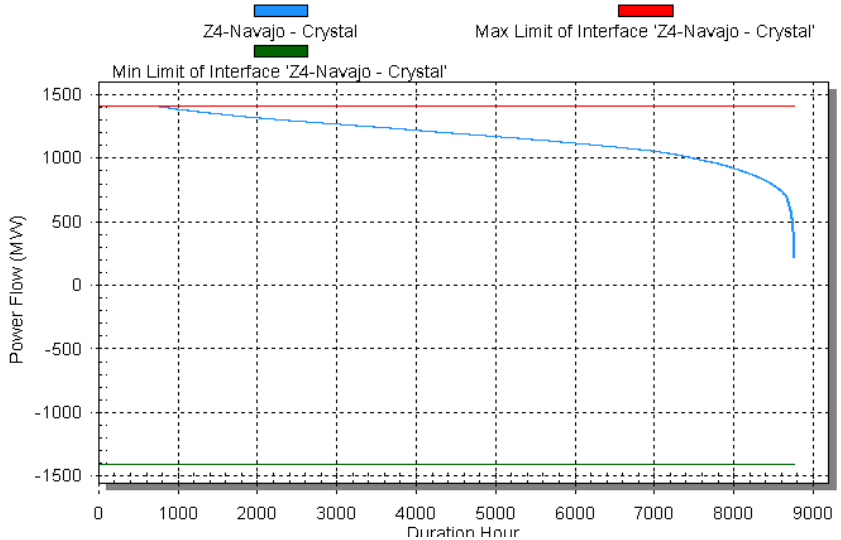
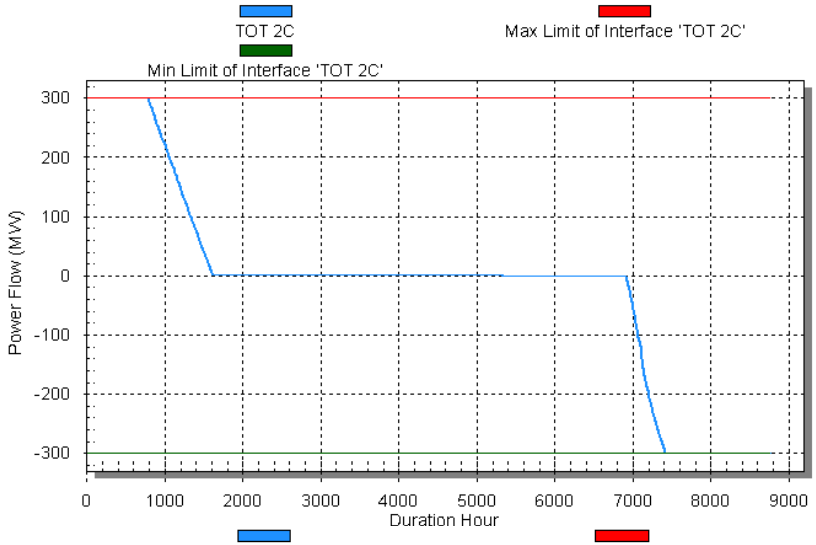
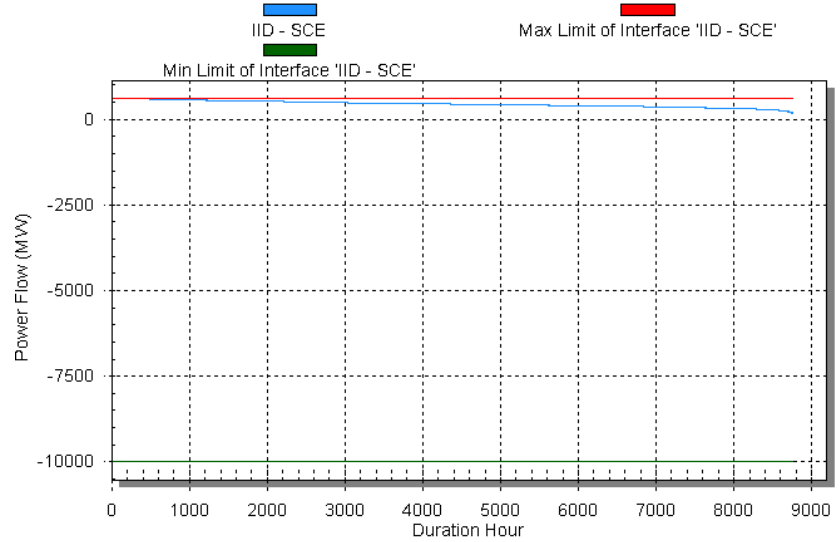
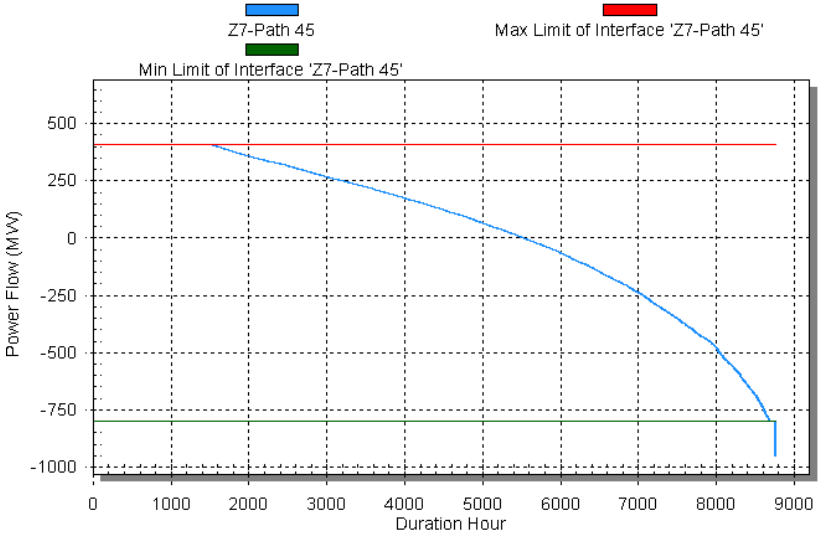








2015 "Do Nothing Case"

September 14, 2005

Congested Paths