Competitive Path Assessment

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Market Surveillance Committee Meeting
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Overview

- Review of local market power mitigation in 2009

- Spring 2010 CPA study

  - Determining candidate paths

  - Scenario/model development

 - Review of results

  - Potential changes

Background

- DMM required to perform CPA on seasonal basis starting in second year of new market design

    - April 1, 2010 → Q2 2010 designations (April – June)

    - Only constraints with 500 hours of "managed congestion" in previous 12 months are "candidate paths" under tariff.

- FERC expressed concern that 3 pivotal supplier test in CPA may be overly stringent, and directed MSC to examine "whether an alternative competitive screen to identify market power opportunities for generation in load pockets should be considered" within first 12 months of new market design, and report findings in one of the ISO's quarterly reports (Sept 21, 2006 Order, PP 1032)
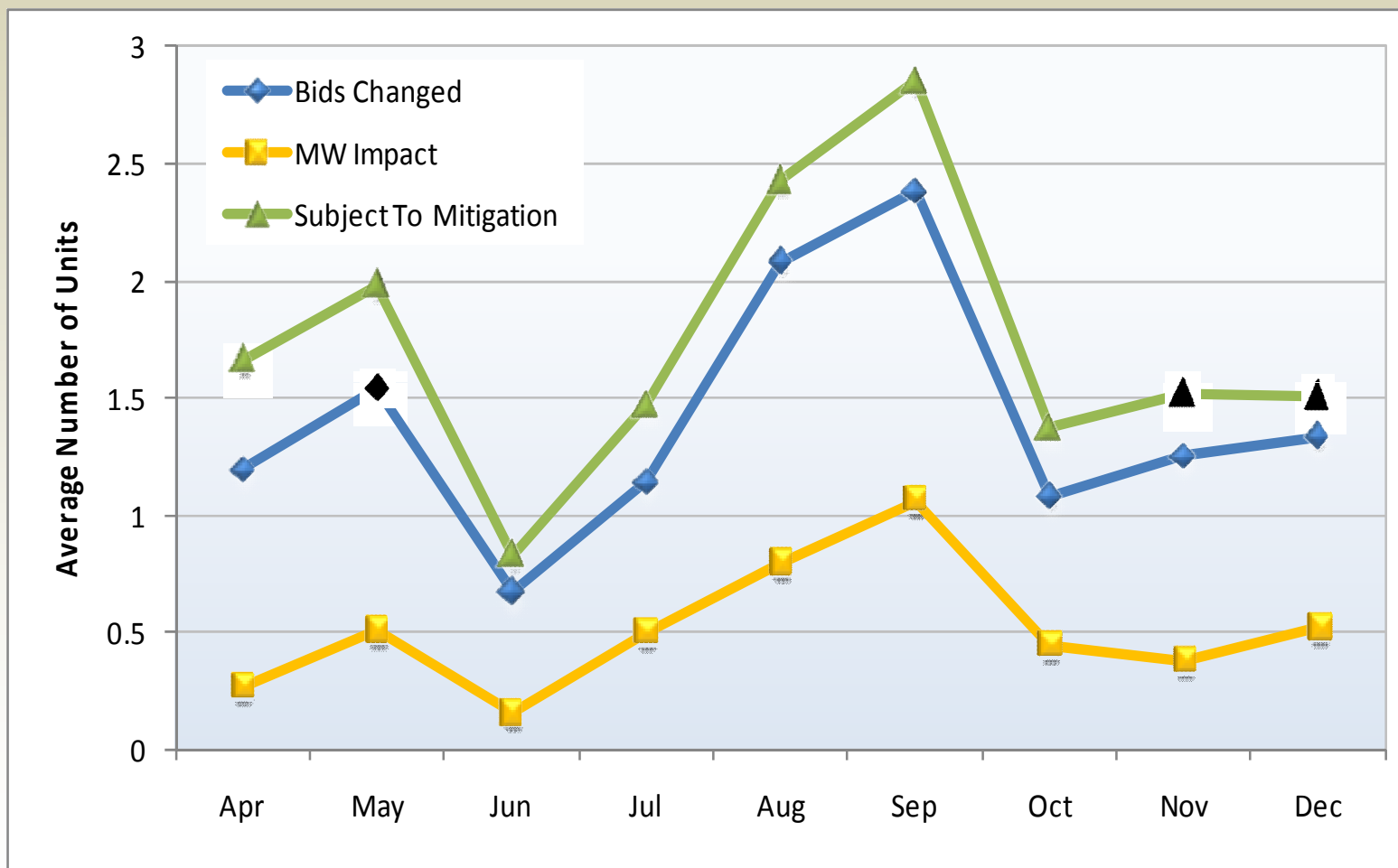
Measuring the frequency and impact of mitigation.
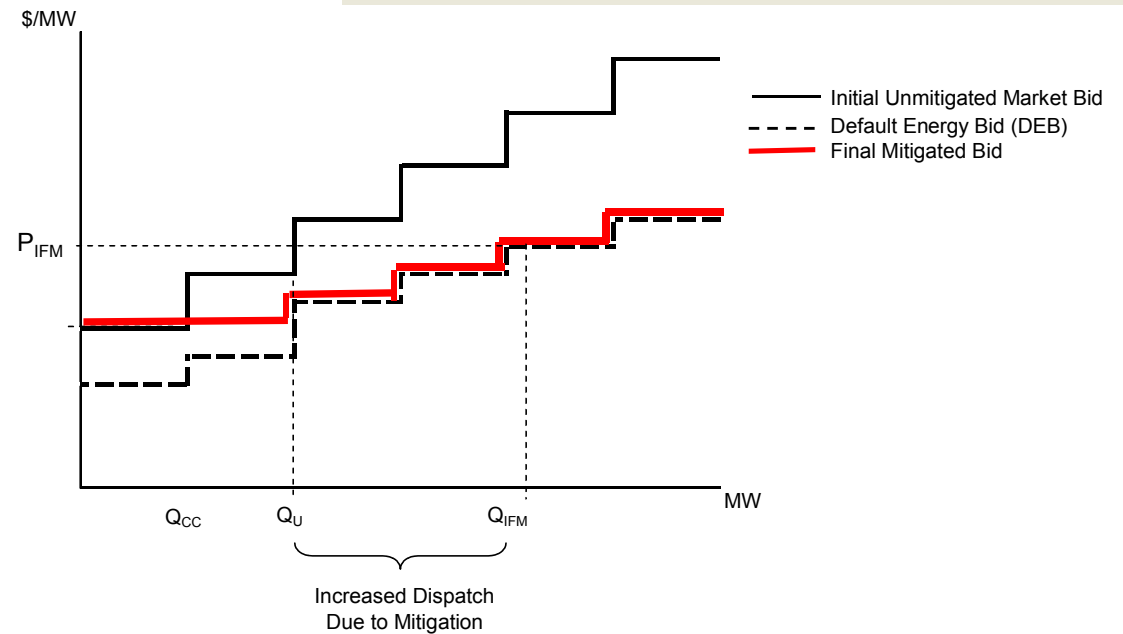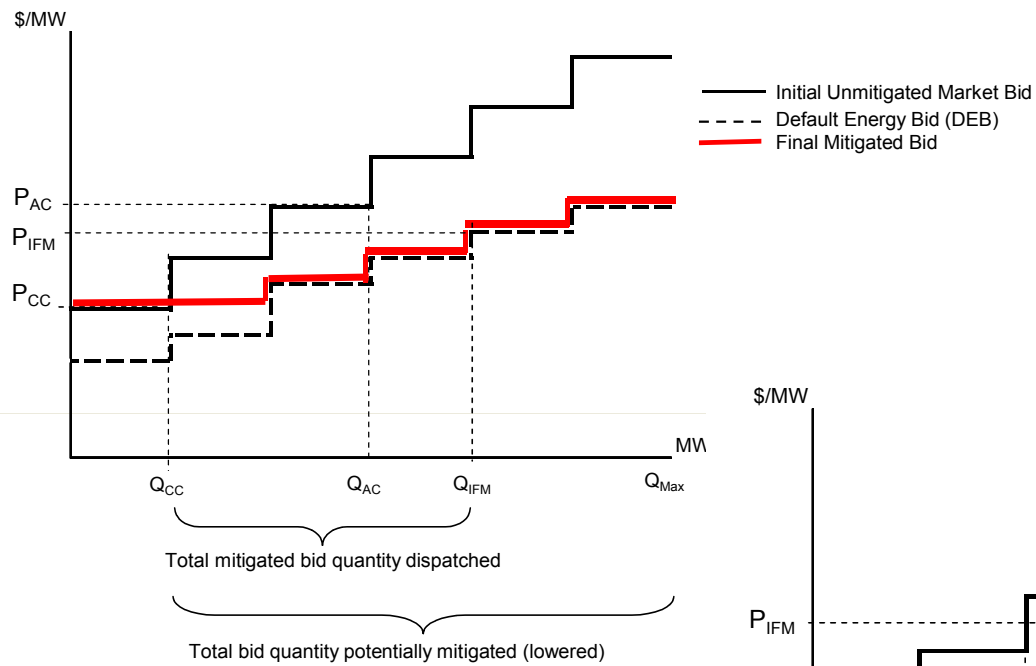
Percent of hours at least one unit was mitigated.
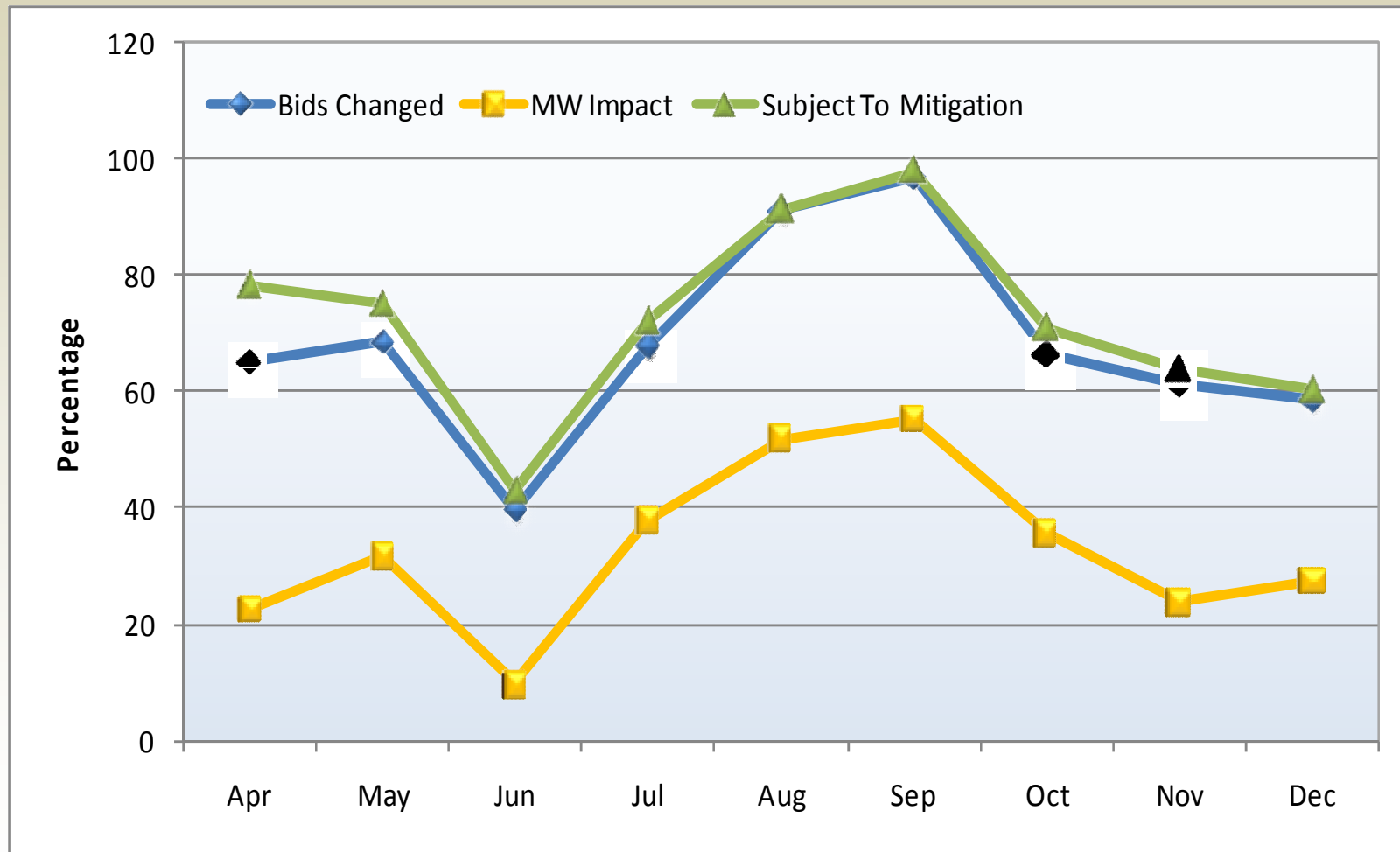
Average number of units mitigated per hour.

Average additional MWs clearing from mitigated units due to mitigation.
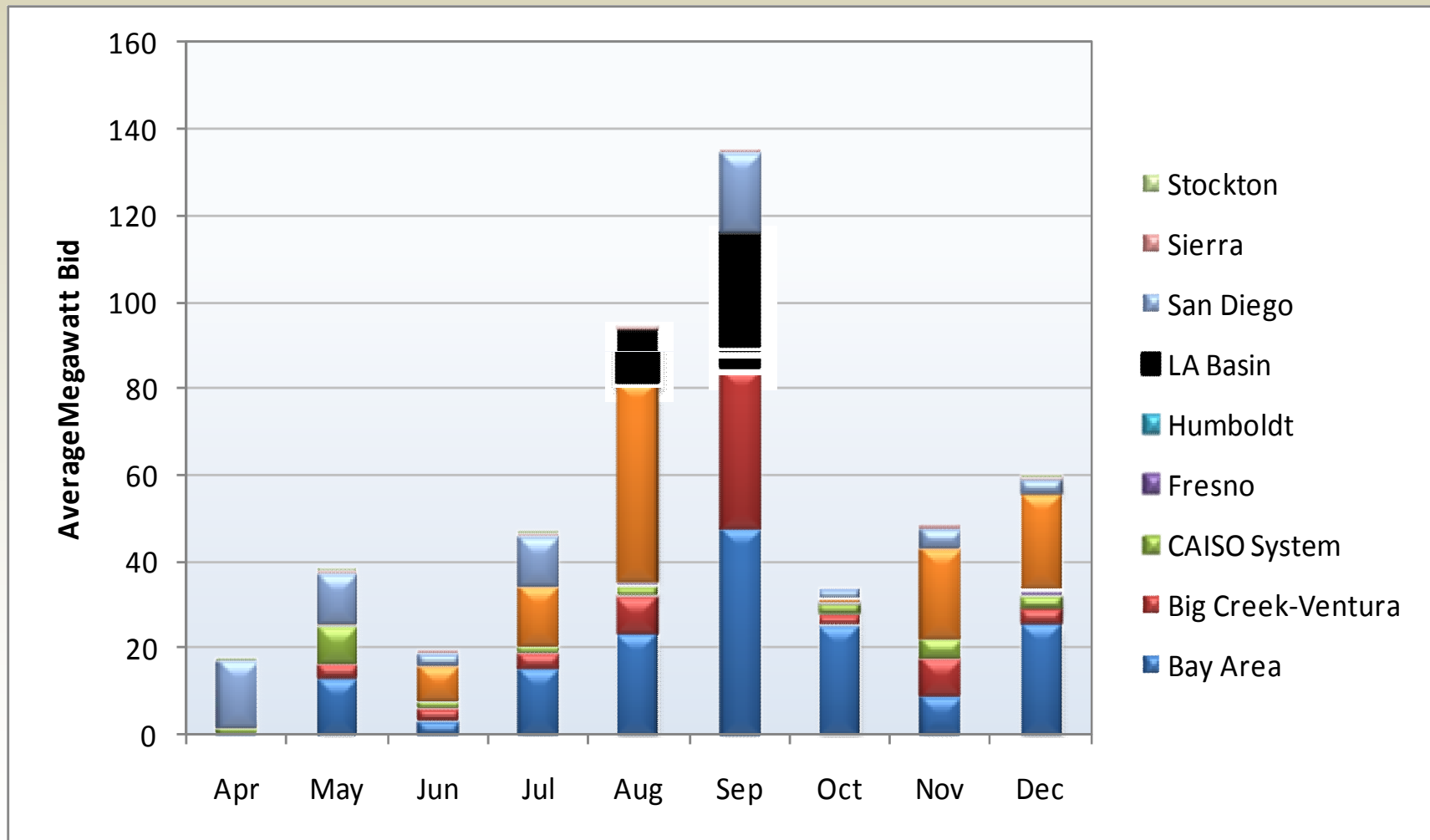
Average additional MWs clearing from mitigated units due to mitigation.
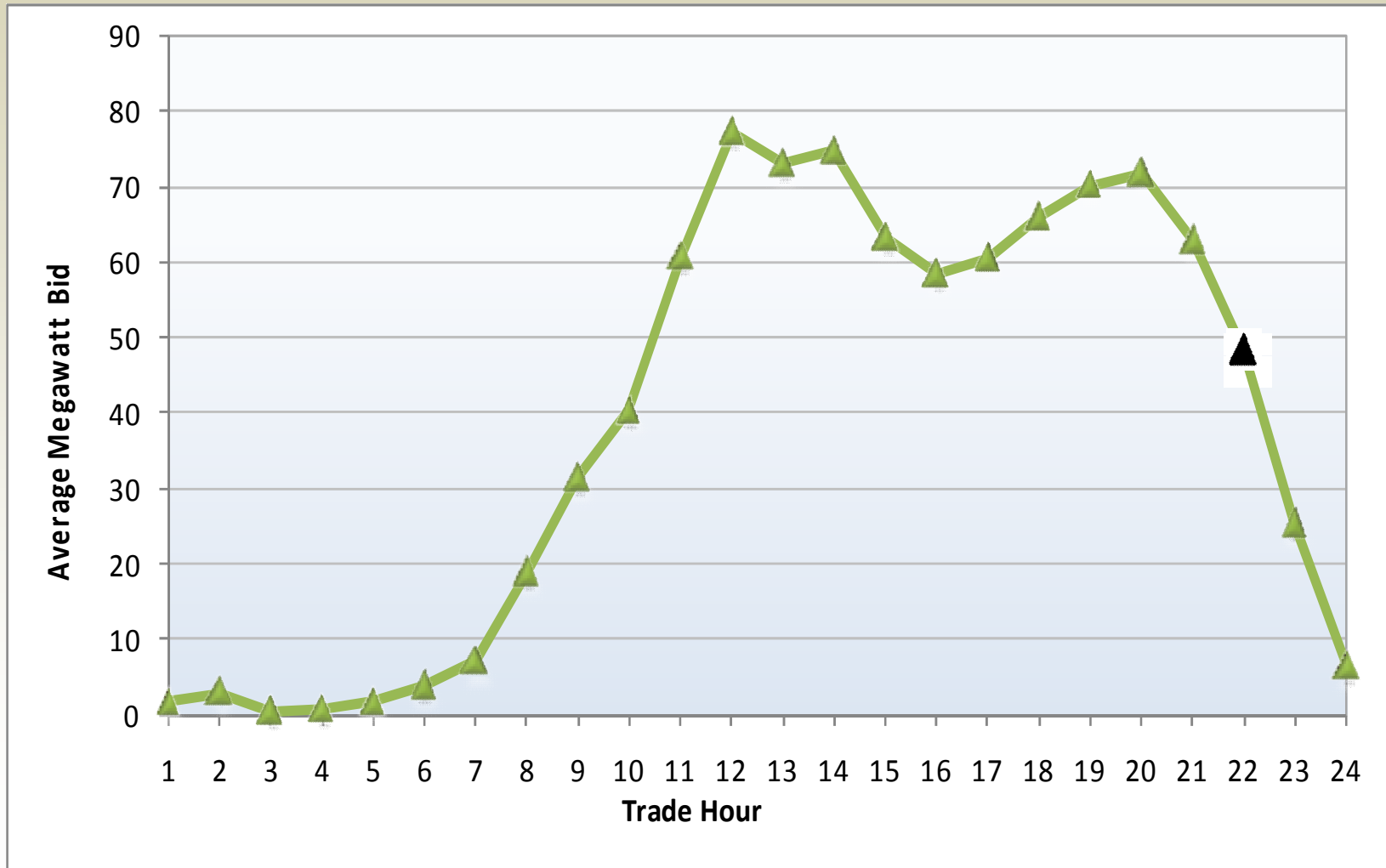
39.7.2.3 Candidate Path Identification.

- The set of candidate constraints that will be evaluated for competitiveness in the initial assessment will be limited to intra-zonal constraints for zones that existed prior to the effective date of this provision, that were managed for Congestion in Real-Time in greater than five hundred (500) hours in the most recent twelve (12)-month period.

- The Congestion frequency threshold of five-hundred (500) hours for designation of competitive constraint candidates will be based on the combination of real-time intra-zonal congestion hours that pre-dated the effective date of this provision, and congestion in IFM and Real-Time markets after the effective date of this provision for the twelve (12) months of historical data.

Screening Candidate Paths

- Pre-MRTU (Q1 2009)
  - RMR and OOS/OOM

- Post MRTU (Q2-Q4 2009)
  - Hours of congestion (LMPM, IFM + RTM)
  - RMR and Exceptional Dispatches

- Operator logs and procedures used to "map" RMR, OOS and Exceptional Dispatches to specific constraints that may have been managed by dispatch.
  - This approach significantly overestimates hours of actual congestion management on many constraints

Screening candidate paths – Hours of potential managed congestion by constraint.

Hours	500	100	50
%/year	5.7%	1.1%	0.6%

Market congestion

Market congestion + RMR +OOS + Exceptional Dispatch
125 constraints > 500 hours

Hours of Potential Managed Congestion

Number of Constraints
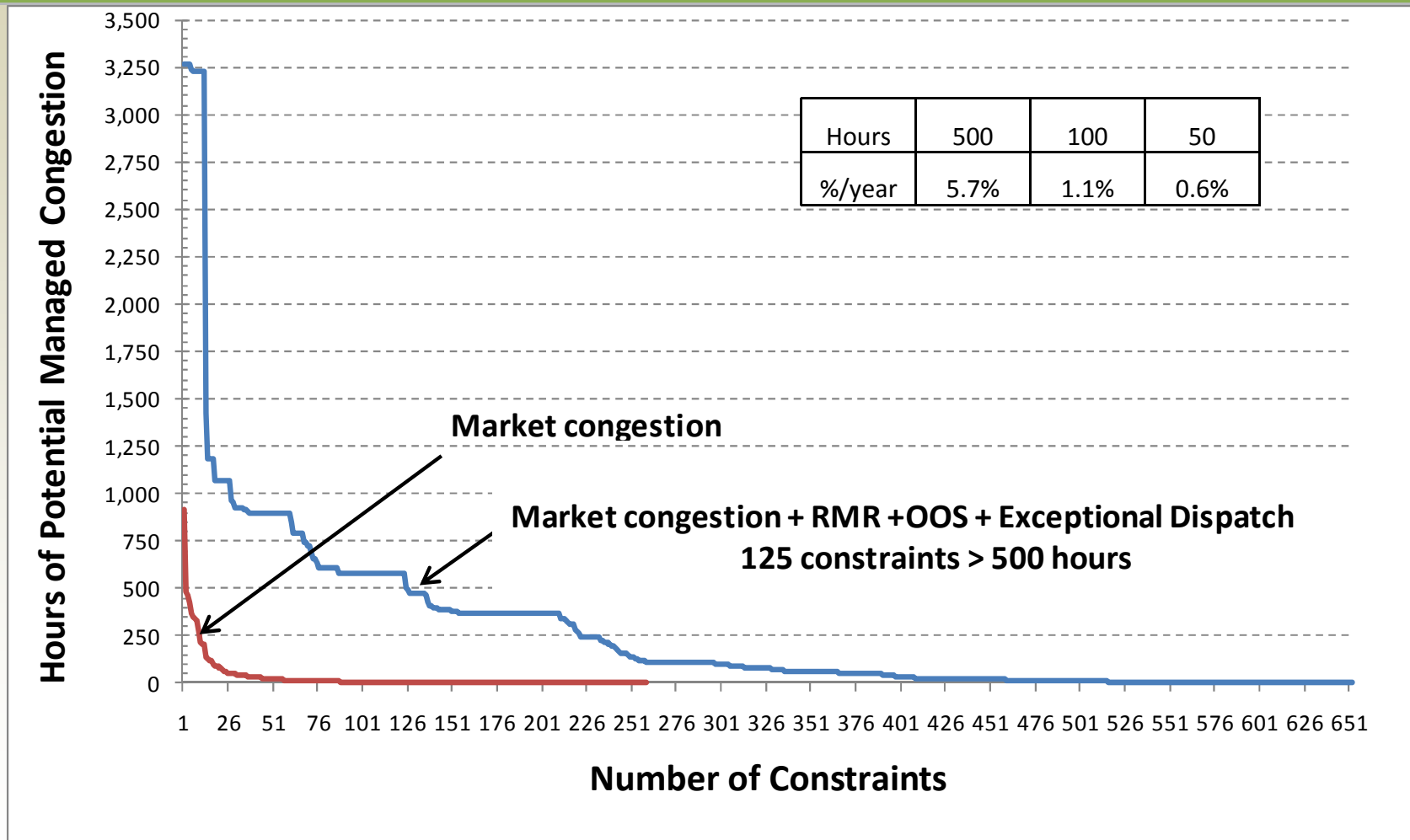
Paths with > 100 hours of market congestion in 2009

CONSTRAINT NAME0	TOTAL HR	Q1 OOS and RMR	Q2-Q4 Mkt Cong.	Q2-Q4 ED and RMR
33912_SPRNGGJ_115_33914_MI-WUK_115_BR_1_1	**915**		**915**	**0**
IVALLYBANK_XFBG	**851**	**106**	**483**	**262**
HUMBOLDT_BG	**1,425**	**8**	**468**	**949**
24074_LAFRESA_230_24065_HINSON_230_BR_1_1	431		431	0
VICTVL_BG	410	0	365	45
SDGE_CFEIMP_BG	**688**	**0**	**349**	**339**
31464_COTWDPGE_115_31463_WHEELBR_115_BR_1_1	344		344	0
LOSBANOSNORTH_BG	327		327	0
24082_LCIENEGA_230_24074_LAFRESA_230_BR_1_1	285	0	269	16
SCE_PCT_IMP_BG	218		218	0
32212_E.NICOLS_115_32214_RIOOSO_115_BR_1_1	210		210	0
SDGEIMP_BG	**720**	**149**	**205**	**366**
33206_BAYSHOR1_115_33208_MARTINC_115_BR_1_1	**727**	**138**	**142**	**447**
30875_MCCALL_230_30880_HENTAP2_230_BR_1_1	463	0	128	335
31482_PALERMO_115_32280_E.MRYJ2_115_BR_1_1	478	3	121	354
30543_ROSSTAP1_230_30550_MORAGA_230_BR_1_1	188		119	69
32218_DRUM_115_32222_DTCH2TAP_115_BR_1_1	179	4	101	74

California ISO

Paths with 40 to 100 hours of market congestion in 2009.

CONSTRAINT NAME0	TOTAL HR	Q1 OOS and RMR	Q2-Q4 Mkt Cong.	Q2-Q4 ED and RMR
MONAIPPDC_MSL	93		93	0
30250_CARIBOU_230_30261_BELDENTP_230_BR_1_1	91		91	0
33205_HNTRSPT_115_33208_MARTINC_115_BR_3_1	**638**	**138**	**89**	**411**
FCORNER5_MSL	86		86	0
30055_GATES1_500_30060_MIDWAY_500_BR_1_3	80		80	0
30105_COTTNWD_230_30245_ROUNDMT_230_BR_3_1	74		74	0
958555/958556FlowLimit#6	63		63	0
1051307-SOL3	61		61	0
BARRE-LEWIS_NG	51		51	0
SC-VNCT_SC-PARD_OUT_NG	50		50	0
T-133OAKLAND_NG	50		50	0
24114_PARDEE_230_24128_S.CLARA_230_BR_1_1	68		48	20
T-165TABLMT_RIOVACADX_NG_SUM	48		48	0
31482_PALERMO_115_31508_HONCJT3_115_BR_1_1	274	3	46	225
32990_MARTINEZ_115_33014_ALHAMTP1_115_BR_1_1	406		44	362
30550_MORAGA_230_30551_MRAGA1M_1.0_XF_1	44		44	0
33252_POTRERO3_20.0_33204_POTRERO_115_XF_G3	43		43	0
VINCNT_BNKS_14_NG	42		42	0
LUGO_VINCENT_BG	40		40	0

Paths with 25 to 40 hours of market congestion in 2009.

CONSTRAINT NAME0	TOTAL HR	Q1 OOS and RMR	Q2-Q4 Mkt Cong.	Q2-Q4 ED and RMR
32290_OLIVHJ1_115_32214_RIOOSO_115_BR_1_1	37		37	0
33203_MISSON_115_33204_POTRERO_115_BR_1_1	**611**	**138**	**34**	**439**
32228_PLACER_115_32236_FLINTJ1_115_BR_1_1	125	20	34	71
31990_DAVIS_115_31962_WDLND_BM_115_BR_1_1	33		33	0
MIGUEL_IMP_BG	338	0	31	307
32200_PEASE_115_31506_HONCJT1_115_BR_1_1	390	3	30	357
T-165PALERMO_COLGT_NG	30		30	0
32208_GLEAFTP_115_32214_RIOOSO_115_BR_1_1	135	3	29	103
24156_VINCENT_500_24155_VINCENT_230_XF_1_P	**506**	**374**	**27**	**105**
32228_PLACER_115_32239_FLINTJ2_115_BR_2_1	87	13	27	47
30005_ROUNDMT_500_30015_TABLEMT_500_BR_1_2	26		26	0
33310_SANMATEO_115_33315_RAVENSWD_115_BR_1_1	**613**	**138**	**25**	**450**
30900_GATES_230_30970_MIDWAY_230_BR_1_1	395	0	25	370

Network Model

- ## DB43 (released in Dec 2009)

  - TransBay cable added
  - Portrero 3 unit retired

- ## No generation or transmission outages

- ## New version of Plexos used to allow incorporation of contingencies

Annual Hydro Production (2002 – 2009) and Study Scenarios

Annual Total CAISO Hydroelectric Production

Hydro Scenario	Spring
High	5/19/2006
Medium	5/25/2005
Low	6/20/2008
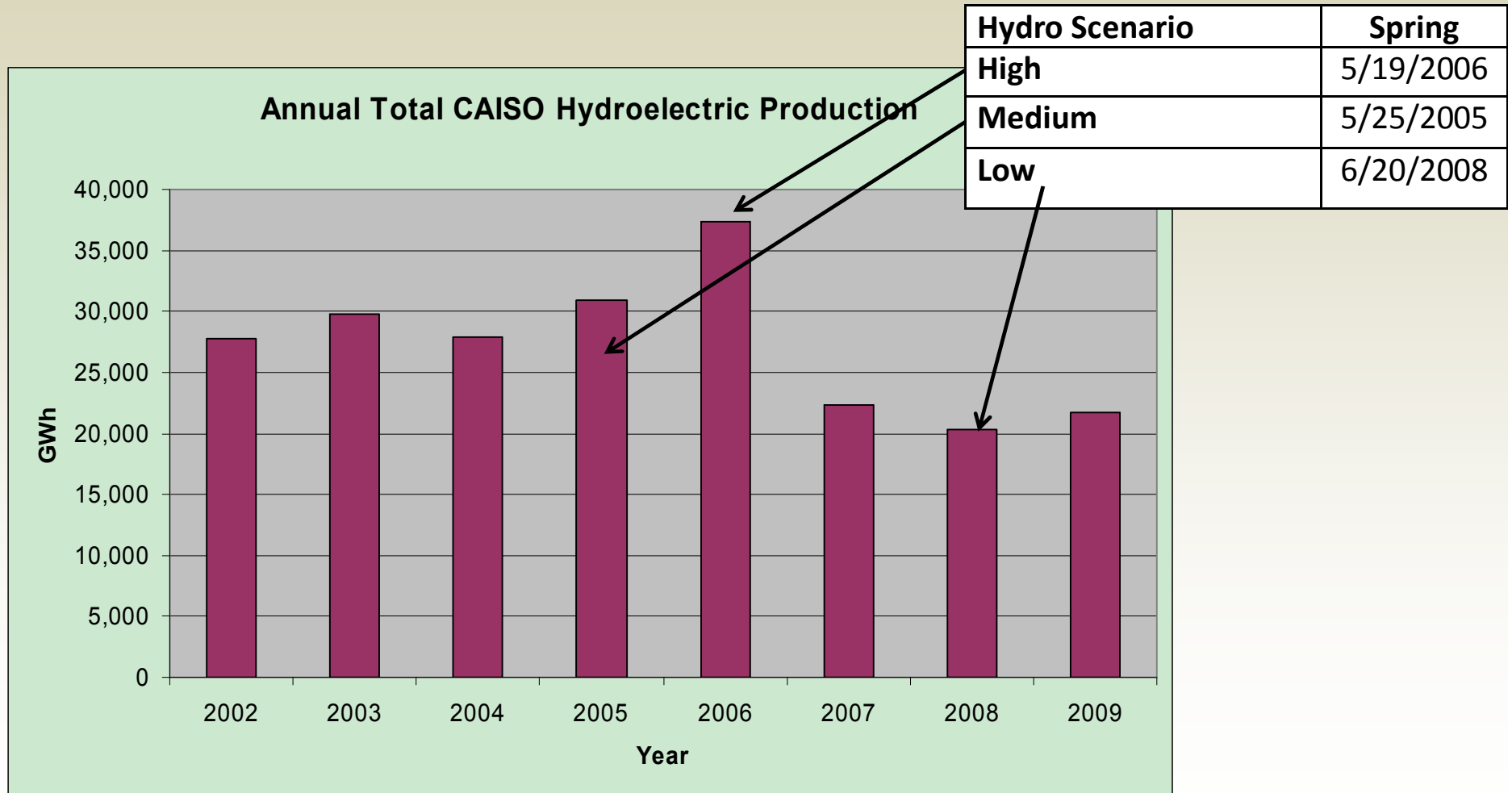
Spring Peak Loads (2002 – 2009)

OPR_YR	SEASON	DAILY_PEAK_LOAD
2005	SPR	38,694
2009	SPR	39,370
2003	SPR	40,117
2004	SPR	40,476
2007	SPR	40,839
2002	SPR	41,023
2006	SPR	43,719
2008	**SPR**	**46,789**

System Daily Peak Load for Three Spring Load Scenarios

Load Scenario	Peak MW	Spring 2008
High	41,545	95 percentile
Medium	36,069	80 percentile
Low	31,832	65 percentile

Updated Supply Survey to Identify Units Under Tolling Contracts

Supplier	Capacity
S1	4,388
S2	2,582
S3	1,898
S4	1,892
S5	1,119
S6	1,036
S7	713
S8	625
S9	552

Results

- All 125 candidate paths found to be competitive under spring conditions studied.

- Market congestion occurred on only 18 of 125 paths in Q2-Q4 2009.

- RSI analysis of 2009 data indicate that most paths deemed competitive on which congestion occurred were competitive in day-ahead market.

2009 RSI Results for Candidate Path Deemed Competitive for Spring 2010 – Average RSI

Constraint_Name	Cong. Hours	Limit	IFM -------------------------------->				RTM---------------------------->			
			RSI0	RSI1	RSI2	RSI3	RSI0	RSI1	RSI2	RSI3
IVALLYBANK_XFBG	483	900	1.27	1.10	1.01	0.98	1.02	0.91	0.88	0.86
HUMBOLDT_BG	468	43	1.42	1.42	1.42	1.42	1.18	1.18	1.18	1.18
SDGE_CFEIMP_BG	349	2321	2.25	1.91	1.86	1.85	1.10	1.09	1.08	1.08
SDGEIMP_BG	205	2106	1.82	1.80	1.78	1.78	1.05	1.05	1.05	1.05
33206_BAYSHOR1_115_33208_MARTIN C_115_BR_1_1	142	136	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
33205_HNTRS PT_115_33208_MARTIN C_115_BR_3_1	89	124	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
33203_MISSON _115_33204_POTRERO _115_BR_1_1	34	125	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24156_VINCENT _500_24155_VINCENT _230_XF_1_P	27	981	1.26	1.16	1.14	1.13	1.02	0.91	0.90	0.89
33310_SANMATEO_115_33315_RAVENSWD_115_BR_1_1	25	64	1.32	0.79	0.75	0.75	1.01	0.55	0.36	0.33
31000_HUMBOLDT_115_31001_HMBLT TM_1.0_XF_1	17	46	1.64	1.57	1.54	1.52	1.03	0.98	0.97	0.95
33204_POTRERO _115_33206_BAYSHOR1_115_BR_1_1	13	87	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
22356_IMPRLVLY_230_22360_IMPRLVLY_500_XF_80	9	591	1.20	1.19	1.18	1.17	1.00	0.99	0.98	0.98
99106_SAN-MAR1_230_99104_MAR-SAN1_230_BR_1_3	6	251	1.00	1.00	1.00	1.00				
33205_HNTRS PT_115_33208_MARTIN C_115_BR_1_1	5	110								
33207_BAYSHOR2_115_33208_MARTIN C_115_BR_2_1	5	125								
33204_POTRERO _115_33207_BAYSHOR2_115_BR_2_1	1	129								
33208_MARTIN C_115_33310_SANMATEO_115_BR_3_1	1	196								

2009 RSI Results for Candidate Path Deemed Competitive in Spring 2010 – Hours RSI < 1

Constraint_Name	Cong. Hours	Limit	IFM ------------------>			RTM -------------->		
			RSI1	RSI2	RSI3	RSI1	RSI2	RSI3
IVALLYBANK_XFBG	483	900		24	57	403	403	403
HUMBOLDT_BG	468	43						
SDGE_CFEIMP_BG	349	2321	1	4	4	110	110	110
SDGEIMP_BG	205	2106				30	30	30
33206_BAYSHOR1_115_33208_MARTIN C_115_BR_1_1	142	136						
33205_HNTRS PT_115_33208_MARTIN C_115_BR_3_1	89	124						
33203_MISSON _115_33204_POTRERO _115_BR_1_1	34	125						
24156_VINCENT _500_24155_VINCENT _230_XF_1_P	27	981				17	17	17
33310_SANMATEO_115_33315_RAVENSWD_115_BR_1_1	25	64	1	1	1	15	15	15
31000_HUMBOLDT_115_31001_HMBLT TM_ 1.0_XF_1	17	46				6	6	7
33204_POTRERO _115_33206_BAYSHOR1_115_BR_1_1	13	87						
22356_IMPRLVLY_230_22360_IMPRLVLY_500_XF_80	9	591				1	1	1
99106_SAN-MAR1_230_99104_MAR-SAN1_230_BR_1_3	6	251						
33205_HNTRS PT_115_33208_MARTIN C_115_BR_1_1	5	110						
33207_BAYSHOR2_115_33208_MARTIN C_115_BR_2_1	5	125						
33204_POTRERO _115_33207_BAYSHOR2_115_BR_2_1	1	129						
33208_MARTIN C_115_33310_SANMATEO_115_BR_3_1	1	196						

Review for 2010 Q1 Candidate Path with 2009 RSI<1 Hour

- ## IVALLYBANK_XFBG

  - Congestion concentrated in short period
  - Low real-time RSI due to transmission limit adjustment

IFM	Hour	Limit	Sept 15-24	Oct 29-30		
	95	900MW	78	16		
RTD	Hour	Limit	May 27-28	July-August	Sept 14-24	Oct 5 - Dec 10
	443	723MW	13	8	110	312

Review for 2010 Q1 Candidate Path with 2009 RSI<1 Hour

- ■ SDGE_CFEIMP_BG/SDGEIMP_BG

  - ▪ Low RSI due to transmission limit adjustment (Normal limit is 2850MW)

CONSTRAINT_NAME	Quarter	IFM Limit	RTD Limit
SDGE_CFEIMP_BG	2	2,360	2,172
SDGE_CFEIMP_BG	3	2,137	2,281
SDGE_CFEIMP_BG	4		1,732

CONSTRAINT_NAME	Quarter	IFM Limit	RTD Limit
SDGEIMP_BG	2	1,473	1,768
SDGEIMP_BG	3	2,323	2,463
SDGEIMP_BG	4	1,835	1,586

California ISO

Modeling Issues

- **Currently using Plexos**

  - Time consuming to map/load CRR model and run scenarios

- **Developing PROBE model for use later in 2010**

  - Awaiting tool to export fully mapped PSS/E file from actual IFM model that can be directly loaded into PROBE

  - By late 2010, may be able to run CPA based on "snapshot" of actual IFM very quickly (1-2 days?)

  - This would allow much more frequent updating of CPA based on actual system conditions.

Potential future modifications within current CPA framework

- Reduce 500 hour threshold

- Base criteria on market congestion

- Update more frequently

- Base on actual market supply

- Generation and transmission outages

- 2-pivotal supplier

Attachment 1:

Residual Supply Index

Methodology and Results
based on 2009 Designations

Residual Supply Index (RSI)

- **RSI is for each congested constraint**

- **For *i*-th congestion**

  - Shift Factor SF(*k,i*): resource *k*'s shift factor on *i*-th congestion
  - Schedule MW(*k*): resource *k*'s output (Energy)
  - Pmax(*k*): resource *k*'s maximum output

- **Dispatched counter flow of resource *k* for SF(*k,i*) < 0:**

  D_CFlow(*k*) = SF(*k,i*)*MW(*k*)

- **Counter flow supply of resource *k* for SF(*k,i*) < 0 :**

  S_CFlow(*k*) = SF(*k,i*)*Pmax(*k*)

Residual Supply Index (RSI)

- Total dispatched counter flow from market participant **P**

    D_CFlow(**P**) = ∑D_CFlow(k) where *k* belongs to **P**

- Total dispatched counter flow from all resources

    Total_D_CFlow = ∑D_CFlow(k) for all *k*

- Total counter flow supply from all resources

    Total_S_CFlow = ∑S_CFlow(k) for all *k*

$$\text{RSI}(0) = \frac{Total\_S\_CFlow}{Total\_D\_CFlow} = \frac{\sum_k S\_CFlow(k)}{\sum_k D\_CFlow(k)}$$

Pivotal Residual Supply Index (RSI)

- RSI(1) = $\dfrac{Total\_S\_CFlow - S\_CFlow(P1)}{Total\_D\_CFlow}$

- RSI(2) = $\dfrac{Total\_S\_CFlow - S\_CFlow(P1) - S\_CFlow(P2)}{Total\_D\_CFlow}$

- RSI(3) = $\dfrac{Total\_S\_CFlow - S\_CFlow(P1) - S\_CFlow(P2) - S\_CFlow(P3)}{Total\_D\_CFlow}$

Averages can be very deceiving.

Average RSI_1 = 2.4

RSI_1 < 0 during 66 of 158 hours of congestion in IFM
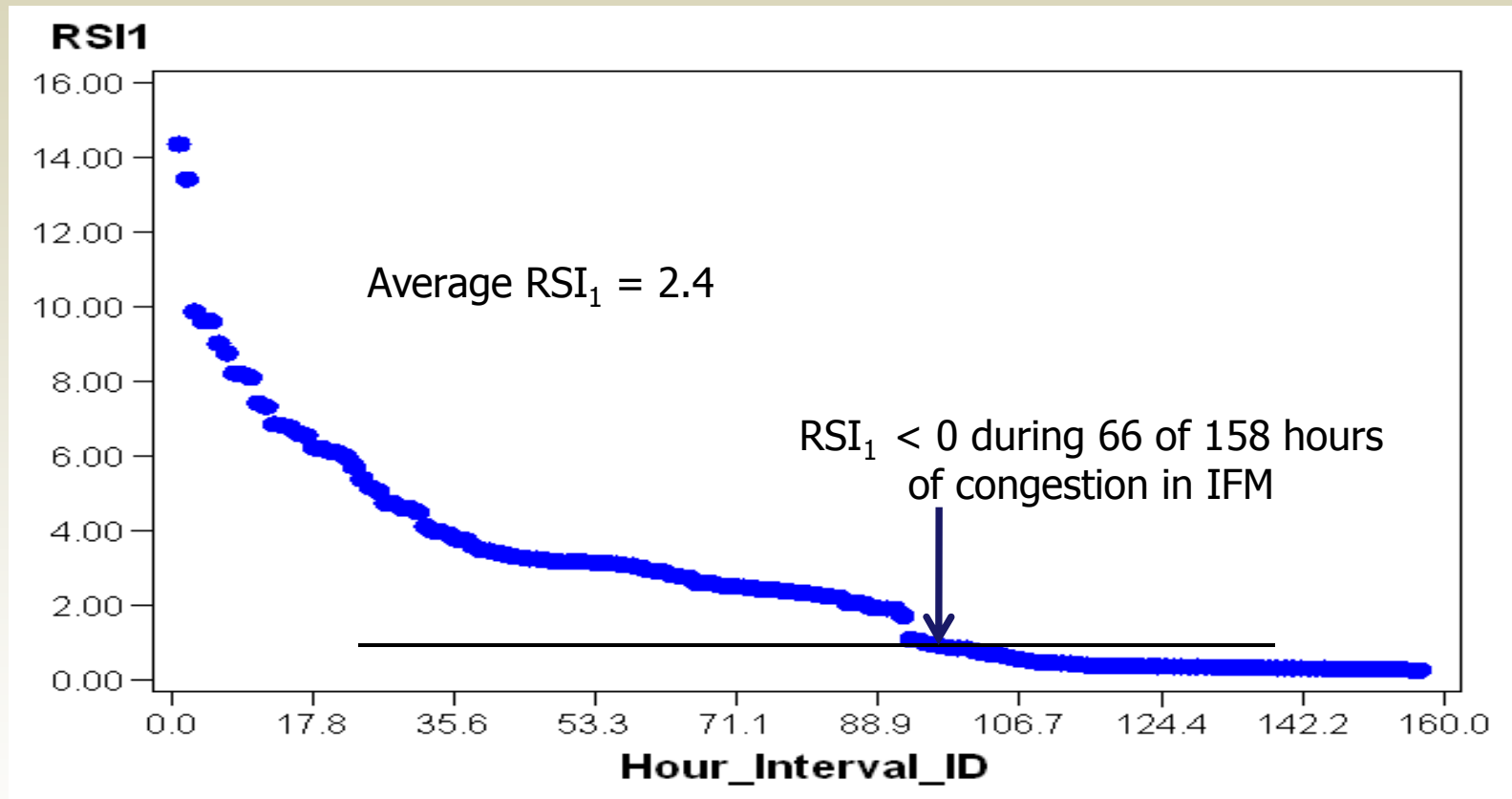
E D R _ F L O W G A T E _ N A M E = 24074 _ LA F R E S A _ 230 _ 24065 _ H I N S O N _ 230 _ B R _ 1 _ 1 M K T _ T Y P E = D A S C U C _ P A S S _ T Y P E _ T E X T = I F M

Hours of Congestion – Non-Candidate Paths in 2009

CONSTRAINT_NAME	Cong. Hours	Avg. Flow	<-- Congested Hours -->			
			LMPM	IFM	LMPM	RTD
24074_LA FRESA_230_24065_HINSON _230_BR_1_1	431	601	252	157	261	263
VICTVL_BG	365	2,508	141	119	193	102
LOSBANOSNORTH_BG	327	2,027	99	107	184	206
24082_LCIENEGA_230_24074_LA FRESA_230_BR_1_1	269	699	217	92	13	31
SCE_PCT_IMP_BG	218	6,577	149	153	28	19
32212_E.NICOLS_115_32214_RIO OSO _115_BR_1_1	210	56	163	169	10	20
30875_MC CALL _230_30880_HENTAP2 _230_BR_1_1	128	380	91	34	19	15
31482_PALERMO _115_32280_E.MRY J2_115_BR_1_1	121	78	89	102	3	5
30543_ROSSTAP1_230_30550_MORAGA _230_BR_1_1	119	379	48	47	37	64
32218_DRUM _115_32222_DTCH2TAP_115_BR_1_1	101	73	90	93	30	37
30250_CARIBOU _230_30261_BELDENTP_230_BR_1_1	91	225	87	5	16	17
30055_GATES1 _500_30060_MIDWAY _500_BR_1_3	80	1,885	69	67	5	8
30105_COTTNWD _230_30245_ROUND MT_230_BR_3_1	74	257	55	52	3	14
958555/958556 Flow Limit #6	63	25	8	15	47	2
1051307-SOL3	61	130	22	24	57	4
BARRE-LEWIS_NG	51	1,470	32	37	9	1

Excludes Constraints with < 50 hours of congestion.

Hours of Congestion – Candidate Paths Deemed as Competitive in 2009

CONSTRAINT_NAME	Cong. Hours	Avg. Flow	LMPM	IFM	LMPM	RTD
IVALLYBANK_XFBG	483	900	85	95	335	443
HUMBOLDT_BG	468	43	149	166	216	228
SDGE_CFEIMP_BG	349	2,321	65	121	187	270
SDGEIMP_BG	205	2,106	85	98	68	92
33206_BAYSHOR1_115_33208_MARTIN C_115_BR_1_1	142	136	102	61	15	12
33205_HNTRS PT_115_33208_MARTIN C_115_BR_3_1	89	124	65	72	2	8
33252_POTRERO3_20.0_33204_POTRERO_115_XF_G3	43	195	19	37	3	1
33203_MISSON_115_33204_POTRERO_115_BR_1_1	34	125	17	3	14	11
MIGUEL_IMP_BG	31	1,900	22	28		
SSONGS_BG	22	1,520	6	3	15	20
31000_HUMBOLDT_115_31001_HMBLT TM_1.0_XF_1	17	46	6	3	7	9
T-133 RAVENSWDSANMAT_NG_SUM	13	115	6	2	1	
33204_POTRERO_115_33206_BAYSHOR1_115_BR_1_1	13	87	2	1	6	6
33205_HNTRS PT_115_33208_MARTIN C_115_BR_1_1	5	110	1		1	3
33207_BAYSHOR2_115_33208_MARTIN C_115_BR_2_1	5	125	3	3	1	1
33253_POTRERO4_13.8_33204_POTRERO_115_XF_14	1	59				1
33255_POTRERO6_13.8_33204_POTRERO_115_XF_16	1	59				1
33254_POTRERO5_13.8_33204_POTRERO_115_XF_15	1	52			1	
99100_PIT-ESH1_230_30527_PITSBRG_230_BR_1_1	1	456			1	1
33208_MARTIN C_115_33310_SANMATEO_115_BR_3_1	1	196				1
33204_POTRERO_115_33207_BAYSHOR2_115_BR_2_1	1	129			1	1
MIGUEL_BKs_MXFLW_NG	1	1,800				

Average RSI (April-December, 2009)
Non-candidate Paths in 2009

Row #	CONSTRAINT_NAME	Cong. Hours	Avg. Flow	IFM				RTM			
				RSI0	RSI1	RSI2	RSI3	RSI0	RSI1	RSI2	RSI3
1	24074_LA FRESA_230_24065_HINSON __230_BR_1_1	431	601	5.12	2.70	2.54	2.42	1.16	0.27	0.14	0.12
2	VICTVL_BG	365	2508	1.15	.92	.84	.79	1.02	0.79	0.72	0.67
3	LOSBANOSNORTH_BG	327	2027	1.48	1.04	.98	.95	1.10	0.88	0.86	0.84
4	24082_LCIENEGA_230_24074_LA FRESA_230_BR_1_1	269	699	6.72	.16	.16	.16	1.36	0.18	0.18	0.18
5	SCE_PCT_IMP_BG	218	6577	1.59	1.42	1.35	1.31	1.01	0.96	0.91	0.89
6	32212_E.NICOLS_115_32214_RIO OSO _115_BR_1_1	210	56	1.05	.95	.87	.82	1.01	0.91	0.83	0.81
7	30875_MC CALL _230_30880_HENTAP2 _230_BR_1_1	128	380	3.40	3.31	3.24	3.19	3.60	3.51	3.45	3.43
8	31482_PALERMO _115_32280_E.MRY J2_115_BR_1_1	121	78	1.01	.95	.90	.88	1.00	0.95	0.90	0.86
9	30543_ROSSTAP1_230_30550_MORAGA __230_BR_1_1	119	379	1.18	.48	.42	.37	1.01	0.69	0.65	0.63
10	32218_DRUM __115_32222_DTCH2TAP_115_BR_1_1	101	73	1.24	1.01	.96	.93	1.05	0.85	0.81	0.78
11	30250_CARIBOU _230_30261_BELDENTP_230_BR_1_1	91	225	1.14	1.03	.94	.91	1.04	0.94	0.86	0.83
12	30055_GATES1 _500_30060_MIDWAY _500_BR_1_3	80	1885	1.76	1.42	1.27	1.23	1.15	0.87	0.80	0.77
13	30105_COTTNWD _230_30245_ROUND MT_230_BR_3_1	74	257	1.09	.65	.60	.58	1.01	0.69	0.66	0.65
14	958555/958556 Flow Limit #6	63	25	1.05	.73	.58	.58	1.02	0.81	0.64	0.64
15	1051307-SOL3	61	130	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	BARRE-LEWIS_NG	51	1470	1.39	1.21	1.08	.95	1.00	0.89	0.80	0.76
17	24114_PARDEE __230_24128_S.CLARA _230_BR_1_1	48	532	2.40	1.52	1.52	1.52	1.06	0.71	0.71	0.71
18	T-165 TABLMT_RIOVACADX_NG_SUM	48	545	1.01	.99	.97	.95	1.00	0.98	0.96	0.95
19	31482_PALERMO _115_31508_HONC JT3_115_BR_1_1	46	80	1.01	.97	.93	.91	1.00	0.99	0.98	0.97
20	32990_MARTINEZ_115_33014_ALHAMTP1_115_BR_1_1	44	95	1.25	.96	.91	.90	1.02	0.81	0.73	0.72
21	VINCNT_BNKS_14_NG	42	1800	1.60	1.28	1.26	1.24	1.02	0.81	0.79	0.79
22	LUGO_VINCENT_BG	40	3080	1.56	1.21	1.13	1.08	1.11	0.92	0.87	0.85
23	32290_OLIVH J1_115_32214_RIO OSO _115_BR_1_1	37	95	1.47	.76	.76	.76	1.01	0.66	0.64	0.64
24	32228_PLACER __115_32236_FLINT J1_115_BR_1_1	34	64	1.18	1.04	.99	.96	1.03	0.95	0.93	0.92
25	32200_PEASE __115_31506_HONC JT1_115_BR_1_1	30	86	1.25	1.23	1.23	1.22	1.05	1.04	1.04	1.03
26	32208_GLEAF TP_115_32214_RIO OSO _115_BR_1_1	29	80	1.04	1.03	1.02	1.01	1.02	1.01	1.00	1.00
27	24156_VINCENT _500_24155_VINCENT _230_XF_1_P	27	981	1.26	1.16	1.14	1.13	1.02	0.91	0.90	0.89
28	32228_PLACER __115_32239_FLINT J2_115_BR_2_1	27	64	1.23	1.16	1.13	1.11	1.02	0.94	0.93	0.92
29	30005_ROUND MT_500_30015_TABLE MT_500_BR_1_2	26	1892	1.13	1.03	1.02	1.00	1.03	0.93	0.91	0.90
30	30900_GATES _230_30970_MIDWAY _230_BR_1_1	25	287	2.27	2.06	1.97	1.90	1.22	1.05	1.01	0.98
31	33310_SANMATEO_115_33315_RAVENSWD_115_BR_1_1	25	64	1.32	.79	.75	.75	1.01	0.55	0.36	0.33
32	24016_BARRE _230_25201_LEWIS _230_BR_1_1	24	1203	4.71	4.45	4.26	4.10	1.04	0.99	0.96	0.94
33	30525_C.COSTA _230_30543_ROSSTAP1_230_BR_1_1	24	328	1.08	.63	.60	.60	1.01	0.70	0.67	0.64
34	SC-VNCT_OUT_DA_NG	23	475	2.90	2.16	2.16	2.16				
35	22192_DOUBLTTP_138_22300_FRIARS _138_BR_1_1	22	174	3.07	3.03	3.03	3.03	1.21	1.21	1.21	1.21

Average RSI (April-December, 2009) Non-candidate Paths in 2009 (continued)

Row #	CONSTRAINT_NAME	Cong. Hours	Avg. Flow	IFM RSI0	RSI1	RSI2	RSI3	RTM RSI0	RSI1	RSI2	RSI3
36	30525_C.COSTA _230_30544_ROSSTAP2_230_BR_2_1	19	329	1.30	.68	.65	.65	1.04	0.49	0.45	0.45
37	32225_BRNSWKT1_115_32222_DTCH2TAP_115_BR_1_1	19	74	1.28	1.10	1.06	1.03	1.04	0.91	0.89	0.87
38	32231_HORSE J2_115_32235_NEWC J2 _115_BR_2_1	17	64	1.29	1.25	1.21	1.19	1.02	0.99	0.97	0.95
39	24156_VINCENT _500_24155_VINCENT _230_XF_4 _P	16	1104	1.45	1.38	1.32	1.28	1.05	0.95	0.90	0.87
40	SONG_SNTG2_OUT_SV_SS-N2_NG	16	1378	1.16	1.14	1.12	1.11				
41	MARTIN_115KV_BUS_D_OUT_NG	15	190	1.00	1.00	1.00	1.00				
42	30550_MORAGA _230_30554_CASTROVL_230_BR_1_1	14	318	1.41	.81	.46	.39	1.00	0.58	0.47	0.41
43	SONG_SNT1_SV_SS_NG	13	1378	1.18	1.15	1.12	1.10				
44	24807_MIRAGE _115_24819_CONCHO _115_BR_1_1	13	247	1.00	.26	.25	.24				
45	32990_MARTINEZ_115_33016_ALHAMTP2_115_BR_1_1	11	91	1.19	1.06	1.01	.98	1.01	0.95	0.93	0.91
46	35122_NWARK EF_115_35350_AMES BS _115_BR_2_1	10	94	1.11	.53	.50	.50	1.00	0.53	0.50	0.50
47	SOUTHLUGO_RV_BG	10	4150	1.11	1.08	1.05	1.02	1.01	0.97	0.95	0.92
48	1021973_SONGS_SNTG1_OUT_NG	9	975	1.17	1.13	1.11	1.09	1.19	1.15	1.11	1.10
49	22356_IMPRLVLY_230_22360_IMPRLVLY_500_XF_80	9	591	1.20	1.19	1.18	1.17	1.00	0.99	0.98	0.98
50	958555/958556 Flow Limit #5	8	25	1.20	1.15	1.12	1.11				
51	SONGS_SNTG2_OUT_NG	7	975	1.78	1.57	1.53	1.51	1.07	0.94	0.92	0.91
52	30525_C.COSTA _230_30565_BRENTWOD_230_BR_1_1	7	417	1.26	1.12	1.09	1.06	1.03	0.88	0.86	0.84
53	1030582_SONG_SNT1_SV_SS_NG	7	1378	1.20	1.13	1.09	1.07				
54	33010_SOBRANTE_115_30540_SOBRANTE_230_XF_1	7	375	1.13	1.04	1.03	1.03				
55	1030579_SONG_SNT2_OUT_NG	6	975	4.22	.93	.92	.92				
56	1030582_SONG_SNT1_OUT_NG	6	975	1.25	1.22	1.20	1.19				
57	31962_WDLND_BM_115_31970_WOODLD _115_BR_1_1	6	118	8.78	8.78	8.78	8.78				
58	99106_SAN-MAR1_230_99104_MAR-SAN1_230_BR_1_3	6	251	1.00	1.00	1.00	1.00				
59	30970_MIDWAY _230_30060_MIDWAY _500_XF_13_S	5	874	1.61	1.47	1.43	1.40				
60	24155_VINCENT _230_24401_ANTELOPE_230_BR_1_1	5	477	1.36	1.16	1.12	1.10	1.02	0.84	0.82	0.82
61	SONG_SNT2_OUT_NG	4	975	1.19	1.16	1.14	1.12				
62	30060_MIDWAY _500_24156_VINCENT _500_BR_3 _2	4	1497	1.12	1.09	1.06	1.03	1.01	0.99	0.96	0.94
63	1030581_SONG_SNT1_OUT_NG	3	975	3.51	3.29	3.26	3.26				
64	1031184_NG1	3	120	1.24	1.07	1.02	.99				
65	22430_SILVERGT_230_22466_MLMS3TAP_230_BR_1_1	3	587	1.51	1.42	1.41	1.40	1.04	1.04	1.04	1.04
66	30790_PANOCHE _230_30900_GATES _230_BR_1_1	3	299	1.18	1.06	.95	.88				
67	32950_PITSBURG_115_32970_CLAYTN _115_BR_4_1	3	279	1.12	1.11	1.10	1.10	1.02	1.01	1.01	1.01
68	1042543 - NG1	2	80	1.17	1.09	1.08	1.07				
69	30790_PANOCHE _230_30900_GATES _230_BR_2_1	2	317	1.60	.97	.89	.83				
70	34713_OGLE TAP_115_34784_CAWELO C_115_BR_1_1	2	102	1.00	1.00	1.00	1.00				

Hours RSI < 1 (April-December, 2009)
Non-candidate Paths in 2009

Row #	CONSTRAINT_NAME	Cong. Hour	Avg. Flow	IFM ------------------------------>			RTM ------------------------------>		
				RSI1 < 1	RSI2 < 1	RSI3 < 1	RSI1 < 1	RSI2 < 1	RSI3 < 1
1	24074_LA FRESA_230_24065_HINSON _230_BR_1_1	431	601	63	65	66	262	263	263
2	VICTVL_BG	365	2508	95	108	111	98	98	98
3	LOSBANOSNORTH_BG	327	2027	60	65	67	199	199	199
4	24082_LCIENEGA_230_24074_LA FRESA_230_BR_1_1	269	699	90	90	90	27	27	27
5	SCE_PCT_IMP_BG	218	6577	10	26	34	19	19	19
6	32212_E.NICOLS_115_32214_RIO OSO _115_BR_1_1	210	56	152	160	161	19	19	20
7	30875_MC CALL _230_30880_HENTAP2 _230_BR_1_1	128	380				1	1	1
8	31482_PALERMO _115_32280_E.MRY J2_115_BR_1_1	121	78	99	100	100	5	5	5
9	30543_ROSSTAP1_230_30550_MORAGA _230_BR_1_1	119	379	45	46	46	64	64	64
10	32218_DRUM _115_32222_DTCH2TAP_115_BR_1_1	101	73	38	78	91	29	29	29
11	30250_CARIBOU _230_30261_BELDENTP_230_BR_1_1	91	225	1	5	5	17	17	17
12	30055_GATES1 _500_30060_MIDWAY _500_BR_1_3	80	1885		7	10	7	8	8
13	30105_COTTNWD _230_30245_ROUND MT_230_BR_3_1	74	257	52	52	52	14	14	14
14	958555/958556 Flow Limit #6	63	25	15	15	15	2	2	2
15	1051307-SOL3	61	130						
16	BARRE-LEWIS_NG	51	1470		4	25	1	1	1
17	24114_PARDEE _230_24128_S.CLARA _230_BR_1_1	48	532				29	29	29
18	T-165 TABLMT_RIOVACADX_NG_SUM	48	545	48	48	48	2	2	2
19	31482_PALERMO _115_31508_HONC JT3_115_BR_1_1	46	80	33	35	35	8	8	8
20	32990_MARTINEZ_115_33014_ALHAMTP1_115_BR_1_1	44	95	10	10	10	16	16	16
21	VINCNT_BNKS_14_NG	42	1800				2	2	2
22	LUGO_VINCENT_BG	40	3080	1	2	4	13	13	13
23	32290_OLIVH J1_115_32214_RIO OSO _115_BR_1_1	37	95	4	4	4	19	19	19
24	32228_PLACER _115_32236_FLINT J1_115_BR_1_1	34	64	13	18	24	6	6	6
25	32200_PEASE _115_31506_HONC JT1_115_BR_1_1	30	86	7	7	7	10	10	10
26	32208_GLEAF TP_115_32214_RIO OSO _115_BR_1_1	29	80		1	1	6	6	6
27	24156_VINCENT _500_24155_VINCENT _230_XF_1 _P	27	981				17	17	17
28	32228_PLACER _115_32239_FLINT J2_115_BR_2_1	27	64				5	5	5
29	30005_ROUND MT_500_30015_TABLE MT_500_BR_1_2	26	1892	4	6	6	9	9	9
30	30900_GATES _230_30970_MIDWAY _230_BR_1_1	25	287				6	6	7
31	33310_SANMATEO_115_33315_RAVENSWD_115_BR_1_1	25	64	1	1	1	15	15	15
32	24016_BARRE _230_25201_LEWIS _230_BR_1_1	24	1203				10	12	12
33	30525_C.COSTA _230_30543_ROSSTAP1_230_BR_1_1	24	328	3	3	3	20	20	20
34	SC-VNCT_OUT_DA_NG	23	475						
35	22192_DOUBLTTP_138_22300_FRIARS _138_BR_1_1	22	174						

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Row #	CONSTRAINT_NAME	Cong. Hour	Avg. Flow	IFM ---------------------------->			RTM ---------------------------->		
				RSI1 < 1	RSI2 < 1	RSI3 < 1	RSI1 < 1	RSI2 < 1	RSI3 < 1
36	30525_C.COSTA _230_30544_ROSSTAP2_230_BR_2_1	19	329	9	9	9	2	2	2
37	32225_BRNSWKT1_115_32222_DTCH2TAP_115_BR_1_1	19	74			3	11	11	11
38	32231_HORSE J2_115_32235_NEWC J2 _115_BR_2_1	17	64				3	3	3
39	24156_VINCENT _500_24155_VINCENT _230_XF_4 _P	16	1104				4	4	4
40	SONG_SNTG2_OUT_SV_SS-N2_NG	16	1378						
41	MARTIN_115KV_BUS_D_OUT_NG	15	190						
42	30550_MORAGA _230_30554_CASTROVL_230_BR_1_1	14	318	8	8	8	5	5	5
43	SONG_SNT1_SV_SS_NG	13	1378						
44	24807_MIRAGE _115_24819_CONCHO _115_BR_1_1	13	247	6	6	6			
45	32990_MARTINEZ_115_33016_ALHAMTP2_115_BR_1_1	11	91	2	2	2	4	4	4
46	35122_NWARK EF_115_35350_AMES BS _115_BR_2_1	10	94	8	8	8	2	2	2
47	SOUTHLUGO_RV_BG	10	4150				7	8	8
48	1021973_SONGS_SNTG1_OUT_NG	9	975						
49	22356_IMPRLVLY_230_22360_IMPRLVLY_500_XF_80	9	591				1	1	1
50	958555/958556 Flow Limit #5	8	25						
51	SONGS_SNTG2_OUT_NG	7	975				1	1	1
52	30525_C.COSTA _230_30565_BRENTWOD_230_BR_1_1	7	417			1	2	2	2
53	1030582_SONG_SNT1_SV_SS_NG	7	1378						
54	33010_SOBRANTE_115_30540_SOBRANTE_230_XF_1	7	375	4	5	5			
55	1030579_SONG_SNT2_OUT_NG	6	975	6	6	6			
56	1030582_SONG_SNT1_OUT_NG	6	975						
57	31962_WDLND_BM_115_31970_WOODLD _115_BR_1_1	6	118						
58	99106_SAN-MAR1_230_99104_MAR-SAN1_230_BR_1_3	6	251						
59	30970_MIDWAY _230_30060_MIDWAY _500_XF_13_S	5	874						
60	24155_VINCENT _230_24401_ANTELOPE_230_BR_1_1	5	477				2	2	2
61	SONG_SNT2_OUT_NG	4	975						
62	30060_MIDWAY _500_24156_VINCENT _500_BR_3_2	4	1497				1	1	2
63	1030581_SONG_SNT1_OUT_NG	3	975						
64	1031184_NG1	3	120			1			
65	22430_SILVERGT_230_22466_MLMS3TAP_230_BR_1_1	3	587						
66	30790_PANOCHE _230_30900_GATES _230_BR_1_1	3	299	1	1	2			
67	32950_PITSBURG_115_32970_CLAYTN _115_BR_4_1	3	279				1	1	1
68	1042543 - NG1	2	80						
69	30790_PANOCHE _230_30900_GATES _230_BR_2_1	2	317	1	1	1			
70	34713_OGLE TAP_115_34784_CAWELO C_115_BR_1_1	2	102						

Row #	CONSTRAINT_NAME	Cong. Hours	Avg. Flow	IFM RSI0	RSI1	RSI2	RSI3	RTM RSI0	RSI1	RSI2	RSI3
1	IVALLYBANK_XFBG	483	900	1.27	1.10	1.01	0.98	1.02	0.91	0.88	0.86
2	HUMBOLDT_BG	468	43	1.42	1.42	1.42	1.42	1.18	1.18	1.18	1.18
3	SDGE_CFEIMP_BG	349	2,321	2.25	1.91	1.86	1.85	1.10	1.09	1.08	1.08
4	SDGEIMP_BG	205	2,106	1.82	1.80	1.78	1.78	1.05	1.05	1.05	1.05
5	33206_BAYSHOR1_115_33208_MARTIN C_115_BR_1_1	142	136	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	33205_HNTRS PT_115_33208_MARTIN C_115_BR_3_1	89	124	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
7	33252_POTRERO3_20.0_33204_POTRERO_115_XF_G3	43	195								
8	33203_MISSON_115_33204_POTRERO_115_BR_1_1	34	125	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
9	MIGUEL_IMP_BG	31	1,900	1.45	1.38	1.36	1.33				
10	SSONGS_BG	22	1,520	1.89	1.81	1.74	1.74	1.07	1.06	1.06	1.06
11	31000_HUMBOLDT_115_31001_HMBLT TM_1.0_XF_1	17	46	1.64	1.57	1.54	1.52	1.03	0.98	0.97	0.95
12	T-133 RAVENSWD SANMAT_NG_SUM	13	115	1.09	1.05	1.02	1.01				
13	33204_POTRERO_115_33206_BAYSHOR1_115_BR_1_1	13	87	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	33205_HNTRS PT_115_33208_MARTIN C_115_BR_1_1	5	110								
15	33207_BAYSHOR2_115_33208_MARTIN C_115_BR_2_1	5	125								
16	33253_POTRERO4_13.8_33204_POTRERO_115_XF_14	1	59								
17	33255_POTRERO6_13.8_33204_POTRERO_115_XF_16	1	59								
18	33254_POTRERO5_13.8_33204_POTRERO_115_XF_15	1	52								
19	99100_PIT-ESH1_230_30527_PITSBRG_230_BR_1_1	1	456								
20	33208_MARTIN C_115_33310_SANMATEO_115_BR_3_1	1	196								
21	33204_POTRERO_115_33207_BAYSHOR2_115_BR_2_1	1	129								
22	MIGUEL_BKs_MXFLW_NG	1	1,800								

Hours RSI < 1 (April-December, 2009) Candidate Paths in 2009 deemed Competitive

Row #	CONSTRAINT_NAME	Cong Hour	Avg. Flow	IFM --->			RTM --->		
					RSI1 < 1	RSI2 < 1	RSI3 < 1		RSI1 < 1	RSI2 < 1	RSI3 < 1
1	IVALLYBANK_XFBG	483	900			24	57		403	403	403
2	HUMBOLDT_BG	468	43								
3	SDGE_CFEIMP_BG	349	2,321		1	4	4		110	110	110
4	SDGEIMP_BG	205	2,106						30	30	30
5	33206_BAYSHOR1_115_33208_MARTIN C_115_BR_1_1	142	136								
6	33205_HNTRS PT_115_33208_MARTIN C_115_BR_3_1	89	124								
7	33252_POTRERO3_20.0_33204_POTRERO _115_XF_G3	43	195								
8	33203_MISSON _115_33204_POTRERO _115_BR_1_1	34	125								
9	MIGUEL_IMP_BG	31	1,900								
10	SSONGS_BG	22	1,520						4	4	4
11	31000_HUMBOLDT_115_31001_HMBLT TM_ 1.0_XF_1	17	46						6	6	7
12	T-133 RAVENSWDSANMAT_NG_SUM	13	115				1				
13	33204_POTRERO _115_33206_BAYSHOR1_115_BR_1_1	13	87								
14	33205_HNTRS PT_115_33208_MARTIN C_115_BR_1_1	5	110								
15	33207_BAYSHOR2_115_33208_MARTIN C_115_BR_2_1	5	125								
16	33253_POTRERO4_13.8_33204_POTRERO _115_XF_14	1	59								
17	33255_POTRERO6_13.8_33204_POTRERO _115_XF_16	1	59								
18	33254_POTRERO5_13.8_33204_POTRERO _115_XF_15	1	52								
19	99100_PIT-ESH1_230_30527_PITSBRG _230_BR_1_1	1	456								
20	33208_MARTIN C_115_33310_SANMATEO_115_BR_3_1	1	196								
21	33204_POTRERO _115_33207_BAYSHOR2_115_BR_2_1	1	129								
22	MIGUEL_BKs_MXFLW_NG	1	1,800								