

Northern California Regional Integration of Renewables



Assessment of Northern California Sub-Regional Renewable Transmission Integration Priorities Beyond 2010

Stakeholders Conference Call

October 13, 2009



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SMUD: Craig Cameron, FOUNG Mua, Joe Tarantino
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Installed MW by Impacts of Injection Points

Scenario	COI Area and N. of CA	Midway Area and S. CA	within N. CA System	Total MW
Scenario 1 - High Midway Wind and Solar with Geo	132	3,425	747	4,304
Scenario 2 - High COI Geo N CA and Nev	1,707	-	1,017	2,724
Scenario 3 - Dispersed through out Northern California	1,577	-	2,692	4,269
Scenario 4 - Minimum COI and No Midway	307	-	3,392	3,699
Scenario 5 - Majority Geothermal	857	450	1,442	2,749
Scenario 6 - Even Distribution with Geo	1,307	1,200	1,542	4,049
Scenario 7 - High Midway wind and solar; Minimum Geo	-	5,600	-	5,600
Scenario 8 - All COI	5,225	-	-	5,225
Scenario 9 - Majority COI and Midway – Stakeholder Suggestion	2,900	2,400	830	6,130
Scenario 10 - CAISO MIX	831	2,669	3,186	6,686
Scenario 11 - RETI	-	-	-	-

Installed Renewable Capacity

Scenario	Geothermal	Biomass	High and Low Wind	CSP Solar	Total
Scenario 1 - High Midway Wind and Solar with Geo	1,325	-	1,979	1,000	4,304
Scenario 2 - High COI Geo N CA and Nev	2,245	-	479	-	2,724
Scenario 3 - Dispersed through out Northern California	745	495	2,629	400	4,269
Scenario 4 - Minimum COI and No Midway	1,075	495	2,129	-	3,699
Scenario 5 - Majority Geothermal	1,775	495	479	-	2,749
Scenario 6 - Even Distribution with Geo	925	495	2,129	500	4,049
Scenario 7 - High Midway wind and solar; Minimum Geo	600	-	3,000	2,000	5,600
Scenario 8 - All COI	725	-	3,500	1,000	5,225
Scenario 9 - Majority COI and Midway – Stakeholder Suggestion	450	-	4,430	1,250	6,130
Scenario 10 - CAISO MIX	185	-	4,101	2,400	6,686
Scenario 11 - RETI	-	-	-	-	-

Scenarios and Legend

Scenario
Scenario 1 - High Midway Wind and Solar with Geo
Scenario 2 - High COI, Geo in N CA and Nev
Scenario 3 - Dispersed through out Northern California
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Upgrade Alt.	Transmission Upgrades Studied
A	No upgrade
B	C3ET Project
C	C3ET Project + Cottle - Tesla/Tracy Project
D	C3ET Project + Cottle - Tesla/Tracy Project + Cottle - Gregg Project
E	CNC + C3ET
F	CNC Only
G	Round Mt - Tesla 500 kV + C3ET Project
H	Round Mt - Tesla 500 kV
I	C3ET Project + Cottle - Tesla/Tracy Project + Cottle - Gregg Project + Round Mt - Tesla 500 kV
J	Round Mt - Tesla 500 kV + CNC
K	Round Mt - Tesla 500 kV + CNC + Malin – Tracy/Tesla 500kV
L	Round Mt - Tesla 500 kV + CNC + C3ET



N-0 Results

AMWSO for Summer Peak

N-0 Analysis Scenario's 1 to 5

Scenario	Upgrade option											
	A	B	C	D	E	F	G	H	I	J	K	L
SCN 1 AMWSO	126	127	121	120	164	164	659	178	218	212	43	215
SCN 1 Delta AMWSO	0	1	-5	-6	38	38	533	52	92	86	-83	89
SCN 2 AMWSO	760	761	758	759	624	608	104	107	139	143	52	141
SCN 2 Delta AMWSO	0	1	-2	-1	-136	-152	-656	-653	-621	-617	-708	-619
SCN 3 AMWSO	107	71	71	68	140	139	124	121	161	164	43	165
SCN 3 Delta AMWSO	0	-36	-36	-39	33	32	17	14	54	57	-64	58
SCN 4 AMWSO	237	201	195	197	254	251	318	275	31	303	187	304
SCN 4 Delta AMWSO	0	-36	-42	-40	17	14	81	38	-206	66	-50	67
SCN 5 AMWSO	82	49	46	45	247	120	179	136	184	175	38	177
SCN 5 Delta AMWSO	0	-33	-36	-37	165	38	97	54	102	93	-44	95

- AMWSO = Sum of (Overloaded line % - 100%) x Limit A Rating
- For calculating a delta AMWSO (Aggregated MW of Single Overloads), the base is taken as the No Upgrade Case (Upgrade Option A)
- The base changes in each scenario due to different additional generation



AMWSO for Summer Peak

N-0 Analysis Scenario's 6 to 10

Scenario	Upgrade option											
	A	B	C	D	E	F	G	H	I	J	K	L
SCN 6 AMWSO	108	44	40	41	117	117	135	133	170	166	39	167
SCN 6 Delta AMWSO	0	-64	-68	-67	9	9	27	25	62	58	-69	59
SCN 7 AMWSO	131	129	124	120	168	100	184	184	213	214	28	214
SCN 7 Delta AMWSO	0	-2	-7	-11	37	-31	53	53	82	83	-103	83
SCN 8 AMWSO	248	506	507	518	91	49	143	179	172	194	78	174
SCN 8 Delta AMWSO	0	258	259	270	-157	-199	-105	-69	-76	-54	-170	-74
SCN 9 AMWSO	71	37	34	33	113	143	140	174	149	212	35	212
SCN 9 Delta AMWSO	0	-34	-37	-38	42	72	69	103	78	141	-36	141
SCN 10 AMWSO	140	112	107	106	41	134	242	205	238	188	46	192
SCN 10 Delta AMWSO	0	-28	-33	-34	-99	-6	102	65	98	48	-94	52

AMWSO for Fall Off-Peak

N-0 Analysis Scenario's 1 to 5

Scenario	Upgrade option											
	A	B	C	D	E	F	G	H	I	J	K	L
SCN 1 AMWSO	2391	1432	1440	413	1341	2284	1483	2507	467	2423	2524	1494
SCN 1 Delta AMWSO	0	-959	-951	-1978	-1050	-107	-908	116	-1924	32	133	-897
SCN 2 AMWSO	953	604	606	610	620	935	644	377	66	983	1038	105
SCN 2 Delta AMWSO	0	-349	-347	-343	-333	-18	-309	-576	-887	30	85	-848
SCN 3 AMWSO	314	0	3	8	0	316	39	350	71	351	394	40
SCN 3 Delta AMWSO	0	-314	-311	-306	-314	2	-275	36	-243	37	80	-274
SCN 4 AMWSO	554	279	283	280	248	484	427	592	327	564	644	302
SCN 4 Delta AMWSO	0	-275	-271	-274	-306	-70	-127	38	-227	10	90	-252
SCN 5 AMWSO	807	244	229	5	214	744	273	850	42	816	910	264
SCN 5 Delta AMWSO	0	-563	-578	-802	-593	-63	-534	43	-765	9	103	-543

AMWSO for Fall Off-Peak N-0 Analysis Scenario's 6 to 10

Scenario	Upgrade option											
	A	B	C	D	E	F	G	H	I	J	K	L
SCN 6 AMWSO	570	122	126	7	100	516	198	636	72	598	698	180
SCN 6 Delta AMWSO	0	-448	-444	-563	-470	-54	-372	66	-498	28	128	-390
SCN 7 AMWSO	3298	2083	2084	821	1974	3167	2188	3424	893	3286	3498	2119
SCN 7 Delta AMWSO	0	-1215	-1214	-2477	-1324	-131	-1110	126	-2405	-12	200	-1179
SCN 8 AMWSO	298	9	12	72	266	295	75	372	72	345	396	68
SCN 8 Delta AMWSO	0	-289	-286	-226	-32	-3	-223	74	-226	47	98	-230
SCN 9 AMWSO	1211	532	514	228	552	1189	555	1248	106	1038	1155	368
SCN 9 Delta AMWSO	0	-679	-697	-983	-659	-22	-656	37	-1105	-173	-56	-843
SCN 10 AMWSO	365	21	23	10	22	337	106	407	62	399	458	84
SCN 10 Delta AMWSO	0	-344	-342	-355	-343	-28	-259	42	-303	34	93	-281

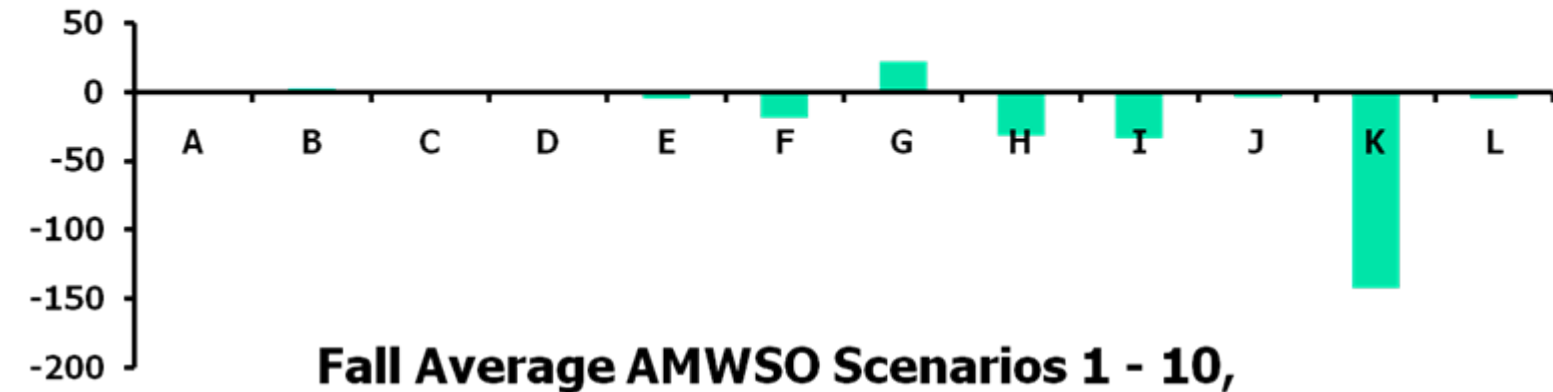
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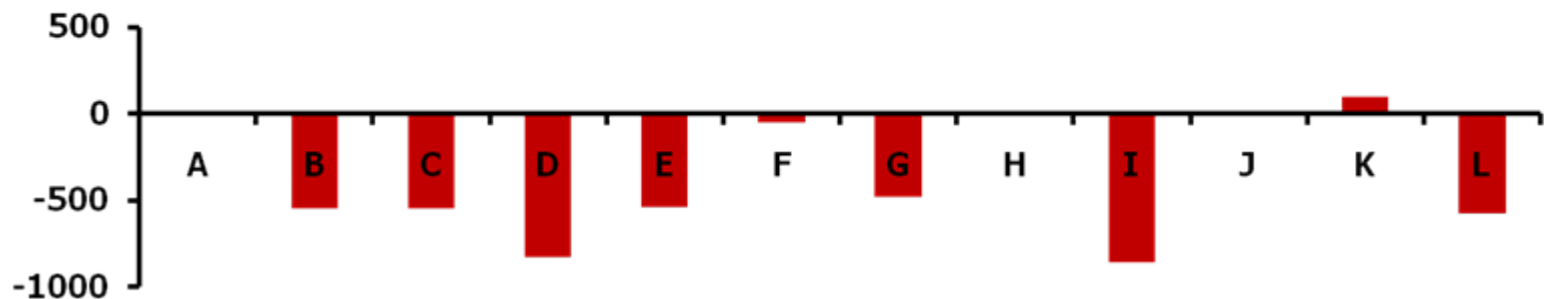
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L	Round Mt - Tesla 500 kV + CNC + C3ET

Average Delta AMWSO Summer & Fall

Summer Average AMWSO Scenarios 1 - 10,
Upgrade A - L



Fall Average AMWSO Scenarios 1 - 10,
Upgrade A - L



- Negative Delta AMWSO = Benefit to the network
- Positive Delta AMWSO = Detrimental to the network

AMWSO for Spring Peak

N-0 Analysis Scenario's 1 to 5

Scenario	Upgrade option											
	A	B	C	D	E	F	G	H	I	J	K	L
SCN 1 AMWSO	5	27	24	23					132			
SCN 1 Delta AMWSO	0	22	19	17					127			
SCN 2 AMWSO	461	463	466	471					989			
SCN 2 Delta AMWSO	0	2	5	10					528			
SCN 3 AMWSO	10	10	7	7					64			
SCN 3 Delta AMWSO	0	0	-3	-4					54			
SCN 4 AMWSO	281						350		124			
SCN 4 Delta AMWSO	0						69		-157			
SCN 5 AMWSO	15						92		83			
SCN 5 Delta AMWSO	0						78		69			

AMWSO for Spring Peak

N-0 Analysis Scenario's 6 to 10

Scenario	Upgrade option											
	A	B	C	D	E	F	G	H	I	J	K	L
SCN 6 AMWSO	20	20							100			
SCN 6 Delta AMWSO	0	0							80			
SCN 7 AMWSO	45.2	43.6	42.1	39					153			
SCN 7 Delta AMWSO	0	-2	-3	-6					108			
SCN 8 AMWSO	725					43		13	42	62	0	
SCN 8 Delta AMWSO	0					-682		-712	-683	-663	-725	
SCN 9 AMWSO	217					122		62	65	110		111
SCN 9 Delta AMWSO	0					-95		-155	-152	-107		-106
SCN 10 AMWSO	106				95		177		175.6			
SCN 10 Delta AMWSO	0				-11		71		70			



Next Steps

- Continue with N-0 cases for the Spring
- Complete N-1s
- Analyze Results
- Write Report