

6. Hydroelectric Power Modeling

6.1 MODEL DESCRIPTION

The hydroelectric power model used for the FRWP EIR/EIS analysis, LongTermGen, was recently developed by the Western Area Power Administration (WAPA). WAPA markets and transmits electricity generated in 15 states by power plants that are operated by the Federal government. USBR Central Valley Operations has reviewed LongTermGen and approved of its use. WAPA's CVP transmission system forms an integral part of the Sacramento-area transmission grid, from which the energy needs of the FRWP would be served. The transmission system that serves the FRWP project area occasionally exceeds its maximum rated transfer limits due to continued growth in the Sacramento market. Accordingly, the LongTermGen model was developed specifically for use by the CVP operators to analyze the energy demands of major development proposals and their effect on the power grid. As the LongTermGen model simulates power generation and use for the CVP, it is a useful tool to evaluate hydroelectric power production associated with each of the FRWP alternatives.

One of the primary purposes of the CVP is the delivery of irrigation water supply. Power needed to operate the CVP has first priority and is referred to as Project Use. This includes delivering water to Federal water contractors and wildlife refuges to meet certain environmental objectives. Power in excess of Project Use, called Preference Power, is sold as a means of repaying CVP development costs. LongTermGen, a spreadsheet model, uses operations data from CALSIM II simulations to determine both gross and net CVP power output for the study period. CALSIM II results used as input to LongTermGen include reservoir releases, reservoir storage, and delivery volumes at diversions utilizing WAPA power.

Power plants incorporated in LongTermGen include Trinity, Lewiston, Carr, Spring Creek, Shasta, Keswick, Folsom, Nimbus, New Melones, CVP San Luis and O'Neill. Lewiston is not currently marketed as CVP power; however it is left as a placeholder in the model in the event that it becomes part of CVP power. For the CVP San Luis and O'Neill facilities, the model performs a flow computation to calculate releases because CALSIM II does not simulate these facilities.

6.2 SIMULATION RESULTS

A separate simulation was done for each FRWP modeling scenario. Two figures are provided in this document for each scenario for 2001 Level of Development (LOD). One figure shows monthly average system total energy at the power plants, and the other shows monthly average system total energy at the load center. Two additional figures showing the same information are provided for 2020 LOD. The figures each include the total amount of power generated, project power use, and the net power production available for sale. Three tables are provided for each modeling scenario. One table provides the monthly data values corresponding to the "at plant" and "load center" generation curves in the figures. Two additional tables disaggregate the average monthly values in the figures for 2001 and 2020 LOD, showing the contribution of each power plant.

6.2.1 Alternative 1 Results

Figure 6.2-1 Simulated Monthly Average Total System Energy at Power Plants, Alternative 1, 2001 LOD

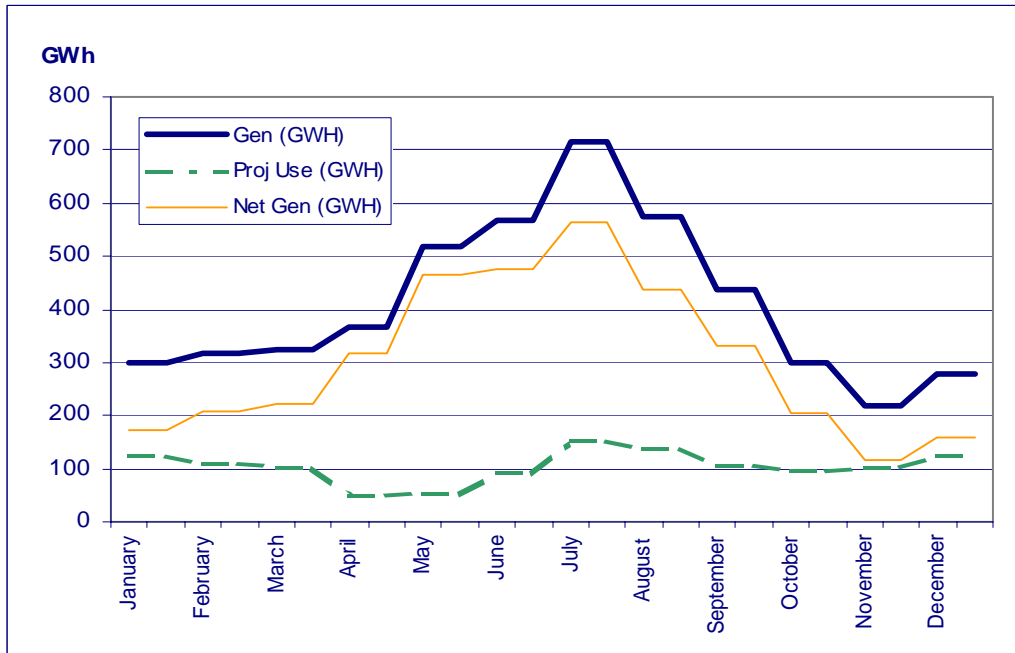


Figure 6.2-2 Simulated Monthly Average Total System Energy at Load Center, Alternative 1, 2001 LOD

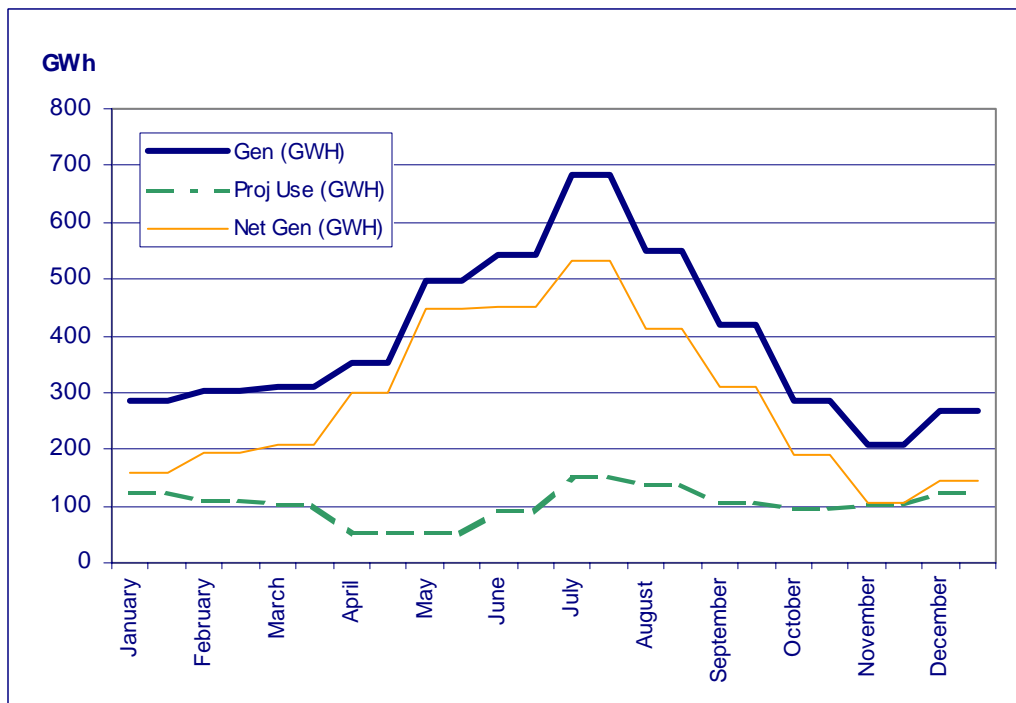


Figure 6.2-3 Simulated Monthly Average Total System Energy at Power Plants, Alternative 1, 2020 LOD

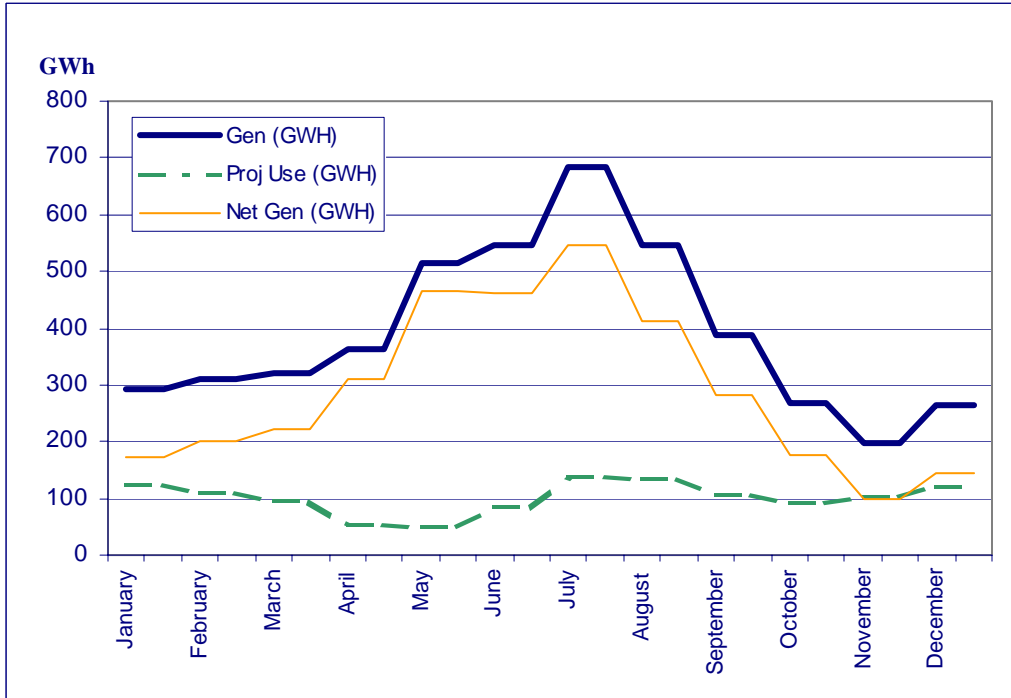


Figure 6.2-4 Simulated Monthly Average Total System Energy at Load Center, Alternative 1, 2020 LOD

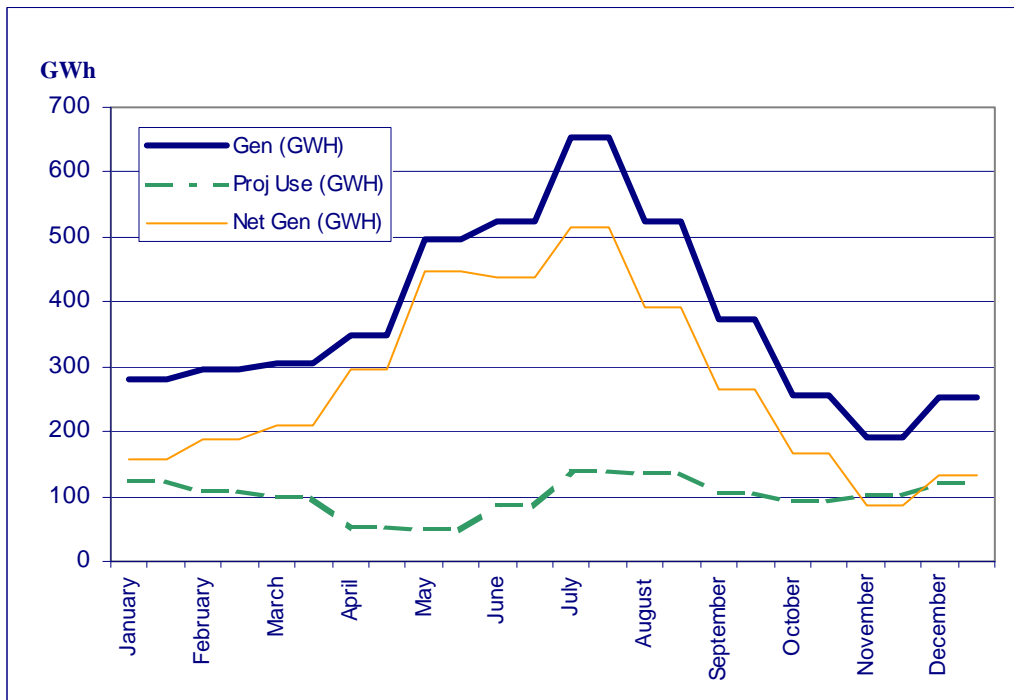


Table 6.2-1 Simulated Monthly Average Total System Energy at Plant and at Load Center, Alternative 1, 2001 LOD and 2020 LOD

Date	At Plant - 2001			At Plant - 2020			At Load Center - 2001			At Load Center - 2020		
	Gen GWh	Proj Use GWh	Net Gen GWh	Gen GWh	Proj Use GWh	Net Gen GWh	Gen GWh	Proj Use GWh	Net Gen GWh	Gen GWh	Proj Use GWh	Net Gen GWh
January	298	124	174	294	122	172	285	125	160	281	123	158
February	317	108	209	311	108	203	303	109	194	297	109	188
March	325	102	223	320	97	223	311	103	208	306	98	208
April	367	51	316	363	52	311	353	52	301	349	53	297
May	518	51	466	516	49	467	498	52	446	497	50	447
June	566	90	476	546	86	461	544	91	453	525	87	438
July	714	151	563	683	138	545	685	152	532	655	139	516
August	574	137	437	547	133	414	550	138	412	525	134	390
September	437	106	331	388	105	283	419	107	312	372	106	266
October	298	95	204	268	90	178	286	96	190	257	91	166
November	219	103	116	199	102	97	209	104	106	190	103	88
December	280	122	158	264	119	145	268	123	145	253	120	132

Table 6.2-2 Simulated Monthly Average Total System Energy at Individual Plants, Alternative 1, 2001 LOD

Date	Trinity	Lewiston	Carr	Sp. Ck.	Shasta	Keswick	Folsom	Nimbus	Tot. North	N. Mel.	CVP SL	O'Neill
January	17.5	0.0	13.7	27.0	139.7	30.4	52.4	6.0	286.6	11.3	0.2	0.0
February	12.2	0.0	5.8	25.5	165.4	32.9	57.9	6.4	306.1	10.8	0.1	0.0
March	16.7	0.0	11.5	24.8	156.2	32.7	57.2	6.8	305.8	18.2	0.9	0.1
April	16.7	0.0	10.0	13.0	158.0	32.7	58.1	6.8	295.2	61.6	9.6	0.5
May	65.0	0.0	13.4	16.7	197.9	41.2	64.4	7.0	405.6	76.1	33.5	2.4
June	42.4	0.0	40.1	37.8	227.8	50.5	68.7	7.6	474.9	51.1	37.6	2.3
July	59.7	0.0	77.4	70.5	270.6	64.4	71.9	8.7	623.2	65.5	24.0	1.1
August	56.2	0.0	77.1	69.7	195.7	51.9	41.7	5.4	497.7	60.5	14.9	0.6
September	51.8	0.0	71.7	67.8	107.8	34.0	42.6	5.6	381.2	55.6	0.1	0.0
October	30.8	0.0	39.5	42.7	100.1	29.0	25.1	3.4	270.6	27.8	0.1	0.0
November	12.7	0.0	11.7	17.6	102.6	25.2	35.2	4.5	209.5	9.5	0.0	0.0
December	14.7	0.0	8.7	15.8	146.5	31.9	46.1	5.6	269.4	10.6	0.1	0.0
Totals	396.4	0.0	380.7	428.7	1968.2	456.8	621.2	73.8	4325.9	458.3	120.9	7.0

Table 6.2-3 Simulated Monthly Average Total System Energy at Individual Plants, Alternative 1, 2020 LOD

Date	Trinity	Lewiston	Carr	Sp. Ck.	Shasta	Keswick	Folsom	Nimbus	Tot. North	N. Mel.	CVP SL	O'Neill
January	17.6	0.0	13.0	26.2	138.9	30.2	50.7	5.7	282.3	11.2	0.1	0.0
February	11.3	0.0	4.8	24.3	163.5	32.4	57.1	6.3	299.7	10.8	0.1	0.0
March	16.3	0.0	11.3	24.2	154.0	32.2	56.3	6.7	301.1	18.3	0.5	0.1
April	17.4	0.0	12.7	14.7	153.7	32.1	56.2	6.6	293.5	61.9	7.4	0.4
May	79.5	0.0	6.3	10.2	200.0	40.7	61.1	6.6	404.5	76.2	32.6	2.6
June	55.8	0.0	23.8	22.0	234.2	49.5	64.3	7.1	456.6	51.2	36.0	2.5
July	59.1	0.0	65.3	59.0	268.8	62.6	68.4	8.3	591.4	65.3	24.6	1.2
August	49.4	0.0	65.9	59.3	202.1	51.9	37.3	4.7	470.6	60.2	14.9	0.8
September	40.0	0.0	51.8	49.3	117.2	33.4	36.0	4.7	332.4	55.5	0.0	0.0
October	24.8	0.0	28.9	32.8	98.4	27.3	24.2	3.3	239.8	27.7	0.4	0.1
November	11.5	0.0	8.9	15.1	94.8	23.3	31.6	4.0	189.4	9.5	0.0	0.0
December	14.4	0.0	7.7	15.1	138.0	30.4	42.6	5.1	253.3	10.7	0.0	0.0
Totals	396.9	0.0	300.5	352.2	1963.7	446.1	586.1	69.2	4114.7	458.5	116.6	7.5

6.2.2 Alternatives 2-5 Results

Figure 6.2-5 Simulated Monthly Average Total System Energy at Power Plants, Alternatives 2-5, 2001 LOD

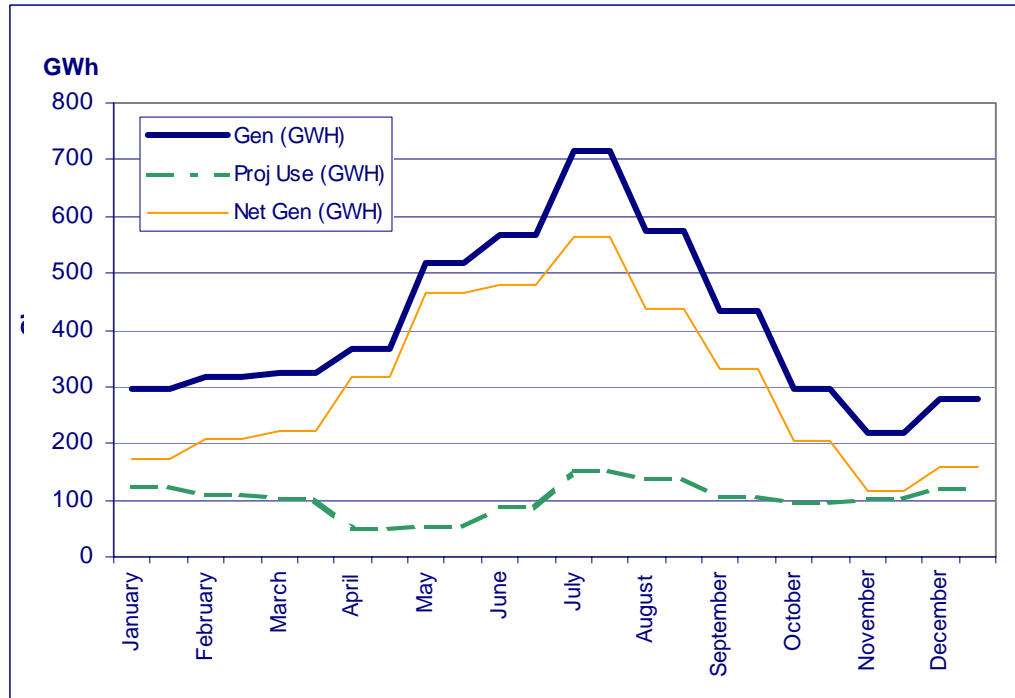


Figure 6.2-6 Simulated Monthly Average Total System Energy at Load Center, Alternatives 2-5, 2001 LOD

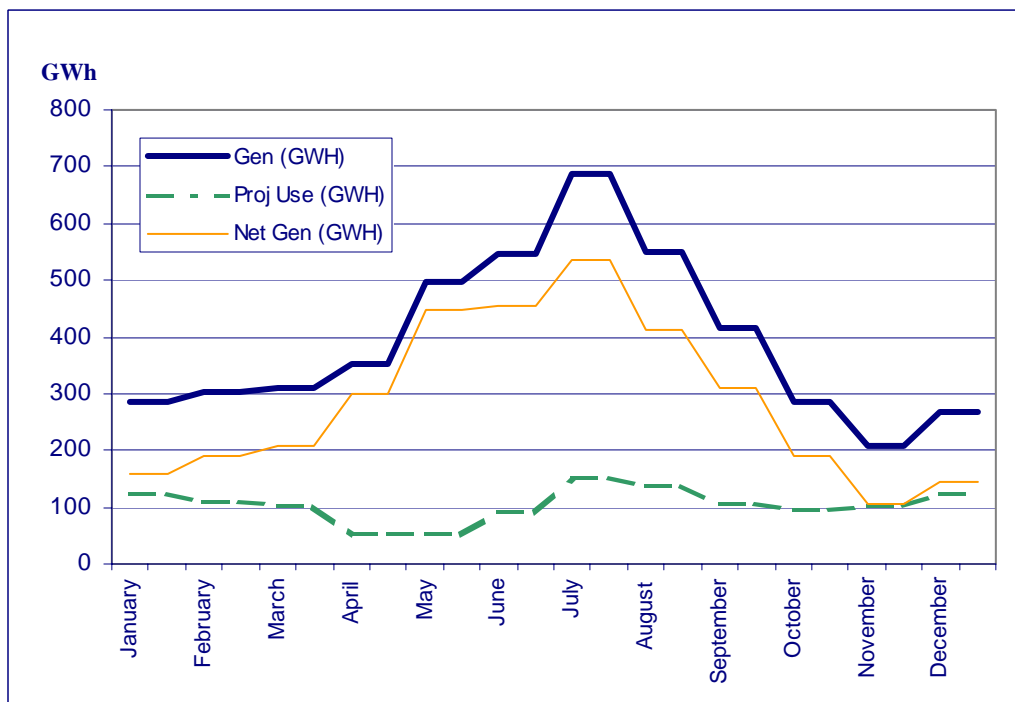


Figure 6.2-7 Simulated Monthly Average Total System Energy at Power Plants, Alternatives 2-5, 2020 LOD

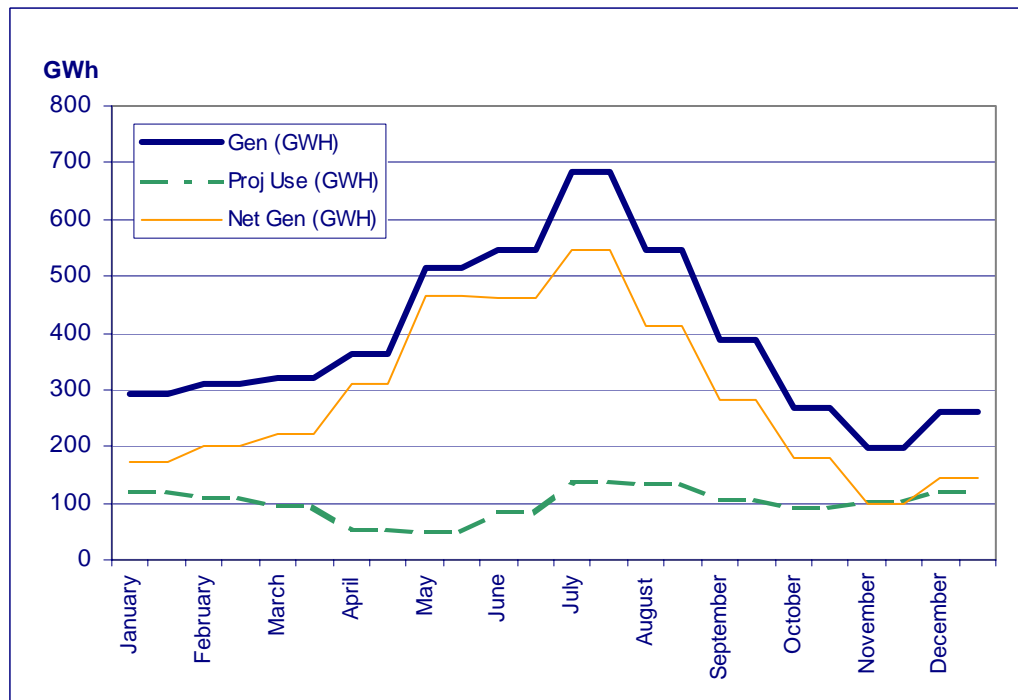


Figure 6.2-8 Simulated Monthly Average Total System Energy at Load Center, Alternatives 2-5, 2020 LOD

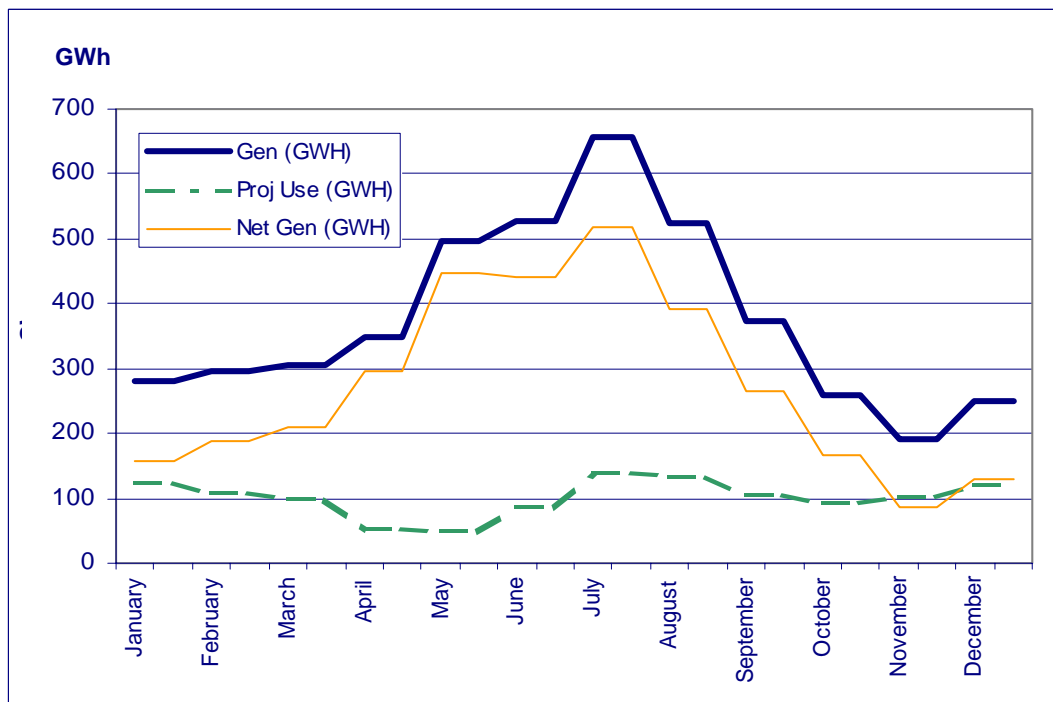


Table 6.2-4 Simulated Monthly Average Total System Energy at Plant and at Load Center, Alternatives 2-5, 2001 and 2020 LOD

Date	At Plant - 2001			At Plant - 2020			At Load Center - 2001			At Load Center - 2020		
	Gen GWh	Proj Use GWh	Net Gen GWh	Gen GWh	Proj Use GWh	Net Gen GWh	Gen GWh	Proj Use GWh	Net Gen GWh	Gen GWh	Proj Use GWh	Net Gen GWh
January	297	124	174	293	121	171	284	125	160	280	123	157
February	316	109	207	309	108	202	302	110	192	296	109	187
March	325	102	223	320	96	223	311	103	208	306	97	209
April	366	51	316	364	52	312	352	51	301	350	52	297
May	517	51	466	515	49	466	498	52	446	496	50	446
June	568	90	478	547	85	462	545	91	455	526	86	439
July	716	151	565	684	137	546	687	152	534	656	139	517
August	574	137	437	546	133	414	550	138	412	524	134	390
September	435	105	330	388	105	283	417	106	311	372	106	267
October	297	95	203	269	90	179	285	95	190	258	91	167
November	219	102	117	199	101	98	209	103	106	190	102	88
December	279	121	158	262	119	143	267	123	145	250	120	130

Table 6.2-5 Simulated Monthly Average Total System Energy at Individual Plants, Alternatives 2-5, 2001 LOD

Date	Trinity	Lewiston	Carr	Sp. Ck.	Shasta	Keswick	Folsom	Nimbus	Tot. North	N. Mel.	CVP SL	O'Neill
January	17.4	0.0	13.7	26.8	139.4	30.4	52.5	6.0	286.0	11.3	0.2	0.0
February	11.9	0.0	5.9	25.5	165.3	32.9	57.4	6.4	305.2	10.8	0.1	0.0
March	16.5	0.0	11.4	24.5	156.2	32.6	57.3	6.8	305.4	18.2	1.0	0.1
April	16.6	0.0	9.9	12.9	158.0	32.8	57.9	6.8	294.8	61.6	9.5	0.5
May	64.9	0.0	13.5	16.7	197.7	41.2	64.5	7.1	405.6	76.1	33.5	2.4
June	42.7	0.0	40.8	38.3	227.8	50.7	68.8	7.6	476.7	51.1	37.7	2.3
July	59.9	0.0	77.7	70.8	271.4	64.7	71.9	8.7	625.3	65.5	23.7	1.1
August	56.0	0.0	76.8	69.4	195.7	51.9	42.2	5.5	497.6	60.5	14.9	0.6
September	51.4	0.0	70.9	67.5	107.5	33.9	42.3	5.6	379.1	55.6	0.2	0.0
October	30.6	0.0	39.3	42.6	99.7	28.9	25.1	3.4	269.6	27.7	0.1	0.0
November	12.9	0.0	12.1	17.8	101.8	25.0	35.0	4.5	209.2	9.5	0.0	0.0
December	14.8	0.0	8.9	15.8	146.1	31.9	45.8	5.6	268.7	10.5	0.1	0.0
Totals	395.6	0.0	380.9	428.7	1966.6	457.0	620.7	73.9	4323.3	458.3	120.9	7.0

Table 6.2-6 Simulated Monthly Average Total System Energy at Individual Plants, Alternatives 2-5, 2020 LOD

Date	Trinity	Lewiston	Carr	Sp. Ck.	Shasta	Keswick	Folsom	Nimbus	Tot. North	N. Mel.	CVP SL	O'Neill
January	17.4	0.0	12.9	26.1	138.6	30.2	50.6	5.7	281.5	11.2	0.1	0.0
February	11.4	0.0	4.7	24.2	162.5	32.2	57.0	6.3	298.4	10.9	0.1	0.0
March	16.2	0.0	11.3	24.2	154.0	32.2	56.3	6.7	301.0	18.3	0.5	0.1
April	17.5	0.0	12.9	14.9	153.7	32.2	56.1	6.6	294.0	61.8	7.4	0.4
May	79.5	0.0	6.3	10.1	199.7	40.7	61.2	6.6	404.1	76.2	32.5	2.6
June	55.8	0.0	24.0	22.3	234.7	49.7	64.5	7.1	458.1	51.1	35.7	2.5
July	59.2	0.0	65.7	59.3	268.8	62.7	68.6	8.3	592.6	65.3	24.8	1.2
August	49.1	0.0	65.5	59.1	202.1	51.9	37.7	4.8	470.2	60.2	15.0	0.8
September	40.0	0.0	52.1	49.1	116.9	33.4	35.9	4.7	332.1	55.5	0.1	0.0
October	25.0	0.0	29.5	33.5	98.1	27.3	24.1	3.3	240.9	27.7	0.3	0.0
November	11.5	0.0	8.9	15.1	94.8	23.4	31.5	4.0	189.1	9.5	0.0	0.0
December	14.0	0.0	7.1	14.4	137.6	30.3	42.4	5.1	251.0	10.7	0.0	0.0
Totals	396.5	0.0	300.9	352.5	1961.7	446.2	586.0	69.2	4113.0	458.5	116.5	7.6

6.2.3 Alternative 6 Results

Figure 6.2-9 Simulated Monthly Average Total System Energy at Power Plants, Alternative 6, 2001 LOD

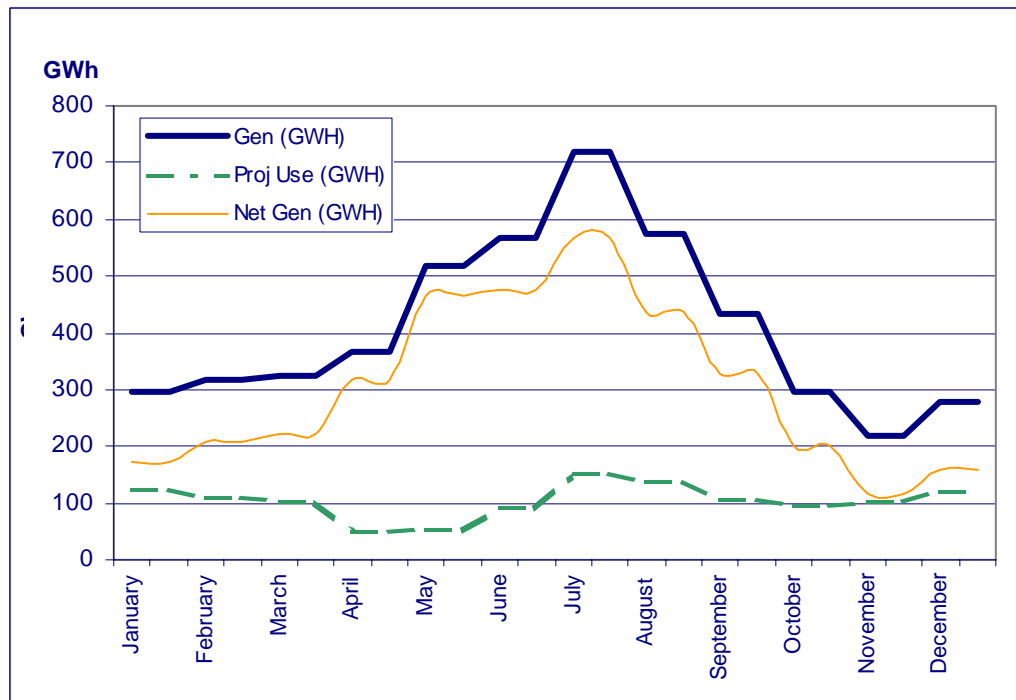


Figure 6.2-10 Simulated Monthly Average Total System Energy at Load Center, Alternative 6, 2001 LOD

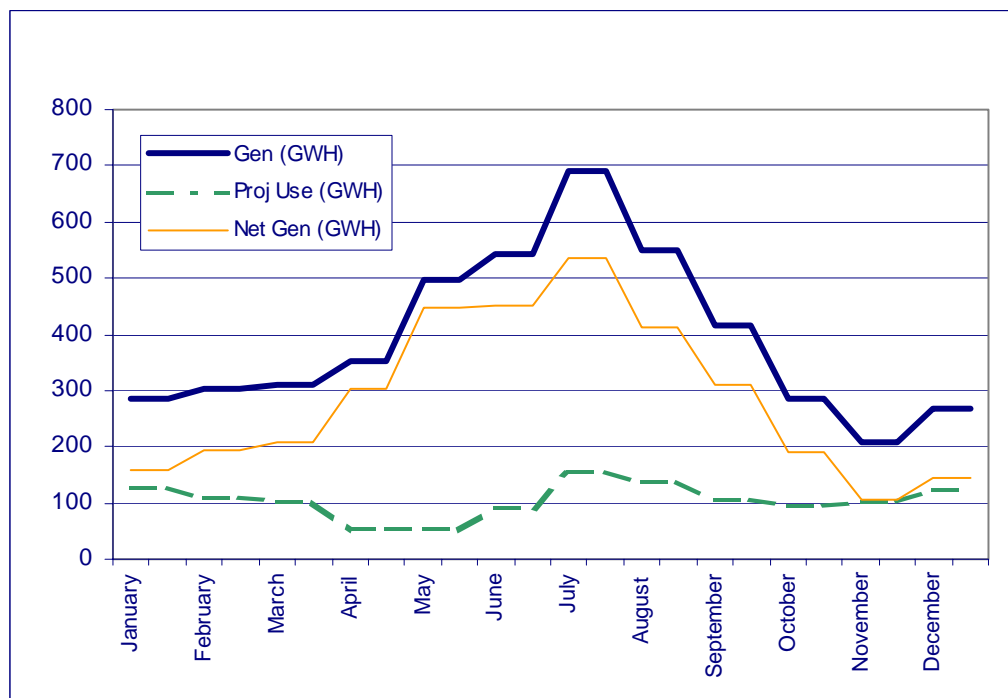


Figure 6.2-11 Simulated Monthly Average Total System Energy at Power Plants, Alternative 6, 2020 LOD

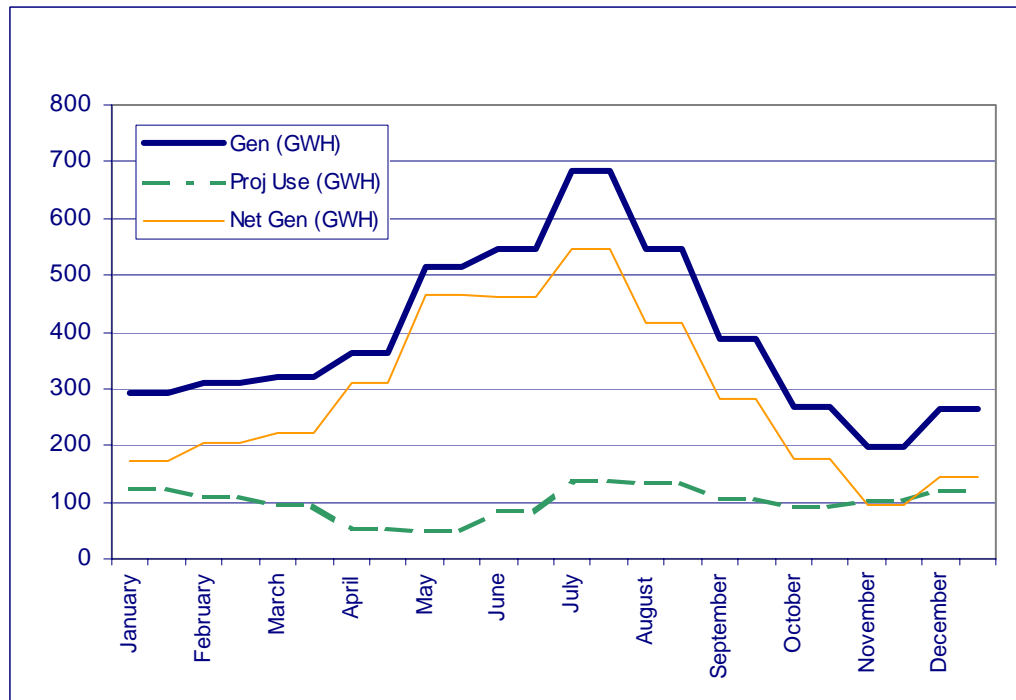


Figure 6.2-12 Simulated Monthly Average Total System Energy at Load Center, Alternative 6, 2020 LOD

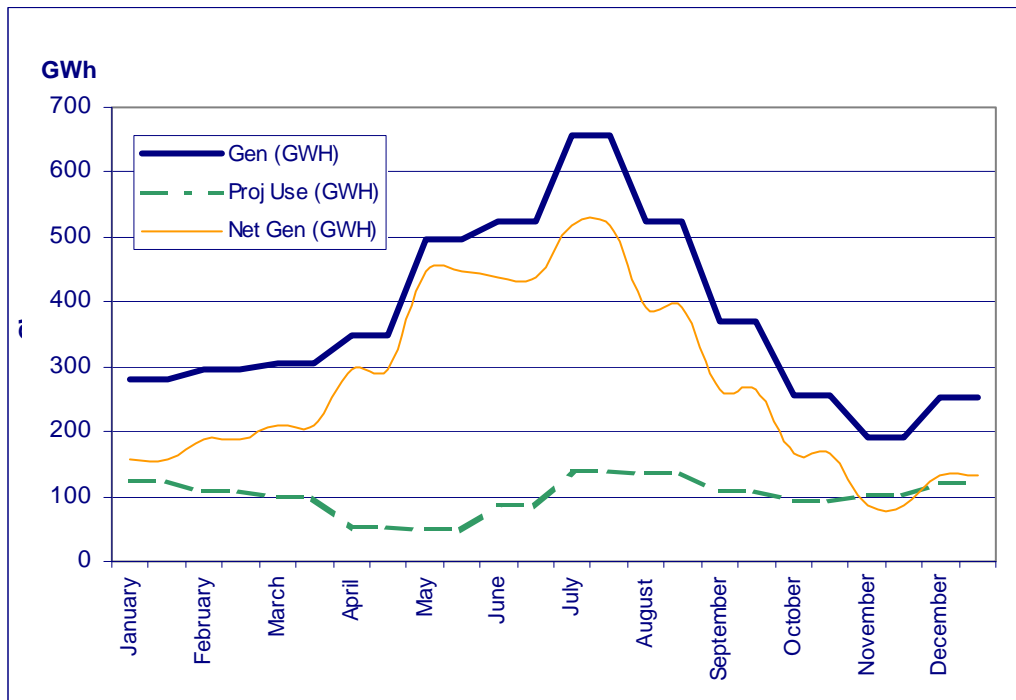


Table 6.2-7 Simulated Monthly Average Total System Energy at Plant and at Load Center, Alternative 6, 2001 and 2020 LOD

Date	At Plant - 2001			At Plant - 2020			At Load Center - 2001			At Load Center - 2020		
	Gen GWh	Proj Use GWh	Net Gen GWh	Gen GWh	Proj Use GWh	Net Gen GWh	Gen GWh	Proj Use GWh	Net Gen GWh	Gen GWh	Proj Use GWh	Net Gen GWh
January	297	124	173	294	122	172	284	125	159	281	123	158
February	317	109	208	310	108	203	303	110	193	297	109	188
March	324	102	223	320	97	224	310	103	208	306	98	209
April	367	51	316	364	52	312	353	52	302	350	53	297
May	518	51	466	516	49	467	498	52	446	496	50	447
June	566	90	476	546	86	461	543	91	452	525	86	438
July	719	152	567	684	137	547	690	153	536	657	139	518
August	574	137	437	547	133	414	551	139	412	525	134	391
September	435	106	329	387	105	282	417	107	311	372	106	265
October	297	95	202	268	90	178	285	96	189	257	91	166
November	218	102	117	198	102	97	209	103	106	190	103	87
December	279	121	158	263	119	144	267	122	145	252	120	132

Table 6.2-8 Simulated Monthly Average Total System Energy at Individual Plants Alternative 6, 2001 LOD

Date	Trinity	Lewiston	Carr	Sp. Ck.	Shasta	Keswick	Folsom	Nimbus	Tot. North	N. Mel.	CVP SL	O'Neill
January	17.3	0.0	13.5	26.7	139.8	30.4	52.1	5.9	285.8	11.2	0.2	0.0
February	12.1	0.0	5.8	25.5	165.4	32.9	57.7	6.4	305.8	10.8	0.1	0.0
March	16.5	0.0	11.3	24.6	156.0	32.6	57.2	6.8	305.0	18.2	0.9	0.1
April	16.7	0.0	10.1	13.1	158.1	32.7	58.1	6.8	295.7	61.6	9.6	0.5
May	64.9	0.0	13.4	16.7	198.0	41.2	64.4	7.0	405.7	76.1	33.5	2.4
June	42.2	0.0	39.9	37.5	228.2	50.6	68.7	7.6	474.7	51.1	37.7	2.3
July	60.6	0.0	78.7	71.6	272.0	64.8	72.2	8.8	628.7	65.5	23.6	1.1
August	56.2	0.0	77.1	69.7	195.3	51.9	42.1	5.4	497.7	60.5	14.8	0.6
September	51.5	0.0	71.1	67.2	107.8	33.9	42.2	5.6	379.4	55.6	0.1	0.0
October	30.6	0.0	39.1	42.3	99.8	28.9	25.2	3.4	269.3	27.7	0.1	0.0
November	12.7	0.0	11.6	17.5	102.4	25.1	35.1	4.5	208.9	9.5	0.0	0.0
December	14.7	0.0	8.7	15.8	146.0	31.8	46.0	5.6	268.6	10.6	0.1	0.0
Totals	396.1	0.0	380.2	428.3	1968.9	456.9	621.0	73.9	4325.4	458.4	120.6	7.0

Table 6.2-9 Simulated Monthly Average Total System Energy at Individual Plants Alternative 6, 2020 LOD

Date	Trinity	Lewiston	Carr	Sp. Ck.	Shasta	Keswick	Folsom	Nimbus	Tot. North	N. Mel.	CVP SL	O'Neill
January	17.5	0.0	13.1	26.3	138.7	30.2	50.7	5.7	282.3	11.2	0.1	0.0
February	11.2	0.0	4.7	24.2	163.4	32.4	57.1	6.3	299.4	10.9	0.1	0.0
March	16.3	0.0	11.4	24.3	154.1	32.2	56.3	6.7	301.3	18.2	0.5	0.1
April	17.5	0.0	12.8	14.8	153.9	32.2	56.2	6.6	294.0	61.9	7.4	0.4
May	79.5	0.0	6.3	10.2	199.8	40.7	61.1	6.6	404.2	76.2	32.6	2.6
June	55.8	0.0	23.8	22.1	234.3	49.5	64.3	7.1	456.9	51.2	35.9	2.5
July	59.1	0.0	65.4	59.0	269.5	62.8	68.9	8.3	592.9	65.3	24.7	1.3
August	49.4	0.0	66.0	59.5	202.0	51.9	37.5	4.8	471.1	60.2	15.0	0.8
September	39.9	0.0	51.8	49.1	116.9	33.3	35.8	4.7	331.5	55.5	0.0	0.0
October	24.8	0.0	28.9	32.8	98.5	27.3	24.1	3.3	239.6	27.7	0.4	0.1
November	11.5	0.0	9.0	15.2	94.5	23.3	31.4	4.0	188.9	9.4	0.0	0.0
December	14.3	0.0	7.6	15.0	137.6	30.3	42.6	5.1	252.5	10.8	0.0	0.0
Totals	396.7	0.0	300.7	352.4	1963.2	446.2	586.1	69.2	4114.6	458.5	116.8	7.6