ECONOMIC ANALYSIS SUMMARY

Fort Churchill Unit 2 **Boiler Design:** **Babcock & Wilcox Gas/Oil**

Parameter	Current Operation	NOx Control				
		LNB	LNB w/ FGR	LNB w/SNCR	ROFA w/Rotamix	LNB w/SCR
Case	**1**	**2**	**3**	**4**	**5**	**6**
NOx Emission Control System	None	LNB	LNB w/ FGR	LNB w/SNCR	ROFA w/Rotamix	LNB w/SCR
TOTAL INSTALLED CAPITAL COST ($)	**0**	**600,000**	**920,000**	**2,523,750**	**5,250,940**	**28,625,000**
Including Other Owner Costs ($)	**0**	**1,050,000**	**1,610,000**	**4,416,563**	**9,189,145**	**35,781,250**
FIRST YEAR O&M COST ($)						
Operating Labor ($)	0	11,300	16,950	22,600	22,600	28,250
Maintenance Material ($)	0	22,600	33,900	45,200	45,200	56,500
Maintenance Labor ($)	0	11,300	16,950	22,600	22,600	28,250
Administrative Labor ($)	0	0	0	0	0	0
TOTAL FIXED O&M COST	**0**	**45,200**	**67,800**	**90,400**	**90,400**	**113,000**
Reagent Cost	0	0	0	278,097	296,453	276,989
SCR Catalyst / FF Bag Cost	0	0	0	0	0	169,500
Electric Power Cost	0	0	252,419	25,242	277,661	126,210
Makeup Water Cost	0	0	0	0	0	0
TOTAL VARIABLE O&M COST	**0**	**0**	**252,419**	**303,339**	**574,114**	**572,698**
TOTAL FIRST YEAR O&M COST	**0**	**45,200**	**320,219**	**393,739**	**664,514**	**685,698**
FIRST YEAR DEBT SERVICE ($)	0	111,359	170,750	468,403	974,564	3,794,816
TOTAL FIRST YEAR COST ($)	**0**	**156,559**	**490,970**	**862,142**	**1,639,078**	**4,480,515**
Power Consumption (MW)	**0.0**	**0.0**	**1.1**	**0.1**	**1.2**	**0.6**
Annual Power Usage (Million kW-Hr/Yr)	**0.0**	**0.0**	**5.0**	**0.5**	**5.6**	**2.5**
CONTROL COST ($/Ton Removed)						
NOx Removal Rate (%)	**0.0%**	**45.4%**	**53.2%**	**59.1%**	**63.0%**	**86.4%**
NOx Removed (Tons/Yr)	**0**	**642**	**752**	**834**	**890**	**1,220**
First Year Average Control Cost ($/Ton NOx Rem.)	**0**	**244**	**653**	**1,033**	**1,843**	**3,673**
Incremental Control Cost ($/Ton NOx Removed)	**0**	**244**	**3,036**	**4,493**	**14,106**	**8,598**
		2-1	3-2	4-3	5-4	6-5

For the other owner costs a factor of 1.75 was used for everything except the SCR to represent balance of plant cost, electrical costs, AFUDC etc.

For the SCR a factor of 1.25 was used because the material cost of $250/kW from the CH2M HILL database already included the balance of plant and a few other costs

INPUT CALCULATIONS

Fort Churchill Unit 2 **Boiler Design:** **Babcock & Wilcox Gas/Oil**

Parameter	Current Operation	NOx Control					Comments
		LNB	LNB w/ FGR	LNB w/SNCR	ROFA w/Rotamix	LNB w/SCR	
Case	1	2	3	4	5	6	
NOx Emission Control System	None	LNB	LNB w/ FGR	LNB w/SNCR	ROFA w/Rotamix	LNB w/SCR	
Unit Design and Coal Characteristics							
Type of Unit	PC	PC	PC	PC	PC	PC	
Net Power Output (kW)	113,000	113,000	113,000	113,000	113,000	113,000	
Net Plant Heat Rate (Btu/kW-Hr)	10,910	10,910	10,910	10,910	10,910	10,910	
Boiler Fuel	No. 6 Fuel Oil	No. 6 Fuel Oil	No. 6 Fuel Oil	No. 6 Fuel Oil	No. 6 Fuel Oil	No. 6 Fuel Oil	
Fuel Heating Value (Btu/Lb)	19,300	19,300	19,300	19,300	19,300	19,300	
Fuel Sulfur Content (wt.%)	0.637%	0.637%	0.637%	0.637%	0.637%	0.637%	
Fuel Ash Content (wt.%)	0.038%	0.038%	0.038%	0.038%	0.038%	0.038%	
Boiler Heat Input, each (MMBtu/Hr)	1,233	1,233	1,233	1,233	1,233	1,233	
Fuel Flow Rate (Lb/Hr)	63,877	63,877	63,877	63,877	63,877	63,877	
(Ton/Yr)	142,689	142,689	142,689	142,689	142,689	142,689	
(MMBtu/Yr)	5,507,791	5,507,791	5,507,791	5,507,791	5,507,791	5,507,791	
Emissions							
Uncontrolled NOx (Lb/Hr)	632	632	632	632	632	632	
(Lb/MMBtu)	0.51	0.51	0.51	0.51	0.51	0.51	
(Lb Moles/Hr)	21.07	21.07	21.07	21.07	21.07	21.07	
(Tons/Yr)	1,413	1,413	1,413	1,413	1,413	1,413	
NOx Removal Rate (%)	0.0%	45.4%	53.2%	59.1%	63.0%	86.4%	
(Lb/Hr)	0	287	337	374	398	546	
(Lb Moles/Hr)	0.00	9.57	11.22	12.45	13.27	18.20	
(Ton/Yr)	0	642	752	834	890	1,220	
NOx Emission Rate (Lb/Hr)	632	345	296	259	234	86	
(Lb/MMBtu)	0.51	0.28	0.24	0.21	0.19	0.07	
(Ton/Yr)	1,413	771	661	578	523	193	
General Plant Data							
Annual Operation (Hours/Year)	4,468	4,468	4,468	4,468	4,468	4,468	
Annual On-Site Power Plant Capacity Factor	51%	0.51	0.51	0.51	0.51	0.51	
Economic Factors							
Interest Rate (%)	8.55%	8.55%	8.55%	8.55%	8.55%	8.55%	
Discount Rate (%)	9.00%	9.00%	9.00%	9.00%	9.00%	9.00%	
Plant Economic Life (Years)	20	20	20	20	20	20	
Installed Capital Costs (including owner costs)							
NOx Emission Control System ($2007)	0	1,050,000	1,610,000	4,416,563	9,189,145	35,781,250	
Total Emission Control Systems ($2007)	0	1,050,000	1,610,000	4,416,563	9,189,145	35,781,250	
NOx Emission Control System ($/kW)	0	9	14	39	81	317	
Total Emission Control Systems ($/kW)	0	9	14	39	81	317	
Total Fixed Operating & Maintenance Costs							
Operating Labor ($)	0	11,300	16,950	22,600	22,600	28,250	
Maintenance Material ($)	0	22,600	33,900	45,200	45,200	56,500	
Maintenance Labor ($)	0	11,300	16,950	22,600	22,600	28,250	
Administrative Labor ($)	0	0	0	0	0	0	
Total Fixed O&M Cost ($)	0	45,200	67,800	90,400	90,400	113,000	
Annual Fixed O&M Cost Escalation Rate (%)	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	
Reagent Cost	None	None	None	Urea	Urea	Anhydrous NH3	
Unit Cost ($/Ton)	0.00	0.00	370.00	370.00	370.00	400.00	
($/Lb)	0.000	0.000	0.185	0.185	0.185	0.200	
Molar Stoichiometry	0.00	0.00	0.00	0.45	0.45	1.00	
Reagent Purity (Wt.%)	100%	100%	100%	100%	100%	100%	
Reagent Usage (Lb/Hr)	0	0	0	336	359	310	
First Year Reagent Cost ($)	0	0	0	278,097	296,453	276,989	
Annual Reagent Cost Escalation Rate (%)	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	
SCR Catalyst / FF Bag Replacement Cost						SCR Catalyst	
Annual SCR Catalyst (m3) / No. FF Bags	0	0	0	0	0	57	
SCR Catalyst ($/m3) / Bag Cost ($/ea.)	3,000	3,000	3,000	3,000	3,000	3,000	
First Year SCR Catalyst / Bag Replace. Cost ($)	0	0	0	0	0	169,500	
Annual SCR Catalyst / Bag Cost Esc. Rate (%)	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	
Auxiliary Power Cost							
Auxiliary Power Requirement (% of Plant Output)	0.00%	0.00%	1.00%	0.10%	1.10%	0.50%	
(MW)	0.00	0.00	1.13	0.11	1.24	0.57	
Unit Cost ($2007/MW-Hr)	50.00	50.00	50.00	50.00	50.00	50.00	
First Year Auxiliary Power Cost ($)	0	0	252,419	25,242	277,661	126,210	
Annual Power Cost Escalation Rate (%)	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	

Economic factors as per Sierra Pacific 2008 Planning Guidelines

Interest Rate
Plant Life

Fort Churchill Unit 2 — Current Operation

Year	Date	TOTAL FIXED O&M COST	Reagent Cost	SCR Catalyst / FF Bag Cost	Electric Power Cost	Makeup Water Cost	TOTAL VARIABLE O&M COST	DEBT SERVICE	TOTAL ANNUAL COST	Control Cost ($/Ton Removed)
0	2013									
1	2014	-	-	-	-	-	-	-	-	-
2	2015	-	-	-	-	-	-	-	-	-
3	2016	-	-	-	-	-	-	-	-	-
4	2017	-	-	-	-	-	-	-	-	-
5	2018	-	-	-	-	-	-	-	-	-
6	2019	-	-	-	-	-	-	-	-	-
7	2020	-	-	-	-	-	-	-	-	-
8	2021	-	-	-	-	-	-	-	-	-
9	2022	-	-	-	-	-	-	-	-	-
10	2023	-	-	-	-	-	-	-	-	-
11	2024	-	-	-	-	-	-	-	-	-
12	2025	-	-	-	-	-	-	-	-	-
13	2026	-	-	-	-	-	-	-	-	-
14	2027	-	-	-	-	-	-	-	-	-
15	2028	-	-	-	-	-	-	-	-	-
16	2029	-	-	-	-	-	-	-	-	-
17	2030	-	-	-	-	-	-	-	-	-
18	2031	-	-	-	-	-	-	-	-	-
19	2032	-	-	-	-	-	-	-	-	-
20	2033	-	-	-	-	-	-	-	-	-

Fort Churchill Unit 2 — LNB

Year	Date	TOTAL FIXED O&M COST	Reagent Cost	SCR Catalyst / FF Bag Cost	Electric Power Cost	Makeup Water Cost	TOTAL VARIABLE O&M COST	DEBT SERVICE	TOTAL ANNUAL COST	Control Cost ($/Ton NOx Removed)
0	2013									
1	2014	45,200	-	-	-	-	-	111,359	156,559	244
2	2015	46,104	-	-	-	-	-	111,359	157,463	245
3	2016	47,026	-	-	-	-	-	111,359	158,385	247
4	2017	47,967	-	-	-	-	-	111,359	159,325	248
5	2018	48,926	-	-	-	-	-	111,359	160,285	250
6	2019	49,904	-	-	-	-	-	111,359	161,263	251
7	2020	50,903	-	-	-	-	-	111,359	162,261	253
8	2021	51,921	-	-	-	-	-	111,359	163,279	254
9	2022	52,959	-	-	-	-	-	111,359	164,318	256
10	2023	54,018	-	-	-	-	-	111,359	165,377	258
11	2024	55,099	-	-	-	-	-	111,359	166,457	259
12	2025	56,201	-	-	-	-	-	111,359	167,559	261
13	2026	57,325	-	-	-	-	-	111,359	168,683	263
14	2027	58,471	-	-	-	-	-	111,359	169,830	265
15	2028	59,640	-	-	-	-	-	111,359	170,999	266
16	2029	60,833	-	-	-	-	-	111,359	172,192	268
17	2030	62,050	-	-	-	-	-	111,359	173,409	270
18	2031	63,291	-	-	-	-	-	111,359	174,650	272
19	2032	64,557	-	-	-	-	-	111,359	175,916	274
20	2033	65,848	-	-	-	-	-	111,359	177,207	276

Fort Churchill Unit 2 — LNB w/ FGR

Year	Date	TOTAL FIXED O&M COST	Reagent Cost	SCR Catalyst / FF Bag Cost	Electric Power Cost	Makeup Water Cost	TOTAL VARIABLE O&M COST	DEBT SERVICE	TOTAL ANNUAL COST	Control Cost ($/Ton NOx Removed)
0	2013									
1	2014	67,800	-	-	252,419	-	252,419	170,750	490,970	653
2	2015	69,156	-	-	257,468	-	257,468	170,750	497,374	662
3	2016	70,539	-	-	262,617	-	262,617	170,750	503,906	670
4	2017	71,950	-	-	267,869	-	267,869	170,750	510,570	679
5	2018	73,389	-	-	273,227	-	273,227	170,750	517,366	688
6	2019	74,857	-	-	278,691	-	278,691	170,750	524,298	697
7	2020	76,354	-	-	284,265	-	284,265	170,750	531,369	707
8	2021	77,881	-	-	289,951	-	289,951	170,750	538,582	716
9	2022	79,439	-	-	295,750	-	295,750	170,750	545,938	726
10	2023	81,027	-	-	301,665	-	301,665	170,750	553,442	736
11	2024	82,648	-	-	307,698	-	307,698	170,750	561,096	746
12	2025	84,301	-	-	313,852	-	313,852	170,750	568,903	757
13	2026	85,987	-	-	320,129	-	320,129	170,750	576,866	767
14	2027	87,707	-	-	326,531	-	326,531	170,750	584,988	778
15	2028	89,461	-	-	333,062	-	333,062	170,750	593,273	789
16	2029	91,250	-	-	339,723	-	339,723	170,750	601,723	800
17	2030	93,075	-	-	346,518	-	346,518	170,750	610,343	812
18	2031	94,936	-	-	353,448	-	353,448	170,750	619,135	824
19	2032	96,835	-	-	360,517	-	360,517	170,750	628,102	835
20	2033	98,772	-	-	367,727	-	367,727	170,750	637,249	848

Fort Churchill Unit 2 — LNB w/SNCR

Year	Date	TOTAL FIXED O&M COST	Reagent Cost	SCR Catalyst / FF Bag Cost	Electric Power Cost	Makeup Water Cost	TOTAL VARIABLE O&M COST	DEBT SERVICE	TOTAL ANNUAL COST	Control Cost ($/Ton NOx Removed)
0	2013									
1	2014	90,400	278,097	-	25,242	-	303,339	468,403	862,142	1,033
2	2015	92,208	283,659	-	25,747	-	309,406	468,403	870,016	1,043
3	2016	94,052	289,332	-	26,262	-	315,594	468,403	878,049	1,052
4	2017	95,933	295,119	-	26,787	-	321,905	468,403	886,242	1,062
5	2018	97,852	301,021	-	27,323	-	328,344	468,403	894,598	1,072
6	2019	99,809	307,041	-	27,869	-	334,910	468,403	903,122	1,082
7	2020	101,805	313,182	-	28,427	-	341,609	468,403	911,817	1,093
8	2021	103,841	319,446	-	28,995	-	348,441	468,403	920,685	1,103
9	2022	105,918	325,835	-	29,575	-	355,410	468,403	929,731	1,114
10	2023	108,036	332,351	-	30,166	-	362,518	468,403	938,957	1,125
11	2024	110,197	338,998	-	30,770	-	369,768	468,403	948,368	1,137
12	2025	112,401	345,778	-	31,385	-	377,164	468,403	957,968	1,148
13	2026	114,649	352,694	-	32,013	-	384,707	468,403	967,759	1,160
14	2027	116,942	359,748	-	32,653	-	392,401	468,403	977,746	1,172
15	2028	119,281	366,943	-	33,306	-	400,249	468,403	987,933	1,184
16	2029	121,666	374,282	-	33,972	-	408,254	468,403	998,323	1,196
17	2030	124,100	381,767	-	34,652	-	416,419	468,403	1,008,922	1,209
18	2031	126,582	389,403	-	35,345	-	424,747	468,403	1,019,732	1,222
19	2032	129,113	397,191	-	36,052	-	433,242	468,403	1,030,759	1,235
20	2033	131,696	405,135	-	36,773	-	441,907	468,403	1,042,006	1,249

Fort Churchill Unit 2 — ROFA w/Rotamix

Year	Date	TOTAL FIXED O&M COST	Reagent Cost	SCR Catalyst / FF Bag Cost	Electric Power Cost	Makeup Water Cost	TOTAL VARIABLE O&M COST	DEBT SERVICE	TOTAL ANNUAL COST	Control Cost ($/Ton NOx Removed)
0	2013									
1	2014	90,400	296,453	-	277,661	-	574,114	974,564	1,639,078	1,843
2	2015	92,208	302,382	-	283,215	-	585,597	974,564	1,652,369	1,858
3	2016	94,052	308,430	-	288,879	-	597,309	974,564	1,665,925	1,873
4	2017	95,933	314,598	-	294,656	-	609,255	974,564	1,679,752	1,888
5	2018	97,852	320,890	-	300,550	-	621,440	974,564	1,693,856	1,904
6	2019	99,809	327,308	-	306,561	-	633,869	974,564	1,708,242	1,920
7	2020	101,805	333,854	-	312,692	-	646,546	974,564	1,722,915	1,937
8	2021	103,841	340,531	-	318,946	-	659,477	974,564	1,737,882	1,954
9	2022	105,918	347,342	-	325,325	-	672,666	974,564	1,753,148	1,971
10	2023	108,036	354,289	-	331,831	-	686,120	974,564	1,768,720	1,988
11	2024	110,197	361,375	-	338,468	-	699,842	974,564	1,784,603	2,006
12	2025	112,401	368,602	-	345,237	-	713,839	974,564	1,800,804	2,024
13	2026	114,649	375,974	-	352,142	-	728,116	974,564	1,817,329	2,043
14	2027	116,942	383,494	-	359,185	-	742,678	974,564	1,834,184	2,062
15	2028	119,281	391,163	-	366,368	-	757,532	974,564	1,851,377	2,081
16	2029	121,666	398,987	-	373,696	-	772,682	974,564	1,868,913	2,101
17	2030	124,100	406,966	-	381,170	-	788,136	974,564	1,886,800	2,121
18	2031	126,582	415,106	-	388,793	-	803,899	974,564	1,905,045	2,142
19	2032	129,113	423,408	-	396,569	-	819,977	974,564	1,923,654	2,163
20	2033	131,696	431,876	-	404,500	-	836,376	974,564	1,942,636	2,184

Fort Churchill Unit 2 — LNB w/SCR

Year	Date	TOTAL FIXED O&M COST	Reagent Cost	SCR Catalyst / FF Bag Cost	Electric Power Cost	Makeup Water Cost	TOTAL VARIABLE O&M COST	DEBT SERVICE	TOTAL ANNUAL COST	Control Cost ($/Ton NOx Removed)
0	2013									
1	2014	113,000	276,989	169,500	126,210	-	572,698	3,794,816	4,480,515	3,673
2	2015	115,260	282,528	172,890	128,734	-	584,152	3,794,816	4,494,229	3,684
3	2016	117,565	288,179	176,348	131,309	-	595,835	3,794,816	4,508,217	3,695
4	2017	119,917	293,942	179,875	133,935	-	607,752	3,794,816	4,522,485	3,707
5	2018	122,315	299,821	183,472	136,613	-	619,907	3,794,816	4,537,038	3,719
6	2019	124,761	305,818	187,142	139,346	-	632,305	3,794,816	4,551,883	3,731
7	2020	127,256	311,934	190,885	142,133	-	644,951	3,794,816	4,567,024	3,744
8	2021	129,801	318,173	194,702	144,975	-	657,850	3,794,816	4,582,468	3,756
9	2022	132,398	324,536	198,596	147,875	-	671,007	3,794,816	4,598,221	3,769
10	2023	135,045	331,027	202,568	150,832	-	684,427	3,794,816	4,614,289	3,782
11	2024	137,746	337,648	206,620	153,849	-	698,116	3,794,816	4,630,679	3,796
12	2025	140,501	344,400	210,752	156,926	-	712,078	3,794,816	4,647,396	3,809
13	2026	143,311	351,288	214,967	160,064	-	726,320	3,794,816	4,664,448	3,823
14	2027	146,178	358,314	219,266	163,266	-	740,846	3,794,816	4,681,840	3,838
15	2028	149,101	365,481	223,652	166,531	-	755,663	3,794,816	4,699,581	3,852
16	2029	152,083	372,790	228,125	169,862	-	770,776	3,794,816	4,717,676	3,867
17	2030	155,125	380,246	232,687	173,259	-	786,192	3,794,816	4,736,133	3,882
18	2031	158,227	387,851	237,341	176,724	-	801,916	3,794,816	4,754,960	3,898
19	2032	161,392	395,608	242,088	180,259	-	817,954	3,794,816	4,774,162	3,913
20	2033	164,620	403,520	246,929	183,864	-	834,313	3,794,816	4,793,749	3,929

ECONOMIC ANALYSIS SUMMARY

Fort Churchill Unit 2 **Boiler Design:**

Parameter	Current Operation	SO2 Control
		SDA
Case	**1**	**7**
SO2 Emission Control System	None	SDA
TOTAL INSTALLED CAPITAL COST ($)	**0**	**22,000,000**
Including Other Owner Costs ($)	**0**	**---**
FIRST YEAR O&M COST ($)		
Operating Labor ($)	0	56,500
Maintenance Material ($)	0	113,000
Maintenance Labor ($)	0	56,500
Administrative Labor ($)	0	0
TOTAL FIXED O&M COST	**0**	**226,000**
Reagent Cost	0	177,197
SCR Catalyst / FF Bag Cost	0	0
Electric Power Cost	0	89,352
Makeup Water Cost	0	25,112
TOTAL VARIABLE O&M COST	**0**	**291,662**
TOTAL FIRST YEAR O&M COST	**0**	**517,662**
FIRST YEAR DEBT SERVICE ($)	0	2,333,232
TOTAL FIRST YEAR COST ($)	**0**	**2,850,894**
Power Consumption (MW)	**0.0**	**0.4**
Annual Power Usage (Million kW-Hr/Yr)	**0.0**	**1.8**
CONTROL COST ($/Ton Removed)		
SO2 Removal Rate (%)	**23.5%**	**84.8%**
SO2 Removed (Tons/Yr)	**0**	**1,540**
First Year Average Control Cost ($/Ton SO2 Rem.)	**0**	**1,852**
Incremental Control Cost ($/Ton SO2 Removed)	**Base**	**1,852**
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INPUT CALCULATIONS

Fort Churchill Unit 2 **Boiler Design:**

Parameter	Current Operation	SO2 Control SDA
Case	1	7
SO2 Emission Control System	None	SDA
Unit Design and Coal Characteristics		
Type of Unit	PC	PC
Net Power Output (kW)	113,000	113,000
Net Plant Heat Rate (Btu/kW-Hr)	10,910	10,910
Boiler Fuel	No. 6 Fuel Oil	No. 6 Fuel Oil
Fuel Heating Value (Btu/Lb)	19,300	19,300
Fuel Sulfur Content (wt.%)	0.637%	0.637%
Fuel Ash Content (wt.%)	0.038%	0.038%
Boiler Heat Input, each (MMBtu/Hr)	1,233	1,233
Fuel Flow Rate (Lb/Hr)	63,877	63,877
(Ton/Yr)	142,689	142,689
(MMBtu/Yr)	5,507,791	5,507,791
Emissions		
Uncontrolled SO2 (Lb/Hr)	813	813
(Lb/MMBtu)	0.659	0.659
(Lb Moles/Hr)	12.68	12.68
(Tons/Yr)	1,815	1,815
SO2 Removal Rate (%)	23.5%	84.8%
(Lb/Hr)	191	689
(Ton/Yr)	427	1,540
SO2 Emission Rate (Lb/Hr)	621	123
(Lb/MMBtu)	0.504	0.10
(Ton/Yr)	1,388	275
General Plant Data		
Annual Operation (Hours/Year)	4,468	4,468
Annual On-Site Power Plant Capacity Factor	51%	0.51
Economic Factors		
Interest Rate (%)	8.55%	8.55%
Discount Rate (%)	9.00%	9.00%
Plant Economic Life (Years)	20	20
Installed Capital Costs (including owner costs)		
SO2 Emission Control System ($2007)	0	22,000,000
Total Emission Control Systems ($2007)	0	22,000,000
SO2 Emission Control System ($/kW)	0	195
Total Emission Control Systems ($/kW)	0	195
Total Fixed Operating & Maintenance Costs		
Operating Labor ($)	0	56,500
Maintenance Material ($)	0	113,000
Maintenance Labor ($)	0	56,500
Administrative Labor ($)	0	0
Total Fixed O&M Cost ($)	0	226,000
Annual Fixed O&M Cost Escalation Rate (%)	2.00%	2.00%
Reagent Cost	None	Lime
Unit Cost ($/Ton)	0.00	91.25
($/Lb)	0.000	0.046
Molar Stoichiometry	0.00	1.10
Reagent Purity (Wt.%)	100%	90%
Reagent Usage (Lb/Hr)	0	869
First Year Reagent Cost ($)	0	177,197
Annual Reagent Cost Escalation Rate (%)	2.00%	2.00%
SCR Catalyst / FF Bag Replacement Cost		
Annual SCR Catalyst (m3) / No. FF Bags	0	0
SCR Catalyst ($/m3) / Bag Cost ($/ea.)	3,000	3,000
First Year SCR Catalyst / Bag Replace. Cost ($)	0	0
Annual SCR Catalyst / Bag Cost Esc. Rate (%)	2.00%	2.00%
Auxiliary Power Cost		
Auxiliary Power Requirement (% of Plant Output)	0.00%	0.35%
(MW)	0.00	0.40
Unit Cost ($2007/MW-Hr)	50.00	50.00
First Year Auxiliary Power Cost ($)	0	89,352
Annual Power Cost Escalation Rate (%)	2.00%	2.00%
Water Cost		
Makeup Water Usage (Gpm)	0	77
Unit Price ($/1000 Gallons)	1.22	1.22
First Year Water Cost ($)	0	25,112
Annual Water Cost Escalation Rate (%)	2.00%	2.00%

Economic factors as per Sierra Pacific 2008 Planning Guidelines

Interest Rate
Plant Life

Fort Churchill Unit 2 — Current Operation

Year	Date	TOTAL FIXED O&M COST	Reagent Cost	SCR Catalyst / FF Bag Cost	Electric Power Cost	Makeup Water Cost	TOTAL VARIABLE O&M COST	DEBT SERVICE	TOTAL ANNUAL COST	Control Cost ($/Ton Removed)
0	2013									
1	2014	-	-	-	-	-	-	-	-	-
2	2015	-	-	-	-	-	-	-	-	-
3	2016	-	-	-	-	-	-	-	-	-
4	2017	-	-	-	-	-	-	-	-	-
5	2018	-	-	-	-	-	-	-	-	-
6	2019	-	-	-	-	-	-	-	-	-
7	2020	-	-	-	-	-	-	-	-	-
8	2021	-	-	-	-	-	-	-	-	-
9	2022	-	-	-	-	-	-	-	-	-
10	2023	-	-	-	-	-	-	-	-	-
11	2024	-	-	-	-	-	-	-	-	-
12	2025	-	-	-	-	-	-	-	-	-
13	2026	-	-	-	-	-	-	-	-	-
14	2027	-	-	-	-	-	-	-	-	-
15	2028	-	-	-	-	-	-	-	-	-
16	2029	-	-	-	-	-	-	-	-	-
17	2030	-	-	-	-	-	-	-	-	-
18	2031	-	-	-	-	-	-	-	-	-
19	2032	-	-	-	-	-	-	-	-	-
20	2033	-	-	-	-	-	-	-	-	-

Fort Churchill Unit 2 — SDA

Year	Date	TOTAL FIXED O&M COST	Reagent Cost	SCR Catalyst / FF Bag Cost	Electric Power Cost	Makeup Water Cost	TOTAL VARIABLE O&M COST	DEBT SERVICE	TOTAL ANNUAL COST	Control Cost ($/Ton Removed)
0	2013									
1	2014	226,000	177,197	-	89,352	25,112	291,662	2,333,232	2,850,894	1,851.68
2	2015	230,520	180,741	-	91,139	25,614	297,495	2,333,232	2,861,247	1,858.40
3	2016	235,130	184,356	-	92,962	26,127	303,445	2,333,232	2,871,807	1,865.26
4	2017	239,833	188,043	-	94,821	26,649	309,514	2,333,232	2,882,579	1,872.26
5	2018	244,630	191,804	-	96,717	27,182	315,704	2,333,232	2,893,566	1,879.39
6	2019	249,522	195,640	-	98,652	27,726	322,018	2,333,232	2,904,772	1,886.67
7	2020	254,513	199,553	-	100,625	28,280	328,458	2,333,232	2,916,203	1,894.10
8	2021	259,603	203,544	-	102,637	28,846	335,027	2,333,232	2,927,862	1,901.67
9	2022	264,795	207,615	-	104,690	29,423	341,728	2,333,232	2,939,755	1,909.40
10	2023	270,091	211,767	-	106,784	30,011	348,563	2,333,232	2,951,886	1,917.27
11	2024	275,493	216,003	-	108,920	30,612	355,534	2,333,232	2,964,259	1,925.31
12	2025	281,003	220,323	-	111,098	31,224	362,644	2,333,232	2,976,879	1,933.51
13	2026	286,623	224,729	-	113,320	31,848	369,897	2,333,232	2,989,752	1,941.87
14	2027	292,355	229,224	-	115,586	32,485	377,295	2,333,232	3,002,882	1,950.40
15	2028	298,202	233,808	-	117,898	33,135	384,841	2,333,232	3,016,276	1,959.10
16	2029	304,166	238,484	-	120,256	33,798	392,538	2,333,232	3,029,936	1,967.97
17	2030	310,250	243,254	-	122,661	34,474	400,389	2,333,232	3,043,870	1,977.02
18	2031	316,455	248,119	-	125,114	35,163	408,397	2,333,232	3,058,083	1,986.25
19	2032	322,784	253,082	-	127,617	35,866	416,564	2,333,232	3,072,580	1,995.67
20	2033	329,239	258,143	-	130,169	36,584	424,896	2,333,232	3,087,367	2,005.27

ECONOMIC ANALYSIS SUMMARY

Fort Churchill Unit 2

Boiler Design:

Parameter	Current Operation	PM Control Fabric Filter
Case	**1**	**8**
PM Emission Control System	None	Fabric Filter
TOTAL INSTALLED CAPITAL COST ($)	**0**	**22,000,000**
Including Other Owner Costs ($)	**0**	**---**
FIRST YEAR O&M COST ($)		
Operating Labor ($)	0	45,200
Maintenance Material ($)	0	90,400
Maintenance Labor ($)	0	45,200
Administrative Labor ($)	0	0
TOTAL FIXED O&M COST	**0**	**180,800**
Reagent Cost	0	0
SCR Catalyst / FF Bag Cost	0	62,400
Electric Power Cost	0	89,352
Makeup Water Cost	0	0
TOTAL VARIABLE O&M COST	**0**	**151,752**
TOTAL FIRST YEAR O&M COST	**0**	**332,552**
FIRST YEAR DEBT SERVICE ($)	0	2,333,232
TOTAL FIRST YEAR COST ($)	**0**	**2,665,784**
Power Consumption (MW)	**0.0**	**0.4**
Annual Power Usage (Million kW-Hr/Yr)	**0.0**	**1.8**
CONTROL COST ($/Ton Removed)		
PM Removal Rate (%)	**0.00%**	**52.98%**
PM Removed (Tons/Yr)	**0**	**47**
First Year Average Control Cost ($/Ton PM Rem.)	**0**	**57,278**
Incremental Control Cost ($/Ton PM Removed)	**Base**	**57,278**

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INPUT CALCULATIONS

Fort Churchill Unit 2 — **Boiler Design:**

Parameter	Current Operation	PM Control Fabric Filter
Case	1	8
PM Emission Control System	None	Fabric Filter
Unit Design and Coal Characteristics		
Type of Unit	PC	PC
Net Power Output (kW)	113,000	113,000
Net Plant Heat Rate (Btu/kW-Hr)	10,910	10,910
Boiler Fuel	No. 6 Fuel Oil	No. 6 Fuel Oil
Fuel Heating Value (Btu/Lb)	19,300	19,300
Fuel Sulfur Content (wt.%)	0.637%	0.637%
Fuel Ash Content (wt.%)	0.038%	0.038%
Boiler Heat Input, each (MMBtu/Hr)	1,233	1,233
Fuel Flow Rate (Lb/Hr)	63,877	63,877
(Ton/Yr)	142,689	142,689
(MMBtu/Yr)	5,507,791	5,507,791
Emissions		
Uncontrolled Fly Ash (Lb/Hr)	31	39
(Lb/MMBtu)	0.03	0.032
(Lb Moles/Hr)	1.0	1.3
(Tons/Yr)	70	88
Fly Ash Removal Rate (%)	0.00%	52.98%
(Lb/Hr)	-8	21
(Ton/Yr)	-18	47
Fly Ash Emission Rate (Lb/Hr)	39	18
(Lb/MMBtu)	0.032	0.015
(Ton/Yr)	88	41
General Plant Data		
Annual Operation (Hours/Year)	4,468	4,468
Annual On-Site Power Plant Capacity Factor	51%	0.51
Economic Factors		
Interest Rate (%)	8.55%	8.55%
Discount Rate (%)	9.00%	9.00%
Plant Economic Life (Years)	20	20
Installed Capital Costs (including owner costs)		
NOx Emission Control System ($2007)	0	0
SO2 Emission Control System ($2007)	0	0
PM Emission Control System ($2007)	0	22,000,000
Total Emission Control Systems ($2007)	0	22,000,000
NOx Emission Control System ($/kW)	0	0
SO2 Emission Control System ($/kW)	0	0
PM Emission Control System ($/kW)	0	195
Total Emission Control Systems ($/kW)	0	195
Total Fixed Operating & Maintenance Costs		
Operating Labor ($)	0	45,200
Maintenance Material ($)	0	90,400
Maintenance Labor ($)	0	45,200
Administrative Labor ($)	0	0
Total Fixed O&M Cost ($)	0	180,800
Annual Fixed O&M Cost Escalation Rate (%)	2.00%	2.00%
Reagent Cost	None	None
Unit Cost ($/Ton)	0.00	0.00
($/Lb)	0.000	0.000
Molar Stoichiometry	0.00	0.00
Reagent Purity (Wt.%)	100%	100%
Reagent Usage (Lb/Hr)	0	0
First Year Reagent Cost ($)	0	0
Annual Reagent Cost Escalation Rate (%)	2.00%	2.00%
SCR Catalyst / FF Bag Replacement Cost		Bags
Annual SCR Catalyst (m3) / No. FF Bags	0	600
SCR Catalyst ($/m3) / Bag Cost ($/ea.)	3,000	104
First Year SCR Catalyst / Bag Replace. Cost ($)	0	62,400
Annual SCR Catalyst / Bag Cost Esc. Rate (%)	2.00%	2.00%
Auxiliary Power Cost		
Auxiliary Power Requirement (% of Plant Output)	0.00%	0.35%
(MW)	0.00	0.40
Unit Cost ($2007/MW-Hr)	50.00	50.00
First Year Auxiliary Power Cost ($)	0	89,352
Annual Power Cost Escalation Rate (%)	2.00%	2.00%

Economic factors as per Sierra Pacific 2008 Planning Guidelines

Interest Rate
Plant Life

Fort Churchill Unit 2 — Current Operation

Year	Date	TOTAL FIXED O&M COST	Reagent Cost	SCR Catalyst / FF Bag Cost	Electric Power Cost	Makeup Water Cost	TOTAL VARIABLE O&M COST	DEBT SERVICE	TOTAL ANNUAL COST	Control Cost ($/Ton Removed)
0	2013									
1	2014	-	-	-	-	-	-	-	-	-
2	2015	-	-	-	-	-	-	-	-	-
3	2016	-	-	-	-	-	-	-	-	-
4	2017	-	-	-	-	-	-	-	-	-
5	2018	-	-	-	-	-	-	-	-	-
6	2019	-	-	-	-	-	-	-	-	-
7	2020	-	-	-	-	-	-	-	-	-
8	2021	-	-	-	-	-	-	-	-	-
9	2022	-	-	-	-	-	-	-	-	-
10	2023	-	-	-	-	-	-	-	-	-
11	2024	-	-	-	-	-	-	-	-	-
12	2025	-	-	-	-	-	-	-	-	-
13	2026	-	-	-	-	-	-	-	-	-
14	2027	-	-	-	-	-	-	-	-	-
15	2028	-	-	-	-	-	-	-	-	-
16	2029	-	-	-	-	-	-	-	-	-
17	2030	-	-	-	-	-	-	-	-	-
18	2031	-	-	-	-	-	-	-	-	-
19	2032	-	-	-	-	-	-	-	-	-
20	2033	-	-	-	-	-	-	-	-	-

Fort Churchill Unit 2 — Fabric Filter

Year	Date	TOTAL FIXED O&M COST	Reagent Cost	SCR Catalyst / FF Bag Cost	Electric Power Cost	Makeup Water Cost	TOTAL VARIABLE O&M COST	DEBT SERVICE	TOTAL ANNUAL COST	Control Cost ($/Ton Removed)
0	2013									
1	2014	180,800	-	62,400	89,352	-	151,752	2,333,232	2,665,784	57,278.39
2	2015	184,416	-	63,648	91,139	-	154,787	2,333,232	2,672,435	57,421.30
3	2016	188,104	-	64,921	92,962	-	157,883	2,333,232	2,679,219	57,567.06
4	2017	191,866	-	66,219	94,821	-	161,040	2,333,232	2,686,139	57,715.74
5	2018	195,704	-	67,544	96,717	-	164,261	2,333,232	2,693,197	57,867.40
6	2019	199,618	-	68,895	98,652	-	167,546	2,333,232	2,700,396	58,022.09
7	2020	203,610	-	70,273	100,625	-	170,897	2,333,232	2,707,740	58,179.87
8	2021	207,682	-	71,678	102,637	-	174,315	2,333,232	2,715,230	58,340.80
9	2022	211,836	-	73,112	104,690	-	177,802	2,333,232	2,722,870	58,504.96
10	2023	216,073	-	74,574	106,784	-	181,358	2,333,232	2,730,663	58,672.40
11	2024	220,394	-	76,065	108,920	-	184,985	2,333,232	2,738,611	58,843.19
12	2025	224,802	-	77,587	111,098	-	188,685	2,333,232	2,746,719	59,017.39
13	2026	229,298	-	79,138	113,320	-	192,458	2,333,232	2,754,988	59,195.08
14	2027	233,884	-	80,721	115,586	-	196,307	2,333,232	2,763,424	59,376.32
15	2028	238,562	-	82,335	117,898	-	200,234	2,333,232	2,772,027	59,561.19
16	2029	243,333	-	83,982	120,256	-	204,238	2,333,232	2,780,803	59,749.75
17	2030	248,200	-	85,662	122,661	-	208,323	2,333,232	2,789,755	59,942.08
18	2031	253,164	-	87,375	125,114	-	212,489	2,333,232	2,798,885	60,138.27
19	2032	258,227	-	89,123	127,617	-	216,739	2,333,232	2,808,198	60,338.37
20	2033	263,391	-	90,905	130,169	-	221,074	2,333,232	2,817,698	60,542.48