

ECONOMIC ANALYSIS SUMMARY

Tracy Unit 1

Boiler Design:

Riley Stoker 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	704,000	1,040,000	2,532,500	4,222,763	16,940,000
Including Other Owner Costs (\$)	0	1,232,000	1,820,000	4,431,875	7,389,835	21,175,000
FIRST YEAR O&M COST (\$)						
Operating Labor (\$)	0	5,500	8,250	11,000	11,000	13,750
Maintenance Material (\$)	0	11,000	16,500	22,000	22,000	27,500
Maintenance Labor (\$)	0	5,500	8,250	11,000	11,000	13,750
Administrative Labor (\$)	0	0	0	0	0	0
TOTAL FIXED O&M COST	0	22,000	33,000	44,000	44,000	55,000
Reagent Cost	0	0	0	19,271	30,252	31,295
SCR Catalyst / FF Bag Cost	0	0	0	0	0	82,500
Electric Power Cost	0	0	50,589	5,059	55,648	25,295
Makeup Water Cost	0	0	0	0	0	0
TOTAL VARIABLE O&M COST	0	0	50,589	24,330	85,900	139,090
TOTAL FIRST YEAR O&M COST	0	22,000	83,589	68,330	129,900	194,090
FIRST YEAR DEBT SERVICE (\$)	0	130,661	193,022	470,027	783,736	2,245,736
TOTAL FIRST YEAR COST (\$)	0	152,661	276,611	538,357	913,636	2,439,825
Power Consumption (MW)	0.0	0.0	0.6	0.1	0.6	0.3
Annual Power Usage (Million kW-Hr/Yr)	0.0	0.0	1.0	0.1	1.1	0.5
CONTROL COST (\$/Ton Removed)						
NOx Removal Rate (%)	0.0%	8.4%	41.1%	31.3%	49.1%	74.5%
NOx Removed (Tons/Yr)	0	15	76	58	91	138
First Year Average Control Cost (\$/Ton NOx Rem.)	0	9,872	3,641	9,310	10,065	17,701
Incremental Control Cost (\$/Ton NOx Removed)	0	9,872	2,048	(14,418)	11,391	32,426
		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

Tracy Unit 1

Boiler Design:

Riley Stoker 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)	55,000	55,000	55,000	55,000	55,000	55,000	
Net Plant Heat Rate (Btu/kW-Hr)	13,291	13,291	13,291	13,291	13,291	13,291	
Boiler Fuel	No. 2 Fuel Oil	No. 2 Fuel Oil	No. 2 Fuel Oil	No. 2 Fuel Oil	No. 2 Fuel Oil	No. 2 Fuel Oil	
Fuel Heating Value (Btu/Lb)	19,858	19,858	19,858	19,858	19,858	19,858	
Fuel Sulfur Content (wt.%)	0.050%	0.050%	0.050%	0.050%	0.050%	0.050%	
Fuel Ash Content (wt.%)	0.038%	0.038%	0.038%	0.038%	0.038%	0.038%	
Boiler Heat Input, each (MMBtu/Hr)	731	731	731	731	731	731	
Fuel Flow Rate (Lb/Hr)	36,811	36,811	36,811	36,811	36,811	36,811	
(Ton/Yr)	33,859	33,859	33,859	33,859	33,859	33,859	
(MMBtu/Yr)	1,344,748	1,344,748	1,344,748	1,344,748	1,344,748	1,344,748	
Emissions							
Uncontrolled NOx (Lb/Hr)	201	201	201	201	201	201	
(Lb/MMBtu)	0.28	0.28	0.28	0.28	0.28	0.28	
(Lb Moles/Hr)	6.70	6.70	6.70	6.70	6.70	6.70	
(Tons/Yr)	185	185	185	185	185	185	
NOx Removal Rate (%)	0.0%	8.4%	41.1%	31.3%	49.1%	74.5%	
(Lb/Hr)	0	17	83	63	99	150	
(Lb Moles/Hr)	0.00	0.56	2.75	2.09	3.29	4.99	
(Ton/Yr)	0	15	76	58	91	138	
NOx Emission Rate (Lb/Hr)	201	184	118	138	102	51	
(Lb/MMBtu)	0.28	0.25	0.16	0.19	0.14	0.07	
(Ton/Yr)	185	169	109	127	94	47	
General Plant Data							
Annual Operation (Hours/Year)	1,840	1,840	1,840	1,840	1,840	1,840	
Annual On-Site Power Plant Capacity Factor	21%	0.21	0.21	0.21	0.21	0.21	
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	1,232,000	1,820,000	4,431,875	7,389,835	21,175,000	
Total Emission Control Systems (\$2007)	0	1,232,000	1,820,000	4,431,875	7,389,835	21,175,000	
NOx Emission Control System (\$/kW)	0	22	33	81	134	385	
Total Emission Control Systems (\$/kW)	0	22	33	81	134	385	
Total Fixed Operating & Maintenance Costs							
Operating Labor (\$)	0	5,500	8,250	11,000	11,000	13,750	
Maintenance Material (\$)	0	11,000	16,500	22,000	22,000	27,500	
Maintenance Labor (\$)	0	5,500	8,250	11,000	11,000	13,750	
Administrative Labor (\$)	0	0	0	0	0	0	
Total Fixed O&M Cost (\$)	0	22,000	33,000	44,000	44,000	55,000	
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	57	89	85	
First Year Reagent Cost (\$)	0	0	0	19,271	30,252	31,295	
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	28	
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	82,500	
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	0.55	0.06	0.61	0.28	
Unit Cost (\$2007/MW-Hr)	50.00	50.00	50.00	50.00	50.00	50.00	
First Year Auxiliary Power Cost (\$)	0	0	50,589	5,059	55,648	25,295	
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

Tracy Unit 1		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	-	-	-	-	-	-	-	-	-

Tracy Unit 1		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	22,000	-	-	-	-	-	130,661	152,661	9,872
2	2015	22,440	-	-	-	-	-	130,661	153,101	9,900
3	2016	22,889	-	-	-	-	-	130,661	153,550	9,929
4	2017	23,347	-	-	-	-	-	130,661	154,008	9,959
5	2018	23,814	-	-	-	-	-	130,661	154,475	9,989
6	2019	24,290	-	-	-	-	-	130,661	154,951	10,020
7	2020	24,776	-	-	-	-	-	130,661	155,437	10,051
8	2021	25,271	-	-	-	-	-	130,661	155,932	10,083
9	2022	25,777	-	-	-	-	-	130,661	156,438	10,116
10	2023	26,292	-	-	-	-	-	130,661	156,953	10,149
11	2024	26,818	-	-	-	-	-	130,661	157,479	10,183
12	2025	27,354	-	-	-	-	-	130,661	158,015	10,218
13	2026	27,901	-	-	-	-	-	130,661	158,562	10,253
14	2027	28,459	-	-	-	-	-	130,661	159,120	10,289
15	2028	29,029	-	-	-	-	-	130,661	159,690	10,326
16	2029	29,609	-	-	-	-	-	130,661	160,270	10,364
17	2030	30,201	-	-	-	-	-	130,661	160,862	10,402
18	2031	30,805	-	-	-	-	-	130,661	161,466	10,441
19	2032	31,421	-	-	-	-	-	130,661	162,082	10,481
20	2033	32,050	-	-	-	-	-	130,661	162,711	10,522

Tracy Unit 1										
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	33,000	-	-	50,589	-	50,589	193,022	276,611	3,641
2	2015	33,660	-	-	51,601	-	51,601	193,022	278,283	3,663
3	2016	34,333	-	-	52,633	-	52,633	193,022	279,988	3,685
4	2017	35,020	-	-	53,685	-	53,685	193,022	281,727	3,708
5	2018	35,720	-	-	54,759	-	54,759	193,022	283,501	3,731
6	2019	36,435	-	-	55,854	-	55,854	193,022	285,311	3,755
7	2020	37,163	-	-	56,971	-	56,971	193,022	287,157	3,779
8	2021	37,907	-	-	58,111	-	58,111	193,022	289,039	3,804
9	2022	38,665	-	-	59,273	-	59,273	193,022	290,960	3,830
10	2023	39,438	-	-	60,459	-	60,459	193,022	292,919	3,855
11	2024	40,227	-	-	61,668	-	61,668	193,022	294,916	3,882
12	2025	41,031	-	-	62,901	-	62,901	193,022	296,954	3,908
13	2026	41,852	-	-	64,159	-	64,159	193,022	299,033	3,936
14	2027	42,689	-	-	65,442	-	65,442	193,022	301,153	3,964
15	2028	43,543	-	-	66,751	-	66,751	193,022	303,316	3,992
16	2029	44,414	-	-	68,086	-	68,086	193,022	305,522	4,021
17	2030	45,302	-	-	69,448	-	69,448	193,022	307,772	4,051
18	2031	46,208	-	-	70,837	-	70,837	193,022	310,067	4,081
19	2032	47,132	-	-	72,254	-	72,254	193,022	312,408	4,112
20	2033	48,075	-	-	73,699	-	73,699	193,022	314,795	4,143

Tracy Unit 1										
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	44,000	19,271	-	5,059	-	24,330	470,027	538,357	9,310
2	2015	44,880	19,657	-	5,160	-	24,817	470,027	539,724	9,334
3	2016	45,778	20,050	-	5,263	-	25,313	470,027	541,118	9,358
4	2017	46,693	20,451	-	5,369	-	25,820	470,027	542,540	9,383
5	2018	47,627	20,860	-	5,476	-	26,336	470,027	543,990	9,408
6	2019	48,580	21,277	-	5,585	-	26,863	470,027	545,469	9,433
7	2020	49,551	21,703	-	5,697	-	27,400	470,027	546,978	9,459
8	2021	50,542	22,137	-	5,811	-	27,948	470,027	548,517	9,486
9	2022	51,553	22,580	-	5,927	-	28,507	470,027	550,087	9,513
10	2023	52,584	23,031	-	6,046	-	29,077	470,027	551,688	9,541
11	2024	53,636	23,492	-	6,167	-	29,659	470,027	553,321	9,569
12	2025	54,708	23,962	-	6,290	-	30,252	470,027	554,987	9,598
13	2026	55,803	24,441	-	6,416	-	30,857	470,027	556,686	9,627
14	2027	56,919	24,930	-	6,544	-	31,474	470,027	558,420	9,657
15	2028	58,057	25,428	-	6,675	-	32,103	470,027	560,187	9,688
16	2029	59,218	25,937	-	6,809	-	32,745	470,027	561,991	9,719
17	2030	60,403	26,456	-	6,945	-	33,400	470,027	563,830	9,751
18	2031	61,611	26,985	-	7,084	-	34,068	470,027	565,706	9,783
19	2032	62,843	27,524	-	7,225	-	34,750	470,027	567,620	9,816
20	2033	64,100	28,075	-	7,370	-	35,445	470,027	569,571	9,850

Tracy Unit 1		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	44,000	30,252	-	55,648	-	85,900	783,736	913,636	10,065	
2	2015	44,880	30,857	-	56,761	-	87,618	783,736	916,234	10,094	
3	2016	45,778	31,474	-	57,896	-	89,370	783,736	918,884	10,123	
4	2017	46,693	32,103	-	59,054	-	91,157	783,736	921,587	10,153	
5	2018	47,627	32,745	-	60,235	-	92,981	783,736	924,344	10,183	
6	2019	48,580	33,400	-	61,440	-	94,840	783,736	927,156	10,214	
7	2020	49,551	34,068	-	62,669	-	96,737	783,736	930,024	10,246	
8	2021	50,542	34,750	-	63,922	-	98,672	783,736	932,950	10,278	
9	2022	51,553	35,445	-	65,200	-	100,645	783,736	935,935	10,311	
10	2023	52,584	36,154	-	66,504	-	102,658	783,736	938,979	10,345	
11	2024	53,636	36,877	-	67,834	-	104,711	783,736	942,083	10,379	
12	2025	54,708	37,614	-	69,191	-	106,805	783,736	945,250	10,414	
13	2026	55,803	38,367	-	70,575	-	108,942	783,736	948,481	10,449	
14	2027	56,919	39,134	-	71,986	-	111,120	783,736	951,775	10,486	
15	2028	58,057	39,917	-	73,426	-	113,343	783,736	955,136	10,523	
16	2029	59,218	40,715	-	74,895	-	115,610	783,736	958,564	10,560	
17	2030	60,403	41,529	-	76,393	-	117,922	783,736	962,061	10,599	
18	2031	61,611	42,360	-	77,920	-	120,280	783,736	965,627	10,638	
19	2032	62,843	43,207	-	79,479	-	122,686	783,736	969,265	10,678	
20	2033	64,100	44,071	-	81,068	-	125,140	783,736	972,976	10,719	

Tracy Unit 1		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	55,000	31,295	82,500	25,295	-	139,090	2,245,736	2,439,825	17,701	
2	2015	56,100	31,921	84,150	25,800	-	141,871	2,245,736	2,443,707	17,729	
3	2016	57,222	32,559	85,833	26,316	-	144,709	2,245,736	2,447,667	17,758	
4	2017	58,366	33,211	87,550	26,843	-	147,603	2,245,736	2,451,705	17,787	
5	2018	59,534	33,875	89,301	27,380	-	150,555	2,245,736	2,455,825	17,817	
6	2019	60,724	34,552	91,087	27,927	-	153,566	2,245,736	2,460,026	17,847	
7	2020	61,939	35,243	92,908	28,486	-	156,637	2,245,736	2,464,312	17,879	
8	2021	63,178	35,948	94,767	29,055	-	159,770	2,245,736	2,468,684	17,910	
9	2022	64,441	36,667	96,662	29,637	-	162,966	2,245,736	2,473,143	17,943	
10	2023	65,730	37,400	98,595	30,229	-	166,225	2,245,736	2,477,691	17,976	
11	2024	67,045	38,148	100,567	30,834	-	169,549	2,245,736	2,482,330	18,009	
12	2025	68,386	38,911	102,578	31,451	-	172,940	2,245,736	2,487,062	18,044	
13	2026	69,753	39,690	104,630	32,080	-	176,399	2,245,736	2,491,888	18,079	
14	2027	71,148	40,483	106,723	32,721	-	179,927	2,245,736	2,496,811	18,114	
15	2028	72,571	41,293	108,857	33,376	-	183,526	2,245,736	2,501,833	18,151	
16	2029	74,023	42,119	111,034	34,043	-	187,196	2,245,736	2,506,955	18,188	
17	2030	75,503	42,961	113,255	34,724	-	190,940	2,245,736	2,512,179	18,226	
18	2031	77,013	43,821	115,520	35,418	-	194,759	2,245,736	2,517,508	18,264	
19	2032	78,554	44,697	117,830	36,127	-	198,654	2,245,736	2,522,944	18,304	
20	2033	80,125	45,591	120,187	36,849	-	202,627	2,245,736	2,528,488	18,344	