

TABLE 1
BAAQMD Marsh Landing Generating Station

CO Catalyst Control Costs/Combined Cycle
CAPITAL COST SUMMARY

Average/Total Cost Effectiveness analysis

DIRECT CAPITAL COSTS (2009 \$)		Explanation of Cost Estimates
		per Turbine/HRSG
1. Purchased Equipment:		
A) Pollution Control Equipment	\$478,000	Base Cost BASF Quote
B) Instrumentation & Controls(No CEMS)	\$47,800	EPA1998 10% of Base Cost
C) Freight & Taxes	\$68,354	8% Taxes; 5% Freight; on 1A & 1B
Total Purchased Equip. Costs (TEC):	\$594,154	Sum 1A,1B,1C
2. Installation Costs:		
A) Foundation & Supports	\$0	EPA1998 8% of TEC
B) Erection and Handling	\$83,200	EPA1998 14% of TEC
C) Electrical	\$0	EPA1998 4% of TEC
D) Piping	\$0	EPA1998 2% of TEC
E) Insulation	\$0	1% of TEC
F) Painting	\$0	EPA1998 1% of TEC
G) Site Preparation	\$0	0% of TEC
Total Installation Costs (TINC):	\$83,200	Sum 2A,2B,2C,2D,2E,2F,2G
Total Direct Capital Costs (TDCC):	\$677,354	Sum TEC,TINC
INDIRECT CAPITAL COSTS		
1. Engineering & Supervision	\$59,400	EPA1998 10% of TEC
2. Construction and Field Exp.	\$29,700	OAQPS 5% of TEC
3. Contractor Fees	\$59,400	OAQPS 10% of TEC
4. Start-up	\$11,900	OAQPS 2% of TEC
5. Performance Testing	\$5,900	OAQPS 1% of TEC
Total Indirect Capital Costs (TICC):	\$166,300	Sum 1,2,3,4,5,6
Total Direct & Indirect Capital Costs (TDICC):	\$843,654	Sum TDCC,TICC
Contingency (@12%):	\$101,200	12% TDICC (std engineering accuracy)
TOTAL CAPITAL COSTS (TCC):	\$944,900	Sum TDICC,Contingency

TABLE 1A Cont'd
BAAQMD Marsh Landing Generating Station

CO Catalyst Control Costs/Combined Cycle
ANNUAL OPERATING COST SUMMARY

DIRECT OPERATING COSTS (2003 \$)		Explanation of Cost Estimates
		per Turbine/HRSG
1. Operating Labor	\$45,443	EPA1998 3 hr/day, @41.50 hr
2. Supervisory Labor	\$6,800	OAQPS 15% Operating Labor
3. Maintenance Labor & Materials	\$45,295	2 hr/day, \$41.50/hr, + 100% materials
4. Electricity Expense (\$0.0527/kWh)	\$0	
5. Catalyst Cost (replace)	\$0	BASF Quote
6. Fuel Penalty (\$0.0041/scf gas)	\$60,015	.15% fuel increase/inch wc, assumed 1.0" bp
7. Annual Catalyst Cost	\$0	Initial Catalyst will last 15 year period
Total Direct Operating Costs (TDOC):	\$157,553	Sum 1 through 7
INDIRECT OPERATING COSTS		
1. Overhead	\$27,300	OAQPS 60% Total Labor
Total Indirect Operating Costs (TIOC):	\$27,300	Sum 1
CAPITAL CHARGES COSTS		
1. Property Tax	\$9,400	OAQPS 1% TCC
2. Insurance	\$9,400	OAQPS 1% TCC
3. General Administrative	\$18,900	OAQPS 2% TCC
4. Capital Recovery Cost (7%, 15 years)	\$103,800	10.98%, TCC
Total Capital Charges Costs (TCCC):	\$141,500	Sum 1,2,3,4
TOTAL ANNUALIZED OPERATING COSTS:	\$326,353	Sum TDOC,TIOC,TCCC

TABLE 1A Cont'd

BAAQMD Marsh Landing Generating Station

CO Catalyst Control Costs/Combined Cycle

		per Turbine/HRSG
Base Uncontrolled Case	9	ppm
Annual Emission Rate	35.2	tpy (0.0201 lb/MMBtu, 1997 MMBtu/hour, 1752 hrs) Startup/Shutdown Emissions Excluded
Controlled Case Emissions		
CO Concentration	2.0	ppm
Annual Emission Rate:	7.8	tpy (0.00446 lb/MMBtu, 1997 MMBtu/hour, 1752 hrs)
CO Reduction from Uncontrolled Case:	27.4	tpy
Control Cost Effectiveness:	\$11,900	per ton CO

References:

OAQPS - OAQPS Cost Control Manual, 5th ED., February 1996.

EPA1998 - Cost Effectiveness fo Oxidation Catalyst Control of HAP Emissions from Stationary
Combustion Turbines, EPA, 1998.

* EPA memo dated 12-30-99, Emissions Stds Division, Docket A-95-51, and May 14, 1999 memo on Stationary CT
control cost options.

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<u>DIRECT CAPITAL COSTS (2009 \$)</u>		<u>Explanation of Cost Estimates</u>
		<u>per Turbine/HRSG</u>
1. Purchased Equipment:		Base Cost
A) Pollution Control Equipment	\$582,000	Catalyst Cost to Meet 0.9 ppm
B) Instrumentation & Controls(No CEMS)	\$58,200	EPA1998 10% of Base Cost
C) Freight & Taxes	\$83,226	8% Taxes; 5% Freight; on 1A & 1B
Total Purchased Equip. Costs (TEC):	\$723,426	Sum 1A,1B,1C
2. Installation Costs:		
A) Foundation & Supports	\$0	EPA1998 8% of TEC
B) Erection and Handling	\$101,300	EPA1998 14% of TEC
C) Electrical	\$0	EPA1998 4% of TEC
D) Piping	\$0	EPA1998 2% of TEC
E) Insulation	\$0	1% of TEC
F) Painting	\$0	EPA1998 1% of TEC
G) Site Preparation	\$0	0% of TEC
Total Installation Costs (TINC):	\$101,300	Sum 2A,2B,2C,2D,2E,2F,2G
Total Direct Capital Costs (TDCC):	\$824,726	Sum TEC,TINC
 INDIRECT CAPITAL COSTS		
1. Engineering & Supervision	\$72,300	EPA1998 10% of TEC
2. Construction and Field Exp.	\$36,200	OAQPS 5% of TEC
3. Contractor Fees	\$72,300	OAQPS 10% of TEC
4. Start-up	\$14,500	OAQPS 2% of TEC
5. Performance Testing	\$7,200	OAQPS 1% of TEC
Total Indirect Capital Costs (TICC):	\$202,500	Sum 1,2,3,4,5,6
Total Direct & Indirect Capital Costs (TDICC):	\$1,027,226	Sum TDCC,TICC
Contingency (@12%):	\$123,300	12% TDICC (std engineering accuracy)
TOTAL CAPITAL COSTS (TCC):	\$1,150,500	Sum TDICC,Contingency

TABLE 1A Cont'd
BAAQMD Marsh Landing Generating Station

CO Catalyst Control Costs/Combined Cycle
ANNUAL OPERATING COST SUMMARY

DIRECT OPERATING COSTS (2003 \$)		Explanation of Cost Estimates
		per Turbine/HRSG
1. Operating Labor	\$45,443	EPA1998 3 hr/day, @41.50 hr
2. Supervisory Labor	\$6,800	OAQPS 15% Operating Labor
3. Maintenance Labor & Materials	\$45,295	2 hr/day, \$41.50/hr, + 100% materials
4. Electricity Expense (\$0.0527/kWh)	\$0	
5. Catalyst Cost (replace)	\$0	Catalyst Cost to Meet 0.9 ppm
6. Fuel Penalty (\$0.0041/scf gas)	\$90,023	.15% fuel increase/inch wc, assumed 1.5" bp
7. Annual Catalyst Cost	\$0	Initial Catalyst will last 15 year period
Total Direct Operating Costs (TDOC):	\$187,561	Sum 1 through 7
INDIRECT OPERATING COSTS		
1. Overhead	\$27,300	OAQPS 60% Total Labor
Total Indirect Operating Costs (TIOC):	\$27,300	Sum 1
CAPITAL CHARGES COSTS		
1. Property Tax	\$11,500	OAQPS 1% TCC
2. Insurance	\$11,500	OAQPS 1% TCC
3. General Administrative	\$23,000	OAQPS 2% TCC
4. Capital Recovery Cost (7%, 15 years)	\$126,300	10.98%, TCC
Total Capital Charges Costs (TCCC):	\$172,300	Sum 1,2,3,4
TOTAL ANNUALIZED OPERATING COSTS:	\$387,161	Sum TDOC,TIOC,TCCC

TABLE 1A Cont'd

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CO Catalyst Control Costs/Combined Cycle

		per Turbine/HRSG
Base Uncontrolled Case	9	ppm
Annual Emission Rate	35.2	tpy (0.0201 lb/MMBtu, 1997 MMBtu/hour, 1752 hrs) Startup/Shutdown Emissions Excluded
Controlled Case Emissions		
CO Concentration	0.9	ppm
Annual Emission Rate:	3.5	tpy (0.00201 lb/MMBtu, 1997 MMBtu/hour, 1752 hrs)
CO Reduction from Uncontrolled Case:	31.7	tpy
Control Cost Effectiveness:	\$12,200	per ton CO

References:

OAQPS - OAQPS Cost Control Manual, 5th ED., February 1996.

EPA1998 - Cost Effectiveness fo Oxidation Catalyst Control of HAP Emissions from Stationary Combustion Turbines, EPA, 1998.

* EPA memo dated 12-30-99, Emissions Stds Division, Docket A-95-51, and May 14, 1999 memo on Stationary CT control cost options.