

TABLE 1a
BAAQMD Mariposa Energy Project

CO Catalyst Control Costs Base Case to 4 PPMVD
CAPITAL COST SUMMARY

Average/Total Cost Effectiveness analysis

DIRECT CAPITAL COSTS (2009 \$)	Explanation of Cost Estimates per Turbine Base Cost
1. Purchased Equipment:	
A) Pollution Control Equipment	\$450,000 EIT Proposal C10-109 (48 ppm base case to 4 ppm CO emission levels)
B) Instrumentation & Controls(No CEMS)	\$45,000 EPA1998 10% of Base Cost
C) Freight & Taxes	\$64,350 8% Taxes; 5% Freight; on 1A & 1B
Total Purchased Equip. Costs (TEC):	<u>\$559,350</u> Sum 1A,1B,1C
2. Installation Costs:	
A) Foundation & Supports	\$0 EPA1998 8% of TEC
B) Erection and Handling	\$78,309 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	<u>\$0</u> 0% of TEC
Total Installation Costs (TINC):	\$78,309 Sum 2A,2B,2C,2D,2E,2F,2G
Total Direct Capital Costs (TDCC):	\$637,659 Sum TEC,TINC
INDIRECT CAPITAL COSTS	
1. Engineering & Supervision	\$55,935 EPA1998 10% of TEC
2. Construction and Field Exp.	\$27,968 OAQPS 5% of TEC
3. Contractor Fees	\$55,935 OAQPS 10% of TEC
4. Start-up	\$11,187 OAQPS 2% of TEC
5. Performance Testing	\$5,594 OAQPS 1% of TEC
Total Indirect Capital Costs (TICC):	<u>\$156,618</u> Sum 1,2,3,4,5
Total Direct & Indirect Capital Costs (TDICC):	\$794,277 Sum TDCC,TICC
Contingency (@12%):	\$95,313 12% TDICC (std engineering accuracy)
TOTAL CAPITAL COSTS (TCC):	<u>\$889,590</u> Sum TDICC,Contingency

TABLE 1a
ANNUAL OPERATING COST SUMMARY

DIRECT OPERATING COSTS (2003 \$)	Explanation of Cost Estimates per Turbine
1. Operating Labor	\$45,443 EPA1998 3 hr/day, @41.50 hr
2. Supervisory Labor	\$6,816 OAQPS 15% Operating Labor
3. Maintenance Labor & Materials	\$30,295 2 hr/day, \$41.50/hr, + 100% materials (estimated at \$0)
4. Electricity Expense (\$0.0527/kWh)	\$0
5. Catalyst Cost (replace)	\$37,143 Based on \$325,000 replacement cost every 8.75 years (25000 hours/4000 hours/year)
6. Fuel Penalty (\$0.0041/scf gas)	\$22,429 0.15% fuel increase/inch wc back pressure (2" BP per EIT Quote)
7. Annual Catalyst Cost	\$0 Initial Catalyst will last 15 year period
Total Direct Operating Costs (TDOC):	\$142,126 Sum 1 through 7
 INDIRECT OPERATING COSTS	
1. Overhead	\$27,266 OAQPS 60% Total Labor
Total Indirect Operating Costs (TIOC):	\$27,266 Sum 1
 CAPITAL CHARGES COSTS	
1. Property Tax	\$8,896 OAQPS 1% TCC
2. Insurance	\$8,896 OAQPS 1% TCC
3. General Administrative	\$17,792 OAQPS 2% TCC
4. Capital Recovery Cost (7%, 15 years)	\$97,677 10.98%, TCC
Total Capital Charges Costs (TCCC):	\$133,261 Sum 1,2,3,4
TOTAL ANNUALIZED OPERATING COSTS:	\$302,652 Sum TDOC,TIOC,TCCC
 Per Turbine	
Base Uncontrolled Case	48.0 in ppmvd
Annual Emission Rate	99.9 TPY (49.96 lb CO/hr @ 48 ppm * 4000 hr/yr / 2000 lb/ton)
 Controlled Case Emissions	
CO Concentration	4.0 ppm (3-hour)
Annual Emission Rate:	8.3 tpy (99.9 TPY * 4 ppmvd CO/48 ppmvd CO)
CO Reduction from Uncontrolled Case:	91.6 tpy
Control Cost Effectiveness:	\$3,304 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,

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

TABLE 1b
BAAQMD Mariposa Energy Project

CO Catalyst Control Costs Base Case to 2 PPMVD
CAPITAL COST SUMMARY

Average/Total Cost Effectiveness analysis

<u>DIRECT CAPITAL COSTS (2009 \$)</u>		Explanation of Cost Estimates per Turbine
1. Purchased Equipment:		Base Cost
A) Pollution Control Equipment	\$850,000	EIT Proposal C10-109
B) Instrumentation & Controls(No CEMS)	\$85,000	EPA1998 10% of Base Cost
C) Freight & Taxes	\$121,550	8% Taxes; 5% Freight; on 1A & 1B
Total Purchased Equip. Costs (TEC):	\$1,056,550	Sum 1A,1B,1C
2. Installation Costs:		
A) Foundation & Supports	\$0	EPA1998 8% of TEC
B) Erection and Handling	\$147,917	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):	\$147,917	Sum 2A,2B,2C,2D,2E,2F,2G
Total Direct Capital Costs (TDCC):	\$1,204,467	Sum TEC,TINC
INDIRECT CAPITAL COSTS		
1. Engineering & Supervision	\$105,655	EPA1998 10% of TEC
2. Construction and Field Exp.	\$52,828	OAQPS 5% of TEC
3. Contractor Fees	\$105,655	OAQPS 10% of TEC
4. Start-up	\$21,131	OAQPS 2% of TEC
5. Performance Testing	\$10,566	OAQPS 1% of TEC
Total Indirect Capital Costs (TICC):	\$295,834	Sum 1,2,3,4,5
Total Direct & Indirect Capital Costs (TDICC):	\$1,500,301	Sum TDCC,TICC
Contingency (@12%):	\$180,036	12% TDICC (std engineering accuracy)
TOTAL CAPITAL COSTS (TCC):	\$1,680,337	Sum TDICC,Contingency

TABLE 1b
ANNUAL OPERATING COST SUMMARY

DIRECT OPERATING COSTS (2003 \$)	Explanation of Cost Estimates per Turbine
1. Operating Labor	\$45,443 EPA1998 3 hr/day, @41.50 hr
2. Supervisory Labor	\$6,816 OAQPS 15% Operating Labor
3. Maintenance Labor & Materials	\$30,295 2 hr/day, \$41.50/hr, + 100% materials (estimated at \$0)
4. Electricity Expense (\$0.0527/kWh)	\$0
5. Catalyst Cost (replace)	\$42,857 Based on \$375,000 replacement cost every 8.75 years (25000 hours/4000 hours/year)
6. Fuel Penalty (\$0.0041/scf gas)	\$33,644 0.15% fuel increase/inch wc back pressure (3" per EIT Quote)
7. Annual Catalyst Cost	\$0 Initial Catalyst will last 15 year period
Total Direct Operating Costs (TDOC):	<u>\$159,055</u> Sum 1 through 7
INDIRECT OPERATING COSTS	
1. Overhead	\$27,266 OAQPS 60% Total Labor
Total Indirect Operating Costs (TIOC):	\$27,266 Sum 1
CAPITAL CHARGES COSTS	
1. Property Tax	\$16,803 OAQPS 1% TCC
2. Insurance	\$16,803 OAQPS 1% TCC
3. General Administrative	\$33,607 OAQPS 2% TCC
4. Capital Recovery Cost (7%, 15 years)	\$184,501 10.98%, TCC
Total Capital Charges Costs (TCCC):	\$251,715 Sum 1,2,3,4
TOTAL ANNUALIZED OPERATING COSTS:	<u><u>\$438,035</u></u> Sum TDOC,TIOC,TCCC
	Per Turbine
Base Uncontrolled Case	48.0 in ppmvd
Annual Emission Rate	99.9 TPY (49.96 lb CO/hr @ 48 ppm * 4000 hr/yr / 2000 lb/ton)
Controlled Case Emissions	
CO Concentration	2.0 ppm (3-hour)
Annual Emission Rate:	4.2 TPY (99.9 TPY * 2 ppm/48 ppm)
CO Reduction from Uncontrolled Case:	95.8 tpy
Control Cost Effectiveness:	\$4,574 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,

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