

**TABLE 2a**  
**BAAQMD Mariposa Energy Project**

**CO Catalyst Control Costs Base Case to 4 PPMVD to 2 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	\$400,000 EIT Proposal C10-109 (difference between 4 ppm and 2 ppm)
B) Instrumentation & Controls(No CEMS)	\$0 EPA1998 10% of Base Cost (assumed \$0 for incremental assessment)
C) Freight & Taxes	\$52,000 8% Taxes; 5% Freight; on 1A & 1B
Total Purchased Equip. Costs (TEC):	<u>\$452,000</u> Sum 1A,1B,1C
2. Installation Costs:	
A) Foundation & Supports	\$0 EPA1998 8% of TEC
B) Erection and Handling	\$0 EPA1998 14% of TEC (assumed \$0 for incremental assessment)
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):	<u>\$0</u> Sum 2A,2B,2C,2D,2E,2F,2G
Total Direct Capital Costs (TDCC):	\$452,000 Sum TEC,TINC
<b>INDIRECT CAPITAL COSTS</b>	
1. Engineering & Supervision	\$45,200 EPA1998 10% of TEC
2. Construction and Field Exp.	\$22,600 OAQPS 5% of TEC
3. Contractor Fees	\$45,200 OAQPS 10% of TEC
4. Start-up	\$9,040 OAQPS 2% of TEC
5. Performance Testing	\$4,520 OAQPS 1% of TEC
Total Indirect Capital Costs (TICC):	<u>\$126,560</u> Sum 1,2,3,4,5
Total Direct & Indirect Capital Costs (TDICC):	\$578,560 Sum TDCC,TICC
Contingency (@12%):	\$69,427 12% TDICC (std engineering accuracy)
TOTAL CAPITAL COSTS (TCC):	<u>\$647,987</u> Sum TDICC,Contingency

**TABLE 2a**  
**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)	\$0 NA
6. Fuel Penalty (\$0.0041/scf gas)	\$11,215 .15% fuel increase/inch wc (EIT Proposal - 1.0" bp)
7. Annual Catalyst Cost	\$0 Initial Catalyst will last 15 year period
Total Direct Operating Costs (TDOC):	<u>\$93,769</u> Sum 1 through 7
<b>INDIRECT OPERATING COSTS</b>	
1. Overhead	\$27,266 OAQPS 60% Total Labor
Total Indirect Operating Costs (TIOC):	\$27,266 Sum 1
<b>CAPITAL CHARGES COSTS</b>	
1. Property Tax	\$6,480 OAQPS 1% TCC
2. Insurance	\$6,480 OAQPS 1% TCC
3. General Administrative	\$12,960 OAQPS 2% TCC
4. Capital Recovery Cost (7%, 15 years)	\$71,149 10.98%, TCC
Total Capital Charges Costs (TCCC):	\$97,068 Sum 1,2,3,4
<b>TOTAL ANNUALIZED OPERATING COSTS:</b>	<u><u>\$218,103</u></u> Sum TDOC,TIOC,TCCC
	Per Turbine
Base Uncontrolled Case	4.0 in ppmvd
Annual Emission Rate	8.3 tpy (99.9 TPY * 4 ppmvd CO/48 ppmvd CO)
<b>Controlled Case Emissions</b>	
CO Concentration	2.0 ppm (3-hour)
Annual Emission Rate:	4.2 tpy (100.8 TPY @ 48 ppm * 2/48) Startup/Shutdown Excluded.
CO Reduction from Uncontrolled Case:	4.2 tpy
Control Cost Effectiveness:	<b>\$52,387</b> 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

**TABLE 2b**  
**BAAQMD Mariposa Energy Project**

**CO Catalyst Control Costs Base Case to 2 PPMVD (3-Hour) to 2 PPMVD (1-Hour)\***  
**CAPITAL COST SUMMARY**

DIRECT CAPITAL COSTS (2009 \$)	Explanation of Cost Estimates	
		Per Turbine
1. Purchased Equipment:		Base Cost
A) Pollution Control Equipment	\$100,000	EIT Proposal C10-109 (cost difference between 2 ppm and 1.5 ppm CO emission levels)
B) Instrumentation & Controls (No CEMS)	\$0	EPA1998 10% of Base Cost (assumed \$0 for incremental assessment)
C) Freight & Taxes	\$13,000	8% Taxes; 5% Freight; on 1A & 1B
Total Purchased Equip. Costs (TEC):	\$113,000	Sum 1A,1B,1C
2. Installation Costs:		
A) Foundation & Supports	\$0	EPA1998 8% of TEC
B) Erection and Handling	\$0	EPA1998 14% of TEC (assumed \$0 for incremental assessment)
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):	\$0	Sum 2A,2B,2C,2D,2E,2F,2G
Total Direct Capital Costs (TDCC):	\$113,000	Sum TEC,TINC
 INDIRECT CAPITAL COSTS		
1. Engineering & Supervision	\$11,300	EPA1998 10% of TEC
2. Construction and Field Exp.	\$5,650	OAQPS 5% of TEC
3. Contractor Fees	\$11,300	OAQPS 10% of TEC
4. Start-up	\$2,260	OAQPS 2% of TEC
5. Performance Testing	\$1,130	OAQPS 1% of TEC
Total Indirect Capital Costs (TICC):	\$31,640	Sum 1,2,3,4,5,6
Total Direct & Indirect Capital Costs (TDICC):	\$144,640	Sum TDCC,TICC
Contingency (@12%):	\$17,357	20% TDICC (std engineering accuracy)
TOTAL CAPITAL COSTS (TCC):	\$161,997	Sum TDICC,Contingency

**TABLE 2b**  
**ANNUAL OPERATING COST SUMMARY**

DIRECT OPERATING COSTS (2003 \$)	Explanation of Cost Estimates per Turbine
1. Operating Labor	\$0 EPA1998 3 hr/day, @41.50 hr
2. Supervisory Labor	\$0 OAQPS 15% Operating Labor
3. Maintenance Labor & Materials	\$7,574 0.5 hr/day, \$41.50/hr, + 100% materials (estimated at \$0)
4. Electricity Expense (\$0.0527/kWh)	\$0
5. Catalyst Cost (replace)	\$0
6. Fuel Penalty (\$0.0041/scf gas)	\$7,850 .15% fuel increase/inch wc (0.7" per EIT Proposal)
7. Annual Catalyst Cost	\$0 Initial Catalyst will last 15 years
<b>Total Direct Operating Costs (TDOC):</b>	<b>\$15,424</b> Sum 1 through 7 Annualized Costs Only
<b>INDIRECT OPERATING COSTS</b>	
1. Overhead	\$4,544 OAQPS 60% Total Labor
<b>Total Indirect Operating Costs (TIOC):</b>	<b>\$4,544</b> Sum 1
<b>CAPITAL CHARGES COSTS</b>	
1. Property Tax	\$1,620 OAQPS 1% TCC
2. Insurance	\$1,620 OAQPS 1% TCC
3. General Administrative	\$3,240 OAQPS 2% TCC
4. Capital Recovery Cost (7%, 15 years)	\$17,787 10.98%, TCC
<b>Total Capital Charges Costs (TCCC):</b>	<b>\$24,267</b> Sum 1,2,3,4
<b>TOTAL ANNUALIZED OPERATING COSTS:</b>	<b>\$44,235</b> Sum TDOC,TIOC,TCCC
Controlled Case Emissions	per Turbine
Base Concentration-Controlled	2.0 ppm - 3 hour - assumed CO concentration of 2 ppm
Annual Emission Rate	4.2 tpy (100.8 TPY @ 48 ppm * 2/48) Startup/Shutdown Excluded.
Incremental Controlled Emissions Case	
CO Concentration	1.5 ppm - 1 hour - assumed CO concentration of 1.5 ppm
Annual Emission Rate:	3.1 tpy (4.2 TPY @ 2 ppm * 1.5/2) Startup/Shutdown Excluded.
CO Reduction from Uncontrolled Case:	1.0 tpy
Control Cost Effectiveness:	<b>\$42,500</b> 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.

\* Vendor assumed that CO emission concentration would need to be 1.5 ppm to achieve a 2 ppm CO 1-hour limit.

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