TABLE 3
Calpine Corp.-Russell City Energy Center
Hayward, CA.
Aux BoilerStart Cost Effectiveness analysis
CAPITAL COST SUMMARY

Costs for emissions reductions for CO and NOx for the addition of an Aux Boiler

DIRECT CAPITAL COSTS (2008 $)		Explanation of Cost Estimates
1. Purchased Equipment:		
A) Pollution Control Equipment	$2,200,000	Base Cost
B) Instrumentation & Controls(No CEMS)	$220,000	EPA1998 10% of Base Cost
C) Freight & Taxes	$314,600	8% Taxes; 5% Freight; on 1A & 1B
Total Purchased Equip. Costs (TEC):	$2,734,600	Sum 1A,1B,1C
2. Installation Costs:		
A) Foundation & Supports	$218,800	EPA1998 8% of TEC
B) Erection and Handling	$382,800	EPA1998 14% of TEC
C) Electrical	$109,400	EPA1998 4% of TEC
D) Piping	$54,700	EPA1998 2% of TEC
E) Insulation	$27,300	1% of TEC
F) Painting	$27,300	EPA1998 1% of TEC
G) Site Preparation	$0	0% of TEC
Total Installation Costs (TINC):	$820,300	Sum 2A,2B,2C,2D,2E,2F,2G
Total Direct Capital Costs (TDCC):	$3,554,900	Sum TEC,TINC
INDIRECT CAPITAL COSTS		
1. Engineering & Supervision	$273,500	EPA1998 10% of TEC
2. Construction and Field Exp.	$136,700	OAQPS 5% of TEC
3. Contractor Fees	$273,500	OAQPS 10% of TEC
4. Start-up	$54,700	OAQPS 2% of TEC
5. Performance Testing	$27,300	OAQPS 1% of TEC
Total Indirect Capital Costs (TICC):	$765,700	Sum 1,2,3,4,5,6
Total Direct & Indirect Capital Costs (TDICC):	$4,320,600	Sum TDCC,TICC
Contingency (@12%):	$518,500	20% TDICC (std engineering accuracy)
TOTAL CAPITAL COSTS (TCC):	$4,839,100	Sum TDICC,Contingency

TABLE 3 Cont'd
Calpine Corp.-RCEC
Hayward, CA.
Aux BoilerStart Cost Effectiveness analysis
ANNUAL OPERATING COST SUMMARY

DIRECT OPERATING COSTS (2008 $)		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)	$75,000	Based on SCR for Boiler
6. Fuel Costs Boiler ($6.75/mmbtu gas)	$151,200	Monthly fuel costs
7. Annual Catalyst Cost	$28,583	CRF, 7%, 3 yrs
Total Direct Operating Costs (TDOC):	$277,321	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	$48,400	OAQPS 1% TCC
2. Insurance	$48,400	OAQPS 1% TCC
3. General Administrative	$96,800	OAQPS 2% TCC
4. Capital Recovery Cost (7%, 15 years)	$531,300	10.98%, TCC
Total Capital Charges Costs (TCCC):	$724,900	Sum 1,2,3,4
TOTAL ANNUALIZED OPERATING COSTS:	$1,029,521	Sum TDOC,TIOC,TCCC

TABLE 3 Cont'd

Calpine Corp.-RCEC
Hayward, CA.
Aux BoilerStart Cost Effectiveness analysis

Nox Reduction for Cold and Warm Start	**0.9**	**TPY of Nox**
Control Cost Effectiveness	**$1,143,912**	Per Ton of Nox

CO Reduction for Cold and Warm Starts	**12.4**	TPY CO
Control Cost Effectiveness:	**$82,800**	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.

* NE estimated cost for additional catalyst to achieve 90% control of CO per EPA study.
* EPA memo dated 12-30-99, Emissions Stds Division, Docket A-95-51, and May 14, 1999 memo on Stationary CT control cost options.