DOCKETED

Docket Number:	08-AFC-09C
Project Title:	Palmdale Energy Project (Formerly Palmdale Hybrid Power Plant) - Compliance
TN #:	206523-2
Document Title:	Palmdale Energy LLC's Response to City of Lancaster Data Request Set No.1 (1-13) DR-5 (Part 6)
Description:	THIS DOCUMENT IS PART OF APPENDICES FILED UNDER TN 206521-2 through TN 206521-7
Filer:	Marie Fleming
Organization:	DayZen LLC
Submitter Role:	Applicant Representative
Submission Date:	11/6/2015 9:23:05 AM
Docketed Date:	11/6/2015

APPENDIX D
Best Available Control Technology Support Data

This appendix contains support materials as referenced in the main BACT analysis text.

To evaluate BACT for the proposed turbines, the guidelines for large combined or cogeneration cycle gas turbines (> 50 MW) as delineated in the District, state, and federal BACT listings were reviewed.

The relevant BACT determinations for the project are shown in Table D1.

Table D1 Proposed BACT Levels for PEP
(Steady State Baseload Operation with and without Duct Firing)

BACT Pollutant	Proposed BACT Limit	Proposed BACT Technology
NO_x	2.0 ppmvd	Dry LNBs with SCR
CO	2.0 ppmvd	CO Catalyst
VOC w/o DB	1.0 ppmvd	CO Catalyst and Sole use of PUC Grade Natural Gas
VOC w/DB	2.0 ppmvd	CO Catalyst and Sole use of PUC Grade Natural Gas
SO_x	<=0.20 grs S/100scf 1.5 lbs.hr	Sole use of PUC Grade Natural Gas
PM10/PM2.5	<=11.8 lb/hr	Sole use of PUC Grade Natural Gas

Tables D2 through D5 present summaries of the most recent BACT determinations for combined-cycle turbines.

Tables D7 and D8 present the SCR and CO Catalyst cost analysis data for the turbines.

Table D2 RBLC BACT Summary for NOx

Table D2 NOx BACT Summary

CTG/HRSG BACT NO_x Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
CA-1050	9/11/00	IDC Bellingham	SCR	1.5	ppm	LAER
CA-1192	6/21/11	Avenal Power Center LLC	SCR, Dry Low NO_x Combustors	1.5	ppmvd	BACT - no duct firing
AZ-0047	12/1/2004	Dome Valley Energy Partners, LLC - Wellton Mohawk Generating Station	SCR, Dry Low NO_x Combustion	2.0	ppmv	BACT
AZ-0039	3/7/03	Salt River Project/Santan Gen. Plant	SCR	2	ppm	LAER
AZ-0043	11/12/03	Duke Energy Arlington Valley	SCR	2.0	ppm	BACT
CA-1177	7/22/09	Otay Mesa	SCR	2	ppmv	BACT -CA
CA	5/21/01	Three Mountain Power	SCR	2.0	ppm	BACT-CA
CA-0997	9/1/03	Sacramento Municipal Utility District	SCR	2.0	ppm	LAER
CA-1096	2/1/2004	Vernon City Power & Light	SCR/DLN	2	ppm	BACT-CA
CA-1144	4/25/07	Caithness Blythe II, LLC	SCR	2.0	ppm	BACT-CA
CA-1191	3/11/10	Victorville 2 Hybrid Power Project	SCR	2.0	ppmvd	BACT-CA
CA-1192	6/21/11	Avenal Power Center LLC	SCR, Dry Low NO_x Combustors	2.0	ppmvd	BACT-CA
CA-1211	3/11/11	Colusa Generating Station	Dry Low NOx Combustors, SCR	2.0	ppmvd	BACT-CA
CA-1212	10/18/11	Palmdale Hybrid Power Project	Dry Low NO_x Combustors, SCR	2.0	ppm	BACT-CA
CA	7/1/2008	Gateway Generating Station	SCR/DLN	2	ppm	BACT-CA
CA	3/1/2005	Los Esteros - Calpine	SCR, water injection	2	ppm	BACT-CA
CA	5/27/2003	Magnolia Power Project	SCR	2	ppm	BACT-CA
CA	12/1/2002	Palomar Escondido - Sempra	SCR/DLN	2	ppm	BACT-CA
CA	6/1/2007	Russell City Energy Center	SCR/DLN	2	ppm	BACT-CA
CA	8/1/2006	San Joaquin Valley Energy Center	SCR/DLN	2	ppm	BACT-CA
CA		Sunlaw Cogen Power	SCONox	2	ppm	BACT-CA
CT-0148	6/22/99	Lake Road Generating Company	SCR, Dry Low NO_x Combustion	2	ppmv	LAER
CT-0151	2/25/08	Kleen Energy Systems, LLC - with duct burner	SCR, Dry Low NO_x Combustion	2.0	ppm	LAER
CT		PDC-El Paso, Meridan	SCR	2	ppm	
DE-0024	1/30/13	Garrison Energy Center LLC/Calpine Corporation	SCR, Low NO_x Combustors	2.0	ppm	LAER
FL-0263	2/8/05	Florida Power and Light Turkey Point Power Plant	SCR, Dry Low NO_x Combustion	2.0	ppmvd	BACT
FL-0280	5/30/06	Florida Municipal Power Agency - Treasure Coast Energy Center	SCR	2.0	ppmvd	BACT
FL-0286	1/10/07	Florida Power and Light West County Energy Center	SCR, Dry Low NO_x Combustion, Water Injection	2.0	ppmvd	BACT
FL-0303	7/30/08	Florida Power and Light West County Energy Center Unit 3	SCR, Dry Low NO_x Combustion	2.0	ppmvd	BACT

CTG/HRSG BACT NO_x Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
FL-0304	9/8/08	Florida Municipal Power Agency - Cane Island Power Park	SCR	2.0	ppmvd	BACT
GA	5/30/12	Effingham County Power Plant	SCR, Dry Low NO_x Combustion	2.0	ppmvd	BACT
GA		McDonough	SCR/DLN	2	ppm	
ID-0018	6/25/10	Idaho Power Company - Langley Gulch Power Plant	SCR, DLN, Good Combustion Practices	2.0	ppmvd	BACT
IN-0158	12/3/12	St. Joseph Energy Center LLC	SCR and DLN	2.0	ppmvd	BACT
MA-0024	4/16/99	ANP Blackstone	SCR, Dry Low NO_x Combustion	2	ppmv	LAER
MA-0025	8/4/99	ANP Bellingham	SCR, Dry Low NO_x Combustion	2	ppmv	LAER
MA-0029	1/25/00	Sithe Mystic Development	SCR, Dry Low NO_x Combustion	2	ppmv	LAER
MA	2/22	Cabot Power Island End Cogeneration Project	SCR	2	ppm	
MA	12/14	Fore River Station, Weymouth	SCR	2	ppm	
NC		Southern Power CO - Plant Rowan County	SCR	2	ppm	
NJ	9/13/12	Hess Newark Energy Center	SCR, Dry Low NO_x Combustion	2.0	ppmvd	BACT
NJ	5/31/12	Woodbridge Energy Center	SCR, Dry Low NO_x Combustion	2.0	ppmvd	BACT
NV-0035	8/16/05	Sierra Pacific Power Company - Tracy Substation Expansion Project	SCR	2.0	ppm	BACT
NV-0037	5/14/04	Sempra Energy Resources - Copper Mountain Power	SCR, Dry Low NO_x Combustion, Steam Injection	2.0	ppmvd	BACT
NV-0038	6/28/05	Ivanpah Energy Center, L.P.	Dry Low NOx Combustors, SCR	2.0	ppmvd	BACT
NY-0095	5/10/06	Caithness Bellport, LLC	SCR	2.0	ppmvd	BACT
NY-0098	1/19/07	New Athen Generating CO. LLC - Athens Generating Plant	SCR, Dry Low NO_x Combustion	2.0	ppmvd	LAER
NY-0100	6/23/05	Empire Generating CO. LLC - Empire Power Plant - turbine only	SCR, Dry Low NO_x Combustion	2.0	ppmvd	LAER
NY	9/27/12	Cricket Valley Energy Center LLC	SCR, Dry Low NO_x Combustion	2.0	ppmvd	LAER
OH-0352	6/18/13	Oregon Clean Energy Center	SCR, Dry Low NOx Combustors, Lean Fuel Technology	2.0	ppmvd	BACT
OK-0129	1/23/09	Associated Electric Cooperative Inc - Chouteau Power Plant	SCR, Dry Low NO_x Combustion	2.0	ppm	BACT
OR-0041	8/8/05	Diamond Wanapa I, L. P. - Wanapa Energy Center	SCR, Dry Low NO_x Combustion	2.0	ppm	BACT
OR-0048	12/29/10	Portland General Electric Carty Plant	SCR	2.0	ppm	BACT
OR	1/6/2005	Turner Energy Center LLC	SCR	2	ppm	
OR	1/18/02	Umatilla Generating - PG&E	SCR, Dry Low NO_x Combustion	2.0	ppmvd	

CTG/HRSG BACT NO_x Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
PA-0226	4/9/02	Limerick Partners, LLC	Low NOx Burners	2.0	ppm	LAER
PA-0286	1/13/13	Moxie Energy LLC/Patriot Energy Plant	SCR	2.0	ppmvd	BACT
PA-0291	4/23/13	Hickory Run Energy LLC	SCR	2.0	ppmvd	Other
RI-0019	5/3/00	Reliant Energy Hope Gen. Facility	SCR, Dry Low NO_x Combustion	2	ppmv	BACT
TX-0546	6/7/09	Pattillo Branch Power Company LLC	SCR	2.0	ppmvd	BACT
TX-0547	6/22/09	Lamar Power Partners II LLC	SCR	2.0	ppmvd	BACT
TX-0548	8/18/09	Madison Bell Partners LP	SCR	2.0	ppmvd	BACT
TX-0590	8/5/10	Pondera Capital Management GP INC - King Power Station	DLN, SCR	2.0	ppmvd	LAER
TX-0600	9/1/11	Thomas C. Ferguson Power Plant	SCR	2.0	ppmvd	BACT
TX-0618	10/15/12	Channel Energy Center LLC	SCR	2.0	ppmvd	LAER
TX-0619	9/26/12	Deer Park Energy Center	SCR	2.0	ppmvd	LAER
TX-0620	9/12/12	ES Josllin Power Plant	SCR	2.0	ppmvd	BACT
VA-0315	12/17/10	Virginia Electric and Power Company - Warren County Power Plant - Dominion	SCR, Dry Low NOx Combustion	2.0	ppmvd	BACT
VA	4/30/13	Stonewall, LLC	Dry Low NOx Combustors, SCR	2.0	ppmvd	LAER
WA	4/20/03	Plymouth Generating Facility	SCR, Dry Low NO_x Combustion	2.0	ppmvd	
WA-0299	4/17/03	Sumas Energy 2 - NESCO	SCR, Dry Low NO_x Combustion	2.0	ppmvd	BACT - Project Cancelled
UT		Calpine Corp Vineyard Energy Center LLC	SCR/DLN	2	ppm	
UT		Summit Vinyard LLC	SCR/DLN	2	ppm	
UT-0066	5/17/04	Pacificorp - Currant Creek Power Project	SCR, Dry Low NO_x Combustion	2.25	ppm	
AZ-0038	4/30/02	Gila Bend Power Generation Station	SCR, Dry Low NO_x Combustion	2.5/2.0	ppmv	BACT
AL-0185	7/12/02	Barton Shoals Energy, LLC	SCR, Dry Low NO_x Combustion	2.5	ppm	BACT
AZ-0033	3/22/01	Mesquite Generating Station	SCR, Dry Low NO_x Combustion	2.5	ppmv	BACT
AZ-0034	2/15/01	Harquahala Generating Project	SCR, Dry Low NO_x Combustion	2.5	ppmv	BACT
CA-1209	3/11/10	High Desert Power Project LLC	SCR, Dry Low NO_x Combustion	2.5	ppmv	BACT
CA-1213	3/1/01	Mountainview Power Project	SCR	2.5	ppm	BACT-CA
CA	5/30/01	Contra Costa	SCR, Dry Low NO_x Combustion	2.5	ppmv	BACT-CA
CA	12/18/01	Elk Hills Power Project	SCR, Dry Low NO_x Combustion	2.5	ppmv	BACT-CA
CA	2/1/02	Delta Energy Center	SCR	2.5	ppm	BACT-CA
CA	12/1/2004	La Paloma PG&E	SCR	2.5	ppm	BACT-CA
CA	11/9/2004	Los Medanos - Calpine	SCR	2.5	ppm	BACT-CA
CA	9/1/01	Metcalf Energy Center	SCR	2.5	ppm	BACT-CA
CA	12/1/2004	Pastoria Energy LLC	SCR/DLN or XONON	2.5	ppm	BACT-CA

CTG/HRSG BACT NO_x Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
CA	12/1/2000	Suter Power Project	SCR	2.5	ppm	BACT-CA
CA		Texaco Global - Sunrise Cogeneration	SCR	2.5	ppm	BACT-CA
CA	3/1/01	Western Midway Sunset Power Project	SCR	2.5	ppm	BACT-CA
CA-1142	12/23/04	Calpine Western Regional Office - Pastoria Energy Facility	XONON or SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT-CA
CA-1143	8/16/04	Calpine Corporation - Sutter Power Plant	SCR, Dry Low NO_x Combustion	2.5	ppmv	BACT-CA
FL-0225	8/17/01	El Paso Broward Energy Center	SCR, Dry Low NO_x Combustion	2.5	ppmv	BACT
FL-0226	9/11/01	El Paso Manatee Energy Center	SCR, Dry Low NO_x Combustion	2.5	ppmv	BACT
FL-0227	9/7/01	El Paso Belle Glade Energy Center	SCR, Dry Low NO_x Combustion	2.5	ppmv	BACT
FL-0241	1/17/02	CPV Cana Power Generation Facility	SCR, Dry Low NO_x Combustion, Wet Injection	2.5	ppmvd	BACT
FL-0244	4/16/03	FPL Martin	SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT
FL-0245	4/15/03	FPL Manatee - Unit 3	SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT
FL-0256	9/8/03	FPC - Hines Energy Complex	SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT
FL-0265	6/8/05	Progress Energy - Hines Power Block 4	SCR	2.5	ppm	
GA	3/24/03	GenPower Rincon	SCR	2.5	ppm	
GA	4/17/03	Savannah Electric and Power - Plant McIntosh	SCR	2.5	ppm	
GA-0105	4/17/03	McIntosh Combined Cycle Facility	SCR, Dry Low NO_x Combustion	2.5	ppm	BACT
GA-0138	4/8/10	Live Oaks Power Plant	SCR, Dry Low NO_x Burners	2.5	ppm	BACT
ME	12/4/98	Westbrook Power LLC	SCR	2.5	ppm	LAER
MI-0366	4/13/2005	Berrien Energy LLC	SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT
NC-0094	1/9/02	GenPower Earleys, LLC	SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT
NC-0095	5/28/02	Mirant Gastonia	SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT
NC-0101	9/29/05	Forsyth Energy Projects, LLC	SCR, Dry Low NO_x Combustion	2.5	ppm	BACT
NC		Progress Energy Carolinas	SCR	2.5	ppm	
NH-0011	4/26/99	AES Londonderry, LLC	SCR, Dry Low NO_x Combustion	2.5	ppmv	BACT
NH-0012	4/26/99	Newington Energy LLC	SCR, Dry Low NO_x Combustion	2.5	ppmv	BACT
NJ-0043	3/28/02	Liberty Generating Station	SCR	2.5	ppmvd	Other
NY		Trigen-Nassau Energy Corp	SCR	2.5	ppm	
OR	7/3/02	Summit Westward - Westward Energy LLC	SCR, Dry Low NO_x Combustion	2.5	ppmvd	
OR-0035	1/16/02	Port Westward - Portland General Electric	SCR, Dry Low NO_x Combustion	2.5	ppm	BACT
OR-0039	12/30/03	California Oregon Border - Peoples Energy	SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT

CTG/HRSG BACT NO_x Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
OR-0040	3/12/03	Klamath Generation LLC - Pacific Power Energy Marketing	SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT
PA-0160	10/10/00	Calpine Construction Finance Co.	SCR, Dry Low NO_x Combustion	2.5	ppmv	LAER
PA-0188	3/28/02	Fairless Energy LLC	SCR, Dry Low NO_x Combustion	2.5	ppmv	LAER
PA-0189	1/16/02	Connectiv - Bethlehem North	SCR, Dry Low NO_x Combustion	2.5	ppmvd	LAER
PA-0223	1/30/02	Duke Energy Fayette, LLC	SCR, Dry Low NO_x Combustion	2.5	ppmvd	LAER
SC	5/28/02	Jasper County Generating Facility	SCR	2.5	ppm	
VA-0261	9/6/02	CPV Cunningham Creek	SCR, Dry Low NO_x Combustion	2.5	ppm	BACT
VA-0262	12/6/02	Mirant Airside Industrial Park	SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT
VA-0287	12/1/03	James City Energy Park	SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT
VA-0289	2/5/04	Duke Energy Wythe, LLC	SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT
WA	6/19/03	Frederickson Power II - West Coast Energy	SCR, Dry Low NO_x Combustion	2.5	ppmvd	
WA	9/20/02	Cliffs Energy Project - GNA Energy	SCR, Dry Low NO_x Combustion	2.5	ppmvd	
WA-0288	9/4/01	Longview Energy Development	SCR	2.5	ppmv	BACT
WA-0291	1/3/03	Wallula Power - Newport Northwest Generation	SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT
WA-0328	1/11/05	BP West Coast Products LLC, BP Cherry Point Cogeneration Project	SCR, Dry Low NO_x Combustion	2.5	ppmvd	BACT
WY-0061	4/4/03	Black Hills Corp - Neil Simpson Two	SCR, Dry Low NO_x Combustion	2.5	ppm	BACT
AZ		Reliant Energy - Desert Basin Generating Project	SCR	3	ppm	
CO-0052	8/11/02	Rocky Mountain Energy Center	SCR, Dry Low NO_x Combustion	3.0	ppm	BACT
CO-0056	5/2/06	Calpine - Rocky Mountain Energy Center, LLC	SCR, Dry Low NO_x Combustion	3.0	ppm	BACT
DE-0016	10/17/00	Hay Road Power Complex Units 5-8	SCR, Dry Low NO_x Combustion	3	ppmv	LAER
GA	1/15/02	Oglethorpe Power Corp - Wansley	SCR	3.0	ppm	
GA-0101	10/23/02	Murray Energy Facility	SCR, Dry Low NO_x Combustion	3	ppm	BACT
GA-0102	1/15/02	Wansley Combined Cycle Energy Facility	SCR, Dry Low NO_x Combustion	3	ppm	BACT
IA	7/23/02	Hawkeye Generation, LLC	SCR, Dry Low NO_x Combustion	3	ppm	
IA	12/20/02	Interstate Power and Light - Exira Station	SCR, Dry Low NO_x Combustion	3	ppm	
IA-0058	4/10/02	MidAmerican Energy, Des Moines Power Station	SCR, Dry Low NO_x Combustion	3	ppm	BACT
IN-0085	6/7/01	PSEG Lawrenceburg Energy Facility	SCR	3	ppmv	BACT

CTG/HRSG BACT NO_x Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
IN-0086	5/9/01	Mirant Sugar Creek LLC	SCR	3	ppmv	BACT
IN-0114	7/24/02	Mirant Sugar Creek LLC	SCR, Dry Low NO_x Combustion	3	ppmvd	BACT
LA	6/6/2005	Crescent City Power LLC	SCR/Low Nox Burners	3	ppm	
MI-0357	2/4/03	Kalkaska Generating LLC	SCR, Dry Low NO_x Combustion	3	ppmvd	BACT
MI-0361	1/30/03	South Shore Power LLC	SCR, Dry Low NO_x Combustion	3	ppmvd	BACT
MN-0054	7/15/04	Fairbault Energy Park	SCR, Dry Low NO_x Combustion	3	ppmvd	BACT
NJ-0066	2/16/06	AES Red Oak LLC	SCR, Dry Low NO_x Combustion	3.0	ppmvd	LAER
NJ		Tosco Bayway Refinery Cogen Project	DLN	3	ppm	
NY-0100	6/23/05	Empire Generating CO. LLC - Empire Power Plant - with duct burner	SCR, Dry Low NO_x Combustion	3.0	ppmvd	LAER
OH-0252	12/28/04	Duke Energy Hanging Rock Energy Facility	SCR, Dry Low NO_x Combustion	3.0	ppm	BACT
PA		SWEC Falls Township, PA	SCR	3	ppm	
VA	4/30/02	Tenaska Bear Garden	SCR	3.0	ppm	
VA-0256	1/20/02	Tenaska Fluvanna	SCR	3.0	ppm	BACT
VA-0260	5/1/02	Henry County Power	SCR, Dry Low NO_x Combustion	3.0	ppm	BACT
AR-0035	8/24/00	Panda - Union Generating Station	SCR, Dry Low NO_x Combustion	3.5	ppmv	BACT
AR-0040	12/29/00	Duke Energy Hot Springs	SCR, Dry Low NO_x Combustion	3.5	ppmv	BACT
AR-0051	4/1/02	Duke Energy - Jackson Facility	SCR, Dry Low NO_x Combustion	3.5	ppm	BACT
AR-0070	8/23/02	Genova Arkansas I, LLC	SCR, Dry Low NO_x Combustion	3.5	ppmvd	BACT
FL-0214	2/5/01	CPV Gulfcoast Power Generating STN	SCR, Dry Low NO_x Combustion	3.5	ppmv	BACT
FL-0239	3/27/02	Jacksonville Electric Authority - Brandy Branch	SCR, Dry Low NO_x Combustion	3.5	ppmvd	BACT
GA		Live Oaks Co LLC	SCR/DLN	3.5	ppm	
IL		Holland Energy	SCR	3.5	ppm	
MI-0267	6/7/01	Renaissance Power LLC	SCR, Dry Low NO_x Combustion	3.5	ppmv	BACT
MI-0365	1/28/03	Mirant Wyandotte LLC	SCR, Dry Low NO_x Combustion	3.5	ppmv	BACT
MS	6/24/02	Crossroads Energy Center	SCR	3.5	ppm	
MS-0055	6/24/02	El Paso Merchant Energy CO.	SCR, Dry Low NO_x Combustion	3.5	ppmv	BACT
MS-0073	11/23/04	Reliant Energy Choctaw County, LLC	SCR	3.5	ppmv	BACT
MS-0059	9/24/02	Pike Generation Facility	SCR, Dry Low NO_x Combustion	3.5	ppmv	BACT
NC-0086	1/10/02	Fayetteville Generation	SCR, Dry Low NO_x Combustion	3.5	ppmvd	BACT
NE-0023	5/29/03	Nebraska Public Power District - Beatrice Power Station	SCR, Dry Low NO_x Combustion	3.5	ppm	BACT

CTG/HRSG BACT NO_x Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
NV-0033	8/19/04	El Dorado Energy, LLC - turbine only	SCR, Dry Low NO_x Combustion	3.5	ppm	BACT
NV	10/16/04	Nevada Power Co.	SCR	3.5	ppm	
OH		Dresden Energy	SCR	3.5	ppm	
OH		PS&G Waterford Energy	SCR	3.5	ppm	
OK-0036	12/10/01	Stephens Energy Facility	SCR, Dry Low NO_x Combustion	3.5	ppmv	BACT
OK-0043	10/22/01	Webers Falls Energy Facility	SCR, Dry Low NO_x Combustion	3.5	ppmv	BACT
OK-0070	6/13/02	Genova OK I Power Project	SCR, Dry Low NO_x Combustion	3.5	ppmvd	BACT
OK-0090	3/21/03	Duke Energy Stephens, LLC	SCR, Dry Low NO_x Combustion	3.5	ppm	BACT
OK-0096	6/6/03	Redbud Power Plant	SCR, Dry Low NO_x Combustion	3.5	ppmvd	BACT
OK-0115	12/12/06	Energetix - Lawton Energy Cogen Facility	SCR, Dry Low NO_x Combustion	3.5	ppmvd	BACT
TN-0144	2/1/02	Haywood Energy Center (Calpine)	SCR, Dry Low NO_x Combustion	3.5	ppm	BACT
TX	12/13/02	Steag (Brazos Valley)	SCR	3.5	ppm	
VA	6/1/02	CPV FLUVANNA	SCR	3.5	ppm	
VA-0255	11/18/02	VA Power - Possum Point	Water Injection, SCR	3.5	ppmvd	LAER
WI-0174	9/20/00	Badger Generating Co LLC	SCR, Dry Low NO_x Combustion	3.5	ppmv	BACT
WV-0014	12/18/01	Panda Culloden Generating Station	SCR, Dry Low NO_x Combustion	3.5	ppmv	BACT
NV-0033	8/19/04	El Dorado Energy, LLC - with duct burner	SCR, Dry Low NO_x Combustion	3.7	ppm	BACT
LA-0224	3/20/08	Southwest Electric Power Company - Arsenal Hill Power Plant	SCR, Dry Low NO_x Combustion	4.0	ppmvd	BACT
KS	2/7/02	Duke Energy - Leavenworth County	SCR, Dry Low NO_x Combustion	4.5	ppm	
LA-0157	3/8/02	Perryville Power Station	SCR, Dry Low NO_x Combustion	4.5	ppm	BACT
MI-0363	1/7/03	Bluewater Energy Center LLC	SCR, Dry Low NO_x Combustion	4.5	ppmv	BACT
LA-0136	7/23/08	Dow Chemical Company - Plaquemine Cogeneration Facility	SCR, Dry Low NO_x Combustion	5.0	ppmvd	BACT
TX	10/8/03	TX Petrochem	SCR	5.0	ppm	
TX	7/23/02	Duke Energy	SCR	5.0	ppm	
TX-0407	12/6/02	Steag-Stearne	SCR, Dry Low NO_x Combustion	5.0	ppm	
LA		Formosa Plastics Corp. - Baton Rouge	DLN	9	ppm	
OK-0117	2/9/07	Public Service Company of Oklahoma - Southwestern Power Plant	SCR, Dry Low NO_x Combustion	9.0	ppm	BACT
OK-0056	2/12/02	Horseshoe Energy Project	SCR	12.5	ppm	BACT
FL-0285	1/26/07	Progress Energy - Bartow Power Plant	Water Injection	15.0	ppmvd	BACT
TN		TVA Lagoon Creek Plant	SCR	15	ppm	
TX-0234	1/8/02	Edinburg Energy Limited Partnership		15	ppm	BACT

CTG/HRSG BACT NO_x Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
TX-0374	3/24/03	Chocolate Bayou Plant - BP Amoco Chemical Co	SCR, Dry Low NO_x Combustion	11.43	lb/hour	BACT
LA-0120	2/26/02	Shell Chemical LP - Geismar Plant	SCR, Dry Low NO_x Combustion	14.5	lb/hour	BACT
OH-0264	5/23/04	Norton Energy Storage, LLC	SCR, Dry Low NO_x Combustion	16	lb/hour	BACT
NM-0044	6/27/04	Clovis Energy Facility - Duke energy Curry LLC	SCR	24.6	lb/hour	BACT
MT-0019	6/7/02	Continental Energy Services Inc. - Silver Bow Gen	SCR	25.2	lb/hour	BACT
OH-0248	9/24/02	Lawrence Energy - Calpine Corporation	SCR, Dry Low NO_x Combustion	30.5	lb/hour	BACT
TX-0352	12/31/02	Brazos Valley Electric Generating Facility	SCR	32.4	lb/hour	BACT
MN		Pleasant Valley	DLN, WI	35	ppm	
TX-0411	3/26/02	Amelia Energy Center	SCR	36.8	lb/hour	
TX-0502	6/5/06	Nacogdoches Power LLC	DLN, SCR	45.4	lb/hour	BACT
TX-0388	2/12/02	Sand Hill Energy Center - Austin Electric Utility		46	lb/hour	BACT
TX-0350	1/31/02	Ennis Tractebel Power	SCR, Dry Low NO_x Combustion	61.8	lb/hour	BACT
TX-0391	12/20/02	Oxy Cogeneration Facility - Oxy Vinyls LP	SCR	115	lb/hour	BACT
OK-0055	2/12/02	Mustang Energy Project	SCR	48.49	tons/year	BACT

Table contains:
Entries from the EPA turbine spreadsheet with a permit issuance date in 2002 - 2012
Entries from the RBLC for new units with a permit issuance date after 2002
Information from state agency websites

Source: Bowie Power Station, Class I Permit Application, Wind River Environmental Group LLC, Arizona DEQ-AQB, September 2013, App D.

Table D3 RBLC BACT Summary for CO

Table D3 CO BACT Summary

CTG/HRSG BACT CO Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis	Averaging Period
CT-0151	2/25/08	Kleen Energy Systems, LLC - turbine only	Oxidation Catalyst	0.9	ppmvd	BACT	1-hour block, no duct firing
CA-1192	6/21/11	Avenal Power Center LLC	Oxidation Catalyst	1.5	ppmvd	BACT	1-hour average, no duct firing, does not apply during first three years of operation
CA-1212	10/18/11	Palmdale Hybrid Power Project	Oxidation Catalyst	1.5	ppmvd	BACT	1-hour, no duct firing, does not apply during 3-year demonstration period
VA	3/12/13	Virginia Electric and Power Company - Warren County Power Plant - Brunswick - without duct burners	Oxidation Catalyst, Good Combustion Practices	1.5	ppmvd	BACT	1-hour average, no duct firing
VA-0315	12/17/10	Virginia Electric and Power Company - Warren County Power Plant - Dominion - without duct burners	Oxidation Catalyst, Good Combustion Practices	1.5	ppmvd	BACT	1-hour average, no duct firing
CT-0151	2/25/08	Kleen Energy Systems, LLC - with duct burner	Oxidation Catalyst	1.7	ppmvd	BACT	1-hour block
GA-0127	1/7/08	Southern Company/Georgia Power - Plant McDonough	Oxidation Catalyst	1.8	ppm	BACT	3-hour
CA	5/27/2003	Magnolia Power Project	Oxidation Catalyst	2	ppm		
CA		City of Victorville	Oxidation Catalyst	2	ppm	w/o duct burners	
CA	6/2/2011	Oakley Generating Station	Oxidation Catalyst	2	ppm		
CA		Sunlaw Cogen Partners		2	ppm		
CA-1050	9/11/00	IDC Bellingham	Oxidation Catalyst	2.0	ppm		
CA-1096	2/1/2004	Vernon City Power & Light	Oxidation Catalyst	2	ppm		
CA-1191	3/11/10	Victorville 2 Hybrid Power Project	Oxidation Catalyst	2.0	ppmvd	BACT	1-hour average, no duct firing
CA-1192	6/21/11	Avenal Power Center LLC	Oxidation Catalyst	2.0	ppmvd	BACT	1-hour average
CA-1212	10/18/11	Palmdale Hybrid Power Project	Oxidation Catalyst	2.0	ppmvd	BACT	1-hour
CT-0148	6/22/99	Lake Road Generating Company	Oxidation Catalyst	2	ppmv	BACT	
GA	5/30/12	Effingham County Power Plant	Oxidation Catalyst	2.0	ppmvd	BACT	
GA	4/17/03	Savannah Electric and Power - Plant McIntosh	Oxidation Catalyst	2.0	ppm		
GA	3/24/03	GenPower Rincon	Oxidation Catalyst	2.0	ppm		
GA	1/15/02	Oglethorpe Power Corp - Wansley	Oxidation Catalyst	2.0	ppm		
GA-0102	1/15/02	Wansley Combined Cycle Energy Facility	Good Combustion Practices	2	ppm	BACT	
GA-0105	4/17/03	McIntosh Combined Cycle Facility	Oxidation Catalyst	2	ppm	BACT	

CTG/HRSG BACT CO Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis	Averaging Period
GA-0138	4/8/10	Live Oaks Power Plant - without duct firing	Good Combustion Practices, Catalytic Oxidation	2.0	ppm	BACT	
ID-0018	6/25/10	Idaho Power Company - Langley Gulch Power Plant	Catalytic Oxidation, DLN, Good Combustion Practices	2.0	ppmvd	BACT	
IN-0158	12/3/12	St. Joseph Energy Center LLC	Oxidation Catalyst	2.0	ppmvd	BACT	
MA	2/22/1999	Cabot Power Island Cogeneraton Project	Oxidation Catalyst	2	ppm		
MA	12/14/2006	Fore River Station Weymouth	Oxidation Catalyst	2	ppm		
MA-0029	1/25/00	Sithe Mystic Development	Oxidation Catalyst	2.0	ppm	BACT	
MI-0366	4/13/2005	Berrien Energy LLC	Oxidation Catalyst	2.0	ppm	BACT	
NJ	9/13/12	Hess Newark Energy Center	Oxidation Catalyst	2	ppmvd	BACT	
NJ	5/31/12	Woodbridge Energy Center	Oxidation Catalyst	2	ppmvd	BACT	
NJ-0043	3/28/02	Liberty Generating Station	Oxidation Catalyst	2	ppmvd	Other	
NY	9/27/12	Cricket Valley Energy Center LLC	Good Combustion Controls and Oxidation Catalyst	2.0	ppmvd	BACT	
NY-0095	5/10/06	Caithness Bellport, LLC	Oxidation Catalyst	2.0	ppmvd	BACT	
OH-0352	6/18/13	Oregon Clean Energy Center	Oxidation Catalyst	2.0	ppmvd	BACT	
OR	1/6/2005	Turner Energy Center LLC	Oxidation Catalyst	2	ppm	>70% load	
OR-0039	12/30/03	California Oregon Border - Peoples Energy	Oxidation Catalyst	2	ppmvd	BACT	
OR-0041	8/8/05	Diamond Wanapa I, L. P. - Wanapa Energy Center	Oxidation Catalyst	2.0	ppmvd	BACT	
PA-0286	1/13/13	Moxie Energy LLC/Patriot Energy Plant	CO Catalyst	2.0	ppmvd	BACT	
PA-0291	4/23/13	Hickory Run Energy LLC	CO Catalyst	2.0	ppmvd	Other	
TX-0546	6/7/09	Pattillo Branch Power Company LLC	Oxidation Catalyst	2	ppmvd	BACT	
TX-0590	8/5/10	Pondera Capital Management GP INC - King Power Station	Oxidation Catalyst, Good Combustion Practices	2.0	ppmvd	BACT	
VA	4/30/13	Stonewall, LLC	Good Combustion Control and Oxidation Catalyst	2.0	ppmvd	BACT	
VA-0261	9/6/02	CPV Cunningham Creek	Oxidation Catalyst	2	ppm	BACT	
WA	6/19/03	Frederickson Power II - West Coast Energy	Oxidation Catalyst	2.0	ppmvd		
WA	4/20/03	Plymouth Generating Facility	Oxidation Catalyst	2	ppmvd		
WA-0288	9/4/01	Longview Energy Development	Oxidation Catalyst	2	ppmvd	BACT	
WA-0291	1/3/03	Wallula Power - Newport Northwest Generation	Oxidation Catalyst	2.0	ppmvd	BACT	
WA-0299	4/17/03	Sumas Energy 2 - NESCO	Oxidation Catalyst	2.0	ppmvd	BACT - Project Cancelled	
WA-0328	1/11/05	BP West Coast Products LLC, BP Cherry Point Cogeneration Project	Oxidation Catalyst	2.0	ppmvd	BACT	
WI-0114	1/13/95	LS Power	Oxidation Catalyst	2	ppmv	BACT	

CTG/HRSG BACT CO Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis	Averaging Period
VA	3/12/13	Virginia Electric and Power Company - Warren County Power Plant - Brunswick - without duct burners	Oxidation Catalyst, Good Combustion Practices	2.4	ppmvd	BACT	
VA-0315	12/17/10	Virginia Electric and Power Company - Warren County Power Plant - Dominion -with duct burners	Oxidation Catalyst, Good Combustion Practices	2.4	ppmvd	BACT	
PA-0189	1/16/02	Connectiv - Bethlehem North	Good Combustion Practices	2.5	ppm	BACT	
NV	10/16/2004	Nevada Power Co.	Oxidation Catalyst	2.6	ppm		
NV-0033	8/19/04	El Dorado Energy, LLC - turbine only	Oxidation Catalyst	2.6	ppm	LAER	
AZ-0039	3/7/03	Salt River Project/Santan Gen. Plant	Oxidation Catalyst	3	ppm	LAER	
AZ-0043	11/12/03	Duke Energy Arlington Valley	Oxidation Catalyst	3	ppm	BACT	
AZ-0047	12/1/2004	Dome Valley Energy Partners, LLC - Wellton Mohawk Generating Station	Oxidation Catalyst	3.0	ppmv	BACT	
CA		City of Victorville	Oxidation Catalyst	3	ppm	w/ duct burners	
CA-1191	3/11/10	Victorville 2 Hybrid Power Project	Oxidation Catalyst	3.0	ppmvd	BACT	
CA-1211	3/11/11	Colusa Generating Station	Catalytice Oxidation System	3.0	ppmvd	BACT	
CO-0056	5/2/06	Calpine - Rocky Mountain Energy Center, LLC	Oxidation Catalyst	3.0	ppm	BACT	
LA-0254	8/16/11	Ninemile Point Electric Generating Plant Units 6A and 6B	Oxidation Catalyst, Good Combustion Practices	3.0	ppmvd	BACT	
MA	4/16/1999	ANP Blackstone	Oxidation Catalyst	3	ppm		
MA		ANP Bellingham	Oxidation Catalyst	3	ppm		
MI	2/8/99	Wyandotte Energy	Oxidation Catalyst	3.0	ppm	LAER	
MI-0267	6/7/01	Renaissance Power LLC	Oxidation Catalyst	3.0	ppmv	BACT	
NV-0037	5/14/04	Sempra Energy Resources - Copper Mountain Power	Oxidation Catalyst	3.0	ppmvd	LAER	
OR	1/6/2005	Turner Energy Center LLC	Oxidation Catalyst	3	ppm	<70% load	
PA		SWEC Falls Township		3	ppm		
PA-0188	3/28/02	Fairless Energy LLC	Oxidation Catalyst	3	ppmvd	BACT	
UT		Summit Valley	Oxidation Catalyst	3	ppm		
UT-0066	5/17/04	Pacificorp - Currant Creek Power Project	Oxidation Catalyst	3.0	ppm		
GA-0138	4/8/10	Live Oaks Power Plant - with duct firing	Good Combustion Practices, Catalytic Oxidation	3.2	ppm	BACT	
MD-0032	11/5/04	Mirant Mid-Atlantic, LLC - Dickerson Unit 5 - turbine only	Oxidation Catalyst	3.2	lb/hour	BACT	
NV-0033	8/19/04	El Dorado Energy, LLC - with duct burner	Oxidation Catalyst	3.5	ppm	LAER	
NV-0035	8/16/05	Sierra Pacific Power Company - Tracy Substation Expansion Project	Oxidation Catalyst	3.5	ppm	BACT	

CTG/HRSG BACT CO Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis	Averaging Period
MI-0365	1/28/03	Mirant Wyandotte LLC	Oxidation Catalyst	3.8	ppm	BACT	
AZ-0033	3/22/01	Mesquite Generating Station	Oxidation Catalyst	4.0	ppmv	BACT	
AZ-0038	4/30/02	Gila Bend Power Generation Station		4	ppm	BACT	
CA	12/1/2008	Russell City Energy Center	Oxidation Catalyst	4	ppm	BACT-CA	
CA	8/1/2006	San Joaquin Valley Energy Center	Oxidation Catalyst	4	ppm	BACT-CA	
CA	12/1/2002	Palomar Escondido - Sempra	Oxidation Catalyst	4	ppm	BACT-CA	
CA	12/18/01	Elk Hills Power Project	Oxidation Catalyst	4.0	ppmv	BACT-CA	
CA	5/21/01	Three Mountain Power		4.0	ppm	BACT-CA	
CA	12/1/2000	Sutter Power Project	Oxidation Catalyst	4	ppm	BACT-CA	
CA-0997	9/1/03	Sacramento Municipal Utility District	Good Combustion Control	4	ppm	LAER	
CA-1143	8/16/04	Calpine Corporation - Sutter Power Plant	Oxidation Catalyst	4.0	ppmvd	BACT-CA	
CA-1144	4/25/07	Caithness Blythe II, LLC		4.0	ppmvd	BACT-CA	
CA-1209	3/11/10	High Desert Power Project LLC	Oxidation Catalyst	4.0	ppmvd	BACT	
LA	6/6/2005	Crescent City Power LLC	Oxidation Catalyst & good combustion	4	ppm		
MI-0361	1/30/03	South Shore Power LLC	Oxidation Catalyst	4	ppmvd	BACT	
NJ		Tosco Bayway Refinery Cogen Project		4	ppm		
NJ-0066	2/16/06	AES Red Oak LLC	Oxidation Catalyst	4.0	ppmvd	BACT	
NV-0038	6/28/05	Ivanpah Energy Center, L.P.	Good Combustion Practice, Oxidation Catalyst	4.0	ppmvd	LAER	
OR	7/3/02	Summit Westward - Westward Energy LLC	Good Combustion Practices	4	ppmvd		
TX-0600	9/1/11	Thomas C. Ferguson Power Plant	Oxidation Catalyst, Good Combustion Practices	4.0	ppmvd	BACT	
TX-0618	10/24/12	Channel Energy Center LLC	Good Combustion	4.0	ppmvd	BACT	
TX-0619	9/26/12	Deer Park Energy Center	Good Combustion	4.0	ppmvd	BACT	
TX-0620	9/12/12	ES Joslin Power Plant	Good Combustion	4.0	ppmvd	BACT	
UT		Calpine - Vineyard Energy Center LLC	Oxidation Catalyst	4	ppm		
WA	9/20/02	Cliffs Energy Project - GNA Energy	Oxidation Catalyst	4	ppmvd		
WI-0174	9/20/00	Badger Generating Co LLC	Oxidation Catalyst	4	ppmv	BACT	
OR-0035	1/16/02	Port Westward - Portland General Electric	Oxidation Catalyst	4.9	ppmvd	BACT	
IA	12/20/02	Interstate Power and Light - Exira Station	Oxidation Catalyst	5	ppm		
IA	7/23/02	Hawkeye Generation, LLC	Oxidation Catalyst	5	ppm		
IA-0058	4/10/02	MidAmerican Energy, Des Moines Power Station	Oxidation Catalyst	5	ppm	BACT	
MI-0256	1/12/01	Covert Generating Co LLC	Oxidation Catalyst	5.0	ppmv	BACT	
MI-0357	2/4/03	Kalkaska Generating LLC	Oxidation Catalyst	5	ppmvd	BACT	
OR-0040	3/12/03	Klamath Generation LLC - Pacific Power Energy Marketing	Oxidation Catalyst	5.0	ppmvd	BACT	
PA-0223	1/30/02	Duke Energy Fayette, LLC	Oxidation Catalyst	5	ppm	BACT	
CA	12/1/2004	La Paloma PG&E	Oxidation Catalyst	6	ppm		
CA	11/9/2004	Los Medanos Energy Center	Oxidation Catalyst	6	ppm		

CTG/HRSG BACT CO Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis	Averaging Period
CA	9/1/01	Metcalf Energy Center		6.0	ppm		
CA	5/30/01	Contra Costa	Oxidation Catalyst	6.0	ppmv	BACT-CA	
CA	3/1/01	Western Midway Sunset Power Project	Oxidation Catalyst	6.0	ppm	BACT-CA	
CA		Texaco Global - Sunrise Cogeneration		6	ppm		
CA-1142	12/23/04	Calpine Western Regional Office - Pastoria Energy Facility	Oxidation Catalyst	6.0	ppmvd	BACT-CA	
CA-1177	9/12/11	Otay Mesa	Oxidation Catalyst	6.0	ppmv	BACT -CA	
CA-1213	3/1/01	Mountainview Power Project	Oxidation Catalyst	6.0	ppm	BACT-CA	
FL-0280	5/30/06	Florida Municipal Power Agency - Treasure Coast Energy Center	Good Combustion	6.0	ppm	BACT	
FL-0304	9/8/08	Florida Municipal Power Agency - Cane Island Power Park	Good Combustion Practices	6.0	ppmvd	BACT	
IN-0085	6/7/01	PSEG Lawrenceburg Energy Facility	Good Combustion	6	ppmv	BACT	
OH-0252	12/28/04	Duke Energy Hanging Rock Energy Facility - turbine only		6.0	ppm	BACT	
OR	1/18/02	Umatilla Generating - PG&E	Oxidation Catalyst	6.0	ppmvd		
FL-0225	8/17/01	El Paso Broward Energy Center	Combustion Controls	7.4	ppmv	BACT	
FL-0226	9/11/01	El Paso Manatee Energy Center	Combustion Controls	7.4	ppmv	BACT	
FL-0227	9/7/01	El Paso Belle Glade Energy Center	Combustion Controls	7.4	ppmv	BACT	
TN-0144	2/1/02	Haywood Energy Center (Calpine)	Good Combustion Practices	7.4	ppm	BACT	
FL-0263	2/8/05	Florida Power and Light Turkey Point Power Plant	Good Combustion Practices	7.6	ppm	BACT	
MD-0032	11/5/04	Mirant Mid-Atlantic, LLC - Dickerson Unit 5 - with duct burner	Oxidation Catalyst	7.6	lb/hour	BACT	
OK	1/21/00	Oneta Generating Station	Combustion Controls	7.8	ppm	BACT	
FL-0241	1/17/02	CPV Cana Power Generation Facility	Good Combustion Practices	8	ppmvd	BACT	
FL-0265	6/8/05	Progress Energy - Hines Power Block 4	Good Combustion	8.0	ppm	BACT	
FL-0285	1/26/07	Progress Energy - Bartow Power Plant	Good Combustion	8.0	ppmvd	BACT	
FL-0286	1/10/07	Florida Power and Light West County Energy Center		8.0	ppmvd	BACT	
OK-0129	1/23/09	Associated Electric Cooperative Inc - Chouteau Power Plant	Good Combustion	8.0	ppmv	BACT	
AR-0070	8/23/02	Genova Arkansas I, LLC	Good Combustion Practices	8.2	ppmvd	BACT	
OK-0070	6/13/02	Genova OK I Power Project	Combustion Controls	8.2	ppm	BACT	
WV-0014	12/18/01	Panda Culloden Generating Station	Good Combustion	8.2	ppmv	BACT	
MD-0032	11/5/04	Mirant Mid-Atlantic, LLC - Dickerson Unit 4 - turbine only	Oxidation Catalyst	8.4	lb/hour	BACT	
CA	12/1/2002	Pastoria Energy LLC	Oxidation Catalyst	9	ppm	BACT-CA	
CO	6/19/00	Fort St. Vrain	Combustion Controls	9.0	ppm	BACT	
CO-0052	8/11/02	Rocky Mountain Energy Center	Oxidation Catalyst	9	ppmvd	BACT	
DE-0016	10/17/00	Hay Road Power Complex Units 5-8	Good Combustion	9	ppmv	BACT	

CTG/HRSG BACT CO Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis	Averaging Period
FL	1/9/02	TECO Bayside Power Station (repowering)	Good Combustion Practices	9.0	ppm		
FL-0214	2/5/01	CPV Gulfcoast Power Generating STN	Combustion Controls	9	ppmv	BACT	
FL-0223	11/4/99	Lake Worth Generating, LLC	Combustion Design	9	ppmv	BACT	
IN-0086	5/9/01	Mirant Sugar Creek LLC	Good Combustion	9	ppmv	BACT	
IN-0087	6/6/01	Duke Energy, Vigo LLC	Good Combustion	9.0	ppmv	BACT	
IN-0114	7/24/02	Mirant Sugar Creek LLC	Good Combustion Practices	9	ppmvd	BACT	
ME	9/14/98	Champion Intl Corp. & Champ. Clean Energy		9.0	ppm	BACT	
MN-0071	6/5/07	Minnesota Municipal Power Agency - Fairbault Energy Park - turbine only	Good Combustion	9.0	ppmvd	BACT	
NC-0086	1/10/02	Fayetteville Generation	Good Combustion Practices	9	ppm	BACT	
NC-0094	1/9/02	GenPower Earleys, LLC	Good Combustion Practices	9	ppm	BACT	
NC-0095	5/28/02	Mirant Gastonia	Good Combustion Practices	9	ppm	BACT	
NY		Trigen Nassau Energy Corp.		9	ppm		
OH-0252	12/28/04	Duke Energy Hanging Rock Energy Facility - with duct burner		9.0	ppm	BACT	
SC	5/28/02	Jasper County Generating Facility	Good Combustion Practices	9	ppm		
VA-0287	12/1/03	James City Energy Park	Good Combustion Practices	9.0	ppm	BACT	
VA-0289	2/5/04	Duke Energy Wythe, LLC - turbine only	Good Combustion Practices	9	ppmvd	BACT	
OH-0248	9/24/02	Lawrence Energy - Calpine Corporation	Oxidation Catalyst	9.8	lb/hour	BACT	
AL-0185	7/12/02	Barton Shoals Energy, LLC	Good Combustion Practices	10.0	ppm	BACT	
CA	2/1/02	Delta Energy Center		10.0	ppm		
FL-0202	8/17/92	Orlando Cogen	Combustion Controls	10	ppmv	BACT	
FL-0244	4/16/03	FPL Martin	Good Combustion Practices	10	ppmvd	BACT	
FL-0245	4/15/03	FPL Manatee - Unit 3	Good Combustion Practices	10	ppmvd	BACT	
FL-0256	9/8/03	FPC - Hines Energy Complex	Good Combustion Practices	10	ppmvd	BACT	
LA-0224	3/20/08	Southwest Electric Power Company - Arsenal Hill Power Plant	Proper Operating Practices	10.0	ppmvd	BACT	
MN-0053	7/15/04	Fairbault Energy Park	Good Combustion Practices	10	ppmvd	BACT	
MN-0060	8/12/05	Northern States Power Co. DBA XCEL Energy - High Bridge Generating Plant - turbine only	Good Combustion Practices	10.0	ppm	BACT	
MN-0066	5/16/06	Northern States Power Co. DBA XCEL Energy - Riverside Plant	Good Combustion Practices	10.0	ppm	BACT	
MO-0049	8/19/99	Kansas City Power & Light	Oxidation Catalyst	10	ppmv	BACT	
MO-0056	3/30/99	Associated Electric Cooperative, Inc.	Good Combustion	10	ppmv	BACT	
NC		Progress Energy - Carolinas	GCP	10	ppm		
OK	3/24/99	Chouteau Power Plant	Combustion Controls	10.0	ppm	BACT	
OK-0036	12/10/01	Stephens Energy Facility		10.0	ppmv	BACT	
OK-0043	10/22/01	Webers Falls Energy Facility	Combustion Controls	10	ppmv	BACT	
OK-0090	3/21/03	Duke Energy Stephens, LLC	Combustion Controls	10	ppm	BACT	

CTG/HRSG BACT CO Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis	Averaging Period
PA-0160	10/10/00	Calpine Construction Finance Co.		10.0	ppmv	BACT	
PA-0226	4/9/02	Limerick Partners, LLC		10	ppm	BACT	
VA-0262	12/6/02	Mirant Airside Industrial Park	Good Combustion Practices	10.3	ppmvd	BACT	
MS	6/24/02	Crossroads Energy Center	Good Combustion Practices	10.4	ppm		
NE-0023	5/29/03	Nebraska Public Power District - Beatrice Power Station	Oxidation Catalyst	10.8	lb/hour	BACT	
MN-0071	6/5/07	Minnesota Municipal Power Agency - Fairbault Energy Park - with duct burner	Good Combustion	11.0	ppmvd	BACT	
MD-0032	11/5/04	Mirant Mid-Atlantic, LLC - Dickerson Unit 4 - with duct burner	Oxidation Catalyst	11.5	lb/hour	BACT	
NC-0101	9/29/05	Forsyth Energy Projects, LLC - turbine only	Good Combustion Practices	11.6	ppm	BACT	
GA-0101	10/23/02	Murray Energy Facility	Good Combustion Practices	12	ppm	BACT	
FL-0239	3/27/02	Jacksonville Electric Authority - Brandy Branch	Good Combustion Practices	12.21	ppmvd	BACT	
MS-0055	6/24/02	El Paso Merchant Energy CO.	Good Combustion Practices	13.8	ppmv	BACT	
VA-0289	2/5/04	Duke Energy Wythe, LLC - with duct burner	Good Combustion Practices	14.6	ppmvd	BACT	
TX	10/8/03	TX Petrochem	Good Combustion Practices	15	ppm		
TX-0547	6/22/09	Lamar Power Partners II LLC	Good Combustion Practices	15	ppmvd	BACT	
NC		Southern Power Co. - Plant Rowan County	GCP	16	ppm		
OK-0115	12/12/06	Energetix - Lawton Energy Cogen Facility	Good Combustion Practices	16	ppmvd	BACT	
KS	2/7/02	Duke Energy - Leavenworth County	Good Combustion Practices	16.9	ppm		
GA		Live Oak Co. LLC	GCP	17	ppm		
OK-0096	6/6/03	Redbud Power Plant	Good Combustion Practices	17.2	ppmvd	BACT	
TX-0548	8/18/09	Madison Bell Partners LP	Good Combustion Practices	17.5	ppmvd	BACT	
MN-0060	8/12/05	Northern States Power Co. DBA XCEL Energy - High Bridge Generating Plant - with duct firing	Good Combustion Practices	18.0	ppm	BACT	
MS-0073	11/23/04	Reliant Energy Choctaw County, LLC		18.36	ppmv	BACT	
TX	7/23/02	Duke Energy		20.0			
TX-0502	6/5/06	Nacogdoches Power LLC	Good Combustion Practices	20.2	ppmvd	BACT	
VA-0256	1/20/02	Tenaska Fluvanna	Good Combustion Practices	21	ppmvd	BACT	
OH-0264	5/23/04	Norton Energy Storage, LLC		23	lb/hour	BACT	
AR-0051	4/1/02	Duke Energy - Jackson Facility	Good Operating Practices	23.6	ppm	BACT	
AZ		Reliant Energy - Desert Basin Generating Project		24	ppm		
LA-0136	7/23/08	Dow Chemical Company - Plaquemine Cogeneration Facility	Good Combustion Practices	25.0	ppmvd	BACT	
LA-0157	3/8/02	Perryville Power Station	Good Operating Practices	25.0	ppm	BACT	

CTG/HRSG BACT CO Comparison

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis	Averaging Period
OK-0117	2/9/07	Public Service Company of Oklahoma - Southwestern Power Plant	Combustion Control	25.0	ppmvd	BACT	
TX	12/13/02	Steag (Brazos Valley)	Good Combustion Practices	25	ppm		
NC-0101	9/29/05	Forsyth Energy Projects, LLC - with duct burner	Good Combustion Practices	25.9	ppm	BACT	
MI-0362	4/21/03	Midland Cogeneration Venture Limited Partnership	Good Combustion Practices	26	lb/hour	BACT	
VA-0255	11/18/02	VA Power - Possum Point		32	lb/hour	BACT	
MN		Pleasant Valley	GCP	35	ppm		
AZ-0034	2/15/01	Harquahala Generating Project	Oxidation Catalyst	37	lb/hour	BACT	
WY-0061	4/4/03	Black Hills Corp - Neil Simpson Two	Good Combustion Practices	37.2	ppmvd	BACT	
NM-0044	6/27/04	Clovis Energy Facility - Duke energy Curry LLC	Good Combustor Design	37.6	lb/hour	BACT	
MS-0059	9/24/02	Pike Generation Facility	Efficient Combustion Practices	40.0	ppmv	BACT	
OK-0055	2/12/02	Mustang Energy Project	Combustion Controls	40	ppm	BACT	
VA-0260	5/1/02	Henry County Power	Good Combustion Practices	41.4	lb/hour	BACT	
MI-0363	1/7/03	Bluewater Energy Center LLC	Catalytic Afterburner	41.7	lb/hour	BACT	
TX-0234	1/8/02	Edinburg Energy Limited Partnership		43	lb/hour	BACT	
LA-0120	2/26/02	Shell Chemical LP - Geismar Plant	Good Combustion Practices	44.0	lb/hour	BACT	
CT		PDC - El Paso Meriden	Oxidation Catalyst	52.4	lb/hr		
TX-0391	12/20/02	Oxy Cogeneration Facility - Oxy Vinyls LP	Good Combustion Practices	64.3	lb/hour	BACT	
TX-0374	3/24/03	Chocolate Bayou Plant - BP Amoco Chemical Co	Good Combustion Practices	66.81	lb/hour	BACT	
TX-0352	12/31/02	Brazos Valley Electric Generating Facility	Good Combustion Control	92.4	lb/hour	BACT	
TX-0388	2/12/02	Sand Hill Energy Center - Austin Electric Utility		98.2	lb/hour	BACT	
TX-0407	12/6/02	Steag-Stearne	Good Combustion Practices	109.4	lb/hour		
TX-0350	1/31/02	Ennis Tractebel Power	None	124	lb/hour	BACT	
MT-0019	6/7/02	Continental Energy Services Inc. - Silver Bow Gen		139.9	lb/hour	Other	
TX-0411	3/26/02	Amelia Energy Center	Good Combustion Practices	208.0	lb/hour		

Table contains:
Entries from the EPA turbine spreadsheet with a permit issuance date in 2002 - 2012
Entries from the RBLC for new units with a permit issuance date after 2002
Information from state agency websites

Source: Bowie Power Station, Class I Permit Application, Wind River Environmental Group LLC, Arizona DEQ-AQB, September 2013, App D.

Table D4 RBLC BACT Summary for PM10/2.5

Table D4 PM/PM10/PM2.5 BACT Summary

CTG/HRSG BACT Comparison for $PM/PM_{10}/PM_{2.5}$

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
OK-0129	1/23/09	Associated Electric Cooperative Inc - Chouteau Power Plant	Natural Gas Fuel	6.59	lb/hour	No duct firing
CA	12/1/2008	Russell City - Calpine	SCR, DLN, Oxidation catalyst	7.5	lbs/hr	BACT-CA
LA-0191	10/12/04	Entergy New Orleans, Inc. - Michoud Electric Generating Plant - turbine only	Use of Clean Burning Fuels	7.85	lb/hour	BACT - no duct firing
CA-1144	4/25/07	Caithness Blythe II, LLC	Use Public Utility Commission Quality Natural Gas with Sulfur Content less than or Equal to 05 grains/100scf	8.0	lb/hour	BACT-CA
VA-0315	12/17/10	Virginia Electric and Power Company - Warren County Power Plant - Dominion -without duct burners	Natural Gas with Sulfur Content of 0.0003% by Weight	8.00	lb/hour	BACT - without duct burners
CA-1192	6/21/11	Avenal Power Center LLC	Pipeline Quality Natural Gas	8.91	lb/hour	BACT - no duct firing
CA		Delta Energy Center		9	lbs/hr	
CA		Duke Energy - Moss Landing	SCR, DLN	9	lbs/hr	
CA		Los Medanos - Calpine	SCR, DLN, Oxidation catalyst	9	lbs/hr	
CA	9/1/01	Metcalf - Calpine	SCR, DLN, Oxidation catalyst	9	lbs/hr	w/o duct burner
CA-0997	9/1/03	Sacramento Municipal Utility District	Good Combustion Control	9	lb/hour	LAER
ME	9/14/98	Champion Intl Corp. & Champ. Clean Energy		9.0	lb/hour	BACT
MO	6/19/00	University of Missouri - Columbia	Combustion Controls	9.0	lb/hour	BACT
NV-0033	8/19/04	El Dorado Energy, LLC - turbine only		9	lb/hour	LAER
CA	3/1/01	Western Midway Sunset Power Project		9.4	lb/hour	BACT-CA
OK	1/21/00	Oneta Generating Station	Use of Natural Gas	9.4	lb/hour	BACT
LA-0191	10/12/04	Entergy New Orleans, Inc. - Michoud Electric Generating Plant - with duct burner	Use of Clean Burning Fuels	9.77	lb/hour	BACT
TX-0374	3/24/03	Chocolate Bayou Plant - BP Amoco Chemical Co	Good Combustion Practices, Only Gaseous Fuels Containing No Ash	10.03	lb/hour	BACT
LA-0120	2/26/02	Shell Chemical LP - Geismar Plant	Good Combustion Practices, Natural Gas	10.8	lb/hour	BACT
NE-0023	5/29/03	Nebraska Public Power District - Beatrice Power Station		10.8	lb/hour	BACT
CA-1096		Vernon City Power & Light		11	lbs/hr	
CA	1/30/2004	Magnolia Power Project	Natural gas fuel	11	lbs/hr	

CTG/HRSG BACT Comparison for $PM/PM_{10}/PM_{2.5}$

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis	
CA		Inland Empire	SCR, DLN, Oxidation catalyst	11	lbs/hr		
CA		SCE/Mountainview 3 and 4	SCR, DLN, Oxidation catalyst	11	lbs/hr		
CT-0151	2/25/08	Kleen Energy Systems, LLC - turbine only		11.0	lb/hour	BACT	
FL-0241	1/17/02	CPV Cana Power Generation Facility	Good Combustion, Clean Fuel	11	lb/hour	BACT	
MD-0032	11/5/04	Mirant Mid-Atlantic, LLC - Dickerson Unit 5 - turbine only		11.0	lb/hour	BACT	
MI-0267	6/7/01	Renaissance Power LLC	Good Combustion	11.0	lb/hour	BACT	
NJ	9/13/12	Hess Newark Energy Center		11	lb/hour	BACT	
TX-0590	8/5/10	King Power Station - Siemens Turbines	Low Ash Fuel	11.1	lb/hour	BACT	
NV-0038	6/28/05	Ivanpah Energy Center, L.P.	Good Combustion Control, Pipeline Quality Natural Gas	11.25	lb/hour	LAER	
CA-1213	3/1/01	Mountainview Power Project		11.5	lb/hour	BACT-CA	
CA-1143	8/16/04	Calpine Corporation - Sutter Power Plant		11.5	lb/hour	BACT-CA	
CA		San Joaquin Valley Energy Center		11.5	lbs/hr		
CA		Feather River - Calpine		11.5	lbs/hr		
NV-0033	8/19/04	El Dorado Energy, LLC - with duct burner		11.6	lb/hour	LAER	
CA-1192	6/21/11	Avenal Power Center LLC	Pipeline Quality Natural Gas	11.78	lb/hour	BACT	
CA-1191	3/11/10	Victorville 2 Hybrid Power Project	Pipeline Quality Natural Gas	12.0	lb/hour	BACT	No duct firing
CA		Metcalf - Calpine	SCR, DLN, Oxidation catalyst	12	lbs/hr	w/ duct burner	
CA-1191		City of Victorville		12	lbs/hr	w/o duct burner	
OH-0264	5/23/04	Norton Energy Storage, LLC		13	lb/hour	BACT	
CA		Morro Bay - Duke		13.3	lbs/hr		
CA-1211	3/11/11	Colusa Generating Station	Natural Gas	13.5	lb/hour	BACT	
CA		Palomar Energy Project		14	lbs/hr		
OR-0039	12/30/03	California Oregon Border - Peoples Energy	Good Combustion, Natural Gas	14	lb/hour	BACT	
VA-0315	12/17/10	Virginia Electric and Power Company - Warren County Power Plant - Dominion -with duct burners	Natural Gas with Sulfur Content of 0.0003% by Weight	14.0	lb/hour	BACT	
VA	4/30/13	Stonewall, LLC	Good Combustion Practices and Pipleine Quality Natural Gas	14.5	lb/hour	BACT	

CTG/HRSG BACT Comparison for $PM/PM_{10}/PM_{2.5}$

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis	
MD-0032	11/5/04	Mirant Mid-Atlantic, LLC - Dickerson Unit 5 - with duct burner		15.0	lb/hour	BACT	
OH-0252	12/28/04	Duke Energy Hanging Rock Energy Facility - turbine only		15.0	lb/hour	BACT	
CT-0151	2/25/08	Kleen Energy Systems, LLC - with duct burner		15.2	lb/hour	BACT	
VA-0256	1/20/02	Tenaska Fluvanna	Use of Natural Gas	16.2	lb/hour	BACT	
NC-0095	5/28/02	Mirant Gastonia	Good Combustion Practices	16.85	lb/hour	BACT	
CA		La Paloma		17.2	lbs/hr		
TN-0144	2/1/02	Haywood Energy Center (Calpine)	Good Combustion Practices, Clean Fuel	17.5	lb/hour	BACT	
VA-0289	2/5/04	Duke Energy Wythe, LLC - turbine only	Good Combustion Practices	17.5	lb/hour	BACT	
CA-1191	3/11/10	Victorville 2 Hybrid Power Project	Pipeline Quality Natural Gas	18.0	lb/hour	BACT	with duct firing
IN-0086	5/9/01	Mirant Sugar Creek LLC	Good Combustion	18	lb/hour	BACT	
OH-0268	3/26/02	Lima Energy Company	Use of Clean Burning Fuels	18	lb/hour	BACT	
OR		Turner Energy Center		18	lbs/hr		
TX-0234	1/8/02	Edinburg Energy Limited Partnership		18	lb/hour	BACT	
TX-0351	3/11/02	Weatherford Electric Generation Facility	None	18	lb/hour	Other	
TX-0620	9/12/12	ES Joslin Power Plant		18.0	lb/hour	BACT	
VA-0262	12/6/02	Mirant Airside Industrial Park	Good Combustion Practices	18.0	lb/hour	BACT	
WV-0014	12/18/01	Panda Culloden Generating Station	Use of Natural Gas	18	lb/hour	BACT	
PA-0291	4/23/13	Hickory Run Energy LLC		18.5	lb/hour	Other	
MI	3/16/00	Southern Energy, Inc.		19.0	lb/hour	BACT	
MI-0366	4/13/05	Berrien Energy, LLC	State of the Art Combustion Techniques and Use of Natural Gas	19.0	lb/hour	BACT	
NM-0044	6/27/04	Clovis Energy Facility - Duke energy Curry LLC		19	lb/hour	BACT	
OK-0036	12/10/01	Stephens Energy Facility		19.1	lb/hour	BACT	
NJ	5/31/12	Woodbridge Energy Center	Use of Natural Gas	19.1	lb/hour	BACT	
MI-0363	1/7/03	Bluewater Energy Center LLC	Use of Natural Gas	19.6	lb/hour	BACT	
TX-0590	8/5/10	Pondera Capital Management GP INC - King Power Station	Low Ash Fuel	19.8	lb/hour	BACT	
CA-1177	7/22/09	Otay Mesa Generating Project		20.0	lb/hour		
FL-0225	8/17/01	El Paso Broward Energy Center	Use of Natural Gas	20.0	lb/hour	BACT	
FL-0227	9/7/01	El Paso Belle Glade Energy Center	Use of Natural Gas	20.0	lb/hour	BACT	

CTG/HRSG BACT Comparison for $PM/PM_{10}/PM_{2.5}$

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
LA-0164	1/31/02	Acadia Power Station, Acadia Power Partners LLC	Good Design, Good Operating and Maintenance Practices	20	lb/hour	BACT
TX-0391	12/20/02	Oxy Cogeneration Facility - Oxy Vinyls LP		20	lb/hour	BACT
CA	5/1/2008	Colussa Generating Station		20.1	lbs/hr	
IN-0114	7/24/02	Mirant Sugar Creek LLC		20.2	lb/hour	BACT
MS-0055	6/24/02	El Paso Merchant Energy CO.	Use of Low Ash Fuel	20.5	lb/hour	BACT
MS-0073	11/23/04	Reliant Energy Choctaw County, LLC		20.59	lb/hour	BACT
IN-0085	6/7/01	PSEG Lawrenceburg Energy Facility	Good Combustion	21	lb/hour	BACT
NV-0037	5/14/04	Sempra Energy Resources - Copper Mountain Power	Use of Low-Sulfur Natural Gas	21.3	lb/hour	LAER
FL-0226	9/11/01	El Paso Manatee Energy Center	Use of Natural Gas	21.8	lb/hour	BACT
MA-0024	4/16/99	ANP Blackstone	Use of Natural Gas	21.8	lb/hour	BACT
NC-0094	1/9/02	GenPower Earleys, LLC	Good Combustion Practices and Design	22	lb/hour	BACT
VA-0255	11/18/02	VA Power - Possum Point		22.2	lb/hour	BACT
WA		Goldendale Energy		22.3	lbs/hr	
MA-0025	8/4/99	ANP Bellingham	Use of Natural Gas	22.6	lb/hour	BACT
LA-0157	3/8/02	Perryville Power Station	Good Operating Practices, Natural Gas	23	lb/hour	BACT
MD-0032	11/5/04	Mirant Mid-Atlantic, LLC - Dickerson Unit 4 - turbine only		23.0	lb/hour	BACT
OH-0252	12/28/04	Duke Energy Hanging Rock Energy Facility - with duct burner		23.3	lb/hour	BACT
VA-0289	2/5/04	Duke Energy Wythe, LLC - with duct burner	Good Combustion Practices	23.7	lb/hour	BACT
MI-0361	1/30/03	South Shore Power LLC	Use of Natural Gas, State of the Art Combustion Techniques	24	lb/hour	BACT
MO	8/19/99	Kansas City Power & Light Co. - Hawthorn Station	Combustion Controls	24.0	lb/hour	BACT
LA-0224	3/20/08	Southwest Electric Power Company - Arsenal Hill Power Plant	Good Combustion Design, Proper Operating Practices/Pipeline Quality Natural Gas	24.23	lb/hour	BACT
VA-0287	12/1/03	James City Energy Park	Good Combustion Design, Clean Fuel	24.7	lb/hour	BACT
AZ-0043	11/12/03	Duke Energy Arlington Valley		25	lb/hour	BACT
GA-0101	10/23/02	Murray Energy Facility	Good Combustion Practices, Clean Fuel	25	lb/hour	BACT

CTG/HRSG BACT Comparison for $PM/PM_{10}/PM_{2.5}$

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
VA-0260	5/1/02	Henry County Power	Good Combustion Design, Clean Fuel	25.3	lb/hour	BACT
TX-0411	3/26/02	Amelia Energy Center	Natural Gas Combustion	25.6	lb/hour	
TX-0350	1/31/02	Ennis Tractebel Power	None	25.62	lb/hour	BACT
MD-0032	11/5/04	Mirant Mid-Atlantic, LLC - Dickerson Unit 4 - with duct burner		26.0	lb/hour	BACT
LA-0254	8/16/11	Ninemile Point Electric Generating Plant Units 6A and 6B - without duct burner	Pipeline Natural Gas, Good Combustion Practices	26.23	lb/hour	BACT
TX-0407	12/6/02	Steag-Stearne	Pipeline Natural Gas	26.9	lb/hour	
TX-0502	6/5/06	Nacogdoches Power LLC	Pipeline Natural Gas	26.9	lb/hour	BACT
TX-0618	10/15/12	Channel Energy Center LLC	Good Combustion, Use of Gaseous Fuel	27.0	lb/hour	BACT
TX-0619	9/26/12	Deer Park Energy Center	Good Combustion, Use of Gaseous Fuel	27.0	lb/hour	BACT
AZ-0034	2/15/01	Harquahala Generating Project	Combustion Controls	27.8	lb/hour	BACT
NJ-0043	3/28/02	Liberty Generating Station		28.8	lb/hour	Other
AR	12/29/00	Duke Energy Hot Springs	Combustion Controls	29.4	lb/hour	BACT
MN	11/17/00	XCEL Energy, Black Dog Electric Generating Station	Use of Natural Gas	29.4	lb/hour	BACT
NJ-0066	2/16/06	AES Red Oak LLC	Use of Natural Gas	29.43	lb/hour	BACT
AZ-0047	12/1/2004	Dome Valley Energy Partners, LLC - Wellton Mohawk Generating Station - Scenario 1	Good Combustion Practices, Natural Gas	29.8	lb/hour	BACT
AZ	2003 Dft	La Paz Generating Facility (W501F)		30.3	lb/hour	BACT
NC-0086	1/10/02	Fayetteville Generation	Combustion Controls	31.3	lb/hour	BACT
TX-0388	2/12/02	Sand Hill Energy Center - Austin Electric Utility		32	lb/hour	BACT
AR-0051	4/1/02	Duke Energy - Jackson Facility	Good Operating Control, Clean Fuel	32.2	lb/hour	BACT
MT-0019	6/7/02	Continental Energy Services Inc. - Silver Bow Gen		32.4	lb/hour	Other
AZ-0047	12/1/2004	Dome Valley Energy Partners, LLC - Wellton Mohawk Generating Station - Scenario 2	Good Combustion Practices, Natural Gas	33.1	lb/hour	BACT
LA-0254	8/16/11	Ninemile Point Electric Generating Plant Units 6A and 6B - with duct burner	Pipeline Natural Gas, Good Combustion Practices	33.16	lb/hour	BACT
TX-0600	9/1/11	Thomas C. Ferguson Power Plant	Pipeline Quality Natural Gas	33.43	lb/hour	BACT
LA-0136	7/23/08	Dow Chemical Company - Plaquemine Cogeneration Facility	Use of Clean Burning Fuels	33.5	lb/hour	BACT
MI-0256	1/12/01	Covert Generating Co LLC	Good Combustion	33.8	lb/hour	BACT
TX-0381	1/31/03	Ennis Tractebel Power	Pipeline Natural Gas	37.6	lb/hour	BACT

CTG/HRSG BACT Comparison for $PM/PM_{10}/PM_{2.5}$

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
TX-0352	12/31/02	Brazos Valley Electric Generating Facility	Good Combustion Control	38.6	lb/hour	BACT
MS-0059	9/24/02	Pike Generation Facility	Good Combustion Practices, Low Ash Fuel	44.2	lb/hour	BACT
AZ	2003 Dft	La Paz Generating Facility (GE 7FA)		45.5	lb/hour	BACT
WA-0299	4/17/03	Sumas Energy 2 - NESCO	Good Combustion Practices, Clean Fuel	0.0039	lb/mmBtu	BACT - Project Cancelled
OR-0040	3/12/03	Klamath Generation LLC - Pacific Power Energy Marketing	Natural Gas	0.0042	lb/mmBtu	BACT
CA-1212	10/18/11	Palmdale Hybrid Power Project	Use of Pipeline Quality Natural Gas	0.0048	lb/mmBtu	BACT - no duct firing
CA-1212	10/18/11	Palmdale Hybrid Power Project	Use of Pipeline Quality Natural Gas	0.0049	lb/mmBtu	BACT
NY-0095	5/10/06	Caithness Bellport, LLC - turbine only	Low Sulfur Fuel	0.0055	lb/mmBtu	BACT
PA-0286	1/13/13	Moxie Energy LLC/Patriot Energy Plant		0.0057	lb/mmBtu	Other
AL-0185	7/12/02	Barton Shoals Energy, LLC	Good Combustion Practices	0.0060	lb/mmBtu	BACT
NY	9/27/12	Cricket Valley Energy Center LLC	Low Sulfur Fuel	0.0060	lb/mmBtu	BACT
AR-0043	2/27/01	Pine Bluff Energy LLC	Good Combustion Practices	0.0065	lb/mmBtu	BACT
CO-0052	8/11/02	Rocky Mountain Energy Center	Good Combustion Control Practices, Pipeline Quality Natural Gas	0.0065	lb/mmBtu	BACT
NY-0095	5/10/06	Caithness Bellport, LLC - with duct burner	Low Sulfur Fuel	0.0066	lb/mmBtu	BACT
UT-0066	5/17/04	Pacificorp - Currant Creek Power Project		0.0066	lb/mmBtu	BACT
OK-0115	12/12/06	Energetix - Lawton Energy Cogen Facility	Good Combustion Practices	0.0067	lb/mmBtu	BACT
OK-0055	2/12/02	Mustang Energy Project	Use of No-Ash Fuel, Efficient Combustion	0.007	lb/mmBtu	BACT
CO-0056	5/2/06	Calpine - Rocky Mountain Energy Center, LLC	Natural Gas Quality Fuel Only, Good Combustion Control Practices	0.0074	lb/mmBtu	BACT
IN-0158	12/3/12	St. Joseph Energy Center LLC	Good Combustion Practice and Fuel Specification	0.0078	lb/mmBtu	BACT
AL-0141	4/10/2000	GPC-Goat Rock Combined Cycle Plant	Efficient Combustion	0.009	lb/mmBtu	BACT
AL-0162	1/8/2001	Autaugaville Combined Cycle Plant	Good Combustion	0.009	lb/mmBtu	BACT
GA-0105	4/17/03	McIntosh Combined Cycle Facility	Good Combustion Practices, Clean Fuel	0.009	lb/mmBtu	BACT
RI-0019	5/3/00	Reliant Energy Hope Gen. Facility		0.009	lb/mmBtu	BACT
VA-0261	9/6/02	CPV Cunningham Creek	Natural Gas	0.009	lb/mmBtu	BACT

CTG/HRSG BACT Comparison for $PM/PM_{10}/PM_{2.5}$

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
OK-0117	2/9/07	Public Service Company of Oklahoma - Southwestern Power Plant	Use of Low Ash Fuel (natural gas), Efficient Combustion	0.0093	lb/mmBtu	BACT
AL-0167	1/26/2001	Calhoun Power Company I, LLC	Good Combustion Practices	0.01	lb/mmBtu	BACT
AZ-0039	3/7/03	Salt River Project/Santan Gen. Plant		0.01	lb/mmBtu	LAER
LA		Crescent City Power LLC		0.01	lb/mmBtu	
MI-0357	2/4/03	Kalkaska Generating LLC	Good Combustion Practices, Clean Fuel	0.01	lb/mmBtu	BACT
MN-0053	7/15/04	Fairbault Energy Park	Good Combustion Practices, Clean Fuel	0.01	lb/mmBtu	BACT
MN-0071	6/5/07	Minnesota Municipal Power Agency - Fairbault Energy Park - turbine only		0.01	lb/mmBtu	BACT
MO-0053	1/1/96	Hawthorne Generating Station		0.01	lb/mmBtu	BACT
MO-0056	3/30/99	Associated Electric Cooperative, Inc.	Good Combustion	0.01	lb/mmBtu	BACT
OK-0041	1/19/00	McClain Energy Facility	Clean Fuels	0.01	lb/mmBtu	BACT
PA-0223	1/30/02	Duke Energy Fayette, LLC	Good Combustion Practices, Use of Natural Gas	0.01	lb/mmBtu	BACT
OH-0248	9/24/02	Lawrence Energy - Calpine Corporation	Burning Natural Gas	0.0101	lb/mmBtu	BACT
GA	5/30/12	Effingham County Power Plant	Pipeline Quality Natural Gas	0.0103	lb/mmBtu	BACT
IA-0058	4/10/02	MidAmerican Energy, Des Moines Power Station		0.0108	lb/mmBtu	BACT
GA-0102	1/15/02	Wansley Combined Cycle Energy Facility	Good Combustion Practices, Low Sulfur Fuel	0.011	lb/mmBtu	BACT
MS-0040	12/31/98	Mississippi Power Plant		0.011	lb/mmBtu	BACT
NV-0035	8/16/05	Sierra Pacific Power Company - Tracy Substation Expansion Project	Best Combustion Practices	0.011	lb/mmBtu	BACT
OK-0056	2/12/02	Horseshoe Energy Project	Low Ash Fuel	0.0117	lb/mmBtu	BACT
AL-0143	3/3/2000	AEC-McWilliams Plant	Good Combustion	0.012	lb/mmBtu	BACT
IN-0087	6/6/01	Duke Energy, Vigo LLC	Good Combustion	0.012	lb/mmBtu	BACT
OK-0096	6/6/03	Redbud Power Plant	Efficient Combustion, Low Ash Fuel	0.012	lb/mmBtu	BACT
AL-0169	2/5/2001	Blount Megawatt Facility	Good Combustion Practices	0.013	lb/mmBtu	BACT
AR-0035	8/24/00	Panda - Union Generating Station	Clean Fuels, Proper Operation	0.014	lb/mmBtu	BACT
AZ-0038	4/30/02	Gila Bend Power Generation Station		0.014	lb/mmBtu	BACT
PA-0188	3/28/02	Fairless Energy LLC		0.014	lb/mmBtu	BACT
PA-0226	4/9/02	Limerick Partners, LLC		0.014	lb/mmBtu	BACT
OK-0043	10/22/01	Webers Falls Energy Facility	Efficient Combustion	0.015	lb/mmBtu	BACT

CTG/HRSG BACT Comparison for $PM/PM_{10}/PM_{2.5}$

RBLC ID	Permit Date	Facility	Control Technology	Emiss. Limit	Emiss. Limit Unit	Basis
OK-0090	3/21/03	Duke Energy Stephens, LLC	Clean Fuel, Efficient Combustion	0.015	lb/mmBtu	BACT
MO-0058	5/9/00	Audrain Generating Station	Good Combustion	0.016	lb/mmBtu	BACT
NC-0101	9/29/05	Forsyth Energy Projects, LLC - turbine only	Good Combustion Practices, Clean Burning Low Sulfur Fuel	0.019	lb/mmBtu	BACT
OK-0070	6/13/02	Genova OK I Power Project	Low Sulfur Fuel, Efficient Combustion	0.019	lb/mmBtu	BACT
AL-0132	11/29/1999	Tenaska Alabama Generating Station	Efficient Combustion	0.02	lb/mmBtu	BACT
AR-0070	8/23/02	Genova Arkansas I, LLC	Good Combustion Practices	0.02	lb/mmBtu	BACT
DE-0016	10/17/00	Hay Road Power Complex Units 5-8	Clean Fuels	0.02	lb/mmBtu	BACT
NC-0101	9/29/05	Forsyth Energy Projects, LLC - with duct burner	Good Combustion Practices, Clean Burning Low Sulfur Fuel	0.021	lb/mmBtu	BACT
PA-0189	1/16/02	Connectiv - Bethlehem North		0.0135	ppm	BACT
MI-0365	1/28/03	Mirant Wyandotte LLC	Good Combustion Practices, Use of Pipeline Quality Natural Gas	5.6	mg/cm	BACT
WA-0291	1/3/03	Wallula Power - Newport Northwest Generation	Natural Gas	0.0029	gr/dscf	LAER
OR-0035	1/16/02	Port Westward - Portland General Electric	Use of Pipeline Quality Natural Gas	0.1	gr/dscf	BACT
OR-0048	12/29/10	Portland General Electric Carty Plant	Clean Fuel	2.5	lb/MMCF	BACT
DE-0024	1/30/2013	Garrison Energy Center, LLC/Calpine Corporation	Fuel usage restriction to natural gas and low sulfur distillate fuel	120.4	tons/year	BACT

Table contains:
Entries from the EPA turbine spreadsheet with a permit issuance date after 2002
Entries from the RBLC for new units with a permit issuance date 2002 - 2013
Information from state agency websites

Source: Bowie Power Station, Class I Permit Application, Wind River Environmental Group LLC, Arizona DEQ-AQB, September 2013, App D.

Table D5 Summary of RBLC Turbine/DB VOC BACT Determinations (4/11 through 4/15)		
RBLC IDs	**Unit Size Range***	**VOC BACT Range, ppm**
TX 0730, TX 0714, TX 0710, WV 0025, TX 0712, NJ 0028, TX 0678, TX 0713, IA 0107, TX 0660, PA 0298, PA 0296, MI 0412, TX 0709, MI 0410, OH 0352, MI 0405, PA 0291, VA 0312, TX 0708, PA 0286, OH 0356, IN 0158, DE 0023, TX 0618, FL 0337, PA 0278, TX 0619, TX 0620, WY 0070, TX 0600, LA 0254	MW: 40 – 1160 mmbtu/hr: 647 - 7146	0.7 (1 unit) 1.0 (5 units) 1.4 (2units) 1.5 (1 unit) 2.0 (10 units) 3.0 (1 unit) 4.0 (4 units) BACT Technology-CO Catalyst, Natural gas, and good combustion practices

*some units were sized by MW, while some units were sized by mmbtu/hr.

Dry Cooling Technology (Cooling Tower) BACT

The proposed facility will use dry cooling technology, i.e., an air cooled condenser coupled to a closed loop cooling system. The system has no emissions potential and is exempt from permitting per AVAQMD Rule 291(E)(4)(c). This system represents BACT.

Auxiliary Boiler

The proposed aux boiler is rated at 110 mmbtu/hr (HHV). The aux boiler will be fired exclusively on natural gas, and will be equipped with ultra low NOx burners (ULNB) and flue gas recirculation (FGR). Exhaust concentrations of NO_x and CO will be limited to 9 and 50 ppmvd at 3% O_2 respectively. VOC emissions will be controlled to a level of 0.0060 lb/mmbtu (15 ppm), while PM10/2.5 emissions are estimated to be 0.007 lbs/mmbtu (HHV). These emissions levels meet the achieved in practice BACT limits for moderate use small boilers firing clean fuels such as natural gas. Table D6 presents a summary of boiler BACT determinations derived from the EPA RBLC and recent CEC aux boiler projects (most recent 5 years).

Table D6 Aux Boiler BACT Summary (2010-2015)

RBLC ID	Size, mmbtu	NO_x, ppm	CO, ppm	VOC, ppm	SO_x, lb/mmbtu	PM10/2.5, lb/mmbtu
TX0731	106	5.4 (SCR)	50	-	-	-
AK0083	243	9	50	13.5	-	0.0074
TX0712	110	9	-	-	-	-
MS0092	261	-	5 (OxCat)	2250	-	0.005
TX0641	150	16	75	-	-	0.0076
IN0197	218	-	-	-	-	-
TX0708	150	18	75	-	-	-
OH0354	249	107	50	-	-	-
CA1212	110	9	50	-	-	0.8
CA1206	178	7	-	-	-	-
OH0336	-	36	100	13.5	-	0.01
Sutter EC	130	5 (SCR)	50	10	0.003	0.007

1. Some limits were converted from lb/mmbtu to ppm.
2. SO_x BACT based on natural gas fuel use

Tables D9 and D10 present the SCR and CO Catalyst control cost data for the Aux Boilers. Table D11 shows the OAQPS cost multipliers used in the cost analyses.

Fire Pump and Emergency Generator Engines

The fire-pump and emergency generator engines will be fired exclusively on CARB certified ultra low sulfur diesel fuel. In addition these engines will comply with the applicable EPA/CARB Tier emissions limits as well as the emissions standards provisions of NSPS Subpart IIII, NESHAPS Subpart ZZZZ, and 40 CFR 89.112 and 113. These engines are low use devices, and as such the foregoing represents BACT for these systems.

GHG BACT

Proposed GHG BACT for the facility processes is as follows:

Turbines:

1. Use of clean fuels (firing natural gas exclusively in the turbines and duct burners).
2. Maintain compliance with the current California GHG emissions performance standards for baseload power facilities at 1100 lbs CO_2/MW-hr.
3. Maintain heat rates for combined cycle operations (turbines plus duct burners) at levels equal to or less than 7100 btu/kW-hr (HHV), and heat rates for simple cycle operations (without duct burners) at levels equal to or less than 8030 btu/kW-hr (HHV).
4. Compliance with the Lbs CO_2/MWh (net) and heat rate values will be based on 365-day rolling averages.

Auxiliary Boiler:

1. Use of clean fuels (firing natural gas exclusively).
2. Use of good combustion practices, periodic tune-ups, and an automated air intake control system for the boiler.
3. Restricted hours of use in support of turbine operations (standby and startup/shutdown operations).

Diesel-fueled IC Engines (Fire Pump and Generator):

1. Use of California ultra low sulfur diesel fuel.
2. Maintain compliance with EPA and CARB Tier emissions standards as applicable.
3. Restricted use hours for readiness testing.

SF6 Breakers:

1. Use of enclosed-pressurized circuit breakers.
2. Annual SF6 leak rates shall not exceed 0.5% by wt.
3. The breakers will be equipped with a 10% by wt. leak detection system.

Facility GHG Limit: Limit facility-wide CO_2e emissions to less than or equal to

2,117,775 tons/yr (1,925,250 metric tons/yr).

Based upon the project GHG BACT analysis, the use of carbon capture and/or sequestration were found to be not technically feasible for the project at its current location, nor were these options found to be cost effective.

Table D7

Palmdale Energy Project

SCR Catalyst Control System (per turbine)

Pollutant Controlled: NOx

CAPITAL COST SUMMARY

DIRECT CAPITAL COSTS		Explanation of Cost Estimates (2014 $)
1. Purchased Equipment:		**per Turbine/DB**
A) Purchased Equipment Costs	$1,100,000	7FA scaleup to SGT6-5000
B) Other Required Systems (aqueous ammonia system	$400,000	Tank plus accessories and skids
C) Instrumentation & Controls	$110,000	EPA OAQPS 10% of A
D) Freight	$55,000	EPA OAQPS 5% of A
E) Taxes	$137,363	8.25% Tax Rate (California avg)
Total Purchased Equip. Costs (TEC):	$1,802,363	
2. Installation Costs:		
A) Foundation & Supports	$144,200	EPA OAQPS 8% of TEC
B) Erection and Handling	$630,800	EPA OAQPS 35% of TEC
C) Electrical	$108,100	EPA OAQPS 6% of TEC
D) Piping	$144,200	EPA OAQPS 8% of TEC
E) Insulation	$36,000	EPA OAQPS 2% of TEC
F) Painting	$72,100	EPA OAQPS 4% of TEC
G) Site Preparation	$41,800	estimated by Project engineer
Total Installation Costs (TINC):	$1,177,200	
Total Direct Capital Costs (TDCC):	$2,979,563	Sum TEC,TINC
INDIRECT CAPITAL COSTS		
1. Engineering & Supervision	$270,400	EPA OAQPS 15% of TEC
2. Construction and Field Exp.	$180,200	EPA OAQPS 10% of TEC
3. Contractor Fees	$90,100	EPA OAQPS 5% of TEC
4. Start-up	$18,000	EPA OAQPS 1% of TEC
5. Performance Testing	$18,000	EPA OAQPS 1% of TEC
Total Indirect Capital Costs (TICC):	$576,700	
Total Direct & Indirect Capital Costs (TDICC):	$3,556,263	Sum TDCC,TICC
Contingency (@ 3%):	$106,700	3% TDICC (EPA OAQPS)
TOTAL CAPITAL COSTS (TCC):	$3,662,963	Sum TDICC,Contingency

ANNUAL OPERATING COST SUMMARY

DIRECT OPERATING COSTS		Explanation of Cost Estimates
1. Operating Labor	$37,975	1 hr/day, @108.50 hr, 350 days/yr
2. Supervisory Labor	$2,848	EPA OAQPS 15% Operating Labor
3. Maintenance Labor	$18,988	0.5 hr/day, @108.50 hr, 350 days/yr
4. Maintenance Materials	$18,988	100% of maintenance labor costs
4. Utility Expenses (gas and electricity, plus fuel penalty c	$227,528	applicant estimate
5. Media replacement and disposal (catalyst, every 3 yrs)	$708,345	applicant estimate
6. Process chemicals costs (ammonia)	$99,229	applicant estimate
7. Annual Media Cost	$326,075	Item 5 divided by media life (yrs), x CRF (7%, 3 yrs, = 0.381)
8. Other Penalties (specify)	$0	Loss power sales $, added SCR maint., see Cost Est tab
Total Direct Operating Costs (TDOC):	$731,631	
INDIRECT OPERATING COSTS		
1. Overhead	$24,494	60% Total Labor, EPA OAQPS
Total Indirect Operating Costs (TIOC):	$24,494	
CAPITAL CHARGES & COSTS		
1. Property Tax	$54,200	EPA OAQPS 1.48% TCC
2. Insurance	$36,600	EPA OAQPS 1% TCC
3. General Administrative	$73,300	EPA OAQPS 2% TCC
4. Capital Recovery Cost	$295,200	7% per OMB, 30 yr plant life, CRF=.0806
Total Capital Charges Costs (TCCC):	$459,300	Sum 1,2,3,4
TOTAL ANNUALIZED OPERATING COSTS:	$1,215,425	Sum TDOC,TIOC,TCCC

COST EFFECTIVENESS EVALUATION

Uncontrolled Case Emissions		
Base Concentration-Uncontrolled	9	ppm with DLN Combustors
Annual Emission Rate	303.8	tpy (steady state emissions only)
Incremental Controlled Emissions Case		
NOx Concentration	2.0	ppm with SCR/DLN
Annual Emission Rate:	67.50	tpy (steady state emissions only)
NOx Reduction from Uncontrolled Case:	236.3	tpy
Control Cost Effectiveness:	**$5,100**	per ton NOx

References:

1. OAQPS - OAQPS Cost Control Manual, 6th ED., January 2002, EPA
2. EPA1998 - Cost Effectiveness fo Oxidation Catalyst Control of HAP Emissions fror Stationary Combustion Turbines, EPA, 1998.
3. NE estimated cost for additional catalyst to achieve 90% control of CO per EPA stu
4. EPA memo dated 12-30-99, ES Division, Docket A-95-51, and May 14, 1999 memo on Stationary CT control cost options.
5. Air Compliance Advisor, Version 7.5, 8-15-2003, EPA-OAQPS. (consulted ref only)
6. SATSOP CT Project, Phase II, SCA Amendment #4, Nov 2001.

References continued:

7. Tesla Power Project, FPL, AFC Section 5.2, October 2001.
8. West County Energy Center, FPL, August 2005.
9. JEA-Greenland Energy Center, B&V, Sept 2008.
10. Vineyard Energy Center, Calpine, Utah DEQ, November 2003.
11. Marsh Landing GS project data scaled to OGS site.
12. Optimization of Ammonia Source for SCR Applications, Paper #46, R.Salib, et.al., Washington Group Int'l.,

Table D8

Palmdale Energy Project

CO Oxidation Catalyst Control System (per turbine)

Pollutant Controlled: CO and VOC

CAPITAL COST SUMMARY

DIRECT CAPITAL COSTS		Explanation of Cost Estimates (2014 $)
1. Purchased Equipment:		**per Turbine/DB**
A) Purchased Equipment Costs	$600,000	BASF, 1/2010 scaleup from 7FA
B) Other Required Systems	$90,000	Internal frame cost per BASF
C) Instrumentation & Controls	$60,000	EPA OAQPS 10% of A
D) Freight	$30,000	EPA OAQPS 5% of A
E) Taxes	$64,350	8.25% Tax Rate
Total Purchased Equip. Costs (TEC):	$844,350	
2. Installation Costs:		
A) Foundation & Supports	$84,400	EPA OAQPS 10% of TEC
B) Erection and Handling	$295,500	EPA OAQPS 35% of TEC
C) Electrical	$8,400	EPA OAQPS 1% of TEC
D) Piping	$16,900	EPA OAQPS 2% of TEC
E) Insulation	$8,400	EPA OAQPS 1% of TEC
F) Painting	$8,400	EPA OAQPS 1% of TEC
G) Site Preparation	$0	estimated by Project engineer
Total Installation Costs (TINC):	$422,000	
Total Direct Capital Costs (TDCC):	$1,266,350	Sum TEC,TINC
INDIRECT CAPITAL COSTS		
1. Engineering & Supervision	$126,700	EPA OAQPS 15% of TEC
2. Construction and Field Exp.	$84,400	EPA OAQPS 10% of TEC
3. Contractor Fees	$42,200	EPA OAQPS 5% of TEC
4. Start-up	$8,400	EPA OAQPS 1% of TEC
5. Performance Testing	$8,400	EPA OAQPS 1% of TEC
Total Indirect Capital Costs (TICC):	$270,100	
Total Direct & Indirect Capital Costs (TDICC):	$1,536,450	Sum TDCC,TICC
Contingency (@ 3%):	$46,100	3% TDICC (EPA OAQPS)
TOTAL CAPITAL COSTS (TCC):	$1,582,550	Sum TDICC,Contingency

ANNUAL OPERATING COST SUMMARY

DIRECT OPERATING COSTS		Explanation of Cost Estimates
1. Operating Labor	$37,975	1 hr/day, @108.50 hr, 350 days/yr
2. Supervisory Labor	$2,848	EPA OAQPS 15% Operating Labor
3. Maintenance Labor	$18,988	0.5 hr/day, @108.50 hr, 350 days/yr
4. Maintenance Materials	$18,988	100% of labor costs
4. Utility Expenses (gas and electricity, plus fuel penalty	$56,507	applicant estimate
5. Media replacement and disposal (catalyst, every 5 yrs	$489,000	applicant estimate
6. Process chemicals costs	$0	applicant estimate
7. Annual Media Cost	$36,179	Item 5 divided by media life (yrs), x CRF (7%, 15 yrs, = 0.1098)
8. Other Penalties (specify)	$0	Loss power sales $, see Cost Est tab
Total Direct Operating Costs (TDOC):	$171,486	
INDIRECT OPERATING COSTS		
1. Overhead	$24,494	60% Total Labor, EPA OAQPS
Total Indirect Operating Costs (TIOC):	$24,494	
CAPITAL CHARGES & COSTS		
1. Property Tax	$23,400	EPA OAQPS 1.48% TCC
2. Insurance	$15,800	EPA OAQPS 1% TCC
3. General Administrative	$31,700	EPA OAQPS 2% TCC
4. Capital Recovery Cost	$127,600	7% per OMB, 30 yr plant life, CRF=.0806
Total Capital Charges Costs (TCCC):	$198,500	Sum 1,2,3,4
TOTAL ANNUALIZED OPERATING COSTS:	$394,479	Sum TDOC,TIOC,TCCC

COST EFFECTIVENESS EVALUATION

Uncontrolled Case Emissions			**VOC**	
Base Concentration-Uncontrolled	9	ppm with DLN and GCPs	3	ppm with DLN and GCPs
Annual Emission Rate	157.8	tpy (steady state emissions only)	22	tpy (steady state emissions only)
Incremental Controlled Emissions Case				
CO Concentration	2.0	ppm with CO Catalyst	2	ppm with CO Catalyst
Annual Emission Rate:	41.20	tpy (steady state emissions only)	14	tpy (steady state emissions only)
CO Reduction from Uncontrolled Case:	116.6	tpy reduced	7	tpy reduced
Control Cost Effectiveness:	**$3,400**	per ton CO	######	per ton VOC

References:

1. OAQPS - OAQPS Cost Control Manual, 6th ED., January 2002, EPA

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

3. NE estimated cost for additional catalyst to achieve 90% control of CO per EPA s

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

5. Air Compliance Advisor, Version 7.5, 8-15-2003, EPA-OAQPS. (consulted ref only)

6. SATSOP CT Project, Phase II, SCA Amendment #4, Nov 2001.

References continued:

7. Tesla Power Project, FPL, AFC Section 5.2, October 2001.

8. West County Energy Center, FPL, August 2005.

9. JEA-Greenland Energy Center, B&V, Sept 2008.

10. Vineyard Energy Center, Calpine, Utah DEQ, November 2003.

11. Marsh Landing GS project data scaled to OGS site.

Table D9

Palmdale Energy Project

SCR Catalyst Control System (Aux Boiler)

Pollutant Controlled: NOx

CAPITAL COST SUMMARY

DIRECT CAPITAL COSTS		Explanation of Cost Estimates (2015 $)
1. Purchased Equipment:		**Aux Boiler**
A) Purchased Equipment Costs	$400,000	scaleup from OGS at 50.6 mmbtu/hr unit
B) Other Required Systems (aqueous ammonia system	$0	included in EC costs
C) Instrumentation & Controls	$40,000	EPA OAQPS 10% of A
D) Freight	$20,000	EPA OAQPS 5% of A
E) Taxes	$37,950	8.25% Tax Rate (California avg)
Total Purchased Equip. Costs (TEC):	$497,950	
2. Installation Costs:		
A) Foundation & Supports	$39,800	EPA OAQPS 8% of TEC
B) Erection and Handling	$74,700	EPA OAQPS 15% of TEC
C) Electrical	$5,000	EPA OAQPS 1% of TEC
D) Piping	$10,000	EPA OAQPS 2% of TEC
E) Insulation	$10,000	EPA OAQPS 2% of TEC
F) Painting	$5,000	EPA OAQPS 1% of TEC
G) Site Preparation	$0	estimated by Project engineer
Total Installation Costs (TINC):	$144,500	
Total Direct Capital Costs (TDCC):	$642,450	Sum TEC,TINC
INDIRECT CAPITAL COSTS		
1. Engineering & Supervision	$49,800	EPA OAQPS 10% of TEC
2. Construction and Field Exp.	$49,800	EPA OAQPS 10% of TEC
3. Contractor Fees	$24,900	EPA OAQPS 5% of TEC
4. Start-up	$5,000	EPA OAQPS 1% of TEC
5. Performance Testing	$5,000	EPA OAQPS 1% of TEC
Total Indirect Capital Costs (TICC):	$134,500	
Total Direct & Indirect Capital Costs (TDICC):	$776,950	Sum TDCC,TICC
Contingency (@ 3%):	$23,300	3% TDICC (EPA OAQPS)
TOTAL CAPITAL COSTS (TCC):	$800,250	Sum TDICC,Contingency

ANNUAL OPERATING COST SUMMARY

DIRECT OPERATING COSTS		Explanation of Cost Estimates
1. Operating Labor	$1,750	0.25 hr/day, @$35 hr, 200 days/yr
2. Supervisory Labor	$131	EPA OAQPS 15% Operating Labor
3. Maintenance Labor	$1,750	0.25 hr/day, @$35 hr, 200 days/yr
4. Maintenance Materials	$1,750	100% of maintenance labor costs
4. Utility Expenses (gas and electricity, plus fuel penalty c	$4,000	applicant estimate
5. Media replacement and disposal (catalyst, every 3 yrs)	$50,000	applicant estimate
6. Process chemicals costs (ammonia)	$6,500	applicant estimate
7. Annual Media Cost	$23,017	Item 5 divided by media life (yrs), x CRF (7%, 3 yrs, = 0.381)
8. Other Penalties (specify)	$0	Loss power sales $, added SCR maint., see Cost Est tab
Total Direct Operating Costs (TDOC):	$38,898	
INDIRECT OPERATING COSTS		
1. Overhead	$1,129	60% Total Labor, EPA OAQPS
Total Indirect Operating Costs (TIOC):	$1,129	
CAPITAL CHARGES & COSTS		
1. Property Tax	$8,000	EPA OAQPS 1% TCC
2. Insurance	$8,000	EPA OAQPS 1% TCC
3. General Administrative	$16,000	EPA OAQPS 2% TCC
4. Capital Recovery Cost	$64,500	7% per OMB, 30 yr plant life, CRF=.0806
Total Capital Charges Costs (TCCC):	$96,500	Sum 1,2,3,4
TOTAL ANNUALIZED OPERATING COSTS:	$136,527	Sum TDOC,TIOC,TCCC

COST EFFECTIVENESS EVALUATION

Base Case Emissions		
Base Concentration-with LNB/FGR	9	ppm with LNB/FGR
Annual Emission Rate	2.95	tpy (steady state emissions only)
Incremental Controlled Emissions Case		assumes 80% control
NOx Concentration	1.8	ppm with SCR/LNB/FGR
Annual Emission Rate:	0.60	tpy (steady state emissions only)
NOx Reduction from Uncontrolled Case:	2.4	tpy
Control Cost Effectiveness:	**$58,100**	per ton NOx

References:

1. OAQPS - OAQPS Cost Control Manual, 6th ED., January 2002, EPA

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

3. NE estimated cost for additional catalyst to achieve 90% control of CO per EPA stu

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

5. Air Compliance Advisor, Version 7.5, 8-15-2003, EPA-OAQPS. (consulted ref only)

6. SATSOP CT Project, Phase II, SCA Amendment #4, Nov 2001.

References continued:

7. Tesla Power Project, FPL, AFC Section 5.2, October 2001.

8. West County Energy Center, FPL, August 2005.

9. JEA-Greenland Energy Center, B&V, Sept 2008.

10. Vineyard Energy Center, Calpine, Utah DEQ, November 2003.

11. Marsh Landing GS project data scaled to OGS site.

12. Optimization of Ammonia Source for SCR Applications, Paper #46, R.Salib, et.al., Washington Group Int'l.,

Table D10

Palmdale Energy Project

CO Oxidation Catalyst Control System (Aux Boiler)

Pollutant Controlled: CO and VOC

CAPITAL COST SUMMARY

DIRECT CAPITAL COSTS		Explanation of Cost Estimates (2015 $)
1. Purchased Equipment:		**Aux Boiler**
A) Purchased Equipment Costs	$230,000	scaleup from OGS at 50.6 mmbtu/hr unit
B) Other Required Systems	$0	included in EC cost
C) Instrumentation & Controls	$23,000	EPA OAQPS 10% of A
D) Freight	$11,500	EPA OAQPS 5% of A
E) Taxes	$21,821	8.25% Tax Rate
Total Purchased Equip. Costs (TEC):	$286,321	
2. Installation Costs:		
A) Foundation & Supports	$22,900	EPA OAQPS 8% of TEC
B) Erection and Handling	$42,900	EPA OAQPS 15% of TEC
C) Electrical	$2,900	EPA OAQPS 1% of TEC
D) Piping	$5,700	EPA OAQPS 2% of TEC
E) Insulation	$2,900	EPA OAQPS 1% of TEC
F) Painting	$2,900	EPA OAQPS 1% of TEC
G) Site Preparation	$0	estimated by Project engineer
Total Installation Costs (TINC):	$80,200	
Total Direct Capital Costs (TDCC):	$366,521	Sum TEC,TINC
INDIRECT CAPITAL COSTS		
1. Engineering & Supervision	$28,600	EPA OAQPS 10% of TEC
2. Construction and Field Exp.	$28,600	EPA OAQPS 10% of TEC
3. Contractor Fees	$14,300	EPA OAQPS 5% of TEC
4. Start-up	$2,900	EPA OAQPS 1% of TEC
5. Performance Testing	$2,900	EPA OAQPS 1% of TEC
Total Indirect Capital Costs (TICC):	$77,300	
Total Direct & Indirect Capital Costs (TDICC):	$443,821	Sum TDCC,TICC
Contingency (@ 3%):	$13,300	3% TDICC (EPA OAQPS)
TOTAL CAPITAL COSTS (TCC):	$457,121	Sum TDICC,Contingency

ANNUAL OPERATING COST SUMMARY

DIRECT OPERATING COSTS		Explanation of Cost Estimates
1. Operating Labor	$1,750	.25 hr/day, @$35 hr, 200 days/yr
2. Supervisory Labor	$131	EPA OAQPS 15% Operating Labor
3. Maintenance Labor	$1,750	.25 hr/day, @$35 hr, 200 days/yr
4. Maintenance Materials	$1,750	100% of labor costs
4. Utility Expenses (gas and electricity, plus fuel penalty	$0	applicant estimate
5. Media replacement and disposal (catalyst, every 15 yr	$50,000	applicant estimate
6. Process chemicals costs	$0	applicant estimate
7. Annual Media Cost	$3,699	Item 5 divided by media life (yrs), x CRF (7%, 15 yrs, = 0.1098)
8. Other Penalties (specify)	$0	Loss power sales $
Total Direct Operating Costs (TDOC):	$9,081	
INDIRECT OPERATING COSTS		
1. Overhead	$1,129	60% Total Labor, EPA OAQPS
Total Indirect Operating Costs (TIOC):	$1,129	
CAPITAL CHARGES & COSTS		
1. Property Tax	$6,800	EPA OAQPS 1.48% TCC
2. Insurance	$4,600	EPA OAQPS 1% TCC
3. General Administrative	$9,100	EPA OAQPS 2% TCC
4. Capital Recovery Cost	$36,800	7% per OMB, 30 yr plant life, CRF=.0806
Total Capital Charges Costs (TCCC):	$57,300	Sum 1,2,3,4
TOTAL ANNUALIZED OPERATING COSTS:	$67,509	Sum TDOC,TIOC,TCCC

COST EFFECTIVENESS EVALUATION

Base Case Emissions			**VOC**	
Base Concentration-LNB/FGR/GCPs	50	ppm with LNB/FGR and GCPs	15	ppm with LNB/FGR and GCPs
Annual Emission Rate	9.9	tpy (steady state emissions only)	1.61	tpy (steady state emissions only)
Incremental Controlled Emissions Case		assumes 70% control		assumes 50% control
CO Concentration	15.0	ppm with CO Catalyst	7.5	ppm with CO Catalyst
Annual Emission Rate:	2.97	tpy (steady state emissions only)	0.81	tpy (steady state emissions only)
CO Reduction from Uncontrolled Case:	7.0	tpy reduced	1	tpy reduced
Control Cost Effectiveness:	**$9,700**	per ton CO	######	per ton VOC

References:

1. OAQPS - OAQPS Cost Control Manual, 6th ED., January 2002, EPA

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

3. NE estimated cost for additional catalyst to achieve 90% control of CO per EPA s

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

5. Air Compliance Advisor, Version 7.5, 8-15-2003, EPA-OAQPS. (consulted ref only)

6. SATSOP CT Project, Phase II, SCA Amendment #4, Nov 2001.

References continued:

7. Tesla Power Project, FPL, AFC Section 5.2, October 2001.

8. West County Energy Center, FPL, August 2005.

9. JEA-Greenland Energy Center, B&V, Sept 2008.

10. Vineyard Energy Center, Calpine, Utah DEQ, November 2003.

11. Marsh Landing GS project data scaled to OGS site.

Table D11 Cost Multiplier Values Per OAQPS*

Cost Parameter	OAQPS Value Range, %	
Instrumentation/Controls	10%	Values used in the cost analyses are within these ranges but may vary depending upon the control system type, the base system being controlled, and any special construction or operation requirements.
Freight	5%	
Taxes	3%	
Foundations/Supports	4-12%	
Erection/Handling	14-50%	
Electrical	1-8%	
Piping	1-30%	
Insulation	1-7%	
Painting	1-2%	
Site Preparation	as Req'd	
Engineering/Supervision	10-20%	
Construction	5-20%	
Contractor Fees	0-10%	
Startup Costs	1-2%	
Performance Testing	1%	
Contingency	3%	
Supervisory Labor	15%	
Maintenance Materials	100%	
Overhead	60%	
Administrative Charges	2%	
Property Taxes	1%	
Insurance	1%	
Capital Recovery Factor	calculated	

* OAQPS - OAQPS Cost Control Manual, 6th ED., January 2002, EPA.
OMB interst rate for CRF calculations is 7%.
CA sales tax rate average is 8.25%.