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OAK RIDGE
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MARTIN MARIETTA

Utility FGD Survey
January–December 1988

Project Summary

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MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

ORNL/Sub--86-57949

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UTILITY FGD SURVEY
JANUARY - DECEMBER 1988

PROJECT SUMMARY

by

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INTRODUCTION

The FGD survey report is prepared annually by PEI Associates, Inc., for the U.S. Department of Energy. Current issues and preceding issues from 1974 to 1981 and October 1984 to present of the utility FGD survey are only available through the National Technical Information Service (NTIS). Preceding issues from January 1982 through September 1984 may be purchased from the Research Reports Center of the Electric Power Research Institute (EPRI). The information in this report is generated by a computerized data base system known as the Flue Gas Desulfurization Information System (FGDIS). The design information contained in the FGDIS encompasses the entire emission control system and the power generating unit to which it is applied. Performance data for operational FGD systems include monthly dependability parameters, service time, and descriptions of operational problems and solutions.

PEI Associates, Inc., has been reporting on the status of utility flue gas desulfurization (FGD) technology since 1974. From 1974 to 1982, this effort was supported by the U.S. Environmental Protection Agency (EPA) under the direction of the Industrial Environmental Research Laboratory-Research Triangle Park. In 1983 and 1984, it was jointly sponsored by EPA and the Electric Power Research Institute. Since January 1985, the program has been sponsored by the U.S. Department of Energy (DOE), Office of Environmental Analysis.

Information for this program is obtained through regular contacts with owner/operator utilities and nonutility generators that sell power to utilities who are currently operating FGD systems or planning to install them. Supplemental information is also solicited from FGD system and equipment suppliers, design/engineering firms, research organizations, and regulatory agencies.

The information collected is stored in the Flue Gas Desulfurization Information System (FGDIS). This data base contains computerized files of descriptive, design, performance, and cost data on all the FGD systems identified in the FGDIS.

This report summarizes the status of FGD technology as of December 1988. It highlights the status of the electric utility power industry, projected growth of coal-fired power generation, and the current status and future trends in FGD application. Also discussed is the implementation status of other control technologies such as fluidized bed boilers, which utilities may opt for instead of FGD systems.

Several ways are available for identifying individual power plant units. Power plants are usually represented by turbine or boiler number in government and industry documents. Because more than one boiler may feed a given

turbine in some cases, or a particular boiler may not be dedicated to a single power plant turbine, such identification can be misleading. This situation may be further complicated when FGD systems are being identified. In general, a one-to-one relationship exists between boilers or turbines and FGD systems for power plants included in this report. For the most part, the power plant boiler designation is used to identify FGD systems in this document. When several boilers feed a single FGD system, however, the boilers feeding the FGD system are indicated in the FGD system name. For example, Duquesne Light's Elrama plant consists of four boilers, the exhausts of which are ducted to a common header that serves a single multimodule FGD system. The plant is thus identified in the data base as "Elrama 1-4."

PROJECT SUMMARY

Table 1 summarizes the status of flue gas desulfurization (FGD) systems in the United States as of the end of December 1988. Total controlled capacity is listed in the table as the summation of the gross unit capacities (MW) brought into compliance by the use of FGD systems, regardless of the percentage of the flue gas scrubbed by the FGD system(s). Equivalent scrubbed capacity is the summation of the effective scrubbed flue gas capacities in equivalent MW, based on the percentage of flue gas scrubbed by the FGD system(s). Table 2 lists the units on which the status has changed during the January-December 1988 period. Details on each status change are given in the Highlights section of this summary. The units included in the figures presented in Table 1 are identified in Table 3.

TABLE 1. NUMBER AND TOTAL CAPACITY OF FGD SYSTEMS

Status	No. of units	Total controlled capacity, MW	Equivalent scrubbed capacity, MW
Operational	154	67,091	62,214
Under construction	15	4,819	4,674
Planned:			
Contract awarded	11	4,625	4,625
Letter of intent	-	-	-
Requesting/evaluating bids	3	140	140
Considering only FGD systems for SO_2 control	35	18,825	18,329
TOTAL	218	95,500	89,982

Figure 1 presents a historic breakdown of utility status reports for operational, under-construction, and planned FGD capacity.[1] The operating FGD capacity has grown significantly each year since 1972. From 1977 to 1982 the capacity under construction was fairly stable, but has steadily decreased since 1982 because of the deferment of planned units. The planned capacity reported by the utilities has increased each year in the past until 1980, when it reached its peak, and has dropped sharply since that time. This drop resulted because fewer power plants were built than had been planned.

TABLE 2. SUMMARY OF FGD SYSTEM STATUS CHANGES, JANUARY - DECEMBER 1988

	Operational		Under Construction		Contract awarded		Letter of intent		Requesting/ eval. bids		Considering FGD		Total	
	No.	MW[a]	No.	MW[a]	No.	MW[a]	No.	MW[a]	No.	MW[a]	No.	MW[a]	No.	MW[a]
Atlantic City Electric														
Cumberland 1											-1	330	-1	330
Central Power & Light														
Valley 1											+1	680	+1	680
CMS Generation														
Filer City 1			+1	30									+1	30
Filer City 2			+1	30									+1	30
Dineh Service Company														
Dineh 1									-1	555			-1	555
Dineh 2											-1	555	-1	555
Dineh 3											-1	555	-1	555
Dineh 4											-1	555	-1	555
General Public Utilities														
Coal 1											-1	300	-1	300
Hadson Corporation														
Alta Vista					+1	70							+1	70
Buena Vista					+1	70							+1	70
Hopewell					+1	70							+1	70
Southampton					+1	70							+1	70
Jacksonville Elec. Authority														
St. Johns River Power Park 2	+1	612	-1	612										
Louisville Gas & Electric														
Trimble County 1			+1	495	-1	495								
Lower Colorado River Authority														
Fayette Power Project 3	+1	451	-1	451										
Northern Indiana Public Service														
Bailly 7-8					+1	550							+1	550
Pacific Power & Light														
Jim Bridger 1			+1	508	-1	508								
Jim Bridger 3	+1	508	-1	508										
Public Service of Colorado														
Arapahoe 4			+1	112									+1	112
Cherokee 1			+1	100									+1	100
Cherokee 2			+1	110									+1	110
Cherokee 3			+1	150									+1	150
Valmont 5			+1	166									+1	166

(continued)

TABLE 2 (continued)

	Operational		Under Construction		Contract awarded		Letter of intent		Requesting/ eval. bids		Considering FGD		Total	
	No.	MW[a]	No.	MW[a]	No.	MW[a]	No.	MW[a]	No.	MW[a]	No.	MW[a]	No.	MW[a]
Public Service of Oklahoma														
Inola 1											+1	660	+1	660
Inola 2											+1	660	+1	660
San Antonio Public Service														
Calaveras 5									-1	535			-1	535
Calaveras 6									-1	535			-1	535
J. K. Spruce 1			+1	535									+1	535
J. K. Spruce 2					+1	535							+1	535
Texas Utilities														
Forest Grove 1					-1	750					+1	750		
Twin Oak 1					-1	750					+1	750		
Twin Oak 2					-1	750					+1	750		
Indeck Energy Services, Inc.														
Turners Falls 1			+1	19									+1	19
FGD status report December 31, 1987	151	60,643	7	3,990	10	6,513[b]	0	0	6	1,765	34	16,374	208	89,285[b]
Total	154	62,214	15	4,674	11	4,625	0	0	3	140	35	18,329	218	89,982

[a] Equivalent scrubber capacity.

[b] This value was modified slightly to reflect a MW correction.

TABLE 3. SUMMARY OF OPERATIONAL AND PLANNED DOMESTIC FGD SYSTEMS

Company plant name	Unit No.	City	State	Capacity, MW (gross)	Fuel design, percent sulfur[a]	FGD process	FGD status[b]	System supplier	Initial startup date[c]
Alabama Electric									
Lowman	2	Leroy	Alabama	255	1.80	Limestone	1	Peabody Process Systems	9/1978
Lowman	3	Leroy	Alabama	255	1.80	Limestone	1	Peabody Process Systems	6/1979
Alamito Co.									
Springerville	1	Springerville	Arizona	400	0.70	Lime/spray drying	1	Joy Mfg./Niro Atomizer	2/1985
Springerville	2	Springerville	Arizona	400	0.70	Lime/spray drying	2	Joy Mfg./Niro Atomizer	6/1990
Springerville	3	Springerville	Arizona	400	0.70	Process not selected	6	Vendor not selected	0/1992
Applied Energy Service[e]									
Beaver Valley	2-5	Monaca	Pennsylvania	126	2.25	Lime	1	FMC	8/1980
Deepwater	1	Pasadena	Texas	165	4.00	Limestone	1	Babcock & Wilcox	3/1986
Arizona Electric Power									
Apache	2	Cochise	Arizona	195	0.70	Limestone	1	Research-Cottrell	8/1978
Apache	3	Cochise	Arizona	195	0.70	Limestone	1	Research-Cottrell	6/1979
Arizona Public Service									
Cholla	1	Joseph City	Arizona	126	0.60	Limestone	1	Research-Cottrell	10/1973
Cholla	2	Joseph City	Arizona	250	0.60	Limestone	1	Research-Cottrell	4/1978
Cholla	4	Joseph City	Arizona	380	0.60	Limestone	1	Research-Cottrell	3/1981
Cholla	5	Joseph City	Arizona	375	0.60	Process not selected	6	Vendor not selected	99/2050
Four Corners	1	Fruitland	New Mexico	186	0.80	Lime/alkaline fly ash	1	GE Environmental Services	11/1979
Four Corners	2	Fruitland	New Mexico	186	0.80	Lime/alkaline fly ash	1	GE Environmental Services	11/1979
Four Corners	3	Fruitland	New Mexico	244	0.80	Lime/alkaline fly ash	1	GE Environmental Services	11/1979
Four Corners	4	Farmington	New Mexico	786	0.80	Lime	1	Babcock & Wilcox	10/1984
Four Corners	5	Farmington	New Mexico	786	0.80	Lime	1	Babcock & Wilcox	10/1984
Associated Electric									
Thomas Hill	3	Moberly	Missouri	670	4.80	Limestone	1	M.W. Kellogg	10/1982
Basin Electric Power									
Antelope Valley	1	Beulah	North Dakota	490	1.22	Lime/spray drying	1	Joy Mfg./Niro Atomizer	5/1983
Antelope Valley	2	Beulah	North Dakota	490	1.22	Lime/spray drying	1	Joy Mfg./Niro Atomizer	10/1985
Antelope Valley	3	Beulah	North Dakota	560	1.22	Lime/spray drying	6	Vendor not selected	99/2050
Laramie River	1	Wheatland	Wyoming	600	0.81	Limestone	1	Research-Cottrell	7/1980
Laramie River	2	Wheatland	Wyoming	600	0.81	Limestone	1	Research-Cottrell	7/1981
Laramie River	3	Wheatland	Wyoming	600	0.81	Lime/spray drying	1	Babcock & Wilcox	11/1982
Big Rivers Electric									
D.B. Wilson	1	Centertown	Kentucky	440	3.80	Limestone	1	M.W. Kellogg	9/1984
Green	1	Sebree	Kentucky	250	4.00	Lime	1	American Air Filter	12/1979
Green	2	Sebree	Kentucky	242	4.00	Lime	1	American Air Filter	11/1980
Central Illinois Light									
Duck Creek	1	Canton	Illnois	396	3.40	Limestone	1	Environeering, Riley Stoker	7/1976

(continued)

TABLE 3 (continued)

Company plant name	Unit No.	City	State	Capacity, MW (gross)	Fuel design, percent sulfur[a]	FGD process	FGD status[b]	System supplier	Initial startup date[c]
Central Illinois Public Service									
Newton	1	Newton	Illinois	590	4.00	Dual alkali	1	GE Environmental Services	9/1979
Central Power & Light									
Coleto Creek	2	Fannin	Texas	720	0.39[d]	Lime/spray drying	3	Joy Mfg./Niro Atomizer	0/2002
Valley	1	Rio Valley	Texas	680	NA[d]	Process not selected	6	Vendor not selected	0/2006
Cincinnati Gas & Electric									
East Bend	2	Rabbit Hash	Kentucky	643	5.20	Lime	1	Babcock & Wilcox	3/1981
Zimmer	1	Moscow	Ohio	1389	4.50	Lime	2	Babcock & Wilcox	4/1991
City Utilities of Springfield									
Southwest	1	Springfield	Missouri	195	3.50	Limestone	1	Air Correction Division, UOP	4/1977
CMS Generation[e]									
Filer City	1	Filer City	Michigan	30	3.00	Lime	2	GE Environmental Services	0/1990
Filer City	2	Filer City	Michigan	30	3.00	Lime	2	GE Environmental Services	0/1990
Cogentrix[e]									
Adrian	1	Adrian	Michigan	55	1.00	Lime/spray drying	5	Vendor not selected	1/1991
Otsego	1	Otsego	Michigan	55	1.00	Lime/spray drying	5	Vendor not selected	1/1991
Colorado Springs Dept. of Pub.									
R.D. Nixon	2	Colorado Springs	Colorado	250	0.50	Process not selected	6	Vendor not selected	0/1999
Colorado Ute Electric									
Craig	1	Craig	Colorado	454	0.96	Limestone	1	Peabody Process Systems	10/1980
Craig	2	Craig	Colorado	454	0.96	Limestone	1	Peabody Process Systems	12/1979
Craig	3	Craig	Colorado	427	0.90	Lime/spray drying	1	Babcock & Wilcox	6/1984
Columbus & Southern Ohio Electric									
Conesville	5	Conesville	Ohio	405	4.50	Lime	1	Air Correction Division, UOP	1/1977
Conesville	6	Conesville	Ohio	405	4.50	Lime	1	Air Correction Division, UOP	6/1978
Cooperative Power Association									
Coal Creek	1	Underwood	North Dakota	550	0.63	Lime/alkaline fly ash	1	Combustion Engineering	7/1979
Coal Creek	2	Underwood	North Dakota	550	0.63	Lime/alkaline fly ash	1	Combustion Engineering	7/1980

(continued)

TABLE 3 (continued)

Company plant name	Unit No.	City	State	Capacity, MW (gross)	Fuel design, percent sulfur[a]	FGD process	FGD status[b]	System supplier	Initial startup date[c]
Delmarva Power & Light									
Delaware City	1	Delaware City	Delaware	28	8.00	Wellman Lord	1	Davy McKee	5/1980
Delaware City	2	Delaware City	Delaware	28	8.00	Wellman Lord	1	Davy McKee	5/1980
Delaware City	3	Delaware City	Delaware	75	8.00	Wellman Lord	1	Davy McKee	5/1980
Deseret Gen. & Trans.									
Bonanza	1	Vernal	Utah	427	0.50	Limestone	1	Combustion Engineering	12/1985
Bonanza	2	Vernal	Utah	427	0.50	Limestone	6	Vendor not selected	99/2050
Duquesne Light									
Elrama	1-4	Elrama	Pennsylvania	510	2.50	Lime	1	GE Environmental Services	10/1975
Phillips	1-6	South Heights	Pennsylvania	408	2.50	Lime	1	GE Environmental Services	7/1973
East Kentucky Power									
J.K. Smith	1	Winchester	Kentucky	650	3.00	Lime	3	Babcock & Wilcox	0/2001
Spurlock	2	Maysville	Kentucky	550	3.60	Lime	1	Thyssen/CEA	12/1982
Grand Haven Board of Light & Power									
J.B. Sims	3	Grand Haven	Michigan	65	2.80	Lime	1	Babcock & Wilcox	5/1983
Grand River Dam Authority									
GRDA	2	Pryor	Oklahoma	575	1.50	Lime/spray drying	1	Flakt	10/1985
Hadson Corporation[e]									
Altavista	1	Altavista	Virginia	70	1.60	Lime	3	Flakt	6/1992
Buena Vista	1	Buena Vista	Virginia	70	1.60	Lime	3	Flakt	8/1992
Hopewell	1	Hopewell	Virginia	70	1.60	Lime	3	Flakt	7/1992
Southhampton	1	Southhampton	Virginia	70	1.60	Lime	3	Flakt	3/1992
Hoosier Energy									
Merom	1	Merom	Indiana	490	4.20	Limestone	1	Mitsubishi Heavy Industries	8/1982
Merom	2	Merom	Indiana	490	4.20	Limestone	1	Mitsubishi Heavy Industries	12/1981
Houston Lighting & Power									
Limestone	1	Jewitt	Texas	780	3.10	Limestone	1	Combustion Engineering	10/1985
Limestone	2	Jewitt	Texas	780	3.10	Limestone	1	Combustion Engineering	10/1986
Malakoff	1	Malakoff	Texas	690	1.10	Limestone	3	GE Environmental Services	0/1997
Malakoff	2	Malakoff	Texas	690	1.10	Limestone	3	GE Environmental Services	0/1999
W.A. Parish	8	Thompsons	Texas	570	0.44	Limestone	1	GE Environmental Services	10/1982
Indeck Energy Services, Inc.[e]									
Turners Falls	1	Turners Falls	Massachusetts	19	NA	Lime	2	GE Environmental Services	8/1989

(continued)

TABLE 3 (continued)

Company plant name	Unit No.	City	State	Capacity, MW (gross)	Fuel design, percent sulfur[a]	FGD process	FGD status[b]	System supplier	Initial startup date[c]
Indianapolis Power & Light									
Patriot	1	Patriot	Indiana	650	3.50	Limestone	6	Vendor not selected	99/2050
Patriot	2	Patriot	Indiana	650	3.50	Limestone	6	Vendor not selected	99/2050
Patriot	3	Patriot	Indiana	650	3.50	Limestone	6	Vendor not selected	99/2050
Petersburg	3	Petersburg	Indiana	532	4.50	Limestone	1	Air Correction Division, UOP	12/1977
Petersburg	4	Petersburg	Indiana	526	4.50	Limestone	1	Research-Cottrell	1/1986
Jacksonville Electric Authority									
St. Johns River Power	1	Jacksonville	Florida	674	2.50	Limestone	1	Research-Cottrell	12/1986
St. Johns River Power	2	Jacksonville	Florida	612	2.50	Limestone	1	Research-Cottrell	3/1988
Kansas City Power & Light									
La Cygne	1	La Cygne	Kansas	740	5.40	Limestone	1	Babcock & Wilcox	12/1972
Kansas Power & Light									
Jeffrey	1	Wamego	Kansas	720	0.32	Limestone	1	Combustion Engineering	8/1978
Jeffrey	2	Wamego	Kansas	720	0.32	Limestone	1	Combustion Engineering	1/1980
Jeffrey	3	Wamego	Kansas	720	0.32	Limestone	1	Combustion Engineering	5/1983
Lawrence	4	Lawrence	Kansas	119	0.55	Limestone	1	Combustion Engineering	1/1997
Lawrence	5	Lawrence	Kansas	355	0.55	Limestone	1	Combustion Engineering	4/1978
Kentucky Utilities									
Green River	1-3	Central City	Kentucky	60	3.80	Lime	1	American Air Filter	9/1975
Lakeland Utilities									
McIntosh	3	Lakeland	Florida	364	1.80	Limestone	1	Babcock & Wilcox	7/1982
Los Angeles Department of Water & Power									
Intermountain	1	Delta	Utah	841	1.00	Limestone	1	GE Environmental Services	2/1986
Intermountain	2	Delta	Utah	841	1.00	Limestone	1	GE Environmental Services	3/1987
Louisville Gas & Electric									
Cane Run	4	Louisville	Kentucky	170	4.00	Lime	1	American Air Filter	8/1976
Cane Run	5	Louisville	Kentucky	181	4.00	Lime	1	Combustion Engineering	12/1977
Cane Run	6	Louisville	Kentucky	260	4.00	Dual alkali	1	Thyssen/CEA	4/1979
Mill Creek	1	Louisville	Kentucky	321	4.50	Limestone	1	Combustion Engineering	12/1980
Mill Creek	2	Louisville	Kentucky	338	4.50	Limestone	1	Combustion Engineering	12/1981
Mill Creek	3	Louisville	Kentucky	412	4.00	Limestone	1	American Air Filter	8/1978
Mill Creek	4	Louisville	Kentucky	496	4.00	Limestone	1	American Air Filter	7/1982
Trimble County	1	Bedford	Kentucky	495	4.50	Limestone	2	Combustion Engineering	12/1990

(continued)

TABLE 3 (continued)

Company plant name	Unit No.	City	State	Capacity, MW (gross)	Fuel design, percent sulfur[a]	FGD process	FGD status[b]	System supplier	Initial startup date[c]
Lower Colorado River Authority									
Fayette Power Project	3	LaGrange	Texas	451	1.70	Limestone	1	Combustion Engineering	3/19/88
Fayette Power Project	4	LaGrange	Texas	451	1.70	Limestone	6	Vendor not selected	99/2050
Marquette Board of Light and Power									
Shiras	3	Marquette	Michigan	44	0.60	Lime/spray drying	1	GE Environmental Services	3/1983
Michigan Southern Central Power Agency									
Endicott	1	Litchfield	Michigan	55	2.25	Limestone	1	Babcock & Wilcox	5/1983
Minnesota Power & Light									
Clay Boswell	4	Cohasset	Minnesota	554	1.00	Lime/alkaline fly ash	1	Peabody Process Systems	2/1980
Minnkota Power									
Milton R. Young	2	Center	North Dakota	440	1.20	Lime/alkaline fly ash	1	Thyssen/CEA	9/1977
Monongahela Power									
Pleasants	1	Willow Island	West Virginia	684	3.00	Lime	1	Babcock & Wilcox	12/1978
Pleasants	2	Willow Island	West Virginia	684	3.00	Lime	1	Babcock & Wilcox	10/1980
Montana Power									
Colstrip	1	Colstrip	Montana	358	0.80	Lime/alkaline fly ash	1	Thyssen/CEA	9/1975
Colstrip	2	Colstrip	Montana	358	0.80	Lime/alkaline fly ash	1	Thyssen/CEA	8/1976
Colstrip	3	Colstrip	Montana	778	0.80	Lime/alkaline fly ash	1	Bechtel/Montana Power	10/1983
Colstrip	4	Colstrip	Montana	778	0.80	Lime/alkaline fly ash	1	Bechtel/Montana Power	12/1985
Montana-Dakota Utilities									
Coyote	1	Beulah	North Dakota	427	0.87	Sodium Carbonate/spray drying	1	Wheelabrator-Frye/R.I.	4/1981
Muscatine Power & Water									
Muscatine	9	Muscatine	Iowa	172	3.21	Limestone	1	Research-Cottrell	4/1983
Nevada Power									
Harry Allen	1	Las Vegas	Nevada	290	NA[d]	Process not selected	6	Vendor not selected	0/1997
Harry Allen	2	Las Vegas	Nevada	290	NA[d]	Process not selected	6	Vendor not selected	0/1999
Harry Allen	3	Las Vegas	Nevada	290	NA[d]	Process not selected	6	Vendor not selected	0/2001
Harry Allen	4	Las Vegas	Nevada	290	NA[d]	Process not selected	6	Vendor not selected	0/2003
Reid Gardner	1	Moapa	Nevada	125	0.50	Sodium carbonate	1	Thyssen/CEA	3/1974
Reid Gardner	2	Moapa	Nevada	125	0.50	Sodium carbonate	1	Thyssen/CEA	4/1974
Reid Gardner	3	Moapa	Nevada	125	0.50	Sodium carbonate	1	Thyssen/CEA	6/1976
Reid Gardner	4	Moapa	Nevada	285	0.90	Sodium carbonate	1	Thyssen/CEA	6/1983

(continued)

TABLE 3 (continued)

Company plant name	Unit No.	City	State	Capacity, MW (gross)	Fuel design, percent sulfur[a]	FGD process	FGD status[b]	System supplier	Initial startup date[c]
New York State Electric & Gas									
Somerset	1	Somerset	New York	680	3.60	Limestone	1	Peabody Process Systems	7/1984
Northern Indiana Public Service									
R.M. Schahfer	17	Wheatfield	Indiana	379	3.25	Dual alkali	1	FMC	4/1983
R.M. Schahfer	18	Wheatfield	Indiana	376	3.25	Dual alkali	1	FMC	12/1985
Bailly	7-8	Porter	Indiana	550	NA[d]	Limestone	3	Pure air	0/1992
Northern States Power									
Riverside	6-7	Minneapolis	Minnesota	150	1.20	Lime/spray drying	1	Joy Mfg./Niro Atomizer	11/1980
Sherburne Co.	1	Becker	Minnesota	750	0.80	Limestone/alkaline fly ash	1	Combustion Engineering	3/1976
Sherburne Co.	2	Becker	Minnesota	750	0.80	Limestone/alkaline fly ash	1	Combustion Engineering	3/1977
Sherburne Co.	3	Becker	Minnesota	850	1.00	Lime/spray drying	1	Joy Mfg./Niro Atomizer	7'1987
Orlando Utilities Commissions									
C.H. Stanton	1	Orlando	Florida	460	3.50	Limestone	1	Combustion Engineering	5/1987
Oxford Energy Co.[e]									
Sterling	1	Sterling	Connecticut	30	1.75	Process not selected	5	Vendor not selected	6/1990
Westley	1	Westley	California	14	1.75	Lime	1	GE Environmental Services	10/1987
Pacific Power & Light									
Dave Johnston	4	Glenrock	Wyoming	330	0.50	Lime/spray drying	1	GE Environmental Services	2/1985
Jim Bridger	1	Rock Springs	Wyoming	508	0.56	Sodium carbonate	2	Babcock & Wilcox	6/1990
Jim Bridger	2	Rock Springs	Wyoming	508	0.56	Sodium carbonate	1	Babcock & Wilcox	6/1986
Jim Bridger	3	Rock Springs	Wyoming	508	0.56	Sodium carbonate	1	Babcock & Wilcox	6/1988
Jim Bridger	4	Rock Springs	Wyoming	508	0.56	Sodium carbonate	1	Air Correction Division, UOP	9/1979
Wyodak	1	Joliet	Wyoming	320	0.55	Lime/spray drying	1	Joy Mfg./Niro Atomizer	9/1986
Pennsylvania Power									
Bruce Mansfield	1	Shippingport	Pennsylvania	835	4.70	Lime	1	GE Environmental Services	12/1975
Bruce Mansfield	2	Shippingport	Pennsylvania	835	4.70	Lime	1	GE Environmental Services	7/1977
Bruce Mansfield	3	Shippingport	Pennsylvania	835	4.75	Lime	1	M.W. Kellogg	6/1980
Philadelphia Electric									
Cromby	1	Phoenixville	Pennsylvania	188	1.70	Magnesium oxide	1	United Engineers	10/1982
Eddystone	1	Eddystone	Pennsylvania	354	1.70	Magnesium oxide	1	United Engineers	9/1982
Eddystone	2	Eddystone	Pennsylvania	354	1.70	Magnesium oxide	1	United Engineers	11/1982

(continued)

TABLE 3 (continued)

Company plant name	Unit No.	City	State	Capacity, MW (gross)	Fuel design, percent sulfur[a]	FGD process	FGD status[b]	System supplier	Initial startup date[c]
Plains Electric G & T									
Plains Escalante	1	Prewitt	New Mexico	233	0.80	Limestone	1	Combustion Engineering	11/1984
Platte River Power Authority									
Rawhide	1	Wellington	Colorado	278	0.29	Lime/spray drying	1	Joy Mfg./Niro Atomizer	12/1983
Public Service Indiana									
Gibson	5	Princeton	Indiana	667	4.40	Limestone	1	M.W. Kellogg	10/1982
Public Service of Colorado									
Arapahoe	4	Denver	Colorado	112	NA[d]	Sodium bicarbonate/ dry injection	2	Public Service of Colorado	12/1990
Cherokee	1	Denver	Colorado	100	NA[d]	Sodium bicarbonate/ dry injection	2	Public Service of Colorado	12/1990
Cherokee	2	Denver	Colorado	110	NA[d]	Sodium bicarbonate/ dry injection	2	Public Service of Colorado	12/1990
Cherokee	3	Denver	Colorado	150	NA[d]	Sodium bicarbonate/ dry injection	2	Public Service of Colorado	12/1990
Cherokee	4	Denver	Colorado	375	0.65	Sodium bicarbonate/ dry injection	2	Public Service of Colorado	4/1989
Pawnee	2	Brush	Colorado	500	0.35	Sodium bicarbonate/ dry injection	6	Public Service of Colorado	0/1994
Valmont	5	Denver	Colorado	166	NA[d]	Sodium bicarbonate/ dry injection	2	Public Service of Colorado	12/1990
Public Service of New Mexico									
San Juan	1	Waterflow	New Mexico	361	0.80	Wellman Lord	1	Davy McKee	4/1978
San Juan	2	Waterflow	New Mexico	350	0.80	Wellman Lord	1	Davy McKee	8/1978
San Juan	3	Waterflow	New Mexico	544	0.80	Wellman Lord	1	Davy McKee	12/1979
San Juan	4	Waterflow	New Mexico	544	0.80	Wellman Lord	1	Davy McKee	5/1982
Public Service of Oklahoma									
Inola	1	Tulsa	Oklahoma	600	NA[d]	Process not selected	6	Vendor not selected	0/2001
Inola	2	Tulsa	Oklahoma	600	NA[d]	Process not selected	6	Vendor not selected	0/2007
Salt River Project									
Coronado	1	St. Johns	Arizona	400	1.00	Limestone	1	M.W. Kellogg	11/1979
Coronado	2	St. Johns	Arizona	400	1.00	Limestone	1	M.W. Kellogg	7/1980
Coronado	3	St. Johns	Arizona	400	0.60	Limestone	2	SPR/M.W. Kellogg	0/2004
San Antonio Public Service									
J.K. Spruce	1	San Antonio	Texas	535	0.35	Limestone	2	Combustion Engineering	5/1992
J.K. Spruce	2	San Antonio	Texas	535	0.35	Limestone	3	Combustion Engineering	5/1997

(continued)

TABLE 3 (continued)

Company plant name	Unit No.	City	State	Capacity, MW (gross)	Fuel design, percent sulfur[a]	FGD process	FGD status[b]	System supplier	Initial startup date[c]
San Miguel Electric									
San Miguel	1	San Miguel	Texas	410	2.00	Limestone	1	Babcock & Wilcox	8/1981
Seminole Electric									
Seminole	1	Palatka	Florida	650	3.00	Limestone	1	Peabody Process Systems	5/1983
Seminole	2	Palatka	Florida	659	3.00	Limestone	1	Peabody Process Systems	9/1984
Sierra Pacific Power									
North Valmy	2	Valmy	Nevada	288	0.50	Lime/spray drying	1	Rockwell International	5/1985
Thousand Springs	1	Wells	Nevada	250	NA[d]	Process not selected	6	Vendor not selected	99/2050
Thousand Springs	2	Wells	Nevada	250	NA[d]	Process not selected	6	Vendor not selected	99/2050
Thousand Springs	3	Wells	Nevada	250	NA[d]	Process not selected	6	Vendor not selected	99/2050
Sikeston Board of Municipal Utilities									
Sikeston	1	Sikeston	Missouri	235	2.80	Limestone	1	Babcock & Wilcox	6/1981
South Carolina Public Service									
Cross	1	Cross	South Carolina	510	1.80	Limestone	3	Peabody Process Systems	99/2050
Cross	2	Cross	South Carolina	510	1.80	Limestone	1	Peabody Process Systems	10/1983
Pee Dee	1	Florence	South Carolina	550	NA[d]	Limestone	6	Vendor not selected	0/2005
Pee Dee	2	Florence	South Carolina	550	NA[d]	Limestone	6	Vendor not selected	0/2006
Winyah	2	Georgetown	South Carolina	315	1.08	Limestone	1	Babcock & Wilcox	7/1977
Winyah	3	Georgetown	South Carolina	315	2.00	Limestone	1	Babcock & Wilcox	7/1980
Winyah	4	Georgetown	South Carolina	315	1.70	Limestone	1	American Air Filter	7/1981
South Mississippi Electric Power									
R.D. Morrow, Sr.	1	Purvis	Mississippi	215	1.50	Limestone	1	Environeering, Riley Stoker	8/1978
R.D. Morrow, Sr.	2	Purvis	Mississippi	215	1.50	Limestone	1	Environeering, Riley Stoker	6/1979
Southern Illinois Power									
Marion	4	Marion	Illinois	184	4.40	Limestone	1	Babcock & Wilcox	4/1979
Southern Indiana Gas & Electric									
A.B. Brown	1	West Franklin	Indiana	265	4.50	Dual alkali	1	FMC	3/1979
A.B. Brown	2	West Franklin	Indiana	265	4.50	Dual alkali	1	FMC	2/1986
Southwestern Electric Power									
Dolet Hills	1	Mansfield	Louisiana	720	0.70	Limestone		Air Correction Division, UOP	12/1985
Henry W. Pirkey	1	Hallsville	Texas	720	0.80	Limestone	1	Air Correction Division, UOP	12/1984
Walker Co.	1	Huntsville	Texas	720	1.49	Process not selected	6	Vendor not selected	0/2005
Walker Co.	2	Huntsville	Texas	720	1.49	Process not selected	6	Vendor not selected	0/2006

(continued)

TABLE 3 (continued)

Company plant name	Unit No.	City	State	Capacity, MW (gross)	Fuel design, percent sulfur[a]	FGD process	FGD status[b]	System supplier	Initial startup date[c]
Southwestern Public Service									
South Plains	1	Idalou	Texas	572	NA[d]	Process not selected	6	Vendor not selected	99/2050
Springfield Water, Light & Power									
Dallman	3	Springfield	Illinois	192	3.30	Limestone	1	Research-Cottrell	10/1980
Sunflower Electric									
Holcomb	1	Holcomb	Kansas	319	1.00	Lime/spray drying	1	Joy Mfg./Niro Atomizer	7/1983
Tampa Electric									
Big Bend	4	Tampa	Florida	455	3.50	Limestone	1	Research-Cottrell	12/1984
Tennessee Valley Authority									
Paradise	1	Paradise	Kentucky	704	3.20	Limestone	1	GE Environmental Services	5/1983
Paradise	2	Paradise	Kentucky	704	3.20	Limestone	1	GE Environmental Services	7/1983
Shawnee	9	Paducah	Kentucky	10	4.00	Lime/spray drying	1	EPRI/TVA/Ontario Hydro	3/1987
Widows Creek	7	Bridgeport	Alabama	575	4.00	Limestone	1	Combustion Engineering	3/1981
Widows Creek	8	Stevenson	Alabama	550	4.00	Limestone	1	Tennessee Valley Authority	5/1977
Texas Municipal Power Agency									
Gibbons Creek	1	Carlos	Texas	443	1.06	Limestone	1	Combustion Engineering	11/1982
Texas Utilities									
Forest Grove	1	Athens	Texas	750	2.10	Limestone	6	Vendor not selected	99/2050
Martin Lake	1	Tatum	Texas	793	0.90	Limestone	1	Research-Cottrell	4/1977
Martin Lake	2	Tatum	Texas	793	0.90	Limestone	1	Research-Cottrell	5/1978
Martin Lake	3	Tatum	Texas	793	0.90	Limestone	1	Research-Cottrell	2/1979
Monticello	3	Mt. Pleasant	Texas	793	1.50	Limestone	1	GE Environmental Services	5/19/78
Sandow	4	Rockdale	Texas	595	1.60	Limestone	1	Combustion Engineering	12/1980
Twin Oak	1	Bremond	Texas	750	1.60	Limestone	6	Vendor not selected	0/1994
Twin Oak	2	Bremond	Texas	750	0.70	Limestone	6	Vendor not selected	0/1995
United Power Association									
Stanton	10	Stanton	North Dakota	60	0.77	Lime/spray drying	1	Research-Cottrell	7/1982
Utah Power & Light									
Hunter	1	Castle Dale	Utah	430	0.60	Lime	1	GE Environmental Services	3/1979
Hunter	2	Castle Dale	Utah	430	0.60	Lime	1	GE Environmental Services	6/1980
Hunter	3	Castle Dale	Utah	424	0.60	Limestone	1	GE Environmental Services	4/1983
Huntington	1	Huntington	Utah	426	0.55	Lime	1	GE Environmental Services	5/1978
Naughton	3	Kemmerer	Wyoming	346	0.55	Sodium carbonate	1	Air Coorrection Division	9/1981

(continued)

TABLE 3 (continued)

Company plant name	Unit No.	City	State	Capacity, MW (gross)	Fuel design, percent sulfur[a]	FGD process	FGD status[b]	System supplier	Initial startup date[c]
Washington Water Power									
Creston Coal	1	Creston	Washington	570	NA[d]	Limestone	6	Vendor not selected	99/2050
Creston Coal	2	Creston	Washington	570	NA[d]	Limestone	6	Vendor not selected	99/2050
Creston Coal	3	Creston	Washington	570	NA[d]	Limestone	6	Vendor not selected	99/2050
Creston Coal	4	Creston	Washington	570	NA[d]	Limestone	6	Vendor not selected	99/2050
West Penn Power									
Mitchell	3	Courtney	Pennsylvania	296	3.00	Lime	1	GE Environmental Services	8/1982
West Texas Utilities									
Oklaunion	1	Oklaunion	Texas	720	0.40	Limestone	1	GE Environmental Services	11/1986
Oklaunion	2	Oklaunion	Texas	720	0.40	Process not selected	6	Vendor not selected	99/2050
White Pine County									
White Pine Power Project	1	Ely	Nevada	820	0.60	Process not selected	6	Vendor not selected	3/1995
White Pine Power Project	2	Ely	Nevada	820	0.60	Process not selected	6	Vendor not selected	3/1996

[a] Coal, unless otherwise stated. The sulfur content listed is the design sulfur content. See Section 2 of the FGD Survey Report for the average sulfur content of the fuel as burned.

[b] FGD status codes are defined as:

1 - Operation units.
2 - Units under construction.
3 - Planned - contract awarded.
4 - Planned, letter of intent signed.
5 - Planned, requesting/evaluating bids.
6 - Planned, considering only FGD systems for SO_2 compliance.

[c] 99/indicates indefinitely deferred unit.

[d] NA = Not available.

[e] Nonutility generator that sells power to utilities.

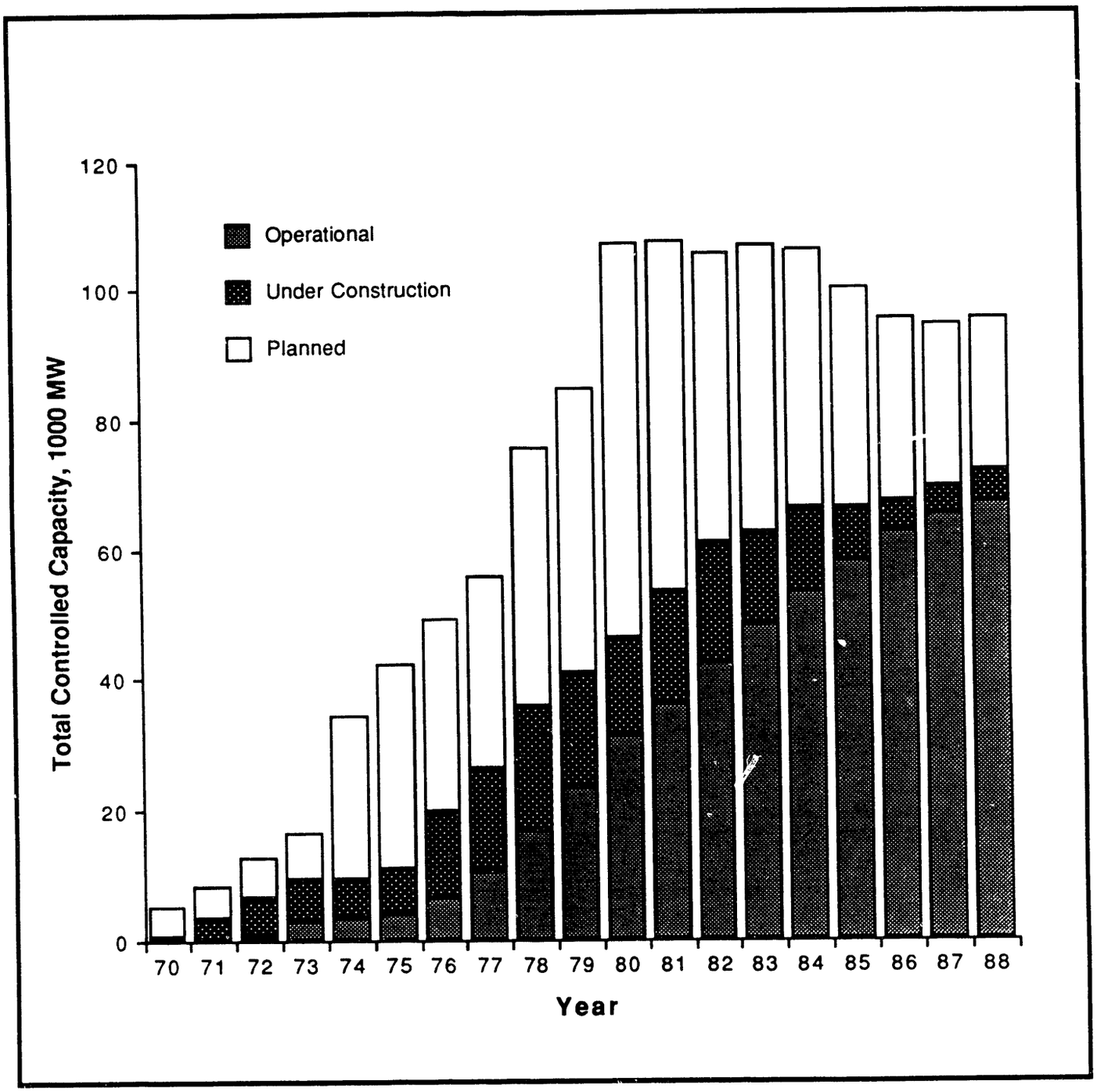

Figure 1. History of utility FGD status reports for operational, under construction, and planned FGD capacity - December 1970 through December 1988.

Figure 2 presents a comparison of actual coal-fired generating capacity and FGD capacity from 1975 through 1988 and projections thereafter through 1998.[1-11] Although the retirement of older units is taken into account in these plots, such retirements affect only the overall coal-fired capacity rate because FGD-controlled capacity represents primarily new power generating capacity. This accounts for the slightly greater slope of the lower line, which depicts FGD-controlled capacity.

Current projections estimate the total power-generating capacity of the U.S. electric utility industry will be 761 GW by the end of 1998.[11] (This value reflects the loss resulting from the retirement of older units, which is considered to be approximately 6,969 MW by the end of 1998.[11]) Approximately 332 GW, or 44 percent of the 1998 total, is estimated to be coal-fired units. Table 4 presents a distribution of present (December 1988) and future (December 1998) power generation sources.

It is interesting to note that the breakdown for the actual power produced by these sources during the past year (Table 5) differs appreciably, especially for coal- and oil-fired sources, from the power generating capacity shown in Table 4. This is due to the effect of the changing economy on the operation of various types of powerplants and also on the fact that coal and nuclear plants tend to be base loaded and other types tend to serve as intermediate or peak loading units.

Based on known commitments of utilities to FGD (as presented in Table 1) and other coal-fired generating capacity expected to be required to incorporate FGD (Figure 2), current and projected percentages of electrical generating capacity controlled by FGD are shown in Table 6. The utility FGD survey includes 13 non-utility units that contribute all or part of the power they produce to the utility grid.

Congeneration and independent power producing facilities are becoming a larger factor of electrical energy production partially as a result of legislation requiring utilities to purchase power whenever possible and the high cost of constructing new units.

Currently the capacity of non-utility units is over 9,758 MW[13] (approximately 1.5 percent of the total in the United States). By 1998, this capacity is expected to increase to 28,839 MW[13] (approximately 3.9 percent of the 1998 capacity). Non-utility units are expected to produce 3.2 percent of the electricity in 1989 and 6.0 percent in 1998.[13]

Table 7 presents data on the planned additions to the electric generating units of non-utility power producers compared with utility additions for the next five years. As shown, the non-utility producers will account for as much as 60 percent of the new capacity in 1989 and will be from 30 to 60 percent of the additional capacity in the following years.

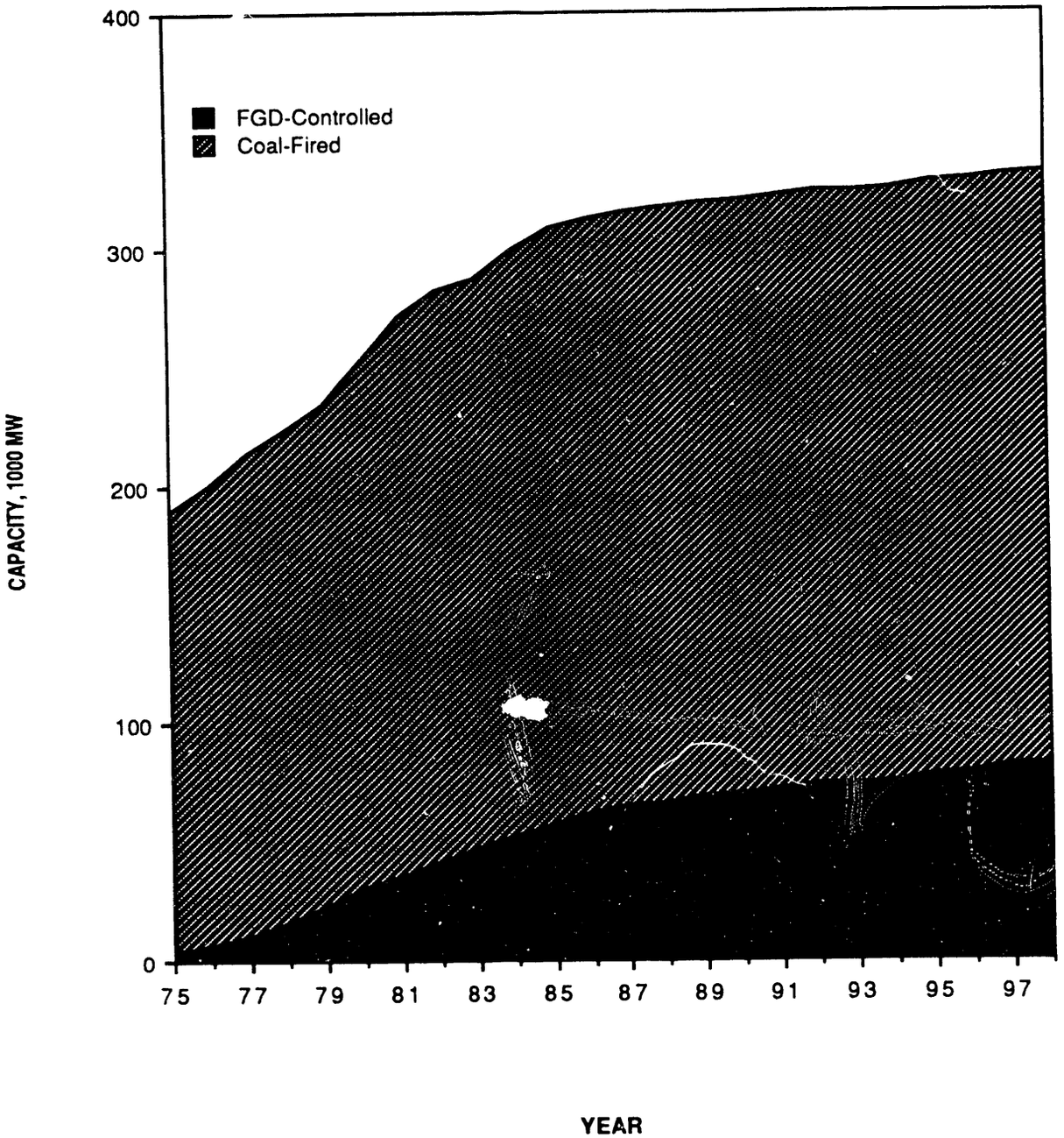

Figure 2. Actual and projected coal-fired generating capacity and FGD capacity, 1988.[I-II]

TABLE 4. POWER GENERATION SOURCES: PRESENT AND FUTURE
(U.S. DOE, Inventory of Power Plants, 1988)[11]

	Coal	Nuclear	Oil	Hydro	Gas	Other	Total generating capacity, GW
December 1988	44%	14%	12%	12%	17%	1%	724
December 1998	44%	15%	11%	12%	17%	1%	761

TABLE 5. POWER PRODUCTION BY SOURCE
(U.S. DOE, Electric Power Monthly, December 1988)[12]

	Coal	Nuclear	Oil	Hydro	Gas	Other	Total energy generated, GWh
January-December 1988	57%	20%	6%	8%	9%	0	2,700,924

TABLE 6. FGD-CONTROLLED GENERATING CAPACITY: PRESENT AND FUTURE
(FGDIS, U.S. DOE Inventory of Power Plants, 1988)[1,11]

	Coal-fired generating capacity controlled by FGD, %	Total generating capacity controlled by FGD, %
December 1988[a]	21.1	9.3
December 1998	24.9	10.9

[a]The December 1988 FGD capacity figures are based on reports by utilities. The figures used for the total generating capacity and the December 1998 coal-fired generating capacity are based on December 1988 DOE-projected figures.

TABLE 7. CAPACITY ADDITIONS OF UTILITIES VERSUS NON-UTILITY PRODUCERS[13]

	Non-utility producers, MW	Utilities, MW
1988 (existing)	9758	724,000
1989	3608	2522
1990	4106	8234
1991	4227	4745
1992	2720	5131
1993	2579	3614

Table 8 gives the percentage of each fuel type that will be added from 1989 to 1998. As shown, coal accounts for 10.7 percent (1938 MW) of these additions. FGD systems will be used by some of the coal-fired units as well as other fuels (e.g., tires, waste). Other coal units will use fluidized bed boilers or will burn low-sulfur coal.

FGD is not the only avenue for SO_2 compliance. The use of fluidized bed boilers is now considered as an option to FGD systems for SO_2 control when the coal alkali content is high. Currently, four fluidized bed boilers are installed at utilities. Three of these are operational demonstration projects sponsored by EPRI: a 160-MW unit at TVA, a 130-MW unit at Northern States Power; and a 110-MW unit at Colorado Ute Electric. Construction on another unit owned by Montana-Dakota Utilities has an 80-MW capacity.[14] Texas-New Mexico Power Company has plans to construct four 150-MW units that will use fluidized bed boilers and become operational from 1990 to 2000.[15]

Further development in this area is expected with the trend toward power-plant life extensions and "repowering" old units with new more-sophisticated generating equipment.

Table 9 shows both the current (December 1988) and projected (after December 2000) breakdown of throwaway-product FGD systems versus saleable-product FGD systems as a percentage of the total known commitments to FGD. If the SO_2 or particulate removed from the flue gas is recovered in a usable or marketable form (e.g., gypsum), the product is considered saleable. If the SO_2 or particulate is not recovered in a usable form, it is considered a throwaway product.

TABLE 8. NON-UTILITY UNIT ADDITIONS BY FUEL TYPE[13]
(Courtesy of North American Electric Reliability Council)

Fuel type	1989-1998 MW	Percent of total planned capacity
Natural gas	3,834	21.2
Hydro	480	2.6
Coal	1,938	10.7
Geothermal	420	2.3
Wind	71	0.4
Solar	131	0.7
Refuse (solid waste)	1,170	6.5
Wood/wood wastes	345	1.9
Other or unknown	9,726	53.7
TOTAL	18,115	100.0

TABLE 9. SUMMARY OF FGD SYSTEMS BY PROCESS
(percentage of total MW)

Process	Byproduct	December 1988	December 2000	December 2000 (normalized)[a]
Throwaway-product				
Wet scrubbing				
Dual alkali		3.4	2.3	2.5
Lime		16.5	13.7	14.9
Lime/alkaline fly ash		7.1	4.9	5.3
Limestone		48.5	43.5	47.3
Limestone/alkaline fly ash		2.4	1.7	1.8
Sodium carbonate		4.0	3.3	3.6
Spray drying				
Lime/spray drying		8.8	8.0	8.8
Process not selected		-	4.3	4.7
Sodium carbonate/spray drying		0.7	0.5	0.5
Dry injection				
Sodium carbonate/dry injection		-	1.7	1.8
Saleable-product				
Wet scrubbing				
Lime	Metals/fly ash/ other	<0.1	<0.1	<0.1
Limestone	Gypsum	4.1	4.7	5.1
Magnesium oxide	Sulfuric acid	1.4	1.0	1.1
Wellman Lord	Sulfuric acid	3.1	2.1	2.3
Spray drying				
Lime	Dry scrubber waste	-	0.3	0.3
Process undecided		-	8.0	-
TOTAL		100.0	100.0	100.0

[a] The effect of those systems listed as "Process undecided" is removed.

HIGHLIGHTS: JANUARY - DECEMBER 1988

The following paragraphs highlight FGD system activities and availabilities during the period of January through December 1988.

Alabama Electric announced in 1988 that the Tombigbee units located in Leroy, Alabama, would be renamed Lowman 1 and 2 after a former general manager for the utility.

Atlantic City Electric reported that they are no longer considering building Cumberland 1. This would have been a 330-MW unit located in Millville, New Jersey.

Central Power and Light announced plans to install a new unit (Valley 1) in the area of Rio Grand Valley, Texas. Startup of the subbituminous-fired 680-MW unit is scheduled for the year 2006.

CMS Generation announced that construction began on the Filer City Station located in Filer City, Michigan. The station consists of two 30-MW units that will fire bituminous coal with an average sulfur content of 2.5 percent. The SO_2 control system on each of these units consists of a lime spray drying system supplied by GE Environmental Services. Startup of the two units is scheduled for 1989.

Dineh Service Company reported the cancellation of the Dineh project due to surplus power in the Midwest. The Dineh Service Company, a joint venture between Public Service of New Mexico, the Navajo Indian Tribe, and several equipment suppliers, had planned to locate four 555-MW units in Bisti, New Mexico.

General Public Utilities announced that they were cancelling their planned unit, Coal 1. This unit, which was to be located in Forked River, New Jersey, had a planned capacity of 300 MW.

Hadson Corporation reported that it has awarded contracts for the construction of four new units. The units will be located in Altavista, Buena Vista, Hopewell, and Southampton, Virginia. The 70-MW (gross) stoker units will be supplied by Babcock and Wilcox and will burn bituminous coal. Each unit will employ a Flakt spray dryer and fabric filter for SO_2 and particulate control. Initial startup of the units is scheduled to commence in 1992.

Indeck Energy Services, Inc., announced that construction began on a new unit in Turners Falls, Massachusetts. The 19-MW unit will fire coal and will be equipped with a lime dry-injection system for SO_2 control. Startup of Turners Falls 1 is scheduled for 1989.

Jacksonville Electric Authority reported that initial operations began on St. Johns River Park 2 in March 1988. This 612-MW unit located in East Port, Florida, has a wet limestone FGD system supplied by Research-Cottrell for SO_2 control and an ESP for particulate control.

Louisville Gas and Electric reported that the Trimble County 1 unit had begun construction prior to 1988. This 495-MW unit located in Bedford, Kentucky, is scheduled for startup by year-end 1990 with commercial operation by summer 1991. A wet limestone FGD system supplied by Combustion Engineering will provide SO_2 control and an ESP will provide particulate control.

Lower Colorado River Authority reported that initial operations began on Fayette Power Project 3 in March 1988 with commerical operations being declared on April 29, 1988. The 451-MW unit located in LaGrange, Texas, is equipped with a wet limestone FGD system supplied by Combustion Engineering for SO_2 control. An ESP supplied by Flakt provides particulate control.

Northern Indiana Public Service Company signed an agreement with Pure Air to retrofit an advanced FGD demonstration project onto Bailly Station units 7 and 8. The bituminous coal-fired units supplied by Babcock and Wilcox have a total rating of 550 MW. The project is being partially underwritten by Federal funding for the Clean Coal Demonstration Program. The wet limestone scrubbing system, which will produce a saleable gypsum product, is scheduled to startup in 1992. The system will be tested for approximately 3 years and then will continue operating for an additional 17 years.

Pacific Power and Light announced that during 1988 construction and initial operations of retrofitted FGD systems commenced on the Jim Bridger units 1 and 3, respectively. The 508-MW units located in Rock Springs, Wyoming, will utilize a Babcock and Wilcox retrofit wet sodium carbonate FGD system for SO_2 control. Each unit is equipped with an existing cold-side ESP for primary particulate control. Initial start-up of the retrofit FGD system on Unit 1 is scheduled for 1990.

Public Service Company of Colorado announced that construction is now underway on six of nine Denver, Colorado, area coal-fired units. The project will retrofit fabric filters and dry sodium bicarbonate injection for SO_2 and particulate control on Cherokee 1, 2, 3, and 4, Arapahoe 4, and Valmont 5. The utility is hoping to reduce its Denver area SO_2 emissions by 70 percent, even though the company already meets the new source performance standards of 1.2 lb SO_2/million Btu by using low-sulfur coal. The utility is in the process of phasing out particulate wet scrubbers at these facilities.

Public Service Company of Oklahoma announced that it has plans to install two new units (Inola 1 and 2) in Tulsa, Oklahoma. The units will fire pulverized subbituminous coal and have a gross rating of 660 MW. Startup of the two units is scheduled for the years 2001 and 2007, respectively.

San Antonio Public Service announced that a contract has been awarded to Combustion Engineering to supply the boiler and wet limestone FGD system for SO_2 control for two new 535-MW units. Construction of Calaveras 5, which has since been renamed J. K. Spruce 1, was initiated in September 1988, and the unit is expected to be operational by 1992. The second unit, Calaveras 6, which has been renamed J. K. Spruce 2, is expected to be on-line by 1997. Both units will be located near San Antonio, Texas.

Texas Utilities announced the indefinite postponement of plans to construct Forest Grove 1. The plans called for a 750-MW unit to be located in Athens, Texas. The utility has since cancelled the FGD system supplier contract for this unit. Texas Utilities also announced the cancellation of FGD system supplier contracts for the Twin Oak 1 and 2 units due to a change in SO_2 design limitations. Initial start-up of the two planned units is still scheduled for 1994 and 1995, respectively.

Table 10 lists the names of the utility systems that reported achieving operating availabilities of 90 percent or greater for the period January through December 1988.

TABLE 10. UTILITY FGD SYSTEMS ACHIEVING AVERAGE ANNUAL AVAILABILITIES OF 90 PERCENT OR GREATER FOR 1988

Utility	Unit
Central Illinois Light	Duck Creek 1
Central Illinois Public Service	Newton 1
Columbus & Southern Ohio Electric	Conesville 5 Conesville 6
Delmarva Power and Light	Delaware City 2 Delaware City 3
Hoosier Energy	Merom 2
Indianapolis Power & Light	Petersburg 3
Minnesota Power & Light	Clay Boswell 4
Montana Power	Colstrip 1 Colstrip 3 Colstrip 4
Muscatine Power and Water	Muscatine 9
Nevada Power	Reid Gardner 1 Reid Gardner 2 Reid Gardner 3 Reid Gardner 4
Northern Indiana Public Service	R. M. Schahfer 17 R. M. Schahfer 18
Orlando Utilities	C. H. Stanton 1
Public Service of Indiana	Gibson 5
South Carolina Public Service	Cross 2 Winyah 3 Winyah 4
Southern Illinois Power	Marion 4
Sunflower Electric	Holcomb 1
United Power Association	Stanton 1A

REFERENCES

1. U.S. Department of Energy. Flue Gas Desulfurization Information System (FGDIS). Computerized Data Base. Energy Information Administration, Forrestal Building, Washington, D.C.

2. U.S. Department of Energy. Inventory of Power Plants in the United States. Office of Utility Project Operations. DOE/RA-0001, December 1977.

3. U.S. Department of Energy. Inventory of Power Plants in the United States - December 1979. Energy Information Administration. DOE/EIA-0095(79), June 1980.

4. U.S. Department of Energy. Inventory of Power Plants in the United States - 1980 Annual. Energy Information Administration. DOE/EIA-0095(80), June 1981.

5. U.S. Department of Energy. Inventory of Power Plants in the United States - 1981 Annual. Energy Information Administration. Office of Coal, Nuclear, Electric, and Alternate Fuels. DOE/EIA-0095(81), September 1982.

6. U.S. Department of Energy. Inventory of Power Plants in the United States - 1983. Energy Information Administration. Office of Coal, Nuclear, Electric, and Alternate Fuels. DOE/EIA-0095(83), July 1984.

7. U.S. Department of Energy. Inventory of Power Plants in the United States - 1984. Energy Information Administration. Office of Coal, Nuclear, Electric, and Alternate Fuels. DOE/EIA-0095(84), July 1985.

8. U.S. Department of Energy. Inventory of Power Plants in the United States, 1985. Energy Information Administration. Office of Coal, Nuclear, Electric, and Alternate Fuels. DOE/EIA-0095(85), August 1986.

9. U.S. Department of Energy. Inventory of Power Plants in the United States, 1986. Energy Information Administration. Office of Coal, Nuclear, Electric, and Alternate Fuels. DOE/EIA-0095 (86). August, 1987.

10. U.S. Department of Energy. Inventory of Power Plants in the United States, 1987. Energy Information Administration. Office of Coal, Nuclear, Electric, and Alternate Fuels. DOE/EIA-0095(87), August 1988.

11. U.S. Department of Energy. Inventory of Power Plants in the United States, 1988. Energy Information Administration. Office of Coal, Nuclear, Electric, and Alternate Fuels. DOE/EIA-0095(88), August 1989.

12. U.S. Department of Energy. Energy Information Administration. Office of Coal, Nuclear, Electric, and Alternate Fuels. Electric Power Monthly, DOE/EIA-0226(88/12), December 1988.

13. North American Electric Reliability Council. 1989 Electricity Supply and Demand for 1989-1998. October 1989.

14. Personal Communication with Sibyl Anderson, EPRI, November 20, 1989.

15. Personal Communication with Alan Davis, Texas-New Mexico Power, November 10, 1988.

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