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**CARBON DIOXIDE SOURCES AND OILFIELDS IN A
NINE-STATE AREA OF THE SOUTHWEST UNITED STATES**

By

Robert E. Finney and Larman J. Heath

Date Published—April 1977

Bartlesville Energy Research Center
Energy Research and Development Administration
Bartlesville, Oklahoma

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CARBON DIOXIDE SOURCES AND OILFIELDS IN A NINE-STATE AREA OF THE SOUTHWEST UNITED STATES

By

Robert E. Finney¹ and Larman J. Heath²

ABSTRACT

Data on the prospective available CO₂ in a nine-State area of the Southwest were collected from scattered sources and compiled to make the information readily available to operators who may be interested in using CO₂ techniques for enhanced oilfield recoveries. Maps of the oilfields in the area studied are provided so that location of supply source can be related to possible point of use.

The best potential sources of CO₂ are flue gas from electric generating plants, flue gas from cement plants, output from ammonia plants and natural gas reservoirs. The CO₂ sources are listed by states and includes the operator's name, location name, county, and average available amounts of CO₂.

INTRODUCTION

Interest in tertiary methods for recovering more oil from known oil accumulations has centered on steam floods, fire floods, detergents, solvents, miscible agents, and various types of gas injection. The CO₂ process, a gas-injection technique, has proved to be attractive for enhanced recovery in terms of both effectiveness of recovery and economics when CO₂ is available locally.

Interest exists today in CO₂ injections, not only in reservoirs containing high gravity-low viscosity oils, but also in those containing the low gravity-high viscosity heavy oils. In some reservoirs, this technique may be applied where other methods of enhanced recovery are not technically or economically feasible. CO₂ floods, even when technically feasible in certain reservoirs, have been severely constrained by the unavailability of sufficient or low-cost sources of carbon dioxide.

The literature contains much information on the technical aspects, laboratory methods, and field investigations of CO₂ flooding for enhanced oil recovery; however, scarcely

¹ Petroleum Engineer

² Project Leader

any information has been published on the availability, location, and economics of obtaining CO₂ from the various sources. The purpose of this study was to locate, identify, and estimate the quantities in potential CO₂ sources. This study was limited to the nine-State area of the Southwest--Arkansas, Colorado, Kansas, Louisiana, Mississippi, Missouri, New Mexico, Oklahoma, and Texas.

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DISCUSSION

The following potential sources of carbon dioxide were investigated:

1. Flue gas output from electric-power-generating plants
2. Flue gas output from cement plants
3. Output from ammonia or urea plants
4. Natural gas reservoirs in the Southwest
5. Fermentation industries
6. Phosphate manufacturing
7. Limestone calcination
8. Flue gas output from refinery operations

From the above list, the best potential sources (1)¹ of carbon dioxide apparently are flue gas from electric-power-generating plants, flue gas from cement plants, output from ammonia or urea plants, and natural gas reservoirs which contain CO₂ in the covered nine-State area. The relative small amounts of carbon dioxide available from the fermentation industry, phosphate manufacturing, and limestone calcination operations would seem to eliminate them from consideration as potential sources. Oil refineries discharge large amounts of flue gas to the atmosphere, but the required investments for gathering systems at the widely diversified operations would make them unattractive for sources of supply.

This study was addressed to the first four primary candidates in the above list as sources of supply.

¹ Underlined numbers in parentheses refer to items listed in the reference at the end of this report.

1. Electric Power Generating Plants

- (a) CO₂ flow rates from stack flue gas ranged from 1 million to 300 million cu ft/day from gas-fired units and up to 2 billion cu ft/day from coal-fired units. The total flue gas output will range 8 to 15 times higher than the CO₂ production from each plant (12). The CO₂ output from each generating unit was estimated by multiplying a constant conversion factor of 0.14 to the megawatt output capacity for the gas-fired units and a factor of 0.84 to the megawatt output capacity for the coal-fired units (10, 11). The coal conversion factor is approximately six times larger than the gas conversion factor because coal-fired units require nine to ten times the air intake as the gas-fired units (10). Conversion factors were determined by dividing the CO₂ outputs by each megawatt output from the individual plants (10). An average factor was determined from several sources. These conversion factors were obtained from data supplied by various power system companies and verified by the Environmental Protection Agency report on point source emissions. No determination was attempted for the total contaminant output or the economics involved in separating the undesirable elements from the flue gas.
- (b) The location and output amounts were determined as point sources; but for convenience and map readability, they were totaled into county listings as indicated on each state map in figures 1 through 9. The indicated county amounts include the gas-fired generators and coal-fired generator outputs. The separations for each point source are included in tables 1 through 9. The oilfields and CO₂ sources for each state are listed in figures 1 through 9 for quick referral of the proximity for county source of supply to any field of interest.
- (c) The recovery of CO₂ from flue gases, compressing it for pipeline transmission, and transportation analysis has not been sufficiently studied, so that an overall economic evaluation is not available. The degree of purity required for a CO₂ injection system has not been fully determined. This determination would be significant to the overall economics of a recovery program. Limited information on present sources places estimated costs of CO₂ separated from flue gas between \$0.80 and \$1.25/mcf (13). This estimate does not include pressurization and transportation charges; these additional significant charges would be influenced by the proximity of source to reservoir and the degree of miscibility required for each reservoir.
- (d) The largest concentrations of CO₂ from flue gas are located at the coal-fired, electric-power-generating plants (9); however, coal-fired units are generally in areas where oil and gas suppliers are not readily available. Consequently, transportation costs for CO₂ could prove this large source of supply to be unattractive for most potential amenable reservoirs.

2. Cement Plants

- (a) CO₂ flow rates vary from 35 million to 123 million cu ft/day (22). Total flue gas output will range 8 to 15 times higher than the CO₂ flow rate. The CO₂ production rate in Mcfd from each plant unit was estimated by applying a constant conversion factor of 90 to the cement output capacity in tons/day for gas-fired units and a constant conversion factor of 178 for the coal-fired units (22). Conversion data were supplied by various cement plant operators and verified by the "point source output emissions" supplied by the Environmental Protection Agency (11). No attempt was made to determine the output contaminants or the economics of separation of the undesirable elements from the flue gas output.
- (b) The point sources and available amounts are listed by each state on enclosure maps shown in figures 1 through 9 and tables 1 through 9. The various state oilfields are shown on each state map in figures 1 through 9 so that easy referral from source of supply to the field of interest may be made.
- (c) The same criteria and limitations expressed in the discussion of electric-power-generating plants would apply to the economic evaluation of obtaining CO₂ from cement plant flue gas output. Best available estimates place the undelivered and unpressurized CO₂ gas between \$0.80 and \$1.25 mcf (13).
- (d) The largest concentrations of available flue gas CO₂ from cement plants are those using coal as a primary fuel. Several of these plant sites are near fields that are potentially amenable to enhanced recovery operations and could become attractive candidates for sources of CO₂.

3. Ammonia Plants

- (a) CO₂ production from ammonia and urea plants vary from 1 million to 14 million cu ft/day. The present source of supply is listed on state maps in figures 1 through 9 with all county sources combined from the separate sources. The sources (1) are listed in tables 1 through 9. This potential source of CO₂ supply is limited in the nine-State area since present supply and demand for CO₂ in the foodstuff and other industries are fairly well balanced. This limited source of supply would be further strained by an increasing demand from the enhanced oil recovery industry.
- (b) Pure CO₂ is typically handled through commercial suppliers and is presently available for delivery at \$2 to \$2.35/mcf. These prices were determined from a survey of the commercial suppliers and the price schedule from AIRCO Industrial Gas Co. (1).

4. Natural Gas Wells

- (a) The carbon dioxide flow rates from natural gas reservoirs varies from small amounts to 87 million cu ft/day with purities up to 99.6 percent. These estimated volumes were calculated based on percentage volumes of CO₂ compared with total gas flow previously reported in the publications (2-8, 16-21). Although some volumes were verified by production from industry reports and other publications, no real significance or correlation to present deliverability or total reserves should be attached to the data shown in tables 1 through 9. The listing of volumes only suggests possible areas of CO₂ reserves. Recently, industry has shown much interest in determining the deliverability and reserves for several areas and has spent considerable time and effort to exploit possible CO₂ reserves. At least two companies have made in-depth studies on transportation installations that might be required in some remote area sources. However, their findings on exploration, development, and the analysis on transportation requirements are confidential and not available for publication. Limited information does indicate that natural sources could be the most attractive source of supply for CO₂.
- (b) The sources available for natural CO₂ gas were not defined sufficiently to indicate on the maps in figures 1 through 9.
- (c) Cost of natural CO₂ would be highly influenced by the degree of purity of produced gas, the degree of compressibility required for transporting, and the proximity of supply source to fields of interest. Some experience has been gained from CO₂ enhanced recovery operations in West Texas which use heretofore - waste CO₂ produced by the separation process at various gasoline plants. This experience factor, coupled with the knowledge gained from natural foodstuff carbon dioxide and the wealth of information on the economic analysis of natural gas production, place the estimated cost of produced carbon dioxide somewhat below the costs for natural gas. Best estimates available place the range from \$0.25 to \$1.00/mcf delivered (13).

SUMMARY

The demand for carbon dioxide miscible flooding techniques has been severely constrained because of the general unavailability of source of supply. The pure carbon dioxide and industrial suppliers in the nine-State area of interest have present deliverability capabilities of 80 to 100 million cu ft/day (1). Additional sources must be found if carbon dioxide miscible enhanced recovery techniques are to be expanded. Natural gas reservoirs offer an attractive alternative and should have the deliverability capability of several billion cu ft/day. Several large reserves have been identified, but these are located at considerable distances from the most favorable oil reservoirs of interest.

Carbon dioxide recovery from flue gas operation may prove to be a viable alternate if relative inexpensive methods for extraction, compression, and transportation can be developed. Carbon dioxide deliverability from flue gas conversion can range up to 125 billion cu ft/day for the area studied. Electric generating power plants represent the largest concentrated sources with cement plants being a good alternative for consideration.

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TABLE 1. - Carbon dioxide sources of supply in Arkansas

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM ELECTRIC GENERATING PLANTS				
Arkansas Electric Coop	Augusta	Woodruff	100	14,000
Do.	Bailey	do.	122	17,000
Do.	Camden	do.	125	17,500
Do.	Fitzhugh	Franklin	59	8,300
Do.	McClellan	Ouachita	134	18,800
Do.	Ozark	do.	50	7,000
Mid Southern Arkansas Power and Light	Cecil Lynch	Pulaski	217	30,300
Do.	Ham Moses	St. Francis	126	17,500
Do.	Harvey Couch	Lafayette	140	19,600
Do.	L. Catherine	Hot Springs	666	93,000
Do.	R. E. Ritchie	Phillips	845	118,000
Do.	Blytheville	Mississippi	189	26,000
CO ₂ OUTPUT FROM CEMENT PLANTS				
Arkansas Cement	Foreman	Bevier		86,000
Ideal Cement	Okay	Pulaski		36,000
CO ₂ PRODUCTION FROM CHEMICAL PLANTS				
Monsanto Chemical	Blytheville	Mississippi		200
Ark Chemical	Helana	Phillips		3,480
CO ₂ OUTPUT FROM NATURAL GAS WELLS				
Carter Oil Co.	Big Creek	Columbia		NA
McAlester Fuel Co.	Dorcheat	do.		93
Barnsdall	McKamie	Lafayette		NA
Carter Oil Co.	Fauke	Miller		180

NA - Not available.

TABLE 2. - Carbon dioxide sources of supply in Colorado

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM ELECTRIC GENERATING PLANTS				
Central Telephone & Utility Co.	Pueblo New	Fremont	34	5,200
Do.	W. N. Clark	do.	41	34,000
City of Colorado Springs	Drake	El Paso	286 ^c	240,000
Do.	G. Birdsal	do.	56	7,800
Colo.-Ute Electric Association	Bullock	Montrose	12	10,000
Do.	Nucla	do.	57	48,000
City of Lamar	Lamar	Prowers	35	4,900
Public Service Co. of Colorado	Alamosa	Alamosa	38	5,300
Do.	Arapohoe	Denver	240 ^c	202,000
Do.	Cameo	Mesa	75 ^c	63,000
Do.	Cherokee	Adams	733 ^c	613,000
Do.	Comanche	Pueblo	700 ^c	566,000
Do.	Valmont	Boulder	180 ^c	151,000
Do.	do.	do.	166	23,000
Do.	Zuni	Denver	108	15,000
Tri-State Generating & Transmission	Wray	do.	202	28,000
Western Colorado Power Co.	Bullock	Montrose	13	1,800
CO ₂ OUTPUT FROM CEMENT PLANTS				
Martin Marietta	Lyons	Arapahoe		77,000
CO ₂ PRODUCTION FROM CHEMICAL PLANTS				
None				
CO ₂ OUTPUT FROM NATURAL GAS WELLS				
U. S. Department of Interior	Model Dome	Las Animas		600
Texaco	White River	Rio Blanco		252

See footnotes at end of table.

TABLE 2. - Carbon dioxide sources of supply in Colorado--Continued

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM NATURAL GAS WELLS--Cont'd.				
Texaco	Tow Creek	Routt		NA
Gulf Oil		Montezuma		17,500
Kerr McGee	Garmesa	Mesa		NA
Amerado Petroleum	W. Salt Wash	do.		NA
Superior	Douglas Creek	Rio Blanco		NA
Lotus Oil Co.	Haxtun	Prowers		490
Gulf Oil	South Canyon	Garfield		212
Do.		Jackson		13,200
Frontier Refiners	White River	Rio Blanco		387
Belco Petroleum	Lisbon S.E.	San Miguel		NA
Pure Oil	do.	do.		NA

c - coal plants

NA - Not available.

TABLE 3. - Carbon dioxide sources of supply in Kansas

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM ELECTRIC GENERATING PLANTS				
Central Telephone & Utility	Cimarron River	Seward	59	8,000
Do.	Clifton	Washington	78	11,000
Do.	Judson Large	Ford	183	26,000
Do.	Mullergren	Barton	133	19,000
Coffeyville Municipal Light	Coffeyville	Montgomery	73	12,000
Empire Electric Co.	Riverton	Cherokee	140	20,000
City of Kansas City	Kaw	Wyandotte	144	21,000
Do.	Quinclore	do.	397	51,000
Kansas City Power and Light	La Cygne	Linn	824 ^c	692,000
Do.	Gordon Evans	Sedgewick	542	76,000
Do.	Murry Gill	do.	370	52,000
Do.	Neosha	Labette	58 ^c	49,000
Do.	Ripley	Sedgewick	75	7,000
Do.	Abilene	Dickinson	111	16,000
Do.	Hutchinson	Reno	550	77,000
Do.	Lawrence	Douglas	661	91,000
Do.	Tecumseh	Shawnee	476	63,000
McPherson Public Utility	---	McPherson	105	15,000
Sunflower Electric Coop	Garden City	Finney	227	32,000
City of Wellington	---	Sumner	57	8,000
Wheatland Electric Coop	Garden City	Finney	17	2,400
Winfield Light and Power	Winfield	Cowley	56	7,800
CO ₂ OUTPUT FROM CEMENT PLANTS				
Ash Grove	Chanute	Allen		86,000
General	Fredonia	Wilson		35,000
Lone Star	Bonner Springs	Leavenworth		70,000
Monarch	Humbolt	Allen		103,000
Universal Atlas	Independence	Montgomery		37,000

See footnotes at end of table.

TABLE 3. - Carbon dioxide sources of supply in Kansas--Continued

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ PRODUCTION FROM CHEMICAL PLANTS				
Arco	Lawrence	Douglas		3,400
Farmland Industries	Dodge City	Ford		3,400
Midwest Solvent	Atchison	Atchison		2,600
F.M.C.	Lawrence	Douglas		1,000
CO ₂ OUTPUT FROM NATURAL GAS WELLS				
Lee Phillips		Rice		NA

c - coal plants

NA - Not available.

TABLE 4. - Carbon dioxide sources of supply in Louisiana

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM ELECTRIC GENERATING PLANTS				
Alexander Electric & Power	D. G. Hunter	Rapides	176	24,600
Cajun Electric Power Coop	Big Cajun	Pointe Coupee	218	30,500
Do.	New Roads	do.	200	28,000
Southwestern Electric Power	Arsenal Hill	Caddo	161	22,000
Do.	Lieberman	do.	276	38,000
Central Louisiana Electric Co.	Coughlin	Evangeline	477	66,800
Do.	Rodemacher	do.	430	60,000
Do.	Teche	St. Mary	426	60,000
Gulf States Utilities	Louisiana	Baton Rouge	334	46,800
Do.	R. S. Nelson	Calcasieu	899	126,000
Do.	Willow Glen	Iberville	2,064	289,000
Houma Light & Water	Houma	Terre Bonne	94	13,000
Lafayette Utility System	Doc. Bonin	Lafayette	337	47,000
Do.	Rodemacher	do.	51	7,000
Louisiana Power & Light	Little Gypsy	St. Charles	1,253	175,000
Do.	Nine Mile Point	Jefferson	1,827	256,000
Do.	Sterlington	Ouachita	710	99,000
Do.	Waterford	St. Charles	576	80,600
New Orleans Public Service	A. B. Paterson	Orleans	226	33,000
Do.	Market St.	do.	103	14,000
Do.	Michoud	do.	905	127,000
City of Minden	Minden	Webster	26	3,600
Monroe Utility Commission	Monroe	Ouachita	228	31,900
City of Morgan	Morgan City	St. Mary	67	9,400
City of Natchitoches	Natchitoches	Natchitoches	58	8,100
New Orleans Sewer and Water	Power House	Orleans	41	5,700
Opelousas Electric and Water	Opelousas	St. Landry	40	5,600
Ruston Water and Light	Ruston	Lincoln	187	26,000

TABLE 4. - Carbon dioxide sources of supply in Louisiana--Continued

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM CEMENT PLANTS				
Lone Star OKC	New Orleans do.	Orlean do.		35,000 50,000
CO ₂ PRODUCTION FROM CHEMICAL PLANTS				
Allied Chemical	Gersmar	Ascension		6,000
Agrico Chemical	Donaldsville	Assumption		10,000
Shell Oil Refinery	Norco	St. Charles		10,000
Monsanto Chemicals	Luling	do.		14,000
American Cynamid	Fortier	do.		10,000
Monsanto Chemicals	Donaldsville	Assumption		10,000
CO ₂ OUTPUT FROM NATURAL GAS WELLS				
Shell Oil Co. Barnwell Drilling	Vixen do.	Caldwell do.		408 700

TABLE 5. - Carbon dioxide sources of supply in Mississippi

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM ELECTRIC GENERATING PLANTS				
Mississippi Power and Light	Andrews	Washington	750	105,000
Do.	B. Wilson	Warren	1,221	213,000
Do.	Delta	Bolivar	208	29,000
Do.	Natchez	Adams	73	10,000
Do.	R. Brown	Hinds	390	54,000
Mississippi Power Co.	Sweatt	Lauderdale	95	13,000
Do.	Watson	Harrison	696	97,000
Mississippi Electric Power Association	Moselle	Jones	227	32,000
Do.	Paulding	do.	20	2,800
CO ₂ OUTPUT FROM CEMENT PLANTS				
Marquette Valley	Branden	Rankin		47,000
	Redwood	Madison		59,000
CO ₂ PRODUCTION FROM CHEMICAL PLANTS				
Miscoa	Yazoo City	Madison		3,400
CO ₂ OUTPUT FROM NATURAL GAS WELLS				
California Co.	Cranfield	Adams		339
CONOCO	Virlelia	Madison		2,800
Carter Oil		Rankin		6,000
Skelly Oil		do.		NA
Chevron Oil		do.		6,000
AMOCO	Tomosla	Humphreys		NA

NA - Not available.

TABLE 6. - Carbon dioxide sources of supply in Missouri

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
Associated Electric Coop	New Madrid	New Madrid	615 ^c	517,000
Do.	Thomas Hill	Randolph	739 ^c	621,000
Central Electric Power Coop	Chamios	Osage	118	17,000
Columbia Water & Light	Columbia	Boone	80	11,000
Empire Electric	Asbury	Jasper	500 ^c	420,000
Hannibal Public Works	Hannibal	Marion	35	5,000
City of Independence	Blue Valley	Jackson	104	14,600
Do.	Jackson Square	do.	100	14,000
Kansas City Power & Light	Grand Ave.	do.	144 ^c	121,000
Do.	Hawthorn	do.	920 ^c	773,000
Do.	Montrose	Henry	546 ^c	459,000
Do.	Northeast	Jackson	366	51,000
Marshall Municipal Utilities	Marceline	Linn	47	9,900
Arkansas-Missouri Power Co.	Jim Hill	Dunklin	35	4,900
Missouri Public Service Co.	Greenwood	Jackson	281	39,000
Do.	Nevada	Vernon	20	2,800
Do.	Ralph Green	Cass	41	5,700
Do.	Sibley	Jackson	450 ^c	378,000
N.W. Electric Power Coop	Missouri City	Clay	60 ^c	50,000
Do.	Palmyra	do.	22 ^c	18,500
City of Springfield	James River	Greene	270	38,000
St. Joseph Light & Power	Lake Road	Buchanan	217	30,400
Union Electric Co.	Ashley	St. Louis	70	9,800
Do.	Howard Bend	do.	104	11,000
Do.	Labadie	Franklin	2,480 ^c	2,083,000
Do.	Meramec	St. Louis	980 ^c	820,000
Do.	Sioux	St. Charles	1,110 ^c	932,000

CO₂ OUTPUT FROM CEMENT PLANTS

Alpha		St. Louis		50,000
Dundee	Clarksville	Warren		216,000

See footnotes at end of table.

TABLE 6. - Carbon dioxide sources of supply in Missouri--Continued

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM CEMENT PLANTS--Cont'd.				
Lehigh	Union Bridge	St. Charles		81,000
Marquette	Cape Girardeau	Cape Girardeau		52,000
Missouri Portland	St. Louis	St. Louis		129,000
Do.	Kansas City	Jackson		103,000
River	Selma	Lincoln		203,000
Universal Atlas	Hannibal	Clark		109,000

c - coal plants

TABLE 7. - Carbon dioxide sources of supply in New Mexico

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM ELECTRIC GENERATING PLANTS				
Arizona Public Service Co.	Four Corners	San Juan	2,172 ^c	1,820,000
Community Public Service	Lordsburg	Hidalgo	55	7,700
El Paso Electric	Rio Grande	Dona Ana	390	54,600
Lea County Electric Coop	Lovington	Lea	134	18,800
New Mexico Public Service	Maddox	do.	184	25,800
Plains Electric General Coop	Algodoner	Sandoval	97	13,600
Public Service Company of New Mexico	Las Vegas	Bernalillo	20	2,800
Do.	Person	do.	115	16,000
Do.	Prager	do.	33	4,600
Do.	Reeves	do.	175	24,000
Do.	San Juan	San Juan	330 ^c	277,000
Do.	Santa Fe	Santa Fe	13	1,800
Southwestern Public Service	Carlsbad	Chaves	46	6,400
Do.	Cunningham	Lea	275	38,000
Do.	Roswell	Chaves	26	3,600
CO ₂ OUTPUT FROM CEMENT PLANTS				
Ideal Cement Co.	Tijeras	Bernalillo		38,000
CO ₂ PRODUCTION FROM CHEMICAL PLANTS				
SEC	Solano	San Miguel		1,700
CO ₂ OUTPUT FROM NATURAL GAS WELLS				
Witt Ice & Gas Co.	Estancia	Torrance		2,350
Arkansas Fuel & Iron	Wagon Mound	Mora		25,000
NA	Maxwell	Colfax		600

See footnotes at end of table.

TABLE 7. - Carbon dioxide sources of supply in New Mexico--Continued

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM NATURAL GAS WELLS--Continued				
Sierra Grande Oil	Rogers No. 1	Union		6,000
NA	Des Moines	do.		NA
American Producing Co.	Bueyeros	Harding		25,000
Timmons Carbonic	Derline No. 1	do.		3,000
Colo-Mer Gas Co.	Baca No. 2	do.		25,000
Frontier	Fruita	San Juan		NA
Core Oil	San Miquel	Mora		
Robert Thorpe	Model Dome	San Juan		4
Equity Oil	Piceance Creek	do.		NA
Belco	S. E. Lisbon	San Miquel		1,200
Delhi Taylor	McElmo	San Juan		6,600
Citgo	3. Douglas Co.	do.		1,700
Tenneco	McElmo	do.		5,760

c - coal plants

NA - Not available.

TABLE 8. - Carbon dioxide sources of supply in Oklahoma

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM ELECTRIC GENERATING PLANTS				
Public Service Co.	Comanche	Comanche	120	16,800
Do.	Northeastern	Rogers	640	89,600
Do.	Riverside	Tulsa	900	126,000
Do.	Tulsa	do.	416	58,000
Do.	Weleetka	Okfuskee	78	10,900
Grand River Dam Authority	Chouteau	Mayes	50	7,000
Oklahoma Gas & Electric	Arbuckle	Woods	75	10,500
Do.	Byng	Pontotoc	14	1,900
Do.	Enid	Garfield	56	7,800
Do.	Horseshoe Lake	Oklahoma	949	133,000
Do.	Muskogee	Muskogee	208	30,000
Do.	Mustang	Canadian	495	69,300
Do.	Osage	Osage	42	5,900
Do.	Seminole	Seminole	1,668	233,000
Western Farmers Coop	Anadarko	Caddo	152	21,000
Do.	Mooreland	Woodward	333	46,600
CO ₂ OUTPUT FROM CEMENT PLANTS				
OKC	Pryor	Rogers		40,000
Ideal	Ada	Pontotoc		55,000
Martin Marietta	Tulsa	Tulsa		108,000
CO ₂ PRODUCTION FROM CHEMICAL PLANTS				
Ni Pak, Inc.	Pryor	Rogers		2,100
CO ₂ OUTPUT FROM NATURAL GAS WELLS				
Pure Oil Co. Amarillo Natural Gas	Keyes (3 wells) Wildcat	Cimarron Texas		2,000+ 675

TABLE 9. - Carbon dioxide sources of supply in Texas

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM ELECTRIC GENERATING PLANTS				
Austin Electric	Decker	Travis	725	101,000
Department	Holby St.	do.	555	77,700
Do.	Seaholm	do.	120	16,800
Brazos Electric Coop	Belton	Parker	24	3,400
Do.	No. Texas	do.	76	10,600
Do.	Palo Pinto	do.	366	52,000
Do.	R. W. Miller	Palo Pinto	395	55,300
Do.	Weatherford	do.	67	9,400
City of Bryan	Bryan	Brazos	241	33,700
Central Power & Light	B. M. Davis	Nueces	650	94,000
Do.	E. S. Joslin	Calhoun	240	33,700
Do.	J. S. Bates	Hidalgo	184	25,800
Do.	La Palma	Cameron	260	36,400
Do.	Laredo	Webb	178	24,900
Do.	L. C. Hill	Nueces	543	76,000
Do.	Nueces Bay	do.	569	79,700
Do.	Victoria	Victoria	520	72,800
Southwestern Electric	Knox Lee	Gregg	550	77,600
Co.	Lone Star	do.	50	7,000
Do.	Wilbur	Marion	879	123,000
Texas Utility Co.	Abilene	Taylor	28	3,900
Do.	Concho	do.	51	7,000
Do.	Fort Chamtom	do.	352	49,300
Taylor Utility Co.	Lake Pauline	do.	47	6,600
Do.	Oak Creek	do.	33	4,600
Do.	Paint Creek	Haskell	235	32,900
Do.	Rio Pecos	Crockett	137	19,000
Do.	San Angelo	Tom Green	137	19,000
Denton Utility	Denton	Denton	150	21,000
El Paso Electric Co.	Newman	El Paso	470	65,800
City of Garland	C.E. Newman	Dallas	92	12,900
Do.	R. Olinger	Collin	204	28,600
Gulf States Utilities	Lewis Creek	Montgomery	530	74,000
Do.	Neches	Jefferson	425	59,500
Do.	Sabrine	Orange	1,450	203,000

TABLE 9. - Carbon dioxide sources of supply in Texas--Continued

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM ELECTRIC GENERATING PLANTS--Cont'd.				
Houston Light and Power Co.	Cedar Bayou	Chambers	2,250	315,000
Do.	Champion	Harris	22	3,000
Do.	Deepwater	do.	314	44,000
Do.	Gable Street	do.	61	8,500
Do.	Greens Bayou	do.	780	109,000
Do.	Hiram Clarke	do.	252	35,000
Do.	P. H. Robinson	Galveston	2,200	308,000
Do.	Sam Bertron	Harris	824	115,000
Do.	T. H. Wharton	do.	1,091	153,000
Do.	W. A. Parish	Ft. Bend	1,197	168,000
Do.	Webster	Harris	600	84,000
Lower Colorado River Authority	Bastrop	Comal	565	7,900
Do.	Comal	do.	60	8,400
Do.	S. Gideon	do.	620	86,800
Do.	T. Ferguson	do.	335	46,900
Lubbock Power & Light	Holley Ave.	Lubbock	98	13,700
Do.	Plant No. 2	do.	100	14,000
Medina Electric Coop	Peasall	Frio	116	16,000
San Antonio Public Service	Leon Creek	Bexar	236	33,000
Do.	Mission Rd.	do.	146	20,000
Do.	O. W. Somners	do.	780	109,000
Do.	V. H. Braunig	do.	985	138,000
Do.	W. B. Tuttle	do.	441	61,700
So. Texas Electric Coop	San Rayburn	Victoria	52	7,300
Do.	Victoria	do.	44	6,200
Southwestern Public Service	Denver City	Yoachim	80	11,200
Do.	East Plant	do.	74	10,400
Do.	Jones	do.	488	68,300
Do.	Moore	Moore	70	9,800
Do.	Nichols	Potter	450	63,000
Do.	Plant X	Lamb	462	64,700
Do.	Riverview	Hutchison	29	4,000

TABLE 9. - Carbon dioxide sources of supply in Texas--Continued

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM ELECTRIC GENERATING PLANTS--Cont'd.				
Dallas Power & Light		Dallas	223	31,000
Do.	Lake Hubbard	do.	890	125,000
Do.	Mountain			
	Creek	do.	1,028	144,000
Do.	North Lake	do.	700	98,000
Do.	Parkdale	do.	327	45,800
Texas Electric Service	Eagle			
	Mountain	Tarrant	665	93,000
Do.	Handley	do.	1,375	193,000
Do.	Graham	Young	610	85,000
Do.	Morgan Creek	Mitchell	833	117,000
Do.	No. Main	Tarrant	121	16,900
Do.	Permian Basin	Ward	720	101,000
Do.	Wichita Falls	Wichita	26	3,600
Texas Power & Light	Big Brown	Freestone	1,150	161,000
Do.	Collin	Collin	153	21,400
Do.	DeCordova	Hood	775	108,000
Do.	Lake Creek	McLennon	317	44,000
Do.	Monticello	do.	1,150	161,000
Do.	River Creek	Red River	110	15,000
Do.	Stryker Creek	Cherokee	675	94,500
Do.	Tradinghouse			
	Creek	McLennon	1,440	202,000
Do.	Trinidad	Henderson	325	46,000
Do.	Valley	Fannin	1,110	150,000
CO ₂ OUTPUT FROM CEMENT PLANTS				
Alpha	Orange	Orange		29,000
Capitol Aggregates	San Antonio	Bexar		64,000
Centex	Corpus Christi	Nueces		48,000
General	Ft. Worth	Tarrant		123,000
Do.	Dallas	Dallas		76,000
Do.	Houston	Harris		94,000
Gifford Hill	Midlothian	Dallas		76,000
Gulf Coast	Houston	Harris		45,000
Ideal	do.	do.		61,000

TABLE 9. - Carbon dioxide sources of supply in Texas--Continued

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM CEMENT PLANTS--Cont'd.				
Kaiser	San Antonio	Bexar		85,000
Lone Star	Houston	Harris		46,000
Do.	Maryneal	do.		46,000
San Antonio Port	Cementville	Bexar		52,000
Southwestern	Odessa	Eaton		22,000
Do.	Amarillo	Potter		20,000
Texas Industries	Midlothian	Dallas		99,000
Universal Atlas	Waco	McLennon		39,000
CO ₂ PRODUCTION FROM CHEMICAL PLANTS				
Tenneco Chemicals	Pasadena	Harris		4,250
Southwest Cyrogenics	Deer Park	do.		1,800
Diamond Shamrock	Dumas	Moore		1,000
Southwest Cyrogenics	Victoria	Victoria		4,100
CO ₂ OUTPUT FROM NATURAL GAS WELLS				
Humble Oil	Jourdanton	Otascosa		35
Texas Co.	Petrolia	Clay		276
Amerada	Seminole	Gaines		NA
ARCO	do.	do.		NA
California Co.	Glasscock	Glasscock		NA
Shell Oil	Yates	Pecos		NA
Canadian River Co.	Panhandle	Potter		NA
Group No. 1 Oil	Big Lake	Reagan		NA
Skelly Oil	Skelly-Grayson	do.		NA
Gulf Oil	McCamey	Upton		NA
Conoco	O'Brien	Winkler		NA
Tidewater	New Hope	Franklin		1,100
Sun Oil	John Creek	Hutchinson		179
Shell Oil	do.	Potter		NA
Mobil	Brown Bassett	Terrell		NA
Do.	L. M. Morrison	Bal Verde		NA
Sun Oil		Crockett		4,700
Texaco		do.		2,000

See footnote at end of table.

TABLE 9. - Carbon dioxide sources of supply in Texas--Continued

Company	Unit	County	Capacity, MW	CO ₂ Output, Mcf/d
CO ₂ OUTPUT FROM NATURAL GAS WELLS--Cont'd.				
Stanolind Oil and Gas	Stuart City	La Salle		237
Humble	San Miquel	McMullen		90
Phillips Oil	Puckett	Pecos		NA
Gulf Oil	Toyah	Reeves		4,000
Anton Oil	Winters	Runnels		280
McElroy Ranch Co.		Stephans		70
General American	Wasson	Yoachim		NA
Shell Oil Co.	Pawnee	Bee		502
Paul Teas	Quinian	Hunt		1,500
CONOCO Oil Co.	Brown Bassett	Terrell		15,300
Mono Corp.	Wildcat	Medina		NA
Sinclair	Brown Bassett	Terrell		4,990
Shell & Huber	Rosita Wash	Duval		2,000
Pan American	Miller	Crockett		1,350
Tenneco	Cheapside	Gonzales		1,000
Industrial Gas	Yoakum	DeWitt		260
Forest Oil Co.	Linterna	Pecos		2,800
Texaco	Dunbar	Rains		2,200
Sunray DX	Wolf Creek	Pitkin		240
Gulf Oil	Buffalo Wallow	Hemphill		34,000
Union Oil	do.	do.		5,800
Couch Oil	Wildcat	Hopkins		8,500
J. L. Hamon	Box Church	Limestone		1,500
Humble Oil	Oates NE	Pecos		3,400
Chevron	Grey Ranch W	do.		87,800
Superior Oil	Mt. Vida	Reeves		35,000

NA - Not available.

LEGEND

- Flue gas CO₂ in MMcfd, gas electric plants
- △ Flue gas CO₂ in MMcfd, coal electric plants
- △ Flue gas CO₂ in MMcfd, cement plants
- Liquid CO₂ in MMcfd, chemical plants
- Oilfields

FIGURE 1. - Oilfields and carbon dioxide sources in Arkansas.

LEGEND

- Flue gas CO₂ in MMcfd, gas electric plants
- △ Flue gas CO₂ in MMcfd, coal electric plants
- △ Flue gas CO₂ in MMcfd, cement plants
- Liquid CO₂ in MMcfd, chemical plants
- Oilfields

FIGURE 2. - Oilfields and carbon dioxide sources in Colorado.

LEGEND

- Flue gas CO₂ in MMcfd, gas electric plants
- △ Flue gas CO₂ in MMcfd, coal electric plants
- △ Flue gas CO₂ in MMcfd, cement plants
- Liquid CO₂ in MMcfd, chemical plants
- Oilfields

FIGURE 3. - Oilfields and carbon dioxide sources in Kansas.

LEGEND

- Flue gas CO₂ in MMcfd, gas electric plants
- △ Flue gas CO₂ in MMcfd, coal electric plants
- △ Flue gas CO₂ in MMcfd, cement plants
- Liquid CO₂ in MMcfd, chemical plants
- Oilfields

FIGURE 4. - Oilfields and carbon dioxide sources in Louisiana.

LEGEND

- Flue gas CO₂ in MMcfd, gas electric plants
- ∟ Flue gas CO₂ in MMcfd, coal electric plants
- △ Flue gas CO₂ in MMcfd, cement plants
- Liquid CO₂ in MMcfd, chemical plants
- Oilfields

FIGURE 5. - Oilfields and carbon dioxide sources in Mississippi.

FIGURE 6. - Oilfields and carbon dioxide sources in Missouri.

LEGEND

- Flue gas CO₂ in MMcfd, gas electric plants
- ∠ Flue gas CO₂ in MMcfd, coal electric plants
- △ Flue gas CO₂ in MMcfd, cement plants
- Liquid CO₂ in MMcfd, chemical plants
- Oilfields

FIGURE 7. - Oilfields and carbon dioxide sources in New Mexico.

LEGEND

- Flue gas CO₂ in MMcfd, gas electric plants
- △ Flue gas CO₂ in MMcfd, coal electric plants
- △ Flue gas CO₂ in MMcfd, cement plants
- Liquid CO₂ in MMcfd, chemical plants
- Oilfields

FIGURE 8. - Oilfields and carbon dioxide sources in Oklahoma.

LEGEND

- Flue gas CO₂ in MMcfd, gas electric plants
- △ Flue gas CO₂ in MMcfd, coal electric plants
- △ Flue gas CO₂ in MMcfd, cement plants
- Liquid CO₂ in MMcfd, chemical plants
- Oilfields

FIGURE 9. - Oilfields and carbon dioxide sources in Texas.