

U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves

1996 Annual Report

December 1997

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Preface

The *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1996 Annual Report* is the 20th prepared by the Energy Information Administration (EIA) to fulfill its responsibility to gather and report annual proved reserves estimates. The EIA annual reserves report series is the only source of comprehensive domestic proved reserves estimates. This publication is used by the Congress, Federal and State agencies, industry, and other interested parties to obtain accurate estimates of the Nation's proved reserves of crude oil, natural gas, and natural gas liquids. These data are essential to the development, implementation, and evaluation of energy policy and legislation.

This report presents estimates of proved reserves of crude oil, natural gas, and natural gas liquids as of December 31, 1996, as well as production volumes for the United States and selected States and State subdivisions for the year 1996. Estimates are presented for the following four categories of natural gas: total gas (wet after lease separation), nonassociated gas and associated-dissolved gas (which are the two major types of wet natural gas), and total dry gas (wet gas adjusted for the removal of liquids at natural gas processing plants). In addition, reserve estimates for two types of natural gas liquids, lease condensate and natural gas plant liquids, are presented. The estimates are based upon data obtained from two annual EIA surveys: Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves" and Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production." Also included is information on indicated additional crude oil reserves and crude oil, natural gas, and lease condensate reserves in nonproducing reservoirs. A discussion of notable oil and gas exploration and development activities during 1996 is provided.

The appendices contain data by operator production size class for crude oil and natural gas reserves and production; the top 100 U.S. fields ranked within an oil or gas proved reserves group for 1996; report Table 1 converted to metric units; historical State

data; a summary of survey operations; a discussion of statistical considerations; methods used to develop the estimates provided in this report; maps of selected State subdivisions; and examples of the survey forms. A glossary of the terms used in this report and in survey Forms EIA-23 and EIA-64A is provided to assist readers in more fully understanding the data.

This annual reserves report was prepared by the Reserves and Production Division (located in Dallas, Texas), Office of Oil and Gas, Energy Information Administration. General information regarding preparation of the report may be obtained from Kenneth A. Vagts, Director, Office of Oil and Gas and John H. Wood, Director, Reserves and Production Division (214-720-6160).

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This is Paul Chapman's 14th and last reserves report as he prepares to retire at the end of the year. His significant contributions to the reserves program will be missed by report users and EIA staff.

Other EIA Oil and Gas Publications

Other reports published by the Energy Information Administration (EIA) offer additional information and analysis related to domestic oil and gas supply. They may be obtained from the Government Printing Office in the same manner as this oil and gas reserves report.

Natural Gas Annual 1996, DOE/EIA-0131(96), September 1997

Petroleum Supply Annual 1996, DOE/EIA-0340(96), June 1997

These annual reports provide comprehensive statistics on supply, disposition, and prices of natural gas and petroleum in the United States.

Natural Gas 1996: Issues and Trends, DOE/EIA-0560(96), December 1996

Focuses on the increasing choices and challenges in the natural gas industry, as regulatory requirements are increasingly removed from the sale and transport of natural gas.

Petroleum 1996: Issues and Trends, DOE/EIA-0615, September 1996

Presents analyses of a broad spectrum of petroleum markets, ranging from the drilling rig in the oil field to the pump at the local gasoline station.

EIA Electronic Documents

Computer users can access and download these electronic-format reports and many other EIA Data and Analysis reports from EIA's Home Page on the World Wide Web. Point your web browser to <http://www.eia.doe.gov>. In the future, many products will only be available in electronic form.

Natural Gas Productive Capacity for the Lower 48 States 1986 Through 1998

Petroleum Marketing Annual 1996

Oil and Gas Field Code Master List 1996

Data archive of historical reserves estimates for U.S. Crude Oil, Natural Gas and Natural Gas Liquids

Historical Natural Gas Annual - 1930 through 1996

Cost and Indices for Domestic Oil and Gas Field Equipment and Production Operations 1993-1996

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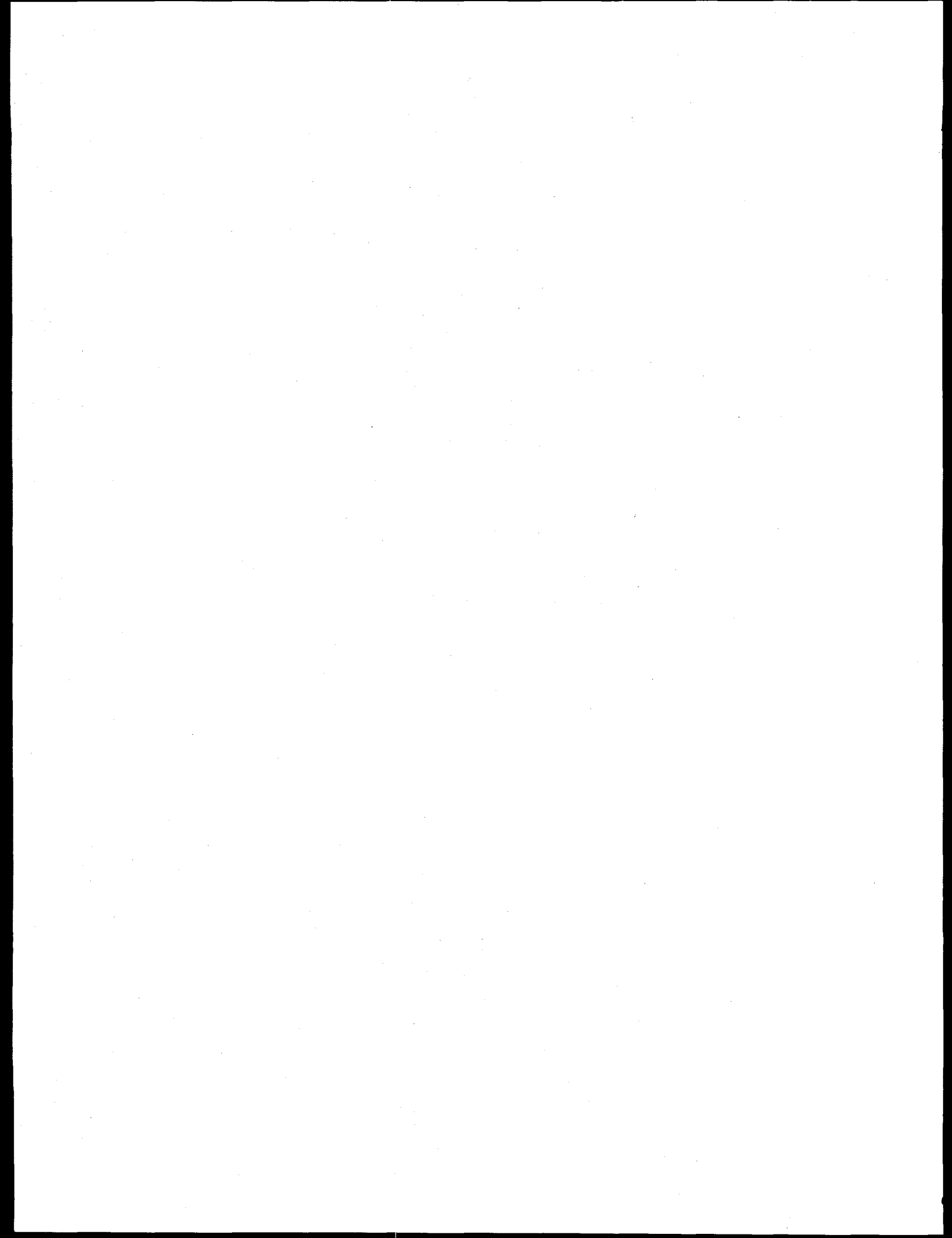
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Executive Summary

U.S. proved reserves of natural gas increased for the third year in a row, the first sustained uptrend since 1967. While gas reserves were up 1 percent, crude oil reserves declined 1 percent in 1996. This was only half the average decline in the last decade, but it extends the oil proved reserves down trend to 9 consecutive years. Large oil and gas discoveries in the Federal offshore—several in deep water—continued to play a major role in increasing gas reserves and preventing a larger decline in oil reserves. Successful oil and gas well completions were up as were oil and gas prices.

As of December 31, proved reserves were:

Dry Natural Gas (billion cubic feet)	
1995	165,146
1996	166,474
Increase	+0.8%
Crude Oil (million barrels)	
1995	22,351
1996	22,017
Decrease	-1.5%
Natural Gas Liquids (million barrels)	
1995	7,399
1996	7,823
Increase	+5.7%

Proved reserves are those quantities that geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. Petroleum engineering and geological judgment are required in estimating proved reserves; therefore, the results are not precise measurements. This report of 1996 U.S. proved reserves of crude oil, natural gas, and natural gas liquids is the 20th in the annual series prepared by the Energy Information Administration.

Natural Gas

Gas reserves rose because reserve additions replaced 107 percent of gas production in 1996. U.S. natural gas reserves began increasing after World War II, peaking in 1967. A rapid decline ensued, interrupted for one year, when the American Petroleum Institute

booked 26 trillion cubic feet of proved reserves for the Prudhoe Bay Field on the Alaskan North Slope. Most of this gas was removed from the proved category in 1988 because lack of a market made it uneconomic. The decline flattened out in 1977, but persisted through 1993 at an average of 1 percent per year. The current 3-year uptrend began in 1994.

For 1996, *revisions and adjustments* to reserves in existing fields were down slightly. *Total discoveries* were up from 1995, at almost the same level as the high discovery year of 1990.

Improved exploration and deepwater production technologies enhanced the ability to discover and develop offshore fields. There were significant events in the Gulf of Mexico, especially in deep waters. Shell's Mars Project in Mississippi Canyon Block 807 Field came on line, establishing a world water-depth record of 2,940 feet for a permanent drilling and production platform.

Oryx's Neptune spar (a floating large-diameter vertical cylinder supporting a deck and tethered to the ocean floor) is an example of the use of state-of-the-art engineering and technology that lowers field development cost in deep water. The Neptune spar allows the exploitation of fields in up to 10,000 feet of water and can be moved to a new site after developed reservoirs are depleted.

Coalbed methane reserves continued to grow, accounting for over 6 percent of 1996 natural gas reserves. Coalbed methane production increased to a trillion cubic feet, over 5 percent of U.S. dry gas production.

U.S. *total discoveries* of dry gas reserves were 12,318 billion cubic feet in 1996, up 12 percent from 1995. Texas and the Gulf of Mexico Federal Offshore accounted for over two-thirds of them. *Total discoveries*, which equaled 65 percent of 1996 gas production, are those reserves attributable to field extensions, new field discoveries, and new reservoir discoveries in old fields. They result from drilling exploratory wells.

- *New field discoveries* were 1,451 billion cubic feet, down from 1995, but 10 percent higher than the prior 10-year average.

- Field *extensions* were 7,757 billion cubic feet, up 13 percent from 1995.
- New *reservoir discoveries in old fields* were 3,110 billion cubic feet, up 27 percent from 1995.

The net volume of *revisions and adjustments* to reserves played a large role in increasing U.S. natural gas proved reserves. It amounted to 7,871 billion cubic feet in 1996. Texas, where proved gas reserves increased in 1996, had the largest increase in *revisions and adjustments*.

Other 1996 natural gas events of note:

- Exploratory gas well completions increased again, reaching 1,011 in 1996.
- *Total discoveries* per exploratory gas well were down in 1996, but roughly twice that of the early 1980s.
- Natural gas prices at the wellhead increased rapidly during the last half of the year, yielding an annual average of \$2.25 per thousand cubic feet, a 45 percent increase.

Crude Oil

Crude oil reserve additions replaced 85 percent of 1996 oil production.

Total discoveries of crude oil were 927 million barrels in 1996, nearly as high as last year and over 40 percent higher than the prior 10-year average for the United States. The Gulf of Mexico Federal Offshore accounted for 34 percent, Alaska for 21 percent, and Texas for 18 percent.

- New *reservoir discoveries in old fields* were 141 million barrels, down sharply from 1995 but still higher than the prior 10-year average.
- New *field discoveries* were 243 million barrels, more than twice those of 1995 and the prior 10-year average. Alaska had 53 percent and the Gulf of Mexico Federal Offshore 39 percent of the *new field discoveries*.
- Field *extensions* added 543 million barrels of proved oil reserves in 1996, more than in 1995.

Revisions and adjustments were 912 million barrels in 1996. They still account for half of total oil reserve additions. Texas and California, States with large oil reserves and large enhanced oil recovery projects,

had over half of *revisions and adjustments*. Alaska's reserves declined in 1996 despite substantial *new field discoveries* because there were few *revisions and adjustments*.

Other 1996 crude oil events of note:

- The annual average domestic first purchase price for crude oil increased to \$18.46 per barrel in 1996, up 24 percent.
- Oil well completions increased to 8,568.

Indicated additional reserves of crude oil were 2,876 million barrels in 1996, an 8-percent increase over 1995. These are crude oil volumes that may become economically recoverable from known reservoirs through the application of improved recovery techniques using current technology. The presence of large *indicated additional reserves* in the Alaskan North Slope, California, Texas, and Louisiana implies that significant upward revisions to crude oil proved reserves can continue to occur in the future.

Improved technology has been an important factor in the increase of oil production and proved reserves in Alaska's West Sak and Kuparuk River fields. It has now made technically feasible projects economically viable.

In the lower 48 States, smaller operators have been successful in their acquisition of properties in existing fields from larger operators. By expanding their drilling programs they have added proved reserves and production to the nation's inventory. In addition, there was an unexpected extension of the Austin Chalk formation, as an oil play, into north Louisiana.

Natural Gas Liquids

U.S. natural gas liquids proved reserves increased 6 percent to 7,823 million barrels in 1996. Natural gas liquids reserves are the sum of natural gas plant liquids and lease condensate reserves.

Total proved reserves of liquid hydrocarbons (crude oil plus natural gas liquids) were 29,840 million barrels in 1996, a slight increase over the 1995 level. Natural gas liquids were about a quarter of total proved reserves of liquid hydrocarbon in 1996.

Methodology Changes

Using the extensive statistical database of reserves information it maintains, EIA has developed a new method of analyzing reserves survey information. Utilizing data submitted by large operators, the total reserves for specific geographic areas are estimated. This new method provides an estimate of National oil and gas reserves that meets EIA's stringent data quality standards while surveying 84 percent fewer operators than in previous years and lowering survey costs. To maintain database quality, this new method will only be applied every other year.

Data

These estimates are based upon analysis of data from Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," filed by 568 operators of oil and gas wells, and Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production," filed by operators of 686 active natural gas processing plants. The U.S. proved reserves estimates for crude oil and natural gas are associated with expected errors of less than 1 percent.

1. Introduction

Background

The principal focus of this report is to provide accurate annual estimates of U.S. proved reserves of crude oil, natural gas, and natural gas liquids. These estimates are essential to the development, implementation, and evaluation of national energy policy and legislation. In the past, the Government and the public relied upon industry estimates of proved reserves. However, the industry ceased publication of reserve estimates after its 1979 report.

In response to a recognized need for credible annual proved reserves estimates, Congress, in 1977, required the Department of Energy to prepare such estimates. To meet this requirement, the Energy Information Administration (EIA) developed a program that established a unified, verifiable, comprehensive, and continuing annual statistical series for proved reserves of crude oil and natural gas. It was expanded to include proved reserves of natural gas liquids for the 1979 and subsequent reports.

Survey Overview

EIA defines proved reserves, the major topic of this report, as those volumes of oil and gas that geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. There are other categories of reserves, but by definition they are more speculative and less precise than proved reserves. Readers who are unfamiliar with the distinctions between types of reserves or with how reserves fit in the description of overall oil and gas resources should see Appendix G.

While the primary topic of this report is proved reserves, information is also presented on indicated additional crude oil reserves. Indicated additional crude oil reserves are not included in proved reserves because of their uncertain economic recoverability. When economic recoverability is demonstrated, these volumes will be reclassified and transferred to the proved reserves category as positive revisions.

This report provides proved reserves estimates for calendar year 1996. It is based on data filed by large operators of oil and gas wells on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," and by operators of all natural gas processing plants on Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production." The U.S. crude oil and natural gas proved reserves estimates are associated with expected errors of less than 1 percent.

Form EIA-23

On Form EIA-23, an operator is defined as an organization or person responsible for the management and day-to-day operation of oil and/or gas wells. This definition eliminates responses from royalty owners, working interest owners (unless they are also operators), and others not directly responsible for oil and gas production operations.

Operator size categories are based upon their annual production as indicated in various Federal, State, and commercial records. Large operators are those that produced at least 1.5 million barrels of crude oil or 15 billion cubic feet of natural gas, or both, during the report year. Intermediate operators produced less than large operators, but more than 400,000 barrels of crude oil or 2 billion cubic feet of natural gas, or both. Small operators are those that produced less than intermediate operators. All data are reported on a total operated basis, encompassing all proved reserves and production associated with wells operated by an individual operator. This concept is also called the "gross operated" or "8/8ths" basis.

Large operators and most intermediate size operators report reserves balance data on Form EIA-23 to show how and why reserves components changed during the year on a field-by-field basis. Intermediate size operators who do not keep reserves data were not asked to provide estimates of reserves at the beginning of the year or annual changes to proved reserves by component of change; i.e., revisions, extensions, and new discoveries. These volumes were estimated by applying an algebraic allocation scheme that preserved the relative relationships between these items within each State or State subdivision, as reported by large and intermediate operators.

The published reserve estimates include an additional term, adjustments, calculated by the EIA, that preserves an exact annual reserves balance of the form:

Published Proved Reserves at End of Previous Report Year

- + Adjustments
- + Revision Increases
- Revision Decreases
- + Extensions
- + New Field Discoveries
- + New Reservoir Discoveries in Old Fields
- Report Year Production
- = Published Proved Reserves at End of Report Year

Adjustments are the annual changes in the published reserve estimates that cannot be attributed to the estimates for other reserve change categories. They result from the survey and statistical estimation methods employed. For example, variations caused by changes in the operator frame, different random samples, changes in reserve estimates following ownership changes, incorrectly reported data, or imputations for missing or unreported reserve changes can contribute to adjustments.

Form EIA-64A

Form EIA-64A data were first collected for the 1979 survey year in order to develop estimates for total natural gas liquids reserves. Data on liquids recovered from natural gas, as reported by natural gas processing plant operators, are combined with lease condensate data collected on Form EIA-23 to provide the total natural gas liquids reserves estimates.

Data Collection Operations

An intensive effort is made each year to maintain an accurate and complete survey frame consisting of operators of oil and gas wells and of natural gas

processing plants. The Form EIA-23 operator frame contained 23,410 probable active operators and the Form EIA-64A plant frame contained 710 probable active natural gas processing plants in the United States when the 1996 surveys were initiated. As usual, additional operators were added to the survey as it progressed, and many operators initially in the sample frame were found to be inactive in 1996.

For the report year 1996, EIA mailed 665 EIA-23 forms to all known large and intermediate size oil and gas well operators that were believed to be active during 1996. Of these, 59 were found to be nonoperators that did not have successor operators in 1996. Data were received from 616 operators, an overall response rate of 100 percent of the active operators in the Form EIA-23 survey. EIA mailed 725 EIA-64A forms to natural gas processing plant operators. More than one form is received for a plant that has more than one operator during the year. Forms were received from 100 percent of the operators of the 686 unique active natural gas processing plants in the Form EIA-64A survey.

National estimates of the production volumes for crude oil, lease condensate, natural gas liquids, and dry natural gas based on Form EIA-23 and Form EIA-64A were compared with corresponding official production volumes published by EIA, which are obtained from non-survey based State sources. For report year 1996, the Form EIA-23 National production estimates were 1.3 percent lower than the comparable *Petroleum Supply Annual 1996* volumes for crude oil and lease condensate combined, and were 0.4 percent higher than the comparable *Natural Gas Annual 1996* volume for 1996 dry natural gas. For report year 1996, the Form EIA-64A National estimates were 2.9 percent higher than the *Petroleum Supply Annual 1996* volume for natural gas plant liquids production.

2. Overview

National Summary

The United States had the following proved reserves as of December 31, 1996:

- Crude Oil — 22,017 million barrels
- Dry Natural Gas — 166,474 billion cubic feet
- Natural Gas Liquids — 7,823 million barrels.

This Overview section summarizes the 1996 proved reserves balances of crude oil, dry natural gas, and natural gas liquids on a National level, and provides historical comparisons between 1996 and years past.

Table 1 lists the estimated annual reserve balances since 1986. In 1996, the proved reserves of dry natural gas increased by 1 percent over the 1995 level. This is third consecutive year that gas reserves have increased. Crude oil proved reserves declined in 1996—down less than 2 percent from 1995's level, but the ninth consecutive year of decline.

Crude Oil

Proved reserves of crude oil decreased by 334 million barrels in 1996. The largest decline was in Alaska, where reserves decreased 306 million barrels. The largest increase occurred in the Federal Offshore areas in the Gulf of Mexico, where 49 million barrels of crude oil proved reserves were added to the National total. Figure 1 shows the crude oil proved reserves levels by major region and Figure 2 shows the components of reserves changes from 1986 through 1996.

As shown in Figure 2, total reserve additions (the positive side of the scale) decreased compared to 1995's level but remained higher than 1994's level. Production of crude oil declined slightly for the sixth year in a row. However, production still exceeded the amount of reserve additions, so U.S. crude oil proved reserves declined slightly in 1996. Operators replaced 85 percent of their 1996 oil production with reserve additions.

Total discoveries are those reserves attributable to field extensions, new field discoveries, and new reservoir discoveries in old fields. There were 927 million barrels of total discoveries of crude oil proved reserves in 1996. This is slightly less than the discoveries in 1995.

Extensions added 543 million barrels of proved reserves. This is 9 percent more than in 1995 and 29 percent more than the average extensions in the prior 10 years (422 million barrels).

New field discoveries were 243 million barrels, more than double the 1995 level. This is more than twice the average volume discovered in the prior 10 years (103 million barrels).

New reservoir discoveries in old fields added 141 million barrels of proved reserves. This is less than half of 1995's decade-high total of 343 million barrels, but is 9 percent higher than the prior 10-year average for the United States (129 million barrels).

Revisions and adjustments added 912 million barrels of proved reserves. This is 79 percent of 1995's volume and 71 percent of the average volume of the prior 10 years (1,293 million barrels).

Crude oil reserves have been primarily sustained by continuing upward revisions and adjustments to the reserves of older fields. During the 1986–1995 decade, revisions and adjustments accounted for an average of 66 percent of reserve additions. In 1996, revisions and adjustments accounted for 50 percent of reserve additions.

Production deducted an estimated 2,173 million barrels of proved reserves from the National total. Production was down almost 2 percent from 1995's level (2,213 million barrels) and at 85 percent of the prior 10-year average (2,553 million barrels).

The overall 1996 United States reduction in crude oil proved reserves was 334 million barrels. In the 10 years prior to 1996, the United States had an average annual reduction of 607 million barrels of crude oil proved reserves. The 1996 decline is only 55 percent of that average.

Natural Gas

U.S. proved reserves of dry natural gas increased for the third year in a row in 1996—up 1 percent from 1995's level to a total of 166,474 billion cubic feet. Dry natural gas reserves decreased by 203 billion cubic feet in Alaska, but increased for the lower 48 States by 1,531

Table 1. U.S. Proved Reserves of Crude Oil, Dry Natural Gas, and Natural Gas Liquids, 1986-1996

Year	Adjustments (1)	Revision Increases (2)	Revision Decreases (3)	Revisions ^a and Adjustments (4)	Extensions (5)	New Field Discoveries (6)	New Reservoir Discoveries in Old Fields (7)	Total ^b Discoveries (8)	Production (9)	Proved ^c Reserves 12/31 (10)	Change from Prior Year (11)
Crude Oil (million barrels of 42 U.S. gallons)											
1986	57	2,724	1,869	912	405	48	81	534	2,973	26,889	-1,527
1987	233	3,687	1,371	2,549	484	96	111	691	2,873	27,256	+367
1988	364	2,684	1,221	1,827	355	71	127	553	2,811	26,825	-431
1989	213	2,698	1,365	1,546	514	112	90	716	2,586	26,501	-324
1990	86	2,483	1,000	1,569	456	98	135	689	2,505	26,254	-247
1991	163	2,097	1,874	386	365	97	92	554	2,512	24,682	-1,572
1992	290	1,804	1,069	1,025	391	8	85	484	2,446	23,745	-937
1993	271	2,011	1,516	766	356	319	110	785	2,339	22,957	-788
1994	189	2,364	1,357	1,196	397	64	111	572	2,268	22,457	-500
1995	122	1,823	795	1,150	500	114	343	957	2,213	22,351	-106
1996	175	1,723	986	912	543	243	141	927	2,173	22,017	-334
Dry Natural Gas (billion cubic feet, 14.73 psia, 60° Fahrenheit)											
1986	1,320	21,269	17,697	4,892	6,065	1,099	1,771	8,935	15,610	191,586	-1,783
1987	1,268	17,527	14,231	4,564	4,587	1,089	1,499	7,175	16,114	187,211	-4,375
1988	2,193	23,367	^d 38,427	-12,867	6,803	1,638	1,909	10,350	16,670	^d 168,024	-19,187
1989	3,013	26,673	23,643	6,043	6,339	1,450	2,243	10,032	16,983	167,116	-908
1990	1,557	18,981	13,443	7,095	7,952	2,004	2,412	12,368	17,233	169,346	+2,230
1991	2,960	19,890	15,474	7,376	5,090	848	1,604	7,542	17,202	167,062	-2,284
1992	2,235	18,055	11,962	8,328	4,675	649	1,724	7,048	17,423	165,015	-2,047
1993	972	17,597	12,248	6,321	6,103	899	1,866	8,868	17,789	162,415	-2,600
1994	1,945	21,365	15,881	7,429	6,941	1,894	3,480	12,315	18,322	163,837	+1,422
1995	580	20,465	12,731	8,314	6,843	1,666	2,452	10,961	17,966	165,146	+1,309
1996	3,785	17,132	13,046	7,871	7,757	1,451	3,110	12,318	18,861	166,474	+1,328
Natural Gas Liquids (million barrels of 42 U.S. gallons)											
1986	367	1,030	807	590	263	34	72	369	738	8,165	+221
1987	231	847	656	422	213	39	55	307	747	8,147	-18
1988	11	1,168	715	464	268	41	72	381	754	8,238	+91
1989	-277	1,143	1,020	-154	259	83	74	416	731	7,769	-469
1990	-83	827	606	138	299	39	73	411	732	7,586	-183
1991	233	825	695	363	189	25	55	269	754	7,464	-122
1992	225	806	545	486	190	20	64	274	773	7,451	-13
1993	102	764	640	226	245	24	64	333	788	7,222	-229
1994	43	873	676	240	314	54	131	499	791	7,170	-52
1995	192	968	691	469	432	52	67	551	791	7,399	+229
1996	474	844	669	649	451	65	109	625	850	7,823	+424

^aRevisions and adjustments = Col. 1 + Col. 2 - Col. 3.

^bTotal discoveries = Col. 5 + Col. 6 + Col. 7.

^cProved reserves = Col. 10 from prior year + Col. 4 + Col. 8 - Col. 9.

^dAn unusually large revision decrease to North Slope dry natural gas reserves was made in 1988. It recognizes some 24.6 trillion cubic feet of downward revisions reported during prior years by operators because of economic and market conditions. The Energy Information Administration (EIA) in previous years carried these reserves in the proved category.

Notes: Old means discovered in a prior year. New means discovered during the report year. The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves" and Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production." They may differ from the official EIA production data for crude oil, natural gas, and natural gas liquids for 1996 contained in the *Petroleum Supply Annual 1996*, DOE/EIA-0340(95) and the *Natural Gas Annual 1996*, DOE/EIA-0131(96).

Sources: *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves*, 1986 through 1996 annual reports, DOE/EIA-0216.(1-10)

Figure 1. U.S. Crude Oil Proved Reserves, 1986-1996

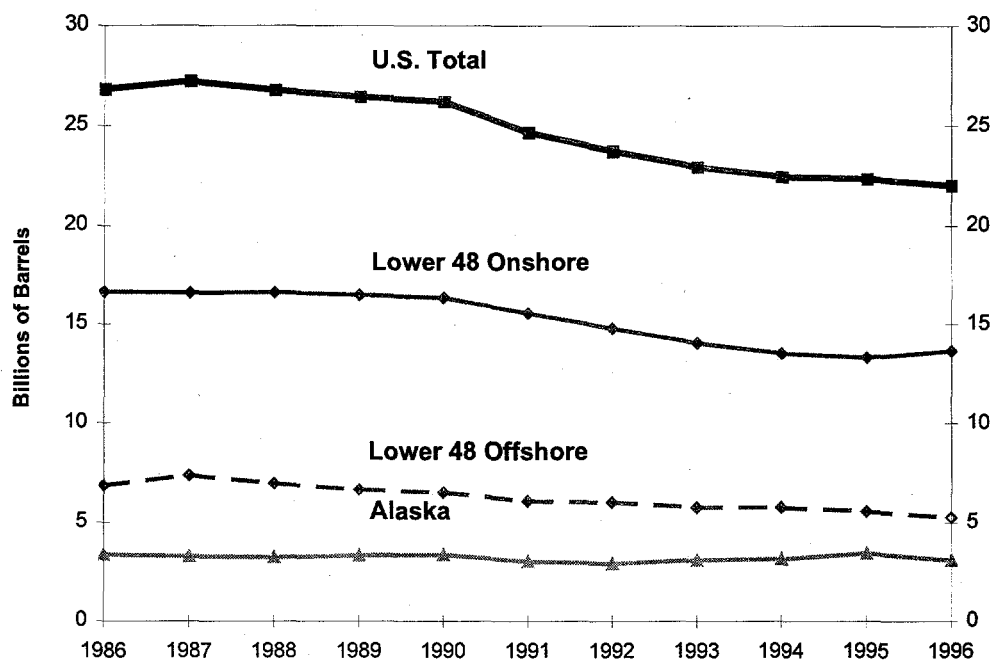
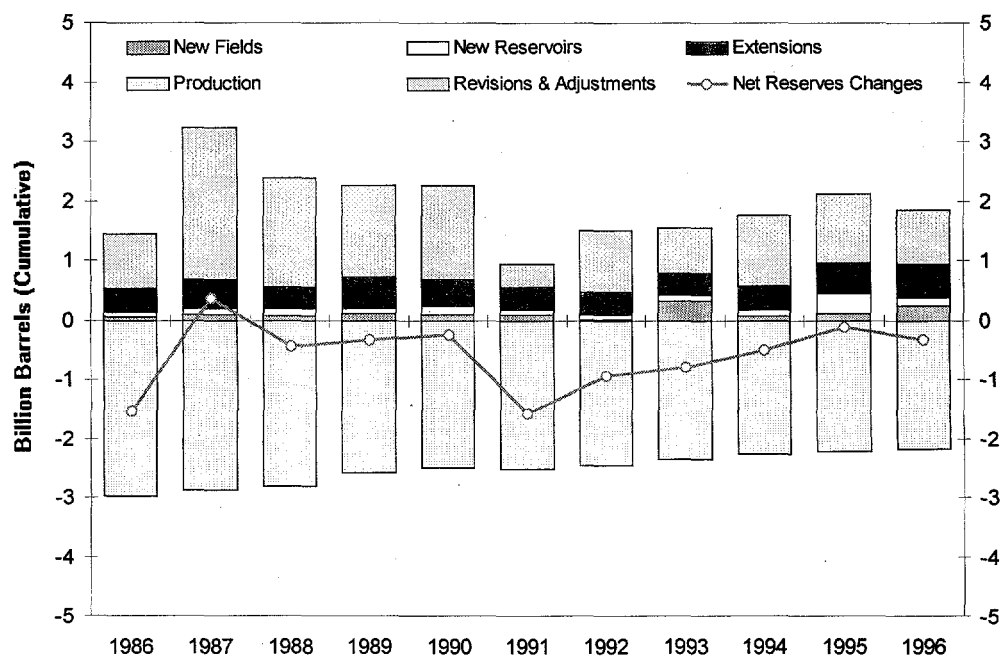


Figure 2. Components of Reserves Changes for Crude Oil, 1986-1996



Source: U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 1986-1995 annual reports, DOE/EIA-0216.{1-10}

billion cubic feet. **Figure 3** shows the dry natural gas proved reserves levels by major region and **Figure 4** shows the components of reserves changes from 1986 through 1996.

Operators were able to replace all of 1996's dry gas production (estimated to be about 18,861 billion cubic feet) with reserve additions, and then add 1,328 billion cubic feet of dry natural gas to the proved reserves total.

For 1996, U.S. *total discoveries* of dry gas reserves were 12,318 billion cubic feet, up 12 percent from 1995. *Total discoveries* were 61 percent of all dry gas reserve additions in 1996, while *revisions and adjustments* provided the rest. Unlike crude oil, *total discoveries* of dry natural gas proved reserves usually exceed the *revisions and adjustments*—in the past decade, *total discoveries* have accounted for an average of 67 percent of all dry gas reserve additions.

Extensions added 7,757 billion cubic feet of proved reserves. This is 13 percent more than 1995's *extensions* and 126 percent of the average of *extensions* over the prior 10 years (6,140 billion cubic feet).

New field discoveries added 1,451 billion cubic feet of proved reserves. This is 13 percent less than what was discovered in 1995, but 10 percent higher than the average volume discovered in the prior 10 years (1,324 billion cubic feet).

New reservoir discoveries in old fields added 3,110 billion cubic feet of proved reserves. This is 27 percent more than the volume discovered in 1995, and 48 percent higher than the prior 10-year average (2,096 billion cubic feet).

Revisions and Adjustments added 7,871 billion cubic feet of proved reserves. This is 95 percent of 1995's revisions and adjustments.

Production deducted an estimated 18,861 billion cubic feet of proved reserves from the National total. Gas production increased 5 percent compared to 1995—to the highest level recorded since 1979.

Coalbed methane gas production and reserves are included in the 1996 totals. However, EIA separately tracks these reserves in order to record the development and performance of this gas source. Coalbed methane gas reserves increased to 10,566 billion cubic feet in 1996, a slight increase over 1995's level. Coalbed methane gas reserves account for 6 percent of 1996 U.S. dry natural gas reserves, and

coalbed methane production rose in 1996 to 1,003 billion cubic feet—5 percent of U.S. dry gas production. No Federal tax incentives for new coalbed methane wells have been available for 3 years.

Natural Gas Liquids

Proved reserves of natural gas liquids (NGL) increased 6 percent to 7,823 million barrels in 1996. An increase of 31 million barrels occurred in Alaska, while the lower 48 States' reserves increased by 393 million barrels. **Figure 5** shows the natural gas liquids proved reserves levels by major region and **Figure 6** shows the components of reserves changes from 1986 through 1996.

Operators replaced 150 percent of their 1996 natural gas liquids production with reserve additions. *Total discoveries* accounted for 49 percent of all NGL reserve additions, while *revisions and adjustments* accounted for the rest.

Total proved reserves of liquid hydrocarbons (crude oil plus natural gas liquids) were 29,840 million barrels in 1996—a slight increase over the 1995 level. Natural gas liquids represented about a quarter of total liquid hydrocarbon proved reserves in 1996.

Reserves Changes Since 1977

EIA has collected oil and gas reserves estimates annually since 1977. **Table 2** lists the cumulative totals of the components of reserves changes for crude oil and dry natural gas from 1977 through 1996. **Table 2** contains two sections, one for the lower 48 States, and another for the U.S. total (which includes Alaska's contribution). Annual averages of each component of reserves changes are also listed in **Table 2**, along with the percentage of that particular component's impact on total U.S. proved reserves. In this section, we compare these averages to the 1996 proved reserves estimates as a means of gauging the past year against history.

Crude Oil: Since 1977 U.S. operators have:

- discovered an average of 792 million barrels per year of new reserves
- revised and adjusted their proved reserves upward by an average of 1,359 million barrels per year from *revisions and adjustments*
- reduced proved reserves by an average 574 million barrels per year (the difference between post-1976 average annual production and

Figure 3. U.S. Dry Natural Gas Proved Reserves, 1986-1996

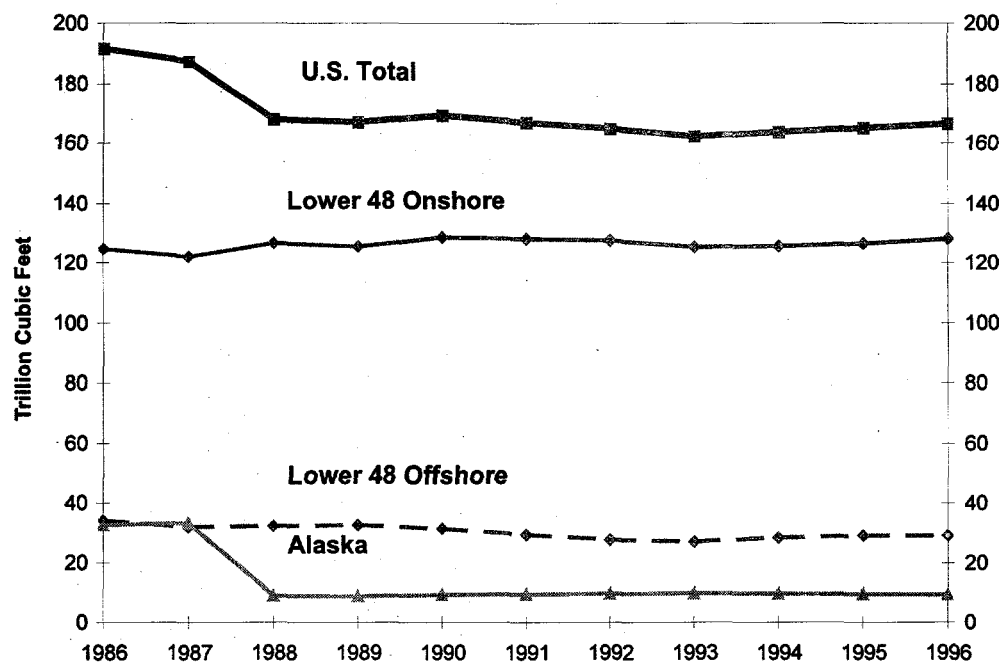
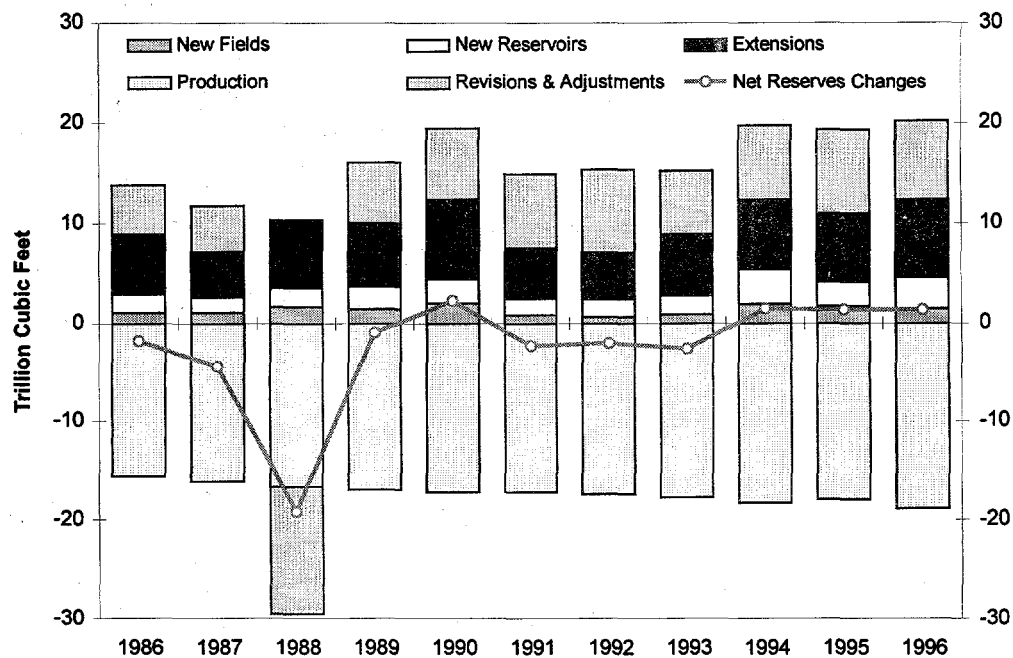


Figure 4. Components of Reserves Changes for Dry Natural Gas, 1986-1996



Source: U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 1986-1995 annual reports, DOE/EIA-0216.{1-10}

Figure 5. U.S. Natural Gas Liquids Proved Reserves, 1986-1996

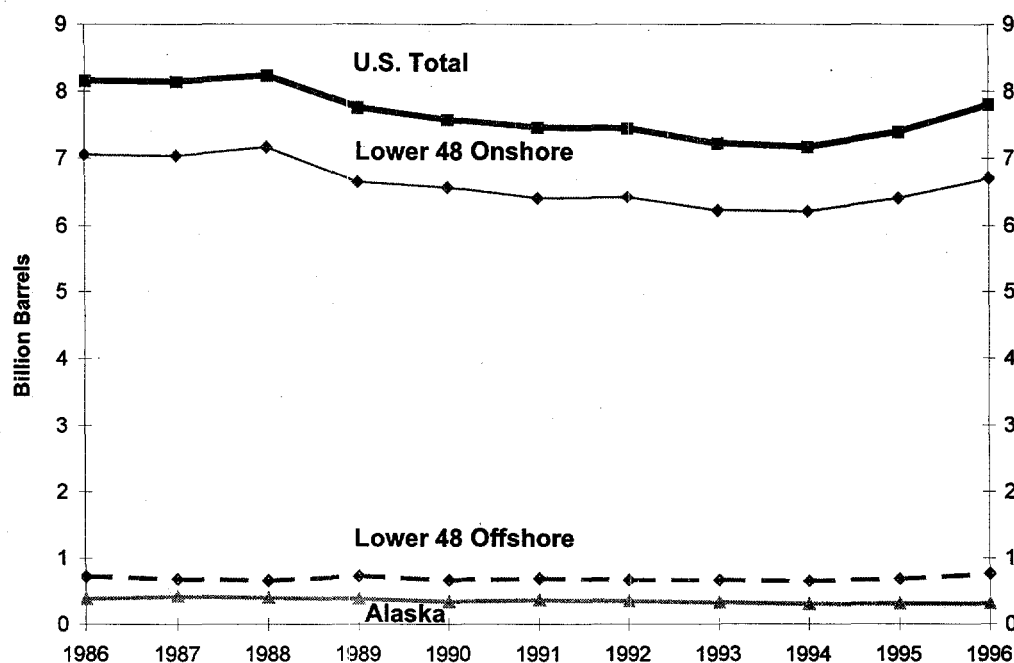
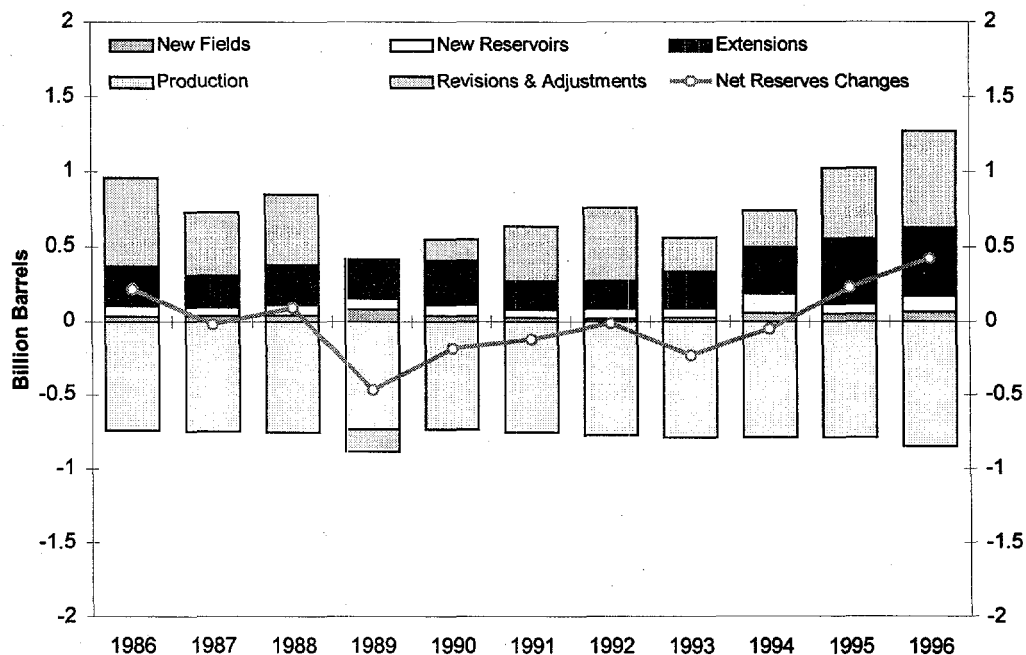


Figure 6. Components of Reserves Changes for Natural Gas Liquids, 1986-1996



Source: U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 1986-1995 annual reports, DOE/EIA-0216.(1-10)

Table 2. Reserves Changes, 1977-1996

Components of Change	Lower 48 States			U.S. Total		
	Volume	Average per Year	Percent of Reserve Additions	Volume	Average per Year	Percent of Reserve Additions
Crude Oil (million barrels of 42 U.S. gallons)						
Proved Reserves as of 12/31/76	24,928	—	—	33,502	—	—
New Field Discoveries	2,467	123	7.2	2,845	142	6.6
New Reservoir Discoveries in Old Fields . .	2,760	138	8.0	2,790	140	6.5
Extensions	9,098	455	26.4	10,201	510	23.7
Total Discoveries	14,325	716	41.6	15,836	792	36.8
Revisions and Adjustments	20,139	1,007	58.4	27,186	1,359	63.2
Total Reserve Additions	34,464	1,723	100.0	43,022	2,151	100.0
Production	42,649	2,132	123.7	54,507	2,725	126.7
Net Reserve Change	-8,185	-409	-23.7	-11,485	-574	-26.7
Dry Natural Gas (billion cubic feet at 14.73 psia and 60° Fahrenheit)						
Proved Reserves as of 12/31/76	180,838	—	—	213,278	—	—
New Field Discoveries	38,886	1,944	12.1	38,974	1,949	12.8
New Reservoir Discoveries in Old Fields . .	51,756	2,588	16.1	52,121	2,606	17.1
Extensions	145,489	7,274	45.3	146,390	7,320	48.1
Total Discoveries	236,131	11,807	73.6	237,485	11,874	78.1
Revisions and Adjustments	84,691	4,235	26.4	66,697	3,335	21.9
Total Reserve Additions	320,822	16,041	100.0	304,182	15,209	100.0
Production	344,480	17,224	107.4	350,986	17,549	115.4
Net Reserve Change	-23,658	-1,183	-7.4	-46,804	-2,340	-15.4

Source: U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1977-1996 annual reports, DOE/EIA-0216.{1-19}

post-1976 average annual reserve additions) because production has outpaced reserve additions.

Crude oil reserves have been primarily sustained by continuing upward *revisions and adjustments* to the reserves of older fields, not *total discoveries*. The bulk of post-1976 crude oil reserves additions were the 27,186 million barrels of *revisions and adjustments*, which accounted for 63 percent of all crude oil reserves additions since 1977. The 15,836 million barrels of *total discoveries* accounted for the remaining 37 percent of reserves additions.

Compared to the average reserves changes since 1977, 1996 was another good year for crude oil discoveries, even though the U.S. reserves total declined. 1996's *total discoveries* of crude oil exceeded the post-1976 U.S. average by 17 percent, while *revisions and adjustments* were less than the post-1976 U.S. average.

In 1996, all three components of *total discoveries* (new fields, new reservoir discoveries in old fields, and

extensions) exceeded the post-1976 averages, but the most significant component was *new field discoveries*. Since 1977, operators have found only an average of 142 million barrels of crude oil proved reserves per year in new fields. In 1996, operators discovered 243 million barrels of proved reserves—71 percent more than the post-1976 average.

Dry Natural Gas: Since 1977, U.S. operators:

- discovered an average of 11,874 billion cubic feet per year of new reserves
- revised and adjusted their proved reserves upward by an average 3,335 billion cubic feet per year
- reduced reserves by an average 2,340 billion cubic feet per year.

Unlike crude oil reserves, natural gas reserves have been sustained primarily by *total discoveries*. *Revisions and adjustments* account for only 22 percent of all reserve additions since 1977. However, since 1986, the contribution from *revisions and adjustments* has increased substantially (39 percent in 1996).

Compared to the average dry natural gas reserves changes since 1977, 1996 had more *total discoveries* than the average. Although 1996's *new field discoveries* were lower than the average, there were more *extensions* and more additions from *new reservoir discoveries in old fields*. Also, as in 1995, there were substantially more gas reserve additions from *net revisions and adjustments* compared to the average. As a result, U.S. total dry natural gas reserves increased for the third year in a row. Operators reported 7,871 billion cubic feet of *net revisions and adjustments* to their dry natural gas proved reserves—136 percent higher than the post-1976 average (3,335 billion cubic feet).

Economics and Drilling

Economics: Table 3 lists the average annual domestic wellhead prices of crude oil and natural gas, as well as the average number of active rotary drilling rigs, from 1970 to 1996.

The U.S. crude oil first purchase price started at an average of \$15.42 per barrel in January 1996, and rose to \$19.58 per barrel in April. Prices dipped briefly in May and June, but rose steadily for the last half of 1996 to peak at \$21.32 per barrel in December 1996. The average U.S. crude oil first purchase price rose from \$14.62 in 1995 to \$18.46 per barrel in 1996.

Table 3. U.S. Average Annual Domestic Wellhead Prices for Crude Oil and Natural Gas, and the Average Number of Active Rotary Drilling Rigs, 1970-1996

Year	Crude Oil		Natural Gas		Number of Rigs
	Current	1996 Constant	Current	1996 Constant	
	(dollars per barrel)		(dollars per thousand cubic feet)		
1970	3.18	11.44	0.17	0.61	1,028
1971	3.39	11.61	0.18	0.62	976
1972	3.39	11.11	0.19	0.62	1,107
1973	3.89	12.08	0.22	0.68	1,194
1974	6.87	19.63	0.30	0.86	1,472
1975	7.67	19.97	0.44	1.15	1,660
1976	8.19	20.17	0.58	1.43	1,658
1977	8.57	19.84	0.79	1.83	2,001
1978	9.00	19.44	0.91	1.97	2,259
1979	12.64	25.13	1.18	2.35	2,177
1980	21.59	39.25	1.59	2.89	2,909
1981	31.77	52.86	1.98	3.29	3,970
1982	28.52	44.63	2.46	3.85	3,105
1983	26.19	39.32	2.59	3.89	2,232
1984	25.88	37.45	2.66	3.85	2,428
1985	24.09	33.69	2.51	3.51	1,980
1986	12.51	17.07	1.94	2.65	964
1987	15.40	20.37	1.67	2.21	936
1988	12.58	16.07	1.69	2.16	936
1989	15.86	19.44	1.69	2.07	869
1990	20.03	23.51	1.71	2.01	1,010
1991	16.54	18.69	1.64	1.85	860
1992	15.99	17.57	1.74	1.91	721
1993	14.25	15.26	2.04	2.18	754
1994	13.19	13.81	R1.85	1.94	775
1995	14.62	14.93	1.55	1.58	723
1996	18.46	18.46	2.25	2.25	779

R=Revised data.

Sources: Current dollars and number of rigs: *Monthly Energy Review July 1997*, DOE/EIA-0035(97/07). 1996 constant dollars: U.S. Department of Commerce, Bureau of Economic Analysis, Gross Domestic Product Implicit Price Deflators, June 1997.

Oil prices vary by region. In Texas the average price was \$20.31 per barrel, while in California it was \$16.71 per barrel, and \$15.32 per barrel on the Alaskan North Slope. The lowest average first purchase price for crude oil in 1996 was \$13.82 per barrel for Federal Offshore California production.[20]

The average natural gas price at the wellhead increased from \$1.55 in 1995 to \$2.25 per thousand cubic feet in 1996. Gas prices started at \$2.08 per thousand cubic feet in January 1996, and remained relatively level until July when they rose to \$2.33 per thousand cubic feet. Prices dipped to \$1.87 (the lowest average price of the year) in September, but rapidly increased with the onset of colder winter weather in the northeast and northern central U.S.—rising to \$3.53 per thousand cubic feet in December 1996 which was the highest average price of the year.[21]

Drilling: From 1995 to 1996, the average active rig count increased from 723 to 779 rigs (Table 3). The rig count remains well below the high activity level of 1981 (average 3,970 rigs), however, it must be realized that a comparison of only the bulk number of wells drilled is not representative of drilling's impact on reserves levels over time. Operators are now using significantly improved drilling and seismic exploration technology to dramatically increase their success rate.

Looking first at exploratory wells, there were 4,123 exploratory wells drilled in 1996 (Table 4). Of these, 21 percent were oil wells, 25 percent were gas wells, and 54 percent were dry holes. The total (which includes dry holes) was 4 percent less than in 1995.

The success rate for exploratory drilling increased from 45 percent in 1995 to 46 percent in 1996. There were 2 percent more exploratory gas wells (Figure 7) and 6 percent fewer exploratory oil wells (Figure 8) than in 1995.

Figures 9 and 10 show the average volume of discoveries per exploratory well for dry natural gas and oil, respectively, since 1977. The average volume of new gas discoveries per exploratory well increased 10 percent in 1996 from the 1995 level. The average volume of new oil discoveries per exploratory well in 1996 is 3 percent higher than last year's level.

There were an estimated 23,679 exploratory and development wells drilled in 1996. This is 5 percent more than in 1995 and is only 82 percent of the average number of wells drilled annually over the prior 10 years (28,834).

Operators completed more oil and gas wells in 1996 than in 1995. For the fourth year in a row, the number of gas well completions exceeded the number of oil well completions in both the exploratory and development categories.

Reserve-to-Production Ratio and Ultimate Recovery

R/P Ratios

The relationship between proved reserves and production levels, expressed as the ratio of reserves to production (R/P ratio) is often used in analyses. For a mature producing area, the R/P ratio tends to be reasonably stable, so that the proved reserves at the end of a year serve as a rough guide to the production level that can be maintained during the following year. Operators report data which yield R/P ratios that vary widely by area depending upon:

- category of operator
- geology and economics
- number and size of new discoveries
- amount of drilling that has occurred.

R/P ratios are an indication of the state of development in an area and, over time, the ratios change. For example, when the Alaskan North Slope oil reserves were booked, the U.S. R/P ratio for crude oil increased because significant production from these reserves did not begin until 7 years after booking due to the need to first build the Trans Alaska pipeline. The U.S. R/P ratio for crude oil decreased from 11.1-to-1 to 9.4-to-1 between 1977 and 1982, as Alaskan North Slope oil production reached high levels.

U.S. crude oil proved reserves decreased in 1996, but oil production decreased as well—resulting in a slight increase in the National average R/P ratio.

Figure 11 shows the U.S. R/P ratio trend for crude oil since 1945. After World War II, increased drilling and discoveries led to a greater R/P ratio. Later, when drilling found fewer reserves than were produced, the ratio became smaller. R/P Ratios also vary geographically. Less developed areas of the country, such as the Pacific offshore, have higher R/P ratios for crude oil than the 1996 National average of 10.1-to-1. Other areas with relatively high R/P ratios are the Permian Basin of Texas and New Mexico, and California, where enhanced oil recovery techniques such as carbon dioxide (CO₂) injection or

Table 4. U.S. Exploratory and Development Well Completions,^a 1970-1996

Year	Exploratory				Total Exploratory and Development			
	Oil	Gas	Dry	Total	Oil	Gas	Dry	Total
1970	763	478	6,193	7,434	13,043	4,031	11,099	28,173
1971	664	472	5,995	7,131	11,903	3,983	10,382	26,268
1972	690	659	6,202	7,551	11,437	5,484	11,013	27,934
1973	654	1,079	6,038	7,771	10,251	6,975	10,466	27,692
1974	870	1,205	6,894	8,969	13,664	7,170	12,205	33,039
1975	991	1,263	7,207	9,461	16,979	8,170	13,736	38,885
1976	1,100	1,362	6,854	9,316	17,697	9,438	13,805	40,940
1977	1,183	1,562	7,402	10,147	18,700	12,119	15,036	45,855
1978	1,191	1,792	8,054	11,037	19,065	14,405	16,591	50,061
1979	1,335	1,920	7,478	10,733	20,703	15,170	16,038	51,911
1980	1,781	2,094	9,035	12,910	32,278	17,223	20,337	69,838
1981	2,667	2,533	12,297	17,497	42,843	19,907	27,284	90,034
1982	2,470	2,168	11,346	15,984	39,142	18,944	26,382	84,468
1983	2,113	1,660	10,271	14,044	37,199	14,556	24,336	76,091
1984	2,335	1,599	11,482	15,416	42,585	17,012	25,797	85,394
1985	1,879	1,282	9,445	12,606	35,021	14,252	21,208	70,481
1986	988	733	5,511	7,232	18,701	8,135	12,766	39,602
1987	859	673	5,179	6,711	16,186	7,757	11,481	35,424
1988	792	663	4,766	6,221	13,322	8,238	10,242	31,802
1989	580	654	4,001	5,235	10,339	9,225	8,491	28,055
1990	628	641	3,855	5,124	12,150	10,705	8,612	31,467
1991	573	R542	3,393	R4,508	11,908	9,452	7,914	29,274
1992	506	R423	2,656	R3,585	9,023	8,091	R6,651	R23,765
1993	R487	R515	2,514	R3,516	8,729	9,864	6,728	25,321
1994	R615	R816	2,203	R3,634	R6,780	R9,057	R5,284	R21,121
1995	R942	R989	R2,386	R4,317	R8,387	R8,692	R5,426	R22,505
1996	884	1,011	2,228	4,123	8,568	9,648	5,463	23,679

^aExcludes service wells and stratigraphic and core testing.

R=Revised data.

Notes: Estimates are based on well completions taken from American Petroleum Institute data tapes through June 1997. Due to the method of estimation, data shown are frequently revised. Data are no longer rounded to nearest 10 wells.

Sources: Years 1970-1972: Energy Information Administration, Office of Oil and Gas. Years 1973-1996: *Monthly Energy Review* July 1997, DOE/EIA-0035(97/07).

steamflooding have improved recoverability of oil in old, mature fields. Areas that have the lowest R/P ratios, like the Mid-Continent region, usually have many older fields. There, even use of new technologies such as horizontal drilling have so far only helped to add reserves equivalent to the annual production, keeping the regional reserves and R/P ratio for oil relatively stable.

Figure 12 shows the historical R/P ratio for wet natural gas since 1945. Prior to 1945, R/P ratios were very high, since the interstate pipeline infrastructure was not well developed. The market for and production of natural

gas grew rapidly after World War II, lowering the R/P ratio. The U.S. average R/P ratio for natural gas decreased in 1996, as reserves and production both increased.

Different marketing, transportation, and production characteristics for gas are seen when looking at regional average R/P ratios, compared to the 1996 U.S. average R/P ratio of about 8.9-to-1. The areas with the higher range of R/P ratios are the less developed areas of the country, such as the Pacific offshore and the Rockies, and also include areas such as Alabama and Colorado, where considerable booking of coalbed

Figure 7. U.S. Exploratory Gas Well Completions, 1977-1996

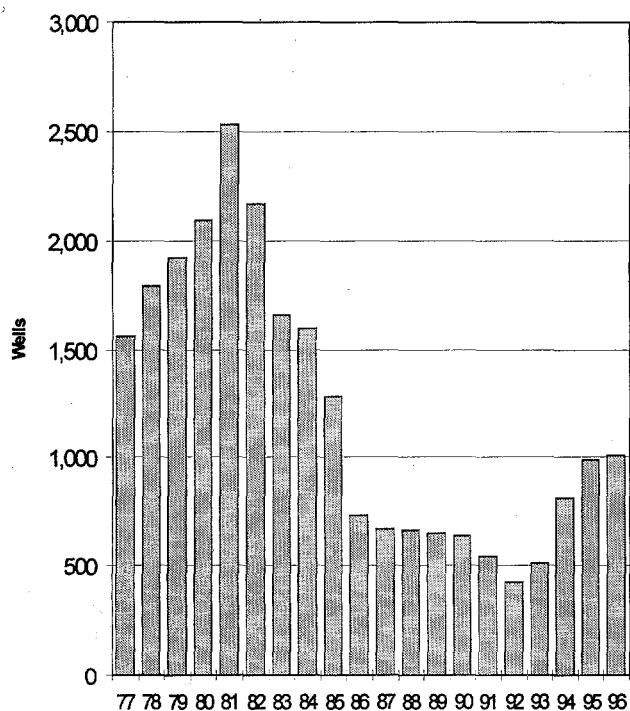


Figure 9. U.S. Total Discoveries of Dry Natural Gas per Exploratory Gas Well Completion, 1977-1996

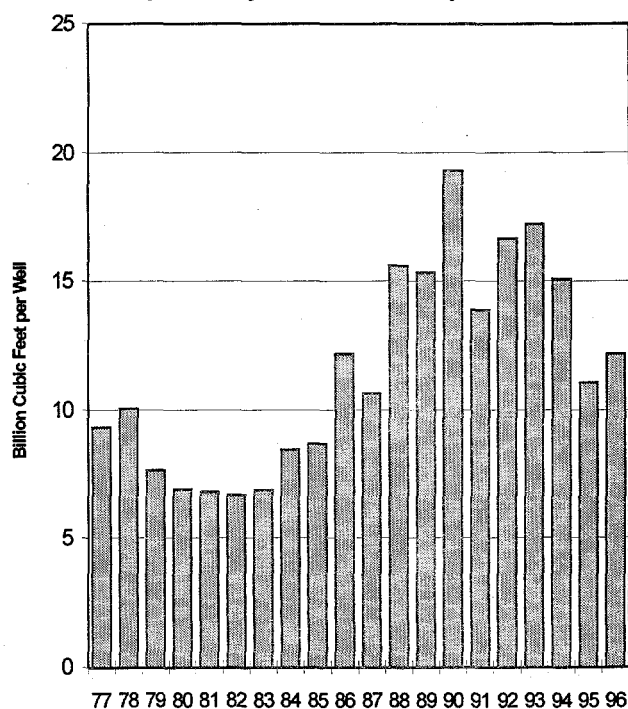


Figure 8. U.S. Exploratory Oil Well Completions, 1977-1996

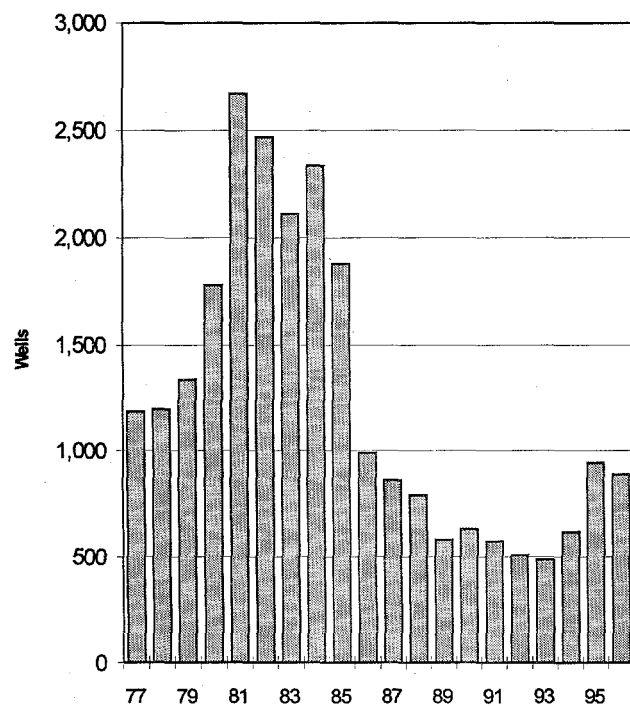
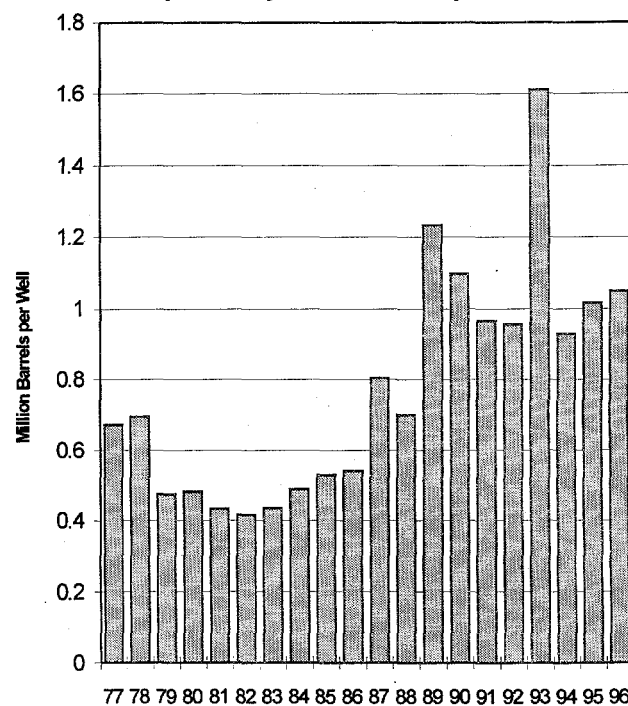


Figure 10. U.S. Total Discoveries of Crude Oil per Exploratory Oil Well Completion, 1977-1996



Source: Energy Information Administration, Office of Oil and Gas.

methane reserves has recently occurred. Several major gas producing areas have R/P ratios below the National average—such as Texas, the Gulf of Mexico Federal Offshore, and Oklahoma. The R/P ratio of these three areas combined decreased from 7.2-to-1 in 1995 to 7.0-to-1 in 1996, and is below the National 1996 average.

Ultimate Recovery

Figures 13 and 14 show successive estimates of ultimate recovery and its components, proved reserves and cumulative production, for crude oil plus lease condensate, and wet natural gas, from 1977 to 1996. They illustrate the continued growth of estimated ultimate recovery over time.

In 1977, U.S. crude oil and lease condensate proved reserves were 33,615 million barrels. Cumulative production for 1977 through 1996 was 54,946 million barrels. This substantially exceeds the 1977 proved reserves, but at the end of 1996 there were still 23,324 million barrels of crude oil and lease condensate proved reserves. Therefore, the estimated ultimate recovery of crude oil significantly increased during this period due to the continuing development of old fields and new field discoveries.

Similarly, the 1977 wet natural gas proved reserves were 209,490 billion cubic feet, and cumulative wet gas production from 1977 through 1996 was 351,234 billion cubic feet. Cumulative wet gas production exceeded the 1977 reserves by 141,744 billion cubic feet, but at the end of 1996 there were still 175,147 billion cubic feet of wet natural gas proved reserves, for the same reasons.

International Perspective

International Reserves

The EIA estimates domestic oil and gas reserves but does not systematically estimate worldwide reserves. As shown in Table 5, international reserves estimates are presented in two widely circulated trade publications. The world's total reserves are estimated to be roughly 1 trillion barrels of oil and 5 quadrillion cubic feet of gas.

The United States ranked 11th in the world for proved reserves of crude oil and 6th for natural gas in 1996, unchanged from 1995. A comparison of EIA's U.S. proved reserves estimates with worldwide estimates

obtained from other sources shows that the United States had about 2 percent of the world's total crude oil proved reserves and over 3 percent of the world's total natural gas proved reserves at the end of 1996. There are sometimes substantial differences between the estimates from these sources, and one reason (among many) for this is that condensate is often included in foreign oil reserve estimates.

The *Oil & Gas Journal* {24} estimate for world oil reserves increased 1.1 percent in 1996, while the *World Oil* {25} estimate increased only 0.7 percent. For world gas reserves, the *Oil & Gas Journal* reported a 0.2 percent increase, while *World Oil* reported a 2.3 percent increase.

Several foreign countries have oil reserves considerably larger than those of the United States. Saudi Arabian oil reserves are the largest in the world, dwarfing U.S. oil reserves. Iraqi oil reserves are more than 4 times U.S. reserves. Closer to home, Venezuela has almost 3 times and Mexico has just over twice the United States' oil reserves.

Proved reserve estimates for various countries differ widely. For example, *World Oil* reported oil reserves for the former Soviet Union (FSU) (combining both the Russian Federation and others) of about 184 billion barrels. This is more than 3 times the *Oil & Gas Journal's* estimate. However, *World Oil* has included more than proved reserves in its 1995 FSU estimate. EIA considers *World Oil's* FSU estimate comparable to the proved plus probable reserves classifications commonly used in the United States. The U.S. oil reserve estimates include only proved reserves.

Petroleum Consumption

The United States is the world's largest energy consumer. The EIA estimates energy consumption and publishes it in its *Annual Energy Review*. In 1996:

- The U.S. consumed 93,810,000,000,000 Btu of energy (93.81 quadrillion Btu).
- 63 percent of U.S. energy consumption was provided by petroleum and natural gas—crude oil and natural gas liquids combined (38 percent), and natural gas (24 percent). {26}
- U.S. petroleum consumption was about 18.3 million barrels of oil and natural gas liquids and 60.2 billion cubic feet of dry gas per day.

Figure 11. Reserves-to-Production Ratios for Crude Oil, 1945-1996

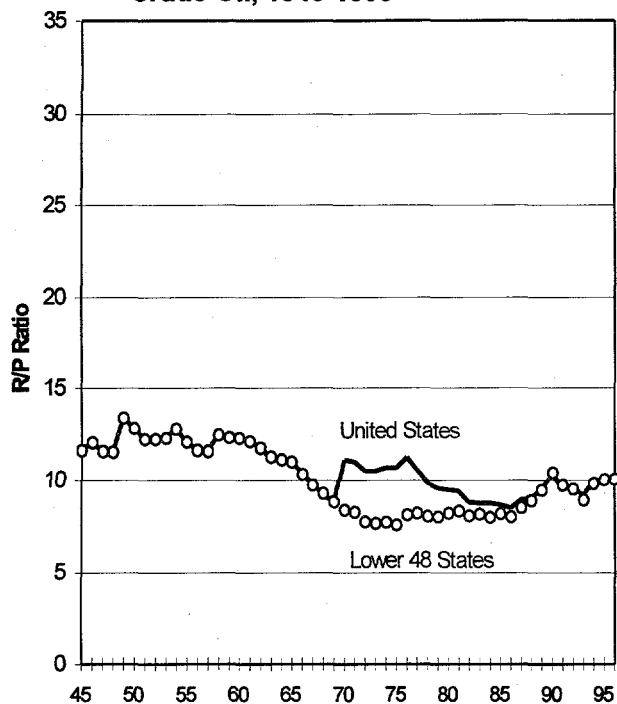


Figure 13. Components of Ultimate Recovery for Crude Oil and Lease Condensate, 1977-1996

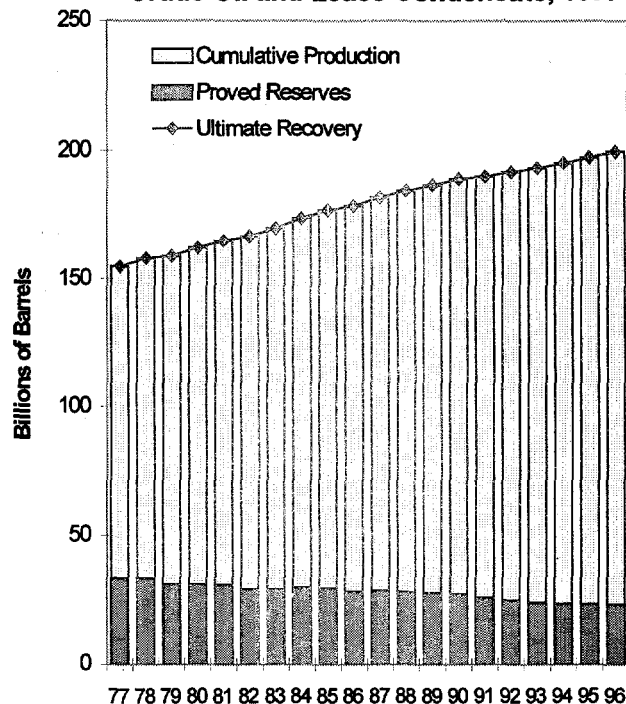


Figure 12. Reserves-to-Production Ratios for Wet Natural Gas, 1945-1996

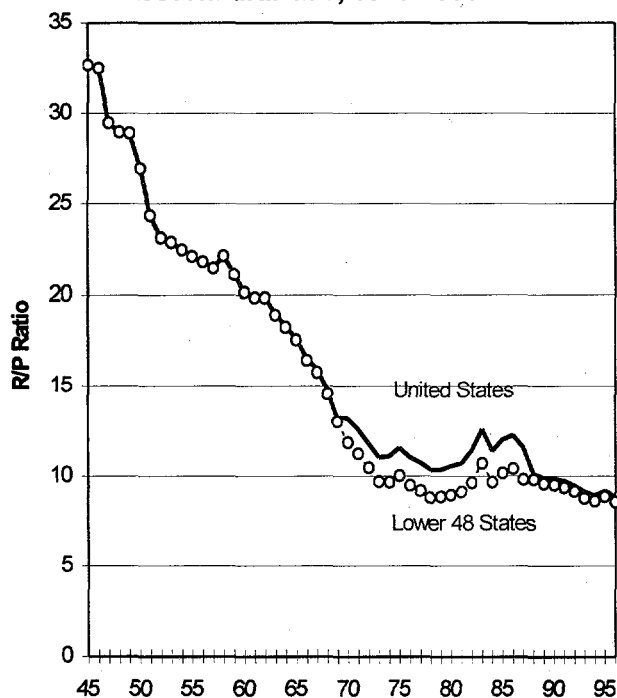
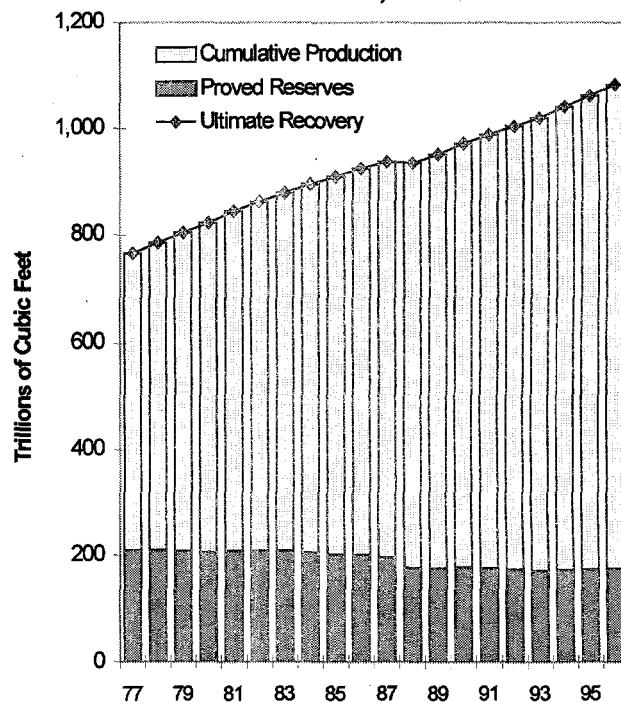


Figure 14. Components of Ultimate Recovery for Wet Natural Gas, 1977-1996



Sources: Annual reserves and production - American Petroleum Institute and American Gas Association (1945-1976)(22) and Energy Information Administration, Office of Oil and Gas (1977-1996)(1-19). Cumulative production: *U.S. Oil and Gas Reserves by Year of Field Discovery* (1977-1988).(23)

Table 5. International Oil and Natural Gas Reserves as of December 31, 1996

Oil (million barrels)				Natural Gas (billion cubic feet)			
Rank ^a	Country	Oil & Gas Journal	World Oil	Rank ^b	Country	Oil & Gas Journal	World Oil
1	Saudi Arabia ^c	^d 261,500	^d 261,800	1	Former U.S.S.R.	1,977,000	1,939,292
2	Former U.S.S.R.	57,000	183,831	2	Iran ^c	741,609	812,238
3	Iraq ^c	112,000	112,000	3	Qatar ^c	250,000	244,815
4	Kuwait ^c	^d 96,500	^d 94,700	4	Saudi Arabia ^c	^d 189,100	^d 195,500
5	Iran ^c	93,000	90,500	5	United Arab Emirates ^c	204,900	195,620
6	United Arab Emirates ^c	97,800	63,510	6	United States	^e 165,146	167,050
7	Venezuela ^c	64,878	72,603	7	Venezuela ^c	141,600	142,951
8	Mexico	48,796	48,472	8	Algeria ^c	130,300	138,900
9	Libya ^c	29,500	29,500	9	Iraq ^c	118,000	118,500
10	China	24,000	34,055	10	Nigeria ^c	104,717	109,700
Top 10 Total		884,974	990,971	Top 10 Total		4,022,372	4,064,566
11	United States	^e 22,351	22,050	11	Indonesia ^c	72,268	135,923
12	Norway	11,234	26,874	12	Norway	47,745	123,303
13	Nigeria ^c	15,521	20,800	13	Malaysia	80,200	79,100
14	Algeria ^c	9,200	12,960	14	Canada	68,118	68,100
15	Indonesia ^c	4,980	9,241	15	Mexico	67,668	63,913
16	Brazil	4,800	6,970	16	Netherlands	64,096	62,304
17	Canada	4,894	5,537	17	Kuwait ^c	^d 52,900	^d 56,725
18	United Kingdom	4,517	5,003	18	Australia	19,429	83,500
19	India	4,333	5,049	19	Libya ^c	46,300	46,300
20	Malaysia	4,000	5,170	20	China	41,357	39,600
21	Angola	5,412	3,601	21	United Kingdom	24,720	26,828
22	Oman	5,138	3,614	22	Oman	30,000	21,100
23	Qatar ^c	3,700	3,916	23	Argentina	21,870	24,308
24	Egypt	3,696	3,700	24	India	24,200	19,502
25	Yemen	4,000	3,100	25	Egypt	20,356	20,400
Top 25 Total		992,749	1,128,556	Top 25 Total		4,703,599	4,935,472
OPEC Total		788,579	771,530	OPEC Total		2,051,694	2,197,172
World Total		1,018,849	1,160,104	World Total		4,945,362	5,177,179

^aRank is based on an average of oil reserves reported by *Oil & Gas Journal* and *World Oil*.

^bRank is based on an average of natural gas reserves reported by *Oil & Gas Journal* and *World Oil*.

^cMember of the Organization of Petroleum Exporting Countries (OPEC).

^dIncludes one-half of the reserves in the Neutral Zone.

^eEnergy Information Administration proved reserves as of December 31, 1995 were published by the *Oil & Gas Journal* as its estimates as of December 31, 1996.

Note: The Energy Information Administration does not certify these international reserves data, but reproduces the information as a matter of convenience for the reader.

Sources: PennWell Publishing Company, *Oil and Gas Journal*, December 30, 1996, pp. 40-41. Gulf Publishing Company, *World Oil*, August, 1997, p. 38.

Dependence on Imports

The United States remains heavily dependent on imported oil and gas to satisfy its ever-increasing appetite for energy. In 1995, the U.S. was dependent on petroleum net imports for 44 percent of energy consumption. In 1996, it increased to a 19-year high of 46 percent.

Net gas imports declined slightly in 1996 to 2.7 trillion cubic feet, which is approximately 12 percent of consumption. Almost all of this gas was pipelined in from Canada, some from Mexico, and a very small amount of liquefied natural gas was imported from Algeria.

Price-competitive Canadian gas exports continue to capture an increasing share of the U.S. market. Venezuela, Saudi Arabia, Canada, Mexico, and Nigeria were the primary foreign suppliers of petroleum to the United States.{27}

List Of Appendices

Appendix A: Reserves by Operator Production Size Class - How much of the National total of proved reserves are owned and operated by the large oil and gas corporations? Appendix A separates the large operators from the small and presents reserves data according to operator production size classes. The top 20 producing companies had 58 percent of U.S. natural gas proved reserves in 1995.

Appendix B: Top 100 Oil and Gas Fields - What fields have the most reserves and production in the United States? The top 100 fields for oil and natural gas out of the inventory of more than 45,000 oil and gas fields are listed in Appendix B. These fields hold two-thirds of U.S. crude oil proved reserves.

Appendix C: Conversion to the Metric System - To simplify international comparisons, a summary of U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves expressed in metric units is included as Appendix C.

Appendix D: Historical Reserves Statistics - Appendix D contains selected historical reserves data presented at the State and National level. Readers interested in a historical look at one specific State or region can review these tables. We have included a new table, Table D9, Deepwater Production and Proved

Reserves of the Gulf of Mexico Federal Offshore 1992-1996. Table D9 contains the production and proved reserves for 1992-1996 for the Gulf of Mexico Federal Offshore region by water depths greater than 200 meters, and less than 200 meters.

Appendix E: Summary of Data Collection Operations - This report is based on two EIA surveys. Proved reserves data is collected annually from U.S. oil and gas field operators on Form EIA-23. Natural gas liquids production data is collected annually from U.S. natural gas plant operators on Form EIA-64A. Appendix E describes survey designs, response statistics, reporting requirements, and how the sampling frames are maintained. Budget reductions at EIA have reduced the scope and coverage of these surveys. Read how the surveys have been modified due to reduced resources.

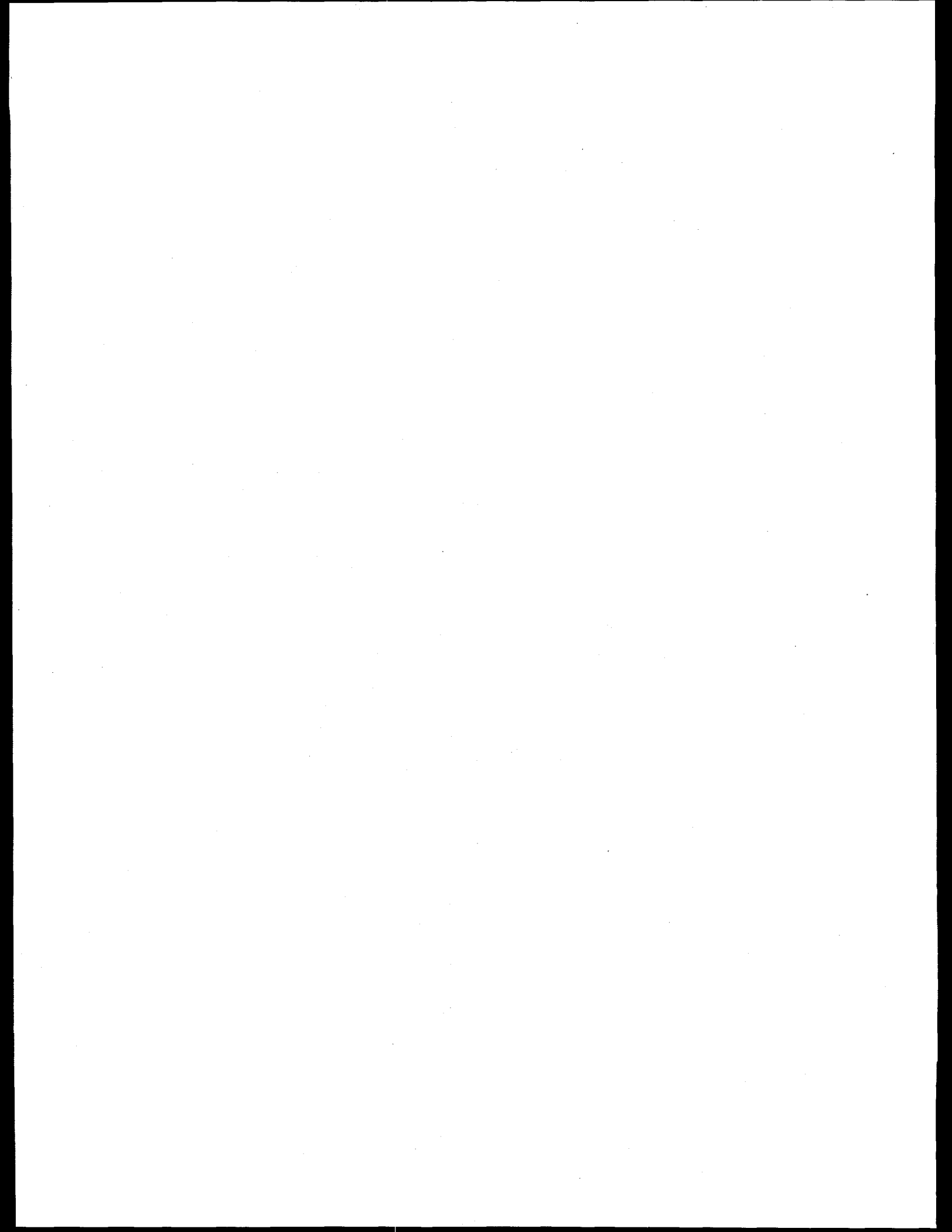
Appendix F: Statistical Considerations - The EIA strives to maintain or improve the accuracy of its reports. Since complete coverage of all oil and gas operators is impractical, the EIA has adopted sound statistical methods to impute data for those operators not sampled and for those data elements that smaller operators are not required to file. These methods are described in Appendix F. A new statistical imputation process, implemented for this 1996 annual report, is described.

Appendix G: Estimation of Reserves and Resources - Reserves are not measured directly. Reserves are estimated on the basis of the best geological, engineering, and economic data available to the estimator. Appendix G describes reserve estimation techniques commonly used by oil and gas field operators and EIA personnel when in the field performing quality assurance checks. A discussion of the relationship of reserves to overall U.S. oil and gas resources is also included.

Appendix H: Maps of Selected State Subdivisions - Certain large producing States have been subdivided into smaller regions to allow more specific reporting of reserves data. Maps of these States identifying the smaller regions are provided in Appendix H.

Appendix I: Annual Survey Forms of Domestic Oil and Gas Reserves - Samples of Form EIA-23 and Form EIA-64A are presented in Appendix I.

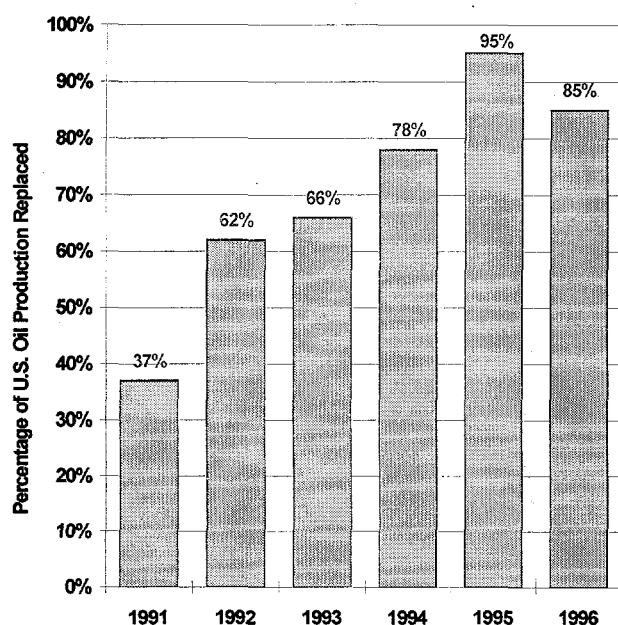
Glossary - Contains definitions of many of the technical terms used in this report.



3. Crude Oil Statistics

The United States had 22,017 million barrels of crude oil proved reserves as of December 31, 1996. This is about 2 percent less than in 1995 and it is the ninth consecutive year that crude oil proved reserves have declined. *Reserve additions* of crude oil (1,839 million barrels) replaced 85 percent of 1996 oil production (Figure 15).

Figure 15. Reserve Additions Replace 85 Percent of U.S. Oil Production in 1996



Source: Energy Information Administration, Office of Oil and Gas.

Alaska, the state with the second largest crude oil reserves in the United States, reported the largest decline in 1996—a decrease of 5.5 percent from 1995's level. In Alaska, reserve additions replaced only 40 percent of production in 1996. This large decline in crude oil reserves had the most significant impact on the National total in 1996.

In 1996, the largest net addition of new crude oil proved reserves came from the Gulf of Mexico Federal Offshore. The Gulf of Mexico Federal Offshore

reported a 2 percent increase (49 million barrels) in crude oil proved reserves. This is the fourth consecutive year that crude oil proved reserves have increased in this area.

Lower-48 States crude oil proved reserves remained essentially constant in 1996, with only a 0.2 percent decline (28 million barrels) from 1995. Texas and California reported declines in crude oil proved reserves, but did not decline as severely as Alaska in 1996 because higher oil prices spurred activity in west Texas and the San Joaquin Basin. Texas replaced 99 percent of its production with new reserves additions, while California replaced 91 percent.

Over the previous 10 years, U.S. crude oil proved reserves have generally been declining (Figure 1). Oil reserves have declined an average of over 2 percent per year. The 1996 decline is less than this average.

Proved Reserves

Table 6 presents the U.S. proved reserves of crude oil as of December 31, 1996, by selected States and State subdivisions.

Figure 16 maps the U.S. 1996 crude oil proved reserves by State. The following four areas account for 78 percent of U.S. crude oil proved reserves:

Area	% of U.S. Oil Reserves
Texas	26
Alaska	24
California	16
Gulf of Mexico Federal Offshore	12
Total	78

Of these four areas, the top three all experienced a decline in crude oil proved reserves during 1996, while the Gulf of Mexico Federal Offshore had an increase.

Discussion of Reserves Changes

Figure 17 maps the change in crude oil proved reserves from 1995 to 1996 by area. Here's how the top four areas fared, compared to the total United States:

Table 6. Crude Oil Proved Reserves, Reserves Changes, and Production, 1996
(Million Barrels of 42 U.S. Gallons)

State and Subdivision	Published Proved Reserves 12/31/95	Changes in Reserves During 1996							Proved Reserves 12/31/96
		Adjustments (+,-)	Revision Increases (+)	Revision Decreases (-)	Extensions (+)	New Field Discoveries (+)	New Reservoir Discoveries in Old Fields (+)	Production (-)	
Alaska	5,580	3	69	60	64	128	0	510	5,274
Lower 48 States	16,771	172	1,654	926	479	115	141	1,663	16,743
Alabama	43	9	8	6	0	1	0	10	45
Arkansas	48	9	15	4	0	0	0	10	58
California	3,462	28	306	110	26	0	2	277	3,437
Coastal Region Onshore	456	21	14	57	10	0	0	19	425
Los Angeles Basin Onshore	227	3	27	4	0	0	0	19	234
San Joaquin Basin Onshore	2,577	3	263	45	16	0	2	219	2,597
State Offshore	202	1	2	4	0	0	0	20	181
Colorado	252	-9	22	12	0	0	0	22	231
Florida	71	0	32	0	0	0	0	6	97
Illinois	119	-2	11	23	1	0	0	12	94
Indiana	13	-2	2	0	0	0	0	2	11
Kansas	275	-3	54	30	11	0	2	43	266
Kentucky	24	-1	1	0	0	0	0	3	21
Louisiana	637	-1	94	65	64	1	24	96	658
North	108	-18	20	4	34	1	4	17	128
South Onshore	387	13	53	47	25	0	7	56	382
State Offshore	142	4	21	14	5	0	13	23	148
Michigan	76	8	9	10	1	0	0	10	74
Mississippi	140	12	23	5	10	0	2	18	164
Montana	178	-8	10	3	5	0	0	14	168
Nebraska	25	4	7	3	0	0	0	5	28
New Mexico	732	-6	90	36	29	3	2	70	744
East	713	-4	88	32	29	3	2	68	731
West	19	-2	2	4	0	0	0	2	13
North Dakota	233	8	27	19	21	9	0	31	248
Ohio	53	0	6	0	0	0	2	8	53
Oklahoma	676	7	55	43	11	0	1	75	632
Pennsylvania	11	-3	2	1	2	0	0	^c ₁	10
Texas	5,743	125	461	261	155	5	3	495	5,736
RRC District 1	90	4	7	8	3	0	0	10	86
RRC District 2 Onshore	61	7	7	3	1	0	0	10	63
RRC District 3 Onshore	267	22	49	29	25	0	0	53	281
RRC District 4 Onshore	50	0	12	5	1	0	0	7	51
RRC District 5	34	1	3	6	2	0	0	5	29
RRC District 6	409	-10	16	20	4	0	0	40	359
RRC District 7B	126	19	11	6	3	1	0	18	136
RRC District 7C	204	6	34	23	20	0	0	22	219
RRC District 8	2,032	33	151	69	78	2	1	149	2,079
RRC District 8A	2,233	20	141	52	12	2	0	149	2,207
RRC District 9	149	27	20	34	1	0	2	21	144
RRC District 10	80	-2	7	6	5	0	0	10	74
State Offshore	8	-2	3	0	0	0	0	^c ₁	8
Utah	216	13	33	13	4	0	0	16	237
West Virginia	28	-2	2	2	1	0	0	2	25
Wyoming	605	-2	77	24	13	1	1	68	603
Federal Offshore	3,089	-4	302	256	125	95	102	368	3,085
Pacific (California)	571	25	1	17	3	0	0	65	518
Gulf of Mexico (Louisiana)	2,269	-28	285	213	120	90	99	265	2,357
Gulf of Mexico (Texas)	249	-1	16	26	2	5	3	38	210
Miscellaneous ^a	^b 22	-8	5	0	0	0	0	^c ₁	18
U.S. Total	22,351	175	1,723	986	543	243	141	2,173	22,017

^aIncludes Arizona, Missouri, Nevada, New York, South Dakota, Tennessee, and Virginia.

^bIndicates the estimate is associated with a sampling error (95 percent confidence interval) that exceeds 20 percent of the estimated value.

^cIndicates the estimate has an expected error greater than 20 percent of the estimated value.

Note: The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves." They may differ from the official Energy Information Administration production data for crude oil for 1996 contained in the *Petroleum Supply Annual 1996*, DOE/EIA-0340(96).

Source: Energy Information Administration, Office of Oil and Gas.

1996 Crude Oil Proved Reserves
Millions of Barrels

1,000 to 5,750	(4)
100 to 1,000	(11)
1 to 100	(16)
0 to 0	(21)

Four Areas Contain 78 Percent of U.S. Crude Oil Proved Reserves

U.S. Total:
22.017 Billion Barrels

Map Data (Millions of Barrels):

State	Reserves (Millions of Barrels)
Alaska	5,274
California	3,437
Texas	5,736
Louisiana	2,567
Wyoming	168
Montana	248
North Dakota	600
Oklahoma	231
Nebraska	28
South Dakota	237
Minnesota	266
Illinois	94
Michigan	74
Indiana	11
Ohio	53
Pennsylvania	10
West Virginia	21
Maryland	25
Delaware	58
Virginia	6
North Carolina	45
South Carolina	97
Georgia	632
Florida	97

**Changes in Crude Oil Proved Reserves By Area
1995 to 1996, Millions of Barrels**

Change (Millions of Barrels)	Number of States
0 to 50	12
0 to 0	21
-50 to 0	17
-306 to -50	2

Gulf of Mexico Crude Oil Proved Reserves Increase for the fourth year in a row. Alaska and the Pacific Federal Offshore report large declines in 1996.

**Total U.S. Decline:
-334 Million Barrels**

Energy Information Administration
U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1996 Annual Report

Area	Change in U.S. Oil Reserves (million barrels)
Texas	-7
Alaska	-306
California	-25
Gulf of Mexico Federal Offshore	+49
Area Subtotal	-289
U.S. Total	-334

Figure 2 in Chapter 2 shows the components of the changes in crude oil proved reserves for 1996 and the preceding 10 years. These components are discussed below.

Total Discoveries

Total discoveries are those new reserves attributable to *extensions* of existing fields, *new field discoveries*, and *new reservoir discoveries in old fields*. They result from the drilling of exploratory wells.

Total discoveries of crude oil were 927 million barrels in 1996, 3 percent lower than in 1995. Only four areas had *total discoveries* exceeding 35 million barrels:

- The Gulf of Mexico Federal Offshore had 319 million barrels of *total discoveries*, 34 percent of the National total. The Gulf of Mexico Federal Offshore (Louisiana) had 309 million barrels of these *total discoveries* in 1996.
- Alaska had 192 million barrels of *total discoveries*, 21 percent of the National total.
- Texas had 163 million barrels of *total discoveries*, 18 percent of the National total. Half of this was in Texas Railroad Commission (TXRRC) District 8 in west Texas.
- Louisiana had 89 million barrels of *total discoveries*, 10 percent of the National total.

The United States discovered an average of 654 million barrels of new crude oil proved reserves per year in the prior 10 years (1986 through 1995). *Total discoveries* in 1996 were 142 percent of that average.

Extensions: Operators reported 543 million barrels of *extensions* in 1996.

- The highest volume of *extensions* was reported in Texas (155 million barrels) and 50 percent of Texas' *extensions* (78 million of 155 million barrels total) were in west Texas (TX RRC District 8).
- Second, 120 million barrels of *extensions* in the Gulf of Mexico Federal Offshore (Louisiana).

- Alaska and Louisiana tied for third with 64 million barrels of *extensions*.

Despite its large share of U.S. oil reserves, only 26 million barrels of *extensions* were reported in California, where production is dominated by large, old fields and exploration has been restricted. Over half of California's 1996 *extensions* (16 million barrels) were from the San Joaquin Basin Onshore region.

In the prior 10 years, U.S. operators reported an average of 422 million barrels of *extensions* per year. The 1996 *extensions* were 129 percent of that average.

New Field Discoveries: There were 243 million barrels of *new field discoveries* reported in 1996. Only eight areas in the United States reported any *new field discoveries*. Of these, only four contributed more than 1 percent to the total:

- Alaska (53 percent)
- Gulf of Mexico Federal Offshore (39 percent)
- North Dakota (4 percent)
- Texas (2 percent).

In the prior 10 years, U.S. operators reported an average of 103 million barrels of reserves from *new field discoveries* per year. Reserves from *new field discoveries* in 1996 were 236 percent of that average.

New Reservoir Discoveries in Old Fields: Operators in the United States reported 141 million barrels of crude oil reserves from *new reservoir discoveries in old fields* in 1996. The most significant portion of these were in the Gulf of Mexico Federal Offshore (Louisiana), 99 million barrels or 70 percent. Louisiana reported 24 million barrels (17 percent), and Texas reported 3 million barrels (2 percent). In the prior 10 years, U.S. operators reported an average of 129 million barrels of reserves from *new reservoir discoveries in old fields* per year. Reserves from *new reservoir discoveries in old fields* in 1996 were 109 percent of that average.

Revisions and Adjustments

Thousands of positive and negative *revisions* to proved reserves occur each year as infill wells are drilled, well performance is analyzed, new technology is applied, or economic conditions change. *Adjustments* are the annual changes in the published reserve estimates that cannot be directly attributed to the estimates for other reserve change categories because of the survey and statistical estimation methods employed.

There were 912 million barrels of net *revisions and adjustments* for crude oil in 1996, less than the 1995 total of 1,150 million barrels. Average *revisions and adjustments* for the prior 10 years were 1,293 million barrels, and those for 1996 were only 71 percent of this average.

Production

U.S. *production* of crude oil in 1996 was 2,173 million barrels. This was 2 percent lower than 1995's total of 2,213 million barrels. U.S. crude oil *production* has declined in 10 of the last 11 years, at an average rate of 3 percent.

Areas of Note: Large Discoveries and Reserves Additions

The following State and area discussions summarize notable activities during 1996 concerning expected new field reserves, development plans, and possible production rates as reported in various trade publications. The citations do not necessarily reflect EIA's concurrence, but are considered important enough to be brought to the reader's attention.

The following areas are the major success stories for crude oil reserves and production for 1996.

Alpine Field, Alaska

Although Alaska's proved oil reserves declined 5.5 percent (306 million barrels), a large new field was discovered in Alaska in 1996—the Alpine Field. Operated by ARCO, the Alpine Field is located 34 miles west of the Kuparuk River oil field on Alaska's North Slope.

The following paragraphs were excerpted from an ARCO Press Release, May 7, 1997: "Estimates of peak production have also been increased to 70,000 barrels per day in the year 2001, up 10,000 b/d from the previous estimate. Initial production of 40,000 barrels per day is expected in 2000.

Alpine is 56%-owned by ARCO Alaska, Inc., a subsidiary of Los Angeles-based ARCO, Anadarko Petroleum Corp., and Union Texas Petroleum Alaska Corporation.

Work is expected to begin in December, 1997, pending co-owner approval and receipt of necessary permits. Initial development plans call for the drilling of 50

wells and the installation of associated facilities. After the field is put on production, additional wells targeting the periphery of the field may be drilled.

ARCO and its partners announced plans to develop Alpine in October, 1996 after completion of a 3-dimensional seismic survey and a six-well, four-sidetrack delineation drilling program.

Four Alpine delineation wells were tested and on separate tests flowed high-quality, low-impurity, 40-degree API gravity oil. An unstimulated rate of 2,380 barrels per day was achieved from the Alpine reservoir, a sandstone discovered at a depth of approximately 6,850 feet."

Gulf of Mexico Federal Offshore

Projects in the Gulf of Mexico Federal Offshore provided the largest net increase of crude oil proved reserves in the United States from 1995's level, 49 million barrels. The Gulf of Mexico produced about 303 million barrels of crude oil in 1996, an increase of 4 percent (11 million barrels) over 1995 production (292 million barrels).

Deepwater Production and Reserves: The Federal Offshore is still an exciting frontier. The continuing evolution of deepwater production systems has facilitated the industry's expansion into the deepwater frontiers of the Federal Gulf of Mexico. The evolution of technology from fixed to floating platforms, and using subsea well completions, has allowed extension of production activities into ever deeper water. Appendix D, Historical Reserves Statistics, contains a new table, Table D9, "Deepwater Production and Proved Reserves of the Gulf of Mexico Federal Offshore, 1992-1996". The table contains the production and proved reserves for 1992-1996 for the Gulf of Mexico Federal Offshore region by water depths greater than 200 meters and less than 200 meters. The rapid rise of deepwater proved reserves and production listed in Table D9 are a testament to the successful implementation of the new technology.

Fields in the deepwater are currently producing crude oil at almost twice the annual rate (97 million barrels) that they were only four years earlier in 1992 when the production was 54 million barrels. Fields in the deepwater are currently producing natural gas at over twice the rate (613 billion cubic feet) than they were only five years ago in 1992 when the annual production was 243 billion cubic feet.

Proved reserves of oil and gas in deepwater have roughly doubled in the last four years. In 1996, the proved reserves of crude oil in water deeper than 200 meters exceeded the reserves in shallower water. While crude oil proved reserves in water depths less than 200 meters have remained relatively constant since 1992, the doubling of deepwater reserves has led to overall increases of crude oil proved reserves in the Gulf of Mexico Federal Offshore for four years in a row. Natural gas reserves in the deepwater also increased every year since 1992, and had nearly doubled by 1996. They now account for one-fourth of the natural gas reserves in the Gulf of Mexico Federal Offshore. Natural gas liquids reserves tripled between 1992 and 1996. They now account for almost one-half the natural gas liquids reserves in the Gulf of Mexico Federal Offshore.

Activity on the OCS Prompts Record-Breaking Lease Sales in 1996: Both the April 1996 Central Gulf Lease Sale and the September 1996 Western Gulf Lease Sale set records. The U.S. Department of the Interior's Minerals Management Service (MMS) said it received 929 bids on 617 tracts for acreage offered in the Western Gulf of Mexico offshore Texas and in deeper waters offshore Louisiana.

"This is the first sale in the Western Gulf of Mexico, and only the second sale overall, in which tracts receiving bids in water depths of 200 meters or more are eligible for consideration under provisions of the Deepwater Royalty Relief Act signed by President Clinton this past November," said MMS Director Cynthia Quarterman. "[The Western Gulf of Mexico Lease] Sale, along with the record-breaking Central Gulf Sale earlier this year, are clear indications that the Gulf of Mexico is embarking on a new era for offshore energy development."

MMS officials said 433 tracts that received bids are in water depths of 200 meters or more. The highest bid was on a tract in High Island Block 545A. Each tract is about nine square miles. The highest bid on each tract will go through an evaluation process to assure the American taxpayer receives fair market value. The agency estimates recoverable hydrocarbons to be about 40 million barrels of oil and 0.65 trillion cubic feet of natural gas.{28}

TLPs, Towers, and Spars: Operators in the Federal Offshore waters of the Gulf of Mexico are bringing production on-line using a variety of new production facility systems.

- In May 1996, Shell Deepwater Development repeated its success at the Auger and Ram-Powell Projects with the installation of the **Mars** Tension Leg Platform in Mississippi Canyon Block 807 (2,958 feet water depth).{29}
- Texaco and partner Marathon Oil began constructing a 1,870-foot Compliant Tower for the drilling and production platform at its **Petronius** Project in Viosca Knoll Block 786 (1,753 feet water depth). Texaco expects to bring Petronius onstream in early 1999.{30}
- In September 1996, Oryx Energy Company installed the first floating production spar platform in the Gulf of Mexico at its **Neptune** Project in Viosca Knoll Block 825 (cover photo) in 1,861 feet of water depth.{31}

More Subsea Completions: Operators also plan to develop more projects using subsea completions.

- British Borneo Exploration announced its plans to develop the newly discovered **Morpeth** Project in Ewing Bank Block 921 using subsea completions and a SeaStar system (1,630 feet water depth). A SeaStar system is a floating mini-tension leg platform of relatively low cost developed for the production of smaller deepwater reserves which would be uneconomic to produce using more conventional deepwater systems.{32}
- Texaco and Marathon announced their intentions in 1996 to develop the **Arnold** Project in 1,749 feet of water using subsea completions (the specific platform system is not yet selected).{30}
- The deepest potential project announced to date is the **BAHA** Project that Shell Deepwater Development is considering in Alaminos Canyon Block 600 in an estimated 7,620 feet of water!{32}

The Permian Basin

Plenty of dry land potential was found in 1996. One of the most active onshore areas was the Permian Basin. The largest volume of *extensions* in the United States was reported in Texas in 1996, and the lion's share of those occurred in the Permian Basin (TX RRC Districts 8 and 8A). Adding the *extensions* of eastern New Mexico to those of TX RRC Districts 8 and 8A, the *extensions* from these areas (all in the Permian Basin) exceed those of the Gulf of Mexico Federal Offshore.

Chalk one up for Louisiana

A commercially productive section of the Austin Chalk formation was found to extend into Louisiana, one of the reasons why Louisiana was second only to the Gulf of Mexico Federal Offshore in the volume of *new reservoir discoveries in old fields* in 1996. Besides the chalk, operators discovered a significant volume (13 million barrels) of *new reservoir discoveries in old fields* in the state offshore waters of Louisiana.

Other Gain Areas

Florida: Florida's proved oil reserves increased by 26 million barrels. Exxon, operator of the Jay Field (the largest oil field in Florida), implemented a nitrogen injection project to enhance oil recovery.

Mississippi: Mississippi's proved oil reserves increased by 24 million barrels. The boost was primarily due to *extensions* and *revision increases*.

Utah: Operators in Utah added 21 million more barrels of proved crude oil reserves in 1996 through exploration and acquisitions.

Areas of Note: Large Reserves Declines

The following areas had large declines in crude oil proved reserves due to downward revisions or unreplaced production.

Alaska

Alaska's proved oil reserves declined by 306 million barrels in 1996, the greatest decline of any state in 1996. Alaska replaced only 40 percent of its production with new reserve additions.

Prudhoe Bay field: At Prudhoe Bay Field, the largest producing oil field in the United States, aggressive development drilling and surface optimization efforts created an additional 63,000 barrels per day of production in 1996. By original estimates, Prudhoe Bay would have been producing only 520,000 barrels per day in 1996. Instead, gross production levels averaged 855,000 barrels per day.{33}

Pacific Federal Offshore

Production from the Pacific Federal Offshore declined to 65 million barrels in 1996 (from 1995's level of 72 million). Also, reserve additions fell short of production by a substantial amount. Proved crude oil reserves declined 53 million barrels in this area in 1996.

Oklahoma

Oklahoma's proved oil reserves decreased by 44 million barrels in 1996. Although net revisions and adjustments and extensions were positive, they were not enough to replace 1996 production. Oklahoma's production increased by 1 million barrels from 1995's level (74 million barrels).

Other Decline Areas

California: California's proved oil reserves decreased by 25 million barrels. *Revision decreases* in the Coastal Region Onshore and unreplaced production from the State Offshore waters outpaced reserve additions in the San Joaquin Basin and the Los Angeles Basin.

Illinois: This State's proved oil reserves decreased by 21 percent (25 million barrels)

Colorado: This State's proved oil reserves decreased by 8 percent (21 million barrels).

Reserves in Nonproducing Reservoirs

Not all proved reserves of crude oil were contained in reservoirs that were producing in 1996. Operators reported 3,474 million barrels of proved reserves in nonproducing reservoirs. This is 2 percent less than reported in 1995 (3,563 million barrels).

The reasons for the nonproducing status of these proved reserves are not collected by the EIA. However, previous surveys showed that most of the wells or reservoirs were not producing for operational reasons. These included waiting for well workovers, drilling additional development or replacement wells, installing production or pipeline facilities, and awaiting depletion of other zones or reservoirs before recompletion in reservoirs not currently open to production.

Indicated Additional Reserves

In addition to proved reserves of crude oil, Category I and Category II operators estimate the quantities of crude oil, other than proved reserves, that may become economically recoverable from known reservoirs through the application of improved recovery techniques using current technology. The 1996 volume, 2,876 million barrels, is about 8 percent more than was reported in 1995 (2,669 million barrels).

Table 7 lists the indicated additional reserves by selected States and State subdivisions. The presence of large indicated additional reserves in Alaska, California, south Louisiana and west Texas implies that significant upward revisions to proved crude oil reserves could occur in the future.

Table 7. Reported Indicated Additional Crude Oil Reserves,^a 1996
(Million Barrels of 42 U.S. Gallons)

State and Subdivision	Indicated Additional Reserves	State and Subdivision	Indicated Additional Reserves
Alaska	952	North Dakota	6
Lower 48 States	1,924	Ohio	0
Alabama	0	Oklahoma	43
Arkansas	0	Pennsylvania	0
California	905	Texas	358
Coastal Region Onshore	261	RRC District 1	1
Los Angeles Basin Onshore	0	RRC District 2 Onshore	0
San Joaquin Basin Onshore	644	RRC District 3 Onshore	27
State Offshore	0	RRC District 4 Onshore	<1
Colorado	22	RRC District 5	0
Florida	0	RRC District 6	1
Illinois	0	RRC District 7B	4
Indiana	0	RRC District 7C	5
Kansas	<1	RRC District 8	217
Kentucky	0	RRC District 8A	99
Louisiana	331	RRC District 9	0
North	0	RRC District 10	4
South Onshore	322	State Offshore	0
State Offshore	9	Utah	46
Michigan	0	West Virginia	0
Mississippi	6	Wyoming	14
Montana	0	Federal Offshore	45
Nebraska	0	Pacific (California)	0
New Mexico	148	Gulf of Mexico (Louisiana)	40
East	148	Gulf of Mexico (Texas)	5
West	0	Miscellaneous ^b	0
		U.S. Total	2,876

^aIncludes only those operators who produced 400,000 barrels of crude oil or 2 billion cubic feet of natural gas, or both, during the report year (Category I or Category II operators).

^bIncludes Arizona, Missouri, Nevada, New York, South Dakota, Tennessee, and Virginia.

Source: Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," 1996.

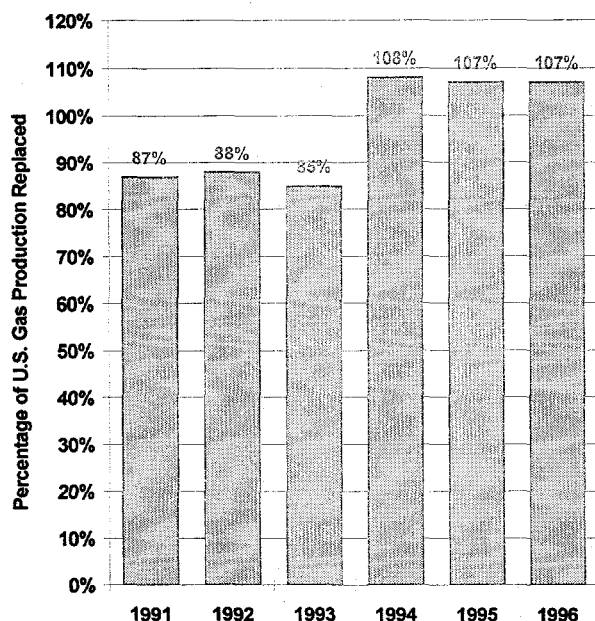
4. Natural Gas Statistics

Dry Natural Gas

Proved Reserves

The Nation's proved reserves of dry natural gas were 166,474 billion cubic feet, about 1 percent (1,328 billion cubic feet) more than in 1995 (Table 8), continuing the growth of the previous year. As a result of the consecutive increases, gas reserves now stand about 4 trillion cubic feet above the 1993 total. Additions to reserves (20,189 billion cubic feet) replaced 107 percent of gas production in 1996 (Figure 18). These are attributable, both to higher *revisions and adjustments* to the reserve estimates of old fields, and to total discoveries, including field *extensions, new field discoveries, and new reservoir discoveries in old fields*. U.S. proved reserves of dry natural gas increased in 1996, for the third year in a row. *Total discoveries* were up and equaled the highest level in the last 10 years. Over two-thirds of the *total discoveries* were in Texas and in the Gulf of Mexico Federal Offshore, where improved exploration and deepwater production technologies enhanced the ability to discover and develop offshore

Figure 18. Reserve Additions Exceed U.S. Natural Gas Production 3 Years in a Row



Source: Energy Information Administration, Office of Oil and Gas.

fields. It is anticipated that technological advances will continue to spur offshore development. The volumetric differences between the estimates reported in Table 8 (dry) and Table 9 (wet) are due to the removal of natural gas liquids at natural gas processing plants. All natural gas proved reserves estimates, in this report, exclude natural gas held in underground storage. The top 5 areas for reserves, which account for 65 percent of U.S. reserves, increased by about one-half of 1 percent, while the entire country increased by about 1 percent. Proved reserves by State are shown on the map in Figure 19.

Area	Percent of U.S. Gas Reserves
Texas	23
Gulf of Mexico Federal Offshore	17
New Mexico	10
Oklahoma	8
Wyoming	7
Total	65

Changes to reserves in 1996 are shown by State on the map in Figure 20. Notable increases are those that occurred in Texas (1,728 billion cubic feet), Michigan (767 billion cubic feet), Colorado (454 billion cubic feet), and Louisiana (269 billion cubic feet). Lower 48 States gas reserves had been generally declining since natural gas prices peaked, in 1983. However, they increased by 1 percent in 1994 and 1995, and were again up 1 percent (1,531 billion cubic feet) in 1996.

Revisions

Revisions and adjustments were down in 1996, but still higher than the prior 10-year average. The net volume of *revisions and adjustments* to reserves played a significant role in increasing U.S. natural gas proved reserves. It amounted to 7,871 billion cubic feet in 1996, a 5 percent decrease from 1995. Large revisions were attributed to new drilling programs, well performance, higher gas prices, and acquisitions.

Discoveries

Total discoveries were up in 1996. *Total discoveries* are those reserves attributable to field *extensions, new field discoveries, and new reservoir discoveries in old fields*; they result from drilling exploratory wells. *Total discoveries*

Table 8. Dry Natural Gas Proved Reserves, Reserves Changes, and Production, 1996
(Billion Cubic Feet at 14.73 psia and 60° Fahrenheit)

State and Subdivision	Published Proved Reserves 12/31/95	Changes in Reserves During 1996							Proved Reserves 12/31/96
		Adjustments (+,-)	Revision Increases (+)	Revision Decreases (-)	Extensions (+)	New Field Discoveries (+)	New Reservoir Discoveries in Old Fields (+)	Production (-)	
Alaska.....	9,497	145	202	171	6	61	0	446	9,294
Lower 48 States.....	155,649	3,640	16,930	12,875	7,751	1,390	3,110	18,415	157,180
Alabama.....	4,868	-44	502	97	177	0	0	373	5,033
Arkansas.....	1,563	33	96	108	57	2	27	200	1,470
California.....	2,243	-114	207	70	16	0	17	217	2,082
Coastal Region Onshore.....	153	8	16	9	1	0	0	13	156
Los Angeles Basin Onshore....	111	-3	16	5	0	0	0	10	109
San Joaquin Basin Onshore....	1,920	-119	174	53	15	0	17	186	1,768
State Offshore.....	59	0	1	3	0	0	0	8	49
Colorado.....	7,256	479	802	398	106	0	5	540	7,710
Florida.....	92	-3	12	0	0	0	0	5	96
Kansas.....	8,571	339	377	953	59	0	3	702	7,694
Kentucky.....	1,044	-55	43	12	10	1	10	58	983
Louisiana.....	9,274	626	1,111	975	575	13	440	1,521	9,543
North.....	2,788	141	473	173	249	4	10	387	3,105
South Onshore.....	5,648	486	534	705	297	9	392	957	5,704
State Offshore.....	838	-1	104	97	29	0	38	177	734
Michigan.....	1,294	581	453	152	17	76	0	208	2,061
Mississippi.....	663	13	87	88	43	0	1	88	631
Montana.....	782	16	59	12	2	0	1	52	796
New Mexico.....	17,491	-106	1,074	1,115	552	4	8	1,423	16,485
East.....	2,867	-45	440	191	139	4	8	432	2,790
West.....	14,624	-61	634	924	413	0	0	991	13,695
New York.....	197	20	36	12	3	0	9	21	232
North Dakota.....	463	22	36	22	5	3	0	45	462
Ohio.....	1,054	101	91	42	0	0	30	121	1,113
Oklahoma.....	13,438	122	1,886	1,602	714	30	66	1,580	13,074
Pennsylvania.....	1,482	139	243	103	38	0	29	132	1,696
Texas.....	36,542	1,081	4,649	3,456	3,204	516	623	4,889	38,270
RRC District 1.....	712	-39	211	36	142	2	0	86	906
RRC District 2 Onshore.....	1,251	127	175	210	132	0	37	190	1,322
RRC District 3 Onshore.....	3,866	290	531	500	533	169	316	856	4,349
RRC District 4 Onshore.....	7,709	94	1,073	1,139	979	95	221	1,263	7,769
RRC District 5.....	1,862	69	144	132	91	226	6	187	2,079
RRC District 6.....	5,726	128	610	272	285	0	5	583	5,899
RRC District 7B.....	440	63	121	51	11	0	5	69	520
RRC District 7C.....	3,107	51	585	159	430	0	11	370	3,655
RRC District 8.....	5,441	323	547	544	245	14	9	583	5,452
RRC District 8A.....	941	22	64	33	6	0	0	69	931
RRC District 9.....	738	-29	53	25	72	0	0	104	705
RRC District 10.....	4,436	-4	499	335	235	10	7	457	4,391
State Offshore.....	313	-14	36	20	43	0	6	72	292
Utah.....	1,580	44	125	79	126	17	0	180	1,633
Virginia.....	1,836	109	46	6	0	0	0	55	1,930
West Virginia.....	2,499	87	301	89	10	0	72	177	2,703
Wyoming.....	12,166	-122	1,193	569	411	0	23	782	12,320
Federal Offshore ^a	29,182	275	3,491	2,912	1,626	728	1,746	5,040	29,096
Pacific (California).....	1,265	24	19	46	31	0	0	49	1,244
Gulf of Mexico (Louisiana) ^a	21,392	256	2,796	2,317	1,369	619	1,447	3,706	21,856
Gulf of Mexico (Texas).....	6,525	-5	676	549	226	109	299	1,285	5,996
Miscellaneous ^b	^c 69	-3	10	3	0	0	0	6	67
U.S. Total.....	165,146	3,785	17,132	13,046	7,757	1,451	3,110	18,861	166,474

^aIncludes Federal offshore Alabama.

^bIncludes Arizona, Illinois, Indiana, Maryland, Missouri, Nebraska, Nevada, Oregon, South Dakota, and Tennessee.

^cIndicates the estimate is associated with a sampling error (95 percent confidence interval) that exceeds 20 percent of the estimated value.

Note: The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," and Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production." They may differ from the official Energy Information Administration production data for natural gas for 1996 contained in the *Natural Gas Annual 1996*, DOE/EIA-0131(96).

Source: Energy Information Administration, Office of Oil and Gas.

Table 9. Natural Gas Proved Reserves, Reserves Changes, and Production, Wet After Lease Separation, 1996 (Billion Cubic Feet at 14.73 psia and 60° Fahrenheit)

State and Subdivision	Published Proved Reserves 12/31/95	Changes in Reserves During 1996							Proved Reserves 12/31/96		
		Adjustments (+,-)	Revision Increases (+)	Revision Decreases (-)	Extensions (+)	New Field Discoveries (+)	New Reservoir Discoveries in Old Fields (+)	Production (-)	Total Gas	Non-associated Gas	Associated Dissolved Gas
Alaska	9,575	69	202	171	6	61	0	446	9,296	3,216	6,080
Lower 48 States	163,901	4,219	17,832	13,586	8,183	1,430	3,209	19,337	165,851	141,136	24,715
Alabama	4,930	-40	507	97	177	0	0	377	5,100	5,062	38
Arkansas	1,566	32	97	108	57	2	27	201	1,472	1,383	89
California	2,355	-111	217	74	16	0	18	228	2,193	610	1,583
Coastal Region Onshore	163	11	17	10	1	0	0	14	168	48	120
Los Angeles Basin Onshore	115	-4	16	5	0	0	0	10	112	0	112
San Joaquin Basin Onshore	2,018	-118	183	56	15	0	18	196	1,864	560	1,304
State Offshore	59	0	1	3	0	0	0	8	49	2	47
Colorado	7,592	493	854	428	112	0	5	564	8,064	7,009	1,055
Florida	110	0	15	0	0	0	0	6	119	0	119
Kansas	9,093	340	399	1,008	62	0	3	744	8,145	8,063	82
Kentucky	1,102	-49	45	12	11	1	10	62	1,046	1,022	24
Louisiana	9,891	577	1,168	1,036	604	14	470	1,611	10,077	9,038	1,039
North	2,863	145	486	178	256	4	10	397	3,189	2,934	255
South Onshore	6,166	401	572	755	317	10	419	1,025	6,105	5,478	627
State Offshore	862	31	110	103	31	0	41	189	783	626	157
Michigan	1,344	589	467	156	18	78	0	215	2,125	1,778	347
Mississippi	667	13	87	89	43	0	1	88	634	587	47
Montana	792	17	59	12	2	0	1	53	806	755	51
New Mexico	18,747	158	1,157	1,222	602	4	9	1,530	17,925	16,232	1,693
East	3,207	25	504	218	160	4	9	494	3,197	1,612	1,585
West	15,540	133	653	1,004	442	0	0	1,036	14,728	14,620	108
New York	197	20	36	12	3	0	9	21	232	229	3
North Dakota	518	19	41	25	6	3	0	50	512	257	255
Ohio	1,054	102	91	42	0	0	30	121	1,114	715	399
Oklahoma	14,295	176	2,013	1,710	762	32	70	1,686	13,952	12,929	1,023
Pennsylvania	1,488	138	244	103	38	0	29	132	1,702	1,655	47
Texas	39,736	1,175	5,037	3,719	3,445	543	662	5,287	41,592	33,432	8,160
RRC District 1	746	-24	225	39	152	2	0	93	969	523	446
RRC District 2 Onshore	1,371	120	189	227	143	0	40	206	1,430	1,178	252
RRC District 3 Onshore	4,156	290	568	535	570	181	338	916	4,652	3,612	1,040
RRC District 4 Onshore	8,021	138	1,123	1,191	1,023	99	231	1,321	8,123	7,877	246
RRC District 5	1,923	66	148	136	94	233	6	193	2,141	2,088	53
RRC District 6	6,036	166	647	287	303	0	5	618	6,252	5,690	562
RRC District 7B	539	52	142	60	12	0	6	81	610	378	232
RRC District 7C	3,468	45	649	176	477	0	12	412	4,063	3,371	692
RRC District 8	6,052	342	606	603	272	16	11	646	6,050	3,069	2,981
RRC District 8A	1,333	6	89	45	8	0	0	97	1,294	18	1,276
RRC District 9	868	7	65	31	89	0	0	128	870	749	121
RRC District 10	4,910	-20	550	369	259	12	7	504	4,845	4,592	253
State Offshore	313	-13	36	20	43	0	6	72	293	287	6
Utah	1,701	39	133	82	132	17	0	193	1,747	1,446	301
Virginia	1,836	109	46	6	0	0	0	55	1,930	1,930	0
West Virginia	2,588	83	312	92	10	0	74	182	2,793	2,722	71
Wyoming	12,712	79	1,267	605	437	0	24	830	13,084	12,260	824
Federal Offshore ^a	29,518	263	3,529	2,945	1,646	736	1,767	5,095	29,419	21,982	7,437
Pacific (California)	1,289	24	19	47	31	0	0	50	1,266	115	1,151
Gulf of Mexico (Louisiana) ^a	21,664	243	2,830	2,346	1,388	626	1,466	3,752	22,119	16,627	5,492
Gulf of Mexico (Texas)	6,565	-4	680	552	227	110	301	1,293	6,034	5,240	794
Miscellaneous ^b	^c 69	-3	11	3	0	0	0	6	68	40	28
U.S. Total	173,476	4,288	18,034	13,757	8,189	1,491	3,209	19,783	175,147	144,352	30,795

^aIncludes Federal offshore Alabama.

^bIncludes Arizona, Illinois, Indiana, Maryland, Missouri, Nebraska, Nevada, Oregon, South Dakota, and Tennessee.

^cIndicates the estimate is associated with a sampling error (95 percent confidence interval) that exceeds 20 percent of the estimated value.

Note: The production estimates in this table are based on data reported on Form EIA-23. They may differ from the official Energy Information Administration production data for natural gas for 1996 contained in the *Natural Gas Annual 1996*, DOE/EIA-0131(96).

Source: Energy Information Administration, Office of Oil and Gas.

Figure 19. 1996 Dry Natural Gas Proved Reserves by Area

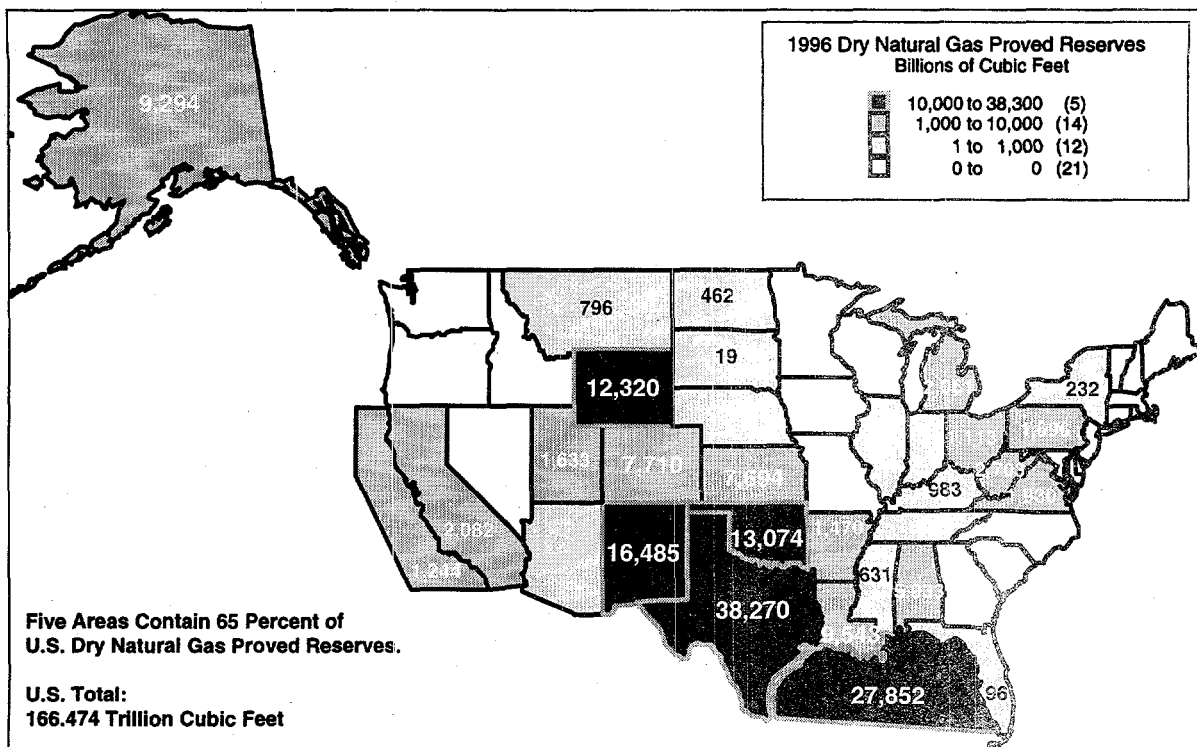
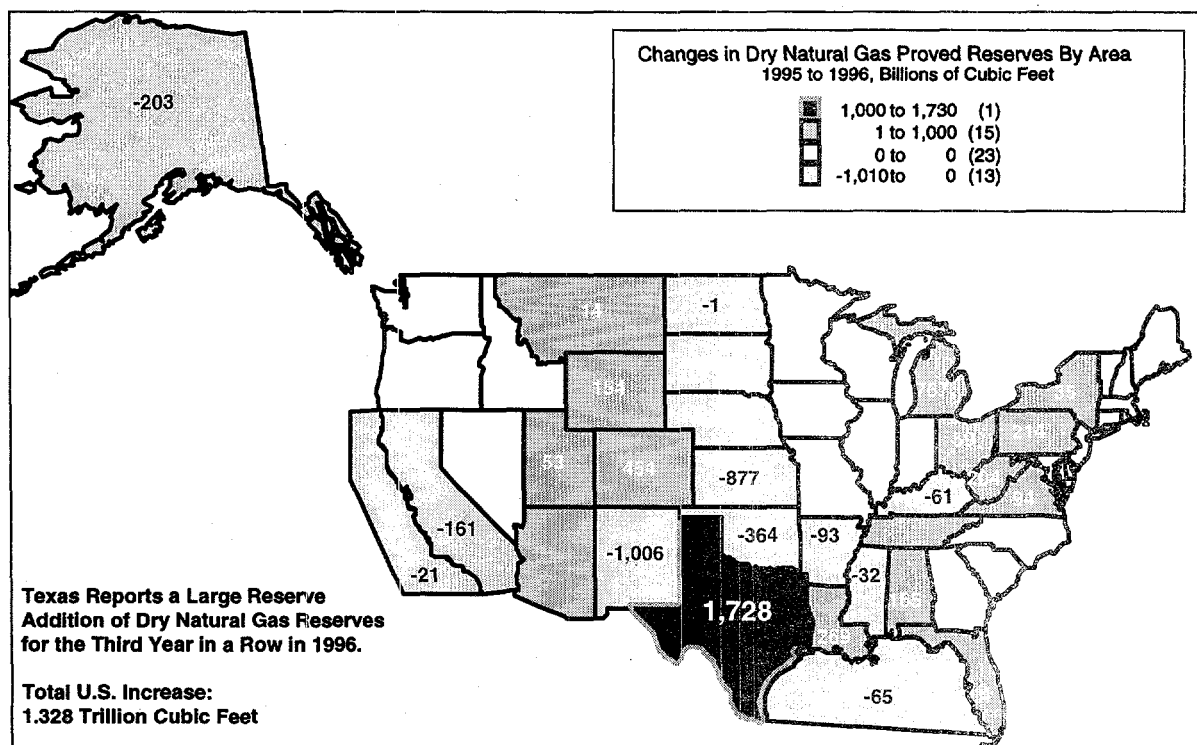


Figure 20. Changes in Dry Natural Gas Proved Reserves by Area, 1995 to 1996



Source: Energy Information Administration, Office of Oil and Gas.

of dry natural gas reserves were 12,318 billion cubic feet, an increase of 12 percent (1,357 billion cubic feet) from the level reported in 1995. These *total discoveries* are equivalent to 65 percent of the level of 1996 gas production. About one-third of the *total discoveries* were in the Gulf of Mexico Federal Offshore. Other areas with large volumes were Texas (35 percent or 4,343 billion cubic feet), particularly south Texas (10 percent), Louisiana (8 percent or 1,028 billion cubic feet), Oklahoma (7 percent or 810 billion cubic feet), and New Mexico (5 percent or 564 billion cubic feet). *New field discoveries* (1,451 billion cubic feet) were 13 percent lower than in 1995. Those areas with the largest *new field discoveries* were the Gulf of Mexico Federal Offshore with 50 percent of them (728 billion cubic feet) and Texas with 36 percent (516 billion cubic feet). *New reservoir discoveries in old fields* were 3,110 billion cubic feet, 27 percent higher than 1995. Among the areas with the largest *new reservoir discoveries in old fields* were the Gulf of Mexico Federal Offshore (56 percent or 1,746 billion cubic feet), Texas (20 percent), and Louisiana (14 percent). The Louisiana portion of the Gulf of Mexico Federal Offshore accounted for 47 percent of the *new reservoir discoveries in old fields*. *Extensions* were 7,757 billion cubic feet, 13 percent higher than in 1995. Areas with the largest *extensions* were Texas (41 percent) and the Gulf of Mexico Federal Offshore (21 percent).

Production

Dry natural gas production increased 5 percent in 1996 (Table 1). Of the five leading producing areas in 1996, only New Mexico increased its production. This increase was primarily the result of coalbed methane production in the San Juan basin. As in 1995, the Gulf of Mexico Federal Offshore and Texas were the leading producers of dry natural gas in 1996, each with over one-fourth of the U.S. total. The next three States combined, Oklahoma, Louisiana, and New Mexico (each with 8 percent) contributed another quarter of the production.

Wet Natural Gas

U. S. proved reserves of wet natural gas, as of December 31, 1996, were 175,147 billion cubic feet, an increase of 1 percent (1,671 billion cubic feet) from that reported in 1995 (Table 9). Proved wet natural gas reserves for the lower 48 States were higher by 1 percent (1,950 billion cubic feet) than in 1995, while those of Alaska decreased by 279 billion cubic feet. Dry natural gas is a roughly 5 percent lower in volume than

wet gas because of the shrinkage that results from the removal of liquids from the wet gas.

Nonassociated Natural Gas

Proved Reserves

U.S. proved reserves of nonassociated (NA) natural gas, wet after lease separation, of 144,352 billion cubic feet increased one percent (1,673 billion cubic feet) in 1996 (Table 10). This increase was the third in a row. Lower 48 States NA wet natural gas proved reserves increased by 1,767 billion cubic feet, or slightly over 1 percent. Those areas with the largest increases of NA wet natural gas reserves were Texas, Michigan, and Colorado. There were also large decreases of NA wet natural gas reserves in Kansas and New Mexico.

Discoveries

NA wet natural gas *total discoveries* of 11,338 billion cubic feet represented a increase of 17 percent (1,646 billion cubic feet) in 1996. The Gulf of Mexico Federal Offshore, Texas, Louisiana, and Oklahoma accounted for 9,400 billion cubic feet, or 83 percent of U.S. NA wet natural gas *total discoveries* in 1996, percentage wise the same percent as last year.

Production

U.S. production of NA wet natural gas increased by 5 percent (857 billion cubic feet) in 1996 (Table 10). As in 1995, the Gulf of Mexico Federal Offshore and Texas, each with over one-fourth of the U.S. total, were the leading producers of wet natural gas in 1996.

Associated-Dissolved Natural Gas

Proved Reserves

U.S. proved reserves of associated-dissolved (AD) natural gas, wet after lease separation, remained virtually the same in 1996 at 30,795 billion cubic feet (Table 11). Lower 48 States proved reserves of AD wet natural gas increased by 183 billion cubic feet to 24,715 billion cubic feet, offsetting the Alaska decrease of 185 billion cubic feet. Those areas of the country with the largest AD wet natural gas reserves were Texas (27 percent), the Gulf of Mexico Federal Offshore (20

Table 10. Nonassociated Natural Gas Proved Reserves, Reserves Changes, and Production, Wet After Lease Separation, 1996
(Billion Cubic Feet at 14.73 psia and 60° Fahrenheit)

State and Subdivision	Published Proved Reserves 12/31/95	Changes in Reserves During 1996						Production (-)	Proved Reserves 12/31/96
		Adjustments (+,-)	Revision Increases (+)	Revision Decreases (-)	Extensions (+)	New Field Discoveries (+)	New Reservoir Discoveries in Old Fields (+)		
Alaska	3,310	66	115	64	0	0	0	211	3,216
Lower 48 States	139,369	4,058	14,685	11,680	7,198	1,269	2,871	16,634	141,136
Alabama	4,886	-42	504	94	175	0	0	367	5,062
Arkansas	1,462	18	79	83	56	2	27	178	1,383
California	736	-111	90	44	3	0	17	81	610
Coastal Region Onshore	54	-4	8	5	0	0	0	5	48
Los Angeles Basin Onshore	0	0	0	0	0	0	0	0	0
San Joaquin Basin Onshore	679	-107	82	39	3	0	17	75	560
State Offshore	3	0	0	0	0	0	0	1	2
Colorado	6,520	507	611	252	112	0	5	494	7,009
Florida	0	0	0	0	0	0	0	0	0
Kansas	9,026	331	380	997	51	0	2	730	8,063
Kentucky	1,075	-48	44	11	11	1	10	60	1,022
Louisiana	8,890	620	995	911	454	12	437	1,459	9,038
North	2,730	146	449	172	149	2	1	371	2,934
South Onshore	5,446	447	464	654	279	10	411	925	5,478
State Offshore	714	27	82	85	26	0	25	163	626
Michigan	1,018	580	403	139	17	78	0	179	1,778
Mississippi	640	-7	74	74	34	0	1	81	587
Montana	739	20	52	11	1	0	1	47	755
New Mexico	17,069	158	866	1,125	530	2	4	1,272	16,232
East	1,648	-3	246	127	88	2	4	246	1,612
West	15,421	161	620	998	442	0	0	1,026	14,620
New York	195	20	35	12	3	0	9	21	229
North Dakota	255	4	14	1	0	3	0	18	257
Ohio	699	51	34	35	0	0	23	57	715
Oklahoma	13,067	281	1,886	1,600	738	32	63	1,538	12,929
Pennsylvania	1,452	135	230	103	38	0	29	126	1,655
Texas	31,949	1,006	3,926	3,144	2,977	526	658	4,466	33,432
RRC District 1	498	-9	79	30	51	2	0	68	523
RRC District 2 Onshore	1,126	94	172	216	143	0	40	181	1,178
RRC District 3 Onshore	3,196	233	355	446	499	176	338	739	3,612
RRC District 4 Onshore	7,812	66	1,094	1,168	1,023	99	231	1,280	7,877
RRC District 5	1,876	38	145	116	93	233	6	187	2,088
RRC District 6	5,425	174	617	238	293	0	5	586	5,690
RRC District 7B	263	95	115	49	1	0	6	53	378
RRC District 7C	2,828	70	522	138	402	0	12	325	3,371
RRC District 8	3,218	280	235	368	85	4	7	392	3,069
RRC District 8A	15	-1	2	0	4	0	0	2	18
RRC District 9	730	-3	53	12	89	0	0	108	749
RRC District 10	4,656	-19	502	343	251	12	7	474	4,592
State Offshore	306	-12	35	20	43	0	6	71	287
Utah	1,424	17	92	62	124	17	0	166	1,446
Virginia	1,836	109	46	6	0	0	0	55	1,930
West Virginia	2,514	94	296	89	10	0	74	177	2,722
Wyoming	11,833	113	1,135	542	417	0	24	720	12,260
Federal Offshore ^a	22,047	206	2,885	2,345	1,447	596	1,487	4,341	21,982
Pacific (California)	94	1	1	0	27	0	0	8	115
Gulf of Mexico (Louisiana) ^a	16,279	214	2,241	1,824	1,202	495	1,191	3,171	16,627
Gulf of Mexico (Texas)	5,674	-9	643	521	218	101	296	1,162	5,240
Miscellaneous ^b	37	-4	8	0	0	0	0	1	40
U.S. Total	142,679	4,124	14,800	11,744	7,198	1,269	2,871	16,845	144,352

^aIncludes Federal offshore Alabama.

^bIncludes Arizona, Illinois, Indiana, Maryland, Missouri, Nebraska, Nevada, Oregon, South Dakota, and Tennessee.

Note: The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves." They may differ from the official Energy Information Administration production data for natural gas for 1996 contained in the *Natural Gas Annual 1996*, DOE/EIA-0131(96).

Source: Energy Information Administration, Office of Oil and Gas.

Table 11. Associated-Dissolved Natural Gas Proved Reserves, Reserves Changes, and Production, Wet After Lease Separation, 1996
(Billion Cubic Feet at 14.73 psia and 60° Fahrenheit)

State and Subdivision	Published Proved Reserves 12/31/95	Changes in Reserves During 1996						Proved Reserves 12/31/96
		Adjustments (+,-)	Revision Increases (+)	Revision Decreases (-)	Extensions (+)	New Field Discoveries (+)	New Reservoir Discoveries in Old Fields (+)	Production (-)
Alaska.....	6,265	3	87	107	6	61	0	235
Lower 48 States	24,532	161	3,147	1,906	985	161	338	2,703
Alabama.....	44	2	3	3	2	0	0	10
Arkansas.....	104	14	18	25	1	0	0	23
California.....	1,619	0	127	30	13	0	1	147
Coastal Region Onshore.....	109	15	9	5	1	0	0	9
Los Angeles Basin Onshore	115	-4	16	5	0	0	0	10
San Joaquin Basin Onshore	1,339	-11	101	17	12	0	1	121
State Offshore.....	56	0	1	3	0	0	0	7
Colorado.....	1,072	-14	243	176	0	0	0	70
Florida.....	110	0	15	0	0	0	0	6
Kansas.....	67	9	19	11	11	0	1	14
Kentucky.....	27	-1	1	1	0	0	0	2
Louisiana.....	1,001	-43	173	125	150	2	33	152
North.....	133	-1	37	6	107	2	9	26
South Onshore.....	720	-46	108	101	38	0	8	100
State Offshore.....	148	4	28	18	5	0	16	26
Michigan.....	326	9	64	17	1	0	0	36
Mississippi.....	27	20	13	15	9	0	0	7
Montana.....	53	-3	7	1	1	0	0	6
New Mexico.....	1,678	0	291	97	72	2	5	258
East.....	1,559	28	258	91	72	2	5	248
West.....	119	-28	33	6	0	0	0	10
New York.....	2	0	1	0	0	0	0	0
North Dakota.....	263	15	27	24	6	0	0	32
Ohio.....	355	51	57	7	0	0	7	64
Oklahoma.....	1,228	-105	127	110	24	0	7	148
Pennsylvania.....	36	3	14	0	0	0	0	6
Texas.....	7,787	169	1,111	575	468	17	4	821
RRC District 1.....	248	-15	146	9	101	0	0	25
RRC District 2 Onshore.....	245	26	17	11	0	0	0	25
RRC District 3 Onshore.....	960	57	213	89	71	5	0	177
RRC District 4 Onshore.....	209	72	29	23	0	0	0	41
RRC District 5.....	47	28	3	20	1	0	0	6
RRC District 6.....	611	-8	30	49	10	0	0	32
RRC District 7B.....	276	-43	27	11	11	0	0	28
RRC District 7C.....	640	-25	127	38	75	0	0	87
RRC District 8.....	2,834	62	371	235	187	12	4	254
RRC District 8A.....	1,318	7	87	45	4	0	0	95
RRC District 9.....	138	10	12	19	0	0	0	20
RRC District 10.....	254	-1	48	26	8	0	0	30
State Offshore.....	7	-1	1	0	0	0	0	1
Utah.....	277	22	41	20	8	0	0	27
Virginia.....	0	0	0	0	0	0	0	0
West Virginia.....	74	-11	16	3	0	0	0	5
Wyoming.....	879	-34	132	63	20	0	0	110
Federal Offshore ^a	7,471	57	644	600	199	140	280	754
Pacific (California).....	1,195	23	18	47	4	0	0	42
Gulf of Mexico (Louisiana) ^a	5,385	29	589	522	186	131	275	581
Gulf of Mexico (Texas).....	891	5	37	31	9	9	5	131
Miscellaneous ^b	32	1	3	3	0	0	0	5
U.S. Total.....	30,797	164	3,234	2,013	991	222	338	2,938

^aIncludes Federal offshore Alabama.

^bIncludes Arizona, Illinois, Indiana, Maryland, Missouri, Nebraska, Nevada, Oregon, South Dakota, and Tennessee.

Note: The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves." They may differ from the official Energy Information Administration production data for natural gas for 1996 contained in the *Natural Gas Annual 1996*, DOE/EIA-0131(96).

Source: Energy Information Administration, Office of Oil and Gas.

percent), and Alaska (20 percent). These areas logically correspond to those areas of the country with the largest volumes of crude oil reserves and production.

Production

U.S. production of AD wet natural gas increased by 2 percent (52 billion cubic feet) in 1996 (Table 11). Those areas of the country with the largest AD wet natural gas production were Texas (28 percent) and the Gulf of Mexico Federal Offshore (24 percent).

Coalbed Methane

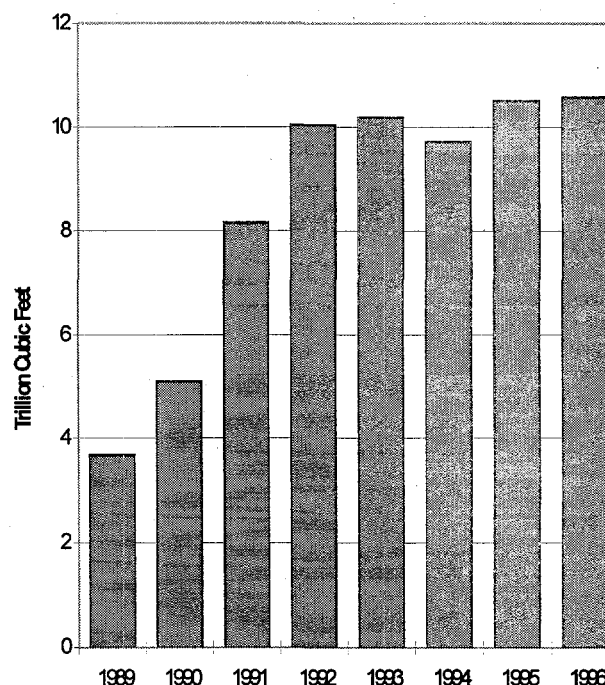
Proved Reserves

Growth of reserves of coalbed methane resumed; they continue to account for 6 percent of 1996 natural gas reserves (Table 12). Reserves in coalbed methane fields increased to 10,566 billion cubic feet, 1 percent more than in 1995 (Figure 21). Coalbed methane proved reserves are principally in New Mexico, Colorado, Alabama, and Virginia. Estimates of proved coalbed methane reserves increased in Colorado and Virginia and decreased in Alabama and New Mexico in 1996. The coalbed methane volumes are a subset of the volumes reported in Tables 8, 9, 10, 11, and 13.

Production

Coalbed methane production grew by more than 5 percent in 1996. Most of the increase occurred in the Basin and Ignacio-Blanco fields of the San Juan basin, and in the Oakwood and Nora fields of southern Virginia.

Figure 21. Coalbed Methane Proved Reserves 1989-1996



Source: Energy Information Administration, Office of Oil and Gas.

Table 12. U.S. Coalbed Methane Proved Reserves and Production, 1993-1996
(Billion Cubic Feet at 14.73 psia and 60° Fahrenheit)

State	1993 Reserves	1993 Production	1994 Reserves	1994 Production	1995 Reserves	1995 Production	1996 Reserves	1996 Production
Alabama	1,237	103	976	108	972	109	823	98
Colorado	3,107	125	2,913	179	3,461	226	3,711	274
New Mexico	4,775	486	4,137	530	4,299	574	4,180	575
Others ^a	1,065	18	1,686	34	1,767	47	1,852	56
Total	10,184	732	9,712	851	10,499	956	10,566	1,003

^aIncludes Kansas, Oklahoma, Pennsylvania, Utah, Virginia, West Virginia, and Wyoming.

Source: Energy Information Administration, Office of Oil and Gas.

Reserves in Nonproducing Reservoirs

Proved natural gas reserves, wet after lease separation, of 33,049 billion cubic feet were reported in nonproducing reservoirs in 1996 (Table 13). This was 627 billion cubic feet, or about 2 percent, less than in 1995. Three areas, Louisiana, New Mexico, and the Gulf of Mexico Federal Offshore, accounted for most of the decrease, while Texas, Wyoming, Michigan, Utah, Virginia, and West Virginia were states where there was an increase. About 39 percent of the reserves in nonproducing reservoirs are located in the Gulf of

Mexico Federal Offshore area. Much of the new deepwater reserves are presently in the nonproducing category. Proved reserves in nonproducing reservoirs were reported by Category I and II operators, who collectively account for about 93 percent of the estimated total wet natural gas production in the United States. Past surveys showed that most of the wells or reservoirs were not producing for operational reasons. These included waiting for well workovers, drilling additional development or replacement wells, installing production or pipeline facilities, and awaiting depletion of other zones or reservoirs before recompletion in reservoirs not currently open to production.

Table 13. Reported Reserves of Natural Gas, Wet After Lease Separation, in Nonproducing Reservoirs, 1996^a
(Billion Cubic Feet at 14.73 psia and 60° Fahrenheit)

State and Subdivision	Nonassociated Gas	Associated-Dissolved Gas	Total
Alaska	69	61	130
Lower 48 States	27,691	5,228	32,919
Alabama	452	4	456
Arkansas	149	7	156
California	31	125	156
Coastal Region Onshore	3	41	44
Los Angeles Basin Onshore	0	24	24
San Joaquin Basin Onshore	28	59	87
State Offshore	0	1	1
Colorado	627	270	897
Florida	0	0	0
Kansas	178	7	185
Kentucky	124	0	124
Louisiana	2,357	349	2,706
North	639	96	735
South Onshore	1,486	202	1,688
State Offshore	232	51	283
Michigan	197	20	217
Mississippi	54	6	60
Montana	94	2	96
New Mexico	1,798	74	1,872
East	187	70	257
West	1,611	4	1,615
New York	5	0	5
North Dakota	118	10	128
Ohio	19	1	20
Oklahoma	1,158	70	1,228
Pennsylvania	57	0	57
Texas	6,979	750	7,729
RRC District 1	75	129	204
RRC District 2 Onshore	244	69	313
RRC District 3 Onshore	500	62	562
RRC District 4 Onshore	2,517	83	2,600
RRC District 5	708	3	711
RRC District 6	1,538	28	1,566
RRC District 7B	5	4	9
RRC District 7C	419	57	476
RRC District 8	357	238	595
RRC District 8A	5	62	67
RRC District 9	7	2	9
RRC District 10	478	9	487
State Offshore	126	4	130
Utah	258	107	365
Virginia	101	0	101
West Virginia	198	4	202
Wyoming	2,983	24	3,007
Federal Offshore ^b	9,753	3,382	13,135
Pacific (California)	66	44	110
Gulf of Mexico (Louisiana) ^b	7,835	2,954	10,789
Gulf of Mexico (Texas)	1,852	384	2,236
Miscellaneous ^c	1	16	17
US Total	27,760	5,289	33,049

^aIncludes only those operators who produced 400,000 barrels of crude oil or 2 billion cubic feet of natural gas, or both, during the report year (Category I or Category II operators).

^bIncludes Federal Offshore Alabama.

^cIncludes Arizona, Illinois, Indiana, Maryland, Missouri, Nebraska, Nevada, Oregon, South Dakota, and Tennessee.

Source: Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," 1996.

5. Natural Gas Liquids Statistics

Natural Gas Liquids

Proved Reserves

U.S. natural gas liquids proved reserves increased 6 percent to 7,823 million barrels in 1996 (Table 14). The 424 million barrel increase occurred predominantly in the lower 48 States, which increased to 7,486 million barrels in 1996. This was the second increase in the lower 48 States since 1988. Overall, reserve additions replaced 150 percent of 1996 natural gas liquids production. Reserve additions from Texas, Gulf of Mexico Federal Offshore, and New Mexico accounted for the majority of the reserve additions. The reserves of three areas account for 56 percent of the Nation's natural gas liquids proved reserves. Of these, Texas had 33 percent, New Mexico had 14 percent, the Gulf of Mexico Federal Offshore had 10 percent, and Oklahoma and Utah-Wyoming each had 9 percent. The volumes of natural gas liquids proved reserves and production shown in Table 14 are the sum of the natural gas plant liquid volumes listed in Table 15 and the lease condensate volumes listed in Table 16. From 1986 through 1996, reserves of natural gas liquids have declined 4 percent.

Discoveries

Total discoveries of natural gas liquids reserves increased by 13 percent in 1996 to 625 million barrels, the highest level since 1986. Areas with the largest *total discoveries* were Texas (42 percent), the Gulf of Mexico Federal Offshore (26 percent), Louisiana (10 percent), Oklahoma (7 percent), and New Mexico (6 percent). *New field discoveries*, at 65 million barrels, were 13 million barrels more than in 1995. Areas with the largest *new field discoveries* were the Gulf of Mexico Federal Offshore (45 percent), Texas (37 percent), and Alaska (14 percent). *New reservoir discoveries in old fields*, at 109 million barrels, were 63 percent more than they were in 1995. Areas with the largest *new reservoir discoveries in old fields* were the Gulf of Mexico Federal Offshore (34 percent), Texas (33 percent), and Louisiana (26 percent). *Extensions* were 451 million barrels, an increase of 4 percent over 1995. Areas with the largest *extensions* were Texas (44 percent), the Gulf of Mexico Federal Offshore (22 percent), Oklahoma (9 percent), and New Mexico and Louisiana (8 percent each).

Production

Natural gas liquids production increased 7 percent to 850 million barrels in 1996. Alaskan production increased 10 percent to 33 million barrels in 1996, while lower 48 States production increased 7 percent to 817 million barrels. Five areas accounted for about 79 percent of the Nation's natural gas liquids production. Of these, Texas had 37 percent, the Gulf of Mexico Federal Offshore had 12 percent, Louisiana had 11 percent, Oklahoma had 10 percent, and New Mexico had 9 percent.

Natural Gas Plant Liquids

Proved Reserves

Natural gas plant liquids proved reserves increased 5 percent in 1996 to 6,516 million barrels (Table 15). Five areas accounted for about 76 percent of the Nation's natural gas plant liquids proved reserves: Texas (36 percent), New Mexico (15 percent), Utah-Wyoming (10 percent), Oklahoma (9 percent), and Louisiana (6 percent). The level of natural gas plant liquids reserves depends on both the volume of natural gas reserves and the amount of plant liquids that can be economically extracted from them per unit volume. In 1996, more liquids were extracted per cubic foot of gas production than in 1995. Therefore, the ratio of liquids reserves to natural gas reserves increased, leading to a larger percentage increase in the proved reserves of natural gas plant liquids than in natural gas reserves.

Production

Natural gas plant liquids production increased 7 percent to 688 million barrels in 1996 (Table 15). Five areas accounted for about 78 percent of the Nation's natural gas plant liquids production: Texas (40 percent), New Mexico (11 percent), Oklahoma (11 percent), Louisiana (9 percent), and Utah-Wyoming (6 percent).

Table 14. Natural Gas Liquids Proved Reserves, Reserves Changes, and Production, 1996
(Million Barrels of 42 U.S. Gallons)

State and Subdivision	Published Proved Reserves 12/31/95	Changes in Reserves During 1996							Proved Reserves 12/31/96
		Adjustments (+,-)	Revision Increases (+)	Revision Decreases (-)	Extensions (+)	New Field Discoveries (+)	New Reservoir Discoveries in Old Fields (+)	Production (-)	
Alaska	306	57	12	15	1	9	0	33	337
Lower 48 States	7,093	417	832	654	450	56	109	817	7,486
Alabama	120	5	7	2	0	0	0	11	119
Arkansas	6	-1	0	0	0	0	0	1	4
California	92	1	9	3	1	0	1	9	92
Coastal Region Onshore	8	2	1	1	0	0	0	1	9
Los Angeles Basin Onshore	4	-1	0	0	0	0	0	0	3
San Joaquin Basin Onshore	80	0	8	2	1	0	1	8	80
State Offshore	0	0	0	0	0	0	0	0	0
Colorado	273	10	45	27	5	0	0	19	287
Florida	17	3	3	0	0	0	0	1	22
Kansas	369	23	16	42	3	0	0	31	338
Kentucky	43	5	2	1	0	0	0	3	46
Louisiana	601	-18	62	69	34	0	28	95	543
North	79	6	12	7	8	0	0	13	85
South Onshore	495	-50	43	55	25	0	24	71	411
State Offshore	27	26	7	7	1	0	4	11	47
Michigan	45	5	13	6	0	2	0	6	53
Mississippi	8	-1	1	1	1	0	0	1	7
Montana	8	-2	1	0	0	0	0	0	7
New Mexico	943	177	63	83	37	0	1	79	1,059
East	247	56	48	23	16	0	1	46	299
West	696	121	15	60	21	0	0	33	760
North Dakota	53	-2	3	2	0	0	0	4	48
Oklahoma	674	31	101	85	41	1	3	82	684
Texas	2,524	43	317	221	200	24	36	317	2,606
RRC District 1	26	9	10	2	7	0	0	4	46
RRC District 2 Onshore	93	7	12	15	8	0	2	14	93
RRC District 3 Onshore	272	-2	38	31	35	14	19	56	289
RRC District 4 Onshore	287	26	49	46	43	3	12	51	323
RRC District 5	54	-2	3	3	2	5	0	5	54
RRC District 6	271	18	30	14	15	0	0	30	290
RRC District 7B	70	-7	15	7	1	0	1	8	65
RRC District 7C	274	-8	51	19	35	0	1	31	303
RRC District 8	444	9	43	44	21	1	1	46	429
RRC District 8A	284	-13	18	9	2	0	0	20	262
RRC District 9	94	25	9	4	12	0	0	17	119
RRC District 10	353	-19	39	26	19	1	0	35	332
State Offshore	2	0	0	1	0	0	0	0	1
Utah and Wyoming	593	123	72	39	29	0	1	52	727
West Virginia	62	-4	7	2	0	0	2	4	61
Federal Offshore ^a	655	20	109	71	99	29	37	102	776
Pacific (California)	25	0	0	1	0	0	0	1	23
Gulf of Mexico (Louisiana) ^a	496	16	98	60	96	26	33	84	621
Gulf of Mexico (Texas) ^b	134	4	11	10	3	3	4	17	132
Miscellaneous ^b	7	-1	1	0	0	0	0	0	7
U.S. Total	7,399	474	844	669	451	65	109	850	7,823

^aIncludes Federal offshore Alabama.

^bIncludes Arizona, Illinois, Indiana, Maryland, Missouri, Nebraska, Nevada, New York, Ohio, Oregon, Pennsylvania, South Dakota, Tennessee, and Virginia.

Note: The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," and Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production." They may differ from the official Energy Information Administration production data for natural gas and natural gas liquids for 1996 contained in the publications *Petroleum Supply Annual 1996*, DOE/EIA-0340(96) and *Natural Gas Annual 1996* DOE/EIA-0131(96).

Source: Energy Information Administration, Office of Oil and Gas.

Table 15. Natural Gas Plant Liquids Proved Reserves and Production, 1996
(Million Barrels of 42 U.S. Gallons)

State and Subdivision	1996 Reserves	1996 Production	State and Subdivision	1996 Reserves	1996 Production
Alaska	337	33	North Dakota	40	4
Lower 48 States.....	6,179	655	Oklahoma	615	74
Alabama	52	4	Texas	2,337	277
Arkansas	2	0	RRC District 1	44	4
California	89	9	RRC District 2 Onshore	85	12
Coastal Region Onshore	9	1	RRC District 3 Onshore	210	41
Los Angeles Basin Onshore	3	0	RRC District 4 Onshore	241	39
San Joaquin Basin Onshore	77	8	RRC District 5	48	4
State Offshore	0	0	RRC District 6	242	24
Colorado	254	17	RRC District 7B	64	8
Florida	22	1	RRC District 7C	285	29
Kansas	336	31	RRC District 8	417	45
Kentucky	45	3	RRC District 8A	262	20
Louisiana	381	65	RRC District 9	116	17
North	61	8	RRC District 10	323	34
South Onshore	284	48	State Offshore	0	0
State Offshore	36	9	Utah and Wyoming	639	44
Michigan	48	5	West Virginia	60	4
Mississippi	2	0	Federal Offshore ^a	245	42
Montana	7	0	Pacific (California)	19	1
New Mexico	998	75	Gulf of Mexico (Louisiana) ^a	199	35
East	287	44	Gulf of Mexico (Texas)	27	6
West	711	31	Miscellaneous ^b	7	0
			U.S. Total	6,516	688

^aIncludes Federal Offshore Alabama.

^bIncludes Arizona, Illinois, Indiana, Maryland, Missouri, Nebraska, Nevada, New York, Ohio, Oregon, Pennsylvania, South Dakota, Tennessee, and Virginia.

Note: The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," and Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production." They may differ from the official Energy Information Administration production data for natural gas plant liquids for 1996 contained in the publications *Petroleum Supply Annual 1996*, DOE/EIA-0340(96) and *Natural Gas Annual 1996*, DOE/EIA-0131(96).

Source: Energy Information Administration, Office of Oil and Gas.

Lease Condensate

Proved Reserves

Proved reserves of lease condensate in the United States were 1,307 million barrels in 1996 (Table 16). This was 110 million barrels or 9 percent higher than in 1995. The reserves of four areas account for about 80 percent of the Nation's lease condensate proved reserves. Of these, the Gulf of Mexico Federal Offshore had 40 percent, Texas had 21 percent, Louisiana had 12 percent, and Utah--Wyoming had 7 percent.

Production

Production of lease condensate was 162 million barrels, an increase of 17 million barrels, or 12 percent, in 1996. The production from four areas accounts for about 85 percent of the Nation's lease condensate production. Of

these, the Gulf of Mexico Federal Offshore had 37 percent, Texas had 25 percent, Louisiana had 19 percent, and Oklahoma had 5 percent.

Reserves in Nonproducing Reservoirs

Like crude oil and natural gas, not all lease condensate proved reserves were contained in reservoirs that were producing during 1996. Proved reserves of 494 million barrels of lease condensate, an increase of 12 percent from 1995, were reported in nonproducing reservoirs in 1996. These reserves were reported by Category I and Category II operators who collectively accounted for more than 97 percent of total lease condensate production. About 63 percent of the nonproducing lease condensate reserves were located in the Gulf of Mexico Federal Offshore.

Table 16. Lease Condensate Proved Reserves and Production, 1996
(Million Barrels of 42 U.S. Gallons)

State and Subdivision	1996 Reserves	1996 Production	State and Subdivision	1996 Reserves	1996 Production
Alaska.....	0	0	North Dakota.....	8	0
Lower 48 States.....	1,307	162	Oklahoma.....	69	8
Alabama.....	67	7	Texas.....	269	40
Arkansas.....	2	1	RRC District 1.....	2	0
California.....	3	0	RRC District 2 Onshore.....	8	2
Coastal Region Onshore.....	0	0	RRC District 3 Onshore.....	79	15
Los Angeles Basin Onshore....	0	0	RRC District 4 Onshore.....	82	12
San Joaquin Basin Onshore....	3	0	RRC District 5.....	6	1
State Offshore.....	0	0	RRC District 6.....	48	6
Colorado.....	33	2	RRC District 7B.....	1	0
Florida.....	0	0	RRC District 7C.....	18	2
Kansas.....	2	0	RRC District 8.....	12	1
Kentucky.....	1	0	RRC District 8A.....	0	0
Louisiana.....	162	30	RRC District 9.....	3	0
North.....	24	5	RRC District 10.....	9	1
South Onshore.....	127	23	State Offshore.....	1	0
State Offshore.....	11	2	Utah and Wyoming.....	88	8
Michigan.....	5	1	West Virginia.....	1	0
Mississippi.....	5	1	Federal Offshore ^a	531	60
Montana.....	0	0	Pacific (California).....	4	0
New Mexico.....	61	4	Gulf of Mexico (Louisiana) ^a ...	422	49
East.....	12	2	Gulf of Mexico (Texas).....	105	11
West.....	49	2	Miscellaneous ^b	0	0
			U.S. Total.....	1,307	162

^aIncludes Federal Offshore Alabama.

^bIncludes Arizona, Illinois, Indiana, Maryland, Missouri, Nebraska, Nevada, New York, Ohio, Oregon, Pennsylvania, South Dakota, Tennessee, and Virginia.

Note: The estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves" 1996.

Source: Energy Information Administration, Office of Oil and Gas.

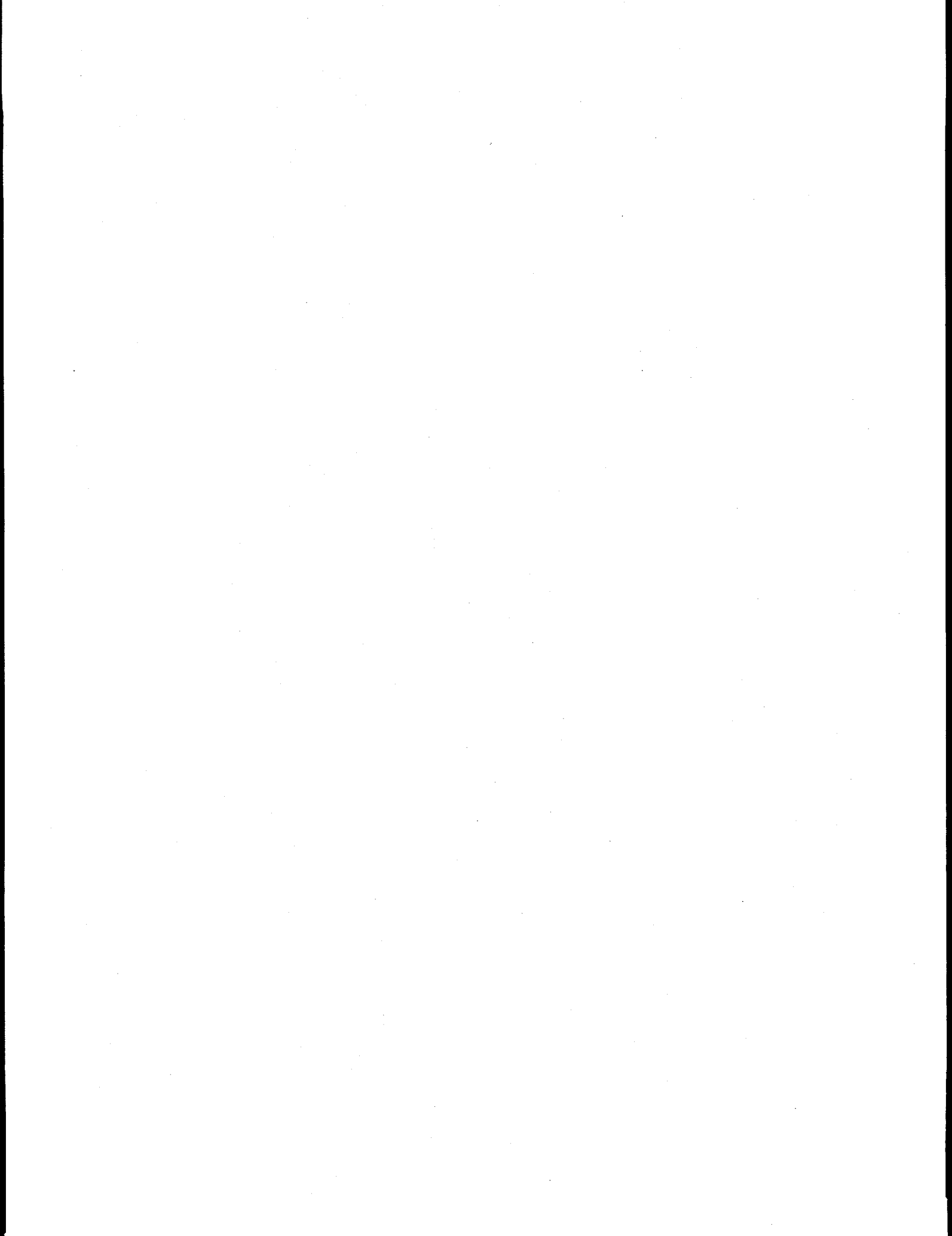
References

1. Energy Information Administration. October 1987. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1986 Annual Report*. DOE/EIA-0216(86). Washington, DC.
2. Energy Information Administration. October 1988. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1987 Annual Report*. DOE/EIA-0216(87). Washington, DC.
3. Energy Information Administration. September 1989. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1988 Annual Report*. DOE/EIA-0216(88). Washington, DC.
4. Energy Information Administration. October 1990. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1989 Annual Report*. DOE/EIA-0216(89). Washington, DC.
5. Energy Information Administration. September 1991. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1990 Annual Report*. DOE/EIA-0216(90). Washington, DC.
6. Energy Information Administration. November 1992. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1991 Annual Report*. DOE/EIA-0216(91). Washington, DC.
7. Energy Information Administration. October 1993. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1992 Annual Report*. DOE/EIA-0216(92). Washington, DC.
8. Energy Information Administration. October 1994. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1993 Annual Report*. DOE/EIA-0216(93). Washington, DC.
9. Energy Information Administration. October 1995. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1994 Annual Report*. DOE/EIA-0216(94). Washington, DC.
10. Energy Information Administration. November 1996. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1995 Annual Report*. DOE/EIA-0216(95). Washington, DC.
11. Energy Information Administration. February 1980. *U.S. Crude Oil and Natural Gas Reserves 1977 Annual Report*. DOE/EIA-0216(77). Washington, DC.
12. Energy Information Administration. September 1980. *U.S. Crude Oil and Natural Gas Reserves 1978 Annual Report*. DOE/EIA-0216(78). Washington, DC.
13. Energy Information Administration. August 1981. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1979 Annual Report*. DOE/EIA-0216(79). Washington, DC.
14. Energy Information Administration. October 1981. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1980 Annual Report*. DOE/EIA-0216(80). Washington, DC.
15. Energy Information Administration. August 1982. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1981 Annual Report*. DOE/EIA-0216(81). Washington, DC.
16. Energy Information Administration. August 1983. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1982 Annual Report*. DOE/EIA-0216(82). Washington, DC.
17. Energy Information Administration. October 1984. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1983 Annual Report*. DOE/EIA-0216(83). Washington, DC.
18. Energy Information Administration. October 1985. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1984 Annual Report*. DOE/EIA-0216(84). Washington, DC.
19. Energy Information Administration. October 1986. *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1985 Annual Report*. DOE/EIA-0216(85). Washington, DC.
20. Energy Information Administration. September 1997. *Petroleum Marketing Monthly*. DOE/EIA-0380(97/09). Washington, DC, pp. 41-45.
21. Energy Information Administration. July 1997. *Natural Gas Monthly*. DOE/EIA-0130(97/07). Washington, DC, p.12.
22. American Petroleum Institute, American Gas Association, and Canadian Petroleum Association. *Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas in the United States and Canada as of December 31, 1979*. Vol. 34. June 1980. Washington, DC.

23. Energy Information Administration, August 1990. *U.S. Oil and Gas Reserves by Year of Field Discovery*. DOE/EIA-0534. Washington, DC.
24. *Oil & Gas Journal*. December 30, 1996. "Worldwide Look and Reserves and Production". Vol. 93, No. 52. Tulsa, OK, p. 41.
25. *World Oil*. August 1997. "World Trends". Houston, TX, p. 38.
26. Energy Information Administration. July 1997. *1996 Annual Energy Review*. DOE/EIA-0384(96). Washington, DC, p. 5.
27. Energy Information Administration. July 1997. *1996 Annual Energy Review*. DOE/EIA-0384(96). Washington, DC, p. 182.
28. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office. Press Release, September 26, 1996.
29. Shell Oil Company, Houston, TX. Press Release, August 8, 1996.
30. Texaco Incorporated, 1996 *Annual Report*, White Plains, NY, p. 13.
31. Oryx Energy Company, Dallas, TX. Press Release, September 12, 1996.
32. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office. "Announced Natural Gas and Oil Deepwater Discoveries and Fields for Active Leases in the Gulf of Mexico", Electronic data table: <http://www.mms.gov/omm/gomr/homepg/offshore/deepwatr/deeptbl2.html>, updated August 25, 1997.
33. Atlantic Richfield Company, 1996 *Annual Report*, Los Angeles, CA, p. 10.
34. U.S. Department of Energy. *DOE This Month*. Vol. 15, No. 8. Washington, DC, August 1992. p. 13.
35. U.S. Department of the Interior. 1995. *National Assessment of the United States Oil and Gas Resources*. U.S. Geological Survey Circular 1118. Denver, CO, pp. 5-6.
36. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office. August 1995. *Estimated Proved Oil and Gas Reserves, Gulf of Mexico, December 31, 1994*. OCS Report MMS 94-0045. New Orleans, LA, pp. 5-6.

Appendix A

Operator Data by Size Class



Operator Data by Size Class

To remain competitive in the domestic oil and gas industry, companies have to reduce costs and look for areas of profitable growth. Over the past few years, we have seen companies restructure to focus on their core areas of profit. This restructuring has taken many forms, for example, laying off employees, early retirements and buyouts, flattening management structure, selective sales of marginally profitable properties, and acquisitions. Documenting some of these changes is important. Appendix A is a series of tables of the proved reserves and production by production size class for the years 1991 through 1996 for the top oil and gas well operators. Because we surveyed only the largest operators (665 operators) for 1996, the categories "501-2,500", and "other" were combined into a single category of "other," so that comparisons between those categories are not possible for 1996. Any additional category is comparable. The tables show the volumetric change and percent change from the previous year and from 1991. In addition they show the 1996 average per operator in each class. All companies that reported to EIA were ranked by production size for each of the 6 years. We computed company production size classes as the sum of the barrel oil equivalent of the crude oil production, lease condensate production, and wet gas production for each operator. The companies were then placed in the following production size classes: 1-10, 11-20, 21-100, 101-500, and all "other" oil and gas operators. The "other" category contains 22,910 small operators. We estimated production and reserves of small operators each year from a sample of approximately 8 percent of these operators, however for 1996 we employed a different methodology. (See Appendix F for details).

Class 1-10 contains the 10 highest producing companies each year on a barrel oil equivalent basis. These companies are not necessarily the same 10 companies each year. For example in 1995 an operator moved from the 11-20 production size class to the 1-10 class, displacing an operator from the group that had been there since 1991. Most of the apparent changes in these two size classes resulted from the movement of operators from size class to size class.

We also include statistics for operator Category sizes at the bottom portion of tables in this appendix. These are

the categories used by EIA in processing and assessing reserves surveys and are presented here as additional perspective. For further explanation of categories sizes see definitions and descriptions in Appendix E.

Natural Gas

Proved Reserves

The wet natural gas proved reserves reported for 1991 through 1996 have changed from 175.3 trillion cubic feet to 175.1 trillion cubic feet (**Table A1**). Reserves have been increasing for the last three years in a row and are back to the 1991 level. These proved reserves are highly concentrated in the larger companies. In 1996, the top 20 (Class 1-10 and Class 11-20) producing companies had 56 percent of the proved reserves of natural gas. The next two size classes contain 80 and 400 companies and account for 25 and 13 percent of the U.S. natural gas proved reserves, respectively. The top 20 operators had a decline of 7 percent in their natural gas proved reserves from 1991 to 1996. While the rest of the operators (Class 21-100, Class 101-500, and Class Other) had an increase of 9 percent. In 1996, the top 20 operators' natural gas reserves decreased by 3 percent from 1995. In addition in 1996, the rest of the operators had an increase of 6 percent.

Production

Wet natural gas production has steadily increased from 18.0 trillion cubic feet to 19.9 trillion cubic feet from 1991 through 1996 (**Table A2**) an increase of 10 percent. In 1996, the top 20 producing companies had 53 percent of the production of natural gas, while having 56 percent of the proved reserves. The next two size classes have 27 and 13 percent of the wet gas production, respectively. The top 20 operators had an increase of 8 percent in their natural gas production from 1991 to 1996. The rest of the operators had an increase of 14 percent from 1991 to 1996. The top 20 operators' wet natural gas production had an increase of 2 percent in 1996, while the rest of the operators had an increase of 10 percent, in 1996 from 1995.

Crude Oil

Proved Reserves

Proved reserves of crude oil are more highly concentrated in a few companies than those of natural gas. The 20 largest oil and gas producing companies in 1996 had 70 percent of U.S. proved reserves of crude oil (Table A3), in contrast to wet natural gas where these same companies operated only 56 percent of the total proved reserves. These companies have tended in the past few years to concentrate their domestic operations in fewer fields and focus more of their resources on their foreign operations.

U.S. proved reserves of crude oil declined 1.5 percent in 1996. The top 20 producing companies had a decline of 6 percent in their domestic proved reserves of crude oil during 1996. The top 20 class had a decline of 19 percent in their crude oil proved reserves from 1991 to 1996. The next two size classes account for 14 and 8 percent of the U.S. crude oil proved reserves, respectively. The rest of the operators had a 4 percent increase from 1991 to 1996. A portion of this increase came from property acquisitions. During the 1991-1996 period, many operators were continuing to actively buy, sell, and restructure their oil property positions.

Production

Crude oil production reported for 1991 through 1996 has decreased from 2.5 billion barrels to 2.2 billion barrels (Table A4). The 20 largest oil and gas producing companies had 65 percent of U.S. production of crude oil in 1996, while in 1991 they accounted for 70 percent of production. This is in contrast to wet natural gas where these same companies produced only 53 percent of the total.

U.S. production of crude oil declined by 14 percent from 1991 to 1996. The top 20 operators had a decline of 20 percent in their oil production during the same period. U.S. production of crude oil declined by 2 percent from 1995 to 1996, while the top 20 operators production decreased by 6 percent. The next two size classes account for 14 and 10 percent of the U.S. crude oil production, respectively.

Fields

The number of fields in which Category I and Category II operators were active dropped significantly during the 1991-1996 period. From 1991 through 1996, fields in which these large operators were active dropped by 3,348 or 11 percent (Table A5). Most of the changes in operator field counts resulted from the top 20 operators class concentrating their effort in a diminishing number of fields. From 1991 through 1996, the number of fields in which the top 20 operators were active in dropped by 3,172 or 38 percent, while in 1996 the number dropped 11 percent from 1995.

Table A1. Natural Gas Proved Reserves, Wet After Lease Separation, by Operator Production Size Class, 1991-1996
(Billion Cubic Feet at 14.73 psia and 60° Fahrenheit)

Size Class	1991	1992	1993	1994	1995	1996	1995-1996 Volume and Percent Change	1991-1996 Volume and Percent Change	1996 Average Reserves per Operator
Class 1-10	79,028	74,350	77,552	76,665	75,856	72,606	-3,250	-6,422	7,260.616
Percent of Total	45.1%	42.9%	45.5%	44.6%	43.7%	41.5%	-4.3%	-8.1%	
Class 11-20	25,763	28,442	22,467	22,691	24,648	25,416	768	-347	2,541.599
Percent of Total	14.7%	16.4%	13.2%	13.2%	14.2%	4.5%	3.1%	-1.3%	
Class 21-100	38,362	38,388	39,135	40,566	42,604	43,300	696	4,938	541.248
Percent of Total	21.9%	22.2%	23.0%	23.6%	24.6%	24.7%	1.6%	12.9%	
Class 101-500	19,330	19,728	19,870	20,608	20,150	22,483	2,333	3,153	56.207
Percent of Total	11.0%	11.4%	11.7%	12.0%	11.6%	12.8%	11.6%	16.3%	
Class Other	12,842	12,401	11,466	11,409	10,218	11,342	1,124	-1,500	0.597
Percent of Total	7.3%	7.2%	6.7%	6.6%	5.9%	6.5%	11.0%	-11.7%	
Category I	145,595	144,351	142,892	143,703	148,233	146,601	-1,632	1,006	828.255
Percent of Total	83.0%	83.3%	83.8%	83.6%	85.4%	83.7%	-1.1%	0.7%	
Category II	17,604	17,682	17,305	18,158	15,828	18,382	2,554	778	47.745
Percent of Total	10.0%	10.2%	10.2%	10.6%	9.1%	10.5%	16.1%	4.4%	
Category III	12,126	11,276	10,292	10,078	9,416	10,164	748	-1,962	0.535
Percent of Total	6.9%	6.5%	6.0%	5.9%	5.4%	5.8%	7.9%	-16.2%	
Total Published	175,325	173,309	170,490	171,939	173,476	175,147	1,671	-178	284.330
Percent of Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	1.0%	-0.1%	

Note: There were 23,410 operators in the 1996 sample frame. A sample of 665 operators was drawn including 176 Category I, 385 Category II, and 3 Category III. The "other" size class represents 22,910 operators in 1996.

Source: Energy Information Administration, Office of Oil and Gas.

Table A2. Natural Gas Production, Wet After Lease Separation, by Operator Production Size Class, 1991–1996
(Billion Cubic Feet at 14.73 psia and 60° Fahrenheit)

Size Class	1991	1992	1993	1994	1995	1996	1995–1996 Volume and Percent Change	1991–1996 Volume and Percent Change	1996 Average Production per Operator
Class 1–10	6,857	6,625	6,801	7,216	7,174	7,448	274	591	744.808
Percent of Total	38.1%	36.3%	36.5%	37.6%	38.0%	37.5%	3.8%	8.6%	
Class 11–20	2,864	3,036	2,861	3,083	3,101	3,002	–99	138	300.233
Percent of Total	15.9%	16.6%	15.3%	16.0%	16.4%	15.1%	–3.2%	4.8%	
Class 21–100	4,367	4,592	4,894	4,878	4,871	5,316	445	949	66.445
Percent of Total	24.2%	25.1%	26.3%	25.4%	25.8%	26.7%	9.1%	21.7%	
Class 101–500	2,348	2,411	2,597	2,552	2,477	2,623	146	275	6.557
Percent of Total	13.0%	13.2%	13.9%	13.3%	13.1%	13.2%	5.9%	11.7%	
Class Other	1,576	1,605	1,488	1,481	1,251	1,484	233	–92	0.078
Percent of Total	8.7%	8.8%	8.0%	7.7%	6.6%	7.5%	18.6%	–5.8%	
Category I	14,464	14,767	15,122	15,656	15,800	16,381	581	1,917	92.548
Percent of Total	80.3%	80.8%	81.1%	81.5%	83.7%	82.4%	3.7%	13.3%	
Category II	2,086	2,036	2,159	2,221	1,923	2,128	205	42	5.528
Percent of Total	11.6%	11.1%	11.6%	11.6%	10.2%	10.7%	10.7%	2.0%	
Category III	1,462	1,467	1,360	1,333	1,151	1,364	213	–98	0.072
Percent of Total	8.1%	8.0%	7.3%	6.9%	6.1%	6.9%	18.5%	–6.7%	
Total Published	18,012	18,269	18,641	19,210	18,874	19,873	999	1,861	32.261
Percent of Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	5.3%	10.3%	

Note: There were 23,410 operators in the 1996 sample frame. A sample of 665 operators was drawn including 176 Category I, 385 Category II, and 3 Category III. The "other" size class represents 22,910 operators in 1996.

Source: Energy Information Administration, Office of Oil and Gas.

Table A3. Crude Oil Proved Reserves by Operator Production Size Class, 1991–1996
(Million Barrels of 42 U.S. Gallons)

Size Class	1991	1992	1993	1994	1995	1996	1995–1996 Volume and Percent Change	1991–1996 Volume and Percent Change	1996 Average Reserves per Operator
Class 1–10	16,825	15,733	14,894	14,351	13,891	13,362	–529	–3,463	1,336.246
Percent of Total	68.2%	66.3%	64.9%	63.9%	62.1%	60.7%	–3.8%	–20.6%	
Class 11–20	2,247	2,250	2,389	2,276	2,422	2,013	–409	–234	201.349
Percent of Total	9.1%	9.5%	10.4%	10.1%	10.8%	9.1%	–16.9%	–10.4%	
Class 21–100	2,270	2,370	2,401	2,607	2,623	3,155	532	885	39.439
Percent of Total	9.2%	10.0%	10.5%	11.6%	11.7%	14.3%	20.3%	39.0%	
Class 101–500	1,415	1,463	1,440	1,512	1,793	1,838	45	423	4.595
Percent of Total	5.7%	6.2%	6.3%	6.7%	8.0%	8.3%	2.5%	29.9%	
Class Other	1,925	1,929	1,833	1,711	1,622	1,649	27	–276	0.087
Percent of Total	7.8%	8.1%	8.0%	7.6%	7.3%	7.5%	1.7%	–14.3%	
Category I	21,714	20,767	20,090	19,648	19,647	19,312	–335	–2,402	109.105
Percent of Total	88.0%	87.5%	87.5%	87.5%	87.9%	87.7%	–1.7%	–11.1%	
Category II	1,088	1,150	1,131	1,142	1,103	1,117	14	29	2.903
Percent of Total	4.4%	4.8%	4.9%	5.1%	4.9%	5.1%	1.3%	2.7%	
Category III	1,880	1,828	1,737	1,668	1,600	1,588	–12	–292	0.084
Percent of Total	7.6%	7.7%	7.6%	7.4%	7.2%	7.2%	–0.8%	–15.5%	
Total Published	24,682	23,745	22,957	22,457	22,351	22,017	–334	–2,665	35.742
Percent of Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	–1.5%	–10.8%	

Note: There were 23,410 operators in the 1996 sample frame. A sample of 665 operators was drawn including 176 Category I, 385 Category II, and 3 Category III. The "other" size class represents 22,910 operators in 1996.

Source: Energy Information Administration, Office of Oil and Gas.

Table A4. Crude Oil Production by Operator Production Size Class, 1991–1996
(Million Barrels of 42 U.S. Gallons)

Size Class	1991	1992	1993	1994	1995	1996	1995–1996 Volume and Percent Change	1991–1996 Volume and Percent Change	1996 Average Production per Operator
Class 1–10	1,544	1,458	1,346	1,310	1,270	1,220	–50	–324	121.989
Percent of Total	61.5%	59.6%	57.5%	57.8%	57.4%	56.1%	–3.9%	–21.0%	
Class 11–20	218	231	236	224	221	185	–36	–33	18.530
Percent of Total	8.7%	9.4%	10.1%	9.9%	10.0%	8.5%	–16.3%	–15.1%	
Class 21–100	259	272	276	287	276	307	31	48	3.833
Percent of Total	10.3%	11.1%	11.8%	12.7%	12.5%	14.1%	11.2%	18.5%	
Class 101–500	208	213	202	200	214	213	–1	5	0.533
Percent of Total	8.3%	8.7%	8.6%	8.8%	9.7%	9.8%	–0.5%	2.4%	
Class Other	283	272	279	247	232	248	16	–35	0.013
Percent of Total	11.3%	11.1%	11.9%	10.9%	10.5%	11.4%	6.9%	–12.4%	
Category I	2,068	2,022	1,922	1,879	1,844	1,791	–53	–277	10.118
Percent of Total	82.3%	82.7%	82.2%	82.8%	83.3%	82.4%	–2.9%	–13.4%	
Category II	167	163	153	150	139	143	4	–24	0.372
Percent of Total	6.6%	6.7%	6.5%	6.6%	6.3%	6.6%	2.9%	–14.4%	
Category III	277	261	264	239	230	239	9	–38	0.013
Percent of Total	11.0%	10.7%	11.3%	10.5%	10.4%	11.0%	3.9%	–13.7%	
Total Published	2,512	2,446	2,339	2,268	2,213	2,173	–40	–339	3.528
Percent of Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	–1.8%	–13.5%	

Note: There were 23,410 operators in the 1996 sample frame. A sample of 665 operators was drawn including 176 Category I, 385 Category II, and 3 Category III. The "other" size class represents 22,910 operators in 1996.

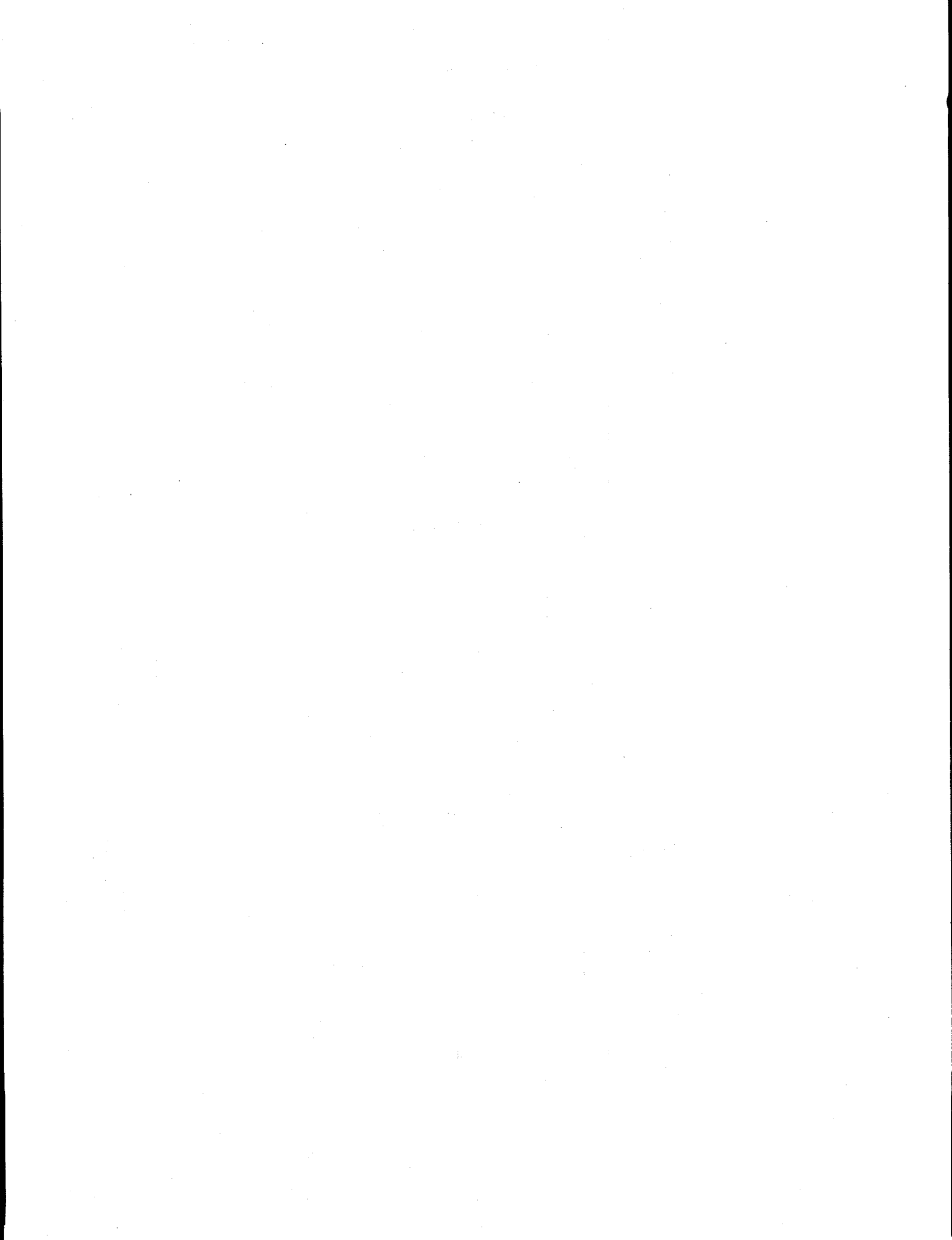
Source: Energy Information Administration, Office of Oil and Gas.

Table A5. Operator Field Count by Operator Production Size Class, 1991–1996

Size Class	1991	1992	1993	1994	1995	1996	1995–1996 Number and Percent Change	1991–1996 Number and Percent Change	1996 Average Number of Fields per Operator
Class 1–10	4,947	4,189	3,591	3,258	3,113	2,800	–313	–2,147	280.000
Percent of Total	16.7%	14.7%	13.2%	12.2%	11.9%	10.7%	–10.1%	–43.4%	
Class 11–20	3,466	3,432	2,998	2,795	2,772	2,441	–331	–1,025	244.100
Percent of Total	11.7%	12.1%	11.1%	10.5%	10.6%	9.3%	–11.9%	–29.6%	
Class 21–100	8,156	8,003	7,600	7,752	7,569	7,526	–43	–630	94.075
Percent of Total	27.6%	28.2%	28.0%	29.1%	28.9%	28.7%	–0.6%	–7.7%	
Class 101–500	11,824	11,896	11,881	11,878	11,886	12,492	606	668	31.230
Percent of Total	40.0%	41.9%	43.8%	44.6%	45.4%	47.7%	5.1%	5.6%	
Rest	1,760	2,059	1,715	1,897	1,601	952	–649	–808	8.207
Percent of Total	6.0%	7.2%	6.3%	7.1%	6.1%	3.6%	–40.5%	–45.9%	
Category I	18,189	17,620	16,603	16,161	16,256	15,635	–621	–2,554	88.333
Percent of Total	61.5%	62.0%	61.2%	60.7%	62.1%	59.7%	–3.8%	–14.0%	
Category II	11,370	10,799	10,516	10,452	9,939	10,576	637	–794	27.470
Percent of Total	38.5%	38.0%	38.8%	39.3%	37.9%	40.3%	6.4%	–7.0%	
Total Published	29,559	28,419	27,119	26,613	26,195	26,211	16	–3,348	41.148
Percent of Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	0.1%	–11.3%	

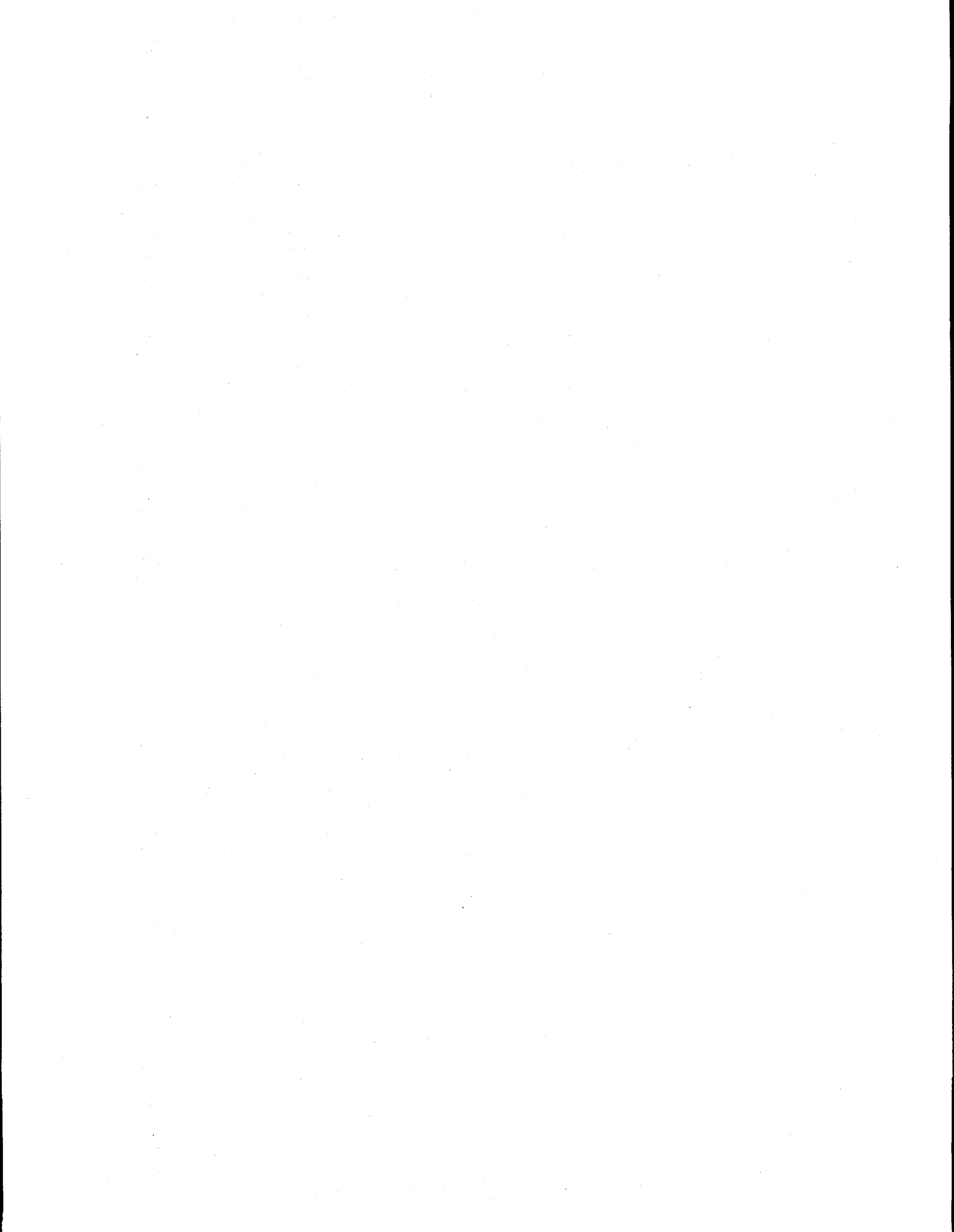
Note: Includes only data from Category I and Category II operators. In 1996, there were 176 Category I operators and 385 Category II operators. The "rest" size class had 65 operators in 1996.

Source: Energy Information Administration, Office of Oil and Gas.



Appendix B

Top 100 Oil and Gas Fields for 1996



Appendix B

Top 100 Oil and Gas Fields for 1996

Appendix B has been changed this year to reflect the reported data for production and proved reserves for fields from the 1996 survey rather than the estimates for total field levels. To give more up-to-date information, the data in this appendix represents the 1996 survey results, using only the data provided by the 568 responding operators of the 1996 survey. In the past, the top 100 field lists usually lagged 1 year behind the report data on which this publication focuses. A 1 year lag reflected the increased analysis time needed to estimate field totals beyond that associated with preparation of the annual reserves report.

Estimates of the proved reserves and production of the top 100 oil and gas fields are contained in **Tables B1 and B2** of this Appendix. The oil field production and reserve data include both crude oil and lease condensate. The gas field production and reserve data is total (Associated-Dissolved and Nonassociated) natural gas, wet after lease separation.

The top 100 oil fields in the United States as of December 31, 1996, had 15,109 million barrels of proved reserves accounting for 65 percent of the total United States (**Table B1**). Although there is considerable grouping of field-level statistics within the tables, rough orders of magnitude can be estimated for the proved reserves, and production of most fields. Many fields in the top 100 groups are operated by only one or two operators, therefore, the totals for proved reserves are grouped as top 10, top 20, top 50, and top 100 to avoid revealing company proprietary data. In the top 20 oil fields for 1996 there are three fields, Mississippi Canyon Blk 807 (Mars), Green Canyon Blk 244 (Troika), and Mississippi Canyon Blk 854 (Ursa) in

the deep water of the Gulf of Mexico Federal Offshore. Two of these three fields, Troika and Ursa, were not in the previous tabulation, and along with Mars, reflect the huge potential of the deep water in the Gulf. The top 100 oil fields in the United States as of December 31, 1996, had 1,225 million barrels of production or 53 percent of the total (**Table B1**). These are approximately the same percentages of reserves and production as reported in the previous publication. Many of the fields in the top 100 are very old, there were 45 oil fields that were discovered prior to 1946. The oldest, Coalinga in California, was discovered in 1887. However, since 1986, an additional 15 oil fields have been added to the top 100 group, all were in the Gulf of Mexico Federal Offshore or Alaska.

The top 100 gas fields in the United States as of December 31, 1996, had 81,901 billion cubic feet of proved reserves or 47 percent of the total (**Table B2**). Unlike the oil fields, the top 100 gas fields show a lesser degree of concentration. Many, but not all, of the same fields are in both tables. As an example, the top three gas fields, Basin, Hugoton Gas Area, and Blanco, are not found in the oil table. The top 100 gas fields in the United States as of December 31, 1996, had 6,381 billion cubic feet of production or 32 percent of the total (**Table B2**). For the top 100 gas fields, this is an increase of 7 percent from those reported in the previous publication. Fewer of the gas fields in the top 100 are very old, there were 22 gas fields that were discovered prior to 1946. The oldest, Big Sandy in Kentucky, was discovered in 1881. However, since 1986, an additional 9 gas fields have been added to the top 100 group, all were in the Gulf of Mexico Federal Offshore, south Texas, or Virginia.

Table B1. Top 100 U.S. Fields Ranked by Oil^a Production within Proved Reserves Group, from Reported 1996 Field Level Data^b
(Million Barrels of 42 U.S. Gallons)

Field Name	Location	Discovery Year	Proved Reserves Rank Group	Reported Production Rank Group
Prudhoe Bay	AK	1967	1-10	286.5
Kuparuk River	AK	1969	1-10	98.8
Midway-Sunset	CA	1901	1-10	59.1
Kern River	CA	1899	1-10	48.3
Belridge South	CA	1911	1-10	40.7
Wasson	TX	1937	1-10	25.2
Elk Hills	CA	1919	1-10	21.6
Yates	TX	1926	1-10	19.9
Milne Point	AK	1982	1-10	14.1
Mississippi Canyon Blk 807	GF	1989	1-10	5.6
Top 10 Volume Subtotal			8,081.7	619.8
Top 10 Percentage of U.S. Total			34.6%	26.5%
Point McIntyre	AK	1988	11-20	57.5
Endicott	AK	1978	11-20	26.6
Wilmington	CA	1932	11-20	19.5
Spraberry Trend Area	TX	1950	11-20	17.3
Hondo	PF	1969	11-20	16.4
Slaughter	TX	1937	11-20	15.5
Levelland	TX	1945	11-20	11.6
San Ardo	CA	1947	11-20	4.3
Green Canyon Blk 244	GF	1994	11-20	0.0
Mississippi Canyon Blk 854	GF	1992	11-20	0.0
Top 20 Volume Subtotal			10,235.1	788.6
Top 20 Percentage of U.S. Total			43.9%	33.8%
Giddings	TX	1960	21-50	24.0
Garden Banks Blk 426	GF	1987	21-50	21.7
East Texas	TX	1930	21-50	19.7
Pescado	PF	1970	21-50	18.5
Viosca Knoll Blk 990	GF	1981	21-50	13.5
Seminole	TX	1936	21-50	12.6
Lost Hills	CA	1910	21-50	12.2
Cymric	CA	1916	21-50	11.5
Niakuk	AK	1984	21-50	11.2
Sho-Vel-Turn	OK	1905	21-50	11.2
Bay Marchand Blk 2	GF & LA	1949	21-50	10.1
Salt Creek	TX	1942	21-50	9.7
Coalinga	CA	1887	21-50	9.7
Cowden North	TX	1930	21-50	9.6
Vacuum	NM	1929	21-50	8.6
Rangely	CO	1902	21-50	8.1
McElroy	TX	1926	21-50	7.8
Fullerton	TX	1942	21-50	6.3
Greater Aneth	UT	1956	21-50	5.5
Wattenberg	CO	1970	21-50	4.7
Ventura	CA	1916	21-50	4.6
Jay	FL & AL	1970	21-50	4.3
Robertson North	TX	1956	21-50	3.9
Howard-Glasscock	TX	1925	21-50	3.6
Hawkins	TX	1940	21-50	3.5
Wasson 72	TX	1940	21-50	3.2
Eunice Monument	NM	1929	21-50	1.3
Alpine	AK	1996	21-50	0.0
Green Canyon Blk 205	GF	1988	21-50	0.0
Viosca Knoll Blk 956	GF	1985	21-50	0.0
Top 50 Volume Subtotal			13,229.3	1,049.2
Top 50 Percentage of U.S. Total			56.7%	44.9%

Table B1. Top 100 U.S. Fields Ranked by Oil^a Production within Proved Reserves Group, from Reported 1996 Field Level Data^b (Continued)
(Million Barrels of 42 U.S. Gallons)

Field Name	Location	Discovery Year	Proved Reserves Rank Group	Reported Production Rank Group
Point Arguello	PF	1981	51-100	15.4
Ewing Bank Blk 873	GF	1991	51-100	13.4
Eugene Island SA Blk 330	GF	1971	51-100	12.3
South Pass SA Blk 89	GF	1969	51-100	7.9
South Pass Blk 61	GF	1955	51-100	7.8
Main Pass SA Blk 299	GF	1967	51-100	7.2
Mcarthur River	AK	1965	51-100	6.1
West Delta Blk 30	GF	1949	51-100	6.0
Port Hudson	LA	1980	51-100	5.4
South Pass Blk 24	GF & LA	1950	51-100	5.1
Ship Shoal Blk 169	GF	1961	51-100	4.9
Oregon Basin	WY	1912	51-100	4.5
Means	TX	1934	51-100	4.5
Goldsmith	TX	1935	51-100	3.9
Grayburg-Jackson	NM	1929	51-100	3.7
Dollarhide	TX & NM	1945	51-100	3.6
Painter Reservoir East	WY	1979	51-100	3.2
Beta	PF	1976	51-100	3.2
Hobbs	NM	1928	51-100	3.1
Hatters Pond	AL	1974	51-100	3.1
Prentice	TX	1950	51-100	3.0
Huntington Beach	CA	1920	51-100	3.0
Dos Cuadras	PF	1968	51-100	2.7
Stephens County Regular	TX	1915	51-100	2.7
Panhandle	TX	1910	51-100	2.6
Garden Banks Blk 387	GF	1990	51-100	2.4
Cedar Lake	TX	1939	51-100	2.4
Mabee	TX	1944	51-100	2.4
Elk Basin	WY & MT	1915	51-100	2.4
Inglewood	CA	1924	51-100	2.4
Bluebell	UT	1949	51-100	2.3
Jo-Mill	TX	1953	51-100	2.3
Welch	TX	1942	51-100	2.3
Hartzog Draw	WY	1976	51-100	2.2
Altamont	UT	1952	51-100	2.2
Pennel	MT	1955	51-100	2.2
Monument	NM	1935	51-100	2.0
Sand Hills	TX	1930	51-100	1.9
Kern Front	CA	1925	51-100	1.8
Cowden South	TX	1930	51-100	1.7
Cottonwood Creek	WY	1953	51-100	1.6
Brea-Olinda	CA	1897	51-100	1.4
Justis	NM	1957	51-100	0.8
Crossett South	TX	1956	51-100	0.8
Ewing Bank Blk 965	GF	1991	51-100	0.0
Garden Banks Blk 260	GF	1995	51-100	0.0
Viosca Knoll Blk 825	GF	1988	51-100	0.0
Green Canyon Blk 254	GF	1994	51-100	0.0
Viosca Knoll Blk 786	GF	1996	51-100	0.0
Ship Shoal SA Blk 349	GF	1994	51-100	0.0
Top 100 Volume Subtotal			15,108.9	1,224.9
Top 100 Percentage of U.S. Total			64.8%	52.5%

^aIncludes lease condensate.

^bOnly 92 percent of the estimated reserves were surveyed by EIA at the field level from large and intermediate operators.

Notes: Fields are grouped in "proved reserves rank groups" and then listed within that group in descending order by annual production rank. The U.S. total production estimate of 2,335 million barrels, used to calculate the percentages in this table, is from the combined totals of Table 6 and Table 16 in this publication. Column totals may not add due to independent rounding.

Source: Energy Information Administration, Office of Oil and Gas.

Table B2. Top 100 U.S. Fields Ranked by Gas^a Production within Proved Reserves Group, from Reported 1996 Field Level Data^b
(Billion Cubic Feet)

Field Name	Location	Discovery Year	Proved Reserves Rank Group	Reported Production Rank Group
Basin	NM	1947	1-10	668.8
Hugoton Gas Area	KS & OK & TX	1922	1-10	558.0
Blanco	NM & CO	1927	1-10	549.4
Carthage	TX	1936	1-10	203.5
Prudhoe Bay	AK	1967	1-10	189.3
Mobile Bay	AL	1985	1-10	131.3
Panhandle West	TX	1918	1-10	129.8
Wattenberg	CO	1970	1-10	86.4
Whitney Canyon-Carter Crk	WY	1978	1-10	81.2
Oakwood	VA	1990	1-10	26.8
Top 10 Volume Subtotal			39,737.5	2,624.5
Top 10 Percentage of U.S. Total			22.7%	13.3%
Giddings	TX	1960	11-20	386.0
Panoma Gas Area	KS	1956	11-20	112.7
Antrim	MI	1965	11-20	88.4
Red Oak-Norris	OK	1910	11-20	75.2
Cook Inlet North	AK	1962	11-20	55.7
Beluga River	AK	1962	11-20	36.5
Madden	WY	1968	11-20	32.1
Fogarty Creek	WY	1975	11-20	31.7
Big Piney-LaBarge	WY	1964	11-20	19.3
Lake Ridge	WY	1981	11-20	14.7
Top 20 Volume Subtotal			49,911.5	3,476.8
Top 20 Percentage of U.S. Total			28.5%	17.6%
Bob West	TX	1990	21-50	119.8
Green Canyon Blk 116	GF	1983	21-50	92.1
Anschutz Ranch East	UT & WY	1979	21-50	84.2
Mocane-Laverne Gas Area	OK & KS & TX	1946	21-50	80.6
Strong City District	OK	1966	21-50	75.2
Matagorda Island Blk 623	GF	1980	21-50	72.7
Mobile Blk 823	GF	1983	21-50	70.6
Watonga-Chickasha Trend	OK	1948	21-50	69.4
McArthur River	AK	1965	21-50	63.7
Wilburton	OK	1941	21-50	62.7
Gomez	TX	1963	21-50	61.1
Spraberry Trend Area	TX	1950	21-50	59.4
Kinta	OK	1914	21-50	55.5
Sawyer	TX	1960	21-50	55.5
Garden Banks Blk 426	GF	1987	21-50	54.9
Bruff	WY	1974	21-50	52.1
Golden Trend	OK	1945	21-50	49.9
Oak Hill	TX	1958	21-50	48.2
Natural Buttes	UT	1940	21-50	45.5
Elk Hills	CA	1919	21-50	43.4
Ozona	TX	1953	21-50	43.2
Fairway	AL	1986	21-50	42.1
Big Sandy	KY	1881	21-50	40.4
Lower Mobile Bay-Mary Ann	AL	1979	21-50	33.1
Tip Top	WY	1928	21-50	25.3
Hondo	PF	1969	21-50	19.3
Wasson	TX	1937	21-50	10.6
Mississippi Canyon Blk 731	GF	1987	21-50	0.0
Mississippi Canyon Blk 854	GF	1992	21-50	0.0
Viosca Knoll Blk 956	GF	1985	21-50	0.0
Top 50 Volume Subtotal			67,472.5	5,007.3
Top 50 Percentage of U.S. Total			38.5%	25.3%

Table B2. Top 100 U.S. Fields Ranked by Gas^a Production within Proved Reserves Group, from Reported 1996 Field Level Data^b (Continued)
(Billion Cubic Feet)

Field Name	Location	Discovery Year	Proved Reserves Rank Group	Reported Production Rank Group
Indian Basin	NM	1963	51-100	69.0
McAllen Ranch	TX	1960	51-100	66.6
High Island SA Blk A573	GF	1973	51-100	55.8
Lake Arthur South	LA	1955	51-100	54.9
Tordilla	TX	1963	51-100	48.3
Elk City	OK	1947	51-100	47.2
Port Hudson	LA	1977	51-100	47.1
South Pass SA Blk 89	GF	1969	51-100	43.6
Mississippi Canyon Blk 194	GF	1975	51-100	43.3
Puckett	TX	1952	51-100	38.9
Knox	OK	1916	51-100	38.2
Brown-Bassett	TX	1953	51-100	37.9
Boonsville	TX	1945	51-100	36.6
Double A Wells	TX	1980	51-100	36.4
Moorewood NE	OK	1979	51-100	36.2
Eumont	NM	1929	51-100	35.8
Sibley	LA	1949	51-100	35.2
Painter Reservoir East	WY	1979	51-100	34.3
South Timbalier Blk 176	GF	1965	51-100	33.4
Waltman	WY	1959	51-100	32.6
Main Pass Blk 41	GF	1956	51-100	32.2
Jeffress NE	TX	1975	51-100	31.3
Mississippi Canyon Blk 354	GF	1977	51-100	25.4
Pegasus	TX	1949	51-100	25.1
Big Piney	WY	1964	51-100	24.2
Newark East	TX	1981	51-100	24.1
Conger	TX	1973	51-100	24.0
Standard Draw	WY	1979	51-100	24.0
Willow Springs	TX	1938	51-100	23.8
Cedar Cove Coal Degas	AL	1983	51-100	23.8
Nora	VA	1949	51-100	22.2
Keystone	TX	1935	51-100	21.7
Kuparuk River	AK	1969	51-100	20.1
A W P	TX	1987	51-100	18.8
Blanco South	NM	1951	51-100	17.7
Trawick	TX	1949	51-100	17.4
Sonora	TX	1954	51-100	15.1
Sugg Ranch	TX	1985	51-100	15.0
Viosca Knoll Blk 783	GF	1985	51-100	13.9
Rulison	CO	1958	51-100	13.8
Mobile Blk 864	GF	1983	51-100	13.7
Kenai	AK	1959	51-100	13.1
Opelika	TX	1937	51-100	12.8
Treasure Isle	TX	1993	51-100	6.7
Mississippi Canyon Blk 807	GF	1989	51-100	6.2
Hawkins	TX	1940	51-100	5.9
Whelan	TX	1937	51-100	4.8
Tri-Cities	TX	1941	51-100	4.7
Brady	WY	1972	51-100	1.1
Green Canyon Blk 244	GF	1994	51-100	0.0
Top 100 Volume Subtotal			81,900.7	6,381.1
Top 100 Percentage of U.S. Total			46.8%	32.3%

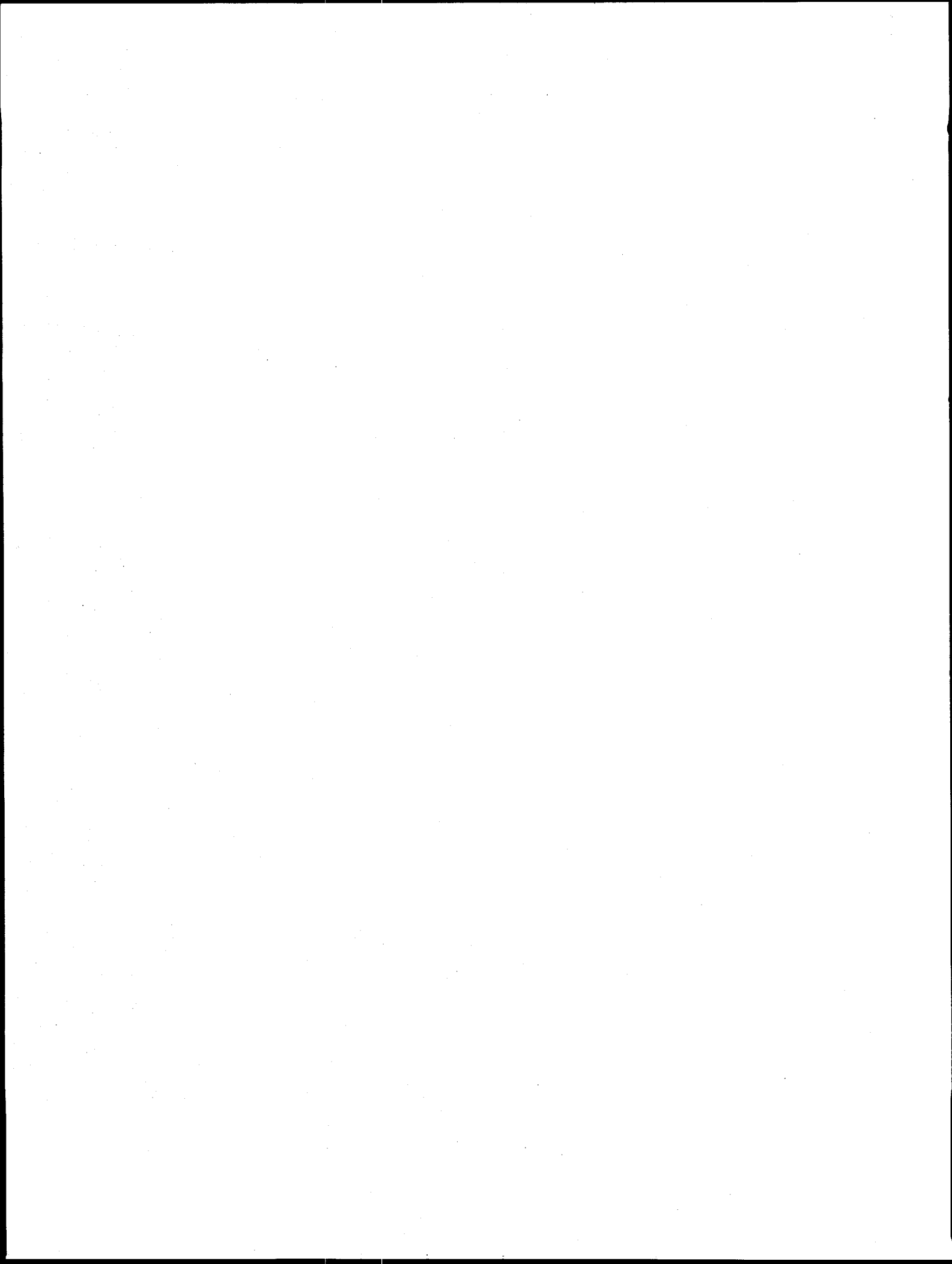
^aWet after lease separation.

^bOnly 92 percent of the estimated reserves were surveyed by EIA at the field level from large and intermediate operators.

— = Not Applicable.

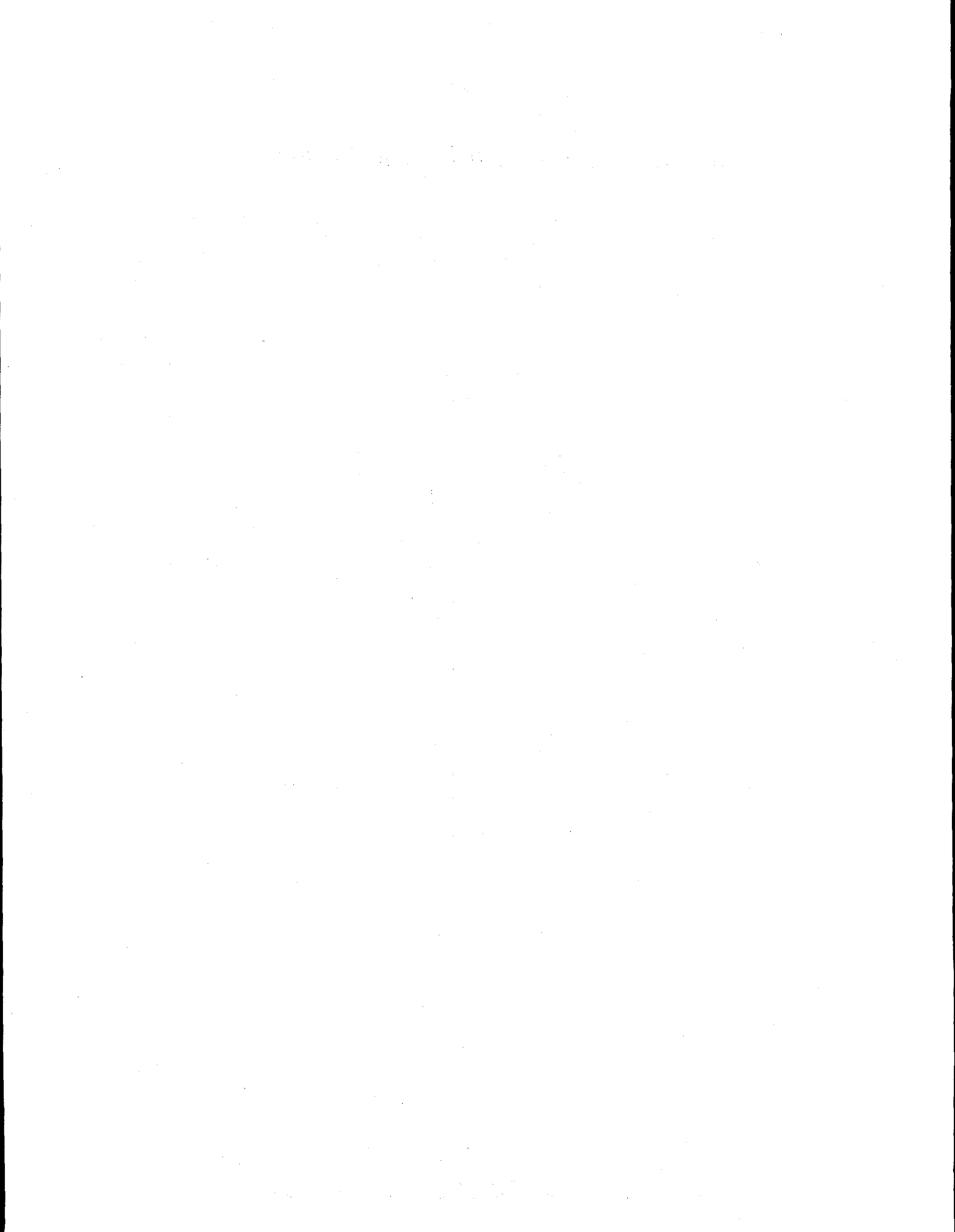
Note: Fields are grouped in "proved reserves rank groups" and then listed within that group in descending order by annual production rank. The U.S. total production estimate of 19,783 billion cubic feet, used to calculate the percentages in this table, is from Table 9 in this publication. Column totals may not add due to independent rounding.

Source: Energy Information Administration, Office of Oil and Gas.



Appendix C

Conversion to the Metric System



Conversion to the Metric System

Public Law 100-418, the Omnibus Trade and Competitiveness Act of 1988, states: "It is the declared policy of the United States—

(1) to designate the metric system of measurement as the preferred system of weights and measures for United States trade and commerce. . . .

(2) to require that each Federal agency, by the end of Fiscal Year 1992, use the metric system of measurement in its procurements, grants, and other business-related activities."{34}

Table C1 is in keeping with the spirit of this law. The petroleum industry in the United States is slowly moving in the direction prescribed by this law and the data collected by EIA are collected in the units that are still common to the U.S. petroleum industry, namely barrels and cubic feet. Standard metric conversion factors were used to convert the National level volumes in **Table 1** to the metric equivalents in **Table C1**. Barrels were multiplied by 0.1589873 to convert to cubic meters and cubic feet were multiplied by 0.02831685 to convert to cubic meters.

Table C1. U.S. Proved Reserves of Crude Oil, Dry Natural Gas, and Natural Gas Liquids, in Metric Units, 1986 -- 1996

Year	Adjustments (1)	Revision Increases (2)	Revision Decreases (3)	Revisions ^a and Adjustments (4)	Extensions (5)	New Field Discoveries (6)	New Reservoir Discoveries in Old Fields (7)	Total ^b Discoveries (8)	Production (9)	Proved ^c Reserves 12/31 (10)	Change from Prior Year (11)
Crude Oil (million cubic meters)											
1986	9.0	433.1	297.1	145.0	64.4	7.6	12.9	84.9	472.7	4,275.0	-242.8
1987	37.2	586.2	218.0	405.4	76.9	15.3	17.6	109.8	456.8	4,333.4	58.4
1988	57.8	426.7	194.1	290.4	56.4	11.3	20.2	87.9	446.9	4,264.8	-68.6
1989	33.9	428.9	217.0	245.8	81.7	17.8	14.3	113.8	411.1	4,213.3	-51.5
1990	13.7	394.8	159.0	249.5	72.5	15.6	21.5	109.6	398.3	4,174.1	-39.2
1991	25.9	333.4	297.9	61.4	58.0	15.4	14.6	88.0	399.4	3,924.1	-250.0
1992	46.2	286.8	170.0	163.0	62.2	1.3	13.5	77.0	388.9	3,775.2	-148.9
1993	43.1	319.7	241.0	121.8	56.6	50.7	17.5	124.8	371.9	3,649.9	-125.3
1994	30.1	375.8	215.7	190.2	63.1	10.2	17.6	90.9	360.6	3,570.4	-79.5
1995	19.4	289.8	126.4	182.8	79.5	18.1	54.5	152.1	351.8	3,553.5	-16.9
1996	28.0	273.9	156.8	145.1	86.3	38.6	22.4	147.3	345.5	3,500.4	-53.1
Dry Natural Gas (billion cubic meters)											
1986	37.38	602.27	501.12	138.53	171.74	31.12	50.15	253.01	442.03	5,425.11	-50.49
1987	35.91	496.31	402.98	129.24	129.89	30.84	42.45	203.18	456.30	5,301.23	-123.88
1988	62.09	661.68	d1,088.13	-364.36	192.64	46.38	54.06	293.08	472.04	d4,757.91	-543.32
1989	85.33	755.30	669.50	171.13	179.50	41.06	63.51	284.07	480.91	4,732.20	-25.71
1990	44.08	537.48	380.66	200.90	225.18	56.75	68.30	350.23	487.98	4,795.35	63.15
1991	83.82	563.22	438.17	208.87	144.13	24.01	45.42	213.56	487.11	4,730.67	-64.68
1992	63.29	511.26	338.73	235.82	132.38	18.38	48.82	199.58	493.36	4,672.71	-57.96
1993	27.51	498.29	346.82	178.98	172.82	25.46	52.84	251.12	503.73	4,599.08	-73.63
1994	55.08	604.99	449.70	210.37	196.55	53.63	98.54	348.72	518.82	4,639.35	40.27
1995	16.42	579.50	360.50	235.42	193.77	47.18	69.43	310.38	508.74	4,676.41	37.06
1996	107.18	485.12	369.42	222.88	219.65	41.09	88.07	348.81	534.08	4,714.02	37.61
Natural Gas Liquids (million cubic meters)											
1985	67.8	144.0	118.3	93.5	53.6	7.0	13.5	74.1	119.7	1,263.0	47.9
1987	36.8	134.7	104.3	67.2	33.9	6.2	8.7	48.8	118.8	1,295.3	-2.8
1988	1.8	185.7	113.7	73.8	42.6	6.5	11.4	60.5	119.9	1,309.7	14.4
1989	-44.0	181.7	162.2	-24.5	41.2	13.2	11.8	66.2	116.2	1,235.2	-74.5
1990	-13.2	131.5	96.3	22.0	47.5	6.2	11.6	65.3	116.4	1,206.1	-29.1
1991	37.1	131.2	110.5	57.8	30.0	4.0	8.7	42.7	119.9	1,186.7	-19.4
1992	35.7	128.1	86.6	77.2	30.2	3.2	10.2	43.6	122.9	1,184.6	-2.1
1993	16.2	121.5	101.8	35.9	39.0	3.8	10.2	53.0	125.3	1,148.2	-36.4
1994	6.9	138.8	107.5	38.2	49.9	8.6	20.8	79.3	125.8	1,139.9	-8.3
1995	30.5	153.9	109.9	74.5	68.7	8.3	10.7	87.7	125.8	1,176.3	36.4
1996	75.5	134.2	106.4	103.3	71.7	10.3	17.3	99.3	135.1	1,243.8	67.5

^aRevisions and adjustments = Col. 1 + Col. 2 - Col. 3.

^bTotal discoveries = Col. 5 + Col. 6 + Col. 7.

^cProved reserves = Col. 10 from prior year + Col. 4 + Col. 8 - Col. 9.

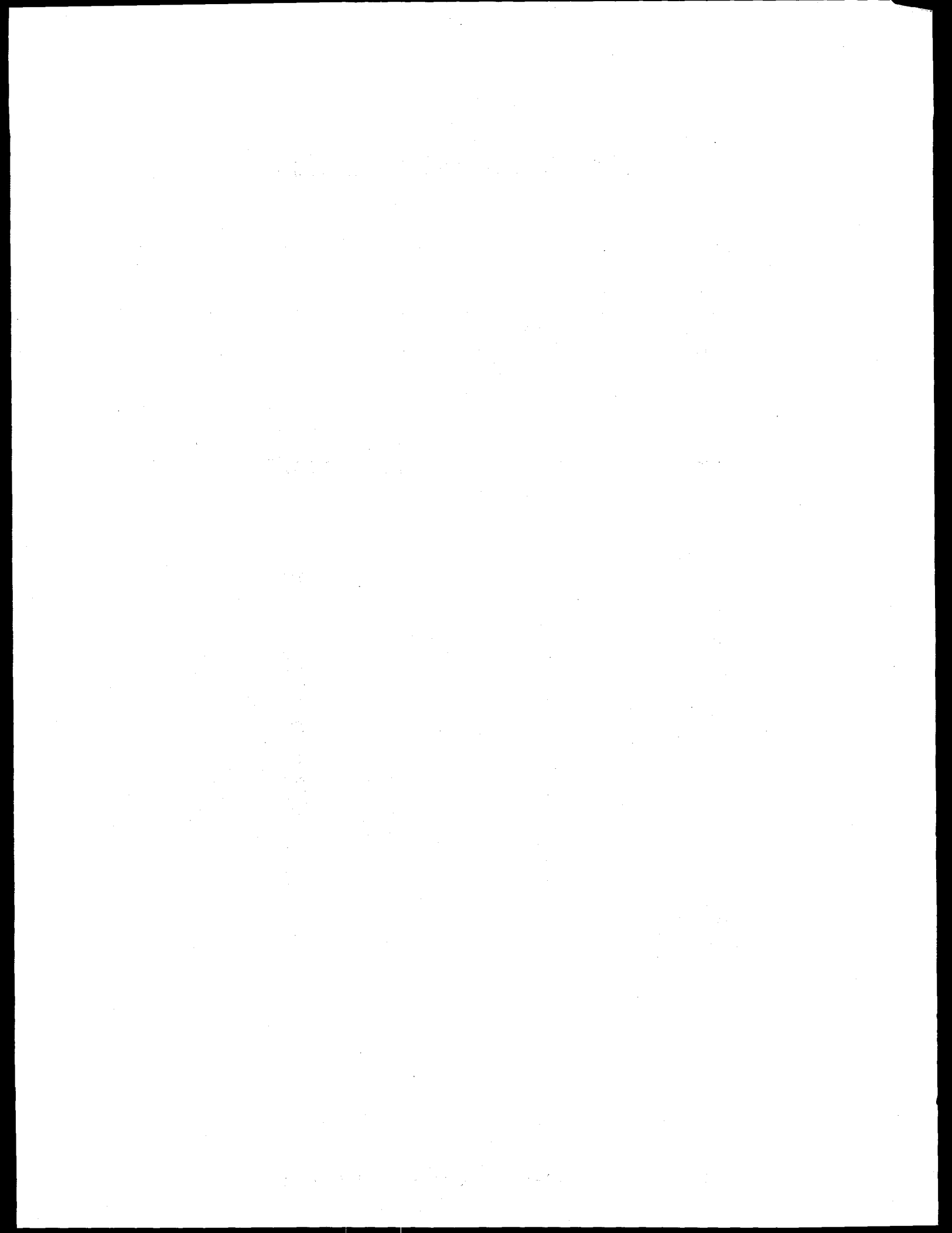
^dAn unusually large revision decrease to North Slope dry natural gas reserves was made in 1988. It recognizes some 696.59 billion cubic meters of downward revisions reported during prior years by operators because of economic and market conditions. EIA in previous years carried these reserves in the proved category.

Notes: Old means discovered in a prior year. New means discovered during the report year. The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves" and Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production." The following conversion factors were used to convert data in Columns 2, 3, 5, 6, 7, 9, and 10: barrels = 0.1589873 per cubic meter, cubic feet = 0.02331685 per cubic meter. Number of decimal digits varies in order to accurately reproduce corresponding equivalents shown on Table 1 in Chapter 2.

Source: U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 1986-1995 annual reports, DOE/EIA-0216.{1-10}

Appendix D

Historical Reserves Statistics



Appendix D

Historical Reserves Statistics

These are selected historical data presented at the State and National level. All historical statistics included have previously been published in the annual reports of 1977 through 1995 of the EIA publication *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves*, DOE EIA-0216.[1-19]

Liquid volumes are in million barrels of 42 U.S. gallons. Gas volumes are in billion cubic feet (Bcf), at 14.73 psia and 60° Fahrenheit. NA appears in this appendix wherever data are not available or are withheld to avoid disclosure of data which may be proprietary. An asterisk (*) marks those estimates associated with sampling errors (95 percent confidence interval) greater than 20 percent of the value estimated.

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Alabama				
1977	85	0	530	NA
1978	*74	0	514	NA
1979	45	NA	652	213
1980	54	NA	636	226
1981	55	NA	648	192
1982	54	NA	^a 648	193
1983	51	NA	^a 785	216
1984	*68	NA	^a 961	200
1985	69	NA	^a 821	182
1986	55	20	^b 951	177
1987	55	20	^b 842	166
1988	54	20	^b 809	166
1989	43	20	^b 819	168
1990	44	<1	^c 4,125	170
1991	43	<1	^c 5,414	145
1992	41	0	^c 5,802	171
1993	41	0	^c 5,140	158
1994	44	0	^c 4,830	142
1995	43	0	4,868	120
1996	45	0	5,033	119

Alaska				
1977	8,413	846	32,243	NA
1978	9,384	398	32,045	NA
1979	8,875	398	32,259	23
1980	8,751	0	33,382	11
1981	8,283	0	33,037	10
1982	7,406	60	34,990	9
1983	7,307	576	34,283	8
1984	7,563	369	34,476	19
1985	7,056	379	33,847	383
1986	6,875	902	32,664	381
1987	7,378	566	33,225	418
1988	6,959	431	9,078	401
1989	6,674	750	8,939	380
1990	6,524	969	9,300	340
1991	6,083	1,456	9,553	360
1992	6,022	1,331	9,638	347
1993	5,775	1,161	9,907	321
1994	5,767	1,022	9,733	301
1995	5,580	582	9,497	306
1996	5,274	952	9,294	337

^aOnshore only; offshore included in Louisiana.

^bOnshore only; offshore included in Federal Offshore - Gulf of Mexico (Louisiana).

^cIncludes State Offshore: 2,519 Bcf in 1990; 3,191 Bcf in 1991; 3,233 Bcf in 1992; 3,364 Bcf in 1993; 3,297 Bcf in 1994; 3,432 Bcf in 1995; 3,509 Bcf in 1996.

Note: See 1988 Chapter 4 discussion "Alaskan North Slope Natural Gas Reserves".

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Arkansas

1977	116	17	1,660	NA
1978	111	8	1,681	NA
1979	107	8	1,703	17
1980	107	11	1,774	16
1981	113	11	1,801	16
1982	107	4	1,958	15
1983	120	4	2,069	11
1984	114	6	2,227	12
1985	97	11	2,019	11
1986	88	9	1,992	16
1987	82	0	1,997	16
1988	77	<1	1,986	13
1989	66	1	1,772	9
1990	60	1	1,731	9
1991	*70	0	1,669	5
1992	58	<1	1,750	4
1993	65	0	1,552	4
1994	51	0	1,607	6
1995	48	0	1,563	6
1996	58	0	1,470	4

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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California - Coastal Region Onshore

1977	679	NA	334	NA
1978	602	NA	350	NA
1979	578	NA	365	22
1980	652	NA	299	23
1981	621	NA	306	14
1982	580	NA	362	16
1983	559	NA	381	17
1984	628	140	265	15
1985	631	152	256	16
1986	592	164	255	15
1987	625	298	238	13
1988	576	299	215	13
1989	731	361	224	11
1990	588	310	217	12
1991	554	327	216	12
1992	522	317	203	10
1993	528	313	189	12
1994	480	238	194	11
1995	456	234	153	8
1996	425	261	156	9

California - Total

1977	5,005	1,047	4,737	NA
1978	4,974	968	4,947	NA
1979	5,265	960	5,022	111
1980	5,470	891	5,414	120
1981	5,441	660	5,617	82
1982	5,405	616	5,552	154
1983	5,348	576	5,781	151
1984	5,707	674	5,554	141
1985	d4,810	d590	d4,325	d146
1986	d4,734	d616	d3,928	d134
1987	d4,709	d1,493	d3,740	d130
1988	d4,879	d1,440	d3,519	d123
1989	d4,816	d1,608	d3,374	d113
1990	d4,658	d1,425	d3,185	d105
1991	d4,217	d1,471	d3,004	d92
1992	d3,893	d1,299	d2,778	d99
1993	d3,764	d965	d2,682	d104
1994	d3,573	d835	d2,402	d92
1995	d3,462	d823	d2,243	d92
1996	d3,437	d905	d2,082	d92

California - Los Angeles Basin Onshore

1977	910	NA	255	NA
1978	493	NA	178	NA
1979	513	NA	163	10
1980	454	NA	193	15
1981	412	NA	154	6
1982	370	NA	96	6
1983	343	NA	107	6
1984	373	126	156	5
1985	420	86	181	6
1986	330	66	142	8
1987	361	105	148	8
1988	391	106	151	7
1989	342	32	137	4
1990	316	3	106	5
1991	272	4	115	4
1992	236	4	97	5
1993	238	4	102	6
1994	221	4	103	5
1995	227	4	111	4
1996	234	0	109	3

^dExcludes Federal offshore; now included in Federal Offshore- Pacific (California).

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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California - San Joaquin Basin Onshore

1977	2,965	NA	3,784	NA
1978	3,099	NA	3,960	NA
1979	3,294	NA	3,941	77
1980	3,360	NA	4,344	81
1981	3,225	NA	4,163	57
1982	3,081	NA	3,901	124
1983	3,032	NA	3,819	117
1984	3,197	384	3,685	105
1985	3,258	350	3,574	120
1986	3,270	368	3,277	109
1987	3,208	1,070	3,102	107
1988	3,439	1,029	2,912	101
1989	3,301	1,210	2,782	95
1990	3,334	1,109	2,670	86
1991	3,126	1,139	2,614	75
1992	2,898	977	2,415	83
1993	2,772	648	2,327	85
1994	2,647	593	2,044	75
1995	2,577	585	1,920	80
1996	2,597	644	1,768	80

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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California - State Offshore

1977	181	NA	114	NA
1978	519	NA	213	NA
1979	632	NA	231	2
1980	604	NA	164	1
1981	NA	NA	NA	NA
1982	NA	NA	NA	NA
1983	NA	NA	NA	NA
1984	NA	25	NA	NA
1985	501	0	314	4
1986	542	18	254	2
1987	515	18	252	2
1988	473	6	241	2
1989	442	5	231	3
1990	420	3	192	2
1991	265	1	59	1
1992	237	1	63	1
1993	226	0	64	1
1994	225	0	61	1
1995	202	0	59	0
1996	181	0	49	0

California-State and Federal Offshore

1977	451	NA	364	NA
1978	780	NA	457	NA
1979	880	NA	553	2
1980	1,004	NA	578	1
1981	1,183	NA	994	5
1982	1,374	NA	1,193	8
1983	1,414	NA	1,474	11
1984	1,509	25	1,448	16
1985	1,492	2	1,433	16
1986	1,516	19	1,579	17
1987	1,552	20	1,704	19
1988	1,497	6	1,793	23
1989	1,429	5	1,727	28
1990	1,382	3	1,646	20
1991	1,050	1	1,221	19
1992	971	1	1,181	21
1993	899	0	1,163	26
1994	878	0	1,231	22
1995	773	0	1,324	25
1996	699	0	1,293	23

California - Federal Offshore

1977	270	NA	250	NA
1978	261	NA	246	NA
1979	248	NA	322	0
1980	400	NA	414	0
1981	NA	NA	NA	NA
1982	NA	NA	NA	NA
1983	NA	NA	NA	NA
1984	NA	0	NA	NA
1985	991	2	1,119	12
1986	974	1	1,325	15
1987	1,037	2	1,452	17
1988	1,024	0	1,552	21
1989	987	0	1,496	25
1990	962	0	1,454	18
1991	785	0	1,162	18
1992	734	<1	1,118	20
1993	673	0	1,099	25
1994	653	0	1,170	21
1995	571	0	1,265	25
1996	518	0	1,244	23

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Colorado				
1977	230	73	2,512	NA
1978	194	75	2,765	NA
1979	159	43	2,608	177
1980	*183	46	2,922	194
1981	147	47	2,961	204
1982	169	100	3,314	186
1983	186	113	3,148	183
1984	198	119	*2,943	155
1985	198	119	2,881	173
1986	207	95	3,027	148
1987	272	67	2,942	166
1988	257	67	3,535	181
1989	359	8	4,274	209
1990	305	8	4,555	169
1991	329	33	5,767	197
1992	304	34	6,198	226
1993	284	22	6,722	214
1994	271	22	6,753	248
1995	252	24	7,256	273
1996	231	22	7,710	287

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Illinois				
1977	*150	1	NA	NA
1978	*158	1	NA	NA
1979	*136	1	NA	NA
1980	113	2	NA	NA
1981	129	1	NA	NA
1982	150	1	NA	NA
1983	135	1	NA	NA
1984	153	1	NA	NA
1985	136	1	NA	NA
1986	135	1	NA	NA
1987	153	5	NA	NA
1988	143	<1	NA	NA
1989	123	<1	NA	NA
1990	131	0	NA	NA
1991	128	52	NA	NA
1992	138	0	NA	NA
1993	116	0	NA	NA
1994	117	0	NA	NA
1995	119	0	NA	NA
1996	94	0	NA	NA

Florida				
1977	213	1	151	NA
1978	168	1	119	NA
1979	128	1	77	21
1980	134	1	84	27
1981	109	1	69	NA
1982	97	1	64	17
1983	78	4	49	11
1984	82	2	65	17
1985	77	2	55	17
1986	67	2	49	14
1987	61	0	49	9
1988	59	0	51	16
1989	50	0	46	10
1990	42	0	45	8
1991	37	0	38	7
1992	36	0	47	8
1993	40	0	50	9
1994	71	0	98	18
1995	71	0	92	17
1996	97	0	96	22

Indiana				
1977	*20	0	NA	NA
1978	*29	0	NA	NA
1979	*40	0	NA	NA
1980	23	0	NA	NA
1981	23	0	NA	NA
1982	28	1	NA	NA
1983	34	3	NA	NA
1984	*33	2	NA	NA
1985	*35	2	NA	NA
1986	*32	2	NA	NA
1987	23	2	NA	NA
1988	*22	0	NA	NA
1989	*16	0	NA	NA
1990	12	0	NA	NA
1991	*16	0	NA	NA
1992	17	0	NA	NA
1993	15	0	NA	NA
1994	15	0	NA	NA
1995	13	0	NA	NA
1996	11	0	NA	NA

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Kansas

1977	*349	3	11,457	NA
1978	303	3	10,992	NA
1979	*377	3	10,243	402
1980	310	2	9,508	389
1981	371	2	9,860	409
1982	378	13	9,724	302
1983	344	13	9,553	443
1984	377	2	9,387	424
1985	423	<1	9,337	373
1986	312	<1	10,509	440
1987	357	<1	10,494	462
1988	327	<1	10,104	345
1989	338	3	10,091	329
1990	321	<1	9,614	313
1991	300	<1	9,358	428
1992	310	0	9,681	444
1993	271	0	9,348	380
1994	260	0	9,156	398
1995	275	<1	8,571	369
1996	266	<1	7,694	338

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Louisiana - Total

1977	3,600	139	57,010	NA
1978	3,448	143	55,725	NA
1979	2,780	76	50,042	1,424
1980	2,751	62	47,325	1,346
1981	2,985	50	47,377	1,327
1982	2,728	49	^e 44,916	1,295
1983	2,707	45	^e 42,561	1,332
1984	2,661	55	^e 41,399	1,188
1985	^f 883	35	^f 14,038	^f 546
1986	^f 826	^f 47	^f 12,930	^f 524
1987	^f 807	^f 56	^f 12,430	^f 525
1988	^f 800	^f 69	^f 12,224	^f 517
1989	^f 745	^f 63	^f 12,516	^f 522
1990	^f 705	^f 22	^f 11,728	^f 538
1991	^f 679	^f 44	^f 10,912	^f 526
1992	^f 668	^f 35	^f 9,780	^f 495
1993	^f 639	^f 338	^f 9,174	^f 421
1994	^f 649	^f 340	^f 9,748	^f 434
1995	^f 637	^f 475	^f 9,274	^f 601
1996	^f 658	^f 331	^f 9,543	^f 543

^eIncludes State and Federal offshore Alabama.

^fExcludes Federal offshore; now included in Federal Offshore- Gulf of Mexico (Louisiana).

Kentucky

1977	30	0	451	NA
1978	*40	0	545	NA
1979	25	0	468	26
1980	*35	12	508	25
1981	29	13	530	25
1982	*36	13	551	35
1983	35	12	554	31
1984	*41	0	613	24
1985	*42	0	766	27
1986	*31	0	841	29
1987	25	0	909	23
1988	*34	0	923	24
1989	33	0	992	16
1990	33	0	1,016	25
1991	*31	0	1,155	24
1992	34	0	1,084	32
1993	26	0	1,003	26
1994	26	0	969	39
1995	24	0	1,044	43
1996	21	0	983	46

Louisiana - North

1977	244	78	3,135	NA
1978	255	78	3,203	NA
1979	216	NA	2,798	96
1980	248	NA	3,076	95
1981	*317	NA	3,270	99
1982	*240	NA	2,912	85
1983	223	NA	2,939	74
1984	165	9	2,494	57
1985	196	5	2,587	65
1986	160	7	2,515	57
1987	175	3	2,306	50
1988	154	23	2,398	56
1989	123	22	2,652	60
1990	120	<1	2,588	58
1991	127	<1	2,384	59
1992	125	<1	2,311	60
1993	108	0	2,325	57
1994	108	0	2,537	69
1995	108	0	2,788	79
1996	128	0	3,105	85

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Louisiana - South Onshore				
1977	1,382	46	18,580	NA
1978	1,242	38	17,755	NA
1979	682	NA	13,994	676
1980	682	NA	13,026	540
1981	642	NA	12,645	544
1982	611	NA	11,801	501
1983	569	NA	11,142	527
1984	585	20	10,331	454
1985	565	16	9,808	442
1986	547	30	9,103	428
1987	505	22	8,693	429
1988	511	35	8,654	421
1989	479	30	8,645	411
1990	435	11	8,171	431
1991	408	33	7,504	417
1992	417	26	6,693	380
1993	382	329	5,932	334
1994	391	331	6,251	337
1995	387	324	5,648	495
1996	382	322	5,704	411

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Michigan				
1977	*233	0	*1,386	NA
1978	*220	9	*1,422	NA
1979	159	23	1,204	112
1980	*205	14	*1,406	112
1981	*240	17	1,118	102
1982	184	34	1,084	97
1983	209	48	1,219	105
1984	180	46	1,112	84
1985	191	37	985	67
1986	146	34	1,139	88
1987	151	27	1,451	111
1988	132	27	1,323	99
1989	128	8	1,342	97
1990	124	3	1,243	81
1991	119	0	1,334	72
1992	102	0	1,223	68
1993	90	0	1,160	57
1994	91	1	1,323	54
1995	76	1	1,294	45
1996	74	0	2,061	53

Louisiana - State Offshore				
1977	1,974	15	35,295	NA
1978	1,951	27	34,767	NA
1979	1,882	14	33,250	652
1980	1,821	13	31,223	711
1981	2,026	16	31,462	684
1982	1,877	21	^e 30,203	709
1983	1,915	15	^e 28,480	731
1984	1,911	27	^e 28,574	677
1985	^f 122	2	^f 1,643	^f 39
1986	^f 119	^f 10	^f 1,312	^f 39
1987	^f 127	^f 22	^f 1,431	^f 46
1988	^f 135	^f 11	^f 1,172	^f 40
1989	^f 143	^f 11	^f 1,219	^f 51
1990	^f 150	^f 11	^f 969	^f 49
1991	^f 144	^f 11	^f 1,024	^f 50
1992	^f 126	^f 9	^f 776	^f 55
1993	^f 149	^f 9	^f 917	^f 30
1994	^f 150	^f 9	^f 960	^f 28
1995	^f 142	^f 151	^f 838	^f 27
1996	^f 148	^f 9	^f 734	^f 47

Mississippi				
1977	241	9	1,437	NA
1978	*250	27	1,635	NA
1979	238	24	1,504	16
1980	202	36	1,769	20
1981	209	93	2,035	18
1982	223	85	1,796	18
1983	205	77	1,596	19
1984	201	50	1,491	15
1985	184	53	1,360	12
1986	199	16	1,300	11
1987	202	12	1,220	11
1988	221	10	1,143	12
1989	218	6	1,104	12
1990	227	8	1,126	11
1991	194	8	1,057	10
1992	165	7	869	9
1993	133	44	797	11
1994	151	40	650	9
1995	140	6	663	8
1996	164	6	631	7

^eIncludes State and Federal offshore Alabama.

^fExcludes Federal offshore; now included in Federal Offshore- Gulf of Mexico (Louisiana).

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Montana				
1977	175	27	*887	NA
1978	158	27	926	NA
1979	152	38	825	10
1980	179	13	*1,287	16
1981	186	11	*1,321	11
1982	216	6	847	18
1983	234	8	896	19
1984	224	4	802	18
1985	232	3	857	21
1986	248	27	803	16
1987	246	<1	780	16
1988	241	0	819	11
1989	225	<1	867	16
1990	221	0	899	15
1991	201	0	831	14
1992	193	0	859	12
1993	171	0	673	8
1994	175	0	717	8
1995	178	0	782	8
1996	168	0	796	7

Nebraska				
1977	22	0	NA	NA
1978	30	1	NA	NA
1979	25	0	NA	NA
1980	*46	0	NA	NA
1981	41	0	NA	NA
1982	*32	0	NA	NA
1983	44	0	NA	NA
1984	*46	0	NA	NA
1985	42	0	NA	NA
1986	*45	7	NA	NA
1987	33	0	NA	NA
1988	42	0	NA	NA
1989	32	0	NA	NA
1990	26	0	NA	NA
1991	26	0	NA	NA
1992	26	0	NA	NA
1993	20	0	NA	NA
1994	22	0	NA	NA
1995	25	0	NA	NA
1996	28	0	NA	NA

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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New Mexico - Total				
1977	605	97	12,000	NA
1978	579	90	12,688	NA
1979	563	77	13,724	530
1980	547	58	13,287	541
1981	555	93	13,870	560
1982	563	76	12,418	531
1983	576	75	11,676	551
1984	660	87	11,364	511
1985	688	99	10,900	445
1986	644	225	11,808	577
1987	654	235	11,620	771
1988	661	241	17,166	1,023
1989	665	256	15,434	933
1990	687	256	17,260	990
1991	721	275	18,539	908
1992	757	293	18,998	1,066
1993	707	211	18,619	996
1994	718	215	17,228	1,011
1995	732	185	17,491	943
1996	744	148	16,485	1,059

New Mexico - East				
1977	576	95	3,848	NA
1978	554	88	3,889	NA
1979	542	77	4,031	209
1980	518	58	3,530	209
1981	522	93	3,598	214
1982	537	76	3,432	209
1983	542	75	3,230	232
1984	625	87	3,197	221
1985	643	98	3,034	209
1986	593	225	2,694	217
1987	608	230	2,881	192
1988	621	235	2,945	208
1989	619	252	3,075	196
1990	633	253	3,256	222
1991	694	275	3,206	205
1992	731	293	3,130	223
1993	688	211	3,034	233
1994	702	215	3,021	234
1995	713	185	2,867	247
1996	731	148	2,790	299

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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New Mexico - West

1977	*29	2	8,152	NA
1978	*25	2	8,799	NA
1979	21	0	9,693	321
1980	*29	0	9,757	332
1981	*33	0	10,272	346
1982	26	0	8,986	322
1983	34	0	8,446	319
1984	35	0	8,167	290
1985	45	1	7,866	236
1986	51	0	9,114	360
1987	46	5	8,739	579
1988	40	6	14,221	815
1989	46	4	12,359	737
1990	54	3	14,004	768
1991	27	0	15,333	703
1992	26	0	15,868	843
1993	19	0	15,585	763
1994	16	0	14,207	777
1995	19	0	14,624	696
1996	13	0	13,695	760

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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North Dakota

1977	155	10	361	NA
1978	162	4	374	NA
1979	211	6	439	47
1980	214	6	537	61
1981	223	8	581	68
1982	237	8	629	71
1983	258	53	600	69
1984	260	54	566	73
1985	255	34	569	74
1986	218	35	541	69
1987	215	33	508	67
1988	216	39	541	52
1989	246	31	561	59
1990	285	0	586	60
1991	232	4	472	56
1992	237	3	496	64
1993	226	7	525	55
1994	226	2	507	55
1995	233	6	463	53
1996	248	6	462	48

New York

1977	NA	NA	165	NA
1978	NA	NA	193	NA
1979	NA	NA	211	0
1980	NA	NA	208	0
1981	NA	NA	*264	0
1982	NA	NA	229	NA
1983	NA	NA	295	NA
1984	NA	NA	389	NA
1985	NA	NA	*369	NA
1986	NA	NA	*457	NA
1987	NA	NA	410	NA
1988	NA	NA	351	NA
1989	NA	NA	368	NA
1990	NA	NA	354	NA
1991	NA	NA	331	NA
1992	NA	NA	329	NA
1993	NA	NA	*264	NA
1994	NA	NA	242	NA
1995	NA	NA	197	NA
1996	NA	NA	232	NA

Ohio

1977	*74	0	495	NA
1978	69	0	684	NA
1979	*82	0	*1,479	0
1980	*116	0	*1,699	0
1981	*112	0	965	0
1982	111	0	1,141	NA
1983	130	0	2,030	NA
1984	*116	0	1,541	NA
1985	79	0	1,331	NA
1986	72	0	1,420	NA
1987	66	0	1,069	NA
1988	64	0	1,229	NA
1989	56	0	1,275	NA
1990	65	0	1,214	NA
1991	66	0	1,181	NA
1992	58	0	1,161	NA
1993	54	0	1,104	NA
1994	58	0	1,094	NA
1995	53	0	1,054	NA
1996	53	0	1,113	NA

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Oklahoma

1977	1,109	69	13,889	NA
1978	979	33	14,417	NA
1979	1,014	35	13,816	583
1980	930	27	13,138	604
1981	950	43	14,699	631
1982	971	25	16,207	745
1983	931	27	16,211	829
1984	940	40	16,126	769
1985	935	37	16,040	826
1986	874	35	16,685	857
1987	788	56	16,711	781
1988	796	79	16,495	765
1989	789	63	15,916	654
1990	734	37	16,151	657
1991	700	54	14,725	628
1992	698	54	13,926	629
1993	680	40	13,289	643
1994	689	47	13,487	652
1995	676	48	13,438	674
1996	632	43	13,074	684

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Texas - Total

1977	9,751	637	56,422	NA
1978	8,911	533	55,583	NA
1979	8,284	471	53,021	2,482
1980	8,206	384	50,287	2,452
1981	8,093	459	50,469	2,646
1982	7,616	377	49,757	2,771
1983	7,539	421	50,052	3,038
1984	7,557	735	49,883	3,048
1985	97,782	609	941,775	92,981
1986	97,152	1,270	940,574	92,964
1987	97,112	1,028	938,711	92,822
1988	97,043	1,099	938,167	92,617
1989	96,966	805	938,381	92,563
1990	97,106	618	938,192	92,575
1991	96,797	756	936,174	92,493
1992	96,441	9612	935,093	92,402
1993	96,171	9581	934,718	92,469
1994	95,847	9491	935,974	92,414
1995	95,743	9395	936,542	92,524
1996	95,736	9358	938,270	92,606

9Excludes Federal offshore; now included in Federal Offshore- Gulf of Mexico (Texas).

Pennsylvania

1977	*57	0	769	NA
1978	27	0	899	NA
1979	33	0	*1,515	1
1980	35	0	951	0
1981	32	0	*1,264	0
1982	37	0	1,429	NA
1983	41	0	1,882	NA
1984	*40	0	1,575	NA
1985	*38	0	*1,617	NA
1986	*26	0	*1,560	1
1987	26	0	1,647	NA
1988	*27	0	2,072	NA
1989	26	0	1,642	NA
1990	22	0	1,720	NA
1991	15	0	1,629	NA
1992	16	0	1,528	NA
1993	14	0	1,717	NA
1994	15	0	1,800	NA
1995	11	0	1,482	NA
1996	10	0	1,696	NA

Texas - RRC District 1

1977	*174	0	1,319	NA
1978	111	2	986	NA
1979	110	0	919	23
1980	*150	0	829	24
1981	127	5	*1,022	26
1982	129	6	892	29
1983	165	6	1,087	43
1984	173	4	838	39
1985	177	8	967	40
1986	144	1	913	35
1987	143	1	812	27
1988	136	1	1,173	30
1989	139	1	1,267	25
1990	252	0	1,048	26
1991	227	0	1,030	28
1992	185	0	933	27
1993	133	0	698	26
1994	100	1	703	26
1995	90	6	712	26
1996	86	1	906	46

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Texas - RRC District 2 Onshore

1977	395	80	3,162	NA
1978	334	1	2,976	NA
1979	292	1	2,974	64
1980	252	1	2,502	64
1981	229	1	2,629	88
1982	206	0	2,493	75
1983	192	0	2,534	99
1984	192	<1	2,512	103
1985	168	0	2,358	100
1986	148	<1	2,180	89
1987	137	0	2,273	102
1988	117	0	2,037	92
1989	107	0	1,770	72
1990	91	0	1,737	80
1991	90	0	1,393	75
1992	86	0	1,389	80
1993	77	0	1,321	86
1994	74	0	1,360	86
1995	61	0	1,251	93
1996	63	<1	1,322	93

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Texas - RRC District 4 Onshore

1977	145	7	9,621	NA
1978	123	3	9,031	NA
1979	113	4	8,326	248
1980	96	3	8,130	252
1981	97	6	8,004	260
1982	87	7	8,410	289
1983	96	3	8,316	292
1984	99	3	8,525	295
1985	98	2	8,250	269
1986	87	2	8,274	281
1987	80	2	7,490	277
1988	65	1	7,029	260
1989	77	<1	7,111	260
1990	67	<1	7,475	279
1991	52	<1	7,048	273
1992	50	<1	6,739	272
1993	59	<1	7,038	278
1994	41	<1	7,547	290
1995	50	<1	7,709	287
1996	51	0	7,769	323

Texas - RRC District 3 Onshore

1977	937	33	7,518	NA
1978	794	22	7,186	NA
1979	630	32	6,315	231
1980	581	11	5,531	216
1981	552	11	5,292	230
1982	509	22	4,756	265
1983	517	27	4,680	285
1984	522	25	4,708	270
1985	471	6	4,180	260
1986	420	3	3,753	237
1987	386	4	3,632	241
1988	360	16	3,422	208
1989	307	11	3,233	213
1990	275	13	2,894	181
1991	300	28	2,885	208
1992	304	27	2,684	211
1993	327	31	2,972	253
1994	330	61	3,366	254
1995	267	27	3,866	272
1996	281	27	4,349	289

Texas - RRC District 5

1977	68	0	931	NA
1978	*68	0	*1,298	NA
1979	55	1	1,155	34
1980	52	0	1,147	44
1981	49	0	1,250	49
1982	45	0	1,308	53
1983	42	0	1,448	73
1984	36	<1	1,874	74
1985	*59	1	2,058	77
1986	*53	1	2,141	86
1987	54	0	2,119	88
1988	48	0	1,996	81
1989	46	0	1,845	80
1990	47	0	1,875	81
1991	46	0	1,863	71
1992	56	0	1,747	71
1993	52	0	1,867	64
1994	49	0	2,011	59
1995	34	0	1,862	54
1996	29	0	2,079	54

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Texas - RRC District 6				
1977	1,568	12	3,214	NA
1978	1,444	3	3,240	NA
1979	1,177	6	3,258	272
1980	1,115	6	4,230	321
1981	1,040	7	4,177	308
1982	947	6	4,326	278
1983	918	5	4,857	342
1984	889	5	4,703	298
1985	851	4	4,822	293
1986	750	2	4,854	277
1987	733	3	4,682	264
1988	685	5	4,961	263
1989	631	4	5,614	266
1990	605	6	5,753	247
1991	504	7	5,233	243
1992	442	7	5,317	251
1993	406	<1	5,508	248
1994	424	<1	5,381	265
1995	409	1	5,726	271
1996	359	1	5,899	290

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Texas - RRC District 7C				
1977	191	NA	2,831	NA
1978	202	NA	2,821	NA
1979	206	NA	2,842	182
1980	207	NA	2,378	135
1981	230	NA	2,503	186
1982	229	NA	2,659	199
1983	228	NA	2,568	219
1984	240	24	2,866	233
1985	243	21	2,914	256
1986	213	22	2,721	246
1987	220	25	2,708	243
1988	212	31	2,781	238
1989	247	16	3,180	238
1990	274	8	3,514	256
1991	253	9	3,291	241
1992	255	33	3,239	289
1993	199	15	3,215	273
1994	221	14	3,316	265
1995	204	8	3,107	274
1996	219	5	3,655	303

Texas - RRC District 7B				
1977	250	NA	699	NA
1978	190	NA	743	NA
1979	208	NA	*751	64
1980	196	NA	*745	85
1981	254	NA	804	102
1982	199	NA	805	105
1983	217	NA	1,027	133
1984	218	62	794	106
1985	239	63	708	104
1986	193	64	684	109
1987	200	46	697	92
1988	205	42	704	98
1989	204	11	459	73
1990	198	8	522	76
1991	184	8	423	82
1992	163	11	455	68
1993	*171	7	477	79
1994	145	5	425	62
1995	126	4	440	70
1996	136	4	520	65

Texas - RRC District 8				
1977	2,915	127	11,728	NA
1978	2,795	102	11,093	NA
1979	2,686	88	10,077	505
1980	2,597	86	9,144	498
1981	2,503	105	8,546	537
1982	2,312	75	8,196	588
1983	2,350	99	8,156	681
1984	2,342	363	7,343	691
1985	2,333	325	7,330	665
1986	2,183	592	7,333	717
1987	2,108	399	6,999	640
1988	2,107	412	7,058	547
1989	2,151	366	6,753	554
1990	2,152	282	6,614	558
1991	2,114	328	6,133	477
1992	2,013	260	5,924	444
1993	2,057	262	5,516	439
1994	2,002	256	5,442	414
1995	2,032	187	5,441	444
1996	2,079	217	5,452	429

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Texas - RRC District 8A

1977	2,626	291	1,630	NA
1978	2,439	330	1,473	NA
1979	2,371	270	1,055	351
1980	2,504	196	1,057	290
1981	2,538	247	1,071	335
1982	2,481	200	1,041	296
1983	2,366	203	966	262
1984	2,413	217	907	282
1985	2,711	147	958	283
1986	2,618	559	845	331
1987	2,735	525	876	307
1988	2,800	569	832	326
1989	2,754	377	1,074	332
1990	2,847	285	1,036	354
1991	2,763	363	1,073	333
1992	2,599	273	1,239	257
1993	2,435	264	1,043	298
1994	2,223	154	1,219	267
1995	2,233	156	941	284
1996	2,207	99	931	262

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Texas - RRC District 10

1977	*120	4	7,744	NA
1978	90	0	7,406	NA
1979	97	2	6,784	375
1980	89	2	6,435	369
1981	107	2	6,229	364
1982	112	2	6,210	391
1983	105	6	5,919	413
1984	108	6	5,461	440
1985	*140	5	5,469	433
1986	*104	5	5,276	428
1987	102	2	4,962	417
1988	99	4	4,830	363
1989	97	3	4,767	342
1990	99	3	4,490	328
1991	95	2	4,589	356
1992	89	<1	4,409	336
1993	83	<1	4,040	329
1994	75	<1	4,246	326
1995	80	6	4,436	353
1996	74	4	4,391	332

Texas - RRC District 9

1977	260	28	724	NA
1978	190	27	*908	NA
1979	200	30	*700	79
1980	218	37	649	92
1981	225	34	953	86
1982	219	17	*1,103	119
1983	220	18	932	121
1984	214	25	900	119
1985	285	27	892	111
1986	237	19	868	119
1987	206	21	834	115
1988	202	18	783	106
1989	200	16	703	94
1990	193	12	776	104
1991	162	11	738	101
1992	176	1	670	92
1993	168	2	688	92
1994	159	<1	728	98
1995	149	<1	738	94
1996	144	0	705	119

Texas - State and Federal Offshore

1977	102	0	5,301	NA
1978	131	1	6,422	NA
1979	139	0	7,865	54
1980	149	0	7,510	62
1981	142	0	7,989	75
1982	141	0	7,558	84
1983	123	0	7,562	75
1984	111	0	8,452	98
1985	119	0	8,129	90
1986	103	0	8,176	109
1987	96	0	7,846	98
1988	85	0	7,802	94
1989	75	0	7,573	84
1990	77	0	7,758	87
1991	67	0	7,150	84
1992	197	0	7,344	122
1993	196	0	6,996	119
1994	209	10	6,613	105
1995	257	16	6,838	136
1996	218	5	6,288	133

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Texas - State Offshore				
1977	NA	NA	NA	NA
1978	NA	NA	NA	NA
1979	NA	NA	NA	NA
1980	NA	NA	NA	12
1981	NA	NA	NA	13
1982	NA	NA	NA	18
1983	NA	NA	NA	11
1984	NA	NA	NA	10
1985	7	0	869	10
1986	2	0	732	9
1987	8	0	627	9
1988	7	0	561	5
1989	6	0	605	6
1990	6	0	458	5
1991	7	0	475	5
1992	5	0	348	4
1993	4	0	335	4
1994	4	0	230	2
1995	8	0	313	2
1996	8	0	292	1

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Virginia				
1977	NA	NA	NA	NA
1978	NA	NA	NA	NA
1979	NA	NA	NA	NA
1980	NA	NA	NA	NA
1981	NA	NA	118	NA
1982	NA	NA	122	NA
1983	NA	NA	175	NA
1984	NA	NA	216	NA
1985	NA	NA	235	NA
1986	NA	NA	253	NA
1987	NA	NA	248	NA
1988	NA	NA	230	NA
1989	NA	NA	217	NA
1990	NA	NA	138	NA
1991	NA	NA	225	NA
1992	NA	NA	904	NA
1993	NA	NA	1,322	NA
1994	NA	NA	1,833	NA
1995	NA	NA	1,836	NA
1996	NA	NA	1,930	NA

Utah				
1977	252	6	877	NA
1978	188	7	925	NA
1979	201	NA	948	59
1980	198	NA	1,201	127
1981	190	NA	1,912	277
1982	173	NA	2,161	(h)
1983	187	NA	2,333	(h)
1984	172	8	2,080	(h)
1985	276	13	1,999	(h)
1986	269	14	1,895	(h)
1987	284	22	1,947	(h)
1988	260	21	1,298	(h)
1989	246	50	1,507	(h)
1990	249	44	1,510	(h)
1991	233	66	1,702	(h)
1992	217	65	1,830	(h)
1993	228	54	2,040	(h)
1994	231	70	1,789	(h)
1995	216	50	1,580	(h)
1996	237	46	1,633	(h)

West Virginia				
1977	21	0	1,567	NA
1978	*30	0	1,634	NA
1979	*48	0	1,558	74
1980	30	8	*2,422	97
1981	30	8	1,834	85
1982	48	8	2,148	79
1983	49	0	2,194	91
1984	*76	0	2,136	80
1985	40	0	2,058	85
1986	37	0	2,148	87
1987	34	0	2,242	87
1988	33	0	2,306	92
1989	30	0	2,201	100
1990	*31	0	2,207	86
1991	26	0	2,528	103
1992	27	0	2,356	97
1993	24	0	2,439	108
1994	25	0	2,565	93
1995	28	0	2,499	62
1996	25	0	2,703	61

^hIncluded with Wyoming.

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Wyoming

1977	851	31	6,305	NA
1978	845	36	7,211	NA
1979	841	40	7,526	285
1980	928	28	9,100	341
1981	840	53	9,307	384
1982	856	58	9,758	681
1983	957	61	10,227	789
1984	954	71	10,482	860
1985	951	18	10,617	949
1986	849	126	9,756	950
1987	854	27	10,023	924
1988	815	35	10,308	1,154
1989	825	46	10,744	896
1990	794	42	9,944	812
1991	757	24	9,941	748
1992	689	18	10,826	660
1993	624	12	10,933	600
1994	565	13	10,879	564
1995	605	12	12,166	593
1996	603	14	12,320	727

ⁱUtah and Wyoming are combined.

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Federal Offshore - Pacific (California)

1985	991	NA	1,119	12
1986	974	2	1,325	15
1987	1,037	2	1,452	17
1988	1,024	0	1,552	21
1989	987	0	1,496	25
1990	962	0	1,454	18
1991	785	0	1,162	18
1992	734	0	1,118	20
1993	673	0	1,099	25
1994	653	0	1,170	21
1995	571	0	1,265	25
1996	518	0	1,244	23

Note: Data not tabulated for years 1977-1984.

Federal Offshore - Total

1985	2,862	11	34,492	702
1986	2,715	16	34,223	681
1987	2,639	21	31,931	638
1988	2,629	21	32,264	622
1989	2,747	32	32,651	678
1990	2,805	49	31,433	619
1991	2,620	18	29,448	642
1992	2,569	31	27,767	610
1993	2,745	18	27,143	630
1994	2,780	53	28,388	624
1995	3,089	62	29,182	655
1996	3,085	45	29,096	776

^jIncludes State offshore Alabama.
Note: Data not tabulated for years 1977-1984.

Federal Offshore - Gulf of Mexico (Louisiana)

1985	1,759	11	26,113	610
1986	1,640	14	25,454	566
1987	1,514	19	23,260	532
1988	1,527	21	23,471	512
1989	1,691	32	24,187	575
1990	1,772	49	^k 22,679	^k 519
1991	1,775	18	^k 21,611	^k 545
1992	1,643	31	^k 19,653	^k 472
1993	1,880	18	^k 19,383	^k 490
1994	1,922	43	^k 20,835	^k 500
1995	2,269	46	^k 21,392	^k 496
1996	2,357	40	^k 21,856	^k 621

^fIncludes State and Federal offshore Alabama.
^kIncludes Federal offshore Alabama.
Note: Data not tabulated for years 1977-1984.

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Federal Offshore - Gulf of Mexico (Texas)				
1985	112	0	7,260	80
1986	101	0	7,444	100
1987	88	0	7,219	89
1988	78	0	7,241	89
1989	69	0	6,968	78
1990	71	0	7,300	82
1991	60	0	6,675	79
1992	192	0	6,996	118
1993	192	0	6,661	115
1994	205	10	6,383	103
1995	249	16	6,525	134
1996	210	5	5,996	132

Note: Data not tabulated for years 1977- 1984.

Year	Crude Oil Proved Reserves	Crude Oil Indicated Additional Reserves	Dry Natural Gas Proved Reserves	Natural Gas Liquids Proved Reserves
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Miscellaneous				
1977	23	0	102	NA
1978	24	0	109	NA
1979	22	1	*153	2
1980	*38	0	176	3
1981	40	7	191	21
1982	33	0	69	4
1983	30	8	78	5
1984	23	0	75	5
1985	35	0	76	3
1986	33	0	133	2
1987	30	0	65	4
1988	34	0	83	5
1989	39	0	83	5
1990	43	1	*70	3
1991	42	5	75	8
1992	29	0	92	8
1993	34	0	94	8
1994	20	0	65	8
1995	*22	0	*69	7
1996	18	0	67	7

Note: States included may vary for different report years and hydrocarbon types.

Lower 48 States				
1977	23,367	2,168	175,170	NA
1978	21,971	1,964	175,988	NA
1979	20,935	1,878	168,738	6,592
1980	21,054	1,622	165,639	6,717
1981	21,143	1,594	168,693	7,058
1982	20,452	1,478	166,522	7,212
1983	20,428	1,548	165,964	7,893
1984	20,883	1,956	162,987	7,624
1985	21,360	1,662	159,522	7,561
1986	20,014	2,597	158,922	7,784
1987	19,878	3,084	153,986	7,729
1988	19,866	3,169	158,946	7,837
1989	19,827	2,999	158,177	7,389
1990	19,730	2,514	160,046	7,246
1991	18,599	2,810	157,509	7,106
1992	17,723	2,451	155,377	7,104
1993	17,182	2,292	152,508	6,901
1994	16,690	2,129	154,104	6,869
1995	16,771	2,087	155,649	7,093
1996	16,743	1,924	157,180	7,486

U.S. Total				
1977	31,780	3,014	207,413	NA
1978	31,355	2,362	208,033	NA
1979	29,810	2,276	200,997	6,615
1980	29,805	1,622	199,021	6,728
1981	29,426	1,594	201,730	7,068
1982	27,858	1,478	201,512	7,221
1983	27,735	2,124	200,247	7,901
1984	28,446	2,325	197,463	7,643
1985	28,416	2,041	193,369	7,944
1986	26,889	3,499	191,586	8,165
1987	27,256	3,649	187,211	8,147
1988	26,825	3,600	168,024	8,238
1989	26,501	3,749	167,116	7,769
1990	26,254	3,483	169,346	7,586
1991	24,682	4,266	167,062	7,466
1992	23,745	3,782	165,015	7,451
1993	22,957	3,453	162,415	7,222
1994	22,457	3,151	163,837	7,170
1995	22,351	2,669	165,146	7,399
1996	22,017	2,876	166,474	7,823

Table D1. U.S. Proved Reserves of Crude Oil, 1976–1996
(Million Barrels of 42 U.S. Gallons)

Year	Adjustments ^a (1)	Revision Increases (2)	Revision Decreases (3)	Revisions ^b and Adjustments (4)	Extensions (5)	New Field Discoveries (6)	New Reservoir Discoveries in Old Fields (7)	Total ^c Discoveries (8)	Production (9)	Proved ^d Reserves 12/31 (10)	Change from Prior Year (11)
1976	–	–	–	–	–	–	–	–	–	^e 33,502	–
1977	^f –40	1,503	1,117	346	496	168	130	794	2,862	31,780	–1,722
1978	366	2,799	1,409	1,756	444	267	116	827	3,008	31,355	–425
1979	337	2,438	2,001	774	424	108	104	636	2,955	29,810	–1,545
1980	219	2,883	994	2,108	572	143	147	862	2,975	29,805	–5
1981	138	2,151	880	1,409	750	254	157	1,161	2,949	29,426	–379
1982	–83	2,245	1,811	351	634	204	193	1,031	2,950	27,858	–1,568
1983	462	2,810	1,299	1,973	629	105	190	924	3,020	27,735	–123
1984	159	3,672	1,227	2,604	744	242	158	1,144	3,037	28,446	+711
1985	429	3,037	1,439	2,027	742	84	169	995	3,052	28,416	–30
1986	57	2,724	1,869	912	405	48	81	534	2,973	26,889	–1,527
1987	233	3,687	1,371	2,549	484	96	111	691	2,873	27,256	+367
1988	364	2,684	1,221	1,827	355	71	127	553	2,811	26,825	–431
1989	213	2,698	1,365	1,546	514	112	90	716	2,586	26,501	–324
1990	86	2,483	1,000	1,569	456	98	135	689	2,505	26,254	–247
1991	163	2,097	1,874	386	365	97	92	554	2,512	24,682	–1,572
1992	290	1,804	1,069	1,025	391	8	85	484	2,446	23,745	–937
1993	271	2,011	1,516	766	356	319	110	785	2,339	22,957	–788
1994	189	2,364	1,357	1,196	397	64	111	572	2,268	22,457	–500
1995	122	1,823	795	1,150	500	114	343	957	2,213	22,351	–106
1996	175	1,723	986	912	543	243	141	927	2,173	22,017	–334

^aIncludes operator reported corrections for the years 1978 through 1981. After 1981 operators included corrections with revisions.

^bRevisions and adjustments = Col. 1 + Col. 2 - Col. 3.

^cTotal discoveries = Col. 5 + Col. 6 + Col. 7.

^dProved reserves = Col. 10 from prior year + Col. 4 + Col. 8 - Col. 9.

^eBased on following year data only.

^fConsists only of operator reported corrections and no other adjustments.

– = Not applicable.

Notes: Old means discovered in a prior year. New means discovered during the report year. The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves". They may differ from the official Energy Information Administration production data for crude oil contained in the *Petroleum Supply Annual*, DOE/EIA-0340.

Source: *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves*, 1977 through 1995 annual reports, DOE/EIA-0216.{1-19}

Table D2. U.S. Lower 48 Proved Reserves of Crude Oil, 1976–1996
(Million Barrels of 42 U.S. Gallons)

Year	Adjustments ^a (1)	Revision Increases (2)	Revision Decreases (3)	Revisions ^b and Adjustments (4)	Extensions (5)	New Field Discoveries (6)	New Reservoir Discoveries in Old Fields (7)	Total ^c Discoveries (8)	Production (9)	Proved ^d Reserves 12/31 (10)	Change from Prior Year (11)
1976	–	–	–	–	–	–	–	–	–	^e 24,928	–
1977	^f –40	1,499	1,116	343	496	168	130	794	2,698	23,367	–1,561
1978	–48	1,909	1,400	461	444	142	116	702	2,559	21,971	–1,396
1979	342	2,404	1,975	771	424	108	104	636	2,443	20,935	–1,036
1980	210	2,505	981	1,734	479	143	147	769	2,384	21,054	+119
1981	276	1,887	878	1,285	750	254	157	1,161	2,357	21,143	+89
1982	–82	2,146	1,462	602	633	204	193	1,030	2,323	20,452	–691
1983	462	2,247	1,298	1,411	625	105	190	920	2,355	20,428	–24
1984	160	2,801	1,214	1,747	742	207	158	1,107	2,399	20,883	+455
1985	361	2,864	1,197	2,028	581	84	169	834	2,385	21,360	+477
1986	70	2,001	1,642	429	399	48	81	528	2,303	20,014	–1,346
1987	233	2,566	1,213	1,586	294	38	101	433	2,155	19,878	–136
1988	359	2,399	1,218	1,540	340	43	127	510	2,062	19,866	–12
1989	214	2,438	1,325	1,327	342	108	87	537	1,903	19,827	–39
1990	151	1,997	996	1,152	371	98	135	604	1,853	19,730	–97
1991	164	1,898	1,848	214	327	97	87	511	1,856	18,599	–1,131
1992	297	1,343	1,066	574	279	8	84	371	1,821	17,723	–876
1993	250	1,712	1,514	448	343	319	109	771	1,760	17,182	–541
1994	187	1,873	1,346	714	316	64	111	491	1,697	16,690	–492
1995	117	1,521	765	873	434	114	333	881	1,673	16,771	+81
1996	172	1,654	926	900	479	115	141	735	1,663	16,743	–28

^aIncludes operator reported corrections for the years 1978 through 1981. After 1981 operators included corrections with revisions.

^bRevisions and adjustments = Col. 1 + Col. 2 - Col. 3.

^cTotal discoveries = Col. 5 + Col. 6 + Col. 7.

^dProved reserves = Col. 10 from prior year + Col. 4 + Col. 8 - Col. 9.

^eBased on following year data only.

^fConsists only of operator reported corrections and no other adjustments.

– = Not applicable.

Notes: Old means discovered in a prior year. New means discovered during the report year. The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves". They may differ from the official Energy Information Administration production data for crude oil contained in the *Petroleum Supply Annual*, DOE/EIA-0340.

Source: *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves*, 1977 through 1995 annual reports, DOE/EIA-0216.(1-19)

Table D3. U.S. Proved Reserves of Dry Natural Gas, 1976–1996
(Billion Cubic Feet at 14.73 psia and 60° Fahrenheit)

Year	Adjustments ^a (1)	Revision Increases (2)	Revision Decreases (3)	Revisions ^b and Adjustments (4)	Extensions (5)	New Field Discoveries (6)	New Reservoir Discoveries in Old Fields (7)	Total ^c Discoveries (8)	Production (9)	Proved ^d Reserves 12/31 (10)	Change from Prior Year (11)
1976	—	—	—	—	—	—	—	—	—	^e 213,278	—
1977	^f -20	13,691	15,296	-1,625	8,129	3,173	3,301	14,603	18,843	207,413	-5,865
1978	2,429	14,969	15,994	1,404	9,582	3,860	4,579	18,021	18,805	208,033	+620
1979	-2,264	16,410	16,629	-2,483	8,950	3,188	2,566	14,704	19,257	200,997	-7,036
1980	1,201	16,972	15,923	2,250	9,357	2,539	2,577	14,473	18,699	199,021	-1,976
1981	1,627	16,412	13,813	4,226	10,491	3,731	2,998	17,220	18,737	201,730	+2,709
1982	2,378	19,795	19,340	2,833	8,349	2,687	3,419	14,455	17,506	201,512	-218
1983	3,090	17,602	17,617	3,075	6,909	1,574	2,965	11,448	15,788	200,247	-1,265
1984	-2,241	17,841	14,712	888	8,299	2,536	2,686	13,521	17,193	197,463	-2,784
1985	-1,708	18,775	16,304	763	7,169	999	2,960	11,128	15,985	193,369	-4,094
1986	1,320	21,269	17,697	4,892	6,065	1,099	1,771	8,935	15,610	191,586	-1,783
1987	1,268	17,527	14,231	4,564	4,587	1,089	1,499	7,175	16,114	187,211	-4,375
1988	2,193	23,367	38,427	-12,867	6,803	1,638	1,909	10,350	16,670	^g 168,024	-19,187
1989	3,013	26,673	23,643	6,043	6,339	1,450	2,243	10,032	16,983	167,116	-908
1990	1,557	18,981	13,443	7,095	7,952	2,004	2,412	12,368	17,233	169,346	+2,230
1991	2,960	19,890	15,474	7,376	5,090	848	1,604	7,542	17,202	167,062	-2,284
1992	2,235	18,055	11,962	8,328	4,675	649	1,724	7,048	17,423	165,015	-2,047
1993	972	17,597	12,248	6,321	6,103	899	1,866	8,868	17,789	162,415	-2,600
1994	1,945	21,365	15,881	7,429	6,941	1,894	3,480	12,315	18,322	163,837	+1,422
1995	580	20,465	12,731	8,314	6,843	1,666	2,452	10,961	17,966	165,146	+1,309
1996	3,785	17,132	13,046	7,871	7,757	1,451	3,110	12,318	18,861	166,474	+1,328

^aIncludes operator reported corrections for the years 1978 through 1981. After 1981 operators included corrections with revisions.

^bRevisions and adjustments = Col. 1 + Col. 2 - Col. 3.

^cTotal discoveries = Col. 5 + Col. 6 + Col. 7.

^dProved reserves = Col. 10 from prior year + Col. 4 + Col. 8 - Col. 9.

^eBased on following year data only.

^fConsists only of operator reported corrections and no other adjustments.

^gAn unusually large revision decrease to North Slope dry natural gas reserves was made in 1988. It recognizes some 24.6 trillion cubic feet of downward revisions reported during the last few years by operators because of economic and market conditions. EIA in previous years carried these reserves in the proved category.

— = Not applicable.

Notes: Old means discovered in a prior year. New means discovered during the report year. The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," and Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production". They may differ from the official Energy Information Administration production data for natural gas contained in the *Natural Gas Annual*, DOE/EIA-0131.

Source: *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves*, 1977 through 1995 annual reports, DOE/EIA-0216.{1-19}

Table D4. U.S. Lower 48 Proved Reserves of Dry Natural Gas, 1976-1996
(Billion Cubic Feet at 14.73 psia and 60° Fahrenheit)

Year	Adjustments ^a (1)	Revision Increases (2)	Revision Decreases (3)	Revisions ^b and Adjustments (4)	Extensions (5)	New Field Discoveries (6)	New Reservoir Discoveries in Old Fields (7)	Total ^c Discoveries (8)	Production (9)	Proved ^d Reserves 12/31 (10)	Change from Prior Year (11)
1976	-	-	-	-	-	-	-	-	-	^e 180,838	-
1977	^f -21	13,689	15,229	-1,561	8,056	3,173	3,301	14,530	18,637	175,170	-5,668
1978	2,446	13,912	14,670	1,688	9,582	3,860	4,277	17,719	18,589	175,988	818
1979	-2,202	15,691	16,398	-2,909	8,949	3,173	2,566	14,688	19,029	168,738	-7,250
1980	1,163	15,881	15,819	1,225	9,046	2,539	2,577	14,162	18,486	165,639	-3,099
1981	1,840	16,258	13,752	4,346	10,485	3,731	2,994	17,210	18,502	168,693	3,054
1982	2,367	17,570	19,318	619	8,349	2,687	3,419	14,455	17,245	166,522	-2,171
1983	3,089	17,296	16,875	3,510	6,908	1,574	2,965	11,447	15,515	165,964	-558
1984	-2,245	16,934	14,317	372	8,298	2,536	2,686	13,520	16,869	162,987	-2,977
1985	-1,349	18,252	15,752	1,151	7,098	999	2,960	11,057	15,673	159,522	-3,465
1986	1,618	21,084	16,940	5,762	6,064	1,099	1,761	8,924	15,286	158,922	-600
1987	1,066	16,809	14,164	3,711	4,542	1,077	1,499	7,118	15,765	153,986	-4,936
1988	2,017	22,571	13,676	10,912	6,771	1,638	1,909	10,318	16,270	158,946	4,960
1989	2,997	26,446	23,507	5,936	6,184	1,450	2,243	9,877	16,582	158,177	-769
1990	1,877	17,916	13,344	6,449	7,898	2,004	2,412	12,314	16,894	160,046	+1,869
1991	2,967	19,095	15,235	6,827	5,074	848	1,563	7,485	16,849	157,509	-2,537
1992	1,946	17,878	11,941	7,883	4,621	649	1,724	6,994	17,009	155,377	-2,132
1993	915	16,918	12,139	5,694	6,076	899	1,858	8,833	17,396	152,508	-2,869
1994	1,896	21,121	15,832	7,185	6,936	1,894	3,480	12,310	17,899	154,104	+1,596
1995	973	19,903	12,680	8,196	6,801	1,666	2,452	10,919	17,570	155,649	+1,545
1996	3,640	16,930	12,875	7,695	7,751	1,390	3,110	12,251	18,415	157,180	+1,531

^aIncludes operator reported corrections for the years 1978 through 1981. After 1981 operators included corrections with revisions.

^bRevisions and adjustments = Col. 1 + Col. 2 - Col. 3.

^cTotal discoveries = Col. 5 + Col. 6 + Col. 7.

^dProved reserves = Col. 10 from prior year + Col. 4 + Col. 8 - Col. 9.

^eBased on following year data only.

^fConsists only of operator reported corrections and no other adjustments.

- = Not applicable.

Notes: Old means discovered in a prior year. New means discovered during the report year. The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," and Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production". They may differ from the official Energy Information Administration production data for natural gas contained in the *Natural Gas Annual*, DOE/EIA-0131.

Source: U.S. *Crude Oil, Natural Gas, and Natural Gas Liquids Reserves*, 1977 through 1995 annual reports, DOE/EIA-0216.{1-19}

Table D5. U.S. Proved Reserves of Wet Natural Gas, After Lease Separation, 1978–1996
(Billion Cubic Feet at 14.73 psia and 60° Fahrenheit)

Year	Adjustments ^a (1)	Revision Increases (2)	Revision Decreases (3)	Revisions ^b and Adjustments (4)	Extensions (5)	New Field Discoveries (6)	New Reservoir Discoveries in Old Fields (7)	Total ^c Discoveries (8)	Production (9)	Proved ^d Reserves 12/31 (10)	Change from Prior Year (11)
1978	–	–	–	–	–	–	–	–	–	^e 208,033	–
1979	5,356	17,077	17,300	5,133	9,332	3,279	2,637	15,248	20,079	208,335	+302
1980	1,253	17,668	16,531	2,390	9,757	2,629	2,648	15,034	19,500	206,259	–2,076
1981	2,057	17,156	14,413	4,800	10,979	3,870	3,080	17,929	19,554	209,434	+3,175
1982	2,598	20,596	20,141	3,053	8,754	2,785	3,520	15,059	18,292	209,254	–180
1983	4,363	18,442	18,385	4,420	7,263	1,628	3,071	11,962	16,590	209,046	–208
1984	–2,413	18,751	15,418	920	8,688	2,584	2,778	14,050	18,032	205,984	–3,062
1985	–1,299	19,732	17,045	1,388	7,535	1,040	3,053	11,628	16,798	202,202	–3,782
1986	2,137	22,392	18,557	5,972	6,359	1,122	1,855	9,336	16,401	201,109	–1,093
1987	1,199	18,455	14,933	4,721	4,818	1,128	1,556	7,502	16,904	196,428	–4,681
1988	2,180	24,638	^f 39,569	–12,751	7,132	1,677	1,979	10,788	17,466	^f 176,999	–19,429
1989	2,537	27,844	24,624	5,757	6,623	1,488	2,313	10,424	17,752	175,428	–1,571
1990	1,494	19,861	14,024	7,331	8,287	2,041	2,492	12,820	18,003	177,576	+2,148
1991	3,368	20,758	16,189	7,937	5,298	871	1,655	7,824	18,012	175,325	–2,251
1992	2,543	18,906	12,532	8,917	4,895	668	1,773	7,336	18,269	173,309	–2,016
1993	1,048	18,394	12,853	6,589	6,376	927	1,930	9,233	18,641	170,490	–2,819
1994	1,977	22,345	16,509	7,813	7,299	1,941	3,606	12,846	19,210	171,939	+1,449
1995	889	21,548	13,457	8,980	7,204	1,709	2,518	11,431	18,874	173,476	+1,537
1996	4,288	18,034	13,757	8,565	8,189	1,491	3,209	12,889	19,783	175,147	+1,671

^aIncludes operator reported corrections for the years 1978 through 1981. After 1981 operators included corrections with revisions.

^bRevisions and adjustments = Col. 1 + Col. 2 - Col. 3.

^cTotal discoveries = Col. 5 + Col. 6 + Col. 7.

^dProved reserves = Col. 10 from prior year + Col. 4 + Col. 8 - Col. 9.

^eBased on following year data only.

^fAn unusually large revision decrease to North Slope wet natural gas reserves was made in 1988. It recognizes some 25 trillion cubic feet of downward revisions reported during the last few years by operators because of economic and market conditions. EIA in previous years carried these reserves in the proved category.

– = Not applicable.

Notes: Old means discovered in a prior year. New means discovered during the report year. The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves". They may differ from the official Energy Information Administration production data for natural gas contained in the *Natural Gas Annual*, DOE/EIA-013.

Source: *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves*, 1979 through 1995 annual reports, DOE/EIA-0216.(1-10,12-19)

Table D6. U.S. Lower 48 Proved Reserves of Wet Natural Gas, After Lease Separation, 1978–1996
(Billion Cubic Feet at 14.73 psia and 60° Fahrenheit)

Year	Adjustments ^a (1)	Revision Increases (2)	Revision Decreases (3)	Revisions ^b and Adjustments (4)	Extensions (5)	New Field Discoveries (6)	New Reservoir Discoveries in Old Fields (7)	Total ^c Discoveries (8)	Production (9)	Proved ^d Reserves 12/31 (10)	Change from Prior Year (11)
1978	—	—	—	—	—	—	—	—	—	^e 175,988	—
1979	5,402	16,358	17,069	4,691	9,331	3,264	2,637	15,232	19,851	176,060	+72
1980	1,218	16,577	16,427	1,368	9,446	2,629	2,648	14,723	19,287	172,864	-3,196
1981	2,270	17,002	14,352	4,920	10,973	3,870	3,076	17,919	19,318	176,385	+3,521
1982	2,586	18,371	20,119	838	8,754	2,785	3,520	15,059	18,030	174,252	-2,133
1983	4,366	18,136	17,643	4,859	7,262	1,628	3,071	11,961	16,317	174,755	+503
1984	-2,409	17,844	15,023	412	8,687	2,584	2,778	14,049	17,708	171,508	-3,247
1985	-1,313	19,203	16,490	1,400	7,463	1,040	3,053	11,556	16,485	167,979	-3,529
1986	2,114	22,207	17,797	6,524	6,357	1,122	1,845	9,324	16,073	167,754	-225
1987	1,200	17,733	14,865	4,068	4,772	1,116	1,556	7,444	16,553	162,713	-5,041
1988	2,025	23,829	14,439	11,415	7,099	1,677	1,979	10,755	17,063	167,820	+5,107
1989	2,545	27,616	24,488	5,673	6,467	1,485	2,313	10,265	17,349	166,409	-1,411
1990	1,811	18,784	13,925	6,670	8,232	2,041	2,492	12,765	17,661	168,183	+1,774
1991	3,367	19,961	15,948	7,380	5,281	871	1,614	7,766	17,657	165,672	-2,511
1992	2,265	18,728	12,511	8,482	4,840	668	1,773	7,281	17,851	163,584	-2,088
1993	996	17,714	12,743	5,967	6,349	927	1,922	9,198	18,245	160,504	-3,080
1994	1,924	22,071	16,458	7,537	7,294	1,941	3,606	12,841	18,756	162,126	+1,622
1995	1,304	20,928	13,403	8,829	7,162	1,709	2,518	11,389	18,443	163,901	+1,775
1996	4,219	17,832	13,586	8,465	8,183	1,430	3,209	12,822	19,337	165,851	+1,950

^aIncludes operator reported corrections for the years 1978 through 1981. After 1981 operators included corrections with revisions.

^bRevisions and adjustments = Col. 1 + Col. 2 - Col. 3.

^cTotal discoveries = Col. 5 + Col. 6 + Col. 7.

^dProved reserves = Col. 10 from prior year + Col. 4 + Col. 8 - Col. 9.

^eBased on following year data only.

— = Not applicable.

Notes: Old means discovered in a prior year. New means discovered during the report year. The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves". They may differ from the official Energy Information Administration production data for natural gas contained in the *Natural Gas Annual*, DOE/EIA-0131.

Source: U.S. *Crude Oil, Natural Gas, and Natural Gas Liquids Reserves*, 1979 through 1995 annual reports, DOE/EIA-0216.(1-10,12-19)

Table D7. U.S. Proved Reserves of Natural Gas Liquids, 1978–1996
(Million Barrels of 42 U.S. Gallons)

Year	Adjustments ^a (1)	Revision Increases (2)	Revision Decreases (3)	Revisions ^b and Adjustments (4)	Extensions (5)	New Field Discoveries (6)	New Reservoir Discoveries in Old Fields (7)	Total ^c Discoveries (8)	Production (9)	Proved Reserves 12/31 (10)	Change from Prior Year (11)
1978	—	—	—	—	—	—	—	—	—	^e 6,772	—
1979	^f 64	677	726	15	364	94	97	555	727	6,615	–157
1980	153	743	639	257	418	90	79	587	731	6,728	+113
1981	231	729	643	317	542	131	91	764	741	7,068	+340
1982	299	811	832	278	375	112	109	596	721	7,221	+153
1983	849	847	781	915	321	70	99	490	725	7,901	+680
1984	–123	866	724	19	348	55	96	499	776	7,643	–258
1985	426	906	744	588	337	44	85	466	753	7,944	+301
1986	367	1,030	807	590	263	34	72	369	738	8,165	+221
1987	231	847	656	422	213	39	55	307	747	8,147	–18
1988	11	1,168	715	464	268	41	72	381	754	8,238	+91
1989	–277	1,143	1,020	–154	259	83	74	416	731	7,769	–469
1990	–83	827	606	138	299	39	73	411	732	7,586	–183
1991	233	825	695	363	189	25	55	269	754	7,464	–122
1992	225	806	545	486	190	20	64	274	773	7,451	–13
1993	102	764	640	226	245	24	64	333	788	7,222	–229
1994	43	873	676	240	314	54	131	499	791	7,170	–52
1995	192	968	691	469	432	52	67	551	791	7,399	+229
1996	474	844	669	649	451	65	109	625	850	7,823	+424

^aIncludes operator reported corrections for the years 1978 through 1981. After 1981 operators included corrections with revisions.

^bRevisions and adjustments = Col. 1 + Col. 2 - Col. 3.

^cTotal discoveries = Col. 5 + Col. 6 + Col. 7.

^dProved reserves = Col. 10 from prior year + Col. 4 + Col. 8 - Col. 9.

^eBased on following year data only.

^fConsists only of operator reported corrections and no other adjustments.

— = Not applicable.

Notes: Old means discovered in a prior year. New means discovered during the report year. The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," and Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production". They may differ from the official Energy Information Administration production data for natural gas liquids contained in the *Natural Gas Annual*, DOE/EIA-0131.

Source: U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 1979 through 1995 annual reports, DOE/EIA-0216.(1-10,12-19)

Table D8. U.S. Lower 48 Proved Reserves of Natural Gas Liquids, 1978–1996
(Million Barrels of 42 U.S. Gallons)

Year	Adjustments ^a (1)	Revision Increases (2)	Revision Decreases (3)	Revisions ^b and Adjustments (4)	Extensions (5)	New Field Discoveries (6)	New Reservoir Discoveries in Old Fields (7)	Total ^c Discoveries (8)	Production (9)	Proved ^d Reserves 12/31 (10)	Change from Prior Year (11)
1978	—	—	—	—	—	—	—	—	—	^e 6,749	—
1979	^f 63	677	726	14	364	94	97	555	726	6,592	–157
1980	165	743	639	269	418	90	79	587	731	6,717	+125
1981	233	728	643	318	542	131	91	764	741	7,058	+341
1982	300	811	832	279	375	112	109	596	721	7,212	+154
1983	850	847	781	916	321	70	99	490	725	7,893	+681
1984	–115	847	724	8	348	55	96	499	776	7,624	–269
1985	70	883	731	222	334	44	85	463	748	7,561	–63
1986	363	1,030	804	589	263	34	72	369	735	7,784	+223
1987	179	846	655	370	212	39	55	306	731	7,729	–55
1988	10	1,167	715	462	267	41	72	380	734	7,837	+108
1989	–273	1,141	1,018	–150	259	83	74	416	714	7,389	–448
1990	–60	827	606	161	298	39	73	410	714	7,246	–143
1991	183	815	677	321	187	25	55	267	730	7,104	–142
1992	225	796	542	479	183	20	64	267	746	7,104	0
1993	101	755	631	225	245	24	64	333	761	6,901	–203
1994	38	872	676	234	314	54	131	499	765	6,869	–32
1995	204	918	688	434	432	52	67	551	761	7,093	+224
1996	417	832	654	595	450	56	109	615	817	7,486	+393

^aIncludes operator reported corrections for the years 1978 through 1981. After 1981 operators included corrections with revisions.

^bRevisions and adjustments = Col. 1 + Col. 2 - Col. 3.

^cTotal discoveries = Col. 5 + Col. 6 + Col. 7.

^dProved reserves = Col. 10 from prior year + Col. 4 + Col. 8 - Col. 9.

^eBased on following year data only.

^fConsists only of operator reported corrections and no other adjustments.

— = Not applicable.

Notes: Old means discovered in a prior year. New means discovered during the report year. The production estimates in this table are based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," and Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production". They may differ from the official Energy Information Administration production natural gas liquids contained in the *Natural Gas Annual*, DOE/EIA-0131.

Source: *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves*, 1979 through 1995 annual reports, DOE/EIA-0216.(1-10,12-19)

Table D9. Deepwater Production and Proved Reserves of the Gulf of Mexico Federal Offshore, 1992-1996

Year	Gulf of Mexico			Depth		Deepwater Percentage
	Total	Louisiana ^a	Texas	Greater than 200 meters ^b	Less than 200 meters	
Crude Oil (million barrels of 42 U.S. gallons)						
Production						
1992	267	253	14	54	213	20.2
1993	266	252	14	52	214	19.5
1994	265	245	20	60	205	22.6
1995	292	262	30	83	209	28.4
1996	303	265	38	97	206	32.0
Reserves						
1992	1,835	1,643	192	582	1,253	31.7
1993	2,072	1,880	192	849	1,223	41.0
1994	2,127	1,922	205	908	1,219	42.7
1995	2,518	2,269	249	1,261	1,257	50.1
1996	2,567	2,357	210	1,346	1,221	52.4
Natural Gas, Wet After Lease Separation (billion cubic feet at 14.73 psia and 60° Fahrenheit)						
Production						
1992	4,576	3,292	1,284	243	4,333	5.3
1993	4,651	3,383	1,268	316	4,335	6.8
1994	4,797	3,505	1,292	393	4,404	8.2
1995	4,679	3,421	1,258	418	4,261	8.9
1996	5,045	3,752	1,293	613	4,432	12.2
Reserves						
1992	27,050	20,006	7,044	3,731	23,319	13.8
1993	26,463	19,751	6,712	3,848	22,615	14.5
1994	27,626	21,208	6,418	5,137	22,489	18.6
1995	28,229	21,664	6,565	6,159	22,070	21.8
1996	28,153	22,119	6,034	6,877	21,276	24.4
Natural Gas Liquids (million barrels of 42 U.S. gallons)						
Production						
1992	91	76	15	5	86	5.5
1993	97	80	17	8	89	8.2
1994	98	83	15	9	89	9.2
1995	85	71	14	7	78	8.2
1996	101	84	17	15	86	14.9
Reserves						
1992	590	472	118	107	483	18.1
1993	605	490	115	111	494	18.3
1994	603	500	103	130	473	21.6
1995	630	496	134	232	398	36.8
1996	753	621	132	334	419	44.4

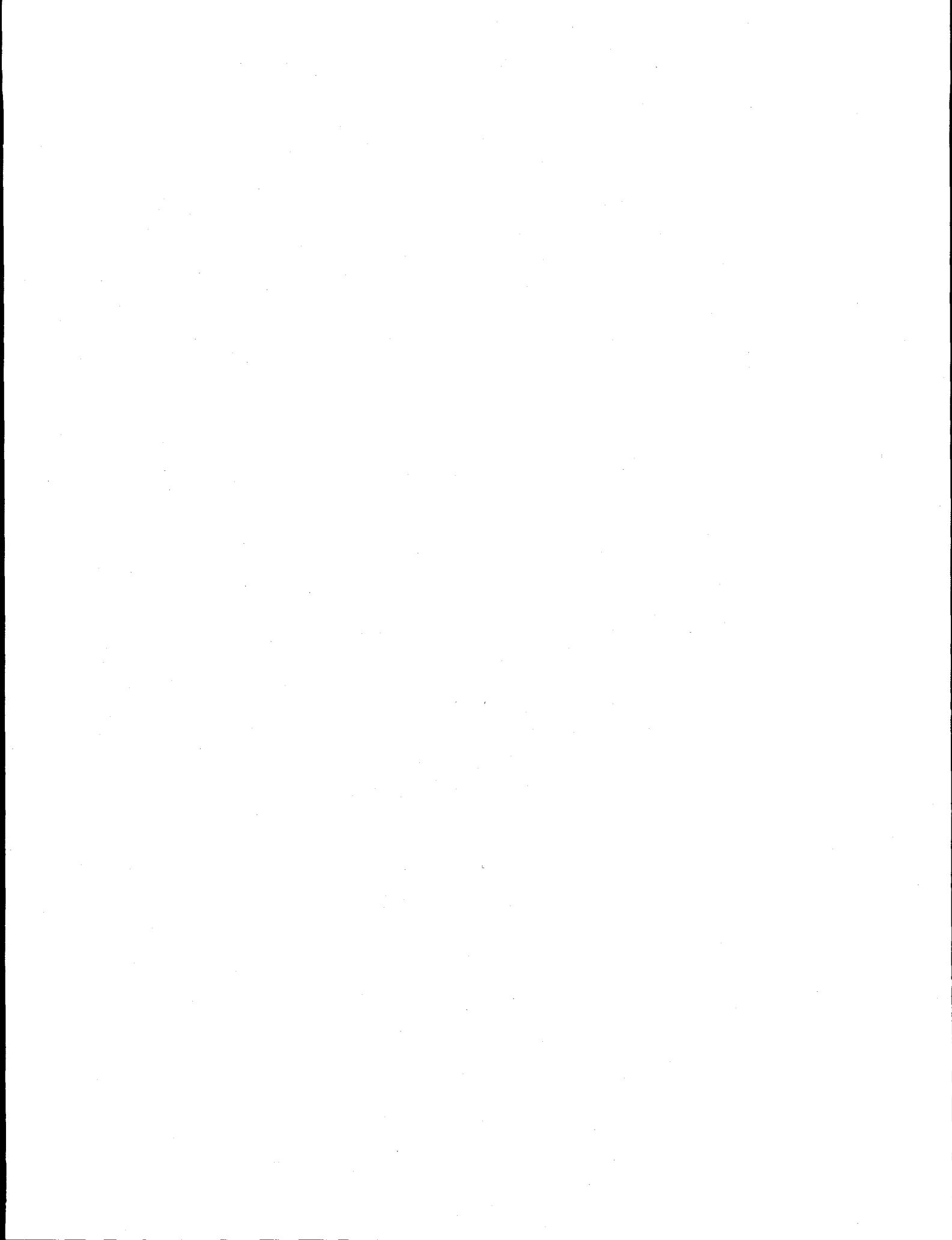
^aIncludes Federal Offshore Alabama.

^bBlocks in Atwater Valley, Ewing Bank, Green Canyon, Mississippi Canyon, Walker Ridge, Alaminos Canyon, Corpus Christi, East Breaks, Garden Banks, Keathley Canyon, Port Isabel are included. In addition, blocks 737-742, 779-786, 817-830, 859-874, 901-918, 943-962, and 987-1006 in Viosca Knoll are included.

Source: Based on data reported on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves."

Appendix E

Summary of Data Collection Operations



Summary of Data Collection Operations

Form EIA-23 Survey Design

The data collected on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves," were used to produce this report. This section provides information concerning the survey design, response statistics, reporting requirements, and frame maintenance.

Form EIA-23 is mailed annually to all known large and intermediate size operators, and a scientifically selected sample of small operators. Operator size categories were based upon their annual production as indicated in various Federal, State, and commercial records. The term **State/subdivision** refers to an individual subdivision within a State or an individual State that is not subdivided. Operators were divided into the three size categories shown below.

- **Category I - Large Operators:** Operators who produced 1.5 million barrels or more of crude oil, or 15 billion cubic feet or more of natural gas, or both.
- **Category II - Intermediate Operators:** Operators who produced at least 400,000 barrels of crude oil or 2 billion cubic feet of natural gas, or both, but less than Category I operators.
- **Category III - Small Operators:** Operators who produced less than the Category II operators.

Category III operators were further subdivided into operators sampled with **Certainty** and operators that were randomly sampled (**Noncertainty**).

Data were filed for calendar year 1996 by crude oil or natural gas well operators who were active as of December 31, 1996. EIA defines an operator as an organization or person responsible for the management and day-to-day operation of crude oil or natural gas wells. The purpose of this definition is to eliminate responses from royalty owners, working interest owners (unless they are also operators), and others not directly responsible for operations. An operator need not be a separately incorporated entity. To minimize reporting burden, corporations are permitted to report on the basis of operating units of the company convenient for them. A large corporation may be represented by a single form or by several forms.

Table E1 shows a comparison of the EIA-23 sample and sampling frame between 1989 and 1996, and depicts the number of active operators, 1989 showing the largest in the series. The 1996 sampling frame consisted of 176 Category I, 486 Category II, 3 Category III **Certainty**, and 22,745 Category III **Noncertainty** operators, for a total of 23,410 active operators. The survey sample consisted of 665 operators selected with **Certainty** that included all of the Category I and II **Certainty** operators and the 3 smaller operators that were selected with **Certainty** because of their size in relation to the area or areas in which they operated.

Form EIA-23 Response Statistics

Each company and its parent company or subsidiaries were required to file Form EIA-23 if they met the survey specifications. Response to the 1996 survey is summarized in Table E2. EIA makes a considerable effort to gain responses from all operators. About 9 percent of those selected turned out to be nonoperators (those that reported being nonoperators during the report year and operators that could not be located). Of the 59 nonoperators, 10 had successor operators that had taken over the production of the nonoperator. These successor operators were subsequently sampled. The overall response rate for the 1996 survey was 100 percent.

Form EIA-23 Reporting Requirements

The collection format for Form EIA-23 actually consists of two forms. The form the respondent is required to file is dependent upon the annual production levels of crude oil, natural gas, and lease condensate. Category I and Category II operators file a more detailed field level data form. Category III operators file a summary report which is aggregated at a State/subdivision level.

The cover page required of all respondents identifies each operator by name and address (Figure I1, Appendix I). The oil and gas producing industry includes a large number of small enterprises. Report

Table E1. Comparison of the EIA-23 Active Operator Sample and Sampling Frame, 1989-1996

Operator Category	Number of Operators							
	1989	1990	1991	1992	1993	1994	1995	1996
Certainty Frame	3,570	2,928	2,702	2,533	2,383	2,337	2,233	665
Category I	134	144	144	157	160	161	161	176
Category II	500	468	484	480	500	482	476	486
Category III	2,936	2,316	2,074	1,896	1,723	1,694	1,596	3
Sampled	3,570	2,928	2,702	2,533	2,383	2,337	2,233	665
Percent Sampled	100	100	100	100	100	100	100	100
Noncertainty Frame	24,062	24,628	22,144	21,640	21,273	21,885	20,533	22,745
Sampled	1,325	1,431	1,760	1,724	1,691	1,737	1,632	0
Percent Sampled	6	6	8	8	8	8	8	0
Total Frame	27,632	27,556	24,846	24,173	23,656	24,222	22,766	23,410
Not Sampled	22,737	23,196	20,384	19,916	19,791	20,148	18,901	22,745
Sampled	4,895	4,360	4,462	4,257	4,074	4,074	3,865	665
Percent Sampled	18	16	18	18	17	17	17	3

Note: The three operators sampled as Category III in 1996 are operating in the Federal Offshore and the Federal Offshore is sampled with Certainty.

Source: Energy Information Administration, Office of Oil and Gas.

Table E2. Form EIA-23 Survey Response Statistics, 1996

Operator Category	Sample Selected	Successor ^a Operators	Net ^b Category		Total Operators	Responding Operators		Nonresponding Operators	
			Changes	Non- ^c operators		Number	Percent	Number	Percent
Certainty									
Category I	176	2	15	-16	177	177	100.0	0	0.0
Category II	486	7	-65	-43	385	385	100.0	0	0.0
Category III	3	1	50	0	54	54	100.0	0	0.0
Subtotal	665	10	0	-59	616	616	100.0	0	0.0
Noncertainty	0	0	0	0	0	0	0	0	0.0
Total	665	10	0	-59	616	616	100.0	0	0.0

^aSuccessor operators are those, not initially sampled, that have taken over the production of a sampled operator.

^bNet of recategorized operators in the sample (excluding nonoperators).

^cIncludes former operators reporting that they were not operators during the report year and operators that could not be located who are treated as nonoperators.

Notes: Data from 568 operators were used to estimate proved reserves for 1996. Data from 48 onshore operators that changed to Category III size class from Category II were not used to make the 1996 proved reserves estimates. In order to have complete coverage in the Federal Offshore, six Category III operators that were operating in the Federal Offshore in 1996 were used to estimate proved reserves. Three of these operators changed size class from Category II to Category III.

Source: Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves" 1996.

year production data were required by State/subdivision areas for crude oil, natural gas, and lease condensate. Proved reserves data for operators were required only for those properties where estimates existed in the respondent's records.

All Category I and Category II operators were required to file field level data on Schedule A, "Operated Proved Reserves, Production, and Related Data by Field," for each oil and/or gas field in which the respondent operated properties (Figure I2, Appendix I). All Category I and those Category II operators who had reserve estimates were required to file on a total

operated basis for crude oil, nonassociated natural gas, associated-dissolved natural gas, and lease condensate. The following data items were required to be filed: proved reserves at the beginning and the end of the report year, revision increases and revision decreases, extensions, new field discoveries, new reservoirs in old fields, production, indicated additional reserves of crude oil, nonproducing reserves, field discovery year, water depth, and field location information.

Category II operators who did not have reserves estimates were required to file the field location information and report year production for the four hydrocarbon types from properties where reserves

were not estimated. These respondents used Schedule B, "Footnotes," to provide clarification of reported data items when required in the instructions, or electively to provide narrative or detail to explain any data item filed (Figure I3, Appendix I).

Crude oil and lease condensate volumes were reported rounded to thousands of barrels of 42 U.S. gallons at 60° Fahrenheit, and natural gas volumes were reported rounded to millions of cubic feet. All natural gas volumes were requested to be reported at 60° Fahrenheit and a pressure base of 14.73 pounds per square inch absolute. Other minor report preparation standards were specified to assure that the filed data could be readily processed.

Oil and Gas Field Coding

A major effort to create standardized codes for all identified oil or gas fields throughout the United States was implemented during the 1982 survey year. Information from previous lists was reviewed and reconciled with State lists and a consolidated list was created. The publication of the *Oil and Gas Field Code Master List 1996*, in December of 1996, was the 14th annual report and reflected data collected through October 1996. This publication was mailed to operators to assist in identifying the field code data necessary for the preparation of Form EIA-23. A copy of this publication may be purchased from the National Energy Information Center (see inside cover page).

Form EIA-23 Comparison with Other Data Series

Estimated crude oil, lease condensate, and natural gas production volumes from Form EIA-23 were compared with official EIA production data supplied by Federal and State oil and natural gas regulatory agencies and published in EIA's monthly and annual reports. Reports published by the Federal and State oil and natural gas regulatory agencies were used to compare specific operator production responses to these agencies with Form EIA-23 responses. When significant differences were found, responses were researched to detect and reconcile possible reporting errors.

For 1996, Form EIA-23 National estimates of production were 2,335 million barrels for crude oil and lease condensate or 31 million barrels (1.3 percent) lower than that reported in the *Petroleum Supply Annual*

1996 for crude oil and lease condensate. Form EIA-23 National estimates of production for dry natural gas were 18,861 billion cubic feet or 68 billion cubic feet (0.4 percent) higher than the *Natural Gas Annual 1996* for 1996 dry natural gas production.

Form EIA-23 Frame Maintenance

Operator frame maintenance is a major data quality control effort. Extensive effort is expended to keep the frame as current as possible. The Form EIA-23 frame contains a listing of all crude oil and natural gas well operators in the United States and must be maintained and updated regularly in order to ensure an accurate frame from which to draw the sample for the annual crude oil and natural gas reserves survey. The original frame, created in 1977, has been revised annually. In addition, outside sources, such as State publications and computer tapes, and commercial information data bases such as Petroleum Information/Dwight's LLC are used to obtain information on operator status and to update addresses for the frame each year.

A maintenance procedure is utilized, using a postcard form with prepaid return postage, to contact possible active crude oil and natural gas well operators presently listed on EIA's master frame, but for whom the listing had not been updated for 2 years. This procedure identifies active operators and nonoperators which improves the frame for future sample selections for the survey. Table E3 provides a summary of changes made to the Form EIA-23 frame of crude oil and natural gas well operators for the 1996 survey mailing. These changes resulted from all frame maintenance activities.

The Form EIA-23 operator frame contained a total of 64,172 entries as of December 27, 1996. Of these, 23,410 were confirmed operators. These are operators who have filed in the past or for whom the EIA has recent production data from an outside source. The remaining operators (including both definite and probable nonoperators) exist as a pool of names and addresses that may be added to the active list if review indicates activity.

Form EIA-64A Survey Design

The data for this report are also collected on Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production." This section provides

Table E3. Summary of the 1996 Operator Frame Activity, Form EIA-23

Total 1995 Operator Frame.....	64,049
Operators.....	22,695
Nonoperators.....	41,354
Changes to 1995 Operator Status ^a	603
From Nonoperator to Operator.....	598
From Operator to Nonoperator.....	5
No Changes to 1995 Operator Status...	63,446
Operators.....	22,113
Nonoperators.....	41,333
Additions to 1995 Operator Frame ^a	123
Operator.....	122
Nonoperator.....	1
Total 1996 Operator Frame.....	64,172
Operators.....	23,410
Nonoperators.....	40,762

^aRelatively few changes were made as frames maintenance was curtailed because only large operators were surveyed in 1996.

Note: Includes operator frame activity through December 27, 1996.

Source: Energy Information Administration, Office of Oil and Gas.

information concerning the survey design, response statistics, reporting requirements, and frame maintenance for Form EIA-64A.

Form EIA-23 for report years 1977 and 1978 required natural gas well operators to report their natural gas data on a fully dry basis. It was discovered in the course of those surveys that many operators had little or no knowledge of the extraction of liquids from their produced natural gas streams once custody transfer had taken place. Therefore, these operators reverted to reporting the only natural gas volume data they had in their possession. These volume data were for dryer natural gas than that which had passed through the wellhead, but wetter than fully dry natural gas. With reference to **Figure E1**, they reported their volumes either at the wellhead or after removal of lease condensate in their lease or field separation facilities.

Some of the larger operators, however, also owned or operated natural gas processing plants. They reported their volumes after removal of both lease condensate and plant liquids, as required by Form EIA-23. The aggregate volumes resulting from the 1977 and 1978 surveys, therefore, were neither fully dry (as was intended) nor fully wet. They do appear to have been more dry than wet simply because the operators who reported fully dry volumes also operated properties that contained the bulk of proved natural gas reserves.

The EIA recognized that its estimates of proved reserves of natural gas liquids (NGL) had to reflect not only those volumes extractable in the future under current economic and operating conditions at the lease or field (lease condensate), but also volumes (plant liquids) extractable downstream at existing natural gas processing plants. Form EIA-64, which already canvassed these processing plants, did not request that the plants' production volumes be attributed to source areas. Beginning with the 1979 survey, a new form to collect plant liquids production according to the area or areas where their input natural gas stream had been produced was mailed to all of the operating plants. The instructions for filing the Form EIA-23 were altered to collect data from natural gas well operators that reflected those volumes of natural gas dried only through the lease or field separation facilities. The reporting basis of these volumes are referred to as "wet after lease separation." The methodology used to estimate NGL reserves by State and State subdivision is provided in Appendix F.

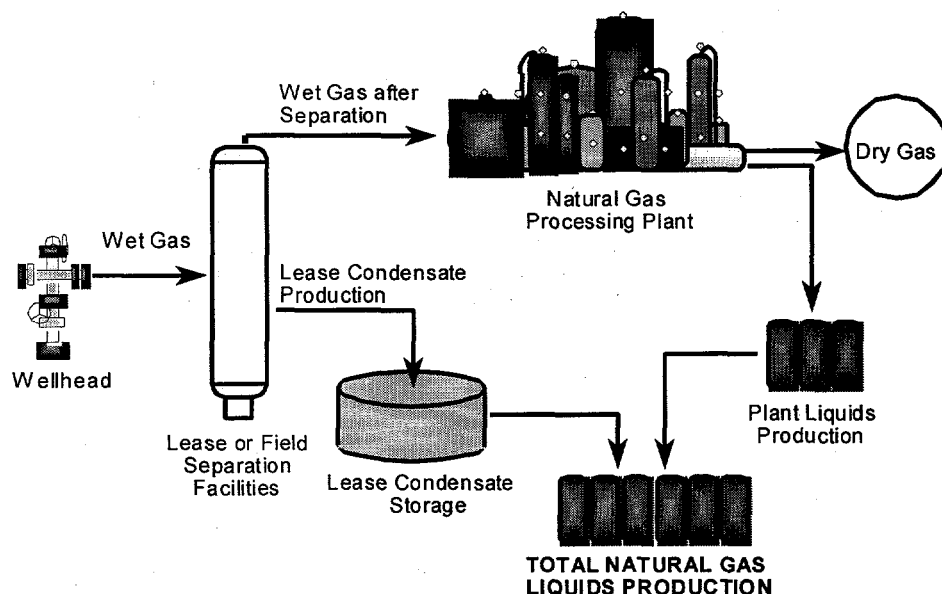
Form EIA-64A Response Statistics

EIA mailed EIA-64A forms to all known natural gas processing plant operators as of January 14, 1996. In addition, plant operators whose plants were shut down or dismantled during 1996 were required to complete forms for the portion of 1996 when the plants were in operation.

Natural gas processing plant operators were requested to file a Form EIA-64A for each of their plants. A total of 265 operators of 725 plants were sent forms. This number included 6 new plants and 9 successor plants identified after the initial 1996 survey mailing. A total of 39 plants were reported as nonoperating according to the Form EIA-64A definition. The response rate was again 100 percent.

Form EIA-64A respondents were requested to report natural gas liquids production data by area of origin. **Table E4** summarizes the responses by plant operators of the volume and origin of natural gas delivered to the processing plants and the volume of the natural gas liquids extracted by the plants by State. The majority of the plant operators reported only one area of origin for the natural gas that was processed by a plant. The State or area of origin reported is generally also the plant's location.

Figure E1. Natural Gas Liquids Extraction Flows



Source: Energy Information Administration, Office of Oil and Gas.

Form EIA-64A Reporting Requirements

Form EIA-64A consisted of the reporting schedule shown in Figure I4, Appendix I. The form identifies the plant, its geographic location, the plant operator's name and address, and the parent company name. The certification was signed by a responsible official of the operating entity. The form pertains to the volume of natural gas received and of natural gas liquids produced at the plant, allocated to each area of origin. Operators also filed the data pertaining to the amount of natural gas shrinkage that resulted from extraction of natural gas liquids at the plant, and the amount of fuel used in processing.

Natural gas liquids volumes were reported rounded to thousands of barrels of 42 U.S. gallons at 60° Fahrenheit, and natural gas volumes were reported rounded to millions of cubic feet. All natural gas volumes were requested to be reported at 60° Fahrenheit and a pressure base of 14.73 pounds per square inch absolute. Other minor report preparation standards were specified to assure that the filed data could be readily processed.

Form EIA-64A Comparison with Other Data Series

Form EIA-64A plant liquids production data were compared with data collected on Form EIA-816, "Monthly Natural Gas Liquids Report." Aggregated production from Form EIA-816 represents the net volume of natural gas processing plant liquid output less input for the report year. These data are published in EIA's *Petroleum Supply Annual* reports. The Form EIA-64A annual responses reflect all corrections and revisions to EIA's monthly estimates. Differences, when found, were reconciled in both sources. For 1996, the Form EIA-64A National estimates were 2.9 percent (19 million barrels) higher than the *Petroleum Supply Annual* 1996 volume for natural gas plant liquids production.

Table E4. Natural Gas Processed and Liquids Extracted at Natural Gas Processing Plants, 1996

Plant Location	Volume of Natural Gas Delivered to Processing Plants			Total Liquids Extracted (thousand barrels)
	State Production	Out of State Production	Natural Gas Processed	
	(million cubic feet)			
Alaska	2,987,364	0	2,987,364	33,346
Lower 48 States	14,112,574	370,721	14,483,295	655,968
Alabama	111,656	1,212	112,868	4,009
Arkansas	214,868	4,609	219,477	383
California	240,566	0	240,566	9,798
Colorado	493,748	215	493,963	16,735
Florida	5,900	2,614	8,514	1,630
Kansas	825,825	144,338	970,163	35,285
Kentucky	44,151	1,864	46,015	1,692
Louisiana	4,496,445	156,232	4,652,677	101,716
Michigan	117,119	0	117,119	4,810
Mississippi	4,521	0	4,521	254
Montana	10,106	35	10,141	431
North Dakota	47,942	0	47,942	3,860
New Mexico	1,129,523	75	1,129,598	75,476
Oklahoma	1,052,170	1,953	1,054,123	70,165
Texas	4,139,267	40,795	4,180,062	279,650
Utah	252,781	12,765	265,546	9,547
West Virginia	70,552	157	70,709	4,849
Wyoming	844,009	1,244	845,253	35,093
Miscellaneous*	11,425	2,613	14,038	585
Total	17,099,938	370,721	17,470,659	689,314

*Includes Illinois, Nebraska, Ohio, Pennsylvania, and Tennessee.

Source: Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production," 1996.

Form EIA-64A Frame Maintenance

The Form EIA-64A plant frame contains data on all known active and inactive natural gas processing plants in the United States. The 1996 plant frame was compared to listings of natural gas processing plants from Form EIA-816, "Monthly Natural Gas Liquids Report"; the *LPG Almanac*; and the *Oil and Gas Journal*. A list of possible additions to the plant frame was compiled. **Table E5** summarizes the Form EIA-64A plant frame changes made as a result of the comparisons as of December 16, 1996.

Table E5. Summary of the 1996 Plant Frame Activity, Form EIA-64A

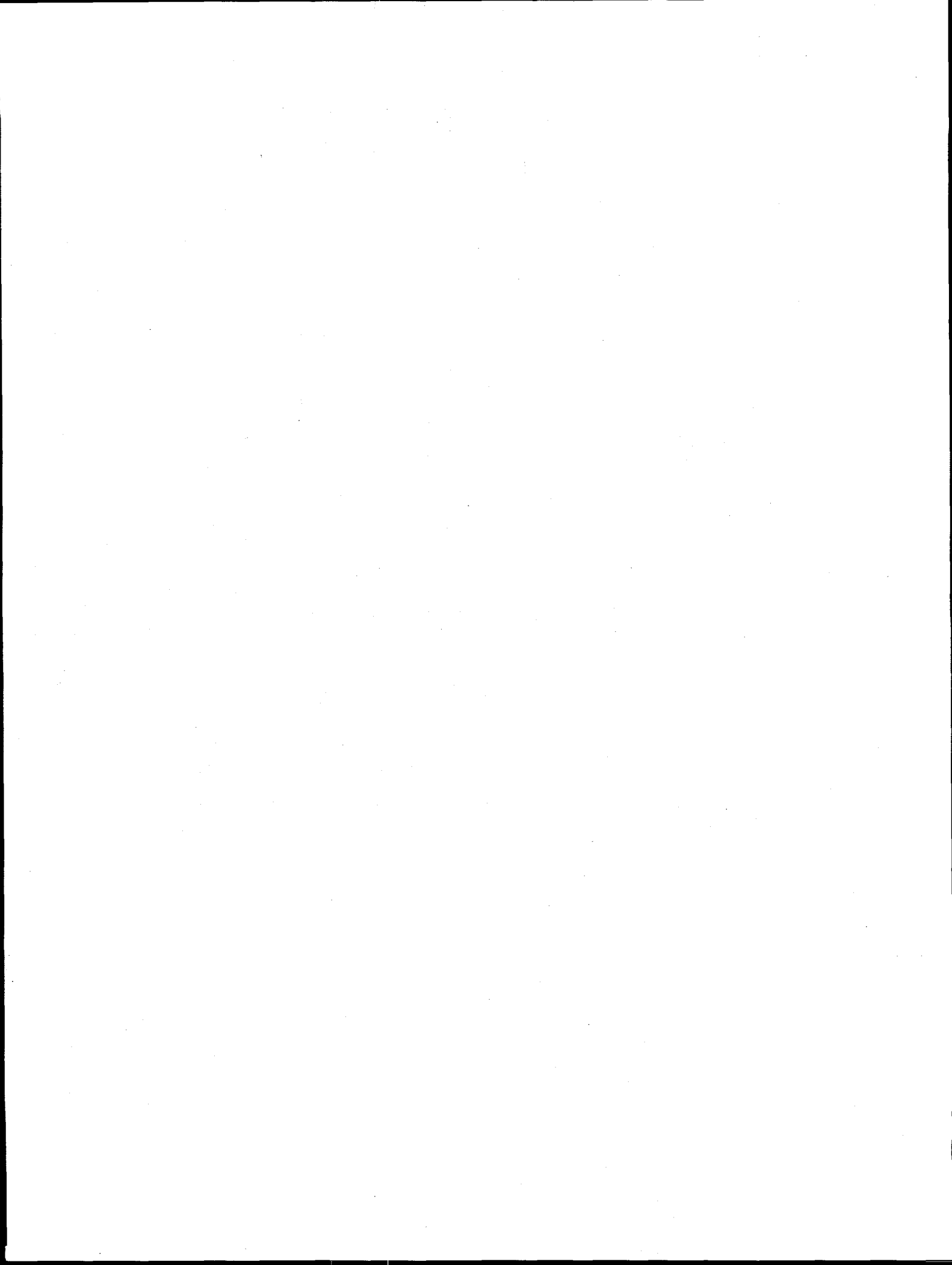
Frame as of 1995 survey mailing	759
Additions	131
Deletions	-180
Frame as of 1996 survey mailing	710

Note: Includes operator frame activity through December 16, 1996.

Source: Energy Information Administration, Office of Oil and Gas.

Appendix F

Statistical Considerations



Statistical Considerations

Survey Methodology

The Form EIA-23 survey is designed to provide reliable estimates for reserves and production of crude oil, natural gas, and lease condensate for the United States. Operators of crude oil and natural gas wells were selected as the appropriate respondent population because they have access to the most current and detailed information, and therefore, presumably have better reserve estimates than do other possible classes of respondents, such as working interest or royalty owners.

While large operators are quite well known, they comprise only a small portion of all operators. The small operators are not well known and are difficult to identify because they go into and out of business, alter their corporate identities, and change addresses frequently. As a result, EIA has historically conducted extensive frame maintenance activities each year to identify all current operators of crude oil and natural gas wells in the country. This was not done for small operators in 1996 because a reduced survey was carried out (see Procedural Change section below).

Sampling Strategy

EIA publishes data on reserves and production for crude oil, natural gas, and lease condensate by State for most States, and by State subdivision for the States of California, Louisiana, New Mexico, and Texas. To meet the survey objectives, while minimizing respondent burden, a random sampling strategy has been used each year since 1977, except for 1996. Each operator reporting on the survey is asked to report production for crude oil, natural gas, and lease condensate for each State/subdivision in which he operates. The term **State/subdivision** refers to an individual subdivision within a State or an individual State that is not subdivided.

- **Category I – Large Operators:** Operators who produced a total of 1.5 million barrels or more of crude, or 15 billion cubic feet or more of natural gas, or both in 1995.

- **Category II – Intermediate Operators:** Operators who produced a total of at least 400,000 barrels of crude oil or 2 billion cubic feet of natural gas, or both, but less than Category I operators in 1995.
- **Category III – Small Operators:** Operators who produced less than the Category II operators in 1995.

State/subdivision volume estimates are calculated as the sum of the certainty strata (Category I and Category II) and in 1996, all modeled Category III volumes in that region. An expected error was calculated for each State/subdivision.

For the States in which subdivision volume estimates are published, the State total is the sum of the individual volume estimates for the subdivisions. The U.S. total is the sum of the State estimates. An expected error was calculated for each State subdivision, State, and for the U.S. total.

Total U.S. Reserve Estimates

Conceptually, the estimates of U.S. reserves and production can be thought of as the sum of the estimates for the individual States. Correspondingly, the estimates for the four States for which estimates are published separately by subdivision (California, Louisiana, New Mexico, and Texas) can be thought of as the sum of the estimates by subdivision. The remaining States are not subdivided and may be considered as a single subdivision.

The estimates of year-end proved reserves and annual production for any State/subdivision is the sum of the volumes in the State/subdivision reported by the certainty stratum operators and an estimate of the total volume in the State/subdivision by the modeled stratum operators. Mathematically, this may be stated as the following sum:

$$\hat{V}_s = V_{sc} + \hat{V}_{sr}$$

where

$$\hat{V}_s = \text{estimated total volume in the State/subdivision}$$

V_{sc} = total volume in the State/subdivision reported by Certainty operators

\hat{V}_{sr} = modeled total volume in the State/subdivision for Category III operators.

The total volume of Certainty operators in the State/subdivision is simply the sum of individual operator's volumes:

$$V_{sc} = \sum_{m=1}^{n_{sc}} V_{scm}$$

where

n_{sc} = number of Certainty operators reporting production in the State/subdivision

V_{scm} = volume reported by the m -th certainty stratum operator in the State/subdivision.

Procedural Change Required by Budget Reduction

This year, as in all past years, EIA's objective was to estimate the total proved reserves of the United States within 1 percent error or less. In the past this was done by EIA's standard procedure: surveying all major (Category I and Category II) operators by field, any Category III operators large enough to be selected with certainty, plus an 8 percent random sample of the considerably more numerous smaller Category III operators by State or State subdivision. EIA then statistically estimated and imputed the nonreported reserves by State and State subdivision. A budget reduction imposed in 1995 did not allow continued use of this procedure in 1996.

To maintain its practice of producing annual reserves estimates and retain its accuracy objective, EIA decided that the sample of the Category III operators could only be processed every other year. This in turn required that a sufficiently accurate estimate would have to be made of *all* Category III reserves every two years starting with report year 1996. The following paragraphs will describe the model used to make the estimate in report year 1996.

The New Statistical Model Used To Estimate All Category III Year-End 1996 Reserves

Relying on EIA's accumulated knowledge of the characteristics of Category III operators' reserves, it

was believed that a one-year-beyond-history estimate of the Category III proved reserves could be modeled, based on the historical reserves estimates for the States and State subdivisions and correlative current and historical oil and gas price data. The model estimate could then be added to the Category I and Category II operators' data (collected as usual on Form EIA-23), to get an estimate of the total proved reserves of the United States. The model had to be designed so that the total estimate of proved reserves met EIA's current quality standards.

The starting point for development of the new Category III estimation methodology was EIA's 19-year data base of detailed reserves data and oil and gas price data. It was recognized that the statistical model had to honor the fundamental causes of reserves change:

- drilling and development activity add new proved reserves;
- operators revise their reserves due to new information or economics and prices;
- production reduces the reserves level.

Last, since each State and State subdivision behaves somewhat differently from the others, an individual model for each of them had to be generated, with the combined results yielding the estimated volume of Category III reserves for the United States.

Several "trial" models were created, all of which were founded on the following knowledge about Category III reserves and their behavior:

- In the absence of major inter-year economic changes, Category III reserves do not change drastically from year to year. However, they often exhibit a downward or upward trend. Consequently, a one-year-extended least-squares estimate (time series trend) based solely on the history of Category III reserves levels for a specific State or State subdivision should be accurate within plus or minus 10 to 15 percent.
- The primary predictable cause of departure of Category III reserves levels from the established time-series trend is economics, i.e., the reserves level reacts to changes in the prices of oil and gas (see Economics section below). Thus, an estimation methodology modified to account for changes in oil and gas prices would be more accurate than one based solely on a time series trend.

- There are limits to the effect on reserve levels that a given price change can produce in one year's time.

The trial models were then tested against the historic Category III proved reserves and price data in order to select the best one. The statistical model selected for use in preparing the 1996 report was:

$$\hat{V}_{3s,t} = \hat{V}_{3s,t-1} \left\{ \begin{array}{l} ARRC_s \\ + A_{s,t} (SP_{s,t} / HP_s) \\ + B_{s,t} [(P_{s,t} - P_{s,t-1}) / SP_{s,t-1}] \end{array} \right\}$$

where

$\hat{V}_{3s,t}$ = estimated volume of the Category III reserves of State or State subdivision s in t , the estimation year

$\hat{V}_{3s,t-1}$ = estimate of Category III reserves of area s in the year prior to the estimation year

$ARRC_s$ = a constant reflecting the average annual rate of reserves change for State or State subdivision s

A_s, B_s = coefficients related to effects of price change on the reserves for State or State subdivision s , with $A \geq 0$ and $0.1 \geq B \geq 0.3$ (see below for more information)

$P_{s,t}$ = annual average oil or gas price in State or State subdivision s in year t

HP_s = annual average oil or gas price in State or State subdivision s over the entire history

$SP_{s,t}$ = $(Price_t / 2) + (Price_{t-1} / 2)$, i.e., the 2-year average annual oil or gas price for State or State subdivision s in year t

$SP_{s,t-1}$ = $(Price_{t-1} / 2) + (Price_{t-2} / 2)$, i.e., the previous year's 2-year average annual oil or gas price for State or State subdivision s .

The coefficients of this equation (i.e., $ARRC_s, A_s, B_s, \hat{V}_{3s,0}$) were simultaneously solved for such that the sum of the squared differences between the estimated quantities and the observed reserves levels was minimized. The algorithm was allowed to choose its own initial reserves volume, $\hat{V}_{3s,0}$, which was solved for along with the coefficients.

Explanation of the Economic Terms

The purpose of the term containing coefficient A_s is to capture the effect of "boom or bust" in drilling activity. EIA's data indicated that when the price of oil or gas was significantly higher than the average historical price in an area, exploration and development activity often increased in that region - adding more proved reserves. Likewise, when the price declined significantly below the historical average price of an area, reserves declined because drilling activity decreased and less reserves were added and/or fewer infill wells were drilled, less well stimulation work was performed, or less application of enhanced recovery methods occurred, reducing both production and proved reserves.

The purpose of the term containing coefficient B_s is to capture the effect of changes in price on annual revisions. Price changes can alter economic limit production rates which, in the case of lower prices, will cause some wells to be shut-in or abandoned. Since prices are more volatile than reserves levels, coefficient B_s was constrained to fall in a range of 0.1 to 0.3.

Results Analysis: Expected Error

To evaluate the accuracy of the selected statistical model in 1996, the model was applied separately to the five preceding years, 1991 through 1995, and the difference between the model estimate and the historic reserves was determined. Only the historical data through 1990 was used to redetermine the model coefficients in order to estimate the reserves in 1991, up to 1991 historic data to estimate 1992, and so on.

The *expected error* in 1996 was the determined by taking the average of the absolute percentage difference between the model estimates and the published proved reserves value for the five year period, 1991-1995. The percentage error in the years 1991 through 1995 are shown in **Table F1**. These errors, and the expected error in 1996, all met EIA's estimation accuracy objective. **Figure F1** and **Figure F2** show the difference between the model estimates and the historical U.S. proved reserves level for crude oil and wet natural gas, respectively. The expected error in 1996 is shown by State/subdivision in **Table F2** and **Table F3**.

Production Estimates

Production was estimated at the State/Subdivision level for Category III operators using a model with the same functional form as for Category III reserves

Table F1. Error Statistics for the Category III Reserves Model

Crude Oil (Million Barrels)							
Year	U.S. Crude Oil Reserves	Lower 48 Onshore Category III Reserves Historical	Lower 48 Onshore Category III Reserves Model Estimate	Difference Model-Historical	Percent Change in Category III from Prior Year	Percent Error Model vs. Historical Category III Reserves	Percent Error Model vs. Historical U.S. Crude Oil Reserves
1990	26,254	1,914.98	—	—	—	—	—
1991	24,682	1,823.13	1,938.16	115.03	-4.80%	6.31%	0.47%
1992	23,745	1,789.22	1,783.68	-5.54	-1.86%	-0.31%	-0.02%
1993	22,957	1,680.21	1,664.61	-15.60	-6.09%	-0.93%	-0.07%
1994	22,457	1,594.48	1,586.10	-8.38	-5.10%	-0.53%	-0.04%
1995	22,351	1,515.93	1,582.58	66.65	-4.93%	4.40%	0.30%
1996	22,017	—	1,589.27	—	—	—	—
Average Absolute Percentage Change in Reserves Per Year					4.56%		
1996 Expected Error*						2.49%	0.18%
Wet Natural Gas (Billion Cubic Feet)							
Year	U.S. Wet Gas Reserves	Lower 48 Onshore Category III Reserves Historical	Lower 48 Onshore Category III Reserves Model Estimate	Difference Model-Historical	Percent Change in Category III from Prior Year	Percent Error Model vs. Historical Category III Reserves	Percent Error Model vs. Historical U.S. Wet Gas Reserves
1990	177,576	12,422	—	—	—	—	—
1991	175,325	12,055	12,494	439	-2.95%	3.64%	0.25%
1992	173,309	11,078	12,624	1,546	-8.10%	13.96%	0.89%
1993	170,490	10,150	11,755	1,605	-8.38%	15.81%	0.94%
1994	171,939	10,400	9,969	-431	2.46%	-4.14%	-0.25%
1995	173,476	9,333	9,346	13	-10.26%	0.14%	0.01%
1996	175,147	—	10,035	—	—	—	—
Average Absolute Percentage Change in Reserves Per Year					6.43%		
1996 Expected Error*						7.54%	0.47%

Figure F1. Modeled vs. Published U.S. Crude Oil Proved Reserves, 1991-1995.

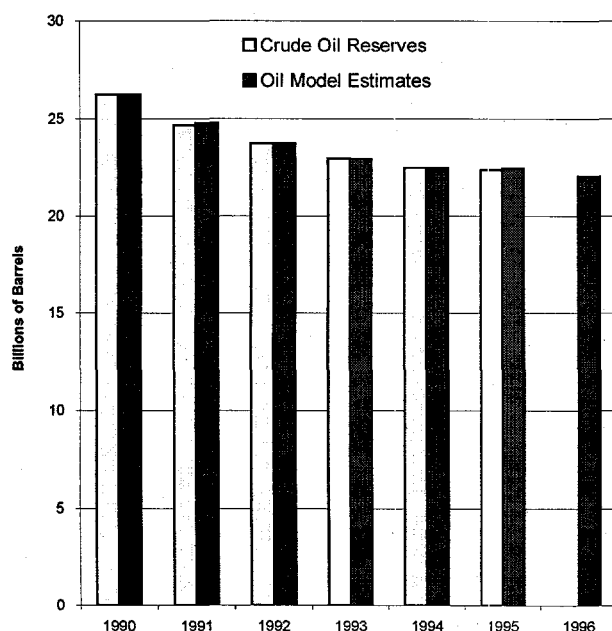


Figure F2. Modeled vs. Published U.S. Wet Natural Gas Proved Reserves, 1991-1995.

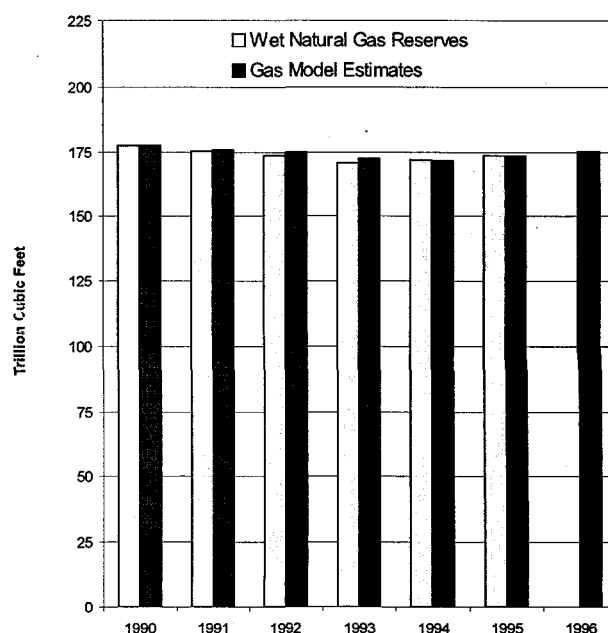


Table F2. Expected Errors for Crude Oil Proved Reserves and Production, 1996
(Million Barrels of 42 U.S. Gallons)

State and Subdivision	1996 Reserves	State and Subdivision	1996 Reserves
United States	42	North Dakota	6
Alabama	3	Ohio	10
Alaska	0	Oklahoma	18
Arkansas	7	Pennsylvania	2
California	20	Texas	30
Coastal Region Onshore	7	RRC District 1	7
Los Angeles Basin Onshore	11	RRC District 2 Onshore	4
San Joaquin Basin Onshore	11	RRC District 3 Onshore	25
State Offshore	0	RRC District 4 Onshore	6
Colorado	13	RRC District 5	2
Florida	1	RRC District 6	11
Illinois	10	RRC District 7B	14
Indiana	2	RRC District 7C	11
Kansas	13	RRC District 8	5
Kentucky	2	RRC District 8A	10
Louisiana	10	RRC District 9	10
North	4	RRC District 10	4
South Onshore	7	State Offshore	1
State Offshore	4	Utah	5
Michigan	9	West Virginia	2
Mississippi	8	Wyoming	6
Montana	6	Federal Offshore	0
Nebraska	3	Pacific (California)	0
New Mexico	11	Gulf of Mexico (Louisiana)	0
East	7	Gulf of Mexico (Texas)	0
West	6	Miscellaneous ^a	6

^aIncludes Arizona, Missouri, Nevada, New York, South Dakota, Tennessee, and Virginia.

Notes: The expected errors are associated with Table 6 reserves estimates. Expected error for each State/subdivision and the United States are independently estimated and do not add.

Source: EIA modeled Category III reserves estimates.

Table F3. Expected Errors for Natural Gas Proved Reserves and Production, Wet After Lease Separation, 1996 (Billion Cubic Feet at 14.73 psia and 60 Degrees Fahrenheit)

State and Subdivision	1996 Reserves	State and Subdivision	1996 Reserves
United States	807	Oklahoma	297
Alabama	337	Pennsylvania	75
Alaska	0	Texas	260
Arkansas	35	RRC District 1	83
California	50	RRC District 2 Onshore	54
Coastal Region Onshore	16	RRC District 3 Onshore	138
Los Angeles Basin Onshore	5	RRC District 4 Onshore	85
San Joaquin Basin Onshore	42	RRC District 5	28
State Offshore	0	RRC District 6	88
Colorado	276	RRC District 7B	60
Florida	1	RRC District 7C	72
Kansas	107	RRC District 8	58
Kentucky	161	RRC District 8A	23
Louisiana	157	RRC District 9	26
North	43	RRC District 10	112
South Onshore	129	State Offshore	13
State Offshore	28	Utah	35
Michigan	79	Virginia	6
Mississippi	38	West Virginia	93
Montana	56	Wyoming	70
New Mexico	90	Federal Offshore ^a	0
East	51	Pacific (California)	0
West	42	Gulf of Mexico (Louisiana) ^a	0
New York	27	Gulf of Mexico (Texas)	0
North Dakota	19	Miscellaneous ^b	3
Ohio	60		

^aIncludes Federal offshore Alabama.

^bIncludes Arizona, Illinois, Indiana, Maryland, Missouri, Nebraska, Nevada, Oregon, South Dakota, and Tennessee.

Notes: The expected errors are associated with Table 9 reserves estimates. Expected error for each State/subdivision and the United States are independently estimated and do not add.

Source: EIA modeled Category III reserves estimates.

estimates. A least squares fit with historical production data was used to determine the appropriate coefficients.

Imputation and Estimation for Reserves Data

In order to estimate reserve balances for National and State/subdivision levels, a series of imputation and estimation steps at the operator level must be carried out. Year-end reserves for operators who provided production data only were imputed on the basis of their production volumes. Imputation was also applied to intermediate operators and modeled Category III volumes as necessary to provide data on each of the reserve balance categories (i.e., revisions, extensions, or new discoveries). Finally, an imputation was required for the natural gas data of the modeled Category III volumes to estimate their volumes of associated-dissolved and nonassociated natural gas. A final adjustment of the data accounts for the differences caused by different sample frames from year to year. Each of these imputations generated only a small percentage of the total estimates. The methods used are discussed in the following sections.

The actual data reported on an operated basis by Form EIA-23 respondents for the report year 1996 are summarized in **Tables F4, F5, F6 and F7**. The differences between these sums and the total estimates shown in **Tables 9, 10, 6 and 16** in the main text represent the aggregate result of statistical estimation and imputation performed by EIA. The modeled reserves data in **Table F4** accounted for 6.5 percent of the published production for natural gas shown in **Table 9** and 5.8 percent of the reserves. Data shown in **Table F5** indicate that the modeled operators accounted for 6.3 percent of the nonassociated natural gas production and 5.8 percent of the reserves published in **Table 10**. The reported data shown in **Table F6** indicate that the modeled operators accounted for 11 percent of published crude oil production and 7.2 percent of the reserves shown in **Table 6**. Additionally, **Table F7** indicates that the modeled operators accounted for 3.1 percent of the published production and 2.5 percent of the published proved reserves for lease condensate shown in **Table 16**.

Imputation of Year-End Proved Reserves

Category I operators were required to submit year-end estimates of proved reserves. Category II and Category

III operators were required to provide year-end estimates of proved reserves only if such estimates existed in their records. Some of these respondents provided estimates for all of their operated properties, others provided estimates for only a portion of their properties, and still others provided no estimates for any of their properties. All respondents did, however, provide annual production data.

A year-end proved reserves estimate was imputed in each case where an estimate was not provided by the respondent. The reported annual production was multiplied by a reserves-to-production (R/P) ratio (**Table F8**) characteristic of operators of similar size in the region where the properties were located. The regional R/P ratios in this report are averages calculated by dividing the modeled Category III operator reserves by the modeled Category III production.

The R/P ratio varied significantly from region to region. This variation was presumably in response to variation in geologic conditions and the degree of development of crude oil and natural gas resources in each area. The average R/P ratio was computed for regional areas similar to the National Petroleum Council regional units (**Figure F3**). These units generally follow the boundaries of geologic provinces wherein the stage of resource development tends to be somewhat similar. **Table F8** lists the R/P ratio calculated for each region.

The regional R/P ratio is determined primarily to provide a factor that can be applied to the production reported by operators without reserve estimates to provide an estimate of the reserves of these operators when aggregated to the regional level.

Imputation of Annual Changes to Proved Reserves by Component of Change

Category II and Category III operators that do not keep reserves data were not asked to provide estimates of beginning-of-year reserves or annual changes to proved reserves by component of change, i.e., revisions, extensions, and discoveries. When they did not provide estimates, these volumes were estimated by applying an algebraic allocation scheme which preserved the relative relationships between these items within each State/subdivision, as reported by Category I and Category II operators, and also preserved an exact annual reserves balance of the following form:

Table F4. Summary of Total Natural Gas, Wet After Lease Separation, Used in Estimation Process, Form EIA-23, 1996 (Million Cubic Feet at 14.73 psia and 60° Fahrenheit)

Data Detail	Operator Category			
	I	II	Modeled	Total
Field Level Reported and Imputed Data				
Proved Reserves as of 12/31/95	149,398,437	13,283,835	—	162,682,272
(+) Revision Increases	14,256,280	1,929,050	—	16,185,330
(-) Revision Decreases	11,266,713	1,240,463	—	12,507,176
(+) Extensions	6,893,696	551,934	—	7,445,630
(+) New Field Discoveries	1,230,150	158,396	—	1,388,546
(+) New Reservoirs in Old Fields	2,332,927	642,667	—	2,975,594
(-) Production in 1996	16,364,448	1,553,801	—	17,918,249
Proved Reserves as of 12/31/96	146,480,700	13,771,630	—	160,252,330
Production Reported Without Proved Reserves	16,588	574,360	—	590,948
Reserves Imputed for Production Reported Without Proved Reserves ^a	120,346	4,609,357	—	4,729,703
State Level Modeled Data				
Production in 1996	—	—	1,277,992	1,277,992
Proved Reserves as of 12/31/96	—	—	10,165,837	10,165,837
Total Production in 1996	16,381,036	2,128,161	1,277,992	19,787,189
Total Proved Reserves as of 12/31/96^b	146,601,046	18,380,987	10,165,837	175,147,870

^aImputed using regional R/P factors (Table F6).

^bMay not equal Table 9 totals (production = 19,783 billion cubic feet; reserves = 175,147 billion cubic feet) that are the sum of data independently rounded at the State/subdivision level.

— = Not applicable.

Note: Field level data are reported volumes and may not balance due to submission of incomplete records.

Source: Based on data filed on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves".

Table F5. Summary of Nonassociated Natural Gas, Wet After Lease Separation, Used in Estimation Process, Form EIA-23, 1996 (Million Cubic Feet at 14.73 psia and 60° Fahrenheit)

Data Detail	Operator Category			
	I	II	Modeled	Total
Field Level Reported and Imputed Data				
Proved Reserves as of 12/31/95	122,675,828	11,511,727	—	134,187,555
(+) Revision Increases	11,691,533	1,618,765	—	13,310,298
(-) Revision Decreases	9,614,529	1,058,456	—	10,672,985
(+) Extensions	6,047,928	513,998	—	6,561,926
(+) New Field Discoveries	1,062,486	106,884	—	1,169,370
(+) New Reservoirs in Old Fields	2,032,911	615,554	—	2,648,465
(-) Production in 1996	13,963,536	1,323,225	—	15,286,761
Proved Reserves as of 12/31/96	119,932,616	11,985,262	—	131,917,878
Production Reported Without Proved Reserves	11,879	495,584	—	507,463
Reserves Imputed for Production Reported Without Proved Reserves ^a	86,717	4,005,771	—	4,092,488
State Level Modeled Data				
Production in 1996	—	—	1,054,343	1,054,343
Proved Reserves as of 12/31/96	—	—	8,342,351	8,342,351
Total Production in 1996	13,975,415	1,818,809	1,054,343	16,848,567
Total Proved Reserves as of 12/31/96^b	120,019,333	15,991,033	8,342,351	144,352,717

^aImputed using regional R/P factors (Table F6).

^bMay not equal Table 10 totals (production = 16,845 billion cubic feet; reserves = 144,352 billion cubic feet) that are the sum of data independently rounded at the State/subdivision level.

— = Not applicable.

Note: Field level data are reported volumes and may not balance due to submission of incomplete records.

Source: Based on data filed on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves".

Table F6. Summary of Crude Oil Used in Estimation Process, Form EIA-23, 1996
(Thousand Barrels of 42 U.S. Gallons)

Data Detail	Operator Category			
	I	II	Modeled	Total
Field Level Reported and Imputed Data				
Proved Reserves as of 12/31/95	19,724,009	864,466	—	20,588,475
(+) Revision Increases	1,355,970	135,231	—	1,491,201
(-) Revision Decreases	753,168	83,597	—	836,765
(+) Extensions	450,546	23,978	—	474,524
(+) New Field Discoveries	195,843	42,971	—	238,814
(+) New Reservoirs in Old Fields	123,978	9,992	—	133,970
(-) Production in 1996	1,790,229	107,863	—	1,898,092
Proved Reserves as of 12/31/96	19,306,935	885,196	—	20,192,131
Production Reported Without Proved Reserves	701	35,202	—	35,903
Reserves Imputed for Production Reported Without Proved Reserves ^a	4,664	226,490	—	231,154
State Level Modeled Data				
Production in 1996	—	—	239,834	239,834
Proved Reserves as of 12/31/96	—	—	1,589,268	1,589,268
Total Production in 1996	1,790,930	143,065	239,834	2,173,829
Total Proved Reserves as of 12/31/96^b	19,311,599	1,111,686	1,589,268	22,012,553

^a Imputed using regional R/P factors (Table F6).

^b May not equal Table 6 totals (production = 2,173 million barrels; reserves = 22,017 million barrels) that are the sum of data independently rounded at the State/subdivision level.

— = Not applicable.

Note: Field level data are reported volumes and may not balance due to submission of incomplete records.

Source: Based on data filed on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves".

Table F7. Summary of Lease Condensate Used in Estimation Process, Form EIA-23, 1996
(Thousand Barrels of 42 U.S. Gallons)

Data Detail	Operator Category			
	I	II	Modeled	Total
Field Level Reported and Imputed Data				
Proved Reserves as of 12/31/95	1,069,246	91,068	—	1,160,314
(+) Revision Increases	162,785	19,347	—	182,132
(-) Revision Decreases	127,915	13,896	—	141,811
(+) Extensions	135,825	4,721	—	140,546
(+) New Field Discoveries	24,671	4,607	—	29,278
(+) New Reservoirs in Old Fields	31,032	4,967	—	35,999
(-) Production in 1996	140,061	13,481	—	153,542
Proved Reserves as of 12/31/96	1,155,572	97,322	—	1,252,894
Production Reported Without Proved Reserves	75	3,692	—	3,767
Reserves Imputed for Production Reported Without Proved Reserves ^a	480	23,814	—	24,294
State Level Modeled Data				
Production in 1996	—	—	5,046	5,046
Proved Reserves as of 12/31/96	—	—	32,680	32,680
Total Production in 1996	140,136	17,173	5,046	162,355
Total Proved Reserves as of 12/31/96^b	1,156,052	121,136	32,680	1,309,868

^a Imputed using regional R/P factors (Table F6).

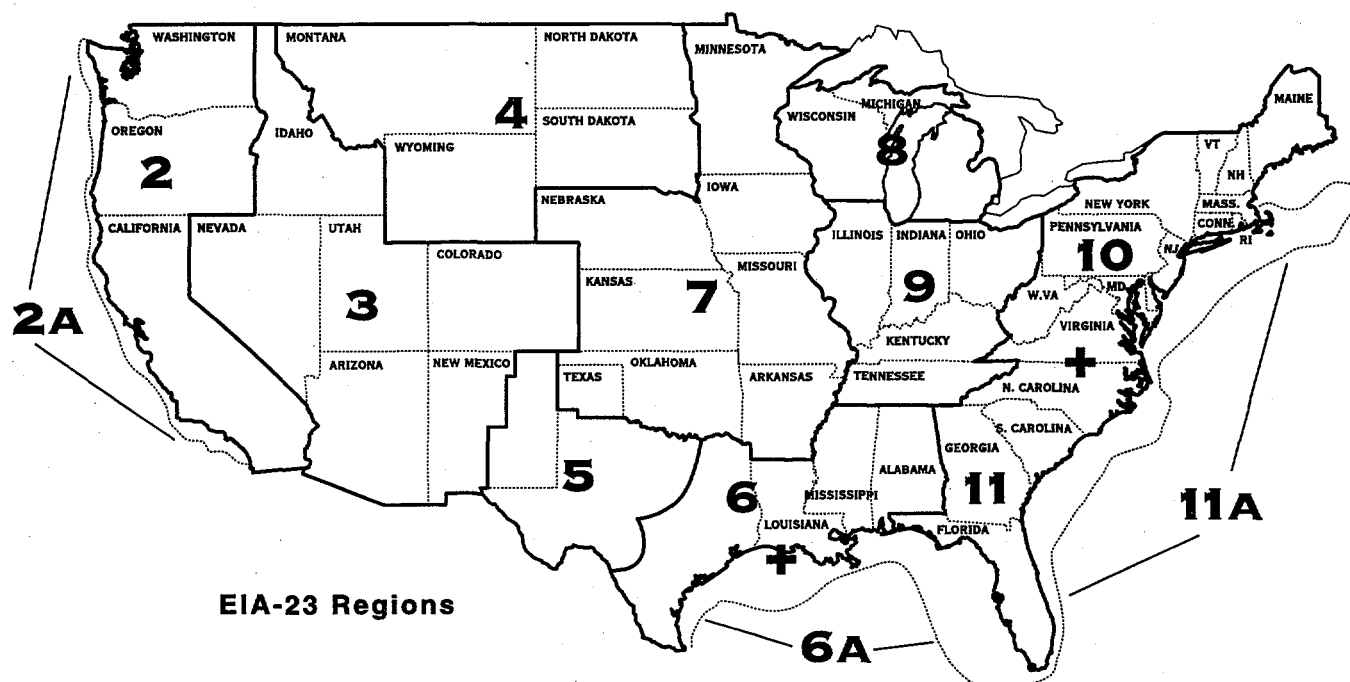
^b May not equal Table 16 totals (production = 162 million barrels; reserves = 1,307 million barrels) that are the sum of data independently rounded at the State/subdivision level.

— = Not applicable.

Note: Field level data are reported volumes and may not balance due to submission of incomplete records.

Source: Based on data filed on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves".

Figure F3. Form EIA-23 Regional Boundaries



Source: Energy Information Administration, Office of Oil and Gas.

Table F8. Reserve to Production Ratios by Region for 1996

Number	Region	Oil	Gas	Lease Condensate
2	Pacific Coast States	6.7	5.1	^a 6.5
3	Western Rocky Mountains	5.8	12.7	^a 6.6
4	Northern Rocky Mountains	7.0	6.1	^a 6.6
5	West Texas and East New Mexico	7.1	7.9	^a 6.6
6 + 6A	Western Gulf Basin and Gulf of Mexico	6.5	7.3	6.4
7	Mid-Continent	6.2	6.6	6.9
8 + 9	Michigan Basin and Eastern Interior	6.3	8.5	^a 6.5
10 + 11	Appalachians	^a 6.6	11.7	^a 6.5
	United States	6.6	7.9	6.5

^aMultiplier of the U.S. national average is used. Effect of the multiplier on the related natural gas or lease condensate reserves estimate is negligible in these regions.

Source: Multipliers calculated from modeled Category III proved reserves and production based on data filed on Form EIA-23, "Annual Survey of Domestic Oil and Gas Reserves".

Published Proved Reserves at End of Previous Report Year

- + Adjustments
- + Revision Increases
- Revision Decreases
- + Extensions
- + New Field Discoveries
- + New Reservoir Discoveries in Old Fields
- Report Year Production
- = Published Proved Reserves at End of Report Year

A ratio was calculated as the sum of the annual production and year-end proved reserves of those respondents who did not provide the reserves balance components, divided by the sum of year-end proved reserves and annual production of those respondents of similar size who did provide these quantities. This ratio was then multiplied by each of the reserves balance components reported by Category I and some Category II operators, to obtain imputed volumes for the reserves balances of the other Category II operators and modeled for Category III operators. These were then added to the State/subdivision totals.

Imputation of Natural Gas Type Volumes

Category III modeled volumes were not estimated by type of natural gas, i.e., nonassociated natural gas (NA) and associated-dissolved natural gas (AD). The total estimated year-end proved reserves of natural gas and the total annual production of natural gas reported by, or imputed to, operators in the State/subdivision certainty and modeled Category III operators were, therefore, subdivided into the NA and AD categories, by State/subdivision, in the same proportion as was reported by Category I and Category II operators in the same area.

Adjustments

The instructions for Schedule A of Form EIA-23 specify that, when reporting reserves balance data, the following arithmetic equation must hold:

Proved Reserves at End of Previous Year

- + Revision Increases
- Revision Decreases
- + Extensions
- + New Field Discoveries
- + New Reservoir Discoveries in Old Fields
- Report Year Production
- = Proved Reserves at End of Report Year

Any remaining difference in the State/subdivision annual reserves balance between the published previous year--end proved reserves and current year--end proved reserves not accounted for by the imputed reserves changes was included in the adjustments for the area. One of the primary historical reasons that adjustments are necessary is that very few of the same Noncertainty operators are sampled each year and the characteristic R/P ratios change each year. Less than 8 percent of the Noncertainty stratum operators sampled in 1994 were sampled again in 1995, and there was no guarantee that in the smaller producing States/subdivision the same number of small operators would be selected each year, or that the operators selected would be of comparable sizes when paired with operators selected in a prior year. Thus, some instability of this stratum from year to year is unavoidable, resulting in minor adjustments to the U.S. total.

Some of the adjustments were, however, more substantial, and could be required for any one or more of the following reasons:

- The frame coverage may or may not have improved between survey years, such that more or fewer Certainty operators were included in one year than in the previous year.
- One or more operators may have reported data incorrectly on Schedule A in the prior year or the current year, but not both, and the error was not detected by edit processing.
- Operation of properties was transferred during the survey year from operators not in the frame or Noncertainty operators not selected for the sample to Certainty operators or Noncertainty operators selected for the sample.
- Operations of properties was transferred during the survey year to an operator with a different evaluation of the proved reserves associated with the properties than that of the prior year's operator.
- Respondent changed classification of natural gas from NA to AD or vice versa.
- The trend in reserve changes imputed for the small operators, that was based on the trend reported by the large operators, did not reflect the actual trend for the small operators.
- Noncertainty operators, who have grown substantially in size since they were added to the frame, occasionally cause a larger standard error than expected.
- The Noncertainty sample for either year in a state may have been an unusual one.

- A large net movement of prior year Category II operators into Category III operator class occurs.

The causes of adjustments are known for some but not all areas. The only problems whose effects cannot be expected to balance over a period of several years are those associated with an inadequate frame or those associated with any actual trend in reserve changes for small operators not being the same as those for large operators. EIA continues to attempt to improve sources of operator data to resolve problems in frame completeness.

Nonsampling Errors

Several sources of possible error, apart from sampling error, are associated with the Form EIA-23 survey. These include bias due to nonresponse of operators in the sample, proved reserve estimation errors, and reporting errors on the part of the respondents to the survey. On the part of EIA, possible errors include inadequate frame coverage, data processing error, and errors associated with statistical estimates. Each of these sources is discussed below. An estimate of the bias from nonresponse is presented in the section on adjustment for operator nonresponse.

Assessing the Accuracy of the Reserve Data

The EIA maintains an evaluation program to assess the accuracy and quality of proved reserve estimates gathered on Form EIA-23. Field teams consisting of petroleum engineers from EIA's Reserves and Production Division conduct technical reviews of reserve estimates and independently estimate the proved reserves of a statistically selected sample of operator properties. The results of these reviews are used to evaluate the accuracy of reported reserve estimates. Operators are apprised of the team's findings to assist them in completing future filings. The magnitude of errors due to differences between reserve volumes submitted by operators on the Form EIA-23 and those estimated by EIA petroleum engineers on their field trips were generally within accepted professional engineering standards.

Respondent Estimation Errors

The principal data elements of the Form EIA-23 survey consist of respondent estimates of proved reserves of crude oil, natural gas, and lease condensate.

Unavoidably, the respondents are bound to make some estimation errors, i.e., until a particular reservoir has been fully produced to its economic limit and abandoned, its reserves are not subject to direct measurement but must be inferred from limited, imperfect, or indirect evidence. A more complete discussion of the several techniques of estimating proved reserves, and the many problems inherent in the task, appears in Appendix G.

Reporting Errors and Data Processing Errors

Reporting errors on the part of respondents are of definite concern in a survey of the magnitude and complexity of the Form EIA-23 program. Several steps were taken by EIA to minimize and detect such problems. The survey instrument itself was carefully developed, and included a detailed set of instructions for filing data, subject to a common set of definitions similar to those already used by the industry. Editing software is continually developed to detect different kinds of probable reporting errors and flag them for resolution by analysts, either through confirmation of the data by the respondent or through submission of amendments to the filed data. Data processing errors, consisting primarily of random keypunch errors, are detected by the same software.

Frame Coverage Errors

Of all the sources of controllable error connected with the Form EIA-23 survey, errors in the operator frame were expected to be the most important. If the frame does not list all operators in a given State, the sample selected from the frame for the State will not represent the entire operator population, a condition called undercoverage. Undercoverage is a problem with certain States, but it does not appear to be a problem with respect to the National proved reserve estimates for either crude oil or natural gas. While it is relatively straightforward to use existing sources to identify large operators and find addresses for them, such is not the case for small operators. A frame such as that used in the 1995 survey is particularly likely to be deficient in States where a large portion of total reserves and production is accounted for by small operators. These States are not likely to allocate sufficient resources to keep track of all operators on a current basis. Some undercoverage of this type seems to exist, particularly, with reference to natural gas operators. EIA is continuing to work to remedy the undercoverage problem in those States where it occurred. Yearly errors

resulting from lack of good frame coverage will impact the overall reliability of the modeled reserves estimates.

Calculation of Reserves of Natural Gas Liquids and Dry Natural Gas

Natural Gas Liquids Reserve Balance

The published reserves, production, and reserves change statistics for crude oil, lease condensate, and natural gas, wet after lease separation, were derived from the data reported on Form EIA-23 and the application of the imputation methods discussed previously. The information collected on Form EIA-64A was then utilized in converting the estimates of the wet natural gas reserves into two components: plant liquids reserve data and dry natural gas reserve data. The total natural gas liquids reserve estimates presented in Table 14 were computed as the sum of plant liquids estimates (Table 15) and lease condensate (Table 16) estimates.

To generate estimates for each element in the reserves balance for plant liquids in a given producing area, the first step was to group all natural gas processing plants that reported this area as an area-of-origin on their Form EIA-64A, and then sum the liquids production attributed to this area over all respondents. Next, the ratio of the liquids production to the total wet natural gas production for the area was determined. This ratio represented the percentage of the wet natural gas that was recovered as natural gas liquids. Finally, it was assumed that this ratio was applicable to the reserves and each component of reserve changes (except adjustments), as well as production. Therefore, each element in the wet natural gas reserves balance was multiplied by this recovery factor to yield the corresponding estimate for plant liquids. Adjustments of natural gas liquids were set equal to the difference between the end of previous year reserve estimates, based upon the current report year Form EIA-23 and Form EIA-64A surveys, and the end of current year reserve estimates published in the preceding year's annual reserves report.

Natural Gas Reserve Balance

This procedure involved downward adjustments of the natural gas data, wet after lease separation, in estimating the volumes of natural gas on a fully dry

basis. These reductions were based on estimates of the gaseous equivalents of the liquids removed (in the case of production), or expected to be removed (in the case of reserves), from the natural gas stream at natural gas processing plants. Form EIA-64A collected the volumetric reduction, or shrinkage, of the input natural gas stream that resulted from the removal of the NGL at each natural gas processing plant.

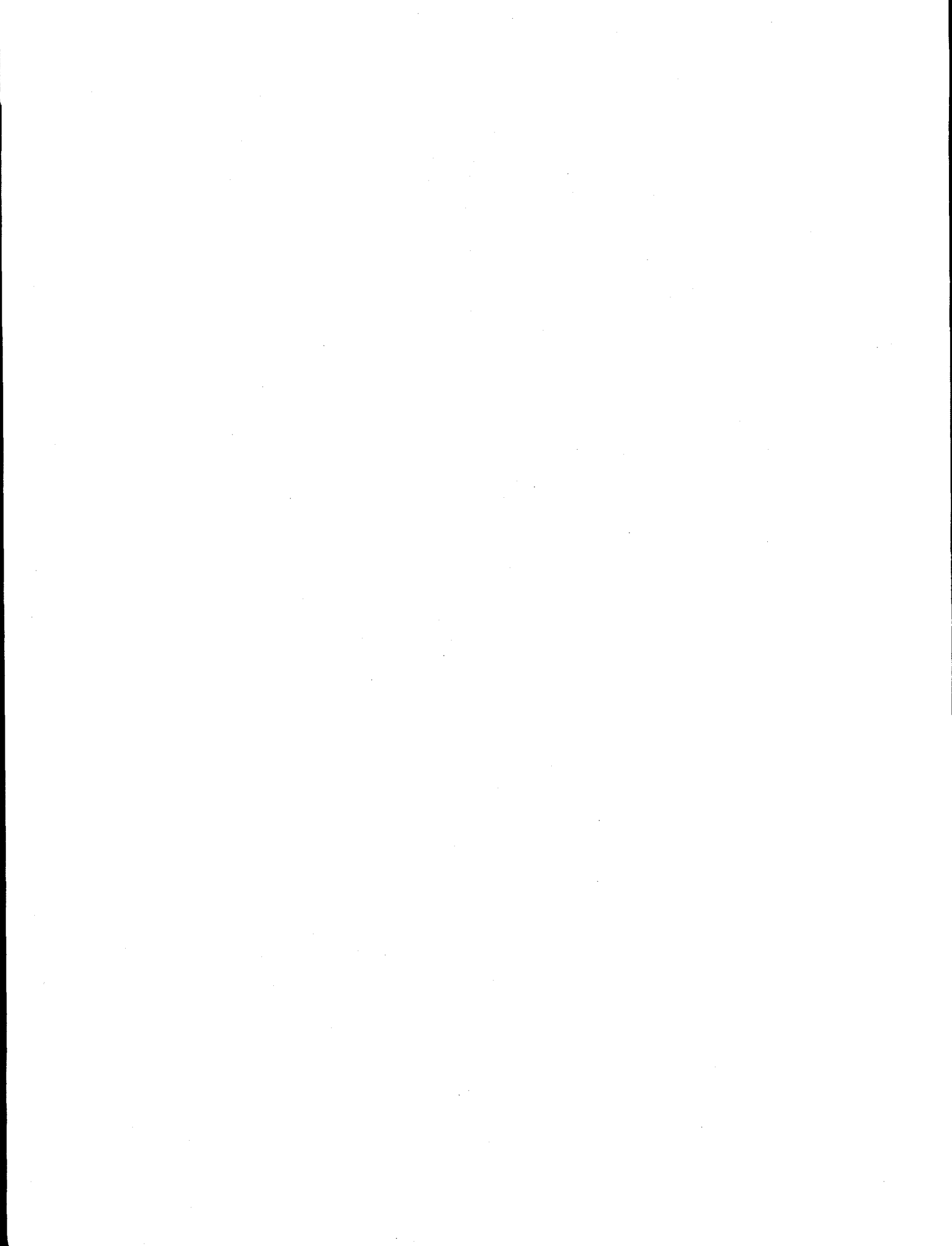
The shrinkage volume was then allocated to the plant's reported area or areas of origin. Because shrinkage is, by definition, roughly in proportion to the NGL recovered, i.e. the NGL produced, the allocation was in proportion to the reported NGL volumes for each area of origin. However, these derived shrinkage volumes were rejected if the ratio between the shrinkage and the NGL production (gas equivalents ratio) fell outside certain limits of physical accuracy. The ratio was expected to range between 1,558 cubic feet per barrel (where NGL consists primarily of ethane) and 900 cubic feet per barrel (where NGL consists primarily of natural gasolines). When the computed gas equivalents ratio fell outside these limits, an imputed ratio was utilized to estimate the plant's natural gas shrinkage allocation to each reported area of origin.

This imputed ratio was that calculated for the aggregate of all other plants reporting production and shrinkage, and having a gas equivalent ratio within the aforesaid limits, from the area in question. The imputed area ratio was applied only if there were at least five plants to base its computation on. If there were less than five plants, the imputed ratio was calculated based on all plants in the survey whose individual gas equivalents ratio was within the acceptable limits. Less than one percent of the liquids production was associated with shrinkage volumes imputed in this manner. Based on the 1996 Form EIA-64A survey, the national weighted average gas equivalents ratio was computed to be 1,398 cubic feet of natural gas shrinkage per barrel of NGL recovered, the same as that in the 1995 survey. The total shrinkage volume (reported plus imputed) for all plants reporting a given area of origin was then subtracted from the estimated value of natural gas production, wet after lease separation, yielding dry natural gas production for the area. The amount of the reduction in the wet natural gas production was then expressed as a percentage of the wet natural gas production. Dry natural gas reserves and reserve changes were determined by reducing the wet natural gas reserves and reserve changes by the same percentage reduction factor.

A further refinement of the estimation process was used to generate an estimate of the natural gas liquids reserves in those States with coalbed methane fields. The States where this procedure was applied were Alabama, Colorado, Kansas, New Mexico, Oklahoma, Pennsylvania, Utah, Virginia, West Virginia, and Wyoming. The first step in the process was to identify all Form EIA-23 reported coalbed methane fields. The assumption was made that coalbed methane fields contained little or no extractable natural gas liquids. Therefore, when the normal shrinkage procedure was applied to the wet gas volume reserve components, the estimate of State coalbed methane volumes were excluded and were not reduced for liquid extraction.

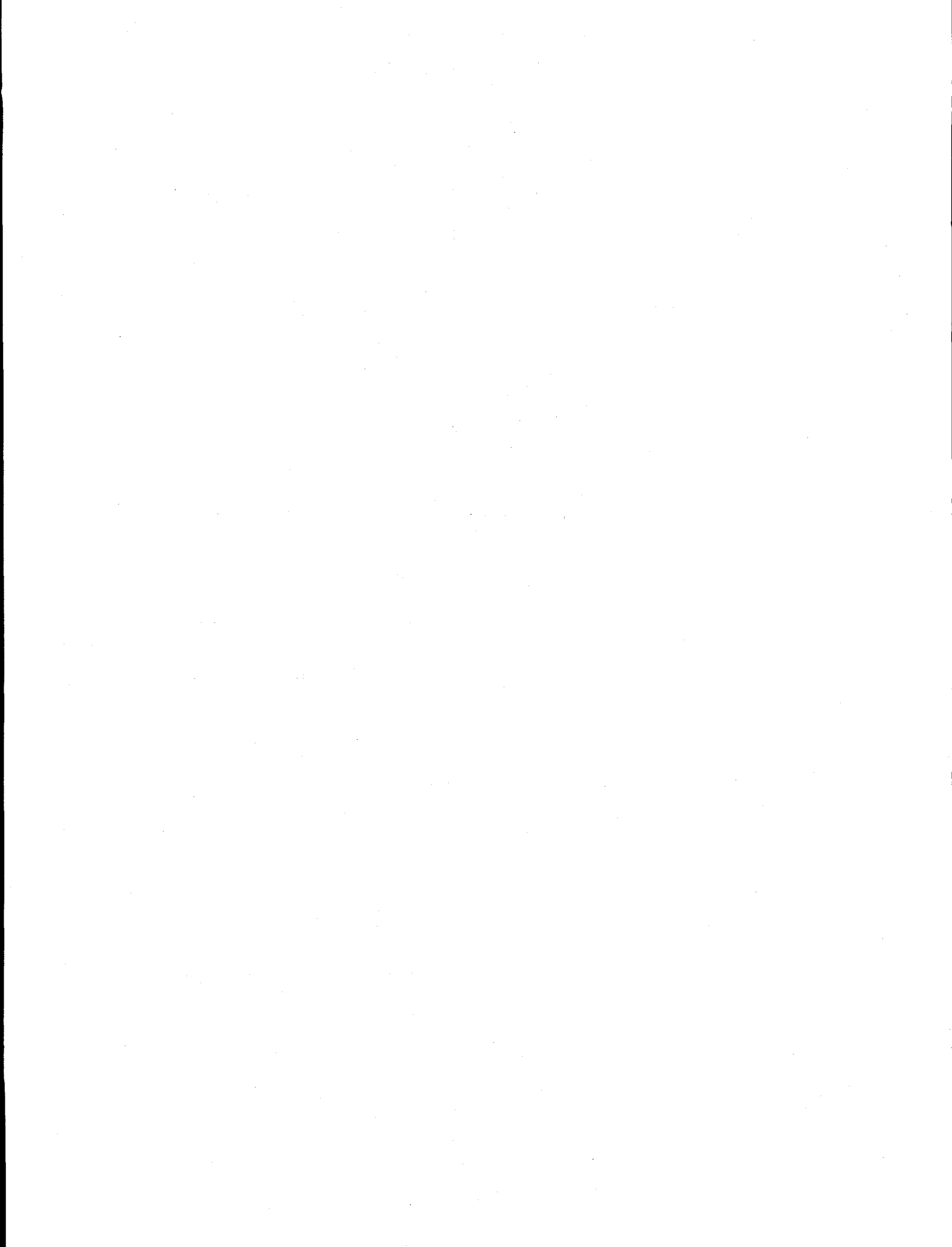
Following the computation for shrinkage, each coalbed field gas volume reserve components was added back to each of the dry gas volume reserve components in a State. The effect of this is that the large increases in reserves in some States from coalbed methane fields did not cause corresponding increases in the State natural gas liquids proved reserves.

Adjustments of dry natural gas were set equal to the difference between the end of previous year reserves estimates, based upon the current report year Form EIA-23 and Form EIA-64A surveys, and the end of current year reserve estimates published in the preceding year's annual reserves report.



Appendix G

Estimation of Reserves and Resources



Estimation of Reserves and Resources

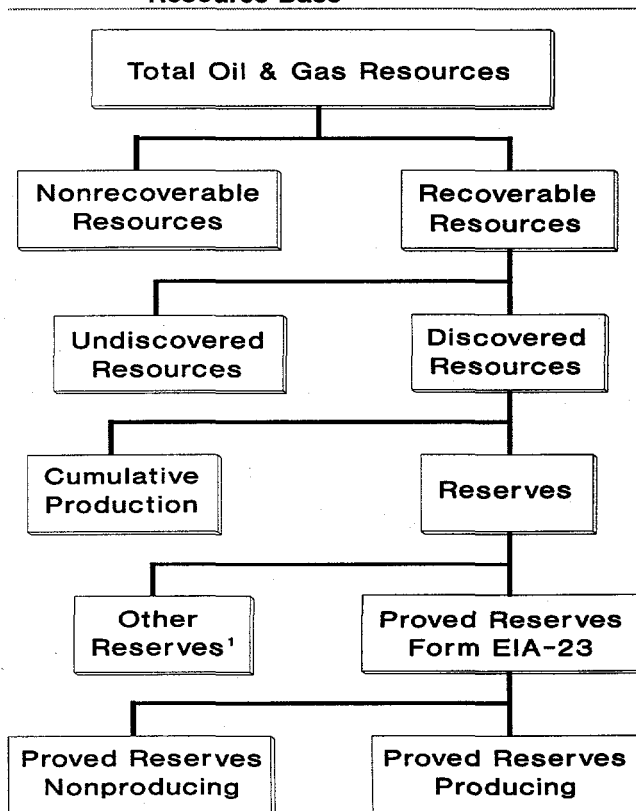
Oil and Gas Resource Base

Universally accepted definitions have not been developed for the many terms used by geologists, engineers, accountants and others to denote various components of overall oil and gas resources. In part, this is because most of these terms describe estimated and therefore uncertain, rather than measured, quantities. The lack of standardized terminology sometimes leads to inaccurate understanding of the meaning and/or import of estimates. Particularly common is an apparently widespread lack of understanding of the substantial difference between the terms "reserves" and "resources", as indicated by the frequent misuse of either term in place of the other.

The total resource base of oil and gas is the entire volume formed and trapped in-place within the Earth before any production. The largest portion of this total resource base is nonrecoverable by current or foreseeable technology. Most of the nonrecoverable volume occurs at very low concentrations throughout the earth's crust and cannot be extracted short of mining the rock or the application of some other approach that would consume more energy than it produced. An additional portion of the total resource base cannot be recovered because currently available production techniques cannot extract all of the in-place oil and gas even when present in commercial concentrations. The inability to recover all of the in-place oil and gas from a producible deposit occurs because of unfavorable economics, intractable physical forces, or a combination of both. Recoverable resources, the subset of the total resource base that is of societal and economic interest, are defined so as to exclude these nonrecoverable portions of the total resource base.

The structure presented in Figure G1 outlines the total resource base and its components. The total resource base first consists of the recoverable and nonrecoverable portions discussed above. The next level down divides recoverable resources into discovered and undiscovered segments. Discovered resources are further separated into cumulative (i.e., all

Figure G1. Components of the Oil and Gas Resource Base



¹Of the numerous other reserve classifications, only "Indicated Additional" reserves are included in this report.

Source: Energy Information Administration, Office of Oil and Gas.

past) production, and reserves. Reserves are additionally subdivided into proved reserves and "other reserves".

Recoverable Resources

Discovered recoverable resources are those economically recoverable quantities of oil and gas for which specific locations are known. While the specific locations of estimated undiscovered recoverable resources are not yet known, they are believed to exist in geologically favorable settings.

Current estimates of undiscovered recoverable resources merit discussion in order to provide a useful sense of scale relative to proved reserves. The sources of official estimates of domestic undiscovered recoverable resources are two agencies of the Department of the Interior (DOI), the United States Geological Survey (USGS) for onshore areas and those offshore waters subject to State jurisdiction, and the Minerals Management Service (MMS) for those offshore waters under Federal jurisdiction.

The USGS defines undiscovered recoverable conventional resources as those expected to be resident in accumulations of sufficient size and quality that they could be produced using conventional recovery technologies, without regard to present economic viability. Therefore, only part of the USGS undiscovered recoverable conventional resource is economically recoverable now. The USGS also defines a class of resources that occur in "continuous-type" accumulations. Unlike conventional oil and gas accumulations, continuous-type accumulations do not occur in discrete reservoirs of limited areal extent. They include accumulations in low-permeability (tight) sandstones, shales, and chinks, and those in coal beds. Again, only part of the continuous-type technically recoverable resource is economically recoverable now. In fact, only a small portion of the in-place continuous-type resource accumulations are estimated to be technically recoverable now. **Table G1** presents the latest available USGS and MMS estimates, along with the EIA 1996 proved reserves estimates.

Technically recoverable resources of wet natural gas (discovered, both proved and unproved, and undiscovered) are estimated at 1,341 trillion cubic feet (**Table G1**). Subtracting U.S. proved reserves of 175 trillion cubic feet yields an unproved technically recoverable resource target of 1,166 trillion cubic feet. This is about 59 times the 1996 gas production level.

Other organizations have also estimated unproved technically recoverable gas resources. For example, the Potential Gas Committee (PGC), an industry sponsored group, provides detailed geology-based gas resource estimates every 2 years. In 1996 the PGC mean estimate of potential gas resources was 1,067 trillion cubic feet, about 99 trillion cubic feet less than the DOI estimates in **Table G1**. Another recent estimate was made by the National Petroleum Council (NPC), an industry-based group that serves in an advisory capacity to the U.S. Secretary of Energy. The NPC's estimate, based on data available at year-end 1990, was 1,135 trillion cubic feet, 111 trillion cubic feet less than

the DOI estimates summarized in **Table G1**. The differences among these estimates are usually due to the availability of newer data, the differences in coverage or resource category definitions, and to legitimate but differing data interpretations. The USGS estimates of reserve growth in known fields are much larger than previous estimates due to the utilization of newer EIA reserves growth data.

While the estimation of undiscovered resources is certainly a more imprecise endeavor than is the estimation of proved reserves, it is clear that substantial volumes of technically recoverable oil and gas resources remain to be found and produced domestically. Current estimates indicate that as much domestic gas remains to be found and then produced as has been to date. Of course, much effort, investment and time will be required to bring this gas to market.

There is a perception that the oil resource base has been more intensively developed than the gas resource base. And in fact, more oil has been produced in the United States than is estimated as remaining recoverable. Nevertheless, the ratio of 1996 unproved technically recoverable oil resources to oil production (**Table G1**) was about 62 to 1, higher than the comparable gas ratio.

Discovered Resources

In addition to cumulative production, which is the sum of current year production and the production in all prior years, estimates of discovered recoverable resources include estimates of reserves. Broadly, reserves are those volumes that are believed to be recoverable in the future from known deposits through the eventual application of present or anticipated technology.

Reserves

Reserves include both **proved reserves** and **other reserves**. Several different reserve classification systems are in use by different organizations, as preferred for operational reasons. These systems utilize and incorporate various definitions of terms such as *measured reserves*, *indicated reserves*, *inferred reserves*, *probable reserves*, and *possible reserves*. As used by the different organizations, the definitions that attach to these terms sometimes overlap, or the terms may require a slightly different interpretation from one organization to the next. Nevertheless, all kinds of "other reserves" are generally less well known and therefore less precisely quantifiable than proved reserves, and their eventual recovery is less assured.

Table G1. Estimated Oil and Gas Reserves and Mean Estimates of Technically Recoverable Oil and Gas Resources

Categories	Crude Oil ^a (million barrels)	Natural Gas (Wet) (billion cubic feet)	Natural Gas Liquids (million barrels)
Lower 48 States			
<u>Discovered</u>			
Proved Reserves (EIA, 1996)	16,743	^b 165,851	7,486
Reserve Growth - conventional, onshore ^c (USGS, 1991)	^d 47,000	290,000	12,900
Reserve Growth - conventional, Federal Offshore (MMS, 1994)	^e 2,200	^e 32,700	NE
Unproved Reserves, Federal Offshore (MMS, 1994)	1,500	5,500	NE
<u>Undiscovered, Technically Recoverable</u>			
Conventional, onshore ^c (USGS, 1993)	21,810	190,280	6,080
Continuous-type - sandstone, shale, chalk; onshore ^c (USGS, 1993)	2,066	308,080	2,119
Continuous-type - coalbeds, onshore ^c (USGS, 1993)	NA	49,910	NA
Federal Offshore - conventional (MMS, 1994)	21,300	142,100	^f <1,800
Subtotal	112,619	1,184,421	NA
Alaska			
<u>Discovered</u>			
Proved Reserves (EIA, 1996)	5,274	9,296	337
Reserve Growth - conventional, onshore ^c (USGS, 1991)	^g 13,000	32,000	500
Reserve Growth conventional, Federal Offshore (MMS, 1994)	0	0	NE
Unproved Reserves, Federal Offshore (MMS, 1994)	400	700	NE
<u>Undiscovered, Technically Recoverable</u>			
Conventional onshore ^c (USGS, 1993)	8,440	68,410	1,120
Continuous-type - sandstone, shale, chalk; onshore ^c (USGS, 1993)	NE	NE	NE
Continuous-type - coalbeds, onshore ^c (USGS, 1993)	NA	NE	NA
Federal Offshore - conventional (MMS, 1994)	24,300	125,900	^f <1,800
Subtotal	51,414	236,306	NA
Total Lower 48 States and Alaska	164,033	1,420,727	32,342
Deductions for Production and Proved Reserves Changes,			
1991-1996	-7,632	-79,898	-4,008
U.S. Total, 1996	156,401	1,340,829	28,334

^a Condensate is included with crude oil for MMS estimates in Federal Offshore regions.

^b Includes 10,566 billion cubic feet of coalbed methane (EIA, 1996).

^c Includes USGS estimates for all onshore plus State Offshore (near-shore and shallow-water areas under State jurisdiction).

^d Using USGS definition, 1,924 million barrels of indicated additional oil reserves in the lower 48 States were included (EIA, 1996).

^e Reserve growth in the Pacific Federal offshore is not included and was not estimated by the MMS.

^f Total undiscovered natural gas liquids for Federal offshore are 1,800 million barrels; MMS source did not separate lower 48 and Alaska estimates of undiscovered natural gas liquids (1986).

^g Using USGS definition, 952 million barrels of indicated additional oil reserves in Alaska were included (EIA, 1996).

NE = not estimated.

NA = not applicable.

Notes: Federal Onshore indicates MMS estimates for Federal Offshore jurisdictions (Outer Continental Shelf and deeper water areas seaward of State Offshore). Energy Information Administration (EIA), onshore and offshore estimated reserves. U.S. Geological Survey (USGS): 1995 National Assessment mean estimates as of the end of 1993 (onshore and State Offshore). Minerals Management Service (MMS): 1996 National Assessment mean estimates as of the end of 1994. The MMS also has end-1994 estimates for economically recoverable resources. Probable and Possible reserves are considered by USGS definition to be part of USGS Reserve Growth, but are separately considered by the MMS as its Unproved Reserves term. The USGS did not set a time limit for the duration of Reserve Growth; the MMS set the year 2020 as the time limit in its estimates of Reserve Growth in existing fields of the Gulf of Mexico. Excluded from the estimates are undiscovered oil resources in tar deposits and oil shales, and undiscovered gas resources in geopressured brines and gas hydrates.

Sources: Energy Information Administration, Office of Oil and Gas; USGS and MMS - *Estimates of Undiscovered Conventional Oil and Gas Resources in the United States—A Part of the Nation's Energy Endowment* (1989), U.S. Department of the Interior; *1995 National Assessment of United States Oil and Gas Resources*, USGS Circular 1118, U.S. Department of the Interior; and *An Assessment of the Undiscovered Hydrocarbon Potential of the Nation's Outer Continental Shelf* (1996), U.S. Department of the Interior.

Measured reserves are defined by the USGS as that part of the identified (i.e., discovered) economically recoverable resource that is estimated from geologic evidence and supported directly by engineering data.[35] They are similarly defined by the MMS, although its system also subdivides them by degree of development and producing status.[36] Measured reserves are demonstrated with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions, and are essentially equivalent to proved reserves as defined by the EIA. Effectively, estimates of proved reserves may be thought of as reasonable estimates (as opposed to exact measures) of "on-the-shelf inventory".

Inferred reserves and indicated reserves, due to their more uncertain economic or technical recoverability, are included in the "other reserves" category. The USGS defines inferred reserves as that part of the identified economically recoverable resource, over and above both measured and indicated (see below) reserves, that will be added to proved reserves in the future through extensions, revisions, and the discovery of new pay zones in already discovered fields.[35] Inferred reserves are considered equivalent to "probable reserves" by many analysts, for example, those of the PGC.

Indicated additional reserves, a separate category, are defined by both the DOI and the EIA as quantities of crude oil that may become economically recoverable in the future from existing productive reservoirs through the application of currently available but as-yet uninstalled recovery technology. At such time as the technology is successfully applied, indicated additional reserves are reclassified to the proved reserves category. Of all the various "other reserves" categories, only indicated additional reserves are estimated by the EIA and reported herein.

Proved Reserves

The EIA defines proved reserves as those volumes of oil and gas that geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. Proved reserves are either proved producing or proved nonproducing (i.e., resident in reservoirs that did not produce during the report year). The latter may represent a substantial fraction of total proved reserves.

Reserve Estimation Methodologies

The adoption of a standard definition of proved reserves for each type of hydrocarbon surveyed by the Form EIA-23 program provided a far more consistent response from operators than if each operator had used their own definition. Such standards, however, do not guarantee that the resulting estimates themselves are determinate. Regardless of the definition selected, proved reserves cannot be measured directly. They are estimated quantities that are inferred on the basis of the best geological, engineering, and economic data available to the estimator, who generally uses considerable judgment in the analysis and interpretation of the data. Consequently, the accuracy of a given estimate varies with and depends on the quality and quantity of raw data available, the estimation method used, and the training and experience of the estimator. The element of judgment commonly accounts for the differences among independent estimates for the same reservoir or field.

Data Used in Making Reserve Estimates

The raw data used in estimating proved reserves include the engineering and geological data for reservoir rock and its fluid content. These data are obtained from direct and indirect measurements. The data available for a given reservoir vary in kind, quality, and quantity. When a reservoir is first discovered only data from a single well are available, and prior to flow testing or actual production, proved reserves can only be inferred. As development of the reservoir proceeds, and flow tests are made or actual production commences, more and more data become available, enabling proved reserves estimates to become more accurate.

Many different kinds of data are useful in making reserves estimates. They may include: data on porosity, permeability, and fluid saturations of the reservoir rocks (obtained directly from core analysis or from various types of electrical measurements taken in a well or several wells); data on the production of fluids from a well or several wells; geologic maps of the areal extent, thickness, and continuity of the reservoir rocks (inferred from well logs, geophysical, and geological data); and reservoir pressure and temperature data. Also involved are economic data including the current price of crude oil and natural gas, and various developmental and operating costs.

Reserve Estimation Techniques

Depending on the kinds and amounts of data available, and a judgment on the reliability of those data, the estimator will select one of several methods of making a proved reserves estimate. Methods based on production performance data are generally more accurate than those based strictly on inference from geological and engineering data. Such methods include the *Production Decline* method (for crude oil or natural gas reservoirs), the *Material Balance* method (for crude oil reservoirs), the *Pressure Decline* method (which is actually a material balance, for natural gas reservoirs), and the *Reservoir Simulation* method (for crude oil or natural gas reservoirs). The reservoir type and production mechanisms and the types and amounts of reliable data available determine which of these methods is more appropriate for a given reservoir. These methods are of comparable accuracy.

Methods not based upon production data include the *Volumetric* method (for crude oil or natural gas reservoirs) and the *Nominal* method. Of these, the *Volumetric* method is the more accurate. Both methods, however, are less accurate than those based on production data. Table G2 summarizes the various methods.

Judgmental Factors in Reserve Estimation

The determination of rock and hydrocarbon fluid properties involves judgment and is subject to some uncertainty; however, the construction of the geologic maps and cross sections and the determination of the size of the reservoir are the major judgmental steps in the *Volumetric* method, and are subject to the greatest uncertainty. Estimates made using the *Material Balance* method, the *Reservoir Simulation* method, or the *Pressure Decline* method are based on the estimator's judgment that the type of reservoir drive mechanism has been identified and on the specification of abandonment conditions. Estimates based on the *Production Decline* method are subject to judgment in constructing the trend line, and are based on the estimator's assumption of reservoir performance through abandonment.

Contributing to the degree of uncertainty inherent in the above methods for estimating reserves are other factors associated with economic considerations and the perceived reservoir limits, which together influence

Table G2. Reserve Estimation Techniques

Method	Comments
Volumetric	Applies to crude oil and natural gas reservoirs. Based on raw engineering and geologic data.
Material Balance	Applies to crude oil and natural gas reservoirs. Is used in estimating reserves. Usually of more value in predicting reserves, and reservoir performance.
Pressure Decline	Applies to nonassociated and associated gas reservoirs. The method is a special case of material balance equation in the absence of water influx.
Production Decline	Applies to crude oil and natural gas reservoirs during production decline (usually in the later stages of reservoir life).
Reservoir Simulation	Applies to crude oil and natural gas reservoirs. Is used in estimating reserves. Usually of more value in predicting reservoir performance. Accuracy increases when matched with past pressure and production data.
Nominal	Applied to crude oil and natural gas reservoirs. Based on rule of thumb or analogy with another reservoir or reservoirs be-

the final reserves estimate. A brief discussion of these other factors follows.

Economic considerations: There has been continuing debate about the effects of prices on proved reserves. Although no all-inclusive statement can be made on the impact of price, the points at issue can be discussed and some general remarks can be made about some circumstances where price may be a factor.

- *Developed gas fields* – In a gas reservoir, price affects the economic limit (i.e., the production rate required to meet operating costs) and, therefore, the abandonment pressure. Thus, price change has some effect on the conversion of noneconomic hydrocarbon resources to the category of proved reserves. In both nearly depleted reservoirs and newly developed reservoirs, the actual increase in the quantity of proved reserves resulting from price rises is generally limited in terms of national volumes (even though the percentage increase for a given reservoir may be great).
- *Developed oil fields* – In developed crude oil reservoirs many of the same comments apply; however, there is an additional consideration. If the price is raised to a level sufficient to justify

initiation of an improved recovery project, and if the improved recovery technique is effective, then the addition to ultimate recovery from the reservoir can be significant. Because of the speculative nature of predicting prices and costs many years into the future, proved reserves are estimated on the basis of current prices, costs, and operating practices in effect as of the date the estimation was made.

- *Successful exploration efforts* – Price can have a major impact on whether a new discovery is produced or abandoned. For example, the decision to set casing in a new onshore discovery, or to install a platform as the result of an offshore discovery, are both price-sensitive. If the decision is made to set pipe or to install a platform, the discoveries in both cases will add to the proved reserves total. If such projects are abandoned, they will make no contribution to the proved reserves total.

Effect of operating conditions: Operating conditions are subject to change caused by changes in economic conditions, unforeseen production problems, new production practices or methods, and the operator's financial position. As with economic conditions, operating conditions to be expected at the time of abandonment are speculative. Thus, current operating conditions are used in estimating proved reserves. In considering the effect of operating conditions, a distinction must be made between processes and techniques that would normally be applied by a prudent operator in producing his oil and gas, and initiation of changes in operating conditions that would require substantial new investment.

- *Compression* – Compression facilities are normally installed when the productive capacity or deliverability of a natural gas reservoir or its individual wells declines. In other cases compression is used in producing shallow, low-pressure reservoirs or reservoirs in which the pressure has declined to a level too low for the gas to flow into a higher pressure pipeline. The application of compression increases the pressure and, when economical, is used to make production into the higher pressure pipeline possible. Compression facilities normally require a significant investment and result in a change in operating conditions. It increases the proved reserves of a reservoir, and reasonably accurate estimates of the increase can be made.
- *Well stimulation* – Procedures that increase productive capacity (workovers, such as

acidizing or fracturing, and other types of production practices) are routine field operations. The procedures accelerate the rate of production from the reservoir, or extend its life, and they have only small effect on proved reserves. Reasonable estimates of their effectiveness can be made.

- *Improved recovery techniques* – These techniques involve the injection of a fluid or fluids into a reservoir to augment natural reservoir energy. Because the response of a given reservoir to the application of an improved recovery technique cannot be accurately predicted, crude oil production that may ultimately result from the application of these techniques is classified as "indicated additional reserves of crude oil" rather than as proved reserves until response of the reservoir to the technique has been demonstrated. In addition, improved recovery methods are not applicable to all crude oil reservoirs. Initiation of improved recovery techniques may require significant investment.
- *Infill drilling* – Infill drilling (drilling of additional wells within a field/reservoir) may result in a higher recovery factor, and, therefore, be economically justified. Predictions of whether infill drilling will be justified under current economic conditions are generally based on the expected production behavior of the infill wells.

Reservoir limits: The initial proved reserves estimate made from the discovery well is subject to significant uncertainty because one well provides little information on the size of the reservoir. The area proved by a discovery well is frequently estimated on the basis of experience in a given producing region. Where there is continuity of the producing formation over wide geographic areas, a relatively large proved area may be assigned. In some cases where reliable geophysical and geological data are available, a reasonable estimate of the extent of the reservoir can be made by drilling a relatively small number of delineation wells. Conversely, a relatively small proved area may be assigned when the producing formation is of limited continuity, owing to either structural or lithological factors.

Additional wells provide more information and reduce the uncertainty of the reserves estimate. As additional wells are drilled, the geometry of the reservoir and, consequently, its bulk volume, become more clearly defined. This process accounts for the large extensions to proved reserves typical of the early stages of most reservoir development.

Appendix H

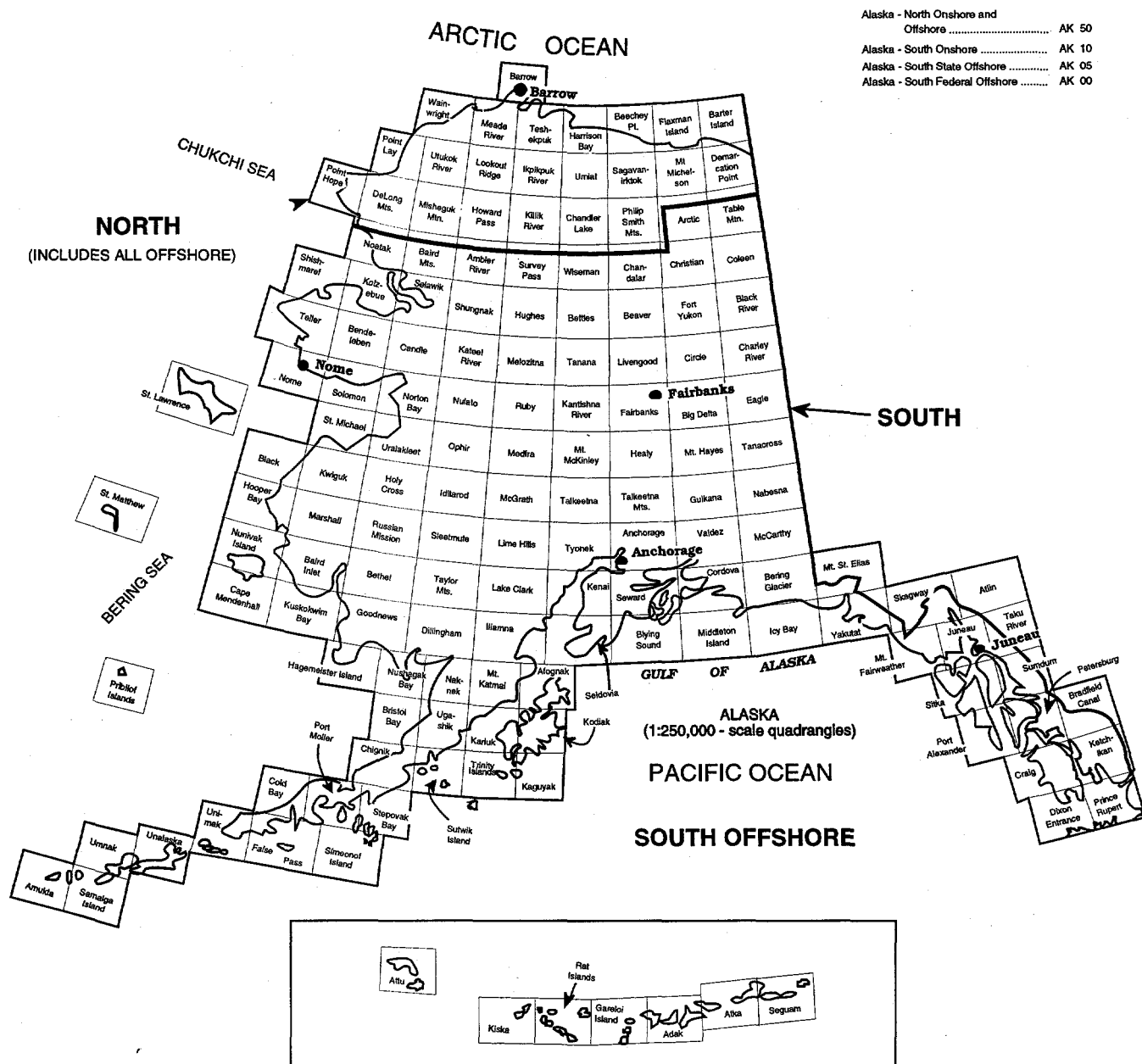
Maps of Selected State Subdivisions



Appendix H

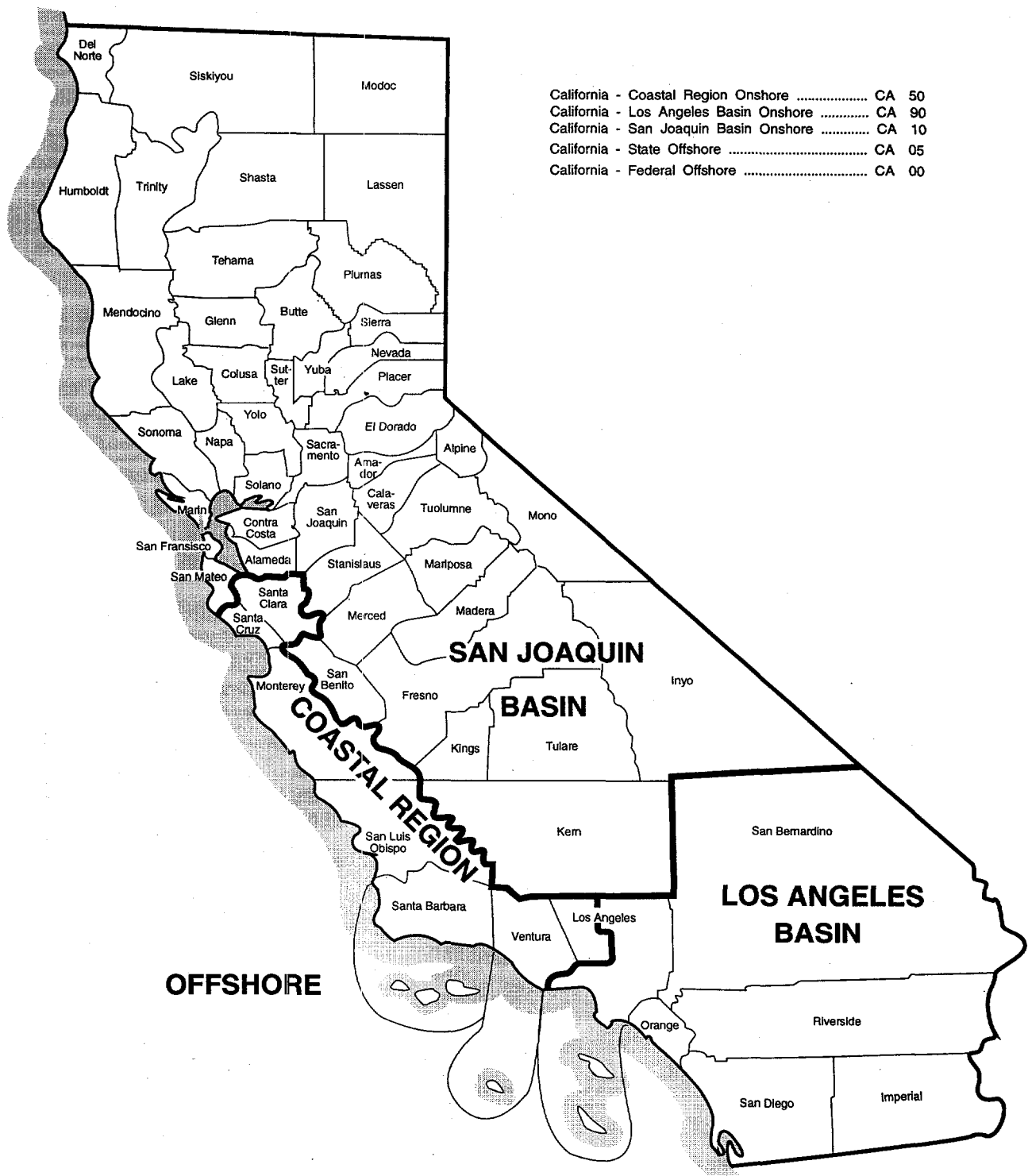
Maps of Selected State Subdivisions

Figure H1. Subdivisions of Alaska



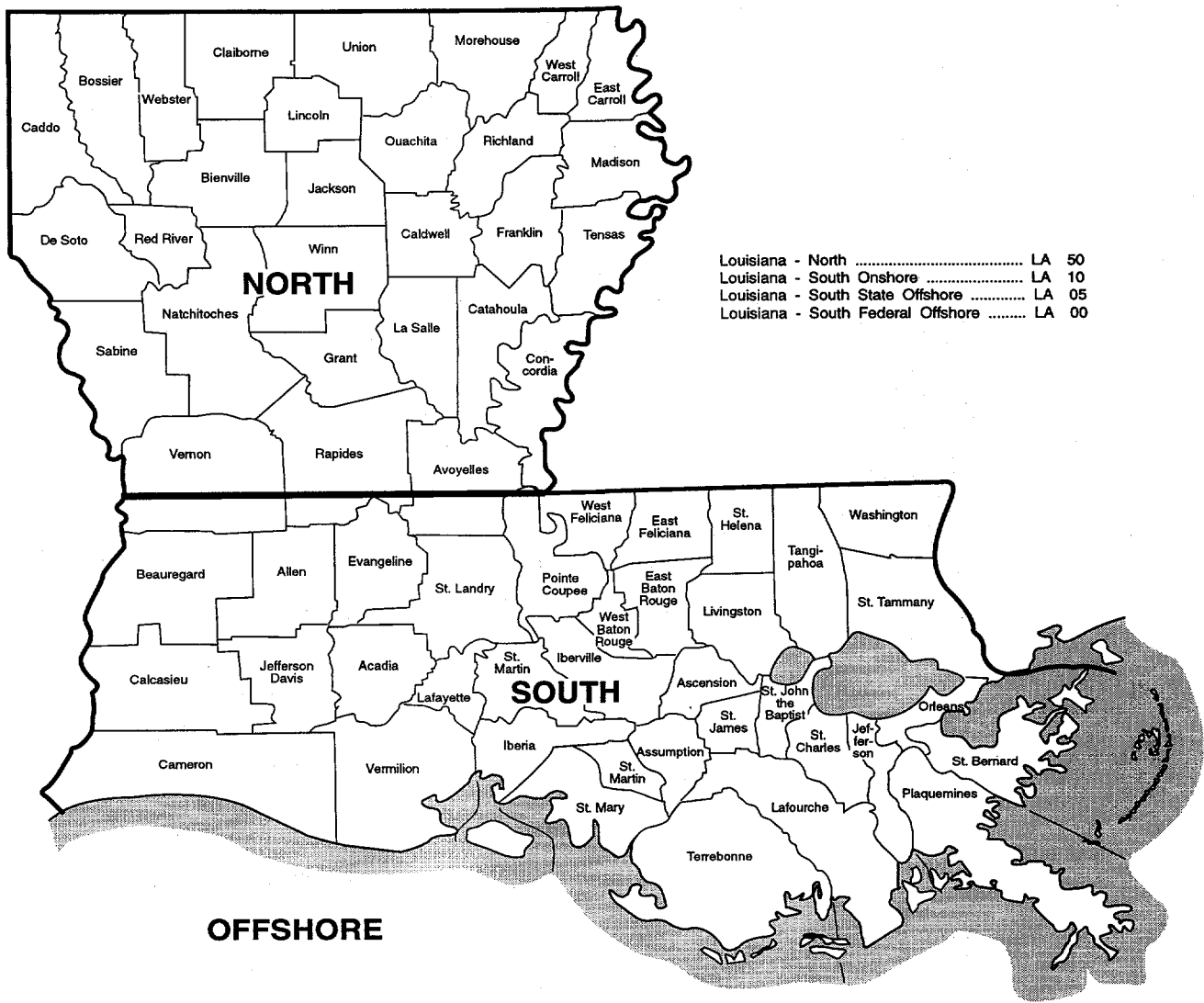
Source: After U.S. Geological Survey.

Figure H2. Subdivisions of California



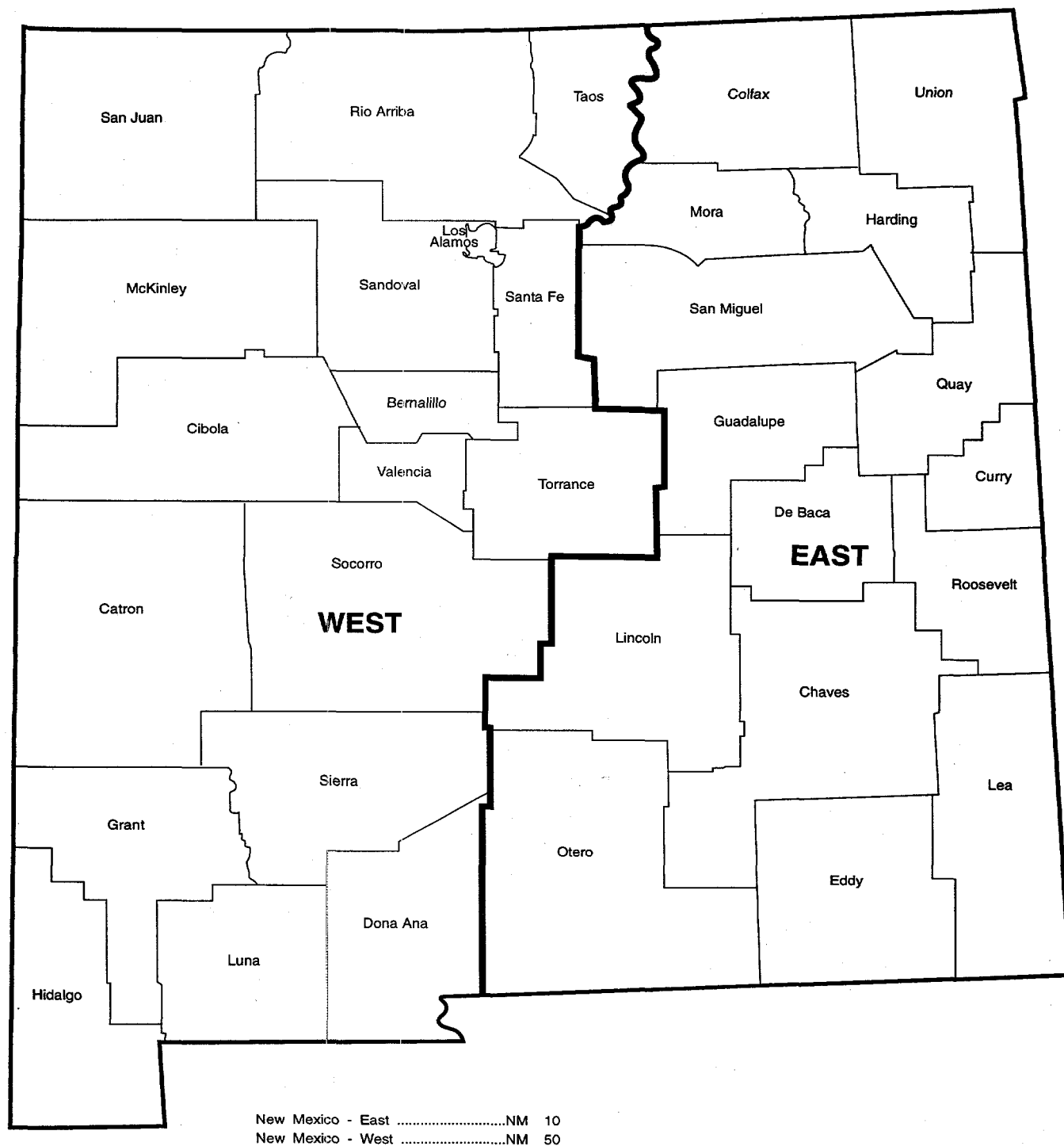
Source: Energy Information Administration, Office of Oil and Gas.

Figure H3. Subdivisions of Louisiana



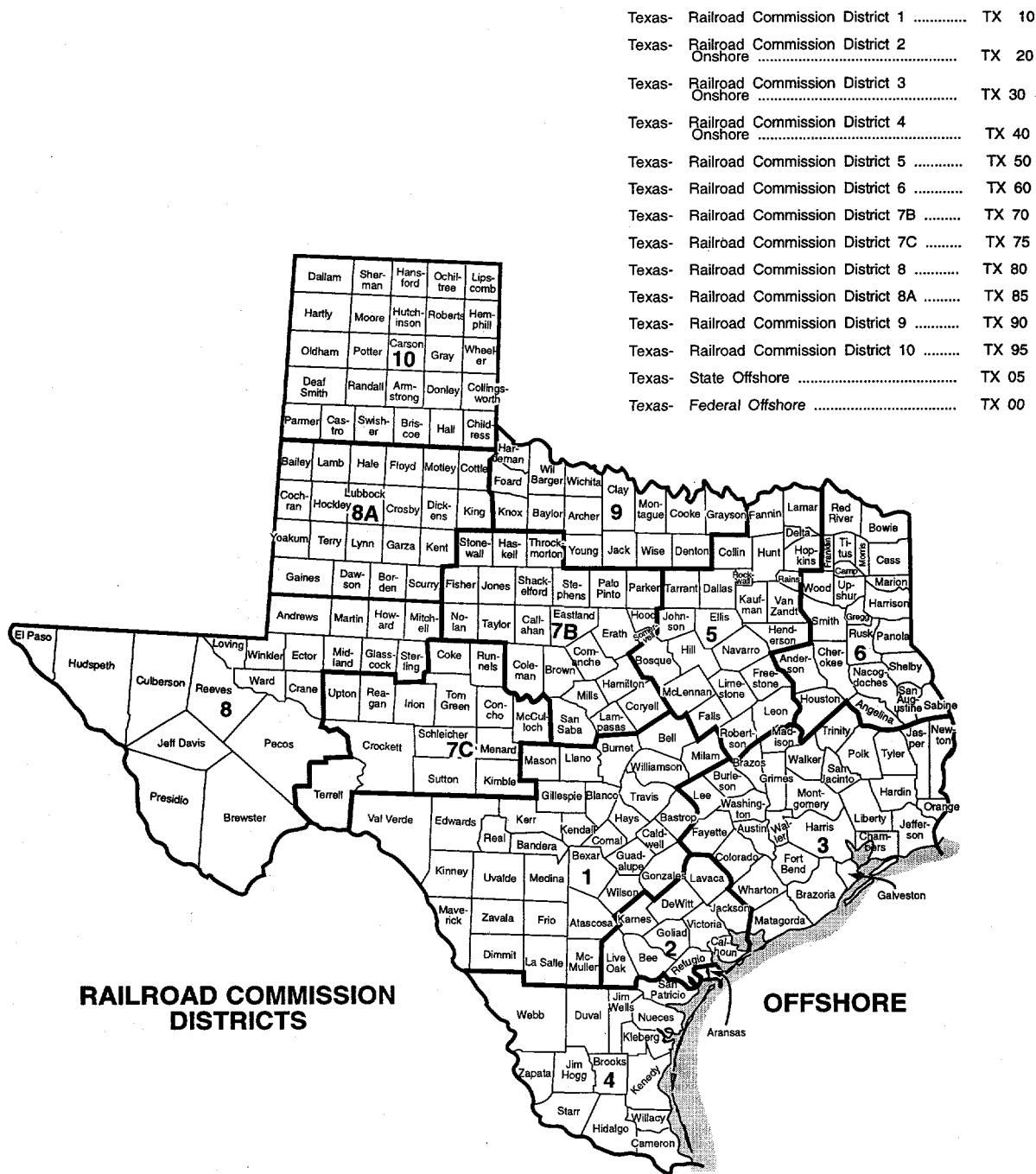
Source: Energy Information Administration, Office of Oil and Gas.

Figure H4. Subdivisions of New Mexico



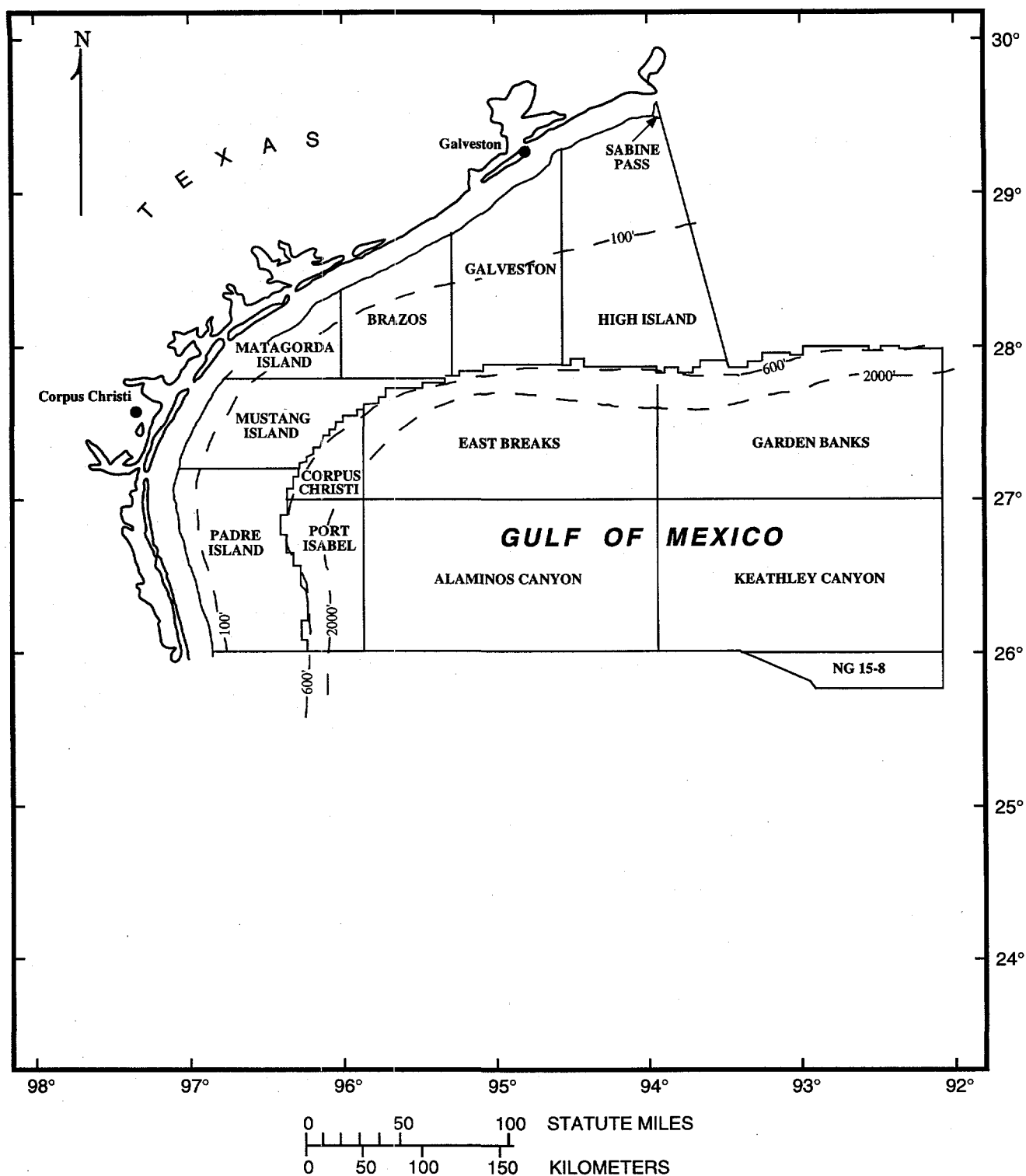
Source: Energy Information Administration, Office of Oil and Gas.

Figure H5. Subdivisions of Texas



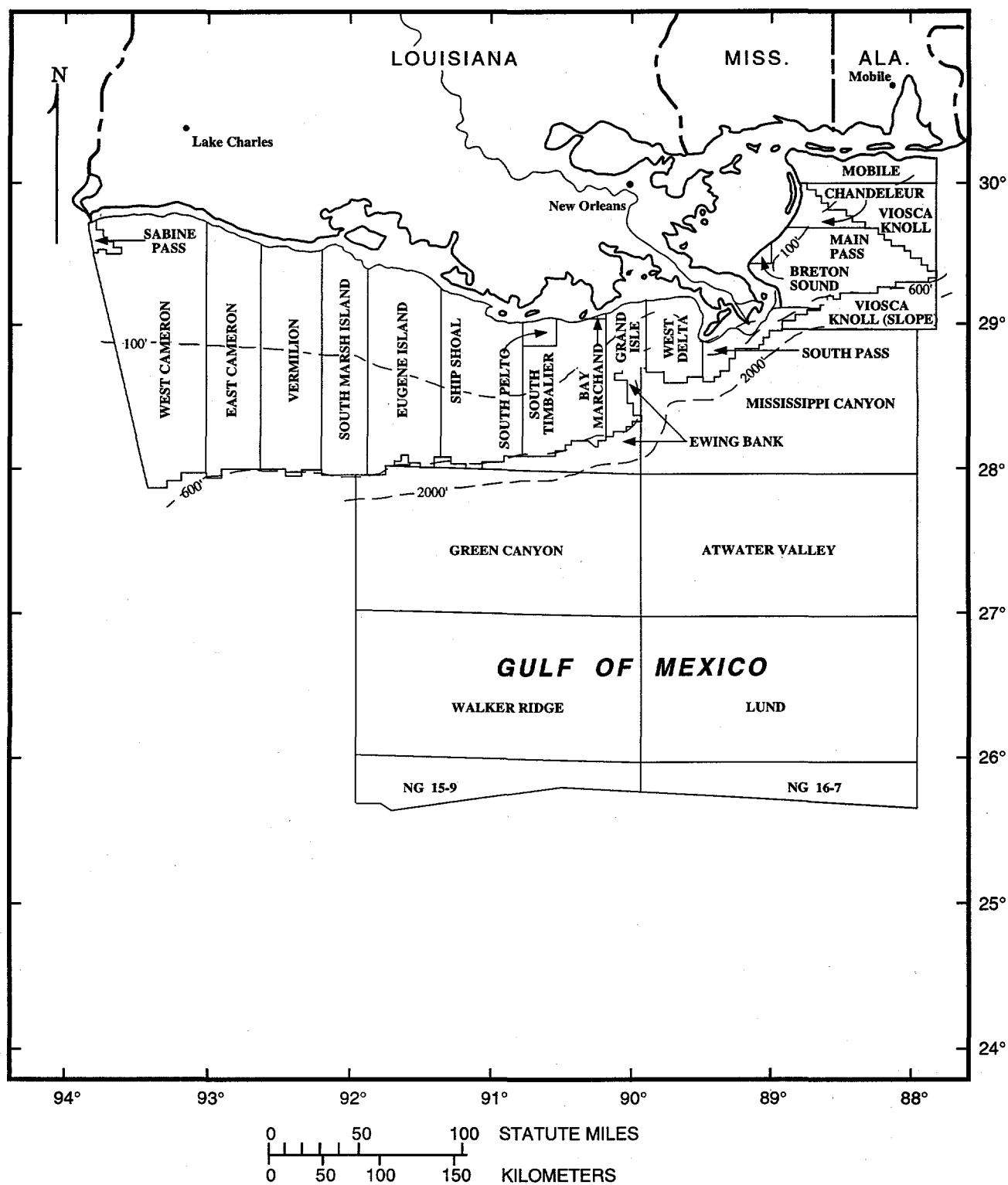
Source: Energy Information Administration, Office of Oil and Gas.

Figure H6. Western Planning Area, Gulf of Mexico Outer Continental Shelf Region



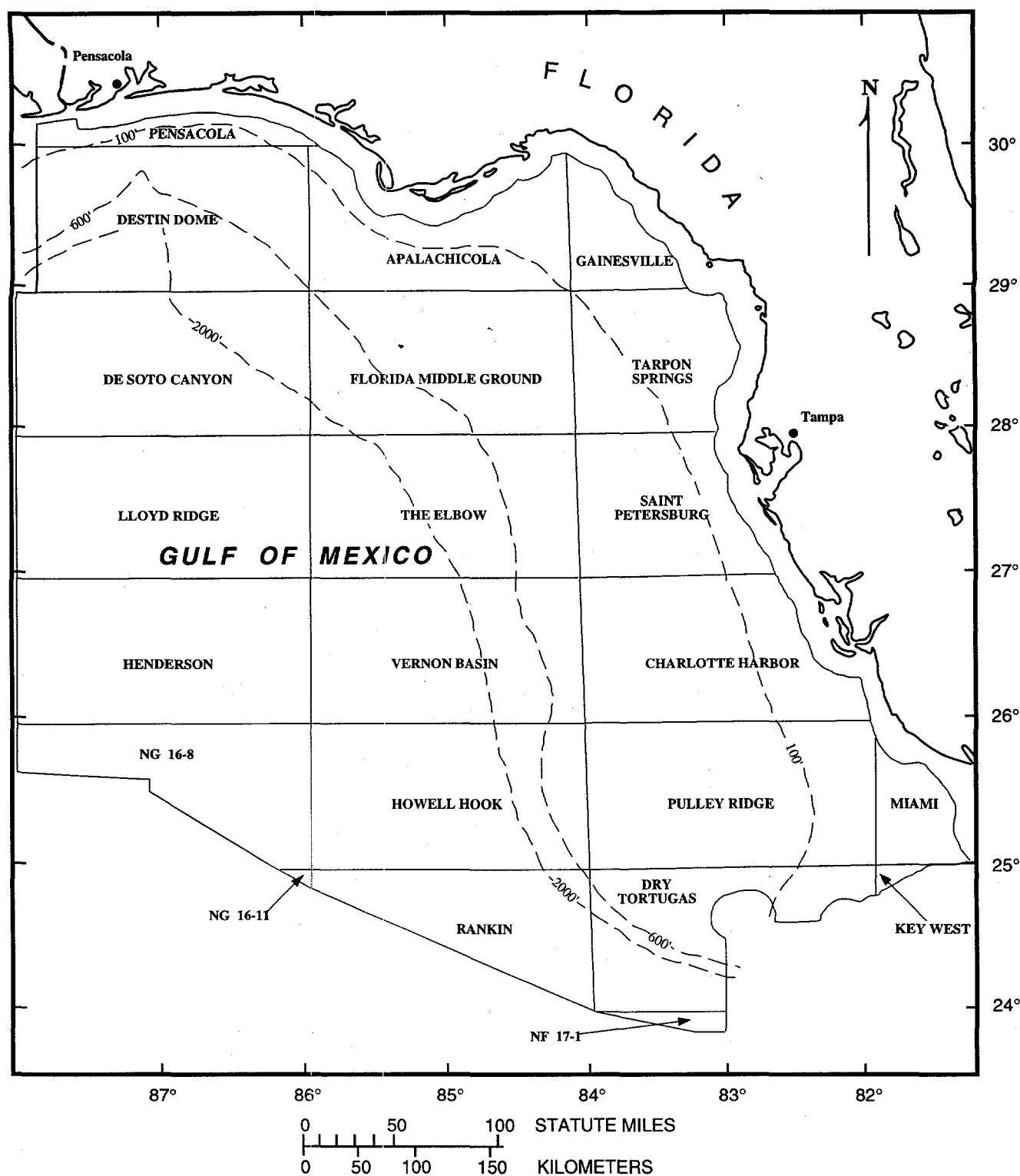
(Dashed lines indicate water depths in feet.)
Source: Energy Information Administration, Office of Oil and Gas.

Figure H7. Central Planning Area, Gulf of Mexico Outer Continental Shelf Region



(Dashed lines indicate water depths in feet.)
Source: Energy Information Administration, Office of Oil and Gas.

Figure H8. Eastern Planning Area, Gulf of Mexico Outer Continental Shelf Region



(Dashed lines indicate water depths in feet.)

Source: Energy Information Administration, Office of Oil and Gas.

Appendix I

**Annual Survey Forms for
Domestic Oil and Gas Reserves**

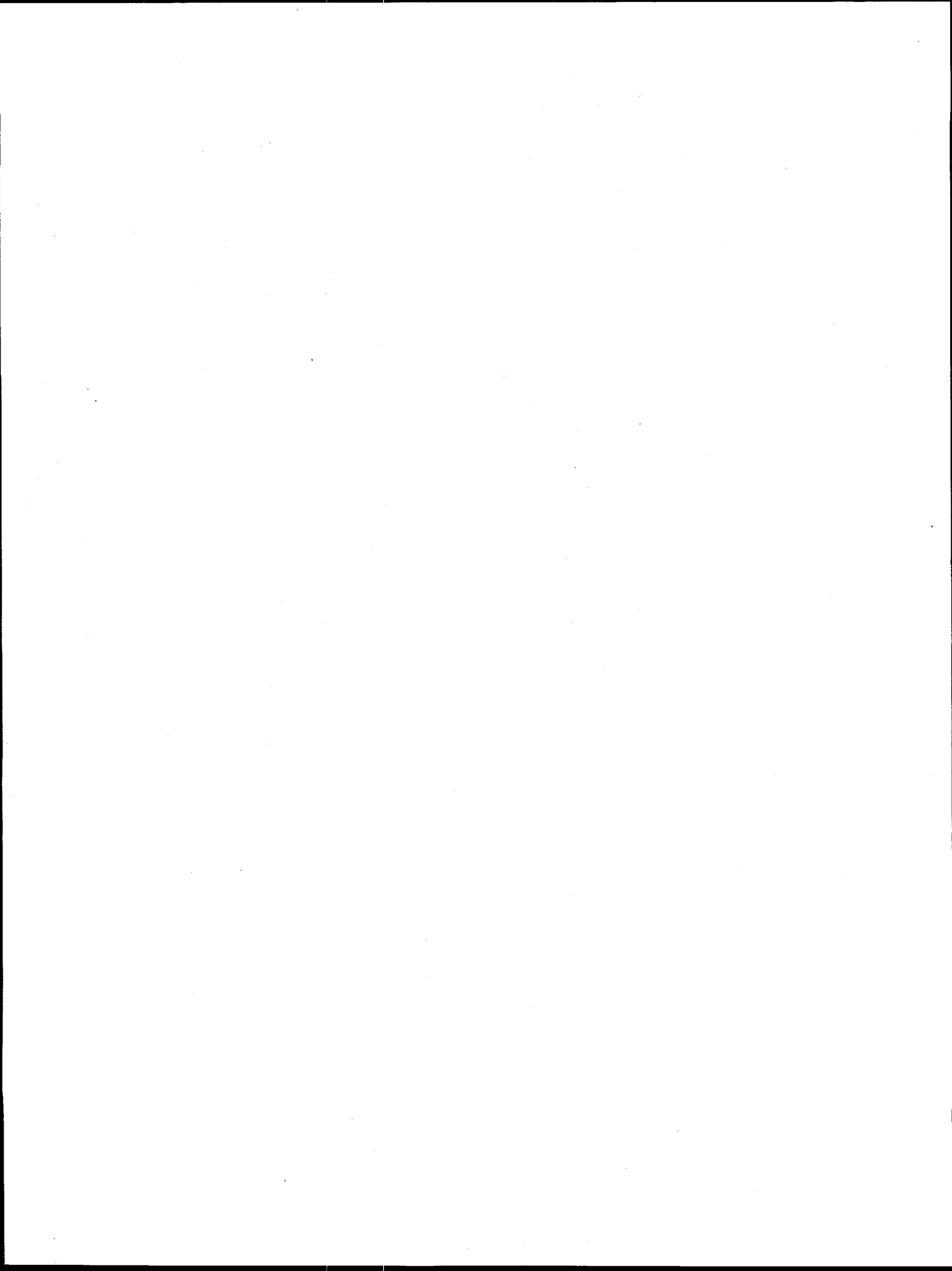


Figure I1. Form EIA-23, Cover Page

OFFICIAL USE ONLY		1996		ANNUAL SURVEY OF DOMESTIC OIL AND GAS RESERVES U.S. DEPARTMENT OF ENERGY CALENDAR YEAR 1996									
<p style="font-size: small;">Form Approved OMB No. 1805-0057 Expires 12/87</p> <p style="font-size: x-small;">This report is mandatory under Public Law 93-275. Failure to comply may result in criminal fines, civil penalties and other sanctions as provided by law. For the sanctions and the provisions concerning the confidentiality of information submitted on this form, see page 2 of the instructions. Public reporting burden for this collection of information is estimated to average from 82 to 333 hours per response, including the time of reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Energy Information Administration, Office of Statistical Standards EI-73, Washington, DC 20585; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.</p>													
COVER PAGE													
IDENTIFICATION		<p>2. I.D. Code FOR DOE USE ONLY</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;">0</td> <td style="width: 10%; text-align: center;">0</td> <td style="width: 10%; text-align: center;">0</td> <td style="width: 10%; text-align: center;">0</td> <td style="width: 10%; text-align: center;">0</td> <td style="width: 10%; text-align: center;">0</td> <td style="width: 10%; text-align: center;">0</td> <td style="width: 10%; text-align: center;">0</td> </tr> </table>				0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0						
<p>1. Were you an operator (see definition of an operator, p. 1) of one or more oil or gas wells on December 31, 1996?</p> <p>(1) <input type="checkbox"/> No... Complete only items 3 through 22 below and return this page with a letter stating when operations ceased and what became of the wells you operated to P.O. Box 1470 Rockville, MD 20849-1470</p> <p>(2) <input type="checkbox"/> Yes... Complete the attached forms and return them to P.O. Box 1470 Rockville, MD 20849-1470</p>		<p>If information to the left is incorrect or is missing, enter correct information below.</p> <p>3. Name _____</p> <p>4. Address _____</p> <p>5. City _____ 6. State _____ 7. Zip Code _____</p> <p>8. EIN _____ Check if Attestor's Social Security Number <input type="checkbox"/></p> <p>9. Name of Contact Person _____</p> <p>10. Telephone Number of Contact Person _____ Area Code () _____</p>											
PARENT COMPANY IDENTIFICATION													
<p>11. Is there a parent company which exercises ultimate control over your company?</p> <p>(1) <input type="checkbox"/> No... Answer 18 thru 22</p> <p>(2) <input type="checkbox"/> Yes... Answer 12 thru 22</p>		<p>12. Name _____</p> <p>13. Address _____</p> <p>14. City _____ 15. State _____ 16. Zip Code _____</p> <p>17. Parent Company EIN _____</p>											
<p>18. What is the total number of pages (including this page) submitted in this filing?</p>		<p style="text-align: center;">ATTESTATION</p> <p>(This report must be attested to by a responsible official of the company.) I hereby swear or affirm that I have read the report and am familiar with its contents, and that to the best of my knowledge, information, and belief, the information provided and appended is true and complete.</p> <p>19. Name of Attestor (Please print) _____</p> <p>20. Title _____</p> <p>21. Signature _____</p> <p>22. Date _____</p>											
<p style="font-size: x-small;">Title 18 USC 1001 makes it a criminal offense for any person knowingly and willingly to make to any Agency or Department of the United States any false, fictitious or fraudulent statements as to any matter within its jurisdiction</p>													

FOR ASSISTANCE CALL 1-800-879-1470

OFFICIAL USE ONLY

ANNUAL SURVEY OF DOMESTIC OIL AND GAS RESERVES

1996

SCHEDULE A - OPERATED PROVED RESERVES, PRODUCTION, AND RELATED DATA BY FIELD

(Report All Liquid Volumes in Thousands of Barrels (Mbbbl) at 60°F;
Report All Volumes of Natural Gas in Millions of Cubic Feet (MMcf) at 60°F and 14.73 psia)

1.0 OPERATOR AND REPORT IDENTIFICATION DATA										REPORT DATE		1.3 ORIGINAL		1.4 AMENDED		1.5 PAGE		FOR DOE USE ONLY	
1.1 OPERATOR I.D. CODE		1.2 OPERATOR NAME		1.3 ORIGINAL		1.4 AMENDED		1.5 PAGE		FOR DOE USE ONLY		1.3 ORIGINAL		1.4 AMENDED		1.5 PAGE		FOR DOE USE ONLY	
2.1																			
1. STATE ABBR.		2. SUBV. CODE		3. COUNTY CODE		4. FIELD CODE		5. OCS BLOCK NUMBER		6. FIELD NAME		7. CALENDAR YEAR PRODUCTION FROM PROPERTIES FOR WHICH RESERVES WERE NOT ESTIMATED		8. FOOTNOTE					
												CRUDE OIL (a) (Mbbbl) ASSOC-DISSOLVED GAS (b) (MMcf) NONASSOCIATED GAS (c) (MMcf) LEASE CONDENSATE (d) (MMcf)		CRUDE OIL (a) (Mbbbl) ASSOC-DISSOLVED GAS (b) (MMcf) NONASSOCIATED GAS (c) (MMcf) LEASE CONDENSATE (d) (MMcf)					
9. WATER DEPTH																			
10. FIELD DISCOVERY YEAR																			
11. INDICATED ADDITIONAL RESERVES OF CRUDE OIL (Mbbbl)																			
12. CRUDE OIL (Mbbbl)																			
13. ASSOCIATED-DISSOLVED GAS (MMcf)																			
14. NONASSOCIATED GAS (MMcf)																			
15. LEASE CONDENSATE (MMcf)																			
2.2																			
1. STATE ABBR.		2. SUBV. CODE		3. COUNTY CODE		4. FIELD CODE		5. OCS BLOCK NUMBER		6. FIELD NAME		7. CALENDAR YEAR PRODUCTION FROM PROPERTIES FOR WHICH RESERVES WERE NOT ESTIMATED		8. FOOTNOTE					
												CRUDE OIL (a) (Mbbbl) ASSOC-DISSOLVED GAS (b) (MMcf) NONASSOCIATED GAS (c) (MMcf) LEASE CONDENSATE (d) (MMcf)		CRUDE OIL (a) (Mbbbl) ASSOC-DISSOLVED GAS (b) (MMcf) NONASSOCIATED GAS (c) (MMcf) LEASE CONDENSATE (d) (MMcf)					
9. WATER DEPTH																			
10. FIELD DISCOVERY YEAR																			
11. INDICATED ADDITIONAL RESERVES OF CRUDE OIL (Mbbbl)																			
12. CRUDE OIL (Mbbbl)																			
13. ASSOCIATED-DISSOLVED GAS (MMcf)																			
14. NONASSOCIATED GAS (MMcf)																			
15. LEASE CONDENSATE (MMcf)																			
2.3																			
1. STATE ABBR.		2. SUBV. CODE		3. COUNTY CODE		4. FIELD CODE		5. OCS BLOCK NUMBER		6. FIELD NAME		7. CALENDAR YEAR PRODUCTION FROM PROPERTIES FOR WHICH RESERVES WERE NOT ESTIMATED		8. FOOTNOTE					
												CRUDE OIL (a) (Mbbbl) ASSOC-DISSOLVED GAS (b) (MMcf) NONASSOCIATED GAS (c) (MMcf) LEASE CONDENSATE (d) (MMcf)		CRUDE OIL (a) (Mbbbl) ASSOC-DISSOLVED GAS (b) (MMcf) NONASSOCIATED GAS (c) (MMcf) LEASE CONDENSATE (d) (MMcf)					
9. WATER DEPTH																			
10. FIELD DISCOVERY YEAR																			
11. INDICATED ADDITIONAL RESERVES OF CRUDE OIL (Mbbbl)																			
12. CRUDE OIL (Mbbbl)																			
13. ASSOCIATED-DISSOLVED GAS (MMcf)																			
14. NONASSOCIATED GAS (MMcf)																			
15. LEASE CONDENSATE (MMcf)																			
2.4																			
1. STATE ABBR.		2. SUBV. CODE		3. COUNTY CODE		4. FIELD CODE		5. OCS BLOCK NUMBER		6. FIELD NAME		7. CALENDAR YEAR PRODUCTION FROM PROPERTIES FOR WHICH RESERVES WERE NOT ESTIMATED		8. FOOTNOTE					
												CRUDE OIL (a) (Mbbbl) ASSOC-DISSOLVED GAS (b) (MMcf) NONASSOCIATED GAS (c) (MMcf) LEASE CONDENSATE (d) (MMcf)		CRUDE OIL (a) (Mbbbl) ASSOC-DISSOLVED GAS (b) (MMcf) NONASSOCIATED GAS (c) (MMcf) LEASE CONDENSATE (d) (MMcf)					
9. WATER DEPTH																			
10. FIELD DISCOVERY YEAR																			
11. INDICATED ADDITIONAL RESERVES OF CRUDE OIL (Mbbbl)																			
12. CRUDE OIL (Mbbbl)																			
13. ASSOCIATED-DISSOLVED GAS (MMcf)																			
14. NONASSOCIATED GAS (MMcf)																			
15. LEASE CONDENSATE (MMcf)																			

Source: Energy Information Administration, Office of Oil and Gas.

Figure I6. Form EIA-64A

EIA-64A (Revised 9/91)

OFFICIAL USE
ONLY

1996

Energy Information Administration
U.S. DEPARTMENT OF ENERGY
Calendar Year 1996

Form Approved
OMB No. 1905-0057
Expires 12/97

ANNUAL REPORT OF THE ORIGIN OF NATURAL GAS LIQUIDS PRODUCTION
FORM EIA-64A

This report is mandatory under Public Law 93-275. Failure to comply may result in criminal fines, civil penalties and other sanctions as provided by law. For the sanctions and the provisions concerning the confidentiality of information submitted on this form, see Page 2 of the Instructions. Public reporting burden for this collection of information is estimated to average 5.9 hours per respondent, including the time of reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Energy Information Administration, Office of Statistical Standards, EI-73, Washington, DC 20585; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

PLEASE COMPLETE THIS
FORM AND RETURN TO

DOMESTIC OIL AND GAS RESERVES PROGRAM
PO BOX 1470
ROCKVILLE, MD 20849-1470

PLANT AND PRODUCTION REPORT IDENTIFICATION

1.0 Does this report reflect active natural gas processing at the facility for the entire year? " Yes " No
Months covered by this report _____ through _____ (Include Explanatory Notes in Section 8.0)

2.0 If label is incorrect or information is missing or no label is given, enter correct information to the right

2.1 Plant Operator's Name

2.2 Contact Person's Name

2.3 Plant Name

2.4 Geographic Location (Use Area of Origin Codes, Page 6)

2.5 Mailing Address

2.6 City State Zip Code

2.7 Telephone Number ()

3.0 Parent Company's Name

4.0 Submission Status ☐ Original ☐ Amended

5.0 Origin of Natural Gas Received and Natural Gas Liquids Produced

Line	Area of Origin Code (A)	Natural Gas Received (MMcf) (B)	Natural Gas Liquids Production (Mbbbl) (C)
5.1			
5.2			
5.3			
5.4			
5.5			
5.6			
5.7			
5.8			
5.9			
5.10			
5.11			
5.12			
5.13			
5.14			
5.15			
5.16	TOTAL		

6.0 Gas Shrinkage Resulting from Natural Gas Liquids Extracted (MMcf)

7.0 Natural Gas Used as Fuel in Processing (MMcf)

8.0 Explanatory Notes

9.0 Certification: I certify that the information provided herein and appended hereto is true and accurate to the best of my knowledge.

Name (Please Print)

Date

Signature

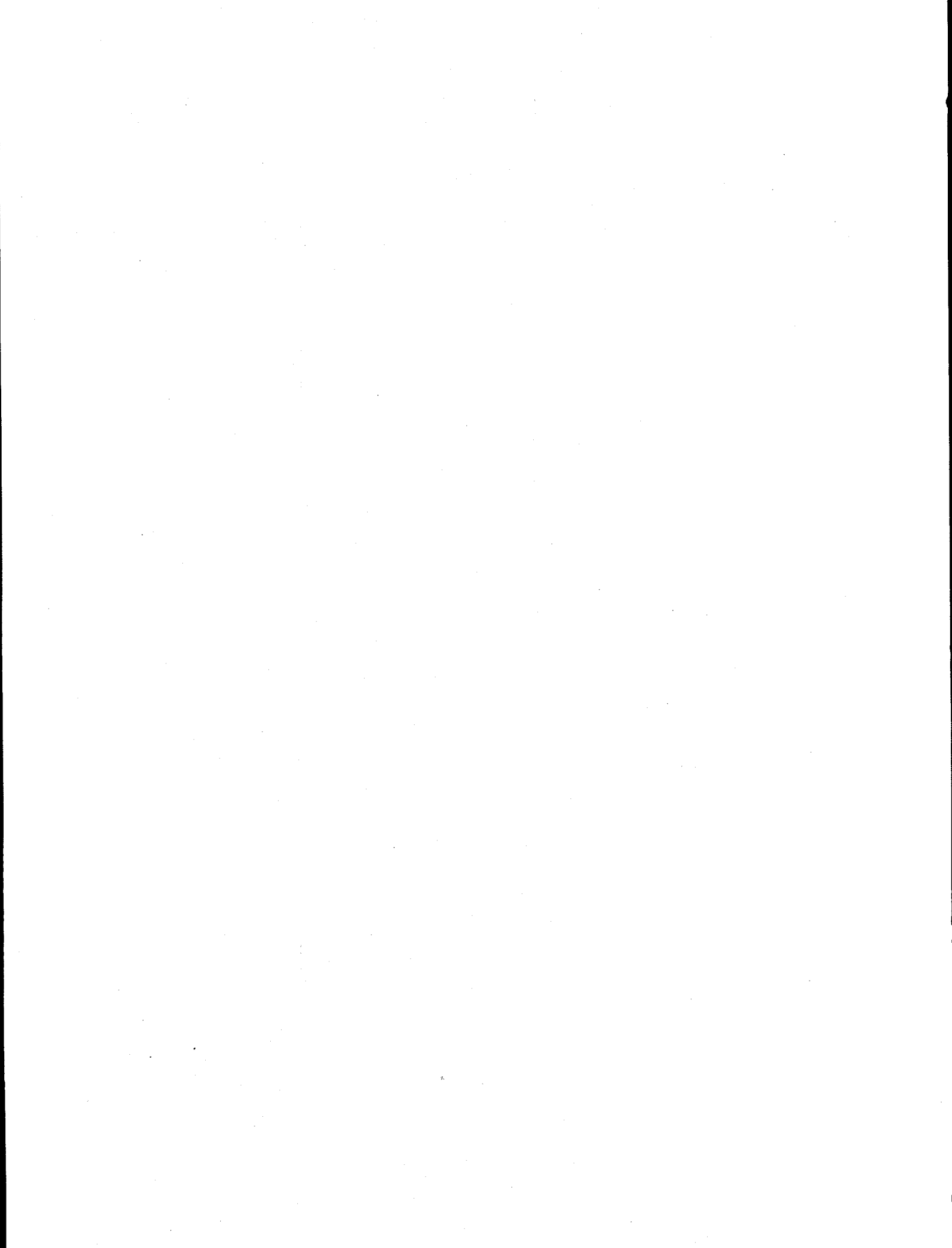
Title

Title 18 USC 1001 makes it a criminal offense for any person knowingly and willingly to make to any Agency or Department of the United States any false, fictitious, or fraudulent statements as to any matter within its jurisdiction.

FOR ASSISTANCE CALL 1-800-879-1470

Source: Energy Information Administration, Office of Oil and Gas.

Glossary



Glossary

This glossary contains definitions of the technical terms used in this report and employed by respondents in completing Form EIA--23, "Annual Survey of Domestic Oil and Gas Reserves," or Form EIA--64A, "Annual Report of the Origin of Natural Gas Liquids Production," for the report year 1995.

Adjustments: The quantity which preserves an exact annual reserves balance within each State or State subdivision of the following form:

Published Proved Reserves at End of Previous Report Year
+ Adjustments
+ Revision Increases
- Revision Decreases
+ Extensions
+ New Field Discoveries
+ New Reservoir Discoveries in Old Fields
+ Report Year Production
= Published Proved Reserves at End of Report Year

These adjustments are the yearly changes in the published reserve estimates that cannot be attributed to the estimates for other reserve change categories because of the survey and statistical estimation methods employed. For example, variations as a result of changes in the operator frame, different random samples or imputations for missing or unreported reserve changes, could contribute to adjustments.

Affiliated (Associated) Company: An "affiliate" of, or a person "affiliated" with, a specific person is a person that directly, or indirectly through one or more intermediaries: controls; or is controlled by; or is under common control with, the person specified. (See **Person and Control**)

Control: The term "control" (including the terms "controlling," "controlled by," and "under common control with") means the possession, direct or indirect, of the power to direct or cause the direction of the management and policies of a person, whether through the ownership of voting shares, by contract, or otherwise. (See **Person**)

Corrections: (See **Revisions**)

Crude Oil: A mixture of hydrocarbons that exists in the liquid phase in natural underground reservoirs

and remains liquid at atmospheric pressure after passing through surface separating facilities. Crude oil may also include:

1. Small amounts of hydrocarbons that exist in the gaseous phase in natural underground reservoirs but are liquid at atmospheric pressure after being recovered from oil well (casinghead) gas in lease separators, and that subsequently are comingled with the crude stream without being separately measured
2. Small amounts of nonhydrocarbons produced with the oil.

When a State regulatory agency specifies a definition of crude oil which differs from that set forth above, the State definition is to be followed and its use footnoted on Schedule B of Form EIA--23.

Extensions: The reserves credited to a reservoir because of enlargement of its proved area. Normally the ultimate size of newly discovered fields, or newly discovered reservoirs in old fields, is determined by wells drilled in years subsequent to discovery. When such wells add to the proved area of a previously discovered reservoir, the increase in proved reserves is classified as an extension.

Field: An area consisting of a single reservoir or multiple reservoirs all grouped on, or related to, the same individual geological structural feature and/or stratigraphic condition. There may be two or more reservoirs in a field that are separated vertically by intervening impervious strata, or laterally by local geologic barriers, or by both.

Field Area: A geographic area encompassing two or more pools that have a common gathering and metering system, the reserves of which are reported as a single unit. This concept applies primarily to the Appalachian region. (See **Pool**)

Field Discovery Year: The calendar year in which a field was first recognized as containing economically recoverable accumulations of oil and/or gas.

Field Separation Facility: A surface installation designed to recover lease condensate from a

produced natural gas stream frequently originating from more than one lease, and managed by the operator of one or more of these leases. (See **Lease Condensate**)

Gross Working Interest Ownership Basis: Gross working interest ownership is the respondent's working interest in a given property plus the proportionate share of any royalty interest, including overriding royalty interest, associated with the working interest. (See **Working Interest and Royalty (including Overriding Royalty) Interest**)

Indicated Additional Reserves of Crude Oil:

Quantities of crude oil (other than proved reserves) which may become economically recoverable from existing productive reservoirs through the application of improved recovery techniques using current technology. These recovery techniques may:

1. Already be installed in the reservoir, but their effects are not yet known to the degree necessary to classify the additional reserves as proved
2. Be installed in another similar reservoir, where the results of that installation can be used to estimate the indicated additional reserves.

Indicated additional reserves are not included in proved reserves due to their uncertain economic recoverability. When economic recoverability is demonstrated, the indicated additional reserves must be transferred to proved reserves as positive revisions.

Lease Condensate: A mixture consisting primarily of pentanes and heavier hydrocarbons which is recovered as a liquid from natural gas in lease or field separation facilities, exclusive of products recovered at natural gas processing plants or facilities.

Lease Separator: A lease separator is a facility installed at the surface for the purpose of (a) separating gases from produced crude oil and water at the temperature and pressure conditions of the separator, and/or (b) separating gases from that portion of the produced natural gas stream which liquefies at the temperature and pressure conditions of the separator.

Natural Gas: A mixture of hydrocarbon compounds and small quantities of various nonhydrocarbons existing in the gaseous phase or in solution with crude oil in natural underground reservoirs at

reservoir conditions. The principal hydrocarbons normally contained in the mixture are methane, ethane, propane, butane, and pentanes. Typical nonhydrocarbon gases which may be present in reservoir natural gas are water vapor, carbon dioxide, helium, hydrogen sulfide, and nitrogen. Under reservoir conditions, natural gas and the liquefiable portions occur either in a single gaseous phase in the reservoir or in solution with crude oil, and are not distinguishable at the time as separate substances. (See **Natural Gas, Associated--Dissolved and Natural Gas, Nonassociated**)

Natural Gas, Associated--Dissolved: The combined volume of natural gas which occurs in crude oil reservoirs either as free gas (associated) or as gas in solution with crude oil (dissolved).

Natural Gas, "Dry": The actual or calculated volumes of natural gas which remain after:

1. The liquefiable hydrocarbon portion has been removed from the gas stream (i.e., gas after lease, field, and/or plant separation)
2. Any volumes of nonhydrocarbon gases have been removed where they occur in sufficient quantity to render the gas unmarketable.

Natural Gas, Nonassociated: Natural gas not in contact with significant quantities of crude oil in a reservoir.

Natural Gas Liquids: Those hydrocarbons in natural gas which are separated from the gas through the processes of absorption, condensation, adsorption, or other methods in gas processing or cycling plants. Generally such liquids consist of propane and heavier hydrocarbons and are commonly referred to as condensate, natural gasoline, or liquefied petroleum gases. Where hydrocarbon components lighter than propane are recovered as liquids, these components are included with natural gas liquids.

Natural Gas Processing Plant: A facility designed to recover natural gas liquids from a stream of natural gas which may or may not have passed through lease separators and/or field separation facilities. Another function of the facility is to control the quality of the processed natural gas stream. Cycling plants are considered natural gas processing plants.

Natural Gas, Wet After Lease Separation: The volume of natural gas remaining after removal of lease condensate in lease and/or field separation facilities, if any, and after exclusion of

nonhydrocarbon gases where they occur in sufficient quantity to render the gas unmarketable. Natural gas liquids may be recovered from volumes of natural gas, wet after lease separation, at natural gas processing plants. (See **Lease Condensate**, **Lease Separator**, and **Field Separation Facility**)

Net Revisions: (See **Revisions**)

New Field: A field discovered during the report year.

New Field Discoveries: The volumes of proved reserves of crude oil, natural gas and/or natural gas liquids discovered in new fields during the report year.

New Reservoir: A reservoir discovered during the report year.

New Reservoir Discoveries in Old Fields: The volumes of proved reserves of crude oil, natural gas, and/or natural gas liquids discovered during the report year in new reservoir(s) located in old fields.

Nonproducing Reservoirs: Reservoirs in which proved liquid or gaseous hydrocarbon reserves have been identified, but which did not produce during the last calendar year regardless of the availability and/or operation of production, gathering, or transportation facilities.

Old Field: A field discovered prior to the report year.

Old Reservoir: A reservoir discovered prior to the report year.

Operator, Gas Plant: The person responsible for the management and day-to-day operation of one or more natural gas processing plants as of December 31 of the report year. The operator is generally a working interest owner or a company under contract to the working interest owner(s). Plants shut down during the report year are also to be considered "operated" as of December 31. (See **Person**)

Operator, Oil and/or Gas Well: The person responsible for the management and day-to-day operation of one or more crude oil and/or natural gas wells as of December 31 of the report year. The operator is generally a working interest owner or a company under contract to the working interest owner(s). Wells included are those which have proved reserves of crude oil, natural gas, and/or

lease condensate in the reservoirs associated with them, whether or not they are producing. Wells abandoned during the report year are also to be considered "operated" as of December 31. (See **Person**, **Proved Reserves of Crude Oil**, **Proved Reserves of Natural Gas**, **Proved Reserves of Lease Condensate**, **Report Year**, and **Reservoir**)

Ownership: (See **Gross Working Interest Ownership Basis**)

Parent Company: The parent company of a business entity is an affiliated company which exercises ultimate control over that entity, either directly or indirectly through one or more intermediaries. (See **Affiliated (Associated) Company and Control**)

Person: An individual, a corporation, a partnership, an association, a joint-stock company, a business trust, or an unincorporated organization.

Pool: In general, a reservoir. In certain situations a pool may consist of more than one reservoir. (See **Field Area**)

Plant Liquids: Those volumes of natural gas liquids recovered in natural gas processing plants.

Production, Crude Oil: The volumes of crude oil which are extracted from oil reservoirs during the report year. These volumes are determined through measurement of the volumes delivered from lease storage tanks, (i.e., at the point of custody transfer) with adjustment for (1) net differences between opening and closing lease inventories, and for (2) basic sediment and water. Oil used on the lease is considered production.

Production, Lease Condensate: The volume of lease condensate produced during the report year. Lease condensate volumes include only those volumes recovered from lease or field separation facilities. (See **Lease Condensate**)

Production, Natural Gas, Dry: The volume of natural gas withdrawn from reservoirs during the report year less (1) the volume returned to such reservoirs in cycling, repressuring of oil reservoirs and conservation operations; less (2) shrinkage resulting from the removal of lease condensate and plant liquids; and less (3) nonhydrocarbon gases where they occur in sufficient quantity to render the gas unmarketable. Volumes of gas withdrawn from gas storage reservoirs and native gas, which has been transferred to the storage category, are not

considered production. This is not the same as marketed production, since the latter also excludes vented and flared gas, but contains plant liquids.

Production, Natural Gas, Wet after Lease Separation: The volume of natural gas withdrawn from reservoirs during the report year less (1) the volume returned to such reservoirs in cycling, repressuring of oil reservoirs and conservation operations; less (2) shrinkage resulting from the removal of lease condensate; and less (3) nonhydrocarbon gases where they occur in sufficient quantity to render the gas unmarketable. Volumes of gas withdrawn from gas storage reservoirs and native gas, which has been transferred to the storage category, are not considered production. This is not the same as marketed production, since the latter excludes vented and flared gas.

Production, Natural Gas Liquids: The volume of natural gas liquids removed from natural gas in lease separators, field facilities, gas processing plants or cycling plants during the report year.

Production, Plant Liquids: The volume of liquids removed from natural gas in natural gas processing plants or cycling plants during the report year.

Proved Reserves of Crude Oil: Proved reserves of crude oil as of December 31 of the report year are the estimated quantities of all liquids defined as crude oil, which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions.

Reservoirs are considered proved if economic producibility is supported by actual production or conclusive formation test (drill stem or wire line), or if economic producibility is supported by core analyses and/or electric or other log interpretations. The area of an oil reservoir considered proved includes (1) that portion delineated by drilling and defined by gas-oil and/or oil-water contacts, if any; and (2) the immediately adjoining portions not yet drilled, but which can be reasonably judged as economically productive on the basis of available geological and engineering data. In the absence of information on fluid contacts, the lowest known structural occurrence of hydrocarbons is considered to be the lower proved limit of the reservoir.

Volumes of crude oil placed in underground storage are not to be considered proved reserves.

Reserves of crude oil which can be produced economically through application of improved recovery techniques (such as fluid injection) are included in the "proved" classification when successful testing by a pilot project, or the operation of an installed program in the reservoir, provides support for the engineering analysis on which the project or program was based.

Estimates of proved crude oil reserves do not include the following: (1) oil that may become available from known reservoirs but is reported separately as "indicated additional reserves"; (2) natural gas liquids (including lease condensate); (3) oil, the recovery of which is subject to reasonable doubt because of uncertainty as to geology, reservoir characteristics, or economic factors; (4) oil that may occur in undrilled prospects; and (5) oil that may be recovered from oil shales, coal, gilsonite, and other such sources. It is not necessary that production, gathering or transportation facilities be installed or operative for a reservoir to be considered proved.

Proved Reserves of Lease Condensate: Proved reserves of lease condensate as of December 31 of the report year are the volumes of lease condensate expected to be recovered in future years in conjunction with the production of proved reserves of natural gas as of December 31 of the report year, based on the recovery efficiency of lease and/or field separation facilities installed as of December 31 of the report year. (See **Lease Condensate and Proved Reserves of Natural Gas**)

Proved Reserves of Natural Gas: Proved reserves of natural gas as of December 31 of the report year are the estimated quantities which analysis of geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions.

Reservoirs are considered proved if economic producibility is supported by actual production or conclusive formation test (drill stem or wire line), or if economic producibility is supported by core analyses and/or electric or other log interpretations.

The area of a gas reservoir considered proved includes: (1) that portion delineated by drilling and defined by gas-oil and/or gas-water contacts, if any; and (2) the immediately adjoining portions not yet drilled, but which can be reasonably judged as economically productive on the basis of available geological and engineering data. In the absence of

information on fluid contacts, the lowest known structural occurrence of hydrocarbons is considered to be the lower proved limit of the reservoir.

Volumes of natural gas placed in underground storage are not to be considered proved reserves.

For natural gas, wet after lease separation, an appropriate reduction in the reservoir gas volume has been made to cover the removal of the liquefiable portions of the gas in lease and/or field separation facilities and the exclusion of nonhydrocarbon gases where they occur in sufficient quantity to render the gas unmarketable.

For dry natural gas, an appropriate reduction in the gas volume has been made to cover the removal of the liquefiable portions of the gas in lease and/or field separation facilities, and in natural gas processing plants, and the exclusion of nonhydrocarbon gases where they occur in sufficient quantity to render the gas unmarketable.

It is not necessary that production, gathering, or transportation facilities be installed or operative for a reservoir to be considered proved. It is to be assumed that compression will be initiated if and when economically justified.

Proved Reserves of Natural Gas Liquids: Proved reserves of natural gas liquids as of December 31 of the report year are those volumes of natural gas liquids (including lease condensate) demonstrated with reasonable certainty to be separable in the future from proved natural gas reserves, under existing economic and operating conditions.

Report Year: The calendar year to which data reported in this publication pertain.

Reserves: (See Proved Reserves)

Reserve Additions: Consist of adjustments, net revisions, extensions to old reservoirs, new reservoir discoveries in old fields, and new field discoveries.

Reserves Changes: Positive and negative revisions, extensions, new reservoir discoveries in old fields, and new field discoveries, which occurred during the report year.

Reservoir: A porous and permeable underground formation containing an individual and separate natural accumulation of producible hydrocarbons (oil and/or gas) which is confined by impermeable rock

or water barriers and is characterized by a single natural pressure system.

Revisions: Changes to prior year--end proved reserves estimates, either positive or negative, resulting from new information other than an increase in proved acreage (extension). Revisions include increases of proved reserves associated with the installation of improved recovery techniques or equipment. They also include correction of prior report year arithmetical or clerical errors and adjustments to prior year--end production volumes to the extent that these alter reported prior year reserves estimates.

Royalty (Including Overriding Royalty) Interests: These interests entitle their owner(s) to a share of the mineral production from a property or to a share of the proceeds therefrom. They do not contain the rights and obligations of operating the property, and normally do not bear any of the costs of exploration, development, and operation of the property.

Subdivision: A prescribed portion of a given State or other geographical region defined in this publication for statistical reporting purposes.

Subsidiary Company: A company which is controlled through the ownership of voting stock, or a corporate joint venture in which a corporation is owned by a small group of businesses as a separate and specific business or project for the mutual benefit of the members of the group. (See **Control**)

Total Discoveries: The sum of extensions, new reservoir discoveries in old fields, and new field discoveries, which occurred during the report year.

Total Liquid Hydrocarbon Reserves: The sum of crude oil and natural gas liquids reserves volumes.

Total Operated Basis: The total reserves or production associated with the wells operated by an individual operator. This is also commonly known as the "gross operated" or "8/8ths" basis.

Working Interest: A working interest permits the owner(s) to explore, develop and operate a property. The working interest owner(s) bear(s) the costs of exploration, development and operation of the property, and in return is (are) entitled to a share of the mineral production from the property or to a share of the proceeds therefrom.