

## 2. Overview

### National Summary

The United States had the following proved reserves as of December 31, 2002:

- **Crude Oil** — 22,677 million barrels
- **Dry Natural Gas** — 186,946 billion cubic feet
- **Natural Gas Liquids** — 7,994 million barrels.

This Overview summarizes the 2002 proved reserves balances of crude oil, dry natural gas, and natural gas liquids on a National level and provides historical comparisons between 2002 and prior years. **Table 1** lists the estimated annual reserve balances since 1992 for crude oil, dry natural gas, and natural gas liquids.

### Crude Oil

Proved reserves of crude oil increased by 231 million barrels in 2002. **Figure 1** shows the crude oil proved reserves levels by major region and **Figure 2** shows the components of reserves changes from 1992 through 2002.

As indicated in **Figure 1**, U.S. crude oil proved reserves increased in 2002 due to reserves additions in the Lower 48 States onshore.

The components of reserves changes for crude oil are shown in **Figure 2**. EIA tracks the components of reserves changes: adjustments, revision increases, revision decreases, sales, acquisitions, extensions, new field discoveries, new reservoir discoveries in old fields, and estimated production.

Total discoveries are those reserves attributable to field extensions, new field discoveries, and new reservoir discoveries in old fields. They result from the drilling of exploratory wells. Total discoveries of crude oil were 946 million barrels in 2002, 7 percent less than the prior 10-year average and 63 percent less than 2001's discoveries of 2,565 million barrels. This is not surprising because 2001, which featured new proved reserves from bp's Thunder Horse Field, was an unusually successful year. Domestic field discoveries of that magnitude are not common.

The majority of crude oil total discoveries in 2002 were extensions, particularly in Texas, California, and the Gulf of Mexico Federal Offshore. The North Slope of

Alaska (normally a major contributor to total discoveries) had no significant impact on the Nation's total discoveries in 2002. Operators discovered 492 million barrels of extensions in 2002, 1 percent more than the prior 10-year average.

New field discoveries accounted for 300 million barrels of crude oil reserves additions. Almost all were in the Gulf of Mexico Federal Offshore (290 of 300 million). This was 15 percent less than the prior 10-year average.

New reservoir discoveries in old fields were 154 million barrels, 47 percent less than in 2001 and 10 percent less than the prior 10-year average.

Reserves additions are the sum of total discoveries, revisions and adjustments, and sales and acquisitions. In 2002, there were 2,106 million barrels of reserves additions. As usual, the net of revisions and adjustments (1,136 million barrels) contributed more to crude oil reserves additions than did total discoveries, accounting for 54 percent of total reserves additions.

The sales component of crude oil reserves changes (804 million barrels) was less than the revision decreases component in 2002 and acquisitions (828 million barrels) were less than revision increases. The net of sales and acquisitions of crude oil proved reserves was 24 million barrels.

Production of crude oil was an estimated 1,875 million barrels in 2002 (lease condensate not included, see Natural Gas Liquids section below for condensate volumes). This was down 2 percent from 2001's level (1,915 million barrels) and down 12 percent from the prior 10-year average (2,132 million barrels). Operators replaced 112% of crude oil production with reserves additions in 2002.

### Natural Gas

Dry natural gas proved reserves increased by 3,486 billion cubic feet in 2002. **Figure 3** shows dry natural gas proved reserves levels by major region. **Figure 4** shows the components of reserves changes from 1992 through 2002.

Total discoveries of dry gas reserves were 17,795 billion cubic feet in 2002. This was 36 percent more than the

**Table 1. Total U.S. Proved Reserves of Crude Oil, Dry Natural Gas, and Natural Gas Liquids, 1992-2002**

| Year  | Adjustments<br>(1) | Net<br>Revisions<br>(2) | Revisions <sup>a</sup><br>and<br>Adjustments<br>(3) | Net of Sales<br>and<br>Acquisitions<br>(4) | Extensions<br>(5) | New Field<br>Discoveries<br>(6) | New Reservoir<br>Discoveries<br>in Old Fields<br>(7) | Total <sup>b</sup><br>Discoveries<br>(8) | Estimated<br>Production<br>(9) | Proved <sup>c</sup><br>Reserves<br>12/31<br>(10) | Change<br>from<br>Prior Year<br>(11) |
|---|--------------------|-------------------------|---|--|-------------------|---------------------------------|--|--|--------------------------------|--|--------------------------------------|
| <b>Crude Oil</b> (million barrels of 42 U.S. gallons)                   |                    |                         |   |  |                   |                                 |  |  |                                |  |                                      |
| 1992  | 290                | 735                     | 1,025   | NA   | 391               | 8                               | 85   | 484                                      | 2,446                          | 23,745   | -937                                 |
| 1993  | 271                | 495                     | 766   | NA   | 356               | 319                             | 110  | 785                                      | 2,339                          | 22,957   | -788                                 |
| 1994  | 189                | 1,007                   | 1,196   | NA   | 397               | 64                              | 111  | 572                                      | 2,268                          | 22,457   | -500                                 |
| 1995  | 122                | 1,028                   | 1,150   | NA   | 500               | 114                             | 343  | 957                                      | 2,213                          | 22,351   | -106                                 |
| 1996  | 175                | 737                     | 912   | NA   | 543               | 243                             | 141  | 927                                      | 2,173                          | 22,017   | -334                                 |
| 1997  | 520                | 914                     | 1,434   | NA   | 477               | 637                             | 119  | 1,233                                    | 2,138                          | 22,546   | +529                                 |
| 1998  | -638               | 518                     | -120  | NA   | 327               | 152                             | 120  | 599                                      | 1,991                          | 21,034   | -1,512                               |
| 1999  | 139                | 1,819                   | 1,958   | NA   | 259               | 321                             | 145  | 725                                      | 1,952                          | 21,765   | +731                                 |
| 2000  | 143                | 746                     | 889   | -20  | 766               | 276                             | 249  | 1,291                                    | 1,880                          | 22,045   | +280                                 |
| 2001  | -4                 | -158                    | -162  | -87  | 866               | 1,407                           | 292  | 2,565                                    | 1,915                          | 22,446   | +401                                 |
| 2002  | 416                | 720                     | 1,136   | 24   | 492               | 300                             | 154  | 946                                      | 1,875                          | 22,677   | +231                                 |
| <b>Dry Natural Gas</b> (billion cubic feet, 14.73 psia, 60° Fahrenheit) |                    |                         |   |  |                   |                                 |  |  |                                |  |                                      |
| 1992  | 2,235              | 6,093                   | 8,328   | NA   | 4,675             | 649                             | 1,724  | 7,048                                    | 17,423                         | 165,015  | -2,047                               |
| 1993  | 972                | 5,349                   | 6,321   | NA   | 6,103             | 899                             | 1,866  | 8,868                                    | 17,789                         | 162,415  | -2,600                               |
| 1994  | 1,945              | 5,484                   | 7,429   | NA   | 6,941             | 1,894                           | 3,480  | 12,315                                   | 18,322                         | 163,837  | +1,422                               |
| 1995  | 580                | 7,734                   | 8,314   | NA   | 6,843             | 1,666                           | 2,452  | 10,961                                   | 17,966                         | 165,146  | +1,309                               |
| 1996  | 3,785              | 4,086                   | 7,871   | NA   | 7,757             | 1,451                           | 3,110  | 12,318                                   | 18,861                         | 166,474  | +1,328                               |
| 1997  | -590               | 4,902                   | 4,312   | NA   | 10,585            | 2,681                           | 2,382  | 15,648                                   | 19,211                         | 167,223  | +749                                 |
| 1998  | -1,635             | 5,740                   | 4,105   | NA   | 8,197             | 1,074                           | 2,162  | 11,433                                   | 18,720                         | 164,041  | -3,182                               |
| 1999  | 982                | 10,504                  | 11,486  | NA   | 7,043             | 1,568                           | 2,196  | 10,807                                   | 18,928                         | 167,406  | +3,365                               |
| 2000  | -891               | 6,962                   | 6,071   | 4,031                                      | 14,787            | 1,983                           | 2,368  | 19,138                                   | 19,219                         | 177,427  | +10,021                              |
| 2001  | 2,742              | -2,318                  | 424   | 2,630                                      | 16,380            | 3,578                           | 2,800  | 22,758                                   | 19,779                         | 183,460  | +6,033                               |
| 2002  | 3,727              | 937                     | 4,664   | 380  | 14,769            | 1,332                           | 1,694  | 17,795                                   | 19,353                         | 186,946  | +3,486                               |
| <b>Natural Gas Liquids</b> (million barrels of 42 U.S. gallons)         |                    |                         |   |  |                   |                                 |  |  |                                |  |                                      |
| 1992  | 225                | 261                     | 486   | NA   | 190               | 20                              | 64   | 274                                      | 773                            | 7,451  | -13                                  |
| 1993  | 102                | 124                     | 226   | NA   | 245               | 24                              | 64   | 333                                      | 788                            | 7,222  | -229                                 |
| 1994  | 43                 | 197                     | 240   | NA   | 314               | 54                              | 131  | 499                                      | 791                            | 7,170  | -52                                  |
| 1995  | 192                | 277                     | 469   | NA   | 432               | 52                              | 67   | 551                                      | 791                            | 7,399  | +229                                 |
| 1996  | 474                | 175                     | 649   | NA   | 451               | 65                              | 109  | 625                                      | 850                            | 7,823  | +424                                 |
| 1997  | -15                | 289                     | 274   | NA   | 535               | 114                             | 90   | 739                                      | 864                            | 7,973  | +150                                 |
| 1998  | -361               | 208                     | -153  | NA   | 383               | 66                              | 88   | 537                                      | 833                            | 7,524  | -449                                 |
| 1999  | 99                 | 727                     | 826   | NA   | 313               | 51                              | 88   | 452                                      | 896                            | 7,906  | +382                                 |
| 2000  | -83                | 459                     | 376   | 145  | 645               | 92                              | 102  | 839                                      | 921                            | 8,345  | +439                                 |
| 2001  | -429               | -132                    | -561  | 102  | 717               | 138                             | 142  | 997                                      | 890                            | 7,993  | -352                                 |
| 2002  | 62                 | 31                      | 93  | 54   | 612               | 48                              | 78   | 738                                      | 884                            | 7,994  | +1                                   |

<sup>a</sup>Revisions and adjustments = Col. 1 + Col. 2.

<sup>b</sup>Total discoveries = Col. 5 + Col. 6 + Col. 7.

<sup>c</sup>Proved reserves = Col. 10 from prior year + Col. 3 + Col. 4 + Col. 8 - Col. 9.

NA=Not available.

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 2002 contained in the *Petroleum Supply Annual 2002*, DOE/EIA-0340(02) and the *Natural Gas Annual 2002*, DOE/EIA-0131(02).

Figure 1. U.S. Crude Oil Proved Reserves, 1992-2002

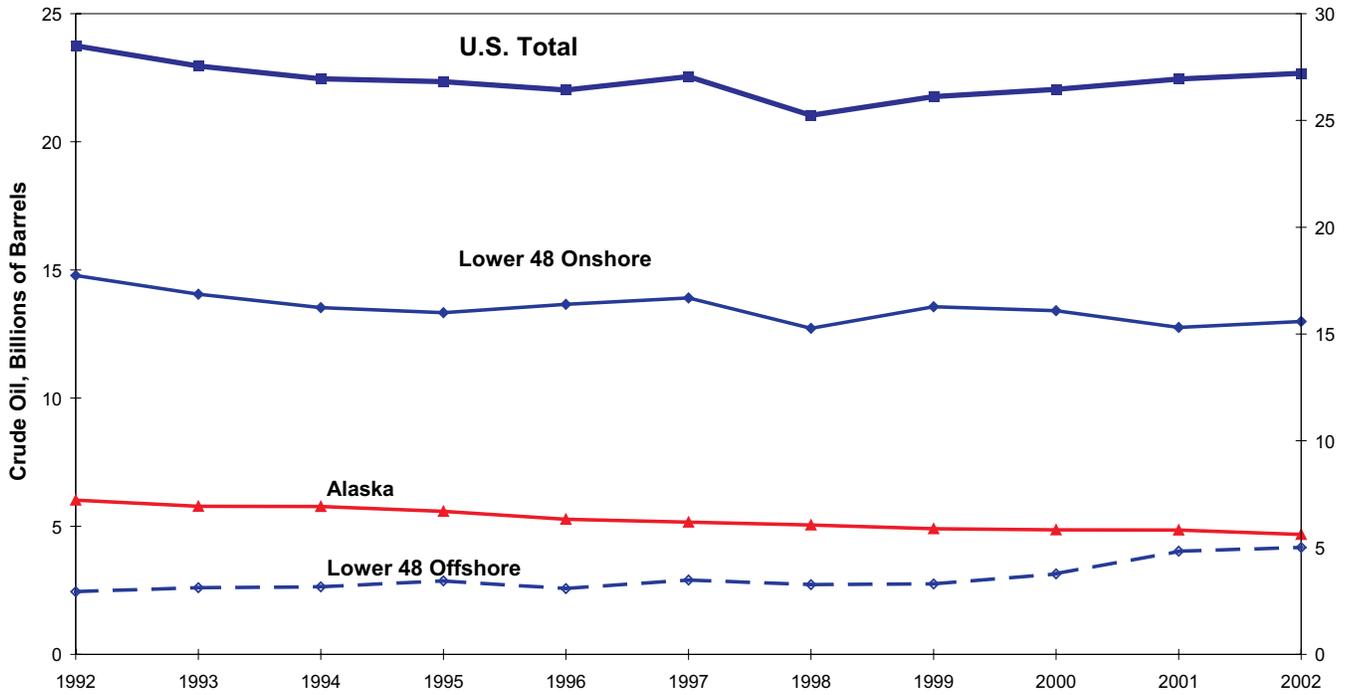
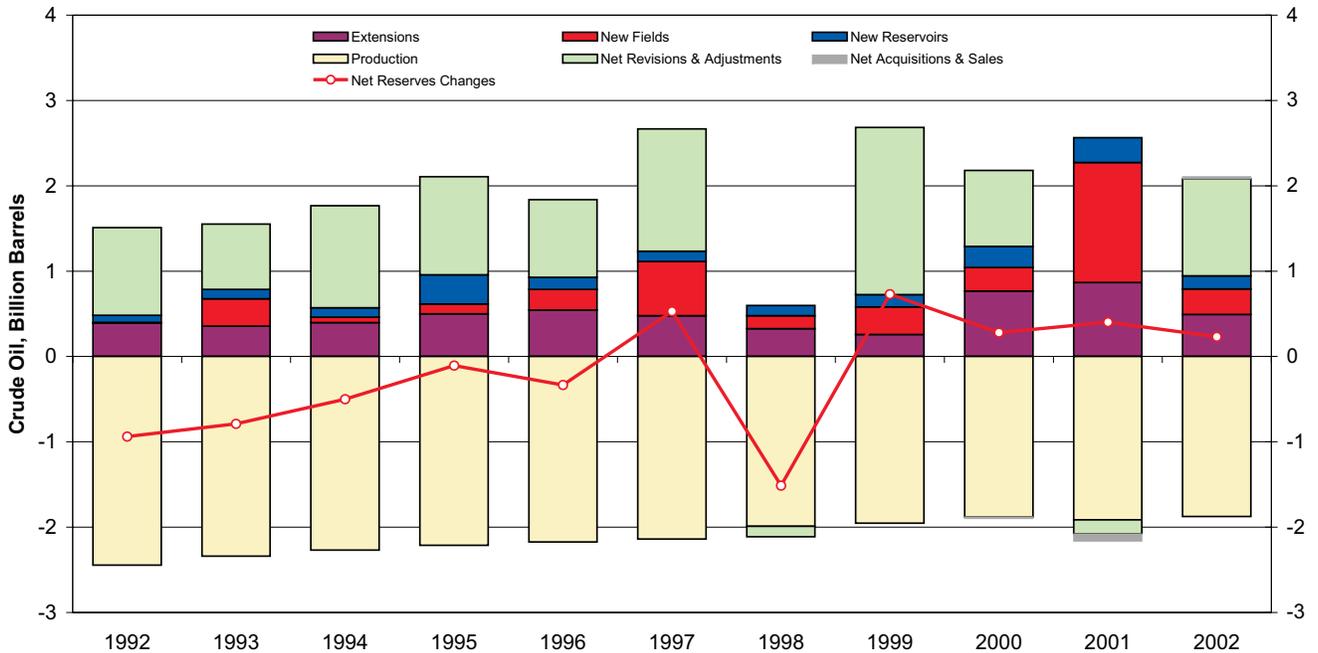


Figure 2. Components of Reserves Changes for Crude Oil, 1992-2002



Source: U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 1992-2001 annual reports, DOE/EIA-0216.{16-25}

Figure 3. U.S. Dry Natural Gas Proved Reserves, 1992-2002

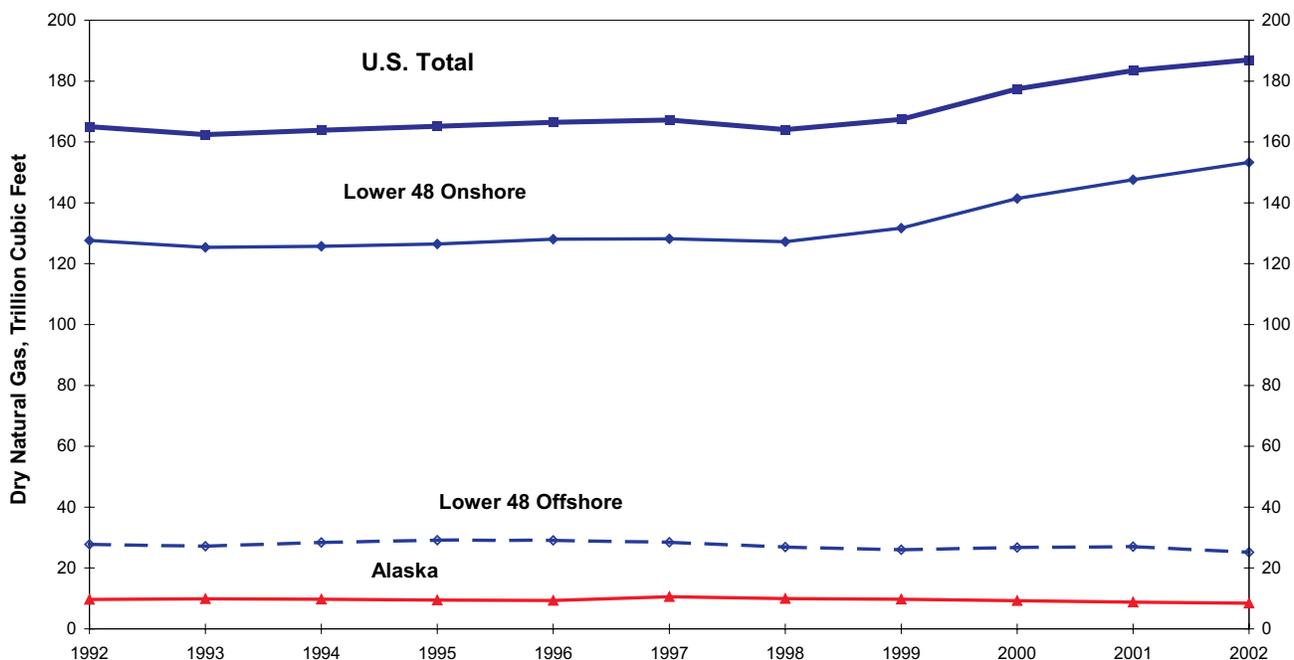
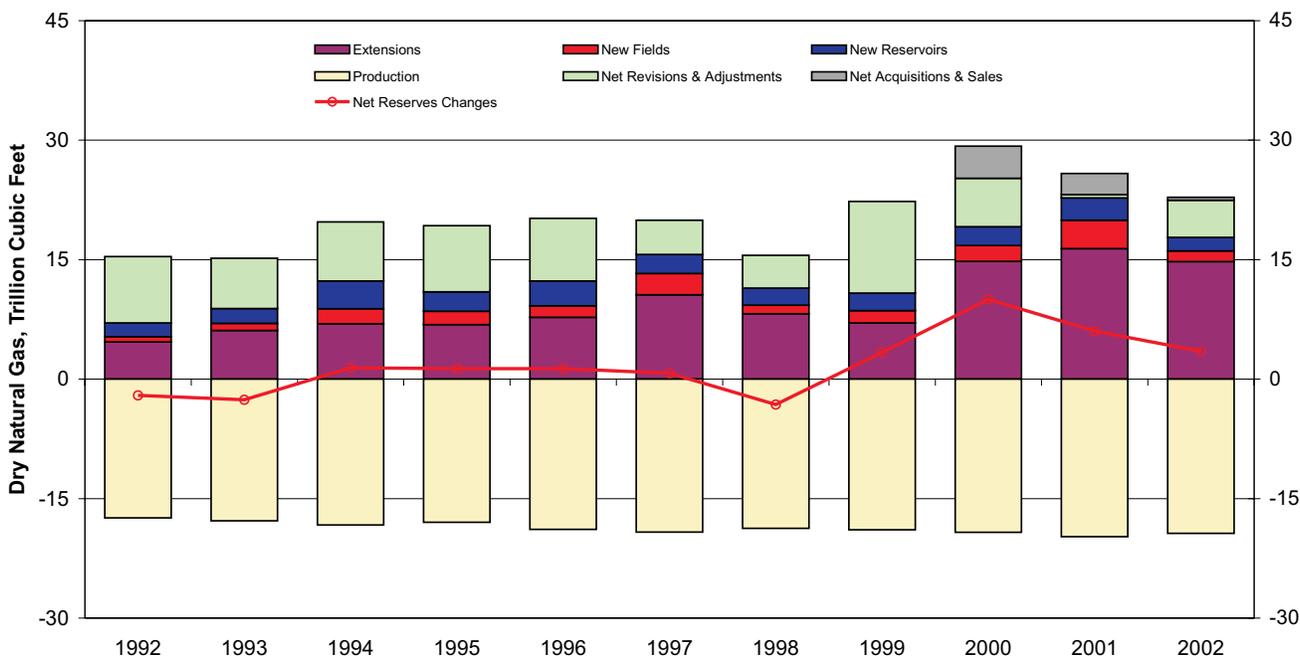


Figure 4. Components of Reserves Changes for Dry Natural Gas, 1992-2002



Source: U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 1992-2001 annual reports, DOE/EIA-0216.{16-25}

prior 10-year average but 22 percent less than in 2001. The majority of natural gas total discoveries in 2002 were from extensions of existing gas fields.

Field extensions were 14,769 billion cubic feet, 10 percent less than extensions in 2001 but 65 percent more than the prior 10-year average of 8,931 billion cubic feet.

New field discoveries were 1,332 billion cubic feet, 63 percent less than the volume discovered in 2001 and 24 percent less than the prior 10-year average.

New reservoir discoveries in old fields were 1,694 billion cubic feet, down 40 percent from 2001 and 31 percent less than the prior 10-year average.

Dry natural gas net revisions and adjustments were 4,664 billion cubic feet. The net of sales and acquisitions of dry natural gas proved reserves was 380 billion cubic feet.

Production removed an estimated 19,353 billion cubic feet of proved reserves from the National total. Dry gas production decreased by 2 percent compared to 2001. Operators replaced 118 percent of dry natural gas production with reserves additions.

Coalbed methane proved reserves and production are included in the 2002 totals. However, EIA tracks these reserves in order to record the development and performance of this unconventional gas source.

Coalbed methane proved reserves and production continued to grow in 2002. Coalbed methane proved reserves were 18,491 billion cubic feet, representing an increase of 5 percent over 2001 and accounting for 10 percent of U.S. dry gas proved reserves. Coalbed methane production was 1,614 billion cubic feet, representing an increase of 3 percent over 2001 and accounting for 8 percent of U.S. dry gas production.

## Natural Gas Liquids

Proved reserves of natural gas liquids increased 1 million barrels to 7,994 million barrels during 2002—essentially level with 2001. **Figure 5** shows the natural gas liquids proved reserves levels by major region and **Figure 6** shows the components of reserves changes from 1992 through 2002.

Operators replaced 100 percent of their 2002 natural gas liquids production with reserve additions. Total

discoveries added 738 million barrels (primarily from extensions), net revisions and adjustments added 93 million barrels, and net sales and acquisitions added 54 million barrels.

Total proved reserves of liquid hydrocarbons (crude oil plus natural gas liquids) were 30,671 million barrels in 2002—a 1 percent increase from the 2001 level. Natural gas liquids represented 26 percent of total liquid hydrocarbon proved reserves in 2002.

## 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 2002. The table has two sections, one for the lower 48 States and another for the entire United States. Annual averages for each component of reserves changes are also listed, along with the percentage of that particular component's impact on total U.S. proved reserves.

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

- Discovered an average of 892 million barrels per year of new reserves
- Had proved reserves additions averaging 2,132 million barrels per year from total discoveries, net revisions and adjustments, and net sales and acquisitions
- Ended each year with an average net reduction in U.S. proved reserves of 416 million barrels (the difference between post-1976 average annual production and post-1976 average annual reserve additions).

Since 1977, crude oil reserves have been primarily sustained by proved ultimate recovery appreciation in existing fields rather than the discovery of new oil fields. Only 11 percent of reserves additions since 1976 were booked as new field discoveries. Proved ultimate recovery appreciation is the sum of net revisions, adjustments, net sales and acquisitions, extensions, and new reservoir discoveries in old fields (see the Proved Ultimate Recovery section later in this chapter.) The 23,195 million barrels of total discoveries since 1977 accounted for 42 percent of reserves additions in the 1977-2002 period.

Compared to the averages of reserves changes since 1977, 2002 was an up year for crude oil discoveries. Total discoveries of crude oil (946 million barrels) in 2002 were 6 percent greater than the post-1976 U.S. average (892 million barrels per year).

Figure 5. U.S. Natural Gas Liquids Proved Reserves, 1992-2002

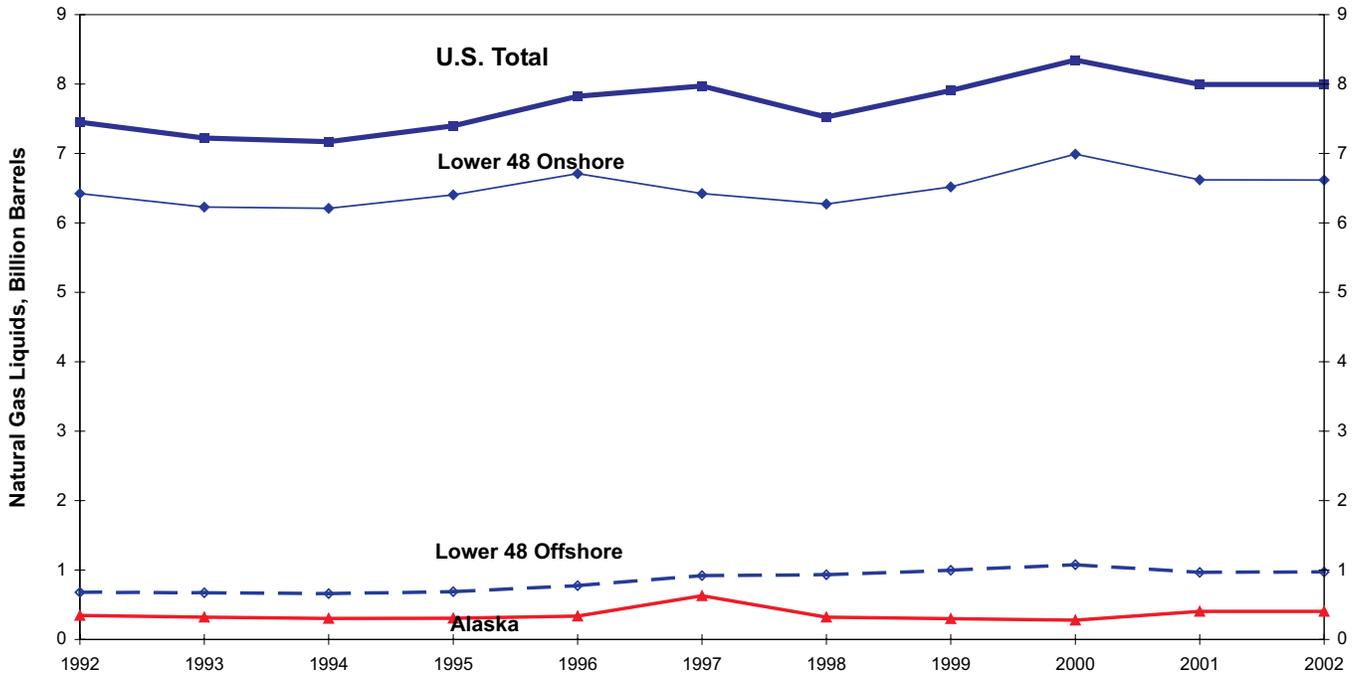
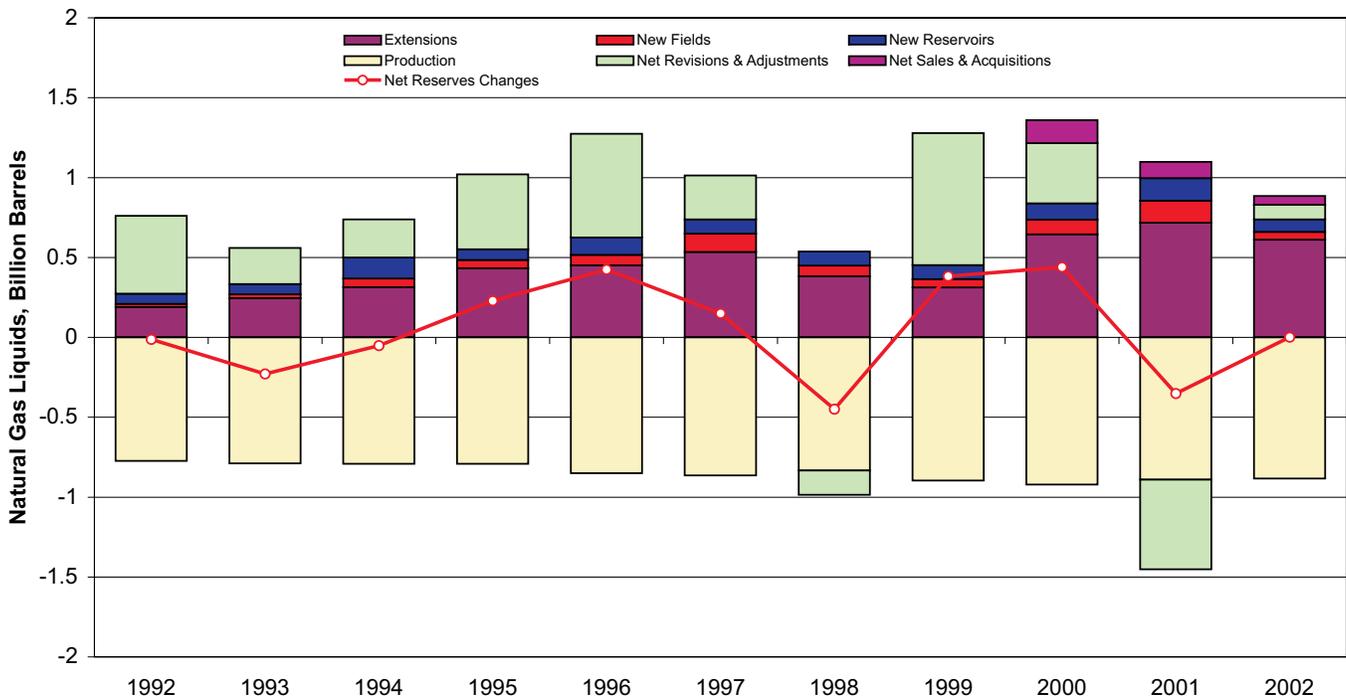


Figure 6. Components of Reserves Changes for Natural Gas Liquids, 1992-2002



Source: U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 1992-2001 annual reports, DOE/EIA-0216.{16-25}

**Table 2. Reserves Changes, 1977-2002**

| Components of Change   | Lower 48 States |                  |                               | U.S. Total     |                  |                               |
|--|-----------------|------------------|-------------------------------|----------------|------------------|-------------------------------|
|  | Volume          | Average per Year | Percent of Reserves Additions | Volume         | Average per Year | Percent of Reserves Additions |
| <b>Crude Oil</b> (million barrels of 42 U.S. gallons)                        |                 |                  |                               |                |                  |                               |
| <b>Proved Reserves as of 12/31/76</b> . . . . .                              | <b>24,928</b>   | —                | —                             | <b>33,502</b>  | —                | —                             |
| New Field Discoveries . . . . .  | 4,987           | 192              | 11.0                          | 5,938          | 228              | 10.7                          |
| New Reservoir Discoveries in Old Fields . . . . .                            | 3,739           | 144              | 8.3                           | 3,869          | 149              | 7.0                           |
| Extensions . . . . .   | 11,832          | 455              | 26.2                          | 13,388         | 515              | 24.2                          |
| <b>Total Discoveries</b> . . . . .   | <b>20,558</b>   | <b>791</b>       | <b>45.5</b>                   | <b>23,195</b>  | <b>892</b>       | <b>41.8</b>                   |
| Revisions, Adjustments, Sales & Acquisitions <sup>a</sup>                    | 24,647          | 948              | 54.5                          | 32,238         | 1,240            | 58.2                          |
| <b>Total Reserves Additions</b> . . . . .                                    | <b>45,205</b>   | <b>1,739</b>     | <b>100.0</b>                  | <b>55,433</b>  | <b>2,132</b>     | <b>100.0</b>                  |
| <b>Production</b> . . . . .  | <b>52,070</b>   | <b>2,003</b>     | <b>115.2</b>                  | <b>66,258</b>  | <b>2,548</b>     | <b>119.5</b>                  |
| <b>Net Reserves Change</b> . . . . .   | <b>-6,865</b>   | <b>-264</b>      | <b>-15.2</b>                  | <b>-10,825</b> | <b>-416</b>      | <b>-19.5</b>                  |
| <b>Dry Natural Gas</b> (billion cubic feet at 14.73 psia and 60° Fahrenheit) |                 |                  |                               |                |                  |                               |
| <b>Proved Reserves as of 12/31/76</b> . . . . .                              | <b>180,838</b>  | —                | —                             | <b>213,278</b> | —                | —                             |
| New Field Discoveries . . . . .  | 50,968          | 1,960            | 11.2                          | 51,190         | 1,969            | 11.6                          |
| New Reservoir Discoveries in Old Fields . . . . .                            | 65,310          | 2,512            | 14.4                          | 65,723         | 2,528            | 14.9                          |
| Extensions . . . . .   | 215,162         | 8,275            | 47.3                          | 218,151        | 8,390            | 49.6                          |
| <b>Total Discoveries</b> . . . . .   | <b>331,440</b>  | <b>12,748</b>    | <b>72.9</b>                   | <b>335,064</b> | <b>12,887</b>    | <b>76.2</b>                   |
| Revisions, Adjustments, Sales & Acquisitions <sup>a</sup>                    | 123,016         | 4,731            | 27.1                          | 104,800        | 4,031            | 23.8                          |
| <b>Total Reserves Additions</b> . . . . .                                    | <b>454,456</b>  | <b>17,479</b>    | <b>100.0</b>                  | <b>439,864</b> | <b>16,918</b>    | <b>100.0</b>                  |
| <b>Production</b> . . . . .  | <b>456,816</b>  | <b>17,570</b>    | <b>100.5</b>                  | <b>466,196</b> | <b>17,931</b>    | <b>106.0</b>                  |
| <b>Net Reserves Change</b> . . . . .   | <b>-2,360</b>   | <b>-91</b>       | <b>-0.5</b>                   | <b>-26,332</b> | <b>-1,013</b>    | <b>-6.0</b>                   |

<sup>a</sup> EIA did not separately collect data on sales and acquisitions of proved reserves until the year 2000.  
Source: U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1977-2002 annual reports, DOE/EIA-0216.{1-25}

Looking at the components of total discoveries in 2002:

- 2002's new field discoveries (300 million barrels) were 32 percent greater than the post-1976 average for crude oil,
- New reservoir discoveries in old fields were 3 percent greater than the post-1976 average, and
- Extensions in 2002 were 4 percent less than the post-1976 average for crude oil.

**Dry Natural Gas:** Since 1977 U.S. operators have:

- Discovered an average of 12,887 billion cubic feet per year of new reserves
- Had proved reserves additions averaging 16,918 billion cubic feet per year from total discoveries, net revisions and adjustments, and net sales and acquisitions
- Had an average net reduction in U.S. reserves of 1,013 billion cubic feet per year.

Like crude oil reserves, natural gas reserves have been sustained primarily by proved ultimate recovery appreciation since 1977. However, extensions rather than net revisions and adjustments are usually the largest component. Extensions account for 50 percent while net revisions and adjustments account for only 24 percent of all reserves additions since 1977. In 2002, the net of revisions, adjustments, sales, and acquisitions was 22 percent of all reserves additions, and extensions were 65 percent of all reserves additions.

Compared to the averages of reserves changes since 1977, 2002 was an up year for natural gas reserves additions from total discoveries. Operators reported 17,795 billion cubic feet of total discoveries of dry natural gas proved reserves, 38 percent more than the post-1976 average (12,887 billion cubic feet). Also, the net of revisions, adjustments, sales, and acquisitions was 25 percent higher in 2002 (5,044 billion cubic feet) as compared to the post-1976 U.S. average (4,031 billion cubic feet per year).

**Table 3. U.S. Average Annual Domestic First Purchase Prices for Crude Oil, Wellhead Prices for Natural Gas, and the Average Number of Active Rotary Drilling Rigs, 1977-2002**

| Year        | Crude Oil            |               | Natural Gas                       |               | Number of Rigs |
|-------------|----------------------|---------------|-----------------------------------|---------------|----------------|
|             | Current              | 2002 Constant | Current                           | 2002 Constant |                |
|             | (dollars per barrel) |               | (dollars per thousand cubic feet) |               |                |
| 1977        | 8.57                 | 21.07         | 0.79                              | 1.94          | 2,001          |
| 1978        | 9.00                 | 20.65         | 0.91                              | 2.09          | 2,259          |
| 1979        | 12.64                | 26.77         | 1.18                              | 2.50          | 2,177          |
| 1980        | 21.59                | 41.88         | 1.59                              | 3.08          | 2,909          |
| 1981        | 31.77                | 56.37         | 1.98                              | 3.51          | 3,970          |
| 1982        | 28.52                | 47.63         | 2.46                              | 4.11          | 3,105          |
| 1983        | 26.19                | 42.08         | 2.59                              | 4.16          | 2,232          |
| 1984        | 25.88                | 40.09         | 2.66                              | 4.12          | 2,428          |
| 1985        | 24.09                | 36.17         | 2.51                              | 3.77          | 1,980          |
| 1986        | 12.51                | 18.38         | 1.94                              | 2.85          | 964            |
| 1987        | 15.40                | 21.97         | 1.67                              | 2.38          | 936            |
| 1988        | 12.58                | 17.35         | 1.69                              | 2.33          | 936            |
| 1989        | 15.86                | 21.08         | 1.69                              | 2.25          | 869            |
| 1990        | 20.03                | 25.62         | 1.71                              | 2.19          | 1,010          |
| 1991        | 16.54                | 20.41         | 1.64                              | 2.02          | 860            |
| 1992        | 15.99                | 19.26         | 1.74                              | 2.10          | 721            |
| 1993        | 14.25                | 16.77         | 2.04                              | 2.40          | 754            |
| 1994        | 13.19                | 15.20         | 1.85                              | 2.13          | 775            |
| 1995        | 14.62                | 16.49         | 1.55                              | 1.75          | 723            |
| 1996        | 18.46                | 20.43         | 2.17                              | 2.40          | 779            |
| 1997        | 17.23                | 18.70         | 2.32                              | 2.52          | 943            |
| 1998        | 10.87                | 11.65         | 1.96                              | 2.10          | 827            |
| 1999        | 15.56                | 16.45         | 2.19                              | 2.31          | 625            |
| 2000        | 26.72                | 27.66         | 3.69                              | 3.82          | 918            |
| 2001        | 24.64                | 25.16         | 6.82                              | 6.96          | 1,118          |
| February    | 25.27                | 25.73         | 5.08                              | 5.17          | 1,136          |
| March       | 22.98                | 23.34         | 4.37                              | 4.44          | 1,163          |
| April       | 23.39                | 23.72         | 4.52                              | 4.58          | 1,206          |
| May         | 24.06                | 24.35         | 4.36                              | 4.41          | 1,234          |
| June        | 23.43                | 23.67         | 3.80                              | 3.84          | 1,270          |
| July        | 22.82                | 22.99         | 3.36                              | 3.39          | 1,278          |
| August      | 23.08                | 23.23         | 3.34                              | 3.36          | 1,252          |
| September   | 22.37                | 22.51         | 2.94                              | 2.96          | 1,193          |
| October     | 18.73                | 18.88         | 2.81                              | 2.83          | 1,111          |
| November    | 16.40                | 16.53         | 3.42                              | 3.45          | 1,000          |
| December    | 15.54                | 15.66         | 3.44                              | 3.47          | 901            |
| <b>2001</b> | <b>21.84</b>         | <b>22.09</b>  | <b>4.02</b>                       | <b>4.07</b>   | <b>1,156</b>   |
| 2002        | 15.89                | 15.98         | 2.35                              | 2.36          | 867            |
| February    | 16.93                | 17.01         | 2.14                              | 2.15          | 825            |
| March       | 20.28                | 20.35         | 2.52                              | 2.53          | 763            |
| April       | 22.52                | 22.58         | 3.02                              | 3.03          | 750            |
| May         | 23.51                | 23.55         | 3.01                              | 3.01          | 826            |
| June        | 22.59                | 22.61         | 2.94                              | 2.94          | 842            |
| July        | 23.51                | 23.51         | 2.89                              | 2.89          | 851            |
| August      | 24.76                | 24.74         | 2.77                              | 2.77          | 848            |
| September   | 26.08                | 26.02         | 2.98                              | 2.97          | 860            |
| October     | 25.29                | 25.20         | 3.35                              | 3.34          | 851            |
| November    | 23.38                | 23.26         | 3.59                              | 3.57          | 834            |
| December    | 25.29                | 25.11         | 3.84                              | 3.81          | 856            |
| <b>2002</b> | <b>22.51</b>         | <b>22.51</b>  | <b>2.95</b>                       | <b>2.95</b>   | <b>830</b>     |

=Revised data.

Sources: Current dollars and number of rigs: *Monthly Energy Review October 2003*, DOE/EIA-0035(2003/10). 2002 constant dollars: U.S. Department of Commerce, Bureau of Economic Analysis, Gross Domestic Product Implicit Price Deflators, October 2003.

## Prices and Drilling

**Prices:** 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 1977 through 2002.

The U.S. crude oil first purchase price started at an average of \$15.54 per barrel in December 2001, rose to \$26.08 in September 2002, then declined to \$25.29 per barrel in December 2002. The average U.S. crude oil first purchase price increased from \$21.84 in 2001 to \$22.51 per barrel in 2002.

Oil prices vary by region. The average 2002 crude oil first purchase price was \$23.41 per barrel in Texas, \$20.11 per barrel in California, \$24.82 per barrel in Colorado, \$22.55 per barrel in Ohio, and \$18.38 per barrel in the California Federal Offshore. The lowest average crude oil first purchase price in 2002 was \$18.18 per barrel for Alaskan North Slope crude.{26}

The average annual wellhead natural gas price decreased from \$4.07 in 2001 to \$2.95 per thousand cubic feet in 2002. Natural gas prices started at \$2.36 per thousand cubic feet in January 2002 and fluctuated between \$2.15 and \$3.03 until October, then increased steadily from \$3.35 to a high of \$3.81 per thousand cubic feet in December 2002.{27}

**Drilling:** The annual average active rig count decreased from 1,156 in 2001 to 830 in 2002 (Table 3), a 28 percent decrease in active rigs.

Looking first at exploratory wells, 2,068 were drilled in 2002 (Table 4). Of these, 11 percent were completed as oil wells, 32 percent were completed as gas wells, and 57 percent were dry holes. Exploratory oil and gas completions (excluding dry holes) in 2002 were 32 percent less (Figures 7 and 8) than the revised 2001 total.

Figures 9 and 10 show the average volume of discoveries per exploratory well for dry natural gas and oil, respectively, since 1977. The 2002 average volume of oil discoveries per exploratory well decreased 47 percent as compared to 2001, while the 2002 average volume of gas discoveries per exploratory well increased 16 percent as compared to 2001.

The number of successful development wells decreased 26 percent for oil and 28 percent for gas from their 2001 levels. Including dry holes, there were an estimated 23,406 exploratory and development wells drilled in 2002. This is 26 percent less than in 2001 and 3

percent less than the average number of wells drilled annually in the prior 10 years (24,177).

For the tenth year in a row, the number of gas well completions exceeded the number of oil well completions in both the exploratory and development categories.

## Mergers and Acquisitions

The following large mergers and acquisitions were announced in 2002, and are expected to have a major impact on the energy industry in the future:

On March 12, 2002, Shareholders of Conoco Incorporated and Phillips Petroleum Company approved the proposed \$15.6 billion merger. The new company ConocoPhillips, is assuming Conoco's home in Houston. The combined firm is the third largest U.S. petroleum company in terms of proved reserves. The U.S. Federal Trade Commission approved the merger in February 2003.{28}

On September 5, 2002, Unocal Corporation commenced its previously announced exchange offer to acquire all outstanding shares of Pure Resources common stock that it did not already own. Unocal, through its subsidiary Union Oil Company of California, already owned approximately 65 percent of Pure's outstanding common stock. In accordance with the final October 9, 2002 agreement, Unocal's Union Oil Company of California subsidiary exchanged 0.74 shares of Unocal common stock for each share of Pure's common stock.{29}

On July 29, 2002, MidAmerican Energy Holdings Company reached a definitive agreement with Dynegy Incorporated to acquire 100 percent ownership of Northern Natural Gas Company for \$928 million in cash and the assumption of \$950 million in debt. The sale closed in August 2002. With its acquisition of Kern River Gas Transmission Company in March 2002, the Kern River pipeline expansion, and completion of the Northern Natural Gas transaction, MidAmerican has become a leading owner of interstate natural gas pipeline systems. Northern Natural Gas is a 16,600-mile interstate pipeline transporting 4.3 billion cubic feet of natural gas per day from the Permian Basin in Texas to the upper Midwest.{30}

On August 1, 2002, Enterprise Products Partners L.P. announced that its operating partnership had completed the acquisition of Mid-America Pipeline

**Table 4. U.S. Exploratory and Development Well Completions,<sup>a</sup> 1970-2002**

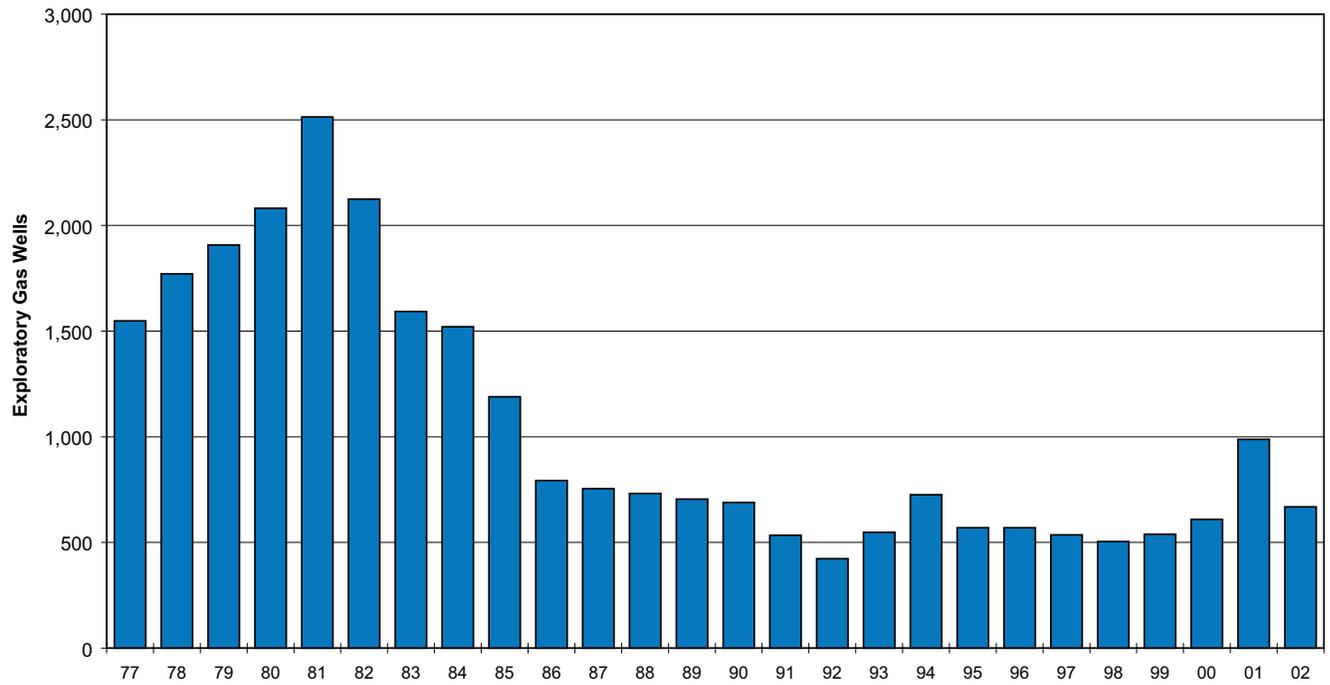
| Year | Exploratory |       |         |         | Total Exploratory and Development |          |         |          |
|------|-------------|-------|---------|---------|-----------------------------------|----------|---------|----------|
|      | Oil         | Gas   | Dry     | Total   | Oil                               | 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 | 642         | 1,067 | 5,952   | 7,661   | 10,167                            | 6,933    | 10,320  | 27,420   |
| 1974 | 859         | 1,190 | 6,833   | 8,882   | 13,647                            | 7,138    | 12,116  | 32,901   |
| 1975 | 982         | 1,248 | 7,129   | 9,359   | 16,948                            | 8,127    | 13,646  | 38,721   |
| 1976 | 1,086       | 1,346 | 6,772   | 9,204   | 17,688                            | 9,409    | 13,758  | 40,855   |
| 1977 | 1,164       | 1,548 | 7,283   | 9,995   | 18,745                            | 12,122   | 14,985  | 45,852   |
| 1978 | 1,171       | 1,771 | 7,965   | 10,907  | 19,181                            | 14,413   | 16,551  | 50,145   |
| 1979 | 1,321       | 1,907 | 7,437   | 10,665  | 20,851                            | 15,254   | 16,099  | 52,204   |
| 1980 | 1,764       | 2,081 | 9,039   | 12,884  | 32,639                            | 17,333   | 20,638  | 70,610   |
| 1981 | 2,636       | 2,514 | 12,349  | 17,499  | 43,598                            | 20,166   | 27,789  | 91,553   |
| 1982 | 2,431       | 2,125 | 11,247  | 15,803  | 39,199                            | 18,979   | 26,219  | 84,397   |
| 1983 | 2,023       | 1,593 | 10,148  | 13,764  | 37,120                            | 14,564   | 24,153  | 75,837   |
| 1984 | 2,198       | 1,521 | 11,278  | 14,997  | 42,605                            | 17,127   | 25,681  | 85,413   |
| 1985 | 1,679       | 1,190 | 8,924   | 11,793  | 35,118                            | 14,168   | 21,056  | 70,342   |
| 1986 | 1,084       | 793   | 5,549   | 7,426   | 19,097                            | 8,516    | 12,678  | 40,291   |
| 1987 | 925         | 754   | 5,049   | 6,728   | 16,164                            | 8,055    | 11,112  | 35,331   |
| 1988 | 855         | 732   | 4,693   | 6,280   | 13,636                            | 8,555    | 10,041  | 32,232   |
| 1989 | 607         | 705   | 3,924   | 5,236   | 10,204                            | 9,539    | 8,188   | 27,931   |
| 1990 | 654         | 689   | 3,715   | 5,058   | 12,198                            | 11,044   | 8,313   | 31,555   |
| 1991 | 592         | 534   | 3,314   | 4,440   | 11,770                            | 9,526    | 7,596   | 28,892   |
| 1992 | 493         | 423   | 2,513   | 3,429   | 8,757                             | 8,209    | 6,118   | 23,084   |
| 1993 | 502         | 548   | 2,469   | 3,519   | 8,407                             | 10,017   | 6,328   | 24,752   |
| 1994 | 570         | 726   | 2,405   | 3,701   | 6,721                             | 9,538    | 5,307   | 21,566   |
| 1995 | 542         | 570   | 2,198   | 3,310   | 7,627                             | 8,354    | 5,075   | 21,056   |
| 1996 | 483         | 570   | 2,136   | 3,189   | 8,314                             | 9,302    | 5,282   | 22,898   |
| 1997 | 428         | 536   | 2,110   | 3,074   | 10,436                            | 11,327   | 5,702   | 27,465   |
| 1998 | 291         | 504   | 1,647   | 2,442   | 7,604                             | 11,308   | 4,840   | 23,212   |
| 1999 | R 154       | R 539 | R 1,195 | R 1,888 | R 4,176                           | R 10,877 | R 3,364 | R 18,417 |
| 2000 | R 264       | R 609 | R 1,288 | R 2,161 | R 7,358                           | R 16,455 | R 4,025 | R 27,838 |
| 2001 | R 317       | R 988 | R 1,444 | R 2,749 | R 8,060                           | R 22,083 | R 2,640 | R 31,478 |
| 2002 | 220         | 668   | 1,180   | 2,068   | 5,996                             | 15,947   | 2,351   | 23,406   |

<sup>a</sup>Excludes service wells and stratigraphic and core testing.

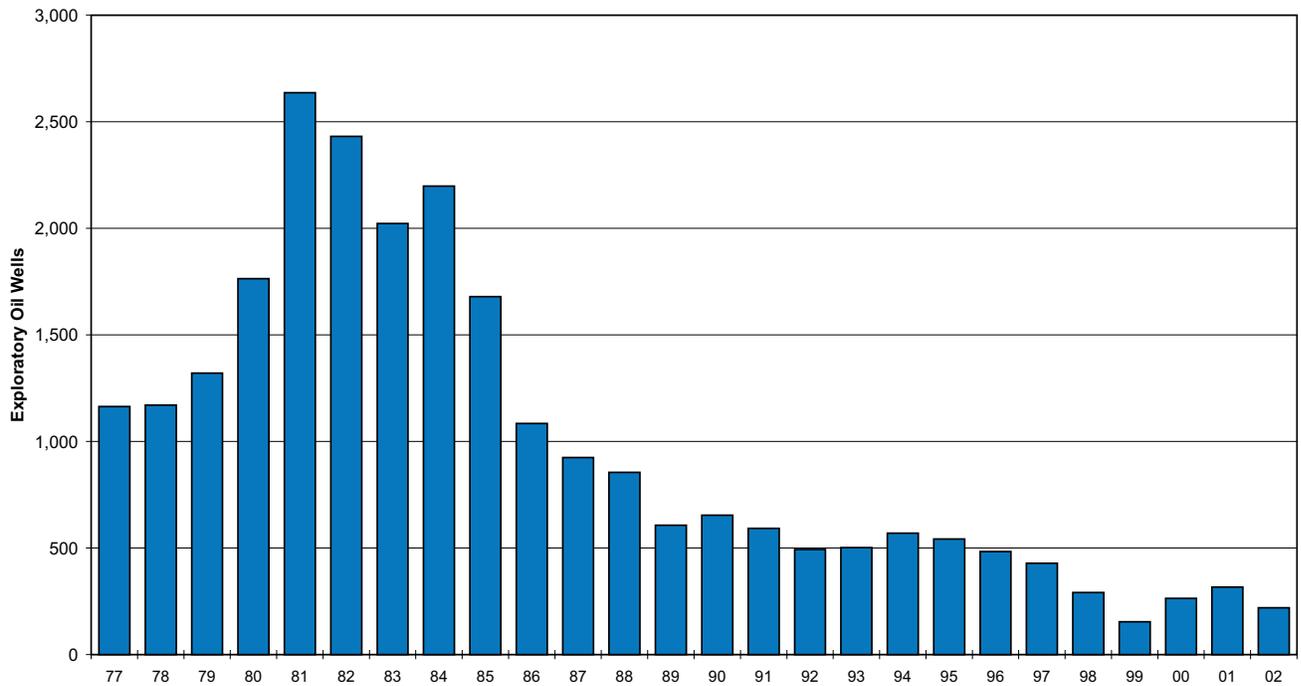
R = Revised Data.

Notes: Estimates include only the original drilling of a hole intended to discover or further develop already discovered oil or gas resources. Other drilling activities, such as drilling an old well deeper, drilling of laterals from the original well, drilling of service and injection wells, and drilling for resources other than oil and gas are excluded.

**Figure 7. U.S. Exploratory Gas Well Completions, 1977-2002**

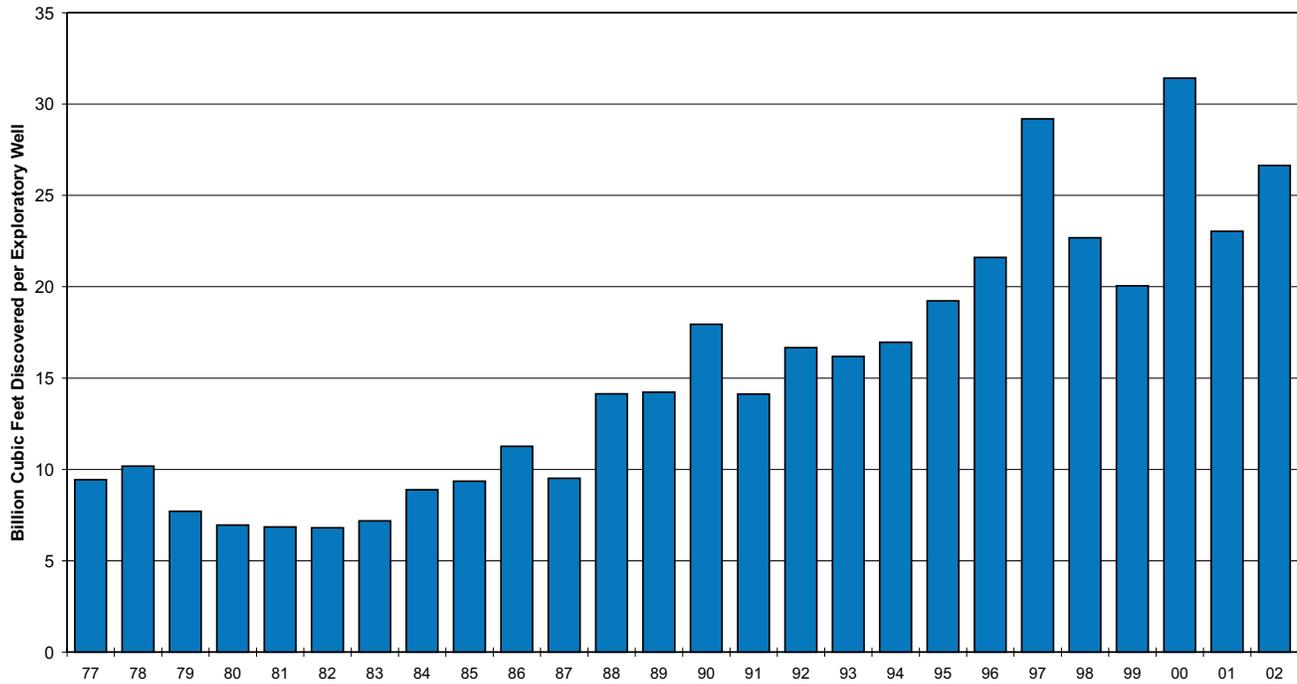


**Figure 8. U.S. Exploratory Oil Well Completions, 1977-2002**

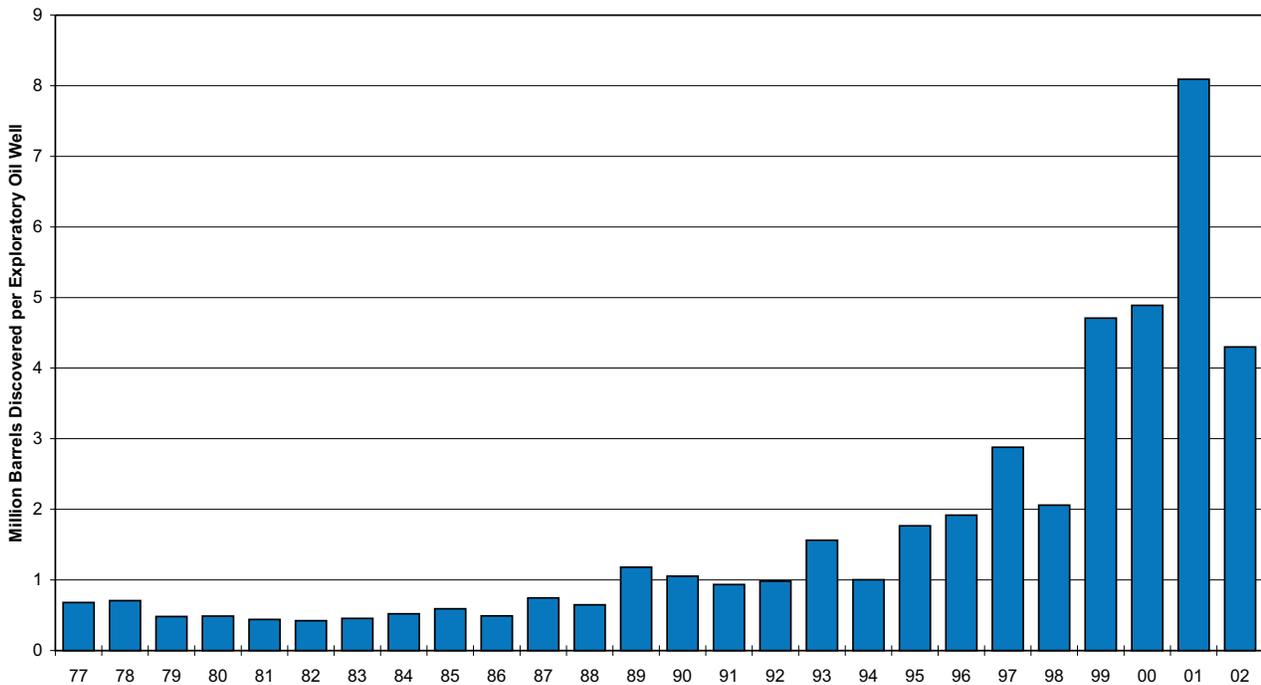


Source: Energy Information Administration, Office of Oil and Gas.

**Figure 9. U.S. Total Discoveries of Dry Natural Gas per Exploratory Gas Well Completion, 1977-2002**



**Figure 10. U.S. Total Discoveries of Crude Oil per Exploratory Oil Well Completion, 1977-2002**



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

Company and Seminole Pipeline Company from affiliates of The Williams Companies Inc. for approximately \$1.2 billion in cash. Mid-America Pipeline is a major natural gas liquids pipeline system with 7,226 miles of pipe and average transportation volumes of approximately 850,000 barrels per day. The Seminole Pipeline, a 1,281-mile pipeline, transports mixed NGLs and NGL products from Hobbs, New Mexico and the Permian Basin to Mont Belvieu, Texas, the largest NGL market hub in the United States. The average volume transported on Seminole is approximately 260,000 barrels per day.<sup>{31}</sup>

## 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
- 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.

In 2002, U.S. crude oil proved reserves increased and oil production decreased, increasing the National average R/P ratio from 11.7 to 12.1.

**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, because of differences in development history and reservoir conditions. The 2002 National average R/P ratio for crude oil was 12.1-to-1. 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 (CO<sub>2</sub>) injection or 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, new technologies such as horizontal drilling have helped 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 natural gas grew rapidly after World War II, lowering the R/P ratio. From 2001 to 2002 the U.S. average R/P ratio for natural gas increased from 9.2 to 9.4 since proved reserves increased and production decreased.

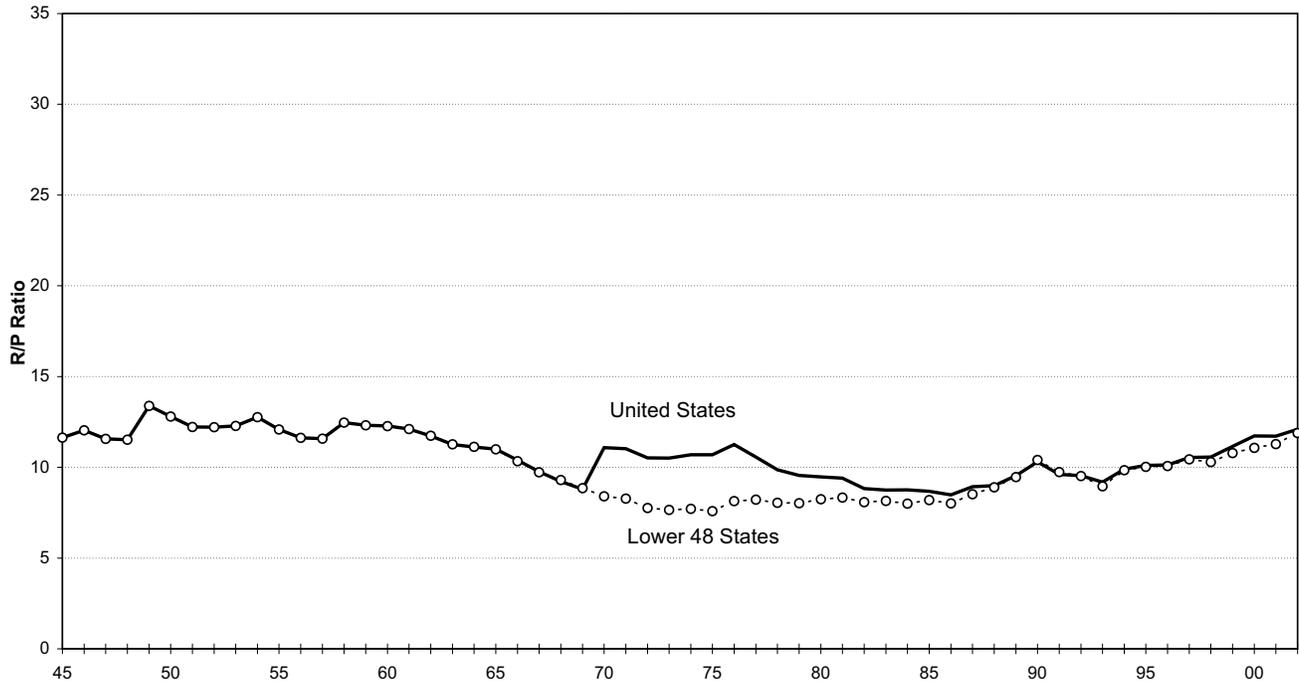
Different marketing, transportation, and production characteristics for gas are seen when looking at regional average R/P ratios, compared to the 2002 U.S. average R/P ratio of about 9.4-to-1. Areas with a higher range of R/P ratios than the National average were the Pacific offshore and the Rockies, and also include areas such as Alabama and Colorado where considerable booking of coalbed methane reserves has recently occurred. Several major gas producing areas have R/P ratios below the National average, particularly Texas, the Gulf of Mexico Federal Offshore, and Oklahoma.

### Proved Ultimate Recovery

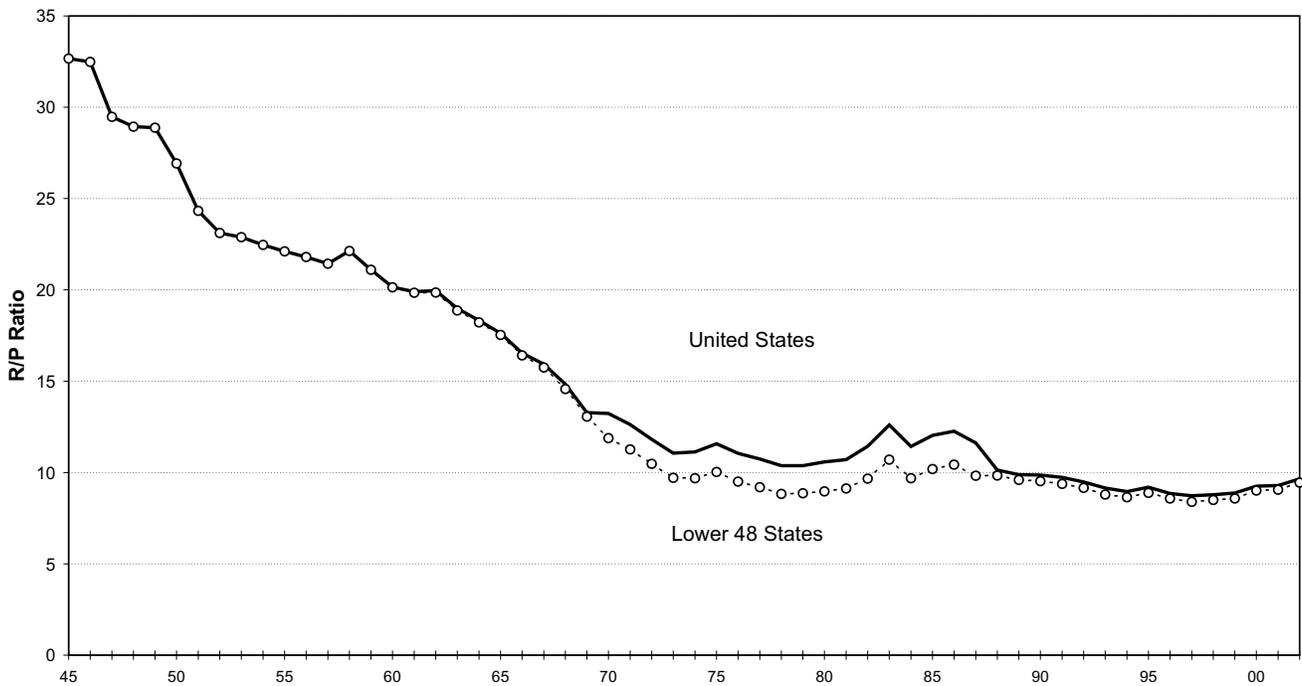
EIA had defined Ultimate Recovery as the sum of proved reserves and cumulative production. However, despite EIA's definition, the volume presented by EIA has often been misinterpreted as the maximum recoverable volume of resources for an area. This neglects the addition of proved reserves over time through ultimate recovery appreciation (a.k.a. reserves growth or field growth) and has led some to make overly-pessimistic resource assessments for the United States. EIA therefore introduced the term, *Proved Ultimate Recovery*:

**Proved Ultimate Recovery** is the sum of proved reserves and cumulative production. It is expected to change over time for any field, group

**Figure 11. Reserves-to-Production Ratios for Crude Oil, 1945-2002**

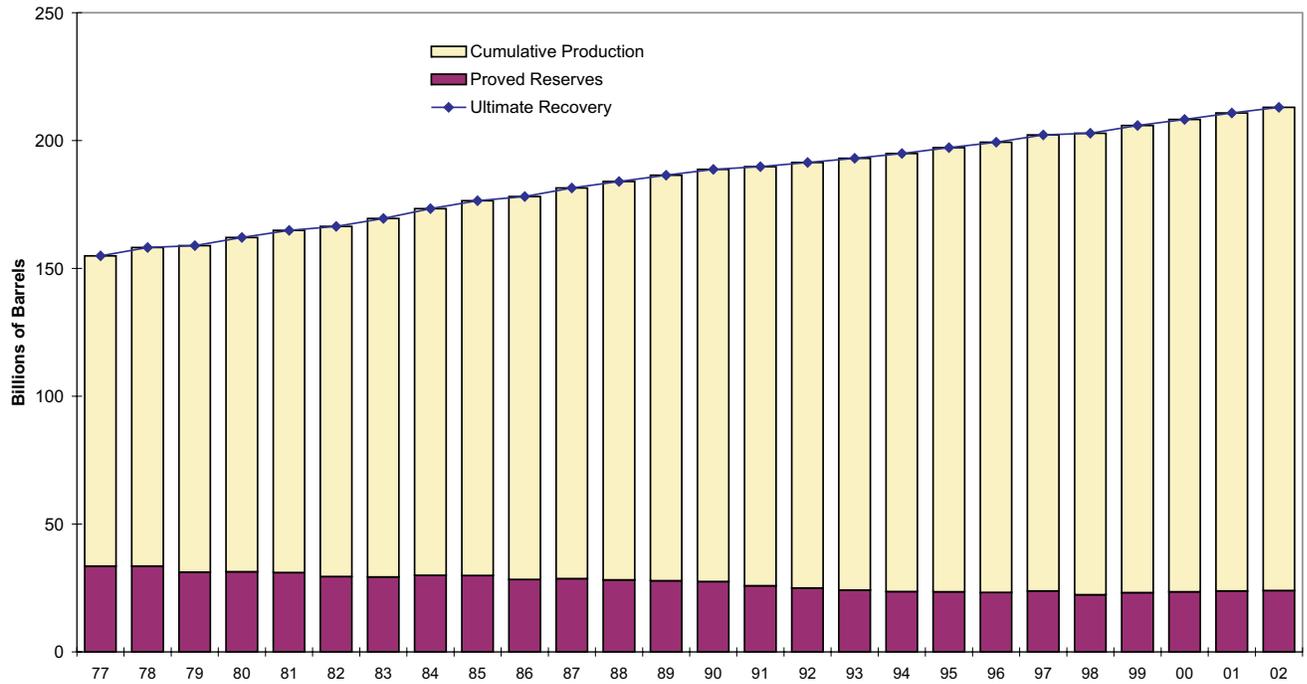


**Figure 12. Reserves-to-Production Ratios for Wet Natural Gas, 1945-2002**

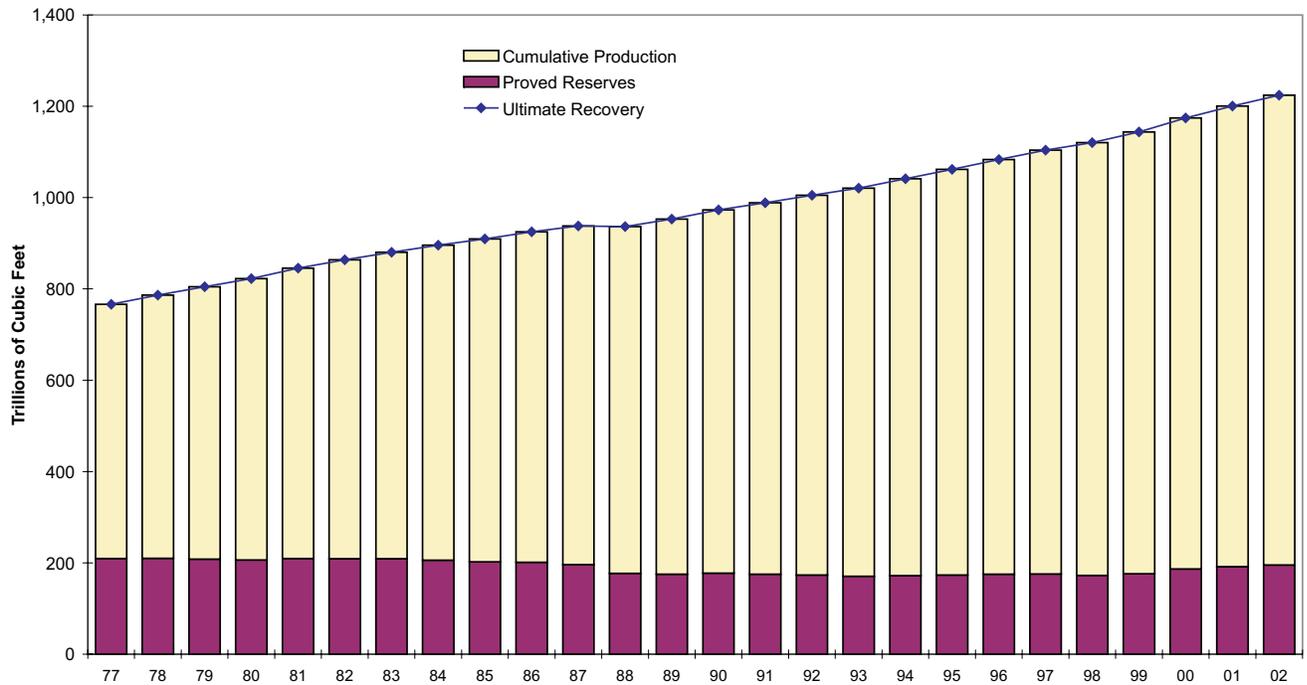


Sources: Annual reserves and production - American Petroleum Institute and American Gas Association (1945–1976) {32} and Energy Information Administration, Office of Oil and Gas (1977–2001){1-25}. Cumulative production: *U.S. Oil and Gas Reserves by Year of Field Discovery* (1977-1988){33}

**Figure 13. Components of Proved Ultimate Recovery for Crude Oil and Lease Condensate, 1977-2002**



**Figure 14. Components of Proved Ultimate Recovery for Wet Natural Gas, 1977-2002**



Sources: Annual reserves and production - American Petroleum Institute and American Gas Association (1945–1976) {32} and Energy Information Administration, Office of Oil and Gas (1977–2001){1-25}. Cumulative production: *U.S. Oil and Gas Reserves by Year of Field Discovery* (1977-1988).{33}

**Table 5. International Oil and Natural Gas Reserves as of December 31, 2002**

| Oil<br>(million barrels) |                                   |                      |                      | Natural Gas<br>(billion cubic feet) |                                   |                      |                      |
|--------------------------|-----------------------------------|----------------------|----------------------|-------------------------------------|-----------------------------------|----------------------|----------------------|
| Rank <sup>a</sup>        | Country                           | Oil & Gas Journal    | World Oil            | Rank <sup>b</sup>                   | Country                           | Oil & Gas Journal    | World Oil            |
| 1                        | Saudia Arabia <sup>c</sup>        | <sup>d</sup> 261,800 | <sup>d</sup> 261,750 | 1                                   | Russia                            | 1,680,000            | 1,700,000            |
| 2                        | Iraq <sup>c</sup>                 | 112,500              | 115,000              | 2                                   | Iran <sup>c</sup>                 | 812,300              | 913,591              |
| 3                        | Kuwait <sup>c</sup>               | <sup>d</sup> 96,500  | <sup>d</sup> 98,850  | 3                                   | Qatar <sup>c</sup>                | 508,540              | 915,992              |
| 4                        | Iran <sup>c</sup>                 | 89,700               | 100,060              | 4                                   | Saudia Arabia <sup>c</sup>        | <sup>d</sup> 224,700 | <sup>d</sup> 234,600 |
| 5                        | Canada                            | 180,021              | 5,485                | 5                                   | United Arab Emirates <sup>c</sup> | 212,100              | 204,050              |
| 6                        | United Arab Emirates <sup>c</sup> | 97,800               | 63,010               | 6                                   | <b>United States</b>              | 183,460              | 188,965              |
| 7                        | Venezuela <sup>c</sup>            | 77,800               | 53,130               | 7                                   | Algeria <sup>c</sup>              | 159,700              | 170,000              |
| 8                        | Russia                            | 60,000               | 58,765               | 8                                   | Nigeria <sup>c</sup>              | 124,000              | 178,500              |
| 9                        | Libya <sup>c</sup>                | 29,500               | 30,000               | 9                                   | Venezuela <sup>c</sup>            | 148,000              | 149,207              |
| 10                       | Nigeria <sup>c</sup>              | 24,000               | 32,000               | 10                                  | Iraq <sup>c</sup>                 | 109,800              | 112,600              |
| <b>Top 10 Total</b>      |                                   | <b>1,029,621</b>     | <b>818,050</b>       | <b>Top 10 Total</b>                 |                                   | <b>4,162,600</b>     | <b>4,767,505</b>     |
| 11                       | <b>United States</b>              | 22,677               | 21,997               | 11                                  | Australia                         | 90,000               | 85,000               |
| 12                       | China                             | 18,250               | 23,700               | 12                                  | Indonesia <sup>c</sup>            | 92,500               | 73,500               |
| 13                       | Qatar <sup>c</sup>                | 15,207               | 19,559               | 13                                  | Malaysia                          | 75,000               | 88,000               |
| 14                       | Mexico                            | 12,622               | 17,197               | 14                                  | Norway                            | 77,300               | 74,730               |
| 15                       | Algeria <sup>c</sup>              | 9,200                | 13,000               | 15                                  | Canada                            | 60,118               | 60,126               |
| 16                       | Norway                            | 10,265               | 9,018                | 16                                  | Netherlands                       | 62,000               | 55,315               |
| 17                       | Brazil                            | 8,322                | 9,813                | 17                                  | Egypt                             | 58,500               | 58,600               |
| 18                       | Angola                            | 5,412                | 8,900                | 18                                  | Kuwait <sup>c</sup>               | <sup>d</sup> 52,200  | <sup>d</sup> 56,600  |
| 19                       | Oman                              | 5,506                | 5,735                | 19                                  | China                             | 53,325               | 46,650               |
| 20                       | Indonesia <sup>c</sup>            | 5,000                | 5,945                | 20                                  | Libya <sup>c</sup>                | 46,400               | 46,000               |
| 21                       | India                             | 5,367                | 4,595                | 21                                  | Oman                              | 29,280               | 31,000               |
| 22                       | United Kingdom                    | 4,715                | 4,476                | 22                                  | Bolivia                           | 24,000               | 28,061               |
| 23                       | Malaysia                          | 3,000                | 4,328                | 23                                  | India                             | 26,943               | 23,550               |
| 24                       | Egypt                             | 3,700                | 3,535                | 24                                  | Argentina                         | 26,960               | 23,431               |
| 25                       | Australia                         | 3,500                | 3,700                | 25                                  | United Kingdom                    | 24,600               | 22,239               |
| <b>Top 25 Total</b>      |                                   | <b>1,162,364</b>     | <b>973,548</b>       | <b>Top 25 Total</b>                 |                                   | <b>4,962,226</b>     | <b>5,540,307</b>     |
| <b>OPEC Total</b>        |                                   | <b>819,007</b>       | <b>792,304</b>       | <b>OPEC Total</b>                   |                                   | <b>2,490,740</b>     | <b>3,054,640</b>     |
| <b>World Total</b>       |                                   | <b>1,212,881</b>     | <b>1,033,993</b>     | <b>World Total</b>                  |                                   | <b>5,501,424</b>     | <b>6,128,653</b>     |

<sup>a</sup>Rank is based on an average of oil reserves reported by *Oil & Gas Journal* and *World Oil*.

<sup>b</sup>Rank is based on an average of natural gas reserves reported by *Oil & Gas Journal* and *World Oil*.

<sup>c</sup>Member of the Organization of Petroleum Exporting Countries (OPEC).

<sup>d</sup>Includes one-half of the reserves in the Neutral Zone.

<sup>e</sup>Energy Information Administration proved reserves as of December 31, 2001 were published by the *Oil & Gas Journal* as its estimates as of December 31, 2002.

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 22, 2002, pp. 113-115. Gulf Publishing Company, *World Oil*, August, 2003, p 23.

of fields, State, or Country. Proved Ultimate Recovery does not represent the maximum recoverable volume of resources for an area. It is instead a gauge of how much has already been produced plus proved reserves. Proved reserves of crude oil or natural gas are the estimated quantities of petroleum which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. When deterministic proved reserves estimation methods are used, the term reasonable certainty is intended to express a high degree of confidence that the estimated quantities will be recovered. When probabilistic methods are used there should be at least a 90 percent probability that the actual quantities recovered will exceed the estimate.

**Figures 13 and 14** show successive estimates of U.S. proved ultimate recovery and its components (proved reserves and cumulative production) for crude oil plus lease condensate and for wet natural gas, during 1977 - 2002. These estimates illustrate the continued appreciation (growth) of proved ultimate recovery over time.

In 1977, U.S. crude oil plus lease condensate proved reserves were 33,615 million barrels. Cumulative production of crude oil plus lease condensate from 1977 - 2002 was 67,664 million barrels, a volume that substantially exceeds 1977 proved reserves. However, at the end of 2002, there were still 24,023 million barrels of crude oil plus lease condensate proved reserves. This reflects the fact that the Nation's estimated proved ultimate recovery of crude oil was fundamentally increased during this period owing to the proved ultimate recovery appreciation process (the continued development of old fields). In fact, only 11 percent of proved reserves additions of crude oil were booked as new field discoveries from 1976 through 2002. The rest came from the proved reserves categories related to the proved ultimate recovery appreciation process.

Similarly, the 1977 proved reserves of wet natural gas were 209,490 billion cubic feet, but more than twice this amount of gas was produced from 1977 through 2002 and there were still 195,561 billion cubic feet of wet natural gas proved reserves in 2002. Only 12 percent of proved reserve additions of natural gas were booked as new field discoveries from 1976 through 2002.

## International Perspective

### International Reserves

The EIA does not currently collect its own data on international oil and gas reserves. However, international reserves estimates are presented in two widely circulated trade publications and are shown in **Table 5** as a service to our readers. The world's total reserves are estimated to be roughly 1 trillion barrels of oil and 6 quadrillion cubic feet of gas.

The United States ranked 11th in the world for reserves of crude oil and 6th for reserves of natural gas in 2002. A comparison of EIA's U.S. proved reserves estimates with worldwide estimates obtained from other sources shows that the United States had 2 percent of the world's total crude oil proved reserves and 3 percent of the world's total natural gas proved reserves at the end of 2002. There are sometimes substantial differences between the estimates from these sources. For example, the *Oil & Gas Journal* reported oil reserves for the United Arab Emirates of about 98 billion barrels. This is about 56 percent higher than the *World Oil* estimate of 63 billion. One reason (among many) for these differences is that condensate is often included in foreign estimates of oil reserve.

The *Oil & Gas Journal*{34} estimate for world oil reserves increased 18 percent in 2002, due to its addition of large reserves of heavy oil from Canadian tar sands; an addition not shared by *World Oil*{35} who's estimate increased only 2 percent. The addition of large Canadian oil reserves in 2002 moves it up in rank from 20th in the world in 2001 to 5th in the world in 2002. For world gas reserves, the *Oil & Gas Journal* reported a 1 percent increase, while *World Oil* reported a 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. Based on averages of the *World Oil* and *Oil & Gas Journal* estimates, Iraqi oil reserves are almost 5 times U.S. reserves. Venezuela and Canada have about 3 times U.S. reserves.

### Petroleum Consumption

The United States is the world's largest energy consumer. The EIA's estimates of energy consumption are published in its *Annual Energy Review*.{36} In 2002:

- The U.S. consumed 97,350,000,000,000,000 Btu of energy (97.35 quadrillion Btu). This was an increase of 1.03 quadrillion Btu from the 2001 level of consumption
- 63 percent of U.S. energy consumption was provided by petroleum and natural gas—crude oil and natural gas liquids combined (39 percent), and natural gas (24 percent)
- U.S. petroleum consumption was about 19.8 million barrels of oil and natural gas liquids and 62.7 billion cubic feet of dry gas per day.

## Dependence on Imports

The United States remains heavily dependent on imported oil and gas to satisfy its ever-increasing appetite for energy. In 2002, crude oil imports made up 61 percent of the U.S. crude oil supply. Saudi Arabia, Mexico, Canada, and Venezuela were the primary foreign suppliers of petroleum to the United States. {37}

Net gas imports increased slightly from the revised 2001 total of 3.73 trillion cubic feet to 3.78 trillion cubic feet in 2002. Imports were used for approximately 19 percent of consumption, and almost all of it was pipelined from Canada. Some came from Mexico, though Mexico remains a net importer of natural gas from the U.S., and some liquefied natural gas was imported from Algeria and Australia.

## 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.

**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. Table B3 in Appendix B lists the top U.S. operators by reported 2002 production and indicates pending mergers announced in 2002 with linked arrows.

**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 again included Table D9, Deepwater Production and Proved Reserves of the Gulf of Mexico Federal Offshore 1992-2002, due to expressed interest from the industry regarding this area. Table D9 contains the production and proved reserves for 1992-2002 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 sampling frame maintenance.

**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.

**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.