

Executive Summary

U.S. proved reserves of crude oil rebounded from their unusually large 1998 decline, growing by about 3.5 percent in 1999 — the largest percentage increase in the 23-year EIA reserves program. Over 137 percent of 1999 oil production was replaced by proved reserve additions. This was not a result of increased drilling, more successful exploratory drilling, or dramatically improved technology. Crude oil prices began slowly increasing from the inflation-adjusted 53-year low of December 1998 and then accelerated during the year, reaching \$22.55 per barrel in December 1999. The resurgent crude price generated the largest positive net revisions to proved reserves in over a decade.

U.S. dry natural gas reserves increased 2 percent in 1999, reversing the 2 percent decline of 1998. Natural gas reserve additions in 1999 replaced 118 percent of gas production.

As of December 31, 1999 proved reserves were:

Crude Oil (million barrels)	
1998	21,034
1999	21,765
Increase	3.5%
Dry Natural Gas (billion cubic feet)	
1998	164,041
1999	167,406
Increase	2.1%
Natural Gas Liquids (million barrels)	
1998	7,524
1999	7,906
Increase	5.1%

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 1999 U.S. proved reserves of crude oil, natural gas, and natural gas liquids is the 23rd in the annual series prepared by the Energy Information Administration.

Crude Oil

Price matters. The 1999 rebound in crude oil reserves was fundamentally driven by price increases just as the unusually large oil reserve declines of 1998 had

been fundamentally driven by very low oil prices. Changes in proved reserves are impacted by price in several ways.

The attainment of higher prices from an initially very low base level implies much better economics for oil producers. The December 1999 oil price used to evaluate oil field economics and estimate proved reserves was roughly three times the December 1998 price; many operators reported that the reason for their positive reserve revisions was the price increase.

Further, the December 1999 price (\$22.55 per barrel) was relatively better for the smaller and marginal oil well operators because they are usually operating closer to their direct operating costs. Texas, like most of the lower-48 States, is basically a stripper well (less than 10 barrels per day per well) State. Texas' proved oil reserves fell 13 percent in 1998, which for the first time in a decade placed Texas second to Alaska in oil reserves. But in 1999, Texas oil reserves increased by over 8 percent while Alaskan reserves dropped, returning Texas to its number one position.

Reserve additions are the sum of total discoveries and revisions and adjustments. For crude oil, the net of revisions and adjustments was the highest in over a decade and replaced 100 percent of 1999 oil production. This price-induced rebound followed 1998's negative net revision and adjustment of 120 million barrels which marked the first time in 22 years that the net of revisions and adjustments had not made a positive contribution to oil reserve additions.

Total discoveries of crude oil were 725 million barrels in 1999, about the prior 10-year average and 21 percent more than those in 1998. The Gulf of Mexico Federal Offshore accounted for over half of them. Total discoveries, which equaled only 37 percent of 1999 oil production, 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. New field discoveries of 321 million barrels were twice those of 1998 and well above the prior 10-year average. Almost all of them were in the Gulf of Mexico Federal Offshore and Alaska. Well over half of the proved reserves of oil in the Gulf of Mexico are now located in deep water (water depths greater than 200 meters).

New reservoir discoveries in old fields were 145 million barrels, about the same as the prior 10-year average. Field extensions were down in 1999 to 60 percent of the prior 10-year average, but still added 259 million barrels of proved oil reserves.

Other 1999 crude oil events of note:

- The annual average domestic first purchase price for crude oil increased 43 percent from the 1998 level to \$15.56 per barrel.
- Exploratory oil completions were down almost 50 percent at 148 and total oil well completions were down about 40 percent at 3,853. For both, the low drilling level reached in 1998 deepened in 1999 and did not begin to ameliorate until after mid-year inasmuch as oil prices did not reach \$15 per barrel until July 1999.
- Total discoveries per exploratory oil well were much higher because most of the discoveries were in the less maturely explored Gulf of Mexico and Alaska and because the drilling level was also down. Nevertheless, as we predicted in the 1998 report, higher oil prices in December 1999 brought back some of the oil reserves that became uneconomic in 1998.

Indicated additional reserves of crude oil decreased 9 percent to 2,865 million barrels in 1999. 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 north Alaska, California, Texas, and Louisiana implies that significant upward revisions to crude oil proved reserves can occur in the future.

Natural Gas

With the 1999 increase, U.S. natural gas proved reserves have increased in 5 of the past 6 years. The combined 1999 reserve increases in Texas, Colorado, and Utah more than account for U.S. net proved reserve additions. Oklahoma and the Gulf of Mexico had significant gas reserve declines.

Proved reserves in the Gulf of Mexico Federal Offshore declined in both 1998 and 1999, even though deepwater Gulf of Mexico Federal Offshore reserves were up substantially in both 1998 and 1999, as was production. However, for those Gulf of Mexico fields located in water less than 200 meters deep, proved reserves declined by 5 percent and production declined by 9 percent in 1999.

The reserve additions of natural gas were higher in 1999 because the net of revisions and adjustments to reserves (11,486 billion cubic feet) was more than twice as high as in 1998 and 70 percent higher than the prior 10-year average. However, natural gas prices were only up 7 percent in 1999 to \$2.08 per thousand cubic feet. The associated-dissolved gas revisions related to oil reserve revisions underwent

larger percentage gains than did those for gas which is not associated with crude oil in the reservoir (nonassociated gas).

The other major component, total discoveries, declined in 1999 to 10,807 billion cubic feet. New field discoveries were 1,568 billion cubic feet, a little more than the prior 10-year average. Field extensions were 7,043 billion cubic feet, down from 1998 and almost exactly at the prior 10-year average. New reservoir discoveries in old fields were 2,196 billion cubic feet, about the same as in 1998 and 6 percent less than the prior 10-year average.

Coalbed methane reserves and production continued to grow faster in 1999 than did the reserves and production of conventional natural gas. Coalbed methane reserves increased to 8 percent of proved dry gas reserves and accounted for 7 percent of total dry gas production in 1999.

Other 1999 natural gas events of note:

- Exploratory gas well completions increased 13 percent in 1999 while development gas well completions declined 15 percent.
- Although the number of exploratory wells increased, the average of total discoveries per exploratory gas well was 16 percent less in 1999.
- U.S. gas production was slightly higher in 1999 according to the EIA reserves survey.

Natural Gas Liquids

U.S. natural gas liquids proved reserves increased 5 percent to 7,906 million barrels in 1999. 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 29,671 million barrels in 1999, a 4 percent increase from the 1998 level. Natural gas liquids represented 27 percent of total liquid hydrocarbon proved reserves in 1999.

Data

These estimates are based upon analysis of data from Form EIA-23, Annual Survey of Domestic Oil and Gas Reserves, filed by 1,897 operators of oil and gas wells, and Form EIA-64A, Annual Report of the Origin of Natural Gas Liquids Production, filed by operators of 608 active natural gas processing plants. By use of improved sampling and imputation procedures, the sample of oil and gas well operators was reduced by almost a third from that of the 1998 survey without sacrificing accuracy. The U.S. proved reserves estimates for crude oil and natural gas are associated with sampling errors of less than 1 percent.