Oil and gas discovery wells drilled in New Mexico in 1989

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Introduction

More wells were drilled for oil and gas in New Mexico in 1989 than in 1988. Data obtained from the New Mexico Oil Conservation Division indicate 1,088 wells were completed in 1989, up 4% from the 1,043 wells completed in 1988 but down 62% from the record 2,867 wells completed in 1981. In the Permian Basin, southeast New Mexico, 631 wells were completed in 1989, down from 738 completions in 1988; 374 wells were completed as oil producers, 148 wells were completed as gas producers, and 109 wells were plugged and abandoned, resulting in a success rate of 83%. In the San Juan Basin, northwest New Mexico, 457 wells were completed in 1989, up from 305 completions in 1988; 53 wells were oil producers, 351 wells were gas producers, and 53 wells were plugged and abandoned, resulting in a success rate of 88%. In addition, one well was completed in the Bravo Dome carbon dioxide gas field of southern Union and eastern Harding Counties.

Total footage of hole drilled in 1989 was 4,665,518 ft, down from 5,344,414 ft in 1988. The average depth of wells drilled in 1989 was 4,288 ft, 835 ft less than the average depth drilled in 1988.

The downturn in drilling over the past eight years has been accompanied by seriously decreased exploratory efforts. Several major oil companies announced reduction or elimination of onshore exploration efforts in the United States. Despite this, however, significant exploratory drilling continued in the Permian, San Juan, Raton, Baca, and Pedregosa Basins and in the Jornada del Muerto of eastern Socorro County (Fig. 1). Significant drilling also took place in the Gallup-Zuni sag west of the Zuni uplift.

For purposes of this report, a significant wildcat discovery is defined as a well in which commercial amounts of oil or gas were discovered in a stratigraphic unit more than 5 miles from the limits of previously discovered pools with commercial production from that stratigraphic unit. A significant wildcat dry hole is defined as a dry hole that was drilled in a not-yet-productive basin or a part of a basin and in which petroleum reservoirs were evaluated. The locations of significant wildcat wells that were completed in 1989 are shown in Fig. 1. Table 1 summarizes the significant wildcat discoveries and Table 2 summarizes the significant wildcat dry holes. Table 3 lists other significant wildcat wells that were being drilled, were not completed, or were held "tight" at the end of 1989.

Each well is designated by a number in parentheses that refers to its location in Fig. 1 and its description in Tables 1, 2, or 3.

Southeast New Mexico

Drilling activity remained slow in 1989 in the three geologic subdivisions of the Permian Basin: the Delaware Basin, the Central Basin platform, and the Northwest shelf. Drilling activity was also light on the Roosevelt uplift. Despite the slow drilling activity, however, several significant oil and gas discoveries were made in the Permian Basin during 1989 (Fig. 1; Table 1). McKamey et al. (1988) presented stratigraphic charts of oil-and gas-producing rock units in southeastern New Mexico, as well as geologic summaries of recently discovered oil and gas pools.

Two significant wildcat discoveries were made in the Delaware Basin during 1989. Oil was found in sandstones of the Delaware Mountain Group (Permian) in the Strata Production No. 1 New Mexico Federal A (1). Gas was found in Atoka clastics (Pennsylvanian) in the Manzano Oil No. 1 Wynell Federal (2). Both oil and gas reservoirs were targets of exploratory drilling in the Delaware Basin during 1989. Main targets of oil exploration were basal sandstones of the Bone Spring Formation and Delaware Mountain Group (Permian). Exploration for gas was concentrated in Strawn, Atokan, and Morrowan strata (Pennsylvanian).

Development drilling in the Delaware Ba-
sin was predominantly for oil in 1989. Major targets for development drilling were oil reservoirs in basinal sands of the shallow (4,000–6,000 ft) Delaware Mountain Group (Permian) and moderately deep (6,000–10,000 ft) Bone Spring Formation (Permian). Development drilling for gas was mostly in deep (10,000–14,000 ft) Morrowan and Atokan (Lower Pennsylvanian) clastic reservoirs.

No significant wildcat discoveries were made on the Central Basin platform in 1989. Exploratory efforts were minimal in this mature, densely drilled area. Deep (10,000–12,000 ft) Ordovician, Silurian, and Devonian targets under the platform and along the western border areas of the platform may still hold exploratory promise. Development drilling was mostly for oil in the shallow (2,000–5,000 ft) San Andres, Grayburg, and Queen formations (Permian) and in moderately deep (5,000–7,000 ft) Blinebry, Tubb, and Drinkard sandstones of the Yesso Formation (Permian).

Six significant gas discoveries were made on the Northwest shelf in 1989. Gas was found in Cisco strata (Upper Pennsylvanian) in the BTA Oil Producers No. 1 8710 JV–P Tank B (3) on the southern part of the shelf. Also on the southern part of the shelf, gas was discovered in Strawn (Middle Pennsylvanian) reservoirs in the Yates Energy No. 1 Desert Rose Federal (4) and in the Bill Fenn Inc. No. 1 Roaring Springs Federal Com. (5). Gas was found in the Wolfcamp (Permian), in the Marathon Oil No. 6 North Indian Basin Unit Gas Com. (6). Gas was discovered in Abo (Permian) reservoirs in the Yates Petroleum No. 2 Agave State AA (7). Farther north on the central part of the shelf, gas was discovered in the Mississippian in the Hanagan Petroleum No. 2 Long Arroyo (8), a re-entry of a wildcat well that had been drilled to Ordovician strata and subsequently abandoned in 1987. Exploration on the Northwest shelf in 1989 was concentrated on oil reservoirs in Wolfcamp (Permian) carbonates and also in Abo carbonates (Permian) near the shelf edge. Oil exploration also emphasized San Andres (Permian) carbonates. There was limited exploration for gas on the Northwest shelf in reservoirs of Ordovician, Silurian, Devonian, Mississippian, Pennsylvanian, and Permian age.

Exploration drilling on the Northwest shelf was slow in 1989. Nevertheless, there was significant development of oil reservoirs in the shallow (2,000–6,000 ft) San Andres, Grayburg, and Queen formations (Permian) of Chaves County and northern Eddy and northern Lea counties. There was also development of Abo (Permian) oil reservoirs along the shelf edge in Lea County. There was limited development of deeper oil reservoirs: Ordovician, Devonian, Pennsylvanian, and Wolfcamp (Permian) carbonates.

The only gas pool extensively developed on the Northwest shelf in 1989 was the Pecos Slope Abo gas pool of north-central Chaves County. There was also limited development of the “pre-Permian” gas pools in Chaves County and Strawn (Middle Pennsylvanian) and Wolfcamp (Permian) gas reservoirs in Chaves and northern Eddy Counties.

The Roosevelt uplift and adjacent areas were drilled sparsely in 1989. No significant wildcat discoveries were made. Exploration was minimal; two wells were drilled to test lower Paleozoic reservoirs in southern Roosevelt County, but neither well was successful. There was limited development of hydrocarbon accumulations in Wolfcamp and San Andres (Permian) carbonates during 1989.

Elsewhere in southeast New Mexico, the Esperanza Energy No. 1 McClain Ranch (14) was drilled to a total depth of 3,000 ft in southeastern De Baca County. Casing was set and perforated in the Glorieta Sandstone and San Andres Formation (Permian), but hydrocarbons were not recovered. The well was reported temporarily abandoned at the end of 1989. In the same township, a location was staked for the Jaguar Energy No. 1 Colter Federal (25); that well is scheduled to be drilled to a total depth of 7,200 ft in Montoya carbonates (Ordovician).

Northwest New Mexico

In 1989, 457 wells were completed in northwest New Mexico, up substantially from 305 completions in 1988 but down from 863 completions in 1985. Virtually all drilling was in the San Juan Basin, which is thus far the only productive area of northwest New Mexico. The diminished rate of drilling since 1985 has been caused by depressed gas prices and a depressed market for gas, the primary petroleum product of the San Juan Basin. Depressed oil prices have also taken a toll on drilling activity in the San Juan Basin.

Exploratory drilling resulted in one significant discovery in the San Juan Basin during 1989. Gas was discovered in the Ojo Alamo Sandstone (Tertiary) in the Robert L. Bayless No. 1 Jicarilla 457 (9) at a depth of approximately 3,200 ft. This is apparently the first well to obtain commercial production from the Ojo Alamo.

Exploratory activity was minimal within the central, productive parts of the San Juan Basin during 1989. However, several signifi-
TABLE 2—Significant wildcat dry holes in New Mexico in 1989; the term formation is used in an informal sense. TA, temporarily abandoned; D&A, dry and abandoned; perf, perforated; acid, acidized; DST, drill-stem test.

<table>
<thead>
<tr>
<th>Number</th>
<th>Location (section-township, range, county)</th>
<th>Operator, well number, and lease</th>
<th>Completion date (m/o/y)</th>
<th>Total depth (ft)</th>
<th>Formation (ft)</th>
<th>Status</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>15-2S-28E, De Baca</td>
<td>Esperanza Energy No. 1 McClain Ranch</td>
<td>11/89</td>
<td>3,000</td>
<td>Glenrota</td>
<td>TA</td>
<td>Perf 2,737-2,751 ft (Glenrota); recovered salt water. Perf &amp; acid 2,679-2,701 ft (San Andres), with no show.</td>
</tr>
<tr>
<td>15</td>
<td>34-32N-15W, San Juan</td>
<td>Wintershall Oil &amp; Gas No. 34-24 Straight Canyon</td>
<td>8/89</td>
<td>9,002</td>
<td>Pinkerton Trail (Pennsylvanian)</td>
<td>D&amp;A</td>
<td>No porous zones were reportedly encountered in the Pennsylvanian section.</td>
</tr>
<tr>
<td>16</td>
<td>29-31N-3E, Rio Arriba</td>
<td>Spur Oil No. 2 Quintan Ranch</td>
<td>7/89</td>
<td>1,461</td>
<td>Entrada</td>
<td>D&amp;A</td>
<td>Perf &amp; acid 1,220-1,232 ft (Morrison) with no show; Perf 375-381 ft &amp; 452-457 ft (Dakota) with no show.</td>
</tr>
<tr>
<td>17</td>
<td>28-31N-3E, Rio Arriba</td>
<td>Salazar Drilling No. 12-1 Hill Ranch</td>
<td>8/89</td>
<td>2,910</td>
<td>granite wash</td>
<td>D&amp;A</td>
<td>No reported shows. Perforated several hundred feet of Pennsylvanian section.</td>
</tr>
<tr>
<td>18</td>
<td>28-18N-19W, Sandoval</td>
<td>Mobil Producing Texas &amp; New Mexico No. 1 Jemez Pueblo</td>
<td>6/89</td>
<td>5,000</td>
<td>Entrada</td>
<td>D&amp;A</td>
<td>DST 3,320-3,325 ft (Entrada); recovered 580 ft water-cut mud + 1,160 ft water.</td>
</tr>
<tr>
<td>19</td>
<td>4-8N-19W, Cibola</td>
<td>Fossil Fuels No. 1 Zuni Tribal</td>
<td>8/89</td>
<td>2,258</td>
<td>Abo</td>
<td>D&amp;A</td>
<td>Unable to log entire well because of sloughing shales. Completed as water well. Drilled on anticline 0.6 miles northeast of Galisteo monoline.</td>
</tr>
<tr>
<td>20</td>
<td>16-35S-19W, Catron</td>
<td>Hunt Oil Co. No. 1-16 State</td>
<td>11/89</td>
<td>6,990</td>
<td>Precambrian</td>
<td>D&amp;A</td>
<td>DST 3,962-3,986 ft (San Andres); recovered 1,848 ft water + 930 ft mud; DST 4,561-4,843 ft (Yeso) recovered 1,196 ft mud.</td>
</tr>
<tr>
<td>22</td>
<td>19-21S-10W, Luna</td>
<td>XFER, Inc. No. 5 Santa Maria UB R&amp;R</td>
<td>4/89</td>
<td>1,150</td>
<td>alkalium</td>
<td>D&amp;A</td>
<td>Water-bearing sands encountered from 65 to 90 ft. Severe caving of hole encountered while drilling.</td>
</tr>
</tbody>
</table>

The Paleozoic and Jurassic sections. Minor amounts of oil are produced from stratigraphic traps in the Entrada Sandstone (Jurassic) in the southeastern part of the basin. Relatively minor amounts of oil and gas are produced from Devonian, Mississippian, and Pennsylvanian reservoirs in structural traps along the western flank of the basin; helium-rich gases have been produced from Mississippian, Pennsylvanian, and Permian reservoirs in this area. The Paleozoic and Jurassic remain essentially frontiers for petroleum exploration in the San Juan Basin. Significant exploration focused on Paleozoic and Jurassic targets during 1989. The Mobil Producing Texas and New Mexico No. 1 Jemez Pueblo (18) was drilled on the southeast margin of the basin approximately 4 miles west of the western escarpment of the Nacimiento Mountains. The well was drilled to test the Entrada Sandstone, which has been upturned to the east along the faulted front of the Nacimientos. Nearest Entrada production is 12 miles northwest in the Media Entrada oil pool. Most details concerning the well have been kept confidential, but it is known that water was recovered from the Entrada during a drill-stem test.

Exploration for hydrocarbons in Paleozoic reservoirs also continued in the northwest part of the San Juan Basin. The Wintershall Oil & Gas No. 34-24 Straight Canyon well (15) was drilled to a total depth of 9,002 feet to test Pennsylvanian carbonates; it was reported that no porous zones were encountered in the Pennsylvanian. Farther west along the Arizona State Line, the Chuska Energy No. 1 Beclabito (32) was re-entered, presumably to test the Pennsylvanian section; originally, the well had been completed in 1968 as a gas well in the Cutler Formation (Permian), but it was plugged and abandoned in 1969. During 1989 a location was staked for the Chuska Energy No. 1 Chimney Rock (33); the well is 0.75 mile northwest of the abandoned Cone Paradox oil pool, which produced from a single well in the Paradox Formation (Pennsylvanian).

Most development drilling in the San Juan Basin during 1989 was for coal-bed methane in the Fruitland Formation (Cretaceous). Kelso et al. (1988) estimated that the total gas contained within Fruitland coal beds in the San Juan Basin is 50 trillion cubic feet (TCF); most of that gas is within the New Mexico part of the basin. It is not known what percentage of the gas is recoverable under current or improved economic conditions, but this source certainly represents a major addition to the state’s producible gas supplies. More than 250 wells were drilled to develop Fruitland coal-bed methane during 1989. Development has been in the Basin Fruitland gas pool of eastern San Juan and western Rio Arriba Counties.

Fruitland gas reservoirs have been ignored for many years because of initial low production volumes and high water cuts. Exploration and development have been concentrated in deeper reservoirs in the Upper Cretaceous, which yield relatively high volumes of gas and little or no water upon initial completion. However, water production from wells completed in Fruitland coals declines with time, and the wells become more economical. Furthermore, lower costs involved with drilling the shallower Fruitland reservoirs (approximately 2,000 feet deep) compensate partially for the relatively low volumes of gas production. More importantly, producers are eligible for a federal gas-production tax credit for wells drilled before January 1, 1991; that tax credit applies to gas produced from those wells prior to the year 2000. As a result of the tax credit, a drilling boom started as operators rushed to discover and develop reserves before the deadline. Some development, no doubt, would have occurred without the tax credit. At the time this report was written, legislation was pending in Congress to extend it another two years. If that legislation passes, exploration and development should continue into 1992 at a relatively brisk pace. Meridian Oil Company and Amoco Production Company are involved with drilling the shallower Fruitland coals in the Fruitland gas pool during 1989. Development has been in the Basin Fruitland gas pool of eastern San Juan and western Rio Arriba Counties.
the major operators in the coal-bed methane play; Nassau Resources, Southland Royalty, Northwest Pipeline, Blackwood & Nichols, and Union Texas Petroleum also have significant lease holdings and have drilled wells within the New Mexico part of the San Juan Basin (Neil H. Whitehead III, personal communication 1989). Sandra Johnson (1989) summarized the Fruitland coal-bed methane play.

Development drilling for gas in reservoirs other than the Fruitland was sluggish during 1989 and was concentrated in San Juan and Rio Arriba Counties. Gas wells were completed in Dakota, Gallup, Mesaverde, and Union Texas Petroleum also have significant lease holdings and have drilled wells within the New Mexico part of the San Juan Basin. Four representative wells (10-13) are shown on Fig. 1 (Gorman and Robeck, 1946; Fig. 1, letter C); approximately 153,000 tons of tar sands were quarried from the Santa Rosa Formation near the town of Santa Rosa in Guadalupe County (Gorman and Robeck, 1946; Fig. 1, letter C); the tar sands were used for road-surfacing material in New Mexico and neighboring states.

In the Raton Basin, Pennzoil embarked on a pilot drilling program to test and evaluate coal-bed methane reservoirs in the Vermejo Formation (Cretaceous). Pennzoil drilled 24 exploration and development wells in the New Mexico part of the basin. Four representative wells (10-13) are shown on Fig. 1 and discussed in Table 1. Depth to production varies from approximately 1,500 ft to approximately 2,500 ft and is dependent on structural elevation of the Vermejo Formation. Fifteen of the wells have been producing since October, 1989 with promising results (Johnson, 1990). If the pilot program is successful, more than 100 wells may be drilled. Factors favoring the coal-bed methane play are the federal gas-production tax credit for coal-bed methane wells drilled prior to 1991, the shallow depth of the wells, and a lack of engineering problems encountered while drilling the wells (Johnson, 1990).

Exploratory interest was sustained in the Estancia Basin of Torrance County. Plans were announced to drill the Lyle Benz No. 2 Benz (27) in the central part of the basin. That well is scheduled to be drilled to a total depth of 1,400 ft and will test the Abo Formation (Permian).

Exploratory activity was quiet elsewhere in New Mexico. Plans were canceled to drill the Leonard Minerals No. 1 Taos Trough Unit

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**TABLE 3—Significant wildcat wells that were being drilled, not completed, “tighf,” or planned in New Mexico at the end of 1989. (owwo, old well worked over).**

<table>
<thead>
<tr>
<th>Number on Fig. 1</th>
<th>Location (section-township-range, county)</th>
<th>Operator, well number, and lease</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>35-24N-14E, Taos</td>
<td>Leonard Minerals No. 1 Taos Trough Unit</td>
<td>Location abandoned. Was to have tested possible overthrust.</td>
</tr>
<tr>
<td>25</td>
<td>4-2S-28E, De Baca</td>
<td>Jaguar Energy No. 1 Colter Federal</td>
<td>Location staked. Scheduled to drill to 7,200 ft to test Montoya (Orudovician).</td>
</tr>
<tr>
<td>27</td>
<td>18-5N-9E, Torrance</td>
<td>Lyle Benz No. 2 Benz</td>
<td>Scheduled to drill to 1,400 ft to test Abo (Permian).</td>
</tr>
<tr>
<td>28</td>
<td>18-9N-18W, McKinley</td>
<td>Fossil Fuels No. 2 Zuni Tribal</td>
<td>Scheduled to drill to total depth of 2,500 ft in Yeso (Permian).</td>
</tr>
<tr>
<td>29</td>
<td>2-30N-3E, Rio Arriba</td>
<td>Heyse Oil No. 2 Rio Chama</td>
<td>Scheduled to drill to 2,000 ft to test Dakota (Cretaceous).</td>
</tr>
<tr>
<td>30</td>
<td>19-31N-3E, Rio Arriba</td>
<td>Spur Oil No. 1 South</td>
<td>Location staked. Scheduled to drill to 1,000 ft to test Entrada (Jurassic).</td>
</tr>
<tr>
<td>33</td>
<td>21-31N-18W, San Juan</td>
<td>Chuska Energy No. 1 Chimney Rock</td>
<td>Scheduled to drill to 8,500 ft to test Paleozoics.</td>
</tr>
</tbody>
</table>

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well (24) in Taos County. That well would have been drilled into a postulated overthrust in the Sangre de Cristo Mountains. For the first time in several years, no wells were drilled in the Tucumcari Basin during 1989. Interest has continued in the basin, however. Ownership of wells in the Newkirk oil pool was transferred from DRC Petroleum to Enercap Corporation in early 1990.

Southwest New Mexico

Four petroleum exploration wells (20–23) were drilled in southwest New Mexico during 1989. Those wells were drilled in the Baca Basin of Catron County, the Jornada del Muerto of eastern Socorro County, the Pedregosa Basin of Hidalgo County, and northwestern Luna County.

The Hunt Oil Company No. 1–16 State (20; Fig. 2) was drilled in the Baca Basin. The well was drilled to a total depth of 6,890 ft in the Abo Formation (Permian) and abandoned with no reported shows. Primary reservoir targets were carbonates in the San Andres Formation (Permian) and carbonates and sandstones in the Yeso Formation (Permian). The Hunt well is the fourth to be drilled in the Baca Basin since 1987. The other three wells were drilled during 1987 and 1988 by a consortium of Shell, BP Exploration (formerly Sohio and Standard Oil), and Elf Aquitaine with Shell as the operator (Broadhead, 1988, 1989). All three wells were abandoned, but gas shows had been reported from the Yeso Formation in the Shell No. 1 SWEPI et al. State located in sec. 2, T4S, R13W, Catron County. The consortium of Shell, BP Exploration, and Elf Aquitaine formed a federal exploration unit known as the “Magic Area” in northern Catron and western Socorro Counties. The exploration unit covers approximately 3.5 million acres. Extensive seismic-reflection surveys were conducted by the consortium in this area.

In eastern Socorro County at the northern end of the Jornada del Muerto, the James K. Anderson No. 1 Wishbone Federal (21; Fig. 3) was drilled on the Prairie Springs anticline. The well was spudded in limestones of the San Andres Formation (Permian) and reached a total depth of 4,989 ft in the Sandia Formation (Pennsylvanian). The well was scheduled to be drilled to a total depth of 4,000 ft in Precambrian basement; however, the Pennsylvanian section was thicker than expected, so Precambrian is at a greater depth than expected. Drilling was complicated by lost circulation. Small, noncommercial gas shows were reportedly encountered in the Pennsylvanian (James K. Anderson, personal communication 1990).

The XTER, Inc. No. 1 Santa Maria DB R&R (22) was drilled in northern Luna County. The well was drilled to a total depth of 1,150 ft in alluvium (Tertiary). No shows were reported. Water-bearing sands were encountered throughout most of the well.

The Arthur B. Ramsey No. 1 Ramsey 25 State Unit (23) was drilled in east-central Hidalgo County. The well was drilled to a total depth of 1,854 ft. Strata at total depth were reported to be Permian. Slight, noncommercial shows of hydrocarbons were reportedly encountered.

Oil and gas production

In 1988, New Mexico was the seventh largest producer of crude oil and the fourth largest producer of natural gas in the United States (Energy Information Administration, 1989). Production of crude oil and lease condensate in New Mexico in 1989 was approximately 67.9 million bbls, a decrease of 4.7% from the 71.2 million bbls produced in 1988 (New Mexico Oil Conservation Division data). Production of natural gas in 1989 was approximately 838 billion ft³ (BCF), an increase of 7.3% from the 781 BCF produced in 1988. In 1988, 90% of the state’s oil and 53% of the state’s gas were produced from the Permian Basin and adjoining areas of southeast New Mexico; 10% of the state’s oil and 47% of the state’s gas were produced from the San Juan Basin of northwest New Mexico. As of December 31, 1988, New Mexico had proved crude oil reserves of 661 million bbls, an increase of 7 million bbls from December 31, 1987 (Energy Information Administration, 1989); the Permian Basin contains 94% of the state’s proved oil reserves and the San Juan Basin contains 6% of the state’s proved oil reserves. Additionally, New Mexico had reserves of 97 million bbls of lease condensate as of December 31, 1988 (Energy Information Administration, 1989); 75% of the state’s condensate reserves are in the San Juan Basin and 25% of the state’s condensate reserves are in the Permian Basin. As of December 31, 1988, New Mexico had proved natural gas reserves of 18.5 trillion ft³ (TCF), an in-
crease of 5.9 TCF from December 31, 1987 (Energy Information Administration, 1989); the San Juan Basin contains 93% of the state's gas reserves and the Permian Basin contains 17% of the state's gas reserves.

The decrease in oil production in 1989 can be traced to the steep decline in the price of crude oil during the first half of 1986 (Fig. 4). The posted price of west Texas intermediate crude oil with a gravity of 40° API (the "benchmark" crude oil of the United States) fell 55% from $27.25/bbl in January 1986 to $12.25/bbl in July 1986. The price subsequently rose to $20.00/bbl in August 1987 and then fell to $13.75/bbl in November 1988. Since the end of 1988, posted prices for west Texas intermediate crude have risen to more than $20.00/bbl during early 1990 when this article was written.

The sharp fall in oil prices at the beginning of 1986 was due to a sudden rise in oil production by several major producing countries (notably Great Britain and Latin American and Middle Eastern countries) in an effort to increase income from oil revenues. The rise in oil production created an oversupply of oil and caused prices to plummet. A gradual reduction of world petroleum stocks, rising worldwide demand, and partially successful attempts by OPEC nations to reinstate production ceilings caused a subsequent gradual, albeit unsteady, price increase. The decrease in price at the end of 1988 was caused by rising worldwide oil production.

Declining oil prices have resulted in a decrease in drilling and exploration activity, which is reflected in the rig count for the state (Fig. 4). As a result of the decreased drilling, oil reserves were not discovered and developed as quickly as in the past. Therefore, new oil reserves were not brought into production at a rate sufficient to offset depletion of existing reserves. The inevitable result was decreased production.

Because of a decrease in oil prices, many marginal and stripper wells were shut in or plugged. Their production may never be regained unless oil prices increase sufficiently to justify the expense of re-opening such wells. Stripper wells are defined as wells that produce less than 10 bbls per day. Approximately 22% of oil production in New Mexico is from stripper wells. Reserves of crude oil that are producible from stripper wells are 98.5 million bbls (Interstate Oil Compact Commission, 1989), approximately 15% of total proved oil reserves in New Mexico.

The U.S. Department of Energy (Energy Information Administration, 1989) estimated that proved oil reserves increased by 7 million bbls from 1987 to 1988. However, discoveries of new fields resulted in only 1 million bbls of additional reserves and discoveries of new reservoirs in existing fields resulted in only 5 million bbls of additional reserves; 15 million bbls of reserves were added by extension of existing fields. These 21 million bbls of reserve additions fell short of production during 1988 by 43 million bbls. The calculated 7-million-bbls increase in reserves was caused by revision of reserve calculations in known fields. These revisions resulted partially from infill drilling programs. The increase of 7 million bbls did not result from discovery of new hydrocarbons.

Despite the decreased rig count and discovery rate, continued oil discoveries in the Permian and San Juan Basins, as well as positive signs and hydrocarbon shows encountered in wildcat wells drilled in the frontier areas, will encourage exploratory drilling and development. However, the number of active rotary rigs in New Mexico is tied to the price of oil (Fig. 4). Gradual declines in future reserves and production will probably be arrested only if oil prices rise enough to increase substantially the number of active rigs. Oil prices must not only rise, but must also stabilize if an increase in the rig count is to occur. Indeed, a decline in volatility of oil prices may affect exploration and drilling as much, or more than, an increase in prices alone. Although prices rose fairly steadily in 1989, the rig count remained low. The low rig count resulted from wary investors who were discouraged by price decreases in the last half of 1988. However, oil prices appear to have stabilized somewhat since the beginning of 1989 and the rig count appears to have increased since late 1989. Barring any drastic price reductions in 1990, drilling rates should increase. However, the rate almost certainly will still be lower than the levels needed to prevent further production declines, unless a major discovery is made. Grant and Foster (1989) discussed the geology of areas in New Mexico that may contain undiscovered oil and gas resources.

The increase in gas production in 1989 was caused primarily by an increased demand for gas. Primary markets for New Mexico gas are in California and these markets developed an increased demand in the last half of the year. The California gas markets continue to face stiff competition from alternate energy sources including fuel oil and hydroelectric power, but the demand for gas in California is expected to grow, possibly by as much as 38% by the year 2000 (Oil and Gas Journal, 1989c). Competition from fuel oil will decrease if the price of crude oil stays relatively high; also, natural gas may replace fuel oil in many of the markets because it is a more environmentally desirable fuel. Strong competition will continue to come from imported Canadian gas and gas produced in the "overthrust belt" of Wyoming; additional pipelines will be built to carry that gas to the California marketplace.

Coal-bed methane production in the San Juan Basin will increase despite competition from other energy sources. New pipelines are under construction in New Mexico and western Colorado that will allow producers access to markets in California, the Gulf Coast, the Midwest, and the Pacific Northwest (Oil and Gas Journal, 1990c, d); these alternative marketplaces will give producers more flexibility than they presently have. In addition, Mojave Pipeline Co. will construct a new pipeline in southern California to gain access to San Juan Basin coal-bed methane through existing El Paso and Transwestern pipelines in northern Arizona and New Mexico (Oil and Gas Journal, 1990b). The Mojave pipeline will transport gas to the heavy-oil fields of central California where it will be used in thermal-enhanced oil recovery. The pipeline is expected to be completed by early 1992. The markets for coal-bed methane made available by the new pipelines should help...
provide a good long-term outlook for gas production in New Mexico and hopefully will provide incentive for additional exploration and development.

Gas production in the state will also be helped by exploration for, and development of, coal-bed methane in the Raton Basin. Current pipeline capacity and gas markets in the basin are relatively small and are unable to support a large increase in production. It appears, however, that adequate pipelines will be constructed if sufficient production is developed to support them (Johnson, 1990). Some of the coal basins may have access to markets in the Midwest.

The calculated increase in gas reserves in 1988 (Energy Information Administration, 1989) was caused by addition of coal-bed methane reserves. Coal-bed methane had not been considered in previous reserve estimates.

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