



Telephone: (212) 867-0052

Petroleum Industry Research Foundation, Inc.

122 EAST 42nd STREET

New York, N. Y. 10168

EXPLORATION ACTIVITIES OF
MAJOR OIL COMPANIES

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This paper analyzes the exploration activities of a group of large integrated petroleum companies and examines their role in the domestic effort to find oil and gas.* The reason for our analysis is that in energy policy debates involving regulation or taxation of the petroleum producing industry, there is often a distinction drawn between the "Majors" and the "Independents." The latter operate entirely or primarily in the producing segment and are usually substantially smaller than the integrated Majors. It should be noted that the distinction between a "Major" and an "Independent" is not clear-cut. Different criteria have been applied for differing policies and regulations. The Department of Energy's now-defunct crude oil allocation program defined 15 companies as "majors" based on their level of integration and refinery capacity. By contrast, the Internal Revenue Service regulations implementing the Crude Oil Windfall Profits Tax Act have the effect of classifying companies with any downstream integration as non-independents, thus subjecting their oil production to higher tax rates. Similarly, the depletion allowance is available only to producing companies with no forward integration.

The Petroleum Industry Research Foundation has prepared several earlier studies on the same subject. In contrast to these studies, this paper uses information from annual reports (as opposed to the direct questionnaires used formerly), discusses a slightly different group of companies, and utilizes

* These data were initially compiled for and presented on May 6, 1983 to the Subcommittee on Oversight of the Committee on Ways and Means of the U.S. House of Representatives.

some data adjustments not formerly introduced. The broad conclusions of the analysis are not changed by these differences.

The data presented here cover costs incurred in oil and gas producing activities (for the sample companies only), and drilling activities and proven reserves data of the sample companies as well as the U. S. industry as a whole. As in earlier reports, we find that the large integrated companies drill a small share of the wells and find a much larger share of the reserve additions due to drilling. In 1980 and 1981, for instance, the large companies drilled 10-15% of the exploratory wells and found over 45% of the oil and gas reserve additions due to drilling (after apportionment of royalty reserves to the finder).

The 23 major companies for which we have assembled the pertinent information for 1980 through 1982 reported net reserves equal to 57% of total U.S. oil and gas reserves (on a BTU equivalent basis) at the beginning of 1982 and net production equal to about half of total U.S. oil and gas production last year. (Appendix A lists the companies.) Gross production of these companies is about 16-17% larger than their reported net figures, since the net data exclude the shares of the royalty owners on whose land or offshore shelf the reserves are located. With the addition of the royalty volumes we find that operationally these 23 companies accounted for about 62% of U.S. production last year and held two-thirds of U. S. reserves. The balance of U.S. oil and gas reserves is held and produced by independent producers and smaller integrated companies, with the

independents accounting for a large majority in this group. Altogether, there may be some 18,000 U.S. oil and gas producers, according to the U.S. Census Bureau. In 1981, 200 of them (including the 23 Majors in our group) accounted for about 90% of total U.S. production.

In the 3-year period 1980-82 the 23 Majors experienced a small but steady decline in both oil and gas reserves, as the following table shows. No industry data are available for year-end 1982 reserves, but from 1979 to 1981 total industry reserves remained approximately unchanged. Thus, the relative position of the Majors in U.S. oil and gas reserves declined slightly. At year-end 1982 their oil reserves (crude and NGL's) were equal to 10 times their annual production which is in line with the industry's reserve/production ratio. For natural gas the Majors' reserve/production ratio was about 13, compared to the industry's ratio of about 12. However, the gas reserves include some 26 TCF of natural gas in Northern Alaska, all of which are held by companies in the Major group and none of which will have a market outlet in the foreseeable future. If we eliminate the Northern Alaskan gas reserves from our totals, the reserve/production ratios of the Majors and the industry as a whole are close, just under 10.

An important reason for the relative decline in the Majors' share of the reserves is the substantial upward revisions in previously discovered reserves (including improved recovery) made by the rest of the industry. In the two-year period, 1980-1981, the industry as a whole revised oil reserves upward by 3.35 billion bbls or 1.8 times as much as the 23 Majors and gas

TABLE 1

CHANGES IN PROVEN U.S. RESERVES OF OIL AND GAS, 1980-1982

(See note for units of measure)

	23 Major Companies			U.S. Total		
	Petroleum Liquids	Natural Gas	Total	Petroleum Liquids	Natural Gas	Total
Reserves as of December 31, 1979	23,195	112,272	42,552	36,425	200,997	71,080
Changes during 1980:						
Revisions	416	(767)	284	NA	NA	NA
Improved Recovery	438	94	454	NA	NA	NA
Subtotal	854	(673)	738	1,993	1,049	2,174
Extensions, Discoveries, Other Additions	620	5,776	1,615	1,449	14,473	3,944
Net Purchases/(Sales)	159	661	273	NA	NA	NA
Production	(2,148)	(9,507)	(3,787)	(3,706)	(18,699)	(6,930)
Reserves as of December 31, 1980	22,679	108,530	41,391	36,533	199,021	70,847
Changes during 1981:						
Revisions	354	1,246	569	NA	NA	NA
Improved Recovery	356	102	374	NA	NA	NA
Subtotal	710	1,348	943	1,357	2,599	1,805
Extensions, Discoveries, Other Additions	701	6,482	1,819	1,925	17,220	4,894
Net Purchases/(Sales)	21	202	56	NA	NA	NA
Production	(2,097)	(9,140)	(3,673)	(3,690)	(18,737)	(6,921)
Reserves as of December 31, 1981	22,015	107,421	40,536	36,494	201,730	71,275
Changes during 1982:						
Revisions	271	1,032	449	-----Data for 1982		
Improved Recovery	266	67	278			
Subtotal	537	1,099	727	Not Available-----		
Extensions, Discoveries, Other Additions	675	5,242	1,579			
Net Purchases/(Sales)	(10)	(36)	(16)			
Production	(2,073)	(8,200)	(3,487)			
Reserves as of December 31, 1982	21,145	105,526	39,339			

Note: Units of measure: Petroleum Liquids in millions of barrels; natural gas in billions of cubic feet; total (petroleum liquids+natural gas) in millions of barrels of oil equivalent (natural gas at 5.8 MCF/Bbl).

U.S. total reserves do not add because Department of Energy's balancing item, "Corrections and Adjustments," is not shown here.

Sources: Annual reports and Form 10-K of 23 large integrated companies, a list of which is attached as Appendix A; U.S. Department of Energy, Energy Information Administration, "U.S. Crude Oil, Natural Gas and Natural Gas Liquids Reserves: 1981 Annual Report," DOE/EIA-0216 (81), August 1982.

reserves upward by 3.65 TCF, or 4.6 times as much as the 23 Majors. (The Majors' volumes are adjusted to include the consequent revisions to their royalty reserves.) Revisions of reserves can be either positive or negative; in 1980 the net gas revisions for the Majors were in fact substantially negative. They represent corrections for previous over-estimates or under-estimates of reported proven reserves and, where applicable, improved recovery projects and techniques. They result from re-examination of existing geological and engineering information or from new information provided through the drilling of development wells. The indicated large upward revisions of existing reserves by the non-Majors suggest that this group of companies has continued to concentrate its efforts in the traditional producing regions which apparently still contain substantial undeveloped oil deposits in known areas. The Majors' oil and gas reserves declined by another 4% and 1.8% respectively in 1982. Total U.S. reserve changes for 1982 are not yet available.

Exploration expenditures of the 23 companies (exclusive of property acquisition) rose by 38% in 1981 and 2.4% in 1982 to \$10.2 billion. Development expenditures (also excluding property acquisition) showed a similar pattern: a 42% increase in 1981 to \$13.8 billion and virtually no further increase in 1982 (see table on page 6). In viewing the levelling off of exploration and development expenditures in 1982 it should be noted that the entire drilling sector of the U.S. oil industry experienced a significant cost deflation last year compared to 1981.

Expenditure data for the industry as a whole are not easily obtainable, and comparability among sources is a continuing problem. Thus, we do not compare the 23-company expenditure totals with any industry-wide figures, and caution against such comparisons. The information cited here has been reported by each of the companies in their annual reports as "Costs Incurred" in oil and gas production activities, and include both capitalized and expensed items. Because expenditures may precede well completion and reserve addition by substantial periods of time, these costs cannot appropriately be related on a year-to-year or short-term basis to reserve addition or drilling activity data.

TABLE 2

COSTS INCURRED BY 23 MAJOR COMPANIES IN U.S. OIL
AND GAS PRODUCING ACTIVITIES (CAPITALIZED AND
EXPENSED), 1980-1982

(Million Dollars)

	1980	1981	1982
Property Acquisition	8,508	8,062	5,449
Exploration	7,184	9,914	10,154
Development	9,688	13,803	13,877

Source: Annual Reports of 23 large integrated companies, a list of which is attached as Appendix A.

The fact that the proved reserves of the largest, financially strongest and technically most sophisticated oil companies have continued to decline despite the incentives of relatively high resource prices and a ready market for all domestic oil (though not all domestic gas) is evidence of our continuing resource depletion. So is the fact that without the upward "paper" revisions of previously discovered reserves, total U.S. oil and gas reserves would have declined in 1980 and 1981 instead of remaining flat for oil and rising marginally for gas.

The measure of success of the petroleum producing industry's exploration effort is the "Additions to Reserves" which are the new reserves found each year and added to existing reserves. These represent the results of the industry's exploration activities, from initial geological surveys to the completion and testing of wells. The table on the following page shows the additions to reserves for the 23 Majors and for the industry as a whole. As shown in their annual reports--that is, excluding the reserves of royalty owners--the Majors accounted for 41% and 37% respectively of total combined additions to oil and gas reserves from drilling in 1980 and 1981. However, these figures understate the true result of their effort, since they found of course also the reserves belonging to their royalty holders. By adjusting for this understatement we find that the 23 companies accounted for 48% and 43% respectively of total combined additions to U.S. oil and gas reserves in the two years under discussion.

TABLE 3

ADDITIONS TO PROVEN U.S. RESERVES OF OIL AND GAS FROM EXPLORATORY DRILLING, 1980-1982

(See Note for Units of Measure)

	1980			1981			1982		
	Petroleum		Total	Petroleum		Total	Petroleum		Total
	Liquids	Natural Gas		Liquids	Natural Gas		Liquids	Natural Gas	
<u>23 Major Companies</u>									
As booked	620	5,776	1,615	701	6,482	1,819	675	5,242	1,579
Adjusted for Royalties	723	6,741	1,885	818	7,564	2,123	788	6,117	1,843
<u>U.S. Total</u>	1,449	14,473	3,944	1,925	17,220	4,894	NA	NA	NA
<u>23 Major Companies'</u>									
<u>Share of U.S. Total (%)</u>									
As booked	43	41	41	36	38	37	NA	NA	NA
Adjusted for Royalties	50	47	48	42	44	43			

Note: Units of measure: Petroleum liquids in millions of barrels; natural gas in billions of cubic feet; total (petroleum liquids + natural gas) in millions of barrels of oil equivalent (natural gas at 5.8 MCF/Bbl).

"23 Major Companies, as booked" are the reserve additions as shown by the companies in their annual reports to shareholders and thus exclude the reserves attributed to royalty owners; "Adjusted for royalties" credits the companies with the finding of these royalty reserves, at an assumed royalty share of 1/7.

Sources: Annual reports and Form 10-K of 23 large integrated companies, a list of which is attached as Appendix A; for U.S. Total, U.S. Department of Energy, op. cit.

The sharp reduction in reserve additions by the Majors shown for 1982 was concentrated mainly in the gas sector and may to some extent have reflected the substantial volume of shut-in gas producing capacity which may have acted as a temporary disincentive to gas exploration.

To put the additions to oil and gas reserves into their proper perspective we must determine the effort that went into finding them and the success of this effort. As we have said, the reserve additions under discussion here are the result of exploratory drilling. In the last three years the 23 Majors in our group drilled an annual average of 2,241 exploratory wells. The volume of oil found per exploratory well by the Majors is substantially higher than that for the industry as a whole. These 23 companies found their 48% and 43% share of total new U.S. reserves in 1980 and 1981 by drilling only 10-15% of all U.S. exploratory wells.* Their discovery volume per exploration well was therefore nearly three times as high as that of the industry as a whole: 870,000 bbls of oil equivalent for the Majors vs. 326,000 bbls for the entire industry. Our earlier study reflected similar differences in finding rates per well.

It should be pointed out that the definition of exploratory wells is sometimes interpreted differently by companies reporting under S.E.C. regulations (such as the 23 Majors in their annual reports) than under the industry's voluntary reports to the American Association of Petroleum Geologists and the American

* The lower share is based on the Census Bureau's "Annual Survey of Oil and Gas," the higher on the American Petroleum Institute-American Association of Petroleum Geologists drilling statistics. The differences between these sources are discussed more fully in an Appendix to our 1982 report.

TABLE 4

DRILLING ACTIVITY IN THE U.S., 1980-1982

(Number of Wells Completed)

	1980		1981		1982	
	<u>Productive</u>	<u>Total</u>	<u>Productive</u>	<u>Total</u>	<u>Productive</u>	<u>Total</u>
<u>23 Major Companies</u>						
Exploratory	1,059	2,069	1,224	2,500	1,046	2,155
Development	6,416	6,859	7,586	8,097	6,659	7,230
Total	7,475	8,927	8,809	10,597	7,705	9,385
<u>U.S. Total, as reported to the</u>						
<u>American Petroleum Institute</u>						
Exploratory	3,574	11,916	4,585	15,168	4,847	16,470
Development	39,182	48,929	50,980	63,370	55,404	69,330
Total	42,756	60,845	55,565	78,538	59,251	85,800
<u>Success Rate on All Wells</u>						
<u>(Total Productive Wells as a</u>						
<u>% of All Wells)</u>						
23 Major Companies	84		83		82	
U.S. Total	70		71		69	

Sources: Annual reports or Form 10-K of 23 large integrated companies a list of which appears as Appendix A; American Petroleum Institute, Quarterly Review of Drilling Statistics for the United States. Classification between exploratory and development wells may differ for these two sets of data.

Petroleum Institute. If, however, the reserves additions of the Majors and the industry as a whole are each related to the total number of wells drilled (thereby eliminating any classification differences between exploratory and development wells), the finding rate of the Majors in 1980 and 1981 would still have been about three times that of the industry. Further, reserves may not be proved until a later period than the well completion is reported, and thus the finding rate calculated by a comparison of the two measures is not a precise or absolute yardstick. The trend, however, is undeniable.

TABLE 5

DOMESTIC RESERVE ADDITIONS PER WELL

(Thousands of Barrels of Oil Equivalent)

	1980	1981	1982
<u>Additions per Exploratory Well</u>			
23 Major Companies, Adjusted for Royalties	911	849	855
U.S. Total	331	323	NA
<u>Additions per Total Well</u>			
23 Major Companies, Adjusted for Royalties	211	200	196
U.S. Total	65	62	NA

Sources: Reserve Additions: See Table 3
Wells Completed: See Table 4

The reason for the consistently higher finding rate of the

Majors appears to be that they operate far more than the Independents in high cost, high risk and high reward areas such as Alaska, the Continental Shelf and the Western Overthrust Belt. They also generally drill deeper wells which increase costs exponentially. As we found in our earlier survey, in 1979 and 1980 the Majors' exploratory wells were 65% and 59% deeper than the industry average.

The higher cost of the wells drilled by the Majors cannot readily be computed from their annual reports since, as noted earlier, their reported exploration expenditures in a given year include components not related directly to their reported wells drilled in that year. However, the Census Bureau report shows that in 1981 drilling and equipping expenditure per exploratory well averaged \$711,000 for the industry but \$2.4 million for the 16 largest companies (most of which are presumably in our group of 23). While the difference in expenditure cannot be directly related to the earlier discussed difference in the finding rate, it is clear that the major oil companies spend substantially more money and find substantially more oil per well drilled than the rest of the industry. Their relatively small share in the total number of exploratory wells drilled must be viewed with these facts in mind.

Altogether then, it appears that the Major oil companies and the Independents perform somewhat different but complementary functions in finding and developing U.S. oil and gas reserves. The Majors, while active in all areas, are increasingly moving into the less accessible, unexplored parts of the Outer

Continental Shelf, in deeper and tighter reservoirs onshore in the lower 48 states and in the Arctic region. The capital and technical requirements to locate and develop these resources are generally beyond the capability of the Independents. The primary discovery function of the latter will remain the location of the remaining reservoirs in the historic on-shore and off-shore areas and the extension of existing reserves by improving their recovery rates. To arrest our continuing resource depletion will undoubtedly require maximum efforts by both groups.

APPENDIX A

LARGE INTEGRATED COMPANIES INCLUDED IN DATA FOR 23 MAJOR COMPANIES

Amerada Hess Corp.	Murphy Oil Corp.
Atlantic Richfield Co.	Pennzoil Co.
Champlin Petroleum Co.	Phillips Petroleum Co.
Cities Service Co.	Shell Oil Company
Coastal Corporation	Standard Oil Co. of California
Conoco Inc. (DuPont)	Standard Oil Co. (Indiana)
Diamond Shamrock Corp.	The Standard Oil Co. (Ohio)
Exxon Corp.	Sun Company
Getty Oil Co.	Tenneco Inc.
Gulf Oil Corp.	Texaco Inc.
Marathon Oil Co. (U.S.Steel)	Union Oil Co. of California
Mobil Corp.	