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The papers reproduced in this Journal were presented at the 1970 Annual Meeting of the Society of Petroleum Evaluation Engineers in Dallas on December 7, 1970. In addition, an informal paper was presented by Herbert F. Poyner, Jr., substituting for Frank E. McGonagill, Jr.
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McConagill, Frank E., Jr.
Moredock, S. Kenneth, Jr.
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Pressler, Edward Doerk
Sims, Henry L.
Taylor, George W.
Vance, Harold
Watson, Joseph P., Jr.
Zeil, Marvin C.

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Moore, J. Hiram
Phillips, Charles E.

Odessa
Jarrell, Malcolm

Richardson
Lowe, Howard R.

San Antonio
Schutz, Charles D.
Spice, William H., Jr.

Victoria
Hamel, Roger C., Jr.
Weatherly, Justin Eugene, Jr.

Wolfe City
Nichols, Earl A.

WASHINGTON, D. C.
Albares, Edward A.
Hamilton, C. E. (Mike)
"Evaluating Investment Merits of Drilling Programs"
by Fraizer M. Stewart

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THE PRESIDENT'S PAGE

Your Society continues to serve you, as in the past, by providing a forum and a "coming together" whereby we who specialize in petroleum evaluation engineering can recognize the talents and experience of each other--thereby elevating the stature of our profession.

Our pressing problem is to gain recognition in financial circles, so as to cause groups and individuals who have need of our expertise to call upon the membership for consultation. No less important is the need to call to the attention of senior management that SPEE members in their employ possess a special talent which can be used to the advantage of their company.

This year, the annual meeting papers are being published at greatly reduced costs. Should you require extra copies for your own further distribution, contact the Secretary, who will assist you as long as the supply lasts.

One of the real delights in serving as President of your Society is to be able to observe the willing, effective cooperation of the officers and members as the work of the Society goes forward. For all the help from each of you, I offer public thanks.

John Ray Brack
MEMBER QUALIFICATIONS

Any person with a bachelor's or advanced degree in engineering or geology, duly licensed by his state as a professional engineer or geologist and ten year's experience in the evaluation of oil and gas properties may qualify to become a member. In the event his state has no professional engineering or geological license laws, the person shall be able to meet the requirements for a license in either of these categories in another state having such laws. Also, a person may substitute five years' responsible petroleum engineering experience or teaching of the subject in a college or university of recognized standing for five years' experience in the evaluation of oil and gas properties.

HISTORY

There has long been a need for a Society which would bring together for their mutual benefit the specialists in petroleum evaluation engineering. Realizing this need, Harold Vance, William Hurst and H. F. Poyner, Jr. secured a charter from the State of Texas for such a Society which is known as "The Society of Petroleum Evaluation Engineers." The number of the charter setting up such a corporation is No. 187252 and was issued by the Secretary of the State of Texas on September 24, 1962.

This corporation was chartered under the Texas Non-Profit Corporation Act and its period of duration is perpetual. The corporation was organized exclusively for educational purposes and to promote the profession of petroleum evaluation engineering, to foster the spirit of scientific research among its members, and to disseminate facts pertaining to petroleum evaluation engineering among its members and the public.

The various, technical associations, such as the American Institute of Mining, Metallurgical, and Petroleum Engineers, the American Association of Petroleum Geologists, and even the requirements of our engineering laws, provide no measure of the experience and ability of an individual in petroleum evaluation. Therefore, a need for this specialized Society is self-evident.
"Sitting Ducks: Many physicians prove to be inept in investment matters," says a recent article in the Wall Street Journal (August 17, 1970). It goes on to cite examples of poor investments they have made in real estate, tax shelter schemes, business ventures, commodities, and common stocks. An official of the S.E.C. says doctors are invariably among the victims of stock fraud cases and they are particularly prone to making bad investments in schemes offering tax shelter. Their penchant for bad investments is not surprising. It arises generally from two companion factors: high income and long busy workdays. According to an official of the American Medical Association, doctors average about $32,000 a year, with incomes of $100,000 from lucrative big city practices not uncommon. After long days at their practice, and time for family and social life, most doctors have little time left to study investments.

Although the comments above were made about physicians, they apply equally well to dentists, other professional people, and business executives who work long hours and have high incomes. An investment area where they frequently bungle is tax shelter schemes. Many are "snowed" or dazzled by glowing statements from oil drilling program representatives about deductibility, tax savings, leverage of investment dollars, and the prospect of multiple return. They get so carried away with this sort of appeal that study of the prospectus, inherent risk, and intrinsic value of the investment are overlooked.

Oil and gas drilling programs are now offered publicly by over 150 different companies. Of the $1.70 billion total for programs filed with the S.E.C. in '69, approximately $50 billion was sold. There are no figures as to what part of this was bought by doctors, dentists, and others in the professions, but several program sponsors contacted on this point said it was about half.

What are Drilling Programs?

An oil drilling program is a joint venture or partnership formed by a management company (sponsor) for a joint effort with investors in the exploration, drilling and development of oil and gas. Also called oil drilling or exploration funds, the word "program" is preferred to "fund" to avoid possible confusion with mutual funds, which invest in ordinary securities. As a rule, prospects to be drilled are not specifically defined at the time the program is formed. The management company furnishes the organization and know-how; investors supply all or most of the capital. Costs and revenues are allocated between management and investors according to a specified sharing arrangement.

The first phase is for the sponsor to form the program vehicle and register the program with the S.E.C. for public offering. The sponsor, whose function is to manage program activities, may be an oil operator or a managing agent. On receiving registration clearance, participation units in the program are offered and sold to investors. Next, program funds are invested in line with program objectives. Subsequently, results are reported to investors, including drilling activity reports during the development phase; year-end financial statements for income tax reporting; and periodic statements of reserves, cash liquidation value, etc., as specified. Finally, investors receive credit for oil and gas sold, are charged with expenses, and the difference, net operating income, is credited or distributed periodically per the program agreement.

At some future time, investors may be offered an opportunity to sell their interests for cash or exchange them for stock, or the program may be dissolved and its assets distributed.

Securities as defined in the Securities Act of 1933 include fractional interests in oil and gas rights, and participations in joint ventures, limited partnerships, and other groups organized for the acquisition and development of oil and gas properties. Offers and sales of such securities to the public must be registered under appropriate federal and state laws unless otherwise exempted. Offering prospectuses of drilling programs follow a special
format designed to provide consistent and thorough disclosure.

Types of Drilling Programs

Oil drilling programs are complex and there are numerous differences between programs. First there are several legal forms of program organization, but most are either joint ventures or limited partnerships.

In the joint venture the investor is literally a co-venturer with the sponsor in the ownership, development and operation of program properties. The operator manages the program under a contract agreement. The investor as a co-owner is exposed to personal liability from operations, but is normally protected by insurance. He may transfer, sell, or pledge his interest subject to restrictions in the agreement.

The limited partnership is formed with the sponsor as general partner and investors as limited partners. An investor’s liability is limited to his capital contributions. Tax rules permit pass through to the limited partners of intangible deductions, depletion, depreciation, and operating and other expenses on the one hand, and revenue from oil and gas sales on the other. Limited partners have no voice in management of the business. There is little liquidity or transferability of interests and no access to net operating income except as provided in the agreement. Of 101 programs studied by the Resource Programs Institute, Inc., earlier this year, about two-thirds were limited partnerships and one-third were joint ventures.

Programs also differ as to their objective or planned utilization of funds. Programs may do exploratory (wildcat) drilling; development drilling on proved or semi-proved properties; production producing properties; conduct secondary or thermal oil recovery operations; or do a combination of these.

Exploration oriented programs are relatively high risk. Their concept is that relatively low cost dollars provided by tax savings incentives should be used for exploration in the hope of finding large reserves yielding a high return. However, successful wells have to pay for dry holes; consequently, return to investors on any one program can vary from nothing to several fold.

The concept of development programs is that the tax-savings leverage makes it feasible to drill close-in proved and semi-proved locations with the expectation of only a modest return, apart from tax effects, and relatively low risk of capital.

Many investors seek primarily a tax shelter with relatively low risk, and to them development programs make sense. Others like the attraction of greater possible return offered by exploratory programs, even though this means greater risk. Still others prefer a balanced program having some exploration but enough development drilling or property purchases to lower the risk and provide prospect of payout even if exploration be unsuccessful. Of the 101 programs in our study, 41 were exploration oriented (70 per cent or more of funds slated for exploration); 17 were development; and 41 were balanced between exploration, development and property purchases.

Sharing Arrangements and Management Compensation

Another important area where programs differ is the sharing arrangement, the allocation of costs and revenue between program management and investors. Management compensation always includes an interest in the oil and gas properties or revenue developed by the program. This interest is partly or entirely "carried" (financed) by the investors. Sharing arrangements may be classified as follows according to the extent of carry:

**Full Carry:** Investors pay all exploration and development costs, both tangible and intangibles. (Sponsor may pay lease acquisition costs, sales commissions, etc.)

**Functional Carry:** Investors pay all non-capital costs, i.e. intangible drilling and dry hole costs. Sponsor pays all capital costs, i.e., equipment and lease acquisition costs for productive leases.

**Exploration Carry:** Investors pay all exploration costs; development costs are shared between investors and sponsor.

**Casing Point Carry:** Investors pay all costs except completion costs, which are shared.

**Disproportionate Carry:** Investors and sponsor share all costs.

The principal form of management compensation is an interest in the properties explored and developed by the program as provided by the sharing arrangement. This interest may be an overriding royalty interest, working interest, reversionary working interest, net operating profits interest, net profits interest, or percent of cash liquidating value. (For definitions see RPI's Glossary of Oil Terms for Investors.) Management also receives one or more of the
following other forms of compensation:
- Management Fee - a front-end charge, being a percentage of either capital contributions or intangible drilling and exploration costs as incurred. The fee ranges from 0 to 15 percent, averaging about 10 percent. Organization and offering expenses, sales commissions, and or overhead costs may be paid by the sponsor or charged to the program. Management may realize a profit to the extent the fee exceeds such costs absorbed.
- Sales of oil and gas leases or properties to the program.
- Rental or sale of tangible equipment to the program.
- Charges for technical services.
- Retention of dry hole or bottom hole contributions.
- Charge for reinvestment of operating income in subsequent programs.
- Monthly supervision charge for each drilling and or producing well.
- Allocated district and overhead costs.
- Turnkey arrangements, under which all work and materials as specified for drilling a well or installing a project are furnished for a stipulated amount.

Appeal of Programs to Investors

The attraction of drilling programs for investors are several:
(1) Shelter of income from taxation.
(2) Leverage of investment through income tax savings.
(3) Glamour of oil drilling; cocktail éclat.
(4) Gambling urge; the hope of a big discovery.
(5) "Paper profits" from exchange of program interests for stock.

The basic and most important factor to the investor is the option to treat intangible drilling costs as an expense for income tax purposes. Such costs may be used to offset income from other sources. Intangibles include practically all exploratory, drilling and completion costs except lease acquisition costs and costs of tangible equipment having salvage value. The drilling program investor is able to leverage his investment to the extent of his income tax savings. Such savings depend on (1) deductibility, i.e., the percentage of capital contributions that are deductible for income tax purposes, and (2) the tax bracket of the income sheltered. Deductibility for various programs varies from 60 to 100 percent. The leverage afforded by tax savings is illustrated by Table 1 which gives the net after-tax or "hard-dollar" cost for each dollar invested.

If the program develops oil and gas production, investors get additional tax benefits from the depletion allowance. Presuming the investor expenses intangibles on his tax report, he has little cost basis left for tax purposes in his producing properties and would therefore take percentage depletion, which is 22 percent of gross revenue, limited to 50 percent of net operating income. Equipment costs are capitalized and recovered through depreciation.

Other features of drilling programs include assessments, if any, in order to maintain position in the program; provision for liquidity of the investment, either to sell at the "cash liquidating value" over the shorter term, or to exchange interests for common stock over the longer term; provision for loans to investors using program interests as collateral; the furnishing of equipment (which must be capitalized) by the sponsor for an interest in the program or on lease to the program.

Suitability of Programs as an Investment

A potential investor should first consider whether a drilling program investment is suitable for him. Recognizing that such investments are considered risky, the potential investor should review his financial situation to determine whether adequate provision has been made for future financial needs, such as home equity and mortgage, insurance, a liquid reserve including savings, adequate securities portfolio, business requirements, miscellaneous debt, etc. Until such prior items have been funded, income should be devoted to strengthening the financial picture.

If the provisions for future financial needs are judged sufficient, then a drilling program investment may be considered if (a) the level of current income is ample enough to cover living expenses and maintain living standards, with allowance for future financial needs, taxes, and a safe margin for contingencies; (b) income will be stable for the next several years, or if it fluctuates the low year of the cycle should be the basis; and (c) income to be sheltered is in a high tax bracket; i.e., over 50 percent. Ignoring these guidelines is a mistake that usually leads to financial problems.

Evaluation of Program Features and Management

Evaluation of a particular drilling program as
a potential investment involves a study of three basic areas: structure and features of the program, program management, and the results of prior programs.

Most commonly, investment counselors study and compare programs on the basis of program structure factors directly affecting potential economic return. An attempt is made to compute and compare the net effect of these factors. Of course, the actual or probable results of drilling itself would have to be added to complete a more meaningful study.

As a first step, the fraction of the investor’s dollar that will be used for acquisition, exploration and development of oil and gas properties is estimated. This is often called the fraction of the dollar "that goes into the ground". It is the part of the dollar left after deducting front-end costs charged to investors. In many cases this still doesn’t give a true picture of "money going into the ground". There may be "hidden costs", such as mark-ups on turnkey drilling arrangements and drilling prospects; reimbursement of organization, offering and overhead expense; fractional interests in oil and gas properties retained by or assigned to third parties; and excessive profits on equipment sold or leased to the program.

Next, sharing arrangement, deductibility and income taxes are taken into account. The object is to estimate the investor’s share of each revenue dollar per dollar invested, after taxes. This part of the analysis requires some assumptions, is difficult to make and is too complex to use for all but the most sophisticated.

Miscellaneous program features include diversification, deductibility, liability, assessability, liquidity, equipment leasing, and loans to participants. These along with possible conflicts of interest should be reviewed to determine whether desired features are included.

In evaluating management the important thing is whether they have found and produced oil and gas profitably, and next whether they have conducted program operations of the type and magnitude being undertaken. The operator should not only be experienced in oil and gas operations but have a good reputation among both the oil industry and the financial community.

**Evaluation of Prior Programs**

Most important is the study of the results of prior programs to determine how investors have fared in the past. The preference is to obtain a reasonable estimate of the ultimate future net revenue returned to the investor for each dollar invested; or better yet, the net revenue year by year so that the discounted present worth both before and after taxes may be computed. However, this requires an estimate of reserves and a forecast of future revenue and expense. Such estimates usually are not available to investors.

Programs can be analyzed extensively from the standpoint of potential economic return based on program structure factors as discussed above. The various economic structure factors do affect what the investor ends up with. But it’s similar to analyzing a large corporation as an investment based on overhead, management and other fixed costs. Although such charges may be large, they include incentives to management which may have an important impact on earnings. The drilling program business is no different in this respect.

The performance of previous programs, particularly those of a similar size, structure, and objective, are a better guide to the probable success of a sponsor’s new program than the economic structure factors. It’s the operator’s ability to find, develop and produce oil and gas profitably that actually pays off the investor. No one year’s results, whether good or bad, may be indicative of the operator’s capability; three years or more are more meaningful. Similarly, programs of recent years are more significant than older programs. Just as a single past program may not represent the average of past programs, prior programs may not be a reliable guide to results for any one future program. Nevertheless, performance of previous programs is generally the best lead to forecasting results of future programs.

Sources of information on the performance of prior drilling programs are limited. Prospective investors generally have just two sources: prospectuses on new programs being offered and sales talk and literature from program representatives. The prospectus gives important factual data on prior programs. On the other hand, it is generally imprudent to take as reliable and complete the presentations of sales personnel on performance of their own programs. Those who have previously invested in drilling programs get periodic reports on those programs containing data on gross and net revenue. In some cases they may also receive estimates of reserves, future net revenue and cash liquidating value prepared by or for the sponsor.
Determining Program Pay-Out Status

The latest drilling program prospectus contains data as of a certain date on the sponsor's prior programs. This is in table form and includes the following applicable to investors:

1. Cumulative capital contributions, i.e., cash subscriptions and assessments.
2. Cumulative expenditures, including operating as well as exploratory and drilling costs.
3. Cumulative receipts, i.e., gross revenue from sales of oil and gas, before deducting operating expenses.
4. Cumulative net cash receipts, i.e., operating income paid or credited to investors, being gross revenue from sales of oil and gas less operating expenses.
5. Receipts (gross revenue) last 3 months.
6. Net cash receipts (operating income) last 3 months.
7. Number of oil wells, gas wells, and dry holes completed.

Dividing cumulative net cash receipts by capital contributions gives the fraction of each dollar invested that has been recouped so far. In percent, this is the percent pay-out to date. Net cash receipts last 3 months gives an idea of the current rate at which the investment is being returned.

Table 2 captioned 'Prior Activities' from a recent prospectus is used as an example. From this information Table 3 is computed.

As can be seen, one can get a fair idea of the better programs compared to the poor from this type of analysis. However, serious qualifications apply. It is not reasonable to assume that operating income will continue at the current rate indefinitely. Reserves of oil and gas under a particular set of properties are depleted (exhausted) gradually by production, and the rate of production must inevitably decline until abandonment. The average life of oil and gas properties from time of discovery to abandonment is about 20 years, but varies from less than a year to perhaps 40 or so. There is the assumption, too, that the last 3 months as reported are representative. This may not be so; the yearly rate may turn out to be higher or lower for numerous reasons -- all wells may not be connected to a pipeline for production; some new wells produce at a high flush production rate when newly completed, but decline rapidly after a few months; some unusual expenditure may be included in operating expenses; etc.

The statistics on oil wells, gas wells, and dry holes are informative but may be misleading. Some completed wells never return the cost of drilling. This can occur for example when management has erroneously over estimated the oil and gas reserves of an area. Consequently, an investor who is unsophisticated in oil and gas should place little weight on well statistics alone.

Projecting Program Payout

Information as to the status of payout and rate of income at a particular time is contained in each prospectus. Therefore, by getting such data from several prospectuses filed over successive years, a table and graph of progressive payout and income with time may be prepared. This however takes a great deal of work and know-how. The trend of payout vs. time for each program may be projected. However, several years production history is usually needed before extrapolation to complete payout can be reasonably made. If a trend is apparent, such projections are usually "in the ball park" and much more accurate than the single point analysis derived from one prospectus. Not only can years to payout (if it will occur) be determined, but the order of magnitude of the overall return to the investor can be approximated.

As mentioned before, obtaining and interpreting such data is costly and tedious. The author's firm has assembled performance data and plotted payout graphs on all programs. These are reproduced in Profile, a continuing study of drilling programs, available on a yearly subscription basis.

Suppose you are an investor in a particular drilling program and want to know just how you are doing. Generally, the investor gets periodic (monthly or quarterly) "run statements". If not, he at least gets an annual financial statement for preparing his tax report. The run statements accompany checks in payment for oil and gas produced and sold. Operating expenses and production taxes are usually deducted by the program operator, so that the check is for the net value or operating income to the investor's interest. Specific information on the run statement includes: gross value, the dollar amount of oil and gas sold during the period for account of the program; net value, the net operating income to the program after deducting operating expenses, production taxes, etc; and net value due the investor, which is program net value multiplied by the investor's decimal ownership.
Such information received monthly, quarterly, or annually can be tabulated. Gross revenue and net operating revenue can be plotted versus time. Net revenue to the investor can be accumulated and also plotted versus time. With sufficient history, the trend of this latter line may be projected to predict whether payout will be reached and when. Generally, two or three years history is needed to provide a trend which can be projected reasonably well. From such a trend, it should be evident whether the investor is apt to get his capital back, get it back and quite a bit more, or get only a fraction of it back. Of course, the investor, or his accountant, knows what his original income tax savings were, so return on after-tax dollars can also be gauged. This type analysis is something that any investor or his advisor can do if run statements and financial statements received from time to time are saved.

Program Appraisals

Another type analysis of program performance is from an actual appraisal of program properties. Investors may receive one or more of the following:

1. Estimate of reserves;
2. Estimate of future net revenue (FNR);
3. Estimate of present worth of FNR discounted at a specified interest rate;
4. Cash liquidating or redemption value (CLV); or
5. Appraisal containing the first three.

These estimates may be prepared by the company's own staff, by others drilling or operating properties for the sponsor, or by an independent consultant. The source of the estimate is very important. Obviously, estimates prepared by capable technical personnel of proven ability who are free from pressure and prejudice are much preferred. It is hardly prudent for an investor, unknowledgeable in petroleum property evaluation, to depend to any great extent on estimates prepared by personnel directly or indirectly connected with the sponsoring company. Unbiased estimates prepared by an independent petroleum consulting firm with a good reputation are much preferred.

A word of caution: even if estimates are prepared by an outside consultant, it makes a great difference whether or not that consultant has a staff of proven ability with a reputation for reliability and integrity.

Estimates of reserves on individual properties made by several different evaluators frequently do not closely agree, i.e., within a few per cent. Reserves are difficult to estimate with accuracy in the early history of a "tight" reservoir, and it is not unusual for estimates to be off 50 per cent or more. With time and the availability of production history, the range of estimates should narrow. After several years history, it would be expected that estimates by competent consultants would be within about 15 percent of each other, particularly if several fields were included.

The preceding paragraph applies really to proved reserves. In the case of a new discovery, where only the discovery well and perhaps an offset have been drilled, there may be little idea as to how large the field may turn out to be. If proved undeveloped and semi-proved or probable reserves are to be included in the estimates, they may be off even more.

Another word of caution: neither future net revenue nor the present worth of FNR discounted at a bank rate of interest is synonymous with fair market value or cash liquidating value. This should be obvious. No one, for example, would expect to pay 100 percent of the future projected operating income for a manufacturing plant.

There is much uncertainty on the part of investors and securities houses as to the profitability of programs to investors. R.P.I. has analyzed the past performance of most public drilling programs. As might be expected, the results of some programs are reasonably good, some mediocre, and some poor. A pre-tax return (net operating income ultimately returned to the investor divided by paid-in capital) of 1.0 to 2.0 is considered acceptable. After taking into account tax effects, the return for that range is more on the order of 1.25 to 3.5, assuming deductibility of 80 per cent or more and a tax bracket of 50 percent or higher.

Conclusions

Before investing in drilling programs, prospective investors should review their financial status, future financial needs, income level and tax bracket to determine their suitability for a high risk investment. Assuming suitability tests are passed, the prospective investor must select from the numerous programs available. Busy professional people and executives have little time to analyze such an investment themselves, and unfortunately there are as yet very few investment advisors who are really knowledgeable in this area.

Analysts usually resort to a review of manag-
ment and study of program structure factors to determine the portion of the investor’s dollar that goes “into the ground”. This, however, is hardly adequate. A better guide is how investors fared in prior programs. In this respect an investor would do well to insist on having the factual data reported in the prospectuses and in audited year-end statements on the program, and if available, reserve reports by independent reliable consultants. Analysis of such data may be somewhat complex, but “why fly partly blind”. Even then, a favorable return to investors on prior programs is no assurance that future programs will do well.

### TABLE 1

Percent Out-of-Pocket Cost of a Drilling Program Participation
(Original Investment Less Tax Savings)/Original Investment).

<table>
<thead>
<tr>
<th>Deductibility:</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investor’s Tax Bracket</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50%</td>
<td>70</td>
<td>65</td>
<td>60</td>
<td>55</td>
<td>50</td>
</tr>
<tr>
<td>60%</td>
<td>64</td>
<td>58</td>
<td>52</td>
<td>46</td>
<td>40</td>
</tr>
<tr>
<td>70%</td>
<td>58</td>
<td>51</td>
<td>44</td>
<td>36</td>
<td>30</td>
</tr>
</tbody>
</table>

### TABLE 3

<table>
<thead>
<tr>
<th>Program</th>
<th>Payout as of 6/30/70</th>
<th>Rate of Payout based on last three months</th>
<th>Years for Payout at Current Rate Approximate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968-1</td>
<td>13%</td>
<td>5% per year</td>
<td>21 years</td>
</tr>
<tr>
<td>1968-2</td>
<td>14%</td>
<td>7% per year</td>
<td>14 years</td>
</tr>
<tr>
<td>1969-1</td>
<td>12%</td>
<td>12% per year</td>
<td>9 years</td>
</tr>
<tr>
<td>1969-2</td>
<td>12%</td>
<td>31% per year</td>
<td>4 years</td>
</tr>
<tr>
<td>1969-3</td>
<td>6%</td>
<td>170% per year</td>
<td>1 year</td>
</tr>
</tbody>
</table>
## TABLE 2

### PRIOR ACTIVITIES

Information concerning prior experience cannot be considered indicative of the results to be expected under the present drilling program. However, for purpose of presentation of these experiences, the following is provided as to the results of such investor-financed operations:

### PAYOUT TABLE

**As of June 30, 1970**

<table>
<thead>
<tr>
<th>Program</th>
<th>Investor Expenditures, Including Operating Costs</th>
<th>Investor Receipts(1)</th>
<th>Sponsor Expenditures, Including Operating Costs(2)</th>
<th>Sponsor Receipts(1)</th>
<th>Capital Costs As % of Inv. Expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968 - I</td>
<td>$365,922</td>
<td>$68,768 $6,590</td>
<td>$111,113</td>
<td>$26,451 $2,689</td>
<td>32.13</td>
</tr>
<tr>
<td>1968 - II</td>
<td>719,119</td>
<td>132,674 17,415</td>
<td>54,590</td>
<td>21,193 2,788</td>
<td>23.75</td>
</tr>
<tr>
<td>1969 - I</td>
<td>495,713</td>
<td>76,028 22,716</td>
<td>137,728</td>
<td>23,346 6,916</td>
<td>30.84</td>
</tr>
<tr>
<td>1969 - II</td>
<td>336,376</td>
<td>47,897 29,871</td>
<td>57,905</td>
<td>11,224 6,477</td>
<td>32.43</td>
</tr>
<tr>
<td>1969 - III</td>
<td>52,139</td>
<td>33,960 24,375</td>
<td>1,544</td>
<td>2,123 1,523</td>
<td>36.00</td>
</tr>
</tbody>
</table>

### INVESTOR NET CASH TABLE

**As of June 30, 1970**

<table>
<thead>
<tr>
<th>Program</th>
<th>Cash Subscribed and Assessed</th>
<th>Net Cash Receipts</th>
<th>Net Cash Received Last 3 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968 - I</td>
<td>$350,861</td>
<td>$46,359</td>
<td>$3,908</td>
</tr>
<tr>
<td>1968 - II</td>
<td>694,232</td>
<td>96,076</td>
<td>11,981</td>
</tr>
<tr>
<td>1969 - I</td>
<td>500,129</td>
<td>57,820</td>
<td>15,260</td>
</tr>
<tr>
<td>1969 - II</td>
<td>331,706</td>
<td>38,658</td>
<td>25,446</td>
</tr>
<tr>
<td>1969 - III</td>
<td>51,200</td>
<td>30,154</td>
<td>21,623</td>
</tr>
</tbody>
</table>

### WELL STATISTICS

**Exploratory Wells**

**As of June 30, 1970**

<table>
<thead>
<tr>
<th>Program</th>
<th>Gross Wells (2)</th>
<th>% Productive</th>
<th>Net Wells (3)</th>
<th>% Productive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oil</td>
<td>Gas</td>
<td>Dry</td>
<td></td>
</tr>
<tr>
<td>1968 - I</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>37.5</td>
</tr>
<tr>
<td>1968 - II</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>50.0</td>
</tr>
<tr>
<td>1969 - I</td>
<td>3</td>
<td>0</td>
<td>5</td>
<td>37.5</td>
</tr>
<tr>
<td>1969 - II</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>1969 - III</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

**Development Wells**

**As of June 30, 1970**

<table>
<thead>
<tr>
<th>Program</th>
<th>Gross Wells (2)</th>
<th>% Productive</th>
<th>Net Wells (3)</th>
<th>% Productive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oil</td>
<td>Gas</td>
<td>Dry</td>
<td></td>
</tr>
<tr>
<td>1968 - I</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>1968 - II</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>1969 - I</td>
<td>19</td>
<td>0</td>
<td>1</td>
<td>95.0</td>
</tr>
<tr>
<td>1969 - II</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>1969 - III</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

(1) Before deducting Operating Costs, which are included in the Expenditure columns.
(2) A "gross well" is one in which any leasehold interest is owned.
(3) A "net well" equals the actual leasehold interest owned in one gross well divided by one hundred.

Example: A 30% leasehold interest in a well is one gross well but .30 net well.
As a matter of policy, the Securities and Exchange Commission disclaims responsibility for any private statements by any of its employees. The views expressed herein are those of the speaker and do not necessarily reflect the views of the Commission or of the speaker's colleagues on the staff of the Commission.

The Structure of the Securities and Exchange Commission

The Exchange Act of 1934 created and established the Securities and Exchange Commission. The Commission, as now organized, is divided into three principal divisions. The Division of Trading and Markets conducts much of the investigative and enforcement work for the Commission, has regulatory responsibility with respect to stock exchanges, administers the registration requirements of investment advisors and broker-dealers, and exercises surveillance over them. Registrations under the Public Utility Holding Company Act of 1935 and the Investment Company Act of 1940 are administered by the Division of Corporate Regulation, which also partially administers the Investment Advisers Act of 1940. All registrations of public offerings, reports, and proxy material under the Securities Act of 1933 and the Securities Exchange Act of 1934 (except with respect to registered investment companies), are reviewed by the Division of Corporation Finance, the largest division of the Commission. This Division is subdivided into 15 branches, each with a Branch Chief and its own group of analysts, attorneys, and accountants. An Assistant Director supervises each group of three branches. The Office of Engineering, composed of three sections, Oil and Gas, Mining, and Valuation, is attached to this Division.

At the present time registration statements, reports, and proxy material required under the 1933 and 1934 Acts are filed with the Division of Corporation Finance. After fees have been paid, and a filing has been accepted, it is assigned to a Branch. When received in the Branch, it is assigned to an analyst or attorney for examination and review. If the filing pertains to oil and gas, a copy is sent to the Securities and Exchange Commission for examination and review. Such filings may provide for an offering of stock, bonds, debentures, warrants, units of participation in drilling programs, or fractional undivided interests in oil and gas rights, or they may involve mergers, proxies, partnership interests, investment contracts, or exchange offers.

Application of the Securities Act of 1933

The term "security" is considered by the average person to mean stocks, bonds, warrants, debentures, notes, or evidences of indebtedness. The 1933 Act not only includes such terms in its definitions of a security, but also considers certificates of interest, participations in any profit-sharing arrangement, fractional undivided interests in oil, gas, or other mineral rights, investment contracts, participations in joint ventures, and limited partnership interests, to be securities. The Act also includes other less common securities in its definition.

The offer and sale of securities by use of the United States mail, or by use of any means or instruments of transportation or communication in interstate commerce, come under the jurisdiction of the 1933 Act.

A registration statement, including the familiar prospectus which is to be provided to the prospective investor, becomes a public document when filed. However, no sale of the involved security may be made until the statement has become effective.

The Securities Act, enacted as Federal law in 1933, provides for full and fair disclosure of all material information about any security offered to the public, and by such provision attempts to eliminate any misrepresentation or fraud connected with its offer and sale.

The purpose of registration is to provide the prospective investor with a prospectus which discloses or sets forth the important facts about the security and the company offering the security. In this way the prospective investor can make a realistic appraisal of the merits of the security or securities being offered and can exercise an informed investment decision.
If proper disclosure is made, and the rules of registration have been followed, the Securities and Exchange Commission cannot deny registration or otherwise bar the public offer and sale of a security, whether or not the price or other terms of the security are fair, or the issuing company offers a reasonable possibility of success for the security investment.

The registration of any security does not protect any investor from loss of the price he pays for the security. Nor does the Securities and Exchange Commission either approve or disapprove a security for merit or for lack of merit. The Commission has no power to do so, and it is unlawful to represent otherwise in the sale of any security.

On the other hand, the Commission does have authority to refuse or suspend the effectiveness of any registration statement, if it finds that the material statements made are misleading, inaccurate, or incomplete, or that material information has been omitted from the prospectus.

The accuracy of the information provided about a security is not guaranteed by registration, nor does the effectiveness of the registration statement mean that the Commission has approved the disclosure provided, or passed upon the merits of the security in any manner.

If a purchaser of a security suffers a loss, and if he can prove that the purchase was made upon information which included incomplete or inaccurate material statements, or failed to include material facts, the Act provides him with a legal recourse for recovery of his investment. Likewise, the purchaser of an unregistered security, not subject to an available exemption, is provided with a civil remedy for the return of the amount of his purchase.

The 1933 Act provides for certain exemptions from the registration requirements for the offer and sale of a security.

An exemption from registration means that the issuing company does not have to meet the formal requirements for the filing or registration statements, and is not subject to all of the civil obligations and liabilities of the Securities Act of 1933. However, it should be emphasized that the issuing company who may qualify for an exemption cannot ignore the Act, or the Commission. The terms and conditions which must be met in qualifying for certain exemptions, such as provided for mainly under Regulations A and B, may require the filing of certain information with the Commission and the subjection of such security offers and sales to the requirements of the Act.

Role of the Section of Oil and Gas

One of the responsibilities of the Section of Oil and Gas is the examination and review of registration statements and other filings which pertain to oil and gas. Usually, this review is focused on the business and property sections of the prospectus, but occasionally involves the consideration of information provided in other parts of the prospectus which have a
bearing on the business and properties disclosure. Oil and gas program filings, as well as those types of exchange offers which involve oil and gas property interests, are reviewed in their entirety. However, the Branch to which a filing is assigned not only is in charge of it, but also provides a full and specific review.

All filings made under Regulation B are recorded and reviewed only by the Section of Oil and Gas. At the present time such filings are related chiefly to single well promotions. Although Regulation A offers are filed with and reviewed by the Regional offices, such filings are also reviewed by the Oil and Gas Section if they involve oil and gas activities of any consequence.

Another responsibility of the Section of Oil and Gas is to review all estimates of reserves placed in registration statements and other filings made with the Commission. This entails, of course, a review of the estimates made by the engineer, including his decline curves, production data, volumetric calculations, maps, and other data, so that the staff can obtain some idea as to the reasonableness of the reserve figures set forth in the prospectus.

The Oil and Gas Section is also involved in those investigations where oil and gas securities and activities are concerned. Whenever and wherever there is a need for oil and gas expertise, the Section may be required to provide help. This type of involvement may range from investigations about stop orders, suspensions, sales literature, and stock market problems, to help with civil and criminal actions.

Members of the Oil and Gas staff may also appear as expert witnesses, give testimony in affidavit form, or may advise with the Commission attorneys in the examination of witnesses or in the taking of depositions and preparation of briefs on matters pertaining to oil and gas.

In effect, the staff of the Section of Oil and Gas serve as advisers to the staff of the Commission, including the Regional and Branch offices, on all matters pertaining to oil and gas.

Role of the Evaluation Engineer

The petroleum evaluation engineer has a heavy role in the making of reserve studies, preparing reserve estimates, making oil and gas property appraisals and valuations, and other associated studies and reports. Adequate consideration is required of the engineer as to the information and problems associated with these studies and reports.

The engineer also has the responsibility for providing his client advice and guidance in the field of reserve estimates and the evaluation of oil and gas properties. Such advice and guidance may be associated with the acquisition of working capital, or with the purchase or sale of properties, either directly or through the purchase or sale of a company, or with mergers and trades, or with the financing of such activities, through loans, production payments, or similar arrangements. This advice and guidance also involves consulting with his client about any problems encountered and considered, as well as any problems indicated for the future.

The evaluation engineer may serve as an expert witness, or may advise with the attorneys of his client in the examination of witnesses, or may give testimony in affidavit form, or may provide his expertise in other related legal matters.

The engineer's role may also involve his expertise in the field of public financing through the registration of equity and debt securities for offer and sale to the public, or it may involve the exchange of such a security for producing property interests. If his client is considering a public financing, or is in the process of issuing securities, the engineer should be able to advise as to the materiality of the problems encountered in his field of expertise. It is not enough for the engineer to have an expertise as to oil and gas production, the estimation of reserves, appraisals, present worth, and fair market value of properties. He also should be knowledgeable enough about the securities laws to advise any client who may be a registrant, or the registrant's attorney, or accountant, as to those problems which are concerned with the reserves and the property and business interests involved in any public offering, or which may be associated with press releases, and other similar activities.

The evaluation engineer not only should be aware that he has a public responsibility connected with any estimation of reserves, or any appraisal, to be used in a security offering, but that he definitely has a role under the law for the protection of the public interest. It would appear that this role, both directly and indirectly, is the heaviest of the responsibilities to be borne by the engineer.

Relation of the Evaluation Engineer to the Securities and Exchange Commission
The evaluation engineer, who prepares reserve estimates and other data which are to be included in registration statements or other filings with the Securities and Exchange Commission, should be aware of his responsibilities under the Act, and should demonstrate a willingness and ability to accept such responsibility. Furthermore, the engineer should be willing and able to make evident the reliability of his information and his reliability as a trained and professional engineer. The engineer must be held accountable for his information and work, for the advice he provides, and for his expertise, and must bear the same liability under the law as any other professional involved in the preparation of a registration statement. In this connection, the engineer should be aware of Section 11 (a) (4) of the Securities Act of 1933, which provides that:

"In case any part of the registration statement, when such part became effective, contained an untrue statement of a material fact or omitted to state a material fact required to be stated there in or necessary to make the statements there in not misleading, any person acquiring such security (unless it is proved that at the time of such acquisition he knew of such untruth or omission) may, either at law or in equity, in any court of competent jurisdiction, sue...every accountant, engineer, or appraiser, or any person whose profession gives authority to a statement made by him, who has with his consent been named as having prepared or certified any part of the registration statement, or as having prepared or certified any report or valuation which is used in connection with the registration statement, with respect to the statement in such registration statement, report, or valuation, which purports to have been prepared or certified by him;..."

The engineer should also provide full cooperation to his client, the client’s attorneys and accountants, and to those members of the Commission staff who will review his work. But even though he has a responsibility to his client in regard to the work which he performs for that client’s the engineer also should bear in mind that he has a direct responsibility to the public and has a very definite role in the protection of the public interest.

In return, the engineer has the right to expect cooperation, courtesy, respect, fair treatment, and fair dealing in his relations with the Commission and its staff.

Reserves

Since the evaluation engineer usually is involved in the reserve estimates in registration statements, a few comments about reserves would appear appropriate.

The reserve terminology and the definitions for such terminology as developed by the American Petroleum Institute, and as used by industry, generally are followed by the Oil and Gas staff and serve as its guide. Likewise, the reserve terminology used in this paper follows the API standards.

Proved reserves, that is, the total amount of estimated net proved future recoverable reserves, expressed in barrels and in mcsf, are usually included in equity and debt filings, in proxy statements and mergers, in filings covering the purchase of property, in exchange offers, particularly those where property interests are exchanged for stock, and in other types of filings where it is necessary to have knowledge as to the amount of the estimated proved future recoverable reserves owned by a registrant. Such reserves are part of the property disclosure and are included for the sole purpose of describing the properties owned. No value is attached to such figures and no value should be included or indicated. Such reserves are not included in drilling program filings, because the securities offered do not include any estimated proved future recoverable reserves, nor are they now included in single well ventures under Regulation B, or S-10 filings, except where the offer and sale of the securities involves an interest in the reserves as part of the property description.

The future recoverable reserves to be included in a prospectus, or other type of filing, are limited to estimated proved reserves, either developed or undeveloped, net to the registrant interest.

The proved undeveloped reserve estimates usually include tested behind-the-pipe formations capable of production and/or offset locations to production. Usually the reserve estimates attributable to such tested formations and locations are reviewed by the Oil and Gas staff to determine the reasons for inclusion, and the reasonableness of the estimates made.

Future recoverable reserves not to be included in a prospectus are those commonly considered to be probable, those that are classified as possible, and those of a secondary recovery nature, where no response to secondary recovery operations has yet been experienced. Of course no reserve estimate should be included in a registration statement, or other filing, unless the security being offered will have a direct interest in or bearing on the
reserve property.

The Oil and Gas staff usually requires that certain types of supplemental information be provided to help them in their review of the property reserve estimates. Such information commonly includes decline curves, which should be plotted to the date of the reserve estimate, production data by months and years, together with cumulative figures, maps of the properties involved, and any other pertinent data used in making estimates. This information should be prepared in such a manner as to be readily understood. The detailed reserve estimates which are supplied for review usually are presented in report form or in person. The report can be sent in for study but should be so arranged that the facts concerning the property reserve estimates can be quickly reviewed. Sometimes it is helpful to have the engineer appear in person, not only for the purpose of presenting the information and the data necessary for the review, but to make himself available for any questions which the staff may have about the properties, or the methods used in making determinations of an unusual nature. This personal approach is helpful particularly for the review of volumetric calculations.

The responsibility of the engineer in all cases is to provide a clear presentation of the reserve study made, to provide to the staff adequate data upon which the reserve estimates are based, and also to indicate to the staff all problem areas, or areas in which problems may arise in the future. The engineer who makes the reserve study must bear this obligation and responsibility and should make available to the staff for their consideration his concern with any present problems, or any area of indicated future problems.

Suggested Form for Showing Data

The staff of the Oil and Gas Section not only is limited in size, and hardly sufficient for the tasks assigned, but has a definite limited time which it should spend on any one filing. Any help received for any review job is greatly appreciated. The supplemental information usually supplied as back-up material for reserves is about as varied as the engineers who prepare the material. Some of the material is easy to review and understand, some is so arranged as to defy understanding in any reasonable time. Hours and sometimes days are required to ferret out the information needed. We have never made any requirement as to a form for the presentation of data but have found from experience that certain arrangements of the information can speed up our review materially and contribute to a quicker comprehension of the material.

Based on this experience, we suggest that the engineer present his supplemental reserve information to us in the following tabular arrangement and form. Columnar sheets are satisfactory and either pencil or ink figures may be used.

Commencing at the left the columns should be headed as follows, and the appropriate information should be arranged under such columnar headings, or captions --

1. State; 2. County; 3. Field; 4. Lease; 5. Number of Wells (stated separately for oil and for gas); 6. Estimated Ultimate Recovery; 7. Gross Production, subdivided into sub-columns (a) Cumulative, (b) Last 12 Months, and (c) Last Month; 8. Gross Reserves, subdivided into sub-columns (a) Producing, (b) Behind Pipe, and (c) Undeveloped Locations; 9. Ratio of Reserves to Production (based on last month); 10. Net Interest; 11. Net Reserves, subdivided into sub-columns (a) Producing, (b) Behind Pipe, and (c) Undeveloped Locations. (Exhibit 1)

For any given lease, the oil production and oil reserves, expressed in barrels, can be stated on the first line, and the gas production and gas reserves, expressed in mcfs, can be stated on a line below. Where condensate is involved, appropriate information can be stated on the third line. If preferable, separate tabulations can be prepared for oil and for gas, with condensate appropriately disclosed with gas, or separately.

The dates should be stated for the reserve estimates as well as for the production provided.

The use of a form such as this would be of great benefit and greatly appreciated. We believe the engineer has the responsibility for the preparation of his data in a form that can be easily understood and quickly reviewed.

By now, you may suspect that we lean heavily on decline trends, and reserve-production ratios. We do to the extent that they are useful tools to point out problem areas, or unusual situations which may require more information, or a more complete understanding of the basis of the reserve estimates submitted, or even an adjustment in the estimate made.

Problems

It may be helpful for you to be aware of some of the problems concerning the estimation of reserves and their use in the registration of securities to be offered and sold to the public.

The use of estimated reserves for promotional purposes, that is, for the raising of public
money and the public financing of registrant activities and registrant projects, requires the exercise of extreme care. The engineer involved in reserve estimates for such purposes should be aware of the many possibilities of misleading the public through errors in calculations, errors in judgment, errors in methods, errors in usage, and in the fact that the estimated figures are not of themselves as accurate as the public usually is inclined to believe, and many times are less precise than the engineer would care to admit.

These possibilities for misleading the public alone offer sufficient reason for the restricted usage of reserve estimates. Such restriction also protects the engineer. As stated before, only proved developed and undeveloped reserve estimates can be used, and then only in the sense that they represent a description of the properties involved.

Too many engineers try to include probable reserves, and secondary reserves which have not yet responded to secondary operations. Other engineers are far too generous with the number of undeveloped locations they include as a proved reserve. Under such circumstances, the estimated reserves included in a prospectus, or submitted for inclusion, may contain about everything but the kitchen sink. The engineer presenting such a reserve estimate to the public should be aware of his own liability and responsibility under such circumstances.

The failure of engineers to properly characterize the type of reserve estimate included in public statements and releases can and sometimes does mislead the public. Qualifying statements to the client are not sufficient. The client must be warned that reserve estimates when publicly released must be characterized for what they are. Occasionally the Commission has had to take action to circumvent, as well as to discourage, the use of reserve estimates in public statements which were not properly qualified for public understanding. Engineers should be conversant with the Appellate Court decision in the Sun-Sunray merger case where an attempt was made to consider a probable reserve as a proved reserve and to force its inclusion in a prospectus. Engineers also should have understanding as to the principles underlying Securities Act Release #5016 concerning the publicity given to certain aspects of the petroleum discoveries on the North Slope of Alaska.

Serious consideration perhaps should be given to the inclusion of some kind of an economic factor in the definition of a proved reserve in order to protect the public interest.

The calculation of estimated future recoverable revenues is a projection of income, and as such is not to be included in a prospectus for public offerings. A projection of income from proved future recoverable reserves is fraught with many misleading possibilities to the public investor.

The term "value" should be used with extreme care and in its narrowest sense, when applied to reserves. The public, particularly, has little concept of the proper usage of the word when applied to reserves. Many professional people also are misled by it, and many times consider the term to be synonymous with "present worth". Engineers should exercise unusual care in its usage and should always advise others as to its proper usage.

Lately, reserve problems have arisen in the field of accounting. Research Study #11, recently published by the American Institute of Certified Public Accountants, Inc., on the extractive industries, among other recommendations for changes in the method of oil and gas accounting, has made a recommendation that reserve estimates and related data be included in the financial statements, at least as supplementary information for evaluation purposes. Serious consideration should be given by engineers to these recommendations because they may lead to certain pressures on evaluation engineers and engineering firms to certify in some manner to their reserve estimates.

Due to the many possibilities for error in an estimate and the unpredictability of old Mother Nature, the engineer who succumbs to such pressure may be involved in the serious situation of furnishing misleading statements to the public, with its resultant liability problem to him.

Also, unreliable or bad estimates can cause or lead to unreliable accounting results. Such estimates can cause earnings to be over or understated, which eventually will have to be retracted and rectified. Bad estimates, under such circumstances, can place management in a very unnecessary and uncomfortable position -- a position of liability brought about sometimes by pressure to satisfy that human emotion known as "pride of ownership".

The problem of protecting the public is never ended. It is hoped that this review of the mutual responsibilities of the Securities and Exchange Commission and the evaluation engineer will serve to coordinate our efforts in meeting our responsibilities.
EXHIBIT I
RESERVE TABULATION SHEET

<table>
<thead>
<tr>
<th>State</th>
<th>County</th>
<th>Field</th>
<th>Lease</th>
<th>Number of Wells</th>
<th>Estimated Ultimate Recovery</th>
<th>Cumulative Production Last 12 Mo.</th>
<th>Last Mo.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Oil Gas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>300,000 200,000 10,000</td>
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<tr>
<td>Texas</td>
<td>Lea</td>
<td>County</td>
<td>Hackberry Field Boxberger</td>
<td>3 - 2 2,000,000 M 400,000 M 20,000 M</td>
<td>100 C</td>
<td>-0-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20,000 C 5,000 C 100 C</td>
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RESERVE TABULATION SHEET (Cont’d)

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<tr>
<th>Gross Barrels or MCF</th>
<th>Reserve to Production Ratio</th>
<th>Net Barrels or MCF</th>
<th>Reserve to Production Ratio</th>
<th>Net Barrels or MCF</th>
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</thead>
<tbody>
<tr>
<td>Developed Producing</td>
<td>Developed Producing</td>
<td>Produced</td>
<td>Developed Producing</td>
<td>Produced</td>
</tr>
<tr>
<td>Reserves</td>
<td>Behind Pipe</td>
<td>Undeveloped</td>
<td>Behind Pipe</td>
<td>Undeveloped</td>
</tr>
<tr>
<td>100,000</td>
<td>13,600</td>
<td>25,000</td>
<td>111</td>
<td>0.65625</td>
</tr>
<tr>
<td>1,600,000 M</td>
<td>-0-</td>
<td>-0-</td>
<td>shut-in</td>
<td>1,050,000 M</td>
</tr>
<tr>
<td>15,000 C</td>
<td>-0-</td>
<td>-0-</td>
<td>shut-in</td>
<td>9,850 C</td>
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</table>

(Suggestions: Use suffix “M” to designate gas.
Use suffix “C” to designate condensate where shown separately.
This form, or, where more fitting, some similar form with appropriate and similar sub-divisions, can be used, provided that the information required by this form is included.)

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The amount of publicly offered Oil and Gas drilling programs has been growing by leaps and bounds over the past three years and new registrations in 1970 indicate that it will be a bigger year than the $1.7 billion registered in 1969. There has been increased emphasis by the oil operators offering these programs to register their programs early and shift money raising to the first half of the year, thereby providing more time for efficient spending of these funds in the last half. However, with the high number of registrations (many for the first time) the registration time is becoming longer and investors don't appear to be cooperating, since money raising is going very slow this year.

Selling these programs has undoubtedly been on an increase in the number of relationships between drilling program companies and prestigious investment banking firms to help place the program. However, failing to raise the expected amount of money in the first half may create the undesirable situation of high registrations in the last half to offset the shortfall. This would then force accelerated year-end drilling to spend the higher amounts of money in the 1970 tax year, under a "drill we must" atmosphere. This can cause lower quality prospects to be drilled, which is often to the detriment of both the oil operator and the investor. Although the 1969 Tax Act favors the oil investment over other tax sheltered investment, there are certain threats from various areas which may thwart the drilling program activities sufficiently to cause reduced investment in these programs in the future. These potential deterrents, which are all interrelated, are such things as, oil operator abuses of the procedure, further governmental regulations, Investor disenchantment, and possible tax revisions in the future that might adversely affect the tax advantages of this type of investment. The pattern for this hard money raising period seems to be that those companies with a "good track record" and an experienced in-house sales force or significant ties with investment banking firms with oil expertise are raising 50-75% of the total amount they registered. Repeat companies with a "reasonable track record" and limited or no in-house and/or external sales capability are raising 25 to 50 percent of their registered amount and many new companies with no sales ties are struggling to raise enough money to become effective. Some companies are reverting to small private placements while waiting for the situation to improve, and others who only made private placements in the past, are going the public offering route to avail themselves of a broader market.

Because of the high capital needs of the oil industry to finance future exploration and development to meet the projected demand, it is essential that this financing technique be preserved. The growth of this activity in this segment of the industry indicates the increased role that independent oil companies are playing in the development of oil and gas reserves; especially in the interior geologic basins neglected by the major oil companies. It also reveals that the companies' internal cash flow plus bank loans, if available, and publicly offered equity or debt/equity issues tend to fall short of providing sufficient capital to maintain the necessary level of exploration and development activity. Obviously the need for accelerated development of domestic reserves looms more and more important because of the deferred development of Alaskan North Slope oil reserves as well as some offshore U.S. reserves and the increasing uncertainty of the availability of foreign reserves.

To preserve this financing technique as an aid to the development of domestic reserves this type of investment must remain attractive to the Investor. Refinement and upgrading of the drilling program activity is needed as well as cooperative effort to bring about greater understanding between the drilling program companies, the government, professional money raisers, and the Investor.

The Oil Investment Institute, formed in 1969, is a trade association for Publicly offered drilling program companies, which has now established business standards and ethics as guidelines to help refine and upgrade the drilling program activity. We also collect and provide the facts to help bridge the educational gap. The permanent staff consists of an Executive Director with a background in the oil industry and in commercial banking, a General Counsel who is a recognized expert in the drilling program
field and a Washington Counsel who is former Chairman of the SEC. The OII has standing committees in the critical areas of business standards; governmental, public and investor relations; statistics, terminology and reporting; grievance and others. In the area of business standards the OII and other companies in the industry reached a consensus on business standards for drilling program companies and the OII adopted these standards in Washington, D.C. on October 16, 1970. To create a more meaningful prospectus the OII is working with the SEC on a revised registration statement for drilling programs. The OII's proposed revisions, which were recently submitted to the SEC, provides for additional disclosure by the companies about their programs to aid the Investor in analyzing and comparing programs.

Regarding regulation of drilling funds, SEC Chairman Hamer Budge testified in hearings before the House of Representatives that they would work with the drilling program industry to formulate a regulatory statute providing for further control of this activity. He named OII as the industry organization with which the SEC would work. Since the oil industry's complex business practices are not readily amenable to further existing regulation, such as the Investment Act of 1940, and the Investors interest are tied to certain advantages sought under the Internal Revenue code it was recognized that a potential conflict existed and additional study was needed to devise compatible regulations. A cooperative effort on this is already underway, as evidenced by Chairman Budge's statement that he was "appreciative of the work that the Oil Investment Institute is doing to help safeguard and protect the Investor in oil and gas drilling programs and the expression of willingness of the Institute to work with the Commission toward this end."

The Oil Investment Institute plans to work with financial institutions and where possible, offer educational seminars on the fundamentals of drilling programs to eliminate some of the confusion that exists regarding these programs. To fulfill their continued obligation to Investors after oil and gas is developed, drilling program companies are considering making periodic reports, which would contain an appraisal of the Investors interest made by competent independent consultants. Many companies do this for Investors now. Also better statistics are being developed that will give a more realistic representation of the overall activity. A typical example here is the confusion about the size of this industry; in 1969 there was a total of $1.7 billion of these programs registered, but because some were multi-year programs the amount of money intended to be raised was only slightly over $1 billion and the actual amount of money raised, based on the best estimates available, was on the order of $500 million or about 50% of the intended amount.

The drilling program activity has grown so large and its impact is so great that the amount of money raised and the timing under which it is raised is significantly effecting the economy of various midwestern oil producing states. It also influences the plans of service companies, and related businesses who serve the companies that offer drilling programs. In fact, it may be that some states, which are highly dependent on oil activity to maintain employment and personal income, would have to seek welfare "taxdollars" from the Federal Government if they lost the oil investment "tax dollars" from high tax bracket individuals as support for their major industry. More importantly, if this happened the people would only be maintained at a subsistence level and needed oil reserves would not get developed.

Money raising and oil finding are independent activities, but because they are interdependent in the drilling program business, a cooperative effort must be undertaken to aid the flow of private capital from the high tax bracket investor, who can take the risks, to the oil operator who is offering a tax sheltered investment in his drilling program. The critical need for this is referred to in the First National City Bank's July Energy Memo, which states that this financing technique is needed and that still further adaptive and innovative financing approaches will be required to ride through the present period of extreme financial stringency if a dangerous gap in supplies of energy and capital is to be avoided.

One requirement of the newly adopted guidelines for drilling fund companies is very relevant to the SPEE members. That is the requirement that qualified independent petroleum engineers should periodically appraise the producing properties so that the operator can report the value of reserves to the investor. Although Lawrence Muir with the SEC told you in his talk that the SEC would not allow reserves to be included in the drilling fund prospectuses, we believe it is essential that reserves be evaluated and reported to the investor after a sufficient period of production has elapsed (two years or more) as a part of the proper reporting to participants in drilling funds. We also believe the SEC should give consideration to allowing independently evaluated reserves to be included in drilling fund
prospectuses. This is the only way that the success of past programs can be adequately represented. I might add that we do recognize the potential for misrepresentation, but we feel that valid appraisals can be obtained from competent engineering consultants.

To insure that good appraisals are made by independent engineering consultants, the OII added an additional requirement to their guidelines in this area. That is that the engineering consultant firm not only be independent of the drilling program company, but also must be considered favorably by financial institutions for whom they have done work in the past. Where a consulting firm's work has been adjudged by banks, when reserves have been pledged as the only collateral on production payment loans, this has allowed a reliable list of consultants to be compiled by the financial institutions. Certainly the work of the SPEE to standardize as well as upgrade the calibre of work done by independent consultants is a significant contribution. I commend you on your effort in the SPEE and we would certainly be interested in the standards you advocate and in a list of the members of this organization.
COMPUTER TIME-SHARING AND THE PETROLEUM EVALUATION ENGINEER

by E. W. Schafer, Assistant Vice President and Petroleum Engineer
Bank of New York, New York, New York

Computer utilization, commonly referred to as time-sharing, is a logical outgrowth of the fact that present day computers have such large capacities and speeds that they are difficult to keep up with. Why not a method whereby many users are feeding data and problems to a central processor unit at the same time, each paying only for the amount of time he actually uses the facility. The comparison to an electric power utility or a gas company is obvious. Certain economies of scale are of benefit to all and like electric power it is there to use only as one needs it.

Briefly, a complete time-sharing system consists of a user's terminal, a phone line to a local vendor and a multiplexing system to field many calls at once to a buffer and a central processor unit, quite often in a distant city.

When I was asked to undertake this assignment, my first reaction was to feel that it would be very presumptuous of me to address this particular group on this subject. After all, consultants have been using computers in their evaluations for years. Discounted cash flow calculations by a computer are routine inclusions with almost every consultant's report. Also flash, material balance and gas solution drive calculations are especially suitable for solutions by computers.

Briefly, I was originally exposed to computers in a college course on Statistics. Prior to this I had long felt that they could be used economically by my predecessor company in the property acquisition field. However, not having an inhouse computer, I prevailed on them to let us experiment with time-share. Since most time-sharing vendors will give you a 30 day cancellable contract, and since the monthly fixed charges are quite low (about $200), they condescended to humor me.

What largely promoted me to accept the invitation to give this talk was the feeling that my own excursion into the realm of time-sharing was both satisfactory and profitable, and, as a result, I may have something of a message to pass on. So deciding I might have something to say, I started putting my thoughts down on

paper.

Concurrently I had just accepted my present position and had not as yet undertaken to set up any of my already developed programs at my new locale. Although a variety of terminals were available at the Bank, I was too busy orientating myself into the job to get right on it.

Of course, when I finally got down to modifying and mounting my programs, I had already been introduced to New York's Bell System. You may have heard that the use of this particular component of the Bell Telephone System in the normal course of business leaves much to be desired. Time-sharing being totally dependent on the existing phone system is very much at the mercy of the local conditions. "Dirty" lines result in garbled instructions to the computer, garbled output and frequent disconnections from the system. After a frustrating week of coping with this condition in the New York area, my first impulse was to call the Program Chairman and tell him the deal was off. I had just about decided time-sharing was completely unworkable, at least in the New York area. I will add, in fairness, that local power conditions and voltage cutbacks during hot weather were not helping the situation any.

However, I was assured that nowhere in the United States were conditions as worse as those which existed in lower Manhattan. In fact, many of the time-sharing vendors have finally given up and moved their multiplex terminals over into New Jersey. Direct trunk lines are then leased and made available to Manhattan users. It appears that this may solve quite a bit of the problem. I don't wish to belabor the point as to the situation in New York, but it does illustrate a very important thing -- the weakest link in the time-sharing system is the existing communications system.

As an aside, you probably are familiar with attempts made by certain computer companies and others to establish their own nation-wide communications systems. Also, experiments have successfully been concluded whereby instructions have been sent to the computer via satellite.

Let us then proceed under the assumption that the communications system will improve,
and time-sharing being a valid concept will demand clean lines and, therefore, workable conditions. In the Southwest where most of you live and work, the system is reasonably tolerable.

My message, which I shall attempt to persuade you to accept, is as follows:
1. Even though you have your own inhouse computers, you should investigate the use of time-sharing; and
2. Every petroleum evaluation engineer should become a programmer.

The advantage of 1. above is that the computer is there when you want it. A petroleum engineer's use of computers cannot be scheduled routinely like most uses of inhouse computers. It is usually very disruptive, and most inhouse computers operate on very tight schedules and on batch principles. This is especially true in banks. Almost every bank in the country now is geared to the use of electronic data processing, but, when departments such as oil and gas come to them and request use of them, they are usually told that they would prefer for the departments to use time-share. Their own computer people encourage time-share. They say it is cheaper than using their own computers and, of course, not disruptive.

Even though you disagree and feel you can legitimately use your own inhouse computer, the only realistic way to originally write and debug your programs is on time-share. Those of you who have ever programmed know that it is quite costly to develop and debug on inhouse computer facilities. It is very disruptive as much trial and error is frequently involved. Quite often the nonprofessional programmer will work on programs on an off-and-on basis, working it in with his other work. The time-share terminal is ready and waiting whenever the spirit moves.

Assuming the engineer concedes that computers would be useful in his business, the reasons why he should become a programmer are as follows: it is easier and faster for an engineer to become an accomplished programmer than to teach a programmer petroleum engineering. Besides, the programmer wants to be primarily a programmer. Presumably, if not, he would have learned something else. Teaching an engineer to program cuts out the middleman. This is not only more economical, but it obviously eliminates misunderstanding and problems of communications. Also, programming requires you to think through a problem methodically. Your own thought processes are examined in detail, and, quite often, solutions not readily apparent suddenly fall into place. You might argue that certain methods or techniques that the programmer-engineer uses might be more costly in central processor unit time than those employed by the expert programmer. In some cases I will concede this point, but all things considered, this is relatively minor.

Program modifications, both temporary and permanent, are more quickly and economically made. Many times a one-time modification to a program is necessary. The engineer-programmer can accomplish them on the spot and at the time-share terminal.

Before we go further, let's talk about some uses of time-share, assuming you are convinced that you should investigate the use. First, a terminal to suit your specific needs must be selected. Although certain brand names will be mentioned, it is not my intention to recommend any one brand, but in a broad sense to show what is available. It has not been intended that this would be all inclusive, but generally all available terminals will fall into one of these groups. The state of the art being what it is, I would expect much change and advancement in this area, though, in the next few years.

Initially, when time-share was marketed, the only terminal available was the conventional Teletype Models 33 and 35. You will note they have a punched tape capability, but the disadvantages of them are that they are slow and have a narrow width. Eventually IBM marketed the 2741 terminal. This was 50% faster than the teletype machine and had a wide carriage and featured the IBM ball head. They do not have tape input/output capabilities. However, there are various versions of the 2741 marketed by Datel and others that incorporate other features. The Datel people have recently marketed a terminal under their name which, in reality, contains IBM component parts but does have a neat little mag tape cartridge that attaches to the unit and can be used for input and output at quite high speeds. Newer terminals such as the Execuport are now able to receive data at 30 characters per second, which is three times the speed of the teletype terminals and twice the speed of the 2741. Obviously, since you are paying for terminal connect time under the time-sharing concept, the faster your input and output the cheaper your cost. This terminal weighs about 27 pounds and is completely portable; all you need is a telephone and you are in business.

Having made the choice of terminal, the next step is installation. As mentioned earlier, as clean a possible telephone line is essential. A
private line to the terminal is desirable. This 
bypasses the office switchboard and leaves one 
less problem area. These direct lines usually 
do not cost more than $6-10 per month. In real 
critical applications, lease lines can be had.

Now, by way of illustration, I should like to 
discuss a specific application of time-share -- 
that of oil property evaluation. This might be 
for acquisition purposes, estate evaluation, 
future planning, economics of proposed de-
velopment drilling or wildcatting etc.

The problem can basically be stated as follows:
1. Engineering
2. Cash Flowing and Discounting
3. Tax Calculations
4. Rate of Return on Equity Calculations

In my opening remarks, I mentioned various 
engineering applications. Here I would confine 
it to aid in flowing future production after the 
engineer has made his reserve determination or 
in simple cases determined trends such as con-
stant percentage decline etc. The computer can 
easily project exponentially, harmonically, 
hyperbolically, so many years at current rate, 
the same and then decline, incline, or, if the 
desired curve cannot readily be expressed 
mathematically, each individual year can be 
inputted. I have also found it very helpful to 
let the computer make the determination when 
the economic level of production has been 
reached.

The cash flowing and discounting is routine, 
and this is precisely what computers are all 
about. Whenever a problem is repetitious and 
time-consuming, computers will be the most 
economical answer. Other than being faster 
and cheaper than hand calculations, a 100% 
degree of accuracy is obtained together with 
readily available by-products that normally are 
not achieved from desk calculations.

Since the demise of the ABC transaction, tax 
calculations have suddenly become all important 
in proposed property acquisitions. The 
nature of oil and gas taxation is such that cer-
tain elections are available. The computer can 
be relied on to make the correct choice and to 
optimize results. This again is a repetitious 
and time-consuming problem.

Finally, to the all important rate of return on 
equity calculation. Almost all acquisitions, 
wildcatting and development programs utilize 
some form of financing and therefore leverage. 
Surprisingly, in these cases many people are 
more concerned with rates of return on the to-
tal monies spent rather than on their equity 
money. It appears intuitive to me that the real 
problem is twofold: 1) what can I expect to 
make on my money and 2) what are the proba-
bilities of achieving 1). Again, a time-consum-
ing, laborious trial and error calculation.

Another problem readily solved by computers 
is material balance predictions of reservoir per-
formance. If you ever have run out a solution 
gas balance of using φ factors (see Tracy, Tech 
Note 256, JPT, January 1955), you have been 
involved with rather laborious trial and error 
procedures. Not only does the computer handle 
this procedure readily, but can also easily de-
pict the results when one manipulates the vari-
sables such as the Kq/KQ extrapolation.

Those of you who are consultants are usually 
called upon to put your results in a finished 
report form. This quite often calls for cash flows 
from each lease, by states and by various cat-
egories. The result is considerable output which 
is too expensive and time-consuming for time-
share. I know of at least one consultant that 
takes advantage of using his time-sharing ven-
don’s high speed terminal, i.e., he inputs his 
data through his conventional terminal and 
causes it to be outputted at the vendor’s loca-
tion and then the printout is delivered to him.

In my discussions of time-sharing with vari-
eous engineers around the country, I have found 
that the one and two-man shops have really 
found the concept to be very attractive and have 
developed their use of time-share to a high de-
gree. This has been partly for competitive rea-
sons, i.e., they were initially forced into it, 
but once they developed the necessary skill to 
operate and program the system, it does give a 
small shop a considerable feeling of power. Two 
specific things they realize is that it is adding 
very little to the overhead when not in use, and 
it allows them to work right up to deadlines 
knowing that the final results can be obtained 
very quickly.

As to the ultimate, let us examine some of the 
possibilities for time-sharing systems. One, I 
would visualize a complete production-financial 
computerized accounting system starting with 
the pipeline gauger in the field and ending with 
the filing of income tax and financial statements. 
Small hand-card punch devices are available. 
Rather than fill out a gauge report or a run ticket, 
they could be utilized, or a small electrical 
operated keypunch is available for about $750. 
These could be placed in the district offices and 
the raw data prepared there. The data could be 
transmitted or the cards delivered to the regional 
or home office where it would be used in the 
following ways (all by the computer):
1. Prepare state and federal reports
2. Establish data banks of production history
for engineering personal use. As an accessory
plotters would be available to prepare decline
curves, P/2 curves, rate/cum curves, water
cut/cumulative curves, etc.

3. Update previously prepared reserve studies.

At the same time, this data would merge with in-
come and expense data as prepared by the Ac-
counting Department.

Ultimately, in our data storage files we
would have by lease:
1. production history
2. oil and gas runs
3. monthly income
4. monthly operating expense
5. reserves
6. district overhead
7. general and administrative overhead
8. state, federal and local taxes other than
inCOME taxes

From this information the calculations and pre-
paration of income tax and financial statements
could readily be prepared.

In addition, a well-testing program, well
allowable and engineering estimates could be
incorporated. The computer would periodically
scan the actual results lease by lease and pin-
point problem areas.

How feasible is all of this on time-share?
Right at the present, most conventional terminals
are too slow. However, eventually high speed
terminals should be readily available, or, perhaps,
the larger companies at least could in
effect set up their own time-sharing system with
the central processor unit with high speed out-
put in their home office corrected to each dis-

tricl office's conventional time-sharing terminal.

Finally, I wish to mention Cathode Ray Tube
(CRT) display devices. These are used to great
advantage by security dealers and analysts.
Large data banks of company financial history
together with instantaneous market activity are
available on the screen at the touch of a few
buttons.

Why would it not be feasible for a group of
companies or consultants to go together and pre-
apare data banks of lease production history,
well histories including logs, pressure history,
etc. This information stored in one location
would be instantly available at each remote ter-

tinal to be typed out or displayed on a CRT
device.

So, while it has not been my intention to give
you a blueprint for success, it is my belief that
learning to program and exposing yourself to
time-share will open up new worlds to you and
result in expanding considerably on your present
capabilities. Basically, we are talking about
problem solving. Programming forces you to
think through the problem more methodically.
As such, you will understand the problem better
and organize your thought process in a manner
that will result in satisfactory conclusions.

The writer wishes to acknowledge the help in
writing the section on terminals of Mr. Deno D.
Papgeorge and Mr. Michael Wengroff of the
Corporate Financial Services Group of the Bank
of New York.

### TABLE I

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<td>yes</td>
<td>yes</td>
<td>no</td>
<td>some models are readily moveable</td>
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<td>BETA</td>
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<td>132 char.</td>
<td>reads</td>
<td>yes</td>
<td>optional</td>
<td>easily moved</td>
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<td>&quot;2741&quot;</td>
<td>15 CPS mainly, but individual models go from 10, 15 &amp; 30 CPS</td>
<td>11&quot; (72 char.) &amp; 15&quot; (130 - 156 char.)</td>
<td>no</td>
<td>no</td>
<td>yes (typical: 90,000 char. capacity on each tape; can be used off line as a selective typewriter)</td>
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<td>Portable</td>
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<td>72 char.</td>
<td>no</td>
<td>optional</td>
<td>option is available</td>
<td>weight: 27 lbs.</td>
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CLOUDY DAYS ON THE ENERGY SCENE

by Bruce C. Netschert, National Economic Research Associates, Inc.
Washington, D.C.

For the past century, the picture of this country in terms of the supply and costs of its energy has been one of bright sunny days. Now and then a few clouds have appeared over certain areas—their threat, for example, the great oil shortage scare just after World War I, when it was thought that this country’s oil resources were being exhausted. By and large, however, there was unrelieved sunshine. Within the past year, in contrast, we have seen for the first time the gathering of ominous storm clouds all around the horizon. It is possible that the storm can sweep down upon us from any direction, or even from all directions at once. During this year there have already been certain isolated thunderstorms, so to speak. There are some who say we shall never see the sun again, at least for the next decade or so, and that the storms will be upon us within the next year or so.

It’s time to give that metaphor a rest, but at least it sets the mood. What I’m talking about, of course, is the Great Energy Supply Crisis of 1970. The truly extraordinary thing about the crisis is not so much that it has occurred, but that it developed with such extreme rapidity and, in so doing, was unforeseen and unforeseeable.

Now to say this to a group of oil men may verge on the foolhardy, but I think at least I have gotten your attention. How can I say that it was unforeseen and unforeseeable when the petroleum industry has been crying the alarm for years about inadequate incentives and the decline in the reserve position? How can I say it was a rapid development when exploration activity has been tumbling for many years?

It is true that the petroleum industry has been saying that prices, hence incentives, were insufficient. But if you will go back and look at the trade journals and general press you will find that the industry has been saying this virtually uninterruptedly ever since World War II. If higher oil and gas prices were not being called for immediately, there was always the contention that they would have to be higher in the future. No, one cannot say that chronic cries of alarm, in good times as well as bad, constitute a true warning of things to come.

As for the speed of the development, although there has been a more or less general decline in drilling activities since the 1957 peak, and although gas production has exceeded reserve additions for the past two years, this has not affected current deliverability levels. Nor has the productive capacity of domestic oil wells been a contributing factor to any oil shortage; all that has happened is a decline in excess capacity. The suddenness I have in mind is illustrated by the fact that as recently as March of this year it was possible to say that there was no real pressure on the supply of residual fuel oil, in the sense that anyone could have all he wanted at a price. Three months later, however, the situation was totally different. There were cries up and down the Atlantic seaboard from those who found themselves unable to get resid commitments at any price, and there were others (to my personal knowledge) who considered switching to the use of resid, quietly investigated the market, and gave up.

No, the fundamental reason for the energy crisis of this year was not price, but the move for environmental preservation—specifically, air pollution abatement. Let me explain. When the utilities in the New York City areas were first ordered to reduce the sulfur content of the fuels they burned in their boilers to two percent or less, they had no idea where a supply of such fuel existed, or whether they could get enough of it to meet their need. Neither did the fuels industries, and I am sure the air pollution control authorities had no idea either. But to everyone’s surprise, the utilities were able to satisfy all their needs and still beat the deadline. Supplies of low-sulfur resid turned up out of nowhere.

Given the national mood on air pollution and the legislation that was being passed at all governmental levels, it was obvious that such sulfur restrictions would come to be applied in most large urban areas; but I think this New York experience may have contributed to the speed with which this development occurred, authorities in other localities being confident that the necessary supply of fuel meeting the new sulfur standards would turn up. It was one thing, however, for New York, a single metropolitan area, to accomplish this; it was another when many metropolitan areas attempted the same thing at
the same time. Chicago, for example, overnight became an important potential resid market when the local large fuel users found themselves unable to get sufficient low-sulfur coal to satisfy the new pollution abatement regulations.

Moreover, it is now apparent that the unusually large growth in the number of new gas customers and the appearance of unsatisfied potential gas customers during the past year or so has been due, at least in part, to the fact that commercial and industrial fuel users, seeing what was in the wind, began converting or trying to convert to gas—the fuel that would remove them from all worries about sulfur restrictions, no matter how severe. Everyone knew that there simply was not enough low-sulfur coal to satisfy the prospective need, so they turned either to gas or to low-sulfur resid as the answer.

Now my point is that no matter what the price of oil and gas might have been over the past year or so, the industry simply could not have met the enormous demand that was flooding onto the markets. Don't forget, nobody has yet gone cold for lack of fuel this year. The main problem is the matter of meeting this new demand growth.

It would be wrong, however, to say that the entire problem has arisen because of air pollution abatement. The crisis would not have been so severe were it not for purely fortuitous events that occurred in the different fuels. I am sure you are familiar with them. In coal there were labor troubles, a shortage of hopper cars for transportation, the boom in the export market and the diversion of coal to that market. In oil there was the Tapline interruption and the squeeze put on the oil companies by the Libyan Government, leading to skyrocketing spot tanker rates, plus the rapid increase in the demand for low-sulfur resid throughout the world. In the electric utility industry it was a combination of troubles on all the environmental fronts, plus delays in completing nuclear plants, plus troubles with a number of very large units that were being put on the line more or less at the same time.

So here we are with the clouds all around us. What's the weather forecast? For the short term—that is, this winter—the outlook is for possible showers. It is the position of the Administration that things are working themselves out and that, barring some really nasty winter weather, we should get through without serious trouble. The labor troubles at the coal mines have simmered down, the ICC has helped pry hopper cars loose, the Japanese have been persuaded not to be quite so aggressive in bidding for coal and domestic refiners are going to turn out resid.

This is the picture Chairman MacCracken of the President's Council of Economic Advisers described to the IPAA early last month. I hope he's right, but it's interesting he didn't have much to say about No. 2 oil. With respect to resid, however, he made a curious argument. "How did we get to rely so heavily on foreign reside?" he asked. His answer was that the opening up of the East coast to foreign resid contributed to a decline in domestic resid production. This is just plain wrong. As I am sure you know, resid has long been an uneconomic product domestically, and the technological trend away from resid output is also of long standing. The import controls for resid were relaxed because East Coast users found their domestic supply constantly declining, so that without recourse to foreign supply they were faced with an absolute scarcity.

So much for the short term. We won't have long to wait for the answer. What about the weather forecast for the long term? I think there is general agreement that the clouds will remain indefinitely. In the first place, the pressures for further pollution abatement and for general environmental preservation will increase in the future. Sulfur limitations are scheduled to go lower almost everywhere there are pollution controls. For example, on October 1, 1973 the permissible maximum sulfur content of fuel oils for burning in Philadelphia will be 0.3 percent for No. 4, No. 5 and No. 6 oils; 0.2 percent for No. 2 oil. This means that price pressures will remain, and the availability of low-cost energy for stationary purposes will be a thing of the past, although I would not expect this to continue indefinitely. The breeder reactor, fusion power, or some as yet unforeseen technology should eventually bring about lower energy costs.

Now let's look at the outlook for the specific fuels. For coal the outlook depends on two things. One is the speed with which new mines can be opened up to supply coal to users who do not have to worry about sulfur content. As the coal industry delights in reminding us, there is no possible long-run supply problem, since our reserves are sufficient for centuries. With a new high level of coal prices, supply should respond although there may be some difficulties in reversing the long-term downtrend in the mine labor force. The second determinant, for those who must use low-sulfur fuels, is the perfection of stack-gas desulfurization. As you probably know, the National Research Council has reported that there is no feasible, economic means of stack-gas desulfurization presently available. Several processes are being worked on, and it should be only a matter of time until one or more
is demonstrated to be commercially reliable. This should take several years, however, and before stack-gas desulfurization can become effective, it will also be necessary to perfect reliable monitoring devices for the stacks, which also do not exist at present. Still further, it will be necessary to demonstrate that such monitoring devices can be feasibly worked into a control program. I would say that it is likely to be towards the end of the decade before all of this could come to pass.

The outlook for oil depends on three things: the first is the availability of foreign low-sulfur crude or low-sulfur resid, including in this "foreign" supply the oil from Alaska. The second is the growth in desulfurization capacity in the United States and the Caribbean. The third is the output of low-sulfur resid from domestic refineries. Between these three developments, I would expect that it would be only a matter of a couple of years before the more severe aspects of the present supply situation will have been alleviated. It is significant in this regard that the solution to the supply problem does not really involve to any great extent the availability of domestic crude from the lower 48 states—that is to say, the size of our remaining oil resources.

I would assume that the supply of No. 2 oil would respond to the new, higher price levels, but New England's experience gives me pause. How is it that the area of the country with the highest prices has complained chronically, under the import control program, about insufficient supply? Can't be the competition from other fuels, for all fuels are high priced in that region. I confess the price behavior of No. 2 oil has always been a mystery to me, and I know of no one outside the industry who claims to really understand it.

Turning to natural gas, it is, as I have noted, the perfect antipollution fuel, thus it is already apparent that no matter what the resource position in gas and no matter how fast new reserves are found and developed, it is unlikely that gas supply can satisfy the potential antipollution demand. I did a little exercise a few years ago in which I took just the four or five major metropolitan centers of the country and assumed that their entire fuel use was converted to gas. I found that it would require something on the order of 6 trillion cubic feet of annual consumption for those centers alone. With projections of gas demand through normal growth already in the 30-to 40-trillion range for the coming decade or so, it is clear that the total potential demand, including all gas use for antipollution purposes, could easily double those levels.

If this sounds unrealistic, I call your attention to the fact that there are now over one hundred Air Quality Control Regions either officially established or in the process of establishment under the Clean Air Act. Every one of these regions will have air pollution regulations, and it is reasonable to assume that many, if not most or all, will have sulfur restrictions as severe as those now effective or scheduled to become effective in the larger cities. If the demand for gas this is going to create were to be satisfied, we would have almost the equivalent of an all-gas economy for stationary fuel use. But that demand is going to remain unsatisfied, because even by drawing on every possible source, including Canadian imports, foreign LNG and any others you might think of, there simply wouldn't be enough gas.

This antipollution demand is artificial, in the sense that it does not stem from normal economic growth or market forces but has arisen because of government policy. If there is going to be unsatisfied demand, then it follows that there will have to be some kind of rationing. One way is to allow the price mechanism to perform this function, as it does in any free market. At any price, those who are unwilling to pay that price are frozen out of the market and the commodity is, in effect, rationed to those who can and will pay the price. But since the present situation was artificially created through pollution abatement, actions to allow free market rationing through the price mechanism would mean that the government would be handing the gas producers a windfall of enormous proportions which would have no corresponding beneficial economic effect. That is, since no matter how great the incentive provided by the price, the industry could not find and produce enough gas to meet the potential demand.

Whatever the justification for FPC price regulation under normal conditions (and I for one believe that that justification is strong), under the new circumstances it is absolutely imperative on the grounds of both economics and equity that such regulation continue. The result will be, of course, that the FPC will end up as the arbiter of gas rationing. But this is eminently logical—some arbiter is needed and the FPC, with its prior experience, is preferable to the air pollution authorities. Nevertheless, there will have to be very close coordination between the FPC and the air pollution people to insure that the equity of the individual consumer is not injured and at the same time that gas makes the maximum feasible contribution to air-pollution abatement.

In any event, the result can only be an increased
cost of energy to the consumer. Every instance of a switch to gas by industrial consumers (including the electric utilities) for any pollution purposes is an instance of increased cost to the consumer, since if gas were at present the cheapest fuel they would have already been using it. Thus the increased cost of energy is one of the costs of pollution abatement.

One of the results of our present energy difficulty has been a renewed push by the energy industries for a National Energy Policy. The trouble is, however, that each of the energy industries views that policy as one that would favor it: the coal industry thinks of its product as the most important because it represents the largest energy resource on which we can draw; the oil and gas industries view themselves as the most important because of the strong national security element. The fact is, any National Energy Policy, if it were adopted, would have to be a compromise and would therefore leave each of the energy industries unsatisfied. But, the important thing is to have not a National Energy Policy but a National Energy and Pollution Abatement Policy. It is the coordination of the measures to preserve the environment with our energy policy that is overriding in importance.

We have entered an era of high-fuel and energy costs because, as I have said, we have adopted a policy of pollution abatement. In economic terms these higher costs are justified in the sense that they constitute costs which were previously ignored. That is, we previously burned high-sulfur fuels and polluted the atmosphere because, for the fuel consumer, this was the least costly avenue. The cost of the pollution was being borne by society in general and no one in particular, thus there was no economic incentive for any individual fuel-burning polluter to change. Now, because of pollution abatement regulations, the change is mandatory, and the cost of pollution—which, in one measure, is the cost of abating it—is appearing in the higher price of low-sulfur fuels.

The producing industry looks with favor on such a high-price situation, but with $4.00 residual oil and 25¢ to 30¢ gas, I suggest that a National Energy and Pollution Abatement Policy may lead in unexpected directions not favorable to the petroleum industry. Take, for example, the reaction of the Administration to the November rise in the price of crude and gasoline. To many in the petroleum industry I suspect it seems a bit unfair that a Republican administration would announce an investigation of a price rise the industry views as long overdue, and espe-

cially unfair when nothing is said about a General Motors' wage settlement that is certain to lead to increased automobile prices.

Without getting involved in whether the General Motors' settlement is or is not inflationary, the point is that there is a valid distinction between the position of the auto industry and that of the petroleum industry. The wage settlement is the product of a process in which the government had no hand. The petroleum industry, in contrast, can charge the prices it does only because of the protection it receives from the government in the form of the import quota system. The government thus has a legitimate interest in changes in oil and oil product prices.

Moreover, it has an even greater interest when it adds a strong kicker to certain petroleum product prices through the air pollution abatement program. The situation with respect to oil, in other words, is like that in gas, which I mentioned earlier. The industry cannot expect to enjoy a free ride from the pollution abatement program—legitimate increased costs in making low-sulfur fuels available will be allowed, but no additional profit kicker will be.

Still further, at the new higher prices for oil and gas it behooves the government policy makers to take a fresh look at the synthetic fuels that can be produced from oil shale and coal. There are some especially attractive features of the synthetic fuels under the new circumstances. For one thing, they dispose of the national security problem; we could be self-sufficient if we wished. Second, there is no problem depending on discovery, with all the uncertainty that presents the policy maker. The known potential is sufficient to satisfy all fuel demands for an indefinite period, certainly for as far in the future as it is feasible to make any policy at this time. Third, and not the least of the advantages, they offer a complete solution to the sulfur aspect of the pollution problem: synthetic fuels from coal and oil shale are desulfurized in the process of production.

I think it becomes increasingly likely, therefore, that government policy in the future will look with favor on the development of a synthetic fuels industry. I would not be surprised if this went so far as active encouragement through tax incentives and direct subsidy; but at the price levels that are likely to prevail, it may be that the synthetic fuels industry will not really need much help. I recognize that there are pollution problems associated with their production -- such as the disposal of the spent shale and the waste culm banks from a coal mine. But the really
attractive oil shale prospect is exploitation through underground nuclear explosives or underground combustion which would make possible the production of shale oil by means of wells, and the coal waste, if necessary, can be put back in the mine.

For the petroleum industry the supplanting of crude oil and natural gas by the synthetic fuels would be mixed blessing. As you know, the majors and some of the independents already hedged against this prospect by taking positions of one sort or another in coal and oil shale. Some have coal company subsidiaries, others hold coal lands, as they do oil shale lands. They would merely shift operations from traditional drilling activities to the operation of mines and conversion plants. It would no longer be the oil industry as we know it, however, but would be a mining and processing industry. The days of the bonanza would be gone—there would be no billion-barrel oil fields; instead there would be billions of dollars of investment in plants for which doubling the output meant doubling or almost doubling the investment. The exploration risk would also be gone, hence the industry would be very much on the defensive in retaining the special tax provisions designed to offset that risk. The small operator would see hard days, indeed, and wildcatting on any significant scale would probably disappear.

In conclusion I would say that although the clouds at present are thick and although the prospects for seeing a wholly clear day again on the energy scene are very small for an indefinite period, perhaps even in our lifetime, I nevertheless believe that within at most two or three years they will thin out considerably as the present crisis is past. Some of the pressure will certainly be removed by the further development of nuclear energy. Its overall advantages on the score of air pollution are so great that the present intense opposition to the sitting of nuclear power plants anywhere will have to give way. As nuclear power comes to constitute a significant portion of total generating capacity, the rate of growth in fossil-fuel needs for power plants will first taper off and then diminish absolutely.

Even before that, however, with the new, higher prices, new gas reserves will come to market as the industry develops the finds it knows about but has been sitting on while waiting for the higher prices. Two to three years should also see adjustment to the fuel oil crises, as new sources of supply are developed and residual desulfurization capacity is brought more into balance.

Just when the sun's rays will first break through the cloud cover will depend on which of the longer term alternatives takes the pressure off gas and low-sulfur oil. It may be synthetic fuels; it may be stack-gas desulfurization; it may be the breeder reactor or, in the very long term, fusion power. It has been said that in the perspective of man's history, the present, heavy reliance on the petroleum hydrocarbons is but a passing phase. Our children and their descendants in the Twenty-First Century will look back at this period just as we look back on the economic troubles of the Great Depression.

"It was a close call for a time, but they made it, with a bit of luck."