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STATEMENT OF FRANK ZARB

ADMINISTRATOR
FEDERAL ENERGY OFFICE

BEFORE THE

SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS

OF THE

HOUSE INTERSTATE AND FOREIGN COMMERCE COMMITTEE

ON THE

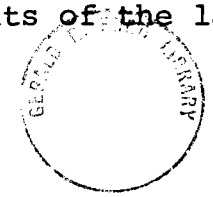
FEA STUDY OF OIL AND GAS RESOURCES,
RESERVES AND PRODUCTIVE CAPACITIES

AUGUST 6, 1976

I. Introduction

Mr. Chairman, Members of the Subcommittee, I am pleased to appear before you to discuss the Federal Energy Administration's (FEA) study of oil and gas resources, reserves, and productive capacities. With me this morning are Dr. John Christie, Assistant Administrator for Policy and Analysis, and a number of my staff members who were directly involved in the study being addressed at these hearings.

As you are well aware, FEA was directed by Congress in the Federal Energy Administration Act (P.L. 93-275) to prepare a "complete and independent analysis of actual oil and gas reserves and resources in the United States and the Outer Continental Shelf, as well as of the existing productivity capacity..." The report to Congress was to be completed in one year after the effective date of P.L. 93-275. The report also was prepared in response to the requirement of section 11 of the Energy Supply and Environmental Coordination Act of 1974. In June 1975, the FEA submitted to the President and the Congress an initial report, and in October 1975 the FEA completed its final report on oil and gas resources, reserves and productive capacities. FEA fulfilled the Congressional mandate in a timely and professionally, competent manner which satisfied the requirements of the law for a "complete and independent analysis."



In my presentation I would like to address five points: (1) the various approaches which were considered for conducting the analysis and the rationale underlying the approach which was finally used; (2) the definitions of key terms used in the operator survey, and what these definitions actually meant in the study; (3) the procedures which were used to verify the operator survey information; (4) the procedures which we used to conduct independent audits of selected fields; and (5) the Administration's current efforts with regard to future studies of oil and gas reserves.

Before turning to the methodology used in the study, let me very briefly summarize the results. Estimated proved reserves were 38.0 billion barrels of crude oil and 240.2 trillion cubic feet of natural gas as of December 31, 1974. These estimates were 10 percent higher than American Petroleum Institute (API) estimates for crude oil and 3 percent higher than comparable American Gas Association (AGA) estimates for natural gas. These variations were no more than might be expected when comparing estimates from different sources. Also, the FEA survey indicated that U.S. estimated productive capacity following December 31, 1974,

was 8.7 million barrels per day of crude oil and 63.4 billion cubic feet per day for natural gas. Mr. Chairman, I would like to submit for the record a short paper which summarizes the results of the study and comparisons of FEA's results with other reserve information.

II. Methodological Approaches

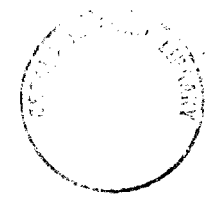
Resources. Separate approaches were used for analyzing resources and reserves. Historically, the U. S. Geological Survey (USGS) has had the responsibility for evaluating mineral resources, and it was felt that the best way of complying with this portion of the mandate was to use the expertise of USGS and also conduct studies using mathematical approaches. The mathematical approaches were made by four teams of mathematical-statistical professionals, and USGS was funded to accelerate an evaluation of oil and gas resources by applying subjective probability procedures and a variety of resource appraisal techniques to geologic information.

Reserves. One possible approach considered for the reserve estimation was to have teams of engineers and geologists make estimates of oil and gas reserves for selected fields.

Although the approach might comply with the "independent" requirement, satisfactory coverage of fields in the allotted time could not be achieved. The Federal Power Commission (FPC) used this approach in their study of gas reserves as of year-end 1970. In two years some 200 gas fields of a total of about 6,400 were studied. However, this approach was deemed impractical because there are about four times as many oil fields as gas fields. Therefore, this method was rejected because of the lack of available competent engineering teams and time constraints.

Consideration was also given to having government engineers participate as members on API and AGA reserve subcommittees. In addition, independent audits would be conducted on selected fields. This approach was considered unsatisfactory in that it was not considered to be independent. Results, therefore, would probably not attain a high degree of credibility.

The FEA also considered the possibility of having State geological and/or regulatory agencies prepare estimates of oil and gas reserves in their States. An assessment of the capability of States to do this work showed that 14 States



made independent Statewide reserve estimates that accounted for about 16 percent of U. S. oil reserves. However, the definitions used by these States varied and were thus not compatible. It was evident that most of the larger oil and gas producing States did not have the professional staffs needed to perform this task.

Consideration was also given to making reserve estimates based upon decline curve analysis. As this method is applicable to less than half of the producing fields, it was not considered to be a realistic alternative as to the "complete" requirement.

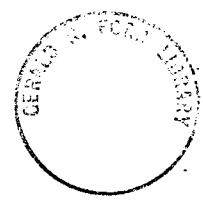
It was concluded that the most viable alternative to obtain estimates of oil and gas reserves in the allotted time was to have the full universe of operators provide reserve estimates and validate their estimates by field auditing. This alternative complied with the "complete" requirement, and it was "independent" of the estimates produced by industry associations.

Two alternative approaches to getting data by field were considered and rejected in the design of the survey form:

(1) Consideration was given to obtaining reserve estimates on a reservoir rather than field basis. Although this approach was preferred technically, the lack of uniformity in reservoir identification and data and the time constraints precluded obtaining and processing reserves data on a reservoir basis. Using fields rather than reservoirs reduced the response and processing burden about 75 percent.

(2) Consideration was given to surveying owners of oil and gas reserves. This approach was not implemented because no listings were available of oil and gas properties by ownership, and there was no manageable process whereby an ownership listing could be developed in the allotted time.

Consideration was also given to obtaining estimates of reserves under different prices. It was concluded that meaningful price sensitivity results could not be obtained from such a large universe. Thus, the survey form was based on a full census of operators, reporting their estimated reserves (producing and shut in), actual production history, productive capacity and related data.



III. Definitions Used in Reserves Survey

Reserves have many meanings and are used in different ways. Oil and gas reserves are usually defined with regard to their proven existence and specified conditions for recovery. In the FEA study the definition used for proved reserves was the definition agreed to by a government-industry task force in 1966, and it has been in general use since 1967. At an interagency meeting in October 1974, FEA was requested by the General Accounting Office (GAO) to use that definition to prevent misunderstandings and avoid confusion in reporting requirements.

Proved reserves are defined as those which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. Reservoirs are considered proved if economic producibility is supported by either actual production or conclusive formation tests. Electric logs, cores, and geophysical data do not constitute a conclusive test in this definition.

All proved reserves are expected to be produced in the future as these estimates are based upon the virtual certainty of their existence and producibility. As one moves into greater uncertainties as to the proof of their existence and producibility, reserve estimates normally increase.

Indicated secondary and tertiary reserves are defined as estimated quantities of crude oil and gas (other than those defined and reported as proved reserves) that may be economically recoverable using present technology and operating conditions from installing enhanced recovery techniques.

Operator was defined as one who is the working interest owner or his representative who is responsible for the management and day-to-day operation of oil and/or gas producing wells. In actual practice, the operator is designated prior to the drilling of a well. This results from the necessity of obtaining drilling permits from government and/or State agencies and proving financial and performance responsibility. The role of an operator extends throughout the producing life of the well and plugging and abandonment

operations. In section B of Part I of the Oil and Gas Reserves Survey form, the respondent was asked, "Were you an operator of oil and/or gas wells in this State as of October 31, 1974?" If the respondent answered "yes," he was to enter the number of fields in which he was an operator and for which he reported information in Part II of the form. Also the respondent was to complete a Part II of the survey form for each field in which he was an operator. Among other items, Part II has as entry 14, estimates of proved reserves "...for all shut-in reservoirs in portion of field operated by respondent."

Nonproducing reservoirs are defined as reservoirs that contained proved reserves of oil and/or gas that were not being produced in 1974 but were expected to be in production before 1985. Typically, all reservoirs having proved reserves of crude oil and gas would be expected to be producing long before 1985 as demand for petroleum and gas continued to increase and domestic output continued to decline. The survey form provided a specific entry for nonproducing reservoirs, and there were numerous submissions by many operators showing shut-in proved reserves estimates for reservoirs in which there was no oil or gas production in 1974.

Productive capacity was defined as the maximum average sustainable productive rate for oil and for gas for the 60-day period after December 31, 1974, taking into account several constraints such as no significant reduction in ultimate recovery and all economically feasible changes to maximize production would be made. This definition differs from annual average production in that wells cannot be produced at maximum capacity continuously. They must be shut in for some periods of time for remedial work, equipment maintenance and repair, etc.

IV. Verification of Survey Information

Quality control procedures were developed to achieve the highest possible quality of information from this survey. Survey forms were first screened to identify usable submissions. Operators making incomplete submissions were contacted for additional data and for corrections. A follow-up letter was mailed to nonrespondents reminding them of the possible imposition of civil and/or criminal penalties for noncompliance.

Data from usable schedules were processed and compared with State benchmark production records for 1973. Comparisons indicated that usable schedules accounted for 97 percent of the crude oil production and 95 percent of the natural gas production. To quantify the impact from nonrespondents and Post Office returns of questionnaires, a stratified sample of both categories was selected, evaluated, and results expanded to the universe. The combined impact from both categories was indicated to account for approximately 12.5 million barrels of crude oil and 41 billion cubic feet of natural gas, or less than one percent of both crude oil and natural gas production.

Review of Operator Submission. All responses from operators were checked for completeness and reasonableness. Mathematical relationships of related data items were used to ascertain reasonableness.

About 14,000 telephone calls were made to operators regarding data omissions or information found to be out of range of normal expectancy.

Additional verification of data submissions was made by selecting at random a number of field data submissions. Operators who had made these submissions were contacted to find out such things as: Were the field name and production numbers submitted to FEA the same as those sent to State authorities? What volume units were used? Were the reserve estimates prepared by an engineer or geologist? What methodology was used to estimate reserves?

V. Auditing of Major Field Studies

A procedure was sought which would provide an independent assessment of survey results. FEA concluded that independent field engineering studies could be made on a number of the larger fields within the time and budget constraints. The results could then be compared to the reserve and production values for those same fields from the operator survey, and a close check on overall values would be regarded as verification of the operator survey technique.

The selection of large fields for engineering studies was determined by two considerations:

1. The engineering costs and time required to determine reserves tend to be related to the number of wells and number of oil and gas reservoirs under study rather than the magnitude of the oil and gas reserves. A far larger percent of total U. S. oil and gas reserves could be studied with the money and manpower resources available by concentrating on large fields rather than on a larger number of small fields. Although the engineering studies were made in less than one percent of the nation's fields, these 59 fields contained over one-half of the U. S. crude oil reserves and over one-fourth of the U. S. gas reserves.

2. The difficult job of matching and comparing the results of the operator survey to the engineering field studies would be made easier by concentrating on large fields rather than on a larger number of small fields.

The engineering field studies were also an experiment in combining the geological and engineering capabilities of government agencies and private consulting firms to produce oil and gas field studies with a common format. For that reason, all government agencies and private contractors were required to make known to FEA:

1. Difficulties that were encountered in making the studies.
2. Extensions of work that would have been done if data or time had been available.
3. Procedures that could be used to improve future studies.

Selection of the Sample. As the field studies were designed to verify the operator survey, the field selection had to be random and independent. A sample of oil and gas fields was drawn which provided a valid group of fields for verification purposes. The sample was drawn from a list of the 125 largest oil fields and the 25 largest gas fields in the United States in terms of 1973 production. Although production and reserves are not precisely congruent, there is a

general correlation. Naturally, before our study was completed we did not know what proved reserves on a field-by-field basis would be. We, therefore, used 1973 production as a sizing mechanism to list fields for possible inclusion in the sample. A stratified selection was made, with a successively smaller fraction studied as the fields diminished in size. A total of 39 oil fields and 11 gas fields was selected.

Selection of Audit Teams. After the statistical sample of oil and gas fields was selected, the sample listing was provided to government agencies with qualified petroleum engineers. From the list, the agencies selected fields which they felt capable of analyzing. The USGS chose five offshore oil fields; four in Louisiana and one in California. The Bureau of Mines (BOM) selected six fields, two of which were gas fields. The FEA's Region VI Office selected six fields, one of which was a gas field, and the Region VIII Office selected one oil field.

A Request for Proposal (RFP) was prepared for the remaining major oil and gas fields, dividing the fields into 20 packages of from one to four fields each. A mailing list of 17 reputable petroleum engineering consulting firms was developed. In late January 1975, the RFP was sent to the 17 firms and advertised in The Commerce Business Daily. Responses to the RFP were received from 11 firms, eight of which were on the mailing list. At least two bids were received on each of the 20 packages.

The bids were reviewed by a technical review committee consisting of five petroleum engineers, three from the FEA, one from the USGS, and one from the BOM. One of the firms was determined not to be technically acceptable. The ten remaining firms, few of which had previous government contracting or bidding experience, were judged to be qualified bidders. Each committee member rated the qualified bidders according to criteria in the RFP. (These included the qualifications of the professional staff, the prior experience in the area, the adequacy of the methodology, and the professional man-days assigned.) The average ratings were forwarded to the contracting office. The contracting officer negotiated with the firms, received the best and final offers, and awarded the contracts.

Since the original sample of 50 fields was awarded for less than the original estimated cost and a probable extension until October 1975 was envisioned for the final report, the reserves study group decided to prepare an RFP for nine additional fields. The RFP was advertised in The Commerce Business Daily on April 11, 1975. The contracts for the nine supplemental fields were awarded through a procedure similar to the original 50 fields. The nine fields were not part of the scientifically selected sample but were large fields selected to improve geographic coverage.

Quality control. To assure that the consulting firms and government agencies were doing a creditable job, the FEA hired a highly respected and competent petroleum reservoir engineer to review the draft reports. After thoroughly reviewing each report, he contacted the author and noted instances of "carelessness" such as misspelling or typographical errors, mathematical inconsistancies, and poor methodology. Many of the errors could be attributed to the short time the contractors and government agencies had to prepare the studies. Most contractors and government agencies were responsive to correcting these errors.

The field studies prepared by the contractors and government agencies were generally not completely prepared from basic well and reservoir data. They were in most instances independently prepared summary reviews of available information and data supplemented with original work to complete the studies. The field studies are, for the most part, practical documents which accomplished their objectives of serving as a useful independent check on the operators survey.

The operator survey estimates were compared with the major field study estimates at the conclusion of both studies. Crude oil proved reserves totaled 19,891 million barrels from the operator survey and 19,416 million barrels from the major field studies, a difference of 2.4 percent. Natural gas proved reserves were 67,485 billion cubic feet from the operator survey and 68,300 billion cubic feet from the major field studies, a difference of 1.2 percent.

VI. Current Efforts for Future Reserve and Resource Studies

FEA made a number of specific recommendations regarding studies of reserves and resources in its October 1975 report. Among those recommendations were periodic estimates

of reserves on a biennial (every two years) basis. Subsequently, FEA has undertaken an effort to review the nature of the government's need for reserves information. On May 27, 1976, FEA held a public conference to solicit comments on the Oil and Gas Reserves Study, alternative bases for reporting, adequacy of definitions, accuracy and reliability of reserve estimations, costs of obtaining reserve information, and alternative methods of collection.

At FEA's initiative, an interagency task force made up of all involved government agencies and chaired by OMB, has been organized to address these issues on a government-wide basis. The task force held a public meeting on July 22, 1976, in which these and other related issues were again addressed. (In both meetings many useful suggestions were made by representatives from industry, universities, public interest groups, trade associations, and other government agencies.)

I emphasize these steps, Mr. Chairman, to point out that we wish to solicit the views of all interested parties--Congress, industry, university professors, and government officials on this complex subject. I hope that these

hearings will result in a better definition of what should be done in the future, and I assure you that we are ready to cooperate with this Subcommittee or others who wish to provide us with comments or suggestions on the collection and assessment of oil and gas reserve and resource information.

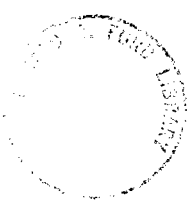
Thank you. I would be pleased to answer your questions.

FEA OIL AND GAS RESERVE AND RESOURCE STUDY

SUMMARY OF RESULTS

January 16, 1976

Prepared by: Office of Data and Analysis
Office of Oil and Gas Analysis
Federal Energy Administration
Washington, D.C. 20461



FEA OIL AND GAS RESERVE AND RESOURCE STUDY: SUMMARY OF RESULTS*

The study was made in response to the Congressional mandate in Section 15(b) of the Federal Energy Administration Act (PL 93-275) to "...submit a report to the President and Congress which will provide a complete and independent analysis of actual oil and gas reserves and resources in the United States and its Outer Continental Shelf as well as of the existing productive capacity and the extent to which such capacity could be increased for crude oil and each major petroleum product each year for the next ten years through full utilization of available technology and capacity...." within one year of enactment of the legislation.

There are various categories of reserves based upon the economics of production and the methods of recovery. In the FEA study both proved reserves and indicated secondary and tertiary reserves estimates were obtained. Proved reserves are defined as the estimated quantities of oil and gas which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years

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*These results are taken from Initial Report, Volume I, Oil and Gas Resources, Reserves, and Product Capacities, FEA, Washington, D.C., June 1975, and Final Report, Volume I, Oil and Gas Resources, Reserves and Productive Capacities, FEA, Washington, D.C., October 1975

from known reservoirs under existing economic and operating conditions. Indicated secondary and tertiary reserves are defined as the estimated quantities of oil and gas (other than those defined and reported as proved reserves) that may be economically recoverable using present technology and economic conditions from the following sources: Known productive reservoirs in existing fields expected to respond to improved recovery techniques where (a) an improved recovery technique has been installed but its effect cannot be fully evaluated, or (b) an improved recovery technique has not been installed but knowledge of reservoir characteristics and the results of a known technique installed in a similar situation are available for use in the estimating procedure.

RESOURCES

Resources are defined as concentrations of naturally occurring solid, liquid, or gaseous materials in or on the earth's crust in such form that economic extraction of a commodity is currently or potentially feasible. In our study two approaches were used to quantify the undiscovered recoverable resources; that is, those undiscovered resources which are estimated to be economically recoverable. One approach involved mathematical-statistical projections, the second used U.S.G.S. geological methods. Mathematical-

statistical projections were made by four teams of reputable academicians hired by FEA. Two teams concluded that useful projections could be developed for explored regions. However, results were widely divergent, and the overlap of respective 95 percent confidence intervals was comparatively small. Excluding Alaska, results of these projections were:

	TEAM 1	TEAM 2
Crude Oil (billion bbls)	28.9 - 37.4	37 - 178
Natural Gas (trillion cubic feet)	354.2 - 490.1	51 - 557

U.S.G.S. prepared estimates of undiscovered recoverable oil and gas resources by geological-statistical methods. Results of their efforts were shown as a range and mean as follows (see Chart 1):

	RANGE	MEAN
Crude Oil (billion barrels)	50 - 127	82
Natural Gas (trillion cubic feet)	322 - 655	484

RESERVES

FEA obtained reserve data through a survey of operators of oil and gas leases. A questionnaire was developed to obtain data on a field basis for crude oil, associated gas and nonassociated gas. Specific data items requested were:

5-year production history (1970-1974), productive capacity, proved reserves, original hydrocarbons in place, secondary and tertiary reserves, gross additions to proved reserves in 1974, principal constraint on productive capacity and principal reason for shut-in reservoirs not being produced. A mail list was developed and questionnaires mailed. Approximately 12,000 operators responded. Response was 97 percent coverage for crude oil and 95 percent for natural gas.

RESERVE RESULTS

Proved reserves of crude oil at December 31, 1974, totaled 38.0 billion barrels, 11 percent higher than the comparable API estimate (see Chart 1). There were 10.2 billion barrels of reserves in reservoirs not being produced. Alaska accounted for 93 percent of the nonproducing crude oil reserves, Louisiana 3.8 percent and California 1.5 percent. Principal resasons for nonproduction were lack of transportation, lack of producing facilities and legal constraints.

End of year 1974 proved reserves of natural gas totaled 240.2 trillion cubic feet, 3 percent higher than the comparable AGA estimate. There were an estimated 41.6 trillion cubic feet of proved reserves in reservoirs not being produced. The North Slope of Alaska contained 57.4 percent

of the nonproducing gas reserves. Louisiana contained 10.5 trillion and Texas 4.9 trillion cubic feet of nonproducing gas reserves and were ranked second and third respectively. Principal reasons for nonproduction were lack of transportation facilities, lack of producing facilities and legal constraints.

PRODUCTIVE CAPACITY

Productive capacity was defined in the study as the maximum daily average sustainable productive rate for the 60-day period following December 31, 1974, taking into account the following conditions:

(1) There would be no significant reduction in ultimate recovery from the field.

(2) All economically feasible changes to maximize production would be made to existing wells, well equipment and surface facilities as well as new drilling and changes in operational practices.

(3) There would be no change in constraints on flaring of gas or discharging of brines into water sheds.

(4) Productivity would decline at capacity operating conditions.

(5) Do not include gas production from underground storage facilities.

(6) There is transportation and a market for all production.

(7) There would be no change in economic conditions, no legal constraints on production, and no changes in ownership equity systems.

The Survey indicated that crude oil productive capacity was 8.67 million barrels per day, approximately 3.5 percent higher than daily average production in 1974 and about 8 percent higher than average daily production reported by the Bureau of Mines in December 1974. (Chart 4). California had the largest unused productive capacity, 178,000 barrels per day, attributed principally to the Naval Petroleum Reserve at Elk Hills.

Operators indicated there were no constraints on productive capacity in 90.3 percent of the producing fields. Well and lease equipment was the principal constraint in 4.1 percent of the fields.

Productive capacity for natural gas was 63.4 billion cubic feet per day, 7 percent higher than daily average production of 59.2 billion cubic feet reported by operators in

1974, and 8 percent higher than the December daily average production reported by the Bureau of Mines. Compared to daily average production in 1974, Texas had the largest reserve producing capacity, about 1 billion cubic feet per day. Kansas and Oklahoma had reserve production capacities of more than 500 million cubic feet per day, and Louisiana had less than 100 million cubic feet per day.

INDICATED RESERVES

Indicated secondary and tertiary reserves are defined as the estimated quantities of crude oil and gas (other than those defined and reported as proved reserves) that may be economically recoverable using present technology and economic conditions from known productive reservoirs where improved recovery techniques have been installed but the effects cannot be fully evaluated and where improved recovery techniques have not been installed but knowledge from similar reservoirs can be used for estimating purposes.

Operators estimated that indicated secondary and tertiary reserves totaled 4.13 billion barrels. Texas and California had the largest volumes, 1.37 billion and 1.33 billion barrels respectively. Nationwide the leading improved recovery technique was water flooding which

accounted for slightly more than half the total. Thermal methods, primarily in California, accounted for 22.6 percent, and gas injection was 8.9 percent. The remainder was distributed among polymer, emulsion, miscible and combination techniques.

AUDITING OF DATA

Each response from operators was audited for completeness and consistency. Some consistency checks used included annual decline in production, reserves-to-production ratios, and gas-oil ratios. More than 14,000 telephone calls were made to operators for obtaining omitted data items and verification of data.

In addition to auditing each response from operators, two additional auditing procedures were followed. Engineering studies were made on 60 of the larger oil and gas fields and more than 700 field submissions were independently audited.

Proved reserves from engineering studies of the 60 fields totaled 19,416 million barrels as compared to 19,891 million barrels from the operator survey (Chart 2). These fields accounted for more than half of the U.S. proved crude oil reserves. Although the totals were close, there were 23

instances where there was a difference of more than 20 percent. This variation indicates the subjective nature of reserve estimation and was expected.

Reserve estimates derived by the same method for a reservoir are unlikely to agree precisely because of the (1) number of factors which must be quantified in preparing reserve estimates, (2) quantifications which must be determined from widely spaced samples and/or incomplete reservoir data, and (3) judgments which must be made by each estimator based on his own experience. Alternative methods of reserve estimation also usually result in different estimates. The range of estimates is dependent upon the ability and integrity of the estimator and is also related to completeness and accuracy of available data and the geological and physical complexity of the reservoir.

Engineering studies for the 60 fields indicated a total proved gas reserve of 68.30 trillion cubic feet as compared to the operator survey estimate of 67.48 trillion cubic feet, a difference of 1.2 percent (Chart 3). There were 34 instances in which natural gas reserve estimates for individual fields differed more than 20 percent.

Separate auditing of more than 700 responses and additional information helped to assess the quality of operator responses. Some noteworthy results were: (1) ninety-four percent of oil and 95 percent of gas reserve estimates were prepared by engineers and/or geologists, (2) principal methods of estimating reserves were decline curve analysis, 57 percent; volumetric calculations, 31 percent; material balance calculations, 7 percent; and other methods, 5 percent, and (3) eighty-one percent of natural gas properties were being produced at capacity at year end 1974.

API and AGA published estimates of proved reserves for the 100 largest oil fields and 50 largest gas fields.* For the 100 oil fields, the API estimate was 8 percent lower than that of the operator survey (Chart 2). In 26 fields estimates were within 10 percent, and in 32 fields the difference was greater than 30 percent. For the 50 gas fields the AGA total was 0.4 percent higher than those of the operator survey (Chart 3). In 20 fields, reserve estimates were within 10 percent, and in 12 fields estimates differed by more than 30 percent.

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*Newsreleases by American Petroleum Institute and American Gas Association, April 15, 1975.

CONCLUSIONS

1. U.S. total reserves estimates developed in the FEA Operator Survey were in general agreement with industry association estimates (11 percent oil, 3 percent gas). In some specific fields, there were substantial differences in estimated proved reserves of crude oil and gas.

2. Auditing of operator responses and independent estimates of reserves prepared by consultants and Government teams also indicated general agreement for totals, although substantial differences in estimated proved reserves occurred for some fields.

CHART 1. U.S. RESOURCE, PROVED RESERVE AND 1974 PRODUCTION OF CRUDE OIL AND NATURAL GAS

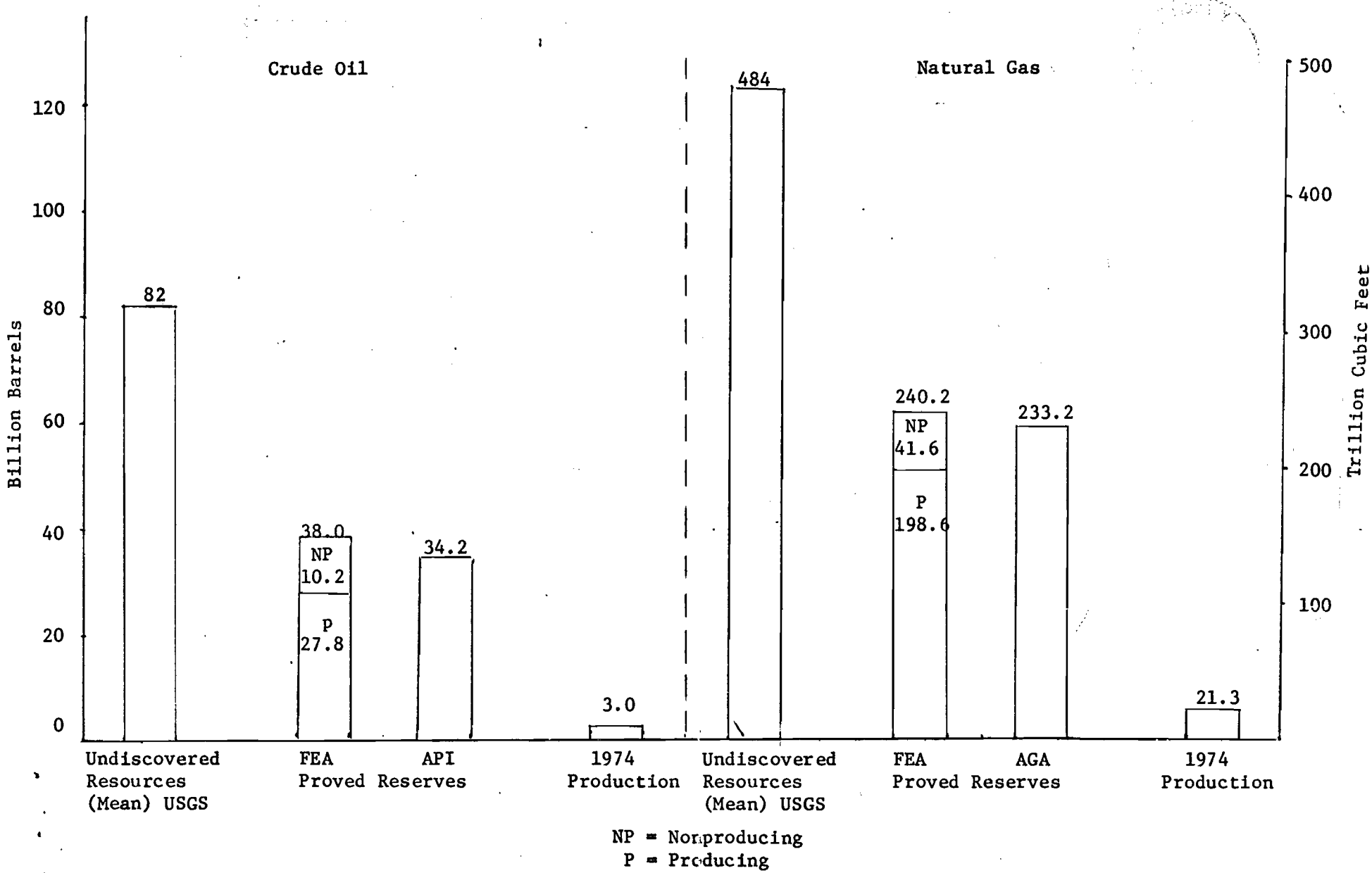

CHART 2. COMPARISON OF CRUDE OIL PROVED RESERVES FOR SELECTED FIELDS--OPERATOR SURVEYS VERSUS MAJOR FIELD AUDIT AND API ESTIMATES

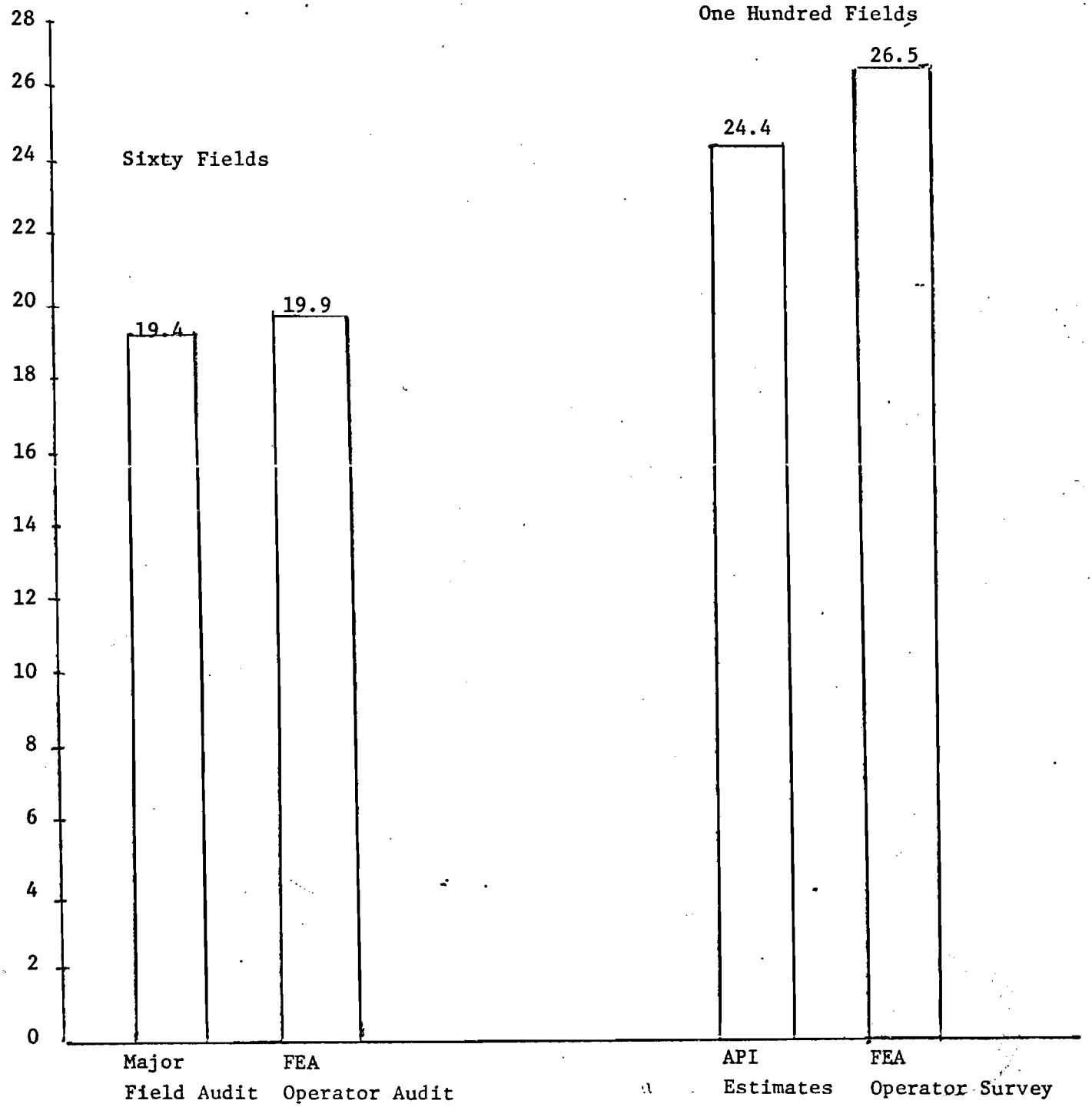

CHART 3. COMPARISON OF NATURAL GAS PROVED RESERVES FOR SELECTED FIELDS - OPERATOR SURVEYS VERSUS MAJOR FIELD AUDIT AND AGA ESTIMATES

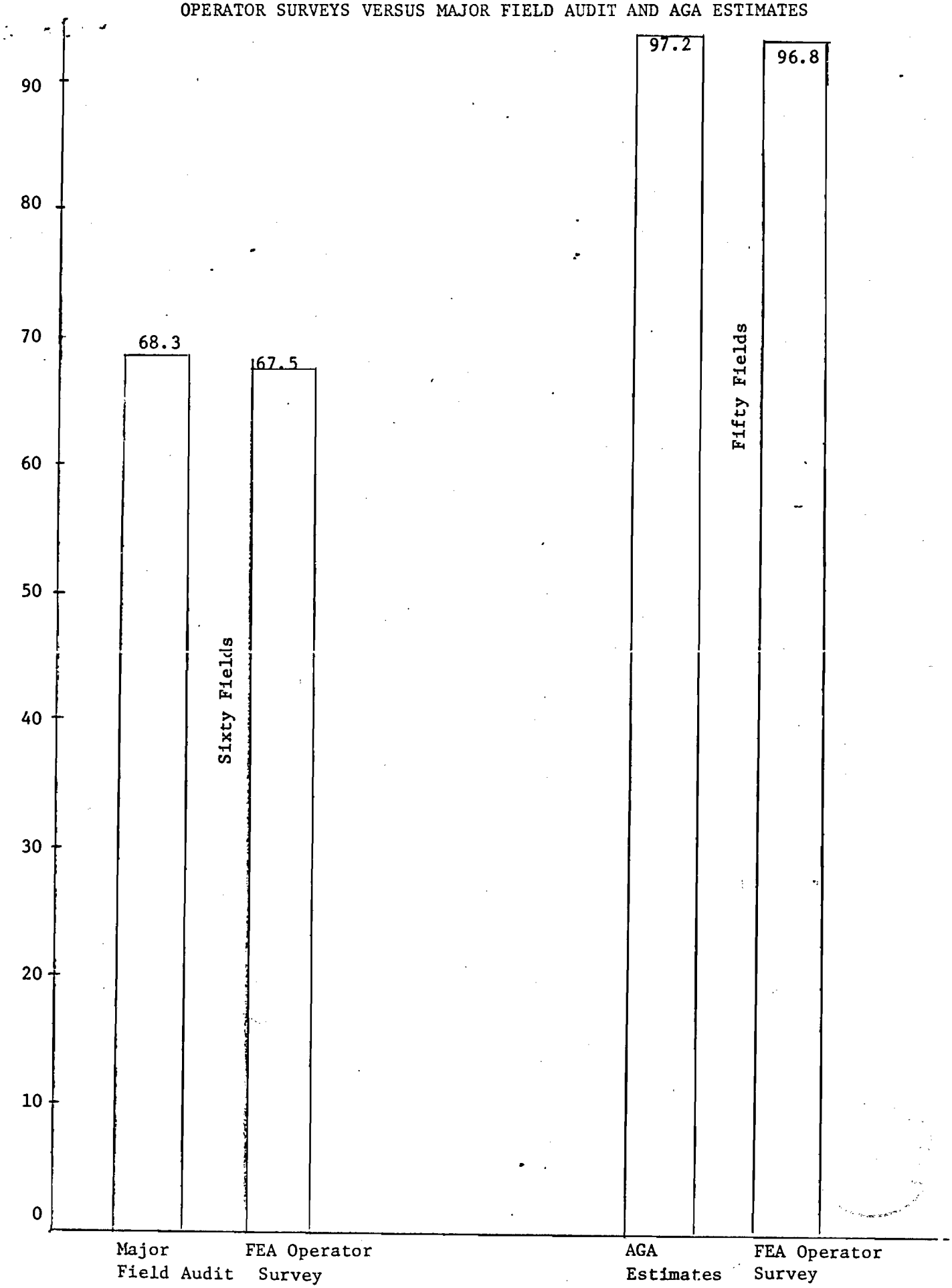

CHART 4. COMPARISON OF AVERAGE DAILY PRODUCTION CAPACITY FOLLOWING DECEMBER 31, 1974 WITH AVERAGE DAILY PRODUCTION FOR CALENDAR 1974 AND DECEMBER 1974