GLOBAL DEMAND AND GLOBAL PRODUCTION:

CLOSER TO BALANCED

by

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Global Demand and Global Production: Closer to Balanced

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Twenty years ago, the nation was totally unconcerned about oil and energy-driven inflation. In 1968 I gave a speech at the dedication of the Science Campus at the University of Southern Colorado, in which I spoke about the impending crisis of declining national production and increasing reliance upon foreign imports, especially from insecure Arabian Gulf countries. The reaction I received was, at best, "ho hum", much was negative, and none was supportive, save for one enlightened chemist. In 1973 the price of oil went up and the supply from the Persian Gulf was cut off. Inflation went rampant and the United States panicked. Political action was swift, but not sure.

It is now 1989. *Deja vu* . Our setting is quite reminiscent of that day in 1968. Complacency rules, the programs of long-term synfuel and alternative energy research have been dismantled and no basic energy supply policy exists. Today our domestic industry is in a shambles, exploratory drilling is at disastrously low levels, our production is declining, demand has increased, and our imports have risen from 26.5% of supply to over 45%.

Let's look just at 1985 to present. At the end of 1984 our active rig count was 2713, by the end of 1985 it was 1898, in mid-1987 it bottomed at 744. At the end of 1988 there were 939 rigs running (Fig. 1). At this writing there are less rigs running, close to the 750 mark than. Comparison of that number to estimates of the number of exploratory wells necessary to discover large fields (Fig. 2) reveals a serious future problem in domestic supply. Since it appears to take over 1000 exploratory wells to discover a field over 10,000,000 barrels of oil equivalent (mmbo) (using 6000 cubic feet of gas = 1 barrel of oil), and approximate 10,000 exploratory wells to discover a field of greater than 50 mmbo, it should be clear that a total of 750 rigs drilling <u>both</u> exploratory and development wells is not sufficient to maintain our production levels. Our daily oil usage now averages almost 18 mmbo per day, of which we produce

about 7.9 mmbo of crude (natural gas liquids not included). Thus we need to discover two 10 mmbo fields every day just to keep pace with our current usage. It would take a statistical 2000 completions per day to eliminate imports, which I do not consider an option. I estimate it would take a statistical 500 completions per day to maintain a production level of 8 million barrels per day. I also recognize that reserves are not synonomous with production levels.

What is demand doing? Isn't conservation keeping demand down and continually decreasing our need for oil? One would believe that to be true from federal pronouncements. Demand is going up. In mid-1985, U.S. demand was about 14.5 million barrels per day. At the end of 1988, our demand had increased to about 18 million barrels per day, an average increase of nearly 7% per year (Fig. 3).

In about the same time period, drilling has gone down from 2713 rigs to present average 750. Imports are going up, from 3.812 million barrels to over 8 million barrels (Fig. 4) (products included). Domestic production continues to fall, from 10.5 million barrels per day (9/85) to 9.6 million barrels (Fig. 5) (natural gas liquids included).

Didn't we drill enough oil wells in the last few years to last us for a long time? After all, there is an oil "glut' today. Domestic production (Fig. 5) is subject to the laws of physics, even if the federal government isn't. Decline curves are inexorable if enhanced oil recovery methods aren't developed and practiced. We topped out at 8,914,000 barrels of oil per day (not including NGL) produced during September of 1985, and production has steadily dropped since then. Even more important, decline curves are not straight lines--once the decline sets in, the first part of the curve is very steep, gradually lessening in declivity until becoming asymptotic to zero, or the economic limit. We are on the steep decline.

In addition, low prices have forced the plugging of many stripper wells, which cannot be placed back into production. The seriousness of this is seen in the average daily production, per well, of our top ten producing states (Fig.

6). Thus, our national decline curve is ever more steep (Fig. 5). Our discovery ratios are not increasing even with our more sophisticated technology--we barely keep pace when oil price/prospect quality are considered (Fig. 7). John Haun was quite correct in 1980 when he warned us that the U.S. could never again be self-sufficient in oil.

In the Global Market:

There are no good numbers for global oil production and consumption. According to the best available numbers (BP), global oil production capacity is somewhere about about 60 mmbo/day, compared to estimates of 61.2 mmbo demand (1987). These figures do not match, obviously: Production figures and consumption figures indicate that the world is already using more than a million barrels per day than it is producing (Fig. 8), but stocks are increasing. The current free world usage is about 50.2 mmbo, up from 47 mmbo in 1986. Free world production is about 41.3 mmbo (1987). Demand growth is estimated at about 2.5% per year, although the U.S. demand actually has increased an average of almost 7% per year since mid-1985. Some estimates of percentage global demand increases are larger than U.S.demand growth, but I have seen no numbers to back those assertions. Best estimates are that actual global production is about 60 mmbo/day, global demand is about the same, based on assumptions that stocks must go up or down significantly if these two figures do not balance.

Potential sustained production by OPEC, assuming that non-OPEC countries are producing at maximum efficient rates, could raise global production to as much as 68 million barrels per day. Assuming our numbers for global usage were correct, that would provide about 7 million barrels per day cushion against a tightening of supply. This is the worst case scenario, I believe. All of the slack would be taken up by OPEC countries, the Persian Gulf providing 6.3 million barrels and the other OPEC countries providing about .7 million barrels. I question whether present production and transportation facilities would permit that sustained level of production, and it remains to be seen whether there is interest in OPEC of greatly expanding productiuon compared to gaining increased prices.

Global growth of consumption appears to be about 1.5% annually, or about 1 million barrels per day per year. Of this, the U.S. is increasing usage by about 250 thousand barrels per day per year. Global consumption, at these rates, will reach 68 million barrels per day by 1994. If the global production decline, calculated at 0.9% /year, is factored in, then the 68 million bopd mark is reached in 1992 (fig. 8).

When demand levels do reach those marks, additional exploitation of Saudi and other Middle Eastern reserves will occur, but volatility in price should markedly decrease. There does not appear to be a real shortage of supply that would send prices skyward for at least ten years. However, firming of prices and long-term price stability is necessary for the domestic independent industry to become healthy and to increase drilling activity.

One other factor must be considered, no matter the concilatory stance of the current Soviet Union leadership. With over 75% of the free world reserves in the Persian Gulf, any Soviet adventurism in the Persian Gulf could end the free world as we know it, or initiate the third world war. The Soviet Union borders on the Persian Gulf; our influence is waning rapidly; our politics ignore all of these realities.

United States Policy

Federal intervention in the petroleum industry has always been unfavorable. I believe that any additional intervention will be equally unfavorable in the long run, but, we are at a crisis and may have to gamble on a favorable long-term impact of federal action. The country needs an oil production policy even more than it needs an energy policy. Our domestic industry has to have the ability and initiative to supplant a significant portion of our daily imports for the future, or we face a very insecure next century.

The end of the oil "glut" is inexorable and the fate of the United States hangs in balance. The geological fraternity cannot solve this problem without investment capital. Investment capital used to come through tax advantages,

but these have been largely removed. What was tax loss of 70% in 1980 became 50% in 1982 and is 33% today. Risk capital is virtually non-existent in this time of low tax rates and poor price structure. If the United States government does not understand the need for a viable domestic industry with a consistent exploration business, then when the "crunch" comes, there will be several years of panic while we try to restructure the industry and locate prospects, drill, and bring the production onstream. Synthetic fuels will take about ten years to to bring on stream in any quantity. Alternate energy may be further off than that, since virtually all significant research has ended under federal sponsorship. Even enhanced oil recovery research is close to extinction.

Solutions?

Two federal actions could alleviate our potential oil shortages. First, stability in oil price is fundamental to any stability in the industry. A floor price for imported oil must be established, at whatever price can be negotiated with congress, with a 100% duty on the difference between the cost of imported oil and a higher floor price. Two things will occur from this: one, the world price of crude will be determined by the United States at that floor price or higher, simply because we are the major purchaser. It is unlikely that OPEC will permit its price to be less than the floor price. If not, then significant revenues will accrue to the federal government from the tax. Two, stability in price will permit the industry to plan. Right now no one can realistically plan an exploration or development program because of price volatility. By dampening the volatility with at least a minimum price, the industry could work with a real price/expense scenario and proceed to right its own ship.

The second federal action is to fund non-federal research in additional oil recovery. There is somewhere between 100 and 160 billion barrels of unswept oil in existing reservoirs. That resource can level the oil price and supply playing field when we can get at it. It is a national problem, and national revenues must be applied to its solution. Congress and the Department of Energy have not been very responsive to national needs in this area, rather, they are continuing to fund high levels of coal research rather

than oil research. Matching money from the various states for additional oil recovery research can be used to create at least a $50,000,000 per year program, compared to the presently funded $5 million program.

Conclusion

Stability in our industry now is preferable to the ultimate costs of meeting the next shortage. As James Schlesinger said recently, "it is already too late to avert the next oil crisis"; it is not too late to mitigate that crisis.

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Captions:

Fig. 1 A. Drilling rig average count for the United States for the indicated calender years. B. Drilling rig count for end of 1984 and march, 1989, showing the precipitous change in count between the high recent count and current levels.

Fig. 2 Number of exploratory wells necessry to discover any economic well, greater than 10 million BOE and greater than 50 million BOE in the United States. Numbers stop at 1980 because of lag time in gaining reserve numbers from new discoveries. Trends are believed to continue.

Fig. 3 United States average oil demand for four recent years. Actual growth in demand over that period is more dramatic if averages are not used, but average growth of approximately 1/2 million barrels of oil per day is significant.

Fig. 4 A. Imported crude oil amounts over four years, averaged by year. B. Percentage of total United States supply supplied by imports, averaged by year, over four years. This figure considers natural gas liquids produced and product imports as well as crude oil produced and imported.

Fig. 5 United States domestic crude oil production averaged by year, over four years.

Fig. 6 Oil production by state for 1986, showing rapid drop in values from Texas (1) to Utah (10) and relatively small per well oil production of large producing states.

Fig. 7 Success rates for domestic wells drilled, 1972 to 1985, showing recent drop-off in success rate, assumed to be due to drops in price and consequent need for greater initial production.

Fig. 8 Comparison of global demand (demand), non-OPEC global decline (decline), summation of global demand and the forecast global decline, and forecast global production, factoring in an eight million barrels per day increase in OPEC praoduction. Summed demand and decline projections

equal production in 1992. Demand is projected to equal production in 1995 if a zero decline occurs. Price stabilization for the domestic producer is forecast to occur between 1992 and 1995 as a result of this projection.

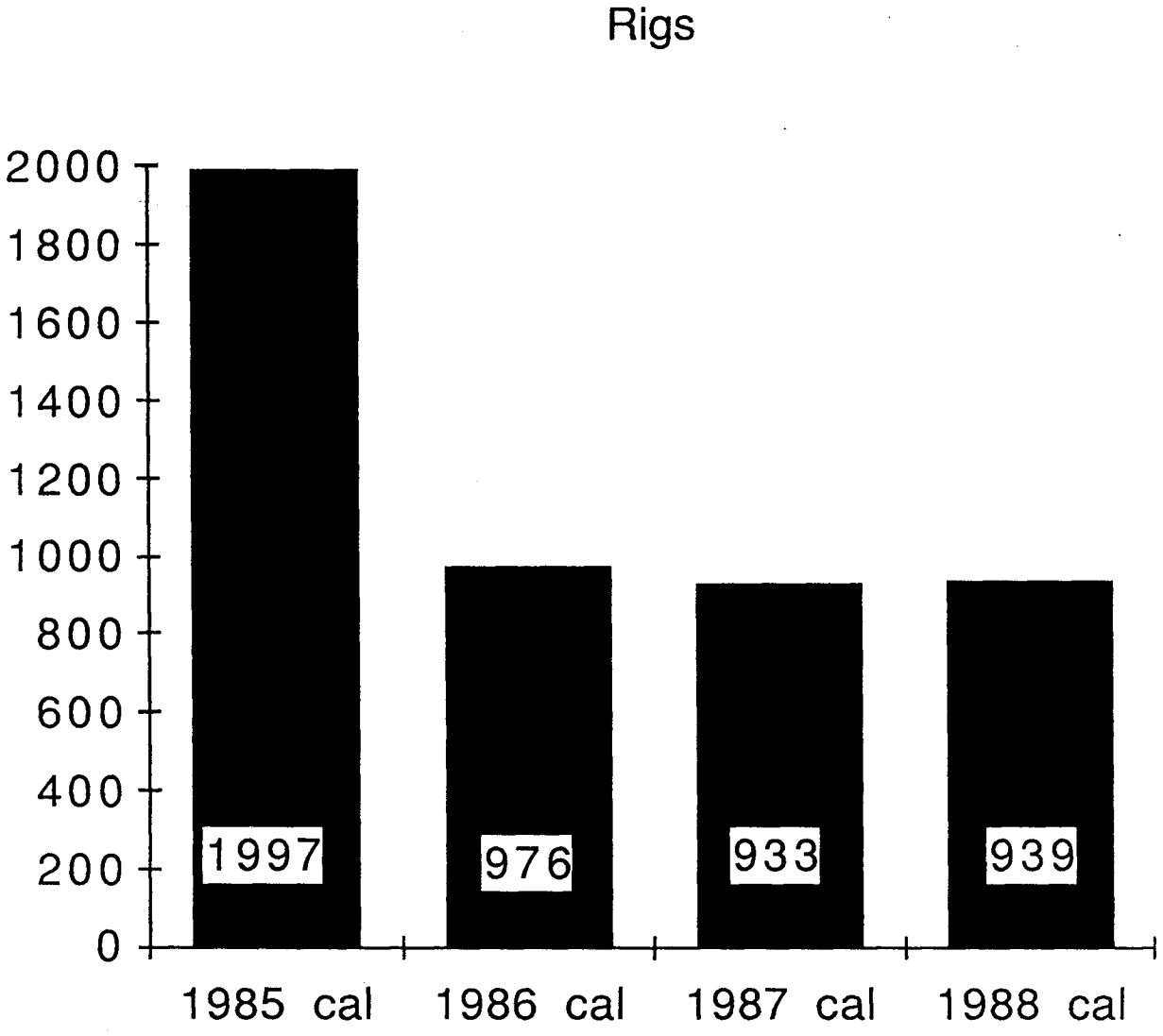

Rigs
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1997
976
933
939
1985 cal
1986 cal
1987 cal
1988 cal

Fig 1A

1969

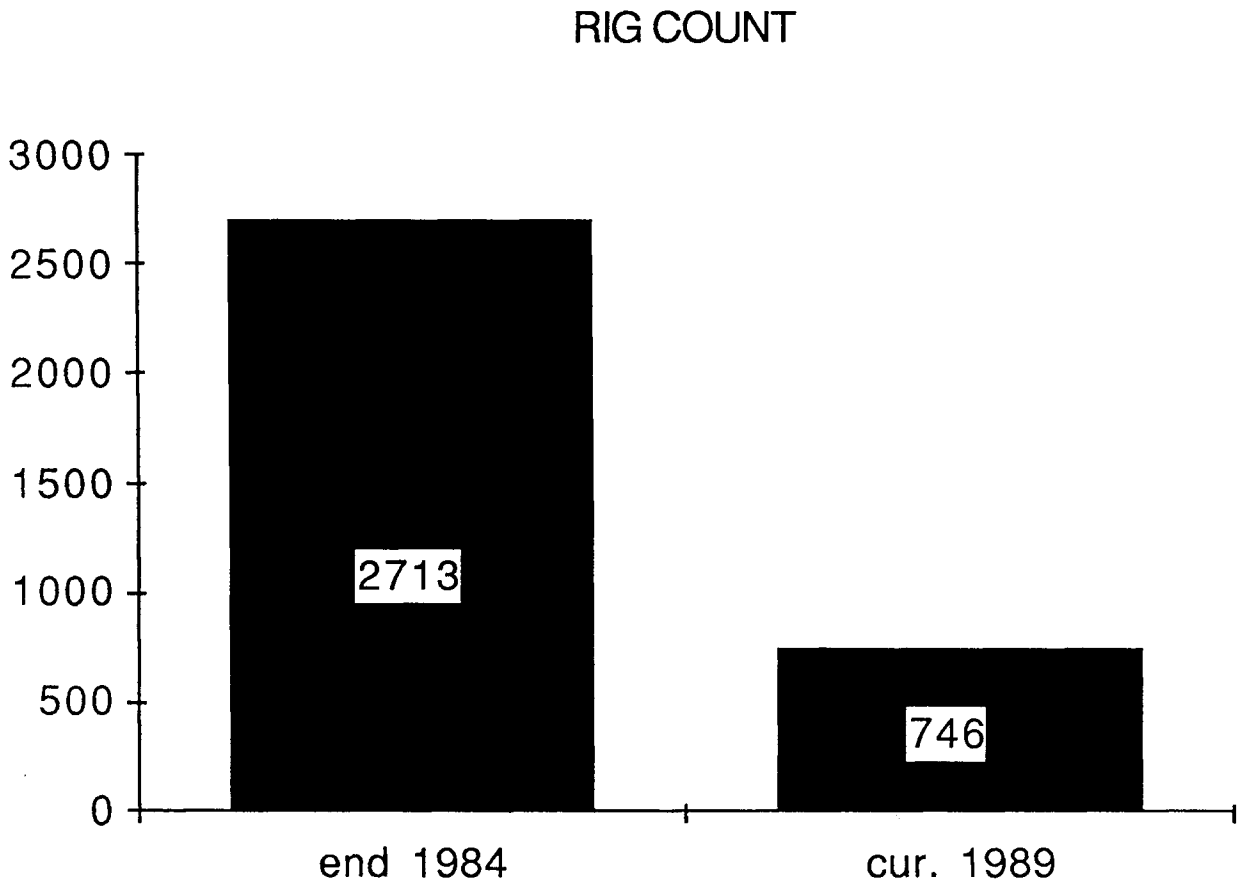

RIG COUNT
3000
2500
2000
1500
1000
500
0
2713
746
end 1984
cur. 1989

Fig. 1B

1989

WELLS NECESSARY TO DISCOVER VARIOUS FIELD SIZES. SEMILOG VERTICAL SCALE.

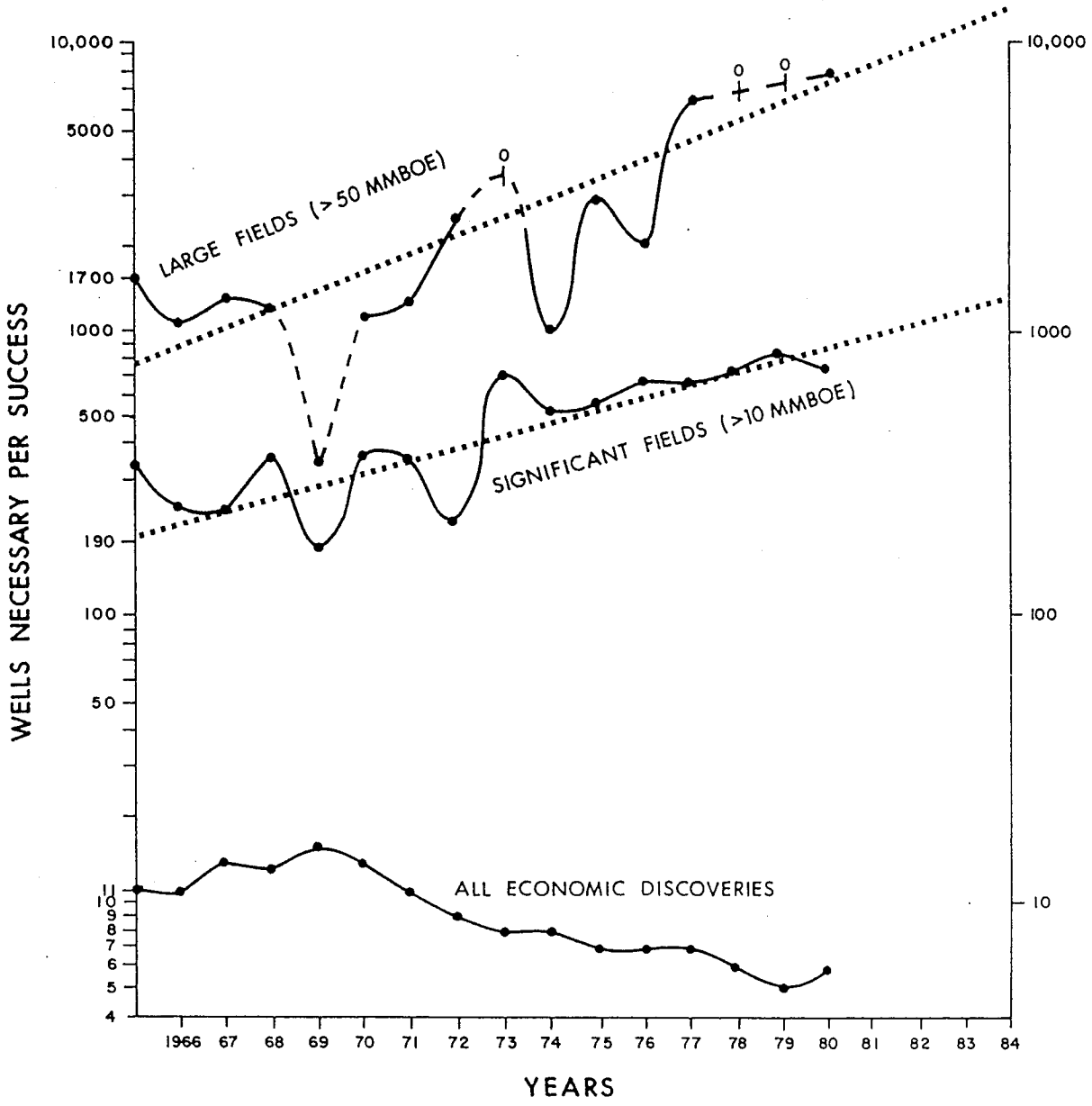


Fig. 2

1989

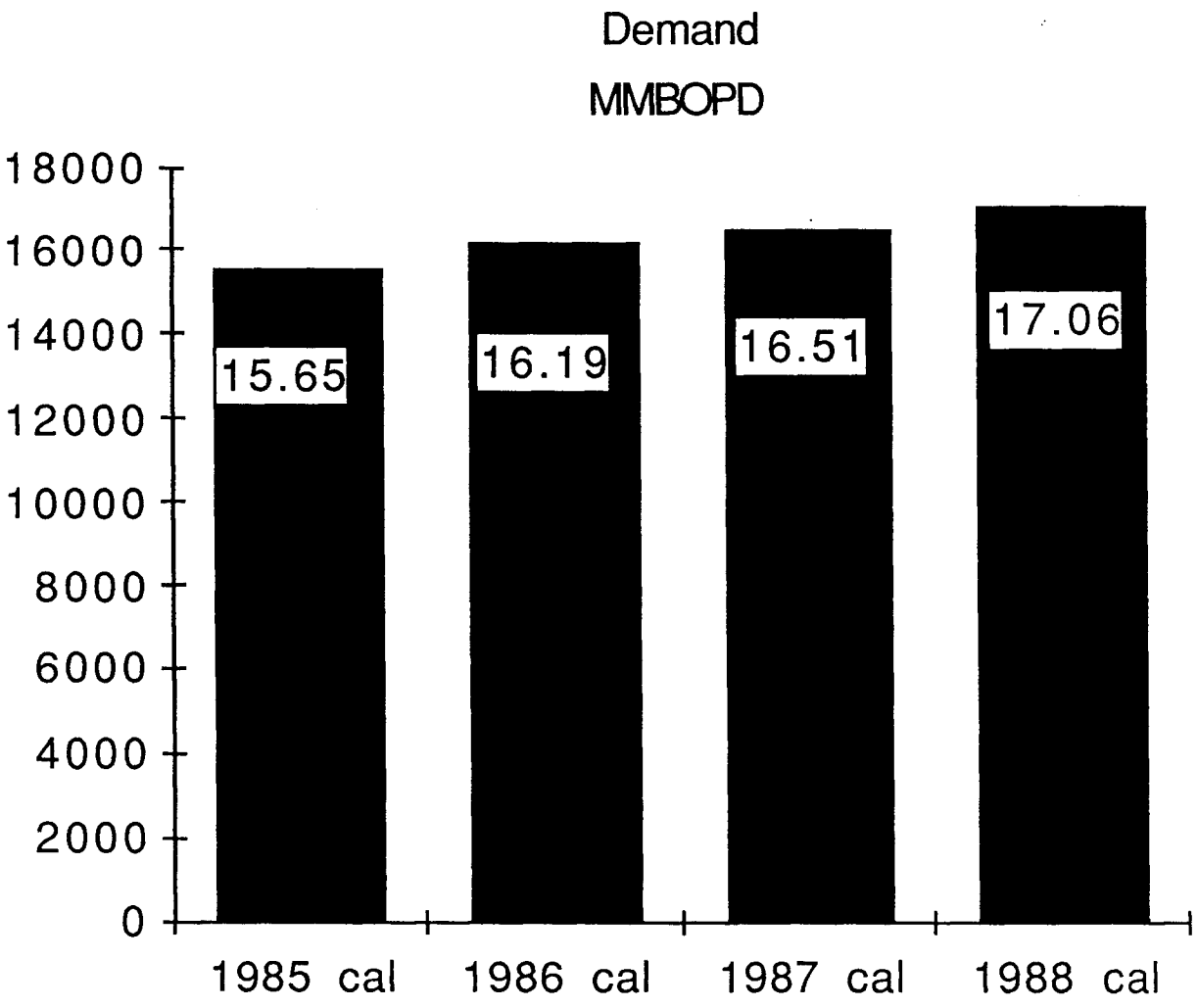
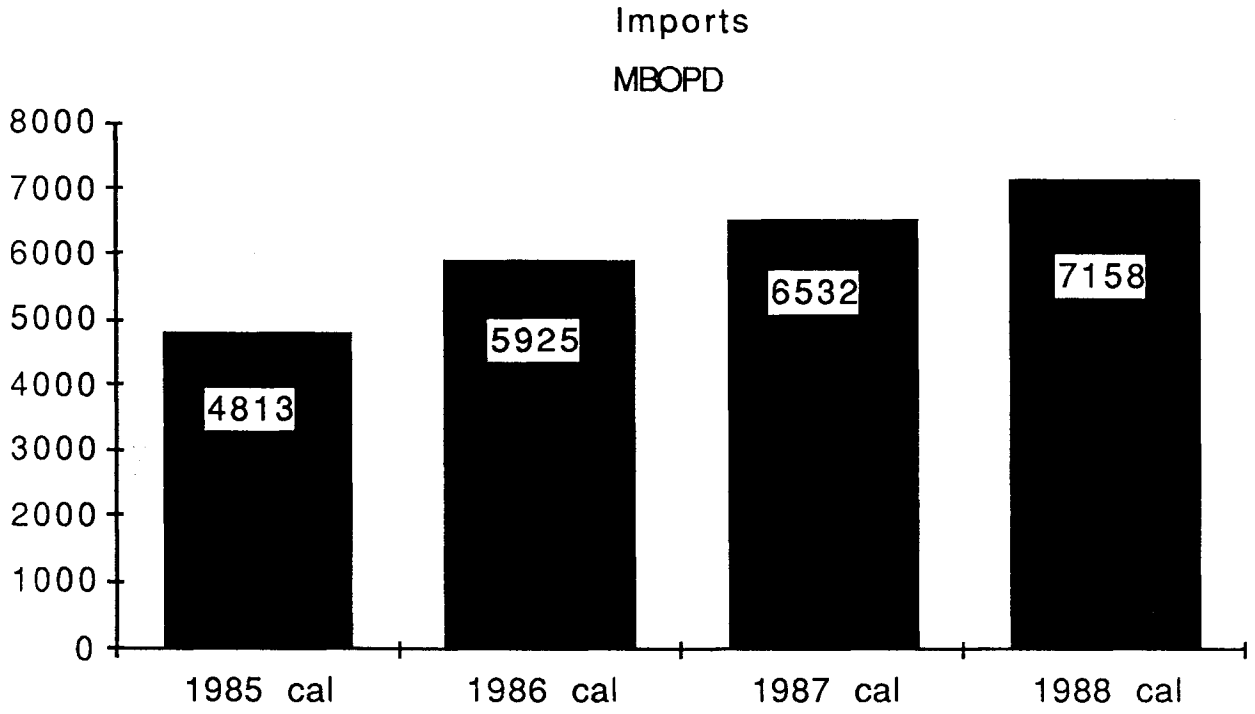

Demand
MMBOPD
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
15.65
16.19
16.51
17.06
1985 cal
1986 cal
1987 cal
1988 cal

Fig 3

1989

U.S. IMPORTS



Fx 4A

1989

U.S. IMPORTS, % OF TOTAL USE

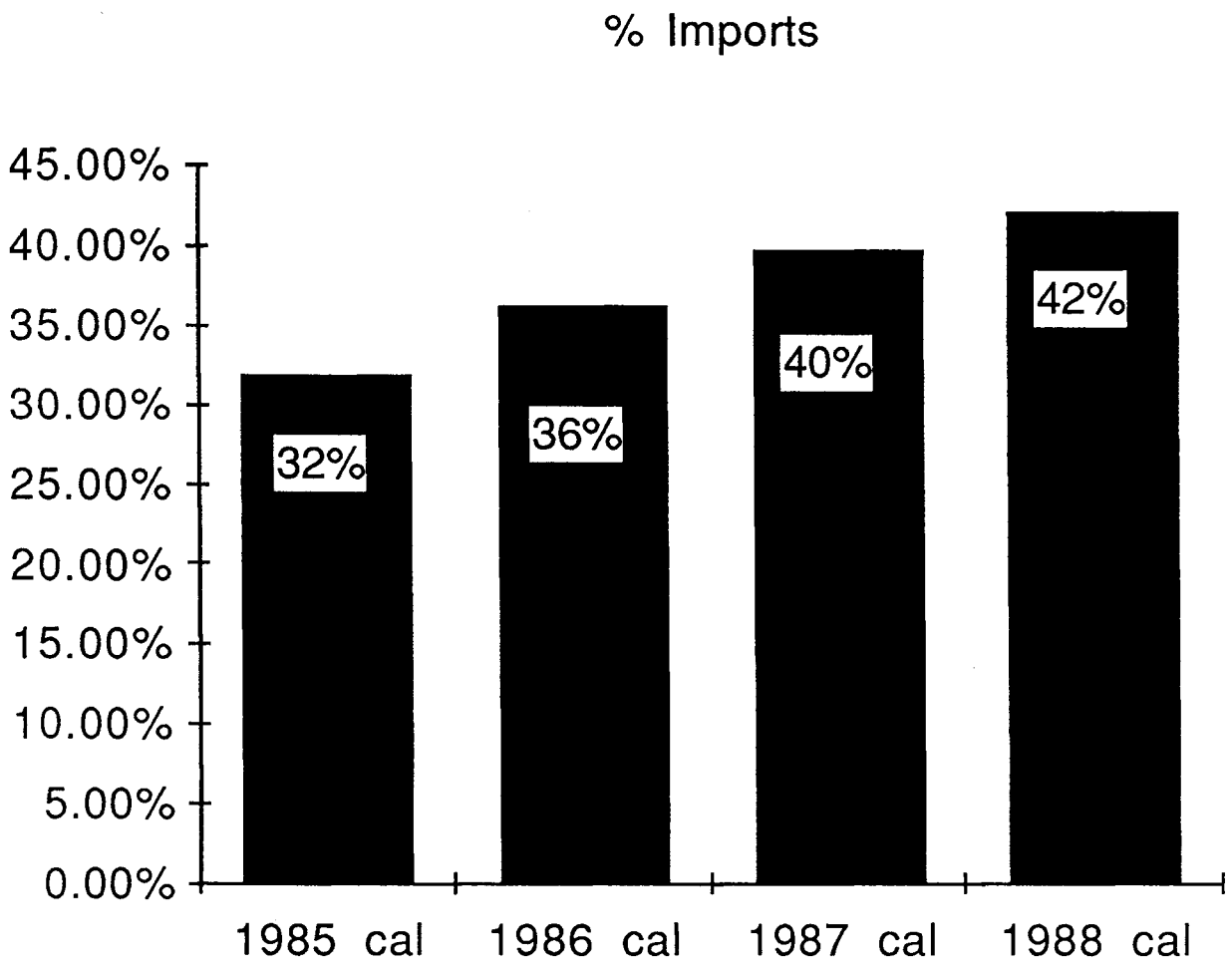


Fig 4B

1987

U.S. CRUDE PRODUCTION

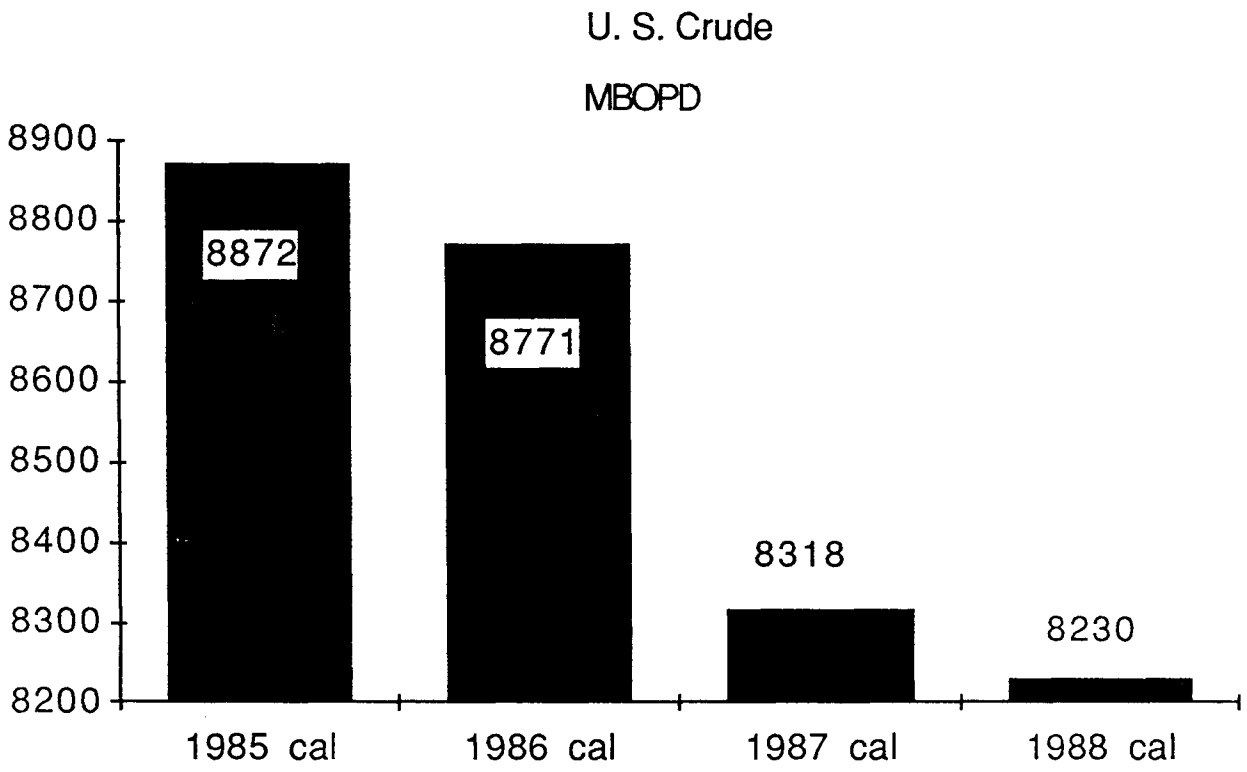


Fig. 5B

1989

FIG. 6 PRODUCTION DATA BY STATE.

Top ten oil producing states of the United States, 1984. Data from I.P.A.A. (1986)

Rank	State	Daily prod. (MBOPD)	Prod. per well per day, bbls.	Number of wells prod.	Prod. per well per day, 1981
1	Texas	2435	11.6	209040	14
2	Alaska	1825	1868	977	2299
3	Louisiana	1392	54	25823	49
4	California	1161	23.2	49874	22
5	Oklahoma	446	4.3	103000	5
6	Wyoming	352	29.2	12038	31
7	New Mexico	215	11.5	18697	12
8	Kansas	207	4	51888	4
9	North Dakota	139	37.6	3697	48
10	Utah	112	57.6	1944	46

Lower level oil producing states of the United States, 1984. Data from I. P. A. A. (1986)

11	Mississippi	84	24.2	3468	30
12	Colorado	83	15.2	5457	29
	Illinois	83	2.7	31100	2
14	Montana	82	19.5	4196	21
15	Michigan	75	14.6	5125	20
16	Alabama	59	72	810	57.6
17	Arkansas	52	5.4	9700	6
18	Ohio	41	1.5	27975	1.6
19	Florida	31	208	149	814
20	Kentucky	21	1	21844	18
21	Nebraska	19	9	2091	18.2
22	Indiana	14	2	7164	2
23	Pennsylvania	13	0.5	24000	0.4
24	West Virginia	10	0.6	15895	0.6

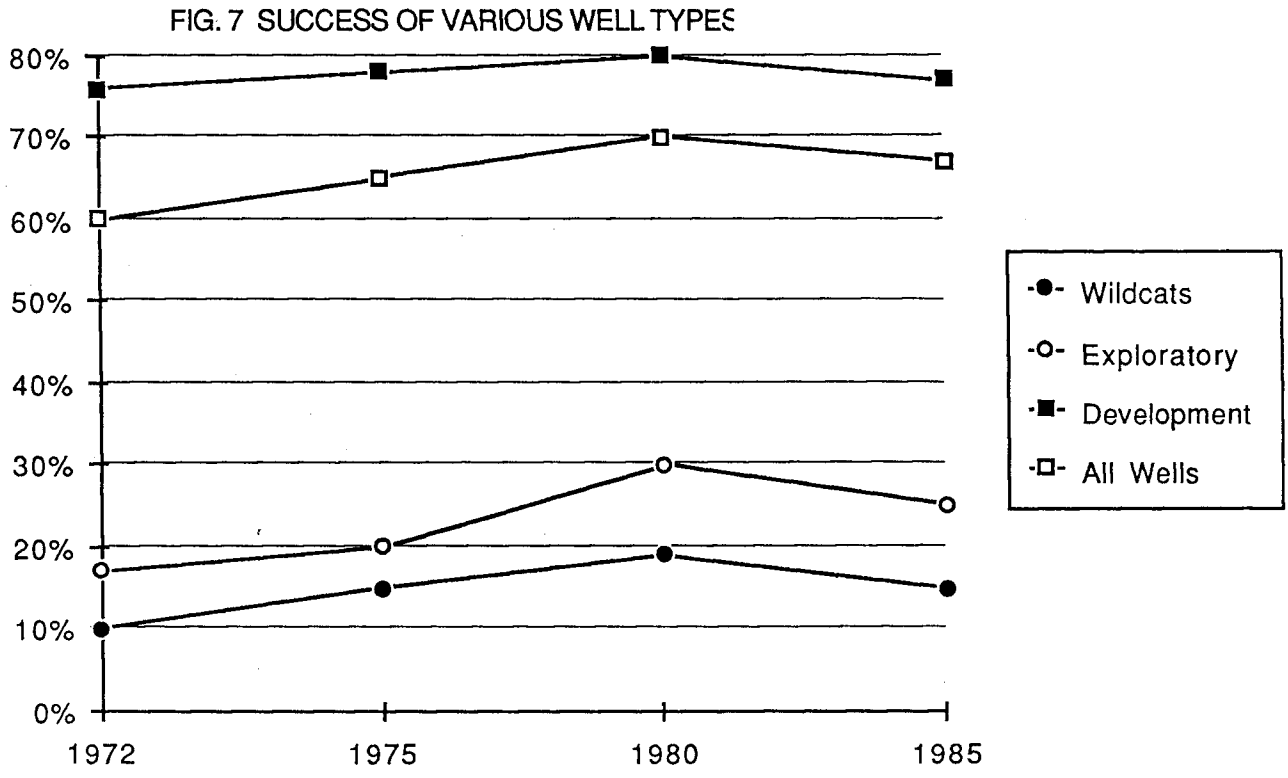


FIG. 7 SUCCESS OF VARIOUS WELL TYPES
80%
70%
60%
50%
40%
30%
20%
10%
0%
1972
1975
1980
1985
Wildcats
Exploratory
Development
All Wells

Fig. 7

1169

GLOBAL OIL BUDGET,W/ DECLINE

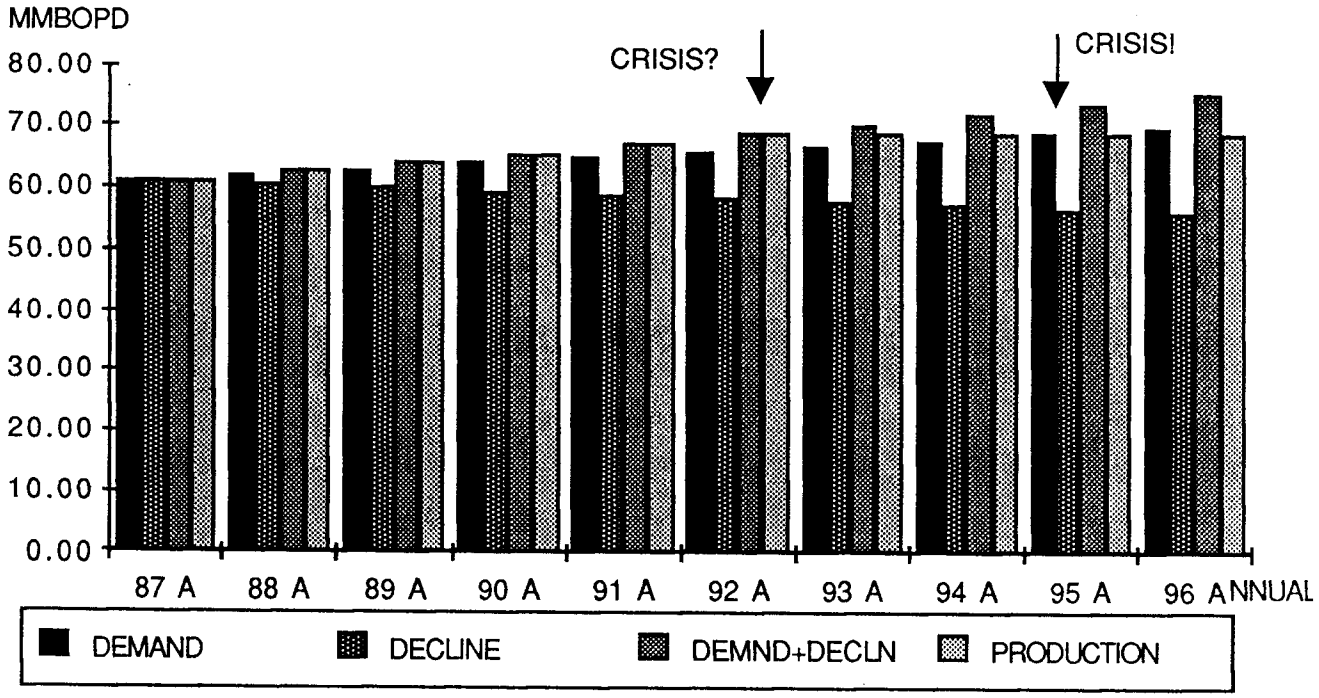


Fig 8

1989