

Introduction

The Origins of Today's Low Oil Prices

In December 1985, the Kingdom of Saudi Arabia reversed its oil market strategy. During the first half of the 1980s it had been serving as the "balance wheel" of the world oil market, raising or cutting back its oil production rate to restrain or shore up prices as necessary, thus maintaining a precarious balance between world oil demand and production capacity. During this time, however, powerful economic forces were eroding its position. The stimulus to oil exploration and development provided by the price boosts of 1973 and 1979 had led to large increases in non-OPEC oil production. From a production rate of 25.6 million barrels per day (mmbd) in 1974, non-OPEC production rose to 37.2 mmbd in 1985.¹ Simultaneously, the higher prices were encouraging investments in energy efficiency; behavioral changes leading to reduced oil use; and fuel switching from oil to coal, natural gas, and other energy sources. Consequently, despite a worldwide rise in economic output of 15 percent between 1979 and 1985, worldwide oil consumption declined by nearly 6 mmbd,² or 9 percent, during the same period.

World oil prices continued for a time on an upward path despite these trends, largely due to the OPEC countries'—and particularly the Saudis'—willingness to cut their production rates to reduce the downward pressure on prices. Between 1979 and 1985, OPEC production was cut in half, and its oil revenues declined from \$285 billion (1985\$) in 1980 to \$131 billion in 1985. The Saudis, having the largest oil reserves and production capacity in OPEC, and having a relatively small population (and thus relatively lower revenue needs), absorbed the brunt of these declines, allowing their production to drop from nearly 10 mmbd during 1979-81 to 2 mmbd during the third quarter of 1985. Finally, however, faced with expecta-

tations of still further production cuts and the unacceptable prospect of a rapid drawdown of their capital reserves, they announced their intention to recapture a fair market share, doubled their production rate, and instituted a series of contractual offerings to oil buyers that gave Saudi oil a competitive advantage in the market.

The immediate result was a sharp drop in oil prices as competing oil producers scrambled to maintain their own market shares. Within 4 months, the average price of oil had been cut in half, from approximately \$28/bbl in December of 1985 to \$14/bbl in April of 1986. From there the price has fluctuated, dropping below \$10 in July and rising to about \$15 in September and \$18 by the end of the **year**. And although there is no consensus as to how prices will behave in the short term, there is almost a universal expectation that oil prices for the next few decades will be significantly lower than the prices projected prior to the Saudi action.

Effects on the Oil Industry

The consequences of the price drop have reverberated through the world economy: the economies of principal oil exporting nations have generally suffered because of sharply reduced oil revenues, while oil importing nations are enjoying the equivalent of a large tax cut. The prices of competing energy sources have been forced downward to compete with newly cheap oil, while production costs of energy-intensive goods and services have dropped. Producers of high-cost oil—and particularly producers in the United States—now face prices that in many cases do not cover replacement costs for their oil, and in some cases do not even cover operating costs. For these producers, the price drop has brought massive economic disruption and the prospects for substantial production declines. In addition, the lower oil prices also appear likely to boost domestic oil consumption. These expected production and consumption trends will result in increased U.S. dependency on foreign oil, and

¹Arthur Andersen & Co, and Cambridge Energy Research Associates, *World Oil Trends: A Statistical Profile*, 1986-87 ed., tables 6 and 10. Excluding natural gas liquids.

²*ibid*,

possibly increased vulnerability to future oil cutoffs.

Although estimates of the timing and extent of the expected drop in U.S. crude oil³ production differ, a mean value for the expected size of the drop would likely be about 2 mmbd by **1990 (from a base of 8.9 mmbd in 1985) if prices average about \$15/bbl.** This reduction would be the cumulative effect of several forces. First, marginal producing wells with high production costs will be shut in either because revenues are too low to pay for daily operating costs, or because the wells require expensive "workovers" that no longer appear attractive at the low prices. Of primary concern here are the several hundred thousand "stripper wells," wells producing 10 barrels per day (bbl/day) or less, that currently account for about 15 percent of U.S. oil production. Second, plans for many of the secondary and tertiary recovery operations that partially compensate for normal production declines in older fields will be canceled and, in a few cases where operating costs are high, existing operations will be shut down. Third, fewer development wells will be drilled; these wells also help maintain field production despite normal production declines in existing wells. Fourth, a slowdown in exploration will depress the inventory of newly discovered fields, and the development prospects associated with those fields, further depressing development well drilling in the future. And fifth, reductions in R&D expenditures will slow the development of new technologies and the acquisition of new knowledge that in the past helped the industry to increase oil recovery and find new sources of oil.

This process appears to have begun. Average U.S. crude oil production during 1986 was 3.3 percent, or 297,000 bbl/day, below 1985 production, while oil products supplied to consumers rose 2.7 percent, or 423,000 bbl/day. Net imports have risen by 24 percent or 1,007,000 bbl/day

³That is, crude plus natural gas liquids recovered in the field, called lease condensate. This is generally what is being referred to when the terms "crude oil" or "oil" production are used. "Total liquids" or "petroleum" production includes, in addition, natural gas liquids recovered from gas processing plants, refinery processing gain, and alcohols.

over the same period.⁴ Also, on a monthly basis, production has dropped even more: from December 1985 to December 1986, U.S. crude oil production dropped by 670,000 bbl/day, or over 7 percents

Although the early 1980s was a boom period in oil drilling, *exploratory* drilling and other exploration activity peaked as early as 1981 and declined rather steadily through 1985, and total oil well completions began to slide in 1985 and dropped precipitously in 1986. Although many analysts view the earlier drops in activity as a necessary correction after a drilling boom, most view the 1986 drop as a virtual dismantling of two important segments of the domestic oil industry, the independent producers and the well service companies, that will greatly harm prospects for U.S. domestic oil production.

Among the activity declines are the following:

- *seismic crew count* dropped by four-fifths from its September 1981 peak to September 1986;
- overall *industry employment* dropped from a 1982 high of 708,000 to **422,000** in September of 1986; oilfield service company employment absorbed four-fifths of the drop, going from 435,000 to 206,000 during the same period;
- *unemployment of senior petroleum geologists* is 25 percent according to a recent American Association of Petroleum Geologists poll;
- *drilling rig counts and utilization rates* fell from 3,970 and 79 percent in 1981 to 3,105 and 55 percent in 1982, to 1,976 and 45 percent in 1985, to about 700 and 20 percent in mid-1986—rig count has since rebounded slightly;
- *well completions*, which peaked at about 89,000 in 1981 and were still at 73,000 in 1985, slid to slightly below 40,000 in 1986;⁵ and

⁴Energy Information Administration, *Weekly Petroleum Status Report. Data for Weeks Ended: Dec. 26, 1986, Jan. 2, 1987*, DOE/EIA-0208(87-01)(87-02).

⁵Ibid.

⁶Independent Petroleum Association of America, "United States Petroleum Statistics, 1986 Final," and "American Petroleum Institute, Quarterly Completion Report, First Quarter 1987."

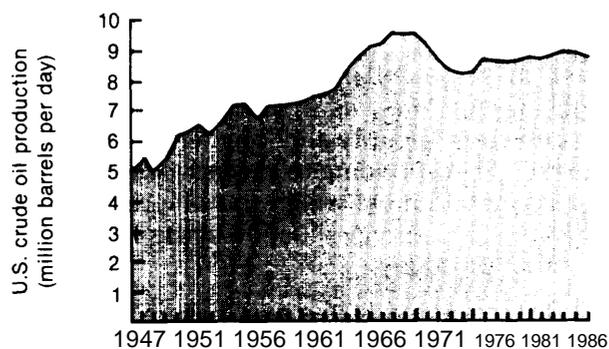
- *exploration/production capital spending* has slid from about \$50 billion in both 1981 and 1982 to \$33 billion in 1985 and then to \$16 billion in 1986.⁷

To an extent, this drop in domestic oil production and industry activity levels is reminiscent of the production decline and drop in drilling that occurred in the early to middle 1970s. As shown in figure 5, U.S. crude oil production had been climbing steadily for decades before the 1970s, and peaked at about 9.6 mmbd in 1970. Production then began a decline that lasted until 1976. In that year, however, the downward trend was arrested by a combination of a surge in drilling activity that slowed and eventually stopped the decline in production in the Lower 48 States, and the onset of production from Prudhoe Bay in Alaska. Prudhoe Bay production eventually reached 1.8 mmbd, almost 20 percent of U.S. oil production, by 1985. Had the 1970-76 rate of decline continued without abatement, lower 48 production would have been 1.7 mmbd lower in 1985 than it actually was; without Alaska as well, U.S. production would have been 3.5 mmbd—more than a third—lower in 1985 (assuming that the effort expended in developing and producing Alaskan oil would not have been transferred elsewhere). Many in the oil industry point to the “rescue” of U.S. oil production by a combination of intensive drilling and the opening of new “frontier” production as a warning for the future if activity levels do not recover and new frontier areas are not opened for exploration and development.

Congressional Concerns

Congress has two basic reasons to be concerned about low oil prices. First, the reduced prices have important implications for the entire U.S. economy. Some of the implications are clearly positive, at least in the short term—the reductions in energy costs to both consumers and industry, and the expected economic stimulus provided by these reductions. Some, however, are sharply negative—the severe reductions in

Figure 5.—U.S. Crude Oil Production, 1947-86



SOURCE: American Petroleum Institute (Energy Information Administration).

revenue streams and values of energy reserves held by energy producers, the resulting drop in investments in exploration and development, and the subsequent loss of business suffered by industries servicing the producers; the damage to the U.S. banking industry caused by the widespread company failures and loan defaults; the potential loss of business suffered by industries supplying products and services that are marketed primarily for their energy-conserving features; and the unemployment, loss of tax receipts, and other negative effects flowing from these problems, largely concentrated in a few key oil-producing States such as Texas, Louisiana, and Oklahoma.

Second, to the extent that the projections of reduced domestic oil production and increased oil demand are correct and the United States is forced to resume high levels of oil imports from politically insecure sources, the current lower prices may represent a potential threat to the United States' national security as well as to its future economic health. Congress clearly viewed the high levels of oil imports of the 1970s as just such a threat, and responded with extensive legislation including programs to promote synfuels development, tax incentives for energy conservation and alternative energy sources, an extensive energy R&D program, and the establishment of the Strategic Petroleum Reserve (SPR). In addition, funds were appropriated to establish military forces specifically designed to deal with threats far from established U.S. military bases, and in particular the Middle Eastern oilfields.

⁷Arthur Andersen & Co. and Cambridge Energy Research Associates, *World Oil Trends: A Statistical Profile, 1986-87* ed.; and *Oil and Gas Journal*, Feb. 23, 1987, p. 31.

Industry advocates of strong congressional measures to fight the increases in U.S. oil imports projected to result from low oil prices have portrayed these potential increases in precisely the same manner, i.e., as a serious threat to the United States' security and long-term economic interests. In responding to this advocacy, however, Congress must weigh the differences between the U.S. energy situation in the 1970s and the situation today.

First, the United States now has an SPR containing approximately 500 million barrels of crude oil, the equivalent of about 100 days of oil imports at current levels. Similarly, Europe and Japan have also added to their strategic storage, although not to the same extent as the United States.

Second, world oil production has become substantially more diversified since the 1970s, with OPEC's share of the world oil market declining from 60 percent in 1979 to approximately 35 percent today. For several years, at least, no single country or cohesive group of countries can control as large a share of the world market as was possible previously. Eventually, however, if oil prices remain below \$20/bbl, OPEC may regain its previous market share.

Third, a considerable portion of any increase in oil consumption both in the United States and in the remainder of the Free World will be reversible. For example, much of increased oil use in transportation will involve changes in consumer behavior, such as increased driving, that would be quickly reversed in case of an oil shortage or large price increase. In the industrial sector, the shifts to oil for a boiler fuel can be rapidly reversed with a shift back to coal or natural gas. Similarly, in the electric utility sector, a substantial portion of any increased oil use is likely to involve the use of existing oil-fired generating capacity—removed from baseline service when oil prices rose in the 1970s—at the expense of coal, gas, or even nuclear plants. As long as the industry retains excess generating capacity, this use can be readily reversed.

A threat to reversibility is the potential for inadequate supplies of natural gas resulting from the same drilling slowdown acting to reduce oil

production. This potential is a realistic possibility only in the United States. There is considerable controversy about U.S. gas supply adequacy for the future. Some analysts are projecting an imminent market tightening within just a few years if gas prices stay low, followed by supply problems as domestic production capability continues to decline. Others claim, however, that such a shortage is extremely unlikely, because additional large volumes of gas can be made available rapidly if markets tighten, by increasing import levels and by developing reserves now kept out of the market by low demand.

Fourth, the United States and its allies have undergone two major price shocks in the recent past, and this additional experience, as well as a series of international agreements on oil sharing, may assist them in a future supply crisis. Many oil experts are skeptical about the usefulness of these agreements, however.

Fifth, U.S. oil prices are no longer controlled as they were during the 1970s. In the event of a new price increase, the market forces that act to reduce demand and increase supply will be felt in full (assuming price controls are not resumed).

Sixth, most of the world's oil trade now operates on the spot market, in contrast to the long-term contracts of the 1970s. Coupled with an active futures market, this new oil trading situation makes single country embargoes, which could never be airtight even in the past, still less of a threat.

These mostly positive changes in the world oil market do not negate arguments that United States security can be threatened by an increase in oil imports, but they clearly lessen the overall risk and should be carefully considered in any policy debate.

The OTA Study

In April, 1986, the Chairmen of the Committee on Government Operations, the Committee on Energy and Commerce, and the Subcommittee on Fossil and Synthetic Fuels of the U.S. House of Representatives asked the Office of Technology Assessment to assess "the effect of

volatile oil prices on short- and long-term domestic oil production . . . (including) an examination of changes in the industry that have already occurred . . . and an evaluation of the significance of these changes to domestic production."⁸

OTA's approach to this assessment explicitly acknowledges the high degree of uncertainty associated with attempting to project future domestic oil production. One cause of this uncertainty is that much of the data on the exploration and development opportunities available to the industry—a crucial determinant of its future behavior and thus of future production potential—is held closely by the individual oil companies. Another cause is that most of the projections available to the public are based on extrapolations from past experience . . . but there has not been a rapid decline in oil prices within the past several decades. It seems reasonable to question whether the statistical record, amassed during a period of escalating prices, is sufficient to forecast the future actions of the oil industry and the likely effects on production of these actions.

Consequently, OTA has not tried to produce yet another forecast based on extrapolation. In-

stead, we have examined and attempted to gain an understanding of an array of factors that will influence future production, with the dual goals of, first, determining how production outcomes may differ from those predicted by extrapolating from past experience, and second, determining how government action might influence future production rates. The factors we examined include:

- changes in industry business strategies and capabilities associated with the restructuring the industry has undergone;
- the profit potential of the array of exploration, development, and production prospects available to the industry;
- the physical nature of the oil resource base;
- changes in the climate for oil and gas investment overseas;
- the deterioration of the industry's service sector;
- the surplus of natural gas deliverability; and
- changes in exploration and development technology.

While OTA could not comprehensively analyze each of these factors and reliably determine their exact effects on future production, it is hoped hope that this study will contribute significantly to Congress' understanding of—and ability to respond to—the evolving domestic oil supply situation.

⁸Letter of Apr. 17, 1986, Jack Brooks, Chairman, Committee on Government Operations, U.S. House of Representatives, to Dr. John H. Gibbons, Director, Office of Technology Assessment.