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FIGURE

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Petroleum has been at the heart of the Nation's efforts to secure its energy future since the 1973-74 oil embargo. Petroleum products currently supply about 40 percent of total U.S. energy needs, and imports account for approximately **30** percent of total petroleum demand. The increases in the price of imported crude that have occurred since 1972—a barrel of imported crude that was selling for $4.80 in 1972 was selling for $31.40 (both expressed in constant 1980 dollars) as of February 1982–have severely strained the national economy by contributing to domestic inflation and trade deficits and by altering demand patterns.

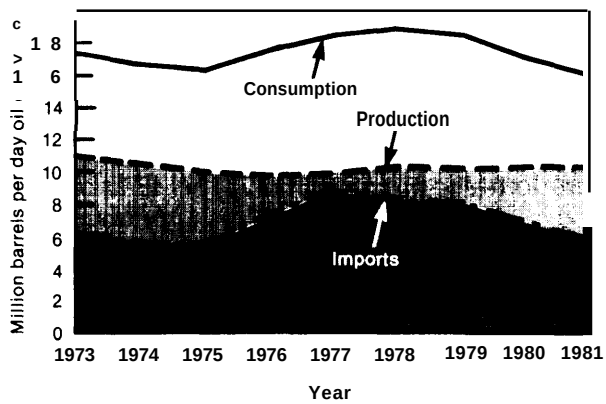
Instead of increasing gradually, petroleum prices have gone up in two large, rapid jumps. These price "shocks" have exacerbated strains on the economy by preventing an orderly adjustment to higher fuel prices. Future price behavior is also very uncertain and complicates economic planning. Subsequent to decontrol of domestic crude oil prices, a continued increase in the price of oil was generally expected. The sharp drop in demand, coupled with reemergence of Iran on the world oil market, however, has created downward pressure on oil prices. A substantial drop in the real price of oil over the next few years is quite possible.

This oil glut will not last indefinitely, however. Indeed, importing nations will eventually again face increasing competition for oil arising from a combination of dwindling world supplies* and increases in demand from both producing and developing nations. This, in turn, will force oil price increases with the possibility that they may again come in the form of price shocks rather than an orderly rise. Thus, the U.S. petroleum problem is not simply that we import oil–indeed, in a stable, economically rational world importing could be economically efficient-but that the supply and price is subject to so much uncertainty and dramatic change.

For 1981, the Nation's imports of crude oil and petroleum products averaged about 5.4 million barrels per day (MMB/D), accounting for about 34 percent of total petroleum demand. These figures compare with 7.5 MMB/D of imports, about 41 percent of total petroleum demand, for 1980. In fact, imports and demand have been on a steady downward trend since their peak in 1978, when imports of 8.2 MMB/D represented 44 percent of total demand (see fig. 3). The principal cause of this downward trend in imports and their share of total petroleum demand was the nearly 120-percent increase in the real price of crude oil since 1978. If the trend were to continue, oil imports could be eliminated by the end of the century.

There is considerable disagreement, however, on whether this trend can be maintained. The current downward trend of prices as a result of a soft market has already been noted. The principal focus of disagreement, however, is the adequacy of the Nation's future domestic supply. The current domestic production of crude oil and natural gas liquids is 10.2 MMB/D. Production of these two liquids has been declining steadily since

Figure 3.—U.S. Petroleum Consumption, Domestic Production, and Imports



SOURCE: Energy Information Administration, U.S. Department of Energy.

*OTA estimates that non-Communist world oil production could range from 45 to 60 MMB/D in 1990 and 40 to 60 MMB/D in 2000, compared to 46 MM B/D in 1980. While an increase in world production is possible, it is more likely that production will remain fairly stable or slightly decline. See *World* Petroleum *Availability 19802000-A Technical Memorandum* (Washington, D. C.: U.S. Congress, Office of Technology Assessment, October 1980), OTA-TM-E-5.

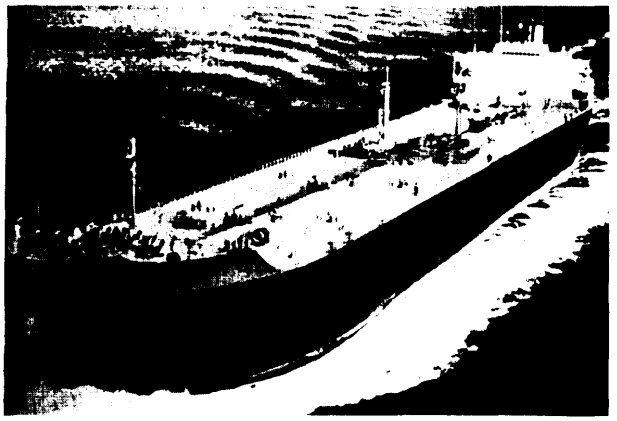


Photo credit: U.S. Department of Energy

Oil tankers deliver most of the crude oil imported to the United States

the peak year of 1970, when it reached 11.3 MMB/D, although the decline has slowed noticeably the last 3 years (see fig. 3). This, coupled with the remarkable upsurge in drilling activity since 1979, has caused some forecasters to predict an increase in production before the end of the century. In its most recent forecast, under a high world oil price scenario, for example, the Energy Information Administration of the Department of Energy forecasts a production rate of 11.2 MMB/D of crude oil and natural gas liquids by 1995.1

Despite this increase in drilling and exploration activity, as figure 3 shows, the effect of higher oil prices to this point has been almost exclusively in reducing demand, not increasing supply. In addition, the Office of Technology Assessment in a study, *World Petroleum Availability: 79802000,* did not find any evidence that a significant upturn in domestic production would occur.[2] In fact, OTA estimated a production rate of **5** to *8* MMB/D by 1990 and 4 to 7 MMB/D by 2000. Exxon's most recent energy outlook forecast domestic production of 7.1 MMB/D by 1990 and 7.8 MMB/D by 2000.[3] Thus, production rate estimates for the middle 1990's differ by as much as 7 MMB/D, an amount greater than current U.S. imports.

In OTA'S judgment, the lower rates estimated in its study are still valid and it would be imprudent to assume otherwise in planning for the 1990's. The principal justification for these lower rate estimates is not so much an actual decline in total oil reserves as the increasing difficulty in extracting the oil that is found. The rate at which oil can be produced is declining because oil is no longer being found in the very large oilfields necessary to sustain or increase total production.

If domestic production does decline to 5 or 8 MMB/D by the mid-1990's, demand will have to decrease even faster than it has during the last few years just to keep imports at their current level. It is possible to greatly reduce petroleum product demand by both fuel switching and increased efficiency of use. This will require a substantial investment, however, and it is not clear yet whether it will be made. The current demand response is a combination of shortrun elasticity to the most recent price rise and the longer run elasticity—involving turnover of capital stock—to the 1973-74 price rise. Current forecasts of energy demand all show a continued, but slower, decline in petroleum demand for the rest of the 1980's but a steadying during the 1990's. In all cases, substantial imports will be necessary in the 1990's if the decline in domestic production assumed above takes place.

Faced with similar prospects after the 1973-74 oil embargo, Congress enacted a wide range of legislation to encourage a reduction of the Nation's dependence on oil imports. First, legislation was enacted to reduce petroleum demand. Foremost among these initiatives was the establishment in the Energy Policy and Conservation Act of the 1985 Corporate Average Fuel Efficiency (CAFE) standards for automobiles. More than half of total U.S. petroleum demand is in the transportation sector, which, in turn, uses about half of its petroleum in passenger vehicles. Other legislation to reduce petroleum demand included: 1) the Powerplant and Industrial Fuel Use Act, whose provisions require large combustors to convert from oil by 199o; and 2) systems of tax credits and financial programs to encourage

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1 Annual Report to Congress, 1980, **vol. 3, DOE/EIA-01 73(80)/3, Energy Information Administration, U.S. Department of Energy, Washington, D. C., March 1981, p. 85.**

2 *World Petroleum Availability: 1980-2000-A* *Technical Memorandum* **(Washington, D. C.: U.S. Congress, Office of Technology Assessment, October 1980), OTA-TM-E-5.**

3Energy Outlook: 1980-2000, **Exxon Co., U. S. A., Houston, Tex., December 1980, p. 7.**

capital investments for energy conservation in industry and buildings. Finally, legislation was passed to augment domestic supplies of petroleum substitutes through the production of synthetic fuels. The Energy Security Act of 1980 established the Synthetic Fuel Corp., with synfuel production goals of **0.5** MMB/D in 1987 and 2.0 MMB/D by 1992.

The efficacy of this approach is now being reevaluated, not only because of the time limitations of the legislation, but also in light of the price increases of 1979, which have caused the Nation to reduce imports more quickly than originally anticipated. The debate centers on whether the Government should continue its approach of the 1975-80 period—and if so which path or paths would be more effective-or whether the Nation can depend primarily on the current high oil cost —not entirely anticipated when the original legislation was passed–to reach an acceptably low level of oil imports. Complicating current debate is uncertainty about where oil prices will go in the immediate future. A steady decline in real prices over the next few years could substantially reduce market pressure toward increased conservation and development of alternative fuels, with the result that the Nation will be that much more economically vulnerable should there be dramatic upsurges in prices later in the decade or throughout the 1990's. Further, no matter which approach is preferable, general concern exists about the side effects of the Nation's movement to free itself from import dependence.

Of particular interest in the ongoing evaluation of policy are the approaches directed at producing synthetic liquid fuels and at reducing petroleum consumption by automobiles. These are by far the largest programs enacted by Congress, both in terms of their costs and of their effects on the economy.

In 1979, the Senate Committee on Commerce, Science, and Transportation requested OTA to assess and compare these two approaches to reducing oil imports. Because mandated increases in CAFE standards were to end in 1985, the committee was interested in whether further standards would be more or less effective than the synfuels program in reducing oil imports. The large increase in oil prices since 1979 and the response to this increase have changed the environment in which that request was made. As a result OTA has broadened its study to consider how far and fast automobile efficiency and synthetic fuels production can develop during the next 20 years, and to evaluate the effects on and risks to the industries involved. Such an evaluation is particularly important for the automobile industry because of its current precarious state. No matter what course the Nation chooses—continued regulation or more reliance on market mechanisms —the industry may be in for continued difficulties if the need for large capital investments continues while demand for automobiles remains relatively low.

In addition to assessing the import reducing potential of synfuels and increases in automobile fuel efficiency, this study also examines, although in considerably less detail, the oil savings that could be gained through fuel switching and conservation by stationary oil users. By combining the three approaches, plausible development scenarios for reductions in oil consumption are derived, leading to estimates for oil imports over the next 20 years.

The body of this report starts with an analysis of policy options that: 1) could influence the rate at which oil imports can be reduced or 2) affect the consequences of changes needed to reduce conventional oil consumption. The next chapter presents the major issues and findings of the report, including a discussion of the cost of oil imports, comparisons between increased automobile fuel efficiency and synfuels, and analyses of issues related solely to one or the other of these options.

The remaining chapters of the report contain the background analyses. Separate chapters on increased automobile fuel efficiency, synfuels, and stationary uses of petroleum present the technical and cost analyses for each. The final chapters analyze the economic and social effects and environmental, health, and safety impacts associated with both increased automobile fuel efficiency and synfuels, as well as the availability of water for synfuels development.