

Projections of U.S. Crude Oil Production

Introduction

Projections of future United States crude oil production are made by a variety of oil companies and associations, consulting firms, government agencies, and individuals. Although several projections are published on a regular schedule (i.e., those of the Gas Research Institute, the Energy Information Administration, Data Resources Inc., Chevron, Conoco, etc.), many appear only at crisis points or in response to proposed government initiatives affecting oil supply. Documentation of the projections is often incomplete or nonexistent, although the projections of the Energy Information Administration, the Gas Research Institute, and Data Resources Inc. are extensively documented.

OTA examined and cataloged the results of a number of projections of future crude oil supply published either in 1985, prior to the price drop, or well enough after the price drop to represent a first guess at the long-term consequences of lower world oil prices. OTA did not attempt a detailed analysis of the methodologies or assumptions of the projections, though the methodologies of many of the major models have been scrutinized in the past.

We caution the reader to be skeptical of the projections, even those made with sophisticated models. Both the simple and the complex projection methods generally rely on extrapolation from past trends to produce estimates of such important variables as the number of wells drilled in a given year. A common source of error for these methods, then, is to force them outside the range where past trends can be hoped to apply. The United States has just undergone a period during which oil prices, a key determinant of industry activity, have undergone a severe dislocation, and one in the opposite direction from past dislocations. Also, during the past few years, several companies comprising a large segment of the industry's reserve replacement capability have been restructured, merged with other companies, or been the object of takeover attempts,

All these changes have serious implications for industry capabilities and business strategies. Historical relationships between industry investment behavior and economic variables such as internal cash flow may be inapplicable to the present economic environment. Finally, the period of the early 1970s to the beginning of the 1980s—when many of the relationships used by the forecasting methods were defined—was a period of extremely rapid growth in activity accompanied by hyperinflation in the costs of drilling and other factors of oil production. It appears unlikely that these relationships will prove stable.

Projections of U.S. Oil Production Made Prior to the Price Break

To keep the recent, very pessimistic forecasts of future U.S. oil production in perspective, it is important to note that a future of declining domestic production and increasing imports was widely predicted even before the sharp 1986 declines in world oil prices. In 1985, a majority of analysts expected oil prices to remain between \$20 to \$25 per barrel for a few years and then begin a gradual increase, in real terms, back to and beyond \$30 (in 1985 dollars) by 2000. According to the Chase Manhattan Bank, a consensus view of future U.S. production under these conditions would have crude oil production decline from about 8.9 million barrels per day (mmbd) in 1985 to below 7 mmbd by 1995 and below 6 mmbd by 2000 (see table 2). Although three of the four other prominent forecasts in table 2 are considerably more optimistic than Chase's, all forecasts project declines from 1985 production levels of at least 1 mmbd by 2000 and 2 mmbd by 2010. Coupled with expected declines in natural gas liquids production and increases in oil demand, large increases in U.S. oil imports seemed inevitable.

As discussed later, there are alternative views of the oil resource base, and the potential of new technology to access greater portions of that base, that lead to more optimistic assessments of fu-

Table 2.—Projections of Future U.S. Oil Production, 1985 Outlook

Source	Projected crude plus condensate production (mmbd)				Price expectation (per barrel)
	1990	1995	2000	2010	
1. DRI	8.60		6.81	5.66	Price to \$20 (1984 dollars) by 1987, stays there until 1994, up to \$30 by 2000.
2. Chevron	8.30	7.60	7.60	6.90	Prices stagnant until 1990s, then rise.
3. Chase "Consensus"	8.31	6.96	5.71	NA	Price drops to low \$20s (1985 dollars) by 1990, rise 0.9 percent/yr to 2000, real 2000 price below 1984 price.
4. EIA Energy Outlook	8.05	6.53	NA	NA	Price dips but is at \$27 (1985 dollars) by 1990, \$30 by 1995.
5. GRI Baseline	8.46	8.18	7.76	6.79	Price dips but is up to \$32 (1984 dollars) by 1995 and \$38 by 2000.

^a1985 production was 8.92 mmbd

NA = Not available

SOURCES: 1 *Energy Review*, winter 1985.2 Economics Department, Chevron Corp., *World Energy Outlook*, June 1985.3 Chase-Manhattan Bank, Global Petroleum Division, *World Oil and Gas 1985*, August, 1985.4, Energy Information Administration, *Annual Energy Outlook 1985*, DOE/EIA-0383(85), February 1986.5 Gas Research Institute, *Baseline Projection Data Book 1985*.6 *GRI Baseline Projection of U S Energy Supply and Demand to 2010*.

ture U.S. oil production potential. These views focus particularly on the continued potential for the growth of reserves in the United States' older fields through both conventional drilling and, via improved technology, through enhanced oil recovery methods. These views, and the expectation that U.S. production could have been maintained for several more decades had prices not dropped so precipitously, are definitely minority positions. Nevertheless, the uncertainty associated with the resource base and the potential for technological innovation easily encompasses such alternative views.

Recent Projections of U.S. Oil Production Assuming Continued Low Oil Prices

Short-Term Projections

Table 3 presents 10 alternative views of the likely magnitude of U.S. oil production during the next 2 to 3 years. Few in the industry expected large reductions in annual oil production by 1986, primarily because the adverse effects of reduced drilling of exploratory and development wells would just be surfacing, and because it was felt

Table 3.—Recent Short-Term Projections of U.S. Oil Production at Low Prices

Source	Projected crude plus condensate production prices (mmbd)				Prices
	1985	1986	1987	1988	
1. Stolz	8.9		7.7		
2. API			8		\$15
3. API			7.1		\$10
4. EIA		8.73	8.52		\$10 by third quarter 1986, \$15 by summer 1987
5. Spears			7.9		
6. CWV		8.35	7.83		\$15
7. ARCO		8	7		"low prices"
8. Chevron				7.6	
9. DRI		8.75	8.5		\$15-\$16
10. IPAA		8.8	8.5		

SOURCES: 1 Earl Stolz, of Howard, Weil, Labouisse, Friedrichs, reported in *Platt's Oilgram News*, Friday, Sept. 5, 1988.2 American Petroleum Institute, *Two Energy Futures. National Choices Today for the 1990s*, July 1988 (1990 production actually for 1991).3 Energy Information Administration, *Short-Term Energy Outlook, July 1986*, DOE/EIA-0202(88/3 Q).4 John Spears, Spears & Associates, Inc., reported in *Oil and Gas Journal Newsletter*, July 28, 1986.5 Jack L. Copeland, Copeland, Wickersham, Wiley & Co., Inc., Presentation to the Keystone Energy Futures Project: Liquid Fuels Policy, July 14, 1988.6 Robert O. Anderson, ARCO.7 Economics Department, Chevron Corp., *World Energy Outlook, June 1986*.8 Data Resources, Inc., *Energy Review*, summer 1988.9 Independent Petroleum Association of America, "Report of the IPAA Supply and Demand Committee Annual Meeting—Dallas, TX, Oct. 26-28, 1986."

that most operators of marginal wells would be unlikely to stop production this soon. For many marginal wells, reservoir characteristics dictate that a prolonged shutdown of production will damage future production potential; for others, stopping production will violate lease terms and result in lease forfeiture. The great majority of operators with wells of this type will hesitate before "shutting in" production because this would be essentially abandoning their investments. Thus, the production projected to be lost by year-end 1986 was expected to largely be from:

- marginal wells requiring immediate expensive repairs,
- the modest number of uneconomic wells and enhanced recovery operations that could be shut in without losing the well or the lease, and
- a small number of marginally economic operations whose owners believed that a price rebound was inevitable and therefore decided to forego small current profits for larger future profits.

The actual 1986 average production, estimated at year end 1986, was about 8.67 mmbd, down about 3 percent from 1985's average production rate. However, the daily rate at year end 1986 had sunk considerably below the average, to about 8.35 mmbd, or nearly 8 percent below the rate a year earlier.¹

The projections for 1987 show more strongly the effects of the expected slowdown in drilling and resulting failure to compensate for natural production declines in existing wells. These projections show a very wide variation. This is par-

tially a function of assumed price; the API projections show a 900,000 barrel per day (bbl/day) production loss in going from a \$15 to a \$10 per barrel oil price. Another potential reason for the variation is a disagreement about how much stripper well production and other marginal production will be shut in, primarily because the available database on the physical and economic characteristics of these wells is too weak to allow reliable projection of production losses.

Both the 1986 and 1987 projections would have been somewhat more pessimistic without widely expected increases in Alaskan oil production. Despite cutbacks at the Milne Point field, increased flows from the Kuparuk River field and the Lisburne reservoir of the Prudhoe Bay field were expected to yield 1.6-percent increases in Alaskan production in both years.²

Longer Term Projections

Table 4 shows 12 recent projections of longer term U.S. oil production. If the two projections with somewhat higher price tracks (GRI and Chevron B) are set aside, there is a strong consensus among the forecasters that a continuation of low oil prices will drive U.S. oil production, which was about 8.9 mmbd in 1985, to 7 mmbd or below by 1990. Coupled with expected drops in natural gas plant liquids production—the GRI projection, assuming moderately higher prices, expects a drop of over 400,000 bbl/day by 1990—these forecasts project total U.S. liquids production to drop by well over 2 mmbd by 1990. In comparison, none of the pre-price break projections (table 2) show expected production declines above 1 mmbd, and most expect a decline of about half that amount.

¹Energy Information Administration, *Weekly Petroleum Status Report, Data for Weeks Ended: December 26, 1986, January 2, 1987*, DOE/EIA-0208(87-01)(87-02), Jan. 7, 1987.

²Energy Information Administration *Short Term Energy Outlook / 1986*, DOE/EIA-0202 (86/3 Q), August 1986.

Table 4.—Recent Projections of Future U.S. Oil Production at Low Prices

Source	Projected crude oil production (mmbd)			Price expectation (dollars/bbl, 1986 \$)
	1990	1995	2000	
1. DRI	7.8	6.3	5.5	\$20 by 1995, \$30 by 2000
2. Chevron	5.9-6.9			\$10 to \$15 thru 1987, \$18-22 by 2000
3. API	6.2			constant \$15
4. CWW	6.1			\$15
5. Unocal	6-6.5			\$13.50
6. Amoco	6.7		4.5	"Low Price"
7. Fisher	6.8			\$15
8. Conoco A	7	5.5	3.5	<\$12 thru 1995, \$20 in 2000
9. Conoco B	7.8	6.9	6.1	<\$20 thru early 1990s, \$20 in 1995, \$26 in 2000
10. GRI	7.3	5.4	5.0	\$12 in 1986, \$14 in 1990, \$21 in 2000
11. NPC	7.1	5.7	4.5	\$12 in 1986, \$14 in 1990, \$21 in 2000
12. DOE	6.9	5.2		\$14-16 thru 1990, \$21 in 1995

SOURCES: 1. Data Resources, inc. Energy Review, summer 1986 2. Economics Department, Chevron Corp., *World Energy Outlook*, June 1986 3. American Petroleum Institute, Two *Energy Futures: National Choices Today for the 1990s*, July 1986 (199) production actually for 1991 4 Jack L. Copeland, Copeland, Wickersham, Wiley & Co., Inc., Presentation to the Keystone Energy Futures Project "Liquid Fuels Policy, July 14, 1988.5. Fred L. Hartley, Unocal Corp., "The High Cost of Low-Priced Oil," submitted to the U.S. Senate Energy and Natural Resources Committee, Mar. 20, 1986.6. Economics Department, Amoco Corp., *World Energy Outlook*, Apr. 30, 1986. 7. William Fisher, Bureau of Economic Geology, University of Texas at Austin, Testimony to the Fossil and Synthetic Fuels Subcommittee, Energy and Commerce Committee, Mar. 6, 1986 8. and 9. A Coordinating and Planning Department, Conoco Inc., *World Energy Outlook Through 2000*, September 1986 10. Gas Research Institute, submission to the National Petroleum Council's Survey of U.S. Future Oil and Gas Outlooks 11 National Petroleum Council, Factors *Affecting U.S. Oil and Gas Outlook*, February 1987 12 U S Department of Energy, *Energy Security A Report to the President of the United States*, DOE/S-0057, March 1987