

What Will Determine Future Production?

Introduction

There is widespread agreement among oil industry analysts that United States oil production is likely to drop substantially in the coming years if oil prices remain at or near their current low levels. As noted earlier, the production decline would come from the combined influence of the closing of thousands of wells and enhanced oil recovery (EOR) projects whose production costs are too high, reduced levels of drilling of production and exploration wells, cutbacks in new EOR projects, and a slowdown in technology improvement with reduced R&D spending.

The logic of these predictions appears generally correct. For one thing, the evidence "on the ground" right now is extremely supportive of a long-term decline in U.S. production; the overall level of activity in development drilling, in all phases of exploration, in enhanced oil recovery, and in R&D have undergone a drastic decline, the existence of natural production declines in existing wells is simply indisputable, and monthly domestic oil production has already dropped by nearly 8 percent over a one year period.¹ Second, many of the companies involved in drilling, well servicing, and other aspects of oil exploration, development, and production have suffered serious financial reversals as a result of the loss of revenue associated with the price drop and the decline in oilfield activity, and their ability to maintain previous levels of activity has suffered as well. Third, the large drop in prices would appear to have an inevitable adverse effect on the economics of drilling and other production prospects, thus sustaining the decline in activity and the current trend towards lower production. And fourth, the variety of available projections of future U.S. oil production have used several different approaches, yet they have arrived at similar conclusions about a substantial production drop.

¹A drop of 680,000 hbl/day in domestic crude production, from December 1985 to December 1986, in Energy Information Administration, *Short-Term Energy Outlook: Quarterly Projections*, January 1987, DOE, EIA-0202(87/1Q)

However, there is considerable uncertainty about the *magnitude* of a production decline, and there are even some grounds to question the idea that the decline must be very large. Before acquiescing to the view of inevitable and large production declines, policy makers should ask whether recent forecasts of future oil production are basically reliable, and should examine carefully the assumptions underlying the pessimistic projections. In OTA's view, there are important questions about the accuracy of these projections, because of changes to the industry that the projections have not taken into account, because of basic uncertainties about key aspects of oil supply responses to price changes, and because the nature of the price changes that have occurred are outside the experience of forecasters. In the following discussion, OTA outlines the concerns about the forecasts, and then reviews some of the primary factors that should be taken into account in projecting future production. OTA does not attempt to arrive at any "most likely" rate of future U.S. oil production. *OTA concludes, however, that the available evidence, although incomplete, points strongly to a continuing, and substantial, decline in U.S. oil production if oil prices remain well below \$20 per barrel.*

The Reliability of Forecasts of U.S. Oil Production

Despite the variety of their level of detail and specific analytical approaches, most forecasts of future oil production can be divided into two basic categories: those that rely primarily on applying relationships (e.g., between production revenues and drilling rates) discovered by examining the historical record of oil exploration, development, and production and those that rely on economic analyses of expected exploration, development, and production opportunities. The two forecasting methods are not mutually exclusive; all economic analyses include the application of some historical analysis.

The great majority of forecasts made available to the public and to Congress use historical rela-

tionships to project future U.S. production. In general, forecasts of this type are particularly vulnerable to errors caused by applying the relationships outside a relatively narrow band around the independent variables. Such forecasts basically are extrapolations from past trends, and remain valid only when the degree of extrapolation—represented by the changes in the independent variables—is small. Current and expected future conditions affecting the oil industry, however, represent considerable changes from past conditions. In fact, as discussed in several of chapters below, there are good reasons to believe that straightforward extrapolation of past trends in several areas—e.g., in the way companies decide how much of their revenues to allocate to exploration and development—will give inaccurate results. Consequently, extrapolative methods now appear to be working well outside of their range of reliability. In OTA's view, forecasts of U.S. oil production based on *uncritical* acceptance of the results of extrapolative methods are an unreliable basis for policymaking.

Forecasts that rely primarily on direct economic analyses of exploration, development, and production prospects may appear more reliable because they are more closely tied to the decision process used by the oil industry. However, such forecasts cannot escape entirely from the problems associated with extrapolating from historic trends; they may use historic data to simulate the industry's method of selecting drilling prospects or budgeting its overall E&D programs, or to estimate certain key variables such as the success rate of wildcats. In addition, the economic analyses are likely to use proprietary data on oilfield opportunities, preventing the access to analytical scrutiny necessary for credibility. Although some of the forecasts of major oil companies may be based on a careful economic analysis of drilling prospects, the assumptions and detailed methodologies behind these forecasts are not available for review. The possibility that some companies have unannounced agendas will, deservedly or not, undercut the credibility of their forecasts. Finally, the reliability of forecasts based on economic analyses demands an accurate assessment of the geologic resources that may be accessed by the industry within the time frame of the fore-

cast. OTA believes that the reliability of resource assessments—especially at the level of detail needed for economic analysis—is inherently low.

Factors Affecting Future Oil Production

In discussing why they believe that U.S. oil production will fall, and fall drastically, in the years to come if world oil prices remain both low and volatile, oil analysts have stressed a number of forces driving the predicted decline. Most have stressed that drastically lowered industry revenues have crippled the industry's ability to recover its past capital investments and pay off its loans, severely damaging the industry's financial health. Some analysts stress in addition (or instead) that the basic economics of E&D investment have been damaged severely by lower oil prices, in other words, that it is no longer profitable to conduct much of the drilling and other E&D activity that was attractive at higher oil prices.

The precise role in industry investment decisionmaking of cash flow, on the one hand, and E&D profit prospects on the other is by no means a settled issue. Some analysts are convinced that cash flow is the critical determinant of the magnitude of E&D investment, and that profit prospects primarily shape only the *nature* of that investment. Indeed, many analytical models of investment spending and drilling use cash flow as the key parameter. Other analysts are equally convinced that cash flow will *not* be the primary determinant of future industry investment, at least for the longer term, that the basic economics of drilling will be the key driving force. A correct assessment of the roles of each of these factors will be critical not only to projecting future production but also to determining effective policy actions to combat a production decline.

Aside from cash flow and the economic prospects for new investment, additional factors that will affect future oil production levels include:

- *the potential for premature loss of some existing production with high operating costs;*
- *the nature of the oil resource base, which is intimately linked to the economic prospects for new investment because it determines the physical character of available investment opportunities;*

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- *the current surplus of gas deliverability*, which discourages gas drilling and can hurt the economics of some oil drilling;
 - *structural changes in the oil industry* that have increased debt, altered the industry's likely business strategy and objectives, and are likely to affect industry efficiency;
 - *changes in the "efficiency" of exploration and development activity* (as measured by factors such as the reserves found per well and the success rate of exploratory drilling), which will alter the historic relationship between E&D activity levels and their results in terms of reserves found and production capability added;
 - *changes in the climate for oil investments in the United States and overseas* that will influence company decisions about dividing E&D investment budgets between the United States and overseas;
 - *prospects for technological change in the industry*, and especially the potential for cost-saving technology to help the industry successfully adapt to an environment of low prices; and
 - *the damage to the oilfield service industry*, which might hamper attempts at a drilling rebound if oilfield investment prospects improve.

The following chapters discuss these factors, where possible drawing conclusions about the direction and likely magnitude of their effect on future production levels.