

I. THE NEED FOR ADEQUATE STATISTICAL DATA CONCERNING TRENDS IN THE COST OF DRILLING AND COMPLETING OIL AND GAS WELLS

THERE are at least three groups to whom data concerning trends in the cost of drilling and completing oil and gas wells are of immediate interest. These are academic economists with research interests in petroleum industry studies, businessmen engaged in the actual making of decisions regarding the drilling of wells, and individuals in government who are concerned with the formulation and implementation of energy resources policies. The uncertainty currently surrounding the present level of drilling and completion costs and the long-run trend of such costs are felt in an intensification of both the long-run and the short-run problems facing the petroleum industry, and in the difficulties attendant upon the formulation of governmental policies concerning the role of the domestic petroleum industry in meeting national fuels needs. Efforts at dispelling this uncertainty, however modest, are in order if it is desired that rational judgments should prevail in the formulation of public policy and in the implementing of the operating decisions of oil company managements. Decision makers in both business and government have imperative need for accurate and reliable cost data to develop and carry out a strategy of energy resource use which will allow public and private interests to make the most economical use of the existing supplies of a crucially important natural resource subject to ultimate depletion.

No one needs to be reminded how vital an ample supply of petroleum is to a modern industrialized economy. What should be emphasized, perhaps, is the role of accurate drilling cost data in insuring an adequate supply of petroleum while at the same time preventing an economically wasteful oversupply. Knowledge of costs is obviously essential to an understanding of the supply function of an industry. For the efficient allocation of resources in a competitive market during any given time period, the relevant supply and demand functions must be equated, insuring the simultaneous determination of an equilibrium price and an equilibrium quantity of the commodity supplied and purchased. This bare framework provided by the elements of the static partial equilibrium analysis of economic theory can serve as an admittedly oversimplified point of departure for an account of the disturbances induced in an otherwise stable equilibrium position by ignorance of the cost basis of the supply curve.

The simplest explanation of the disequilibrium resulting from ignorance of costs can be given if we first ignore the oil imports

issue. An equilibrium price and an equilibrium level of production is then determined where the domestic demand curve for crude oil intersects the domestic supply curve based on actual costs. Let us, for example, assume that the equilibrium price of crude oil is \$3.00 per barrel and that equilibrium production is eight million barrels per day. In the absence of data on costs, however, many drillers are prone to be overoptimistic as to the probable returns from oil and gas exploration and drilling, and to underestimate the costs of discovering and producing crude oil. It cannot be denied that the very uncertainty surrounding the possibility of finding oil (apart from the uncertainty of the costs of drilling and completing wells) appeals to many individuals of sanguine temperament who enjoy the element of risk present in a given venture. The utility, to these individuals, of risk-taking, and the special tax incentive provided by the percentage depletion allowance, tend to encourage a certain number of amateurs to enter the exploration and drilling phase of the petroleum industry. The overoptimistic expectations of this group, and the uncertainty of success present among even the most experienced operators, tend to result in a drilling program based on too low an estimate of actual costs. In other words, the supply curve on the basis of which the operators make their decisions lies below the actual supply curve. This may mean, for example, that at a given price of \$3.00 per barrel, sufficient drilling will take place to result in a productive capacity of ten million barrels of crude oil per day. Only eight million of these daily barrels of production can, however, be produced at or below a true cost of \$3.00 per barrel. To prevent the physical waste and the decline in the market price consequent upon the unimpeded production of ten million barrels per day (since discoverers of higher cost wells can at least minimize losses by producing at full capacity from all suitably located discovery wells), state conservation commissions will limit production to the amount which can be consumed at the current price. Two million barrels per day of potential production will then be shut-in. The economic waste inherent in such a situation is obvious. An excessive amount of resources has been invested in drilling the shut-in production wells. The short-run result is an oversupply which exerts a downward pressure on price at the same time that the true costs of drilling and completing wells is increasing. The long-run result is likely to be the hastening of the day of ultimate depletion of petroleum reserves because of the necessity of drilling additional "offset" wells on properties adjacent to new discovery wells, and to field development wells. These offset wells tend to increase the number of wells in a given field beyond the point of maximum ultimate physical and economic

recovery because of the premature dissipation of field gas pressure, particularly in areas where there is no conservation law. Furthermore, prorationing by state commissions tends, in practice, to increase still more the cost of producing a barrel of oil, in that the incidence of production cutbacks is highest for the most productive wells with the lowest costs of production, while higher cost marginal ("stripper") wells are made exempt from prorationing.

Introducing the possibility of imports of foreign crude oil further aggravates the basic disequilibrium stemming from ignorance of cost trends and the uncertainty of discovery. It is well known that the cost of producing oil in the Middle East is so much less than the average cost of producing oil domestically that large volumes of crude oil may profitably be imported from abroad. This difference in costs between domestic and foreign supplies of crude oil has led to effective pressures for the mandatory limitation of imports into the United States. The effect of those imports which are allowed, however, is to increase the current domestic oversupply of higher-cost crude oil and to increase the amount of shut-in production. This situation aggravates the maladjustments discussed above: excessive investment in exploration and drilling, short-run oversupply with downward pressure on prices concomitant with increasing costs, and a reduction in ultimate long-run supply.

Apart from the complexities of the national security argument, the imports policy issue is essentially one of working out an economically and politically acceptable compromise between the interests of domestic producers (low imports and high crude prices) and consumers (high imports and low crude prices). On grounds of pure economic efficiency, free trade is of course a necessity for the optimal allocation of resources, and no exception can be made for crude oil. On grounds of equity, limitations on imports might be defended as an expedient for the allowing of a "reasonable" return upon investment in domestic petroleum exploration and drilling. The difficulty with the latter argument is that, given the uncertainty of costs and probable discoveries, such a program might result in the allowance of a "reasonable" rate of return on an excessive volume of such investment.

In summary we may say that reliable data on drilling and completion costs may be of use to academic economists, oil company managements, and government officials. Academic economists, as essentially disinterested observers, will be in a position to evaluate costs and cost trends and analyze the purely economic implications of such objective determinants upon the economic desirability of investing resources in various sectors of the fuels market. For example, if the long-run trend of petroleum costs is

sharply upward, it would be economically more efficient to invest less resources in petroleum exploration and drilling, and to invest more in the development of other fuels, particularly in synthetic liquid fuels from oil shales.

Oil company managements will find such cost data of the greatest use in planning and revising exploration and drilling programs, both currently and in terms of long-run objectives. Increases in the costs of drilling and completing wells may lead to an increase in the ratio of development wells to exploratory wells as the maximum degree of risk that can be undertaken decreases. Not all the results of increases in drilling and completion costs need be negative. A knowledge of the increasing trend in costs can stimulate efforts to cut costs; research may be devoted to the development of important new uses for petroleum products; oil companies with holdings of oil shale deposits may devote more effort to developing shale properties as the cost of finding, developing, and producing petroleum increases. Of particular importance is the effect which reliable data on the magnitude of the outlay necessary for conducting profitable operations in the drilling phase of the industry could have on potential entrants with no industry experience and only relatively moderate means. Confronted with such cost data, many such potential entrants might possibly decide not to enter the industry, thus reducing the problem of current oversupply relative to costs and prices.

Policy makers in government will find such cost data invaluable, particularly to the extent that they allow the construction of an acceptable approximation to the supply curve for domestic petroleum products. Relative costs of domestic and foreign crude oil can be compared, in order to facilitate prediction of the effects of alternative import policies. The effect of the depletion allowance on domestic supply can more adequately be appraised, and decisions influencing the future position of the petroleum industry in the energy resources market can be made in the light of more nearly complete knowledge of relative costs and cost trends.