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L. C. Jacobsen

DISCOVERED BUT UNPROVED GAS RESERVES

L. C. JACOBSEN†

At the end of 1970 a cumulative total of 648 trillion cubic feet of natural gas had been discovered and proved in the United States (exclusive of Alaska), and remaining proved reserves were 260 trillion cubic feet. An additional amount has been discovered but not yet proved, and of course a still greater amount remains to be discovered.

The first of the above supplements to gas supplies is the discovered but not yet proved "reserves". The quantity cannot be measured directly at the present time, but data are available to show fairly precisely the amount of such discovered but unproved gas that has existed in the past, and by projection of trends to make a reasonable estimate of the amount that now exists.

The American Gas Association has in recent years been estimating the ultimate recovery (production plus reserves) of natural gas by year of discovery, and, of course, for many years has been reporting the annual additions to proved reserves. With these two sets of data the amount of gas now known to have been discovered to any given date can be compared to the amount converted to proved reserves by the same date.

These data are summarized in Table 1, and are shown in form of cumulative curves in Figure 1. In Figure 1 the horizontal distance between the two curves represents the time between discovery and establishment as proved reserves, and the vertical distance measures

TABLE 1
CUMULATIVE NATURAL GAS RESERVES
DISCOVERED AND PROVED IN THE
UNITED STATES (EXCEPT ALASKA) THROUGH 1970
(Trillions of cubic feet)

Year	Discoveries	Proved Reserves	Difference	Average Time Lag (yrs.)
1930	181.4	90 (est.)	91.4	12
1935	224.4	120 (est.)	124.4	10
1940	314.5	156.7	157.8	11
1945	366.3	232.9	133.4	9
1950	431.6	299.9	131.7	7
1955	495.1	381.9	113.2	6
1960	576.1	480.0	96.1	5
1965	625.1	576.3	48.8	3
1970	647.8	647.8	0	0

†Ph.D. Pennsylvania State University; Manager of Uranium Operations, Sohio Petroleum Company.

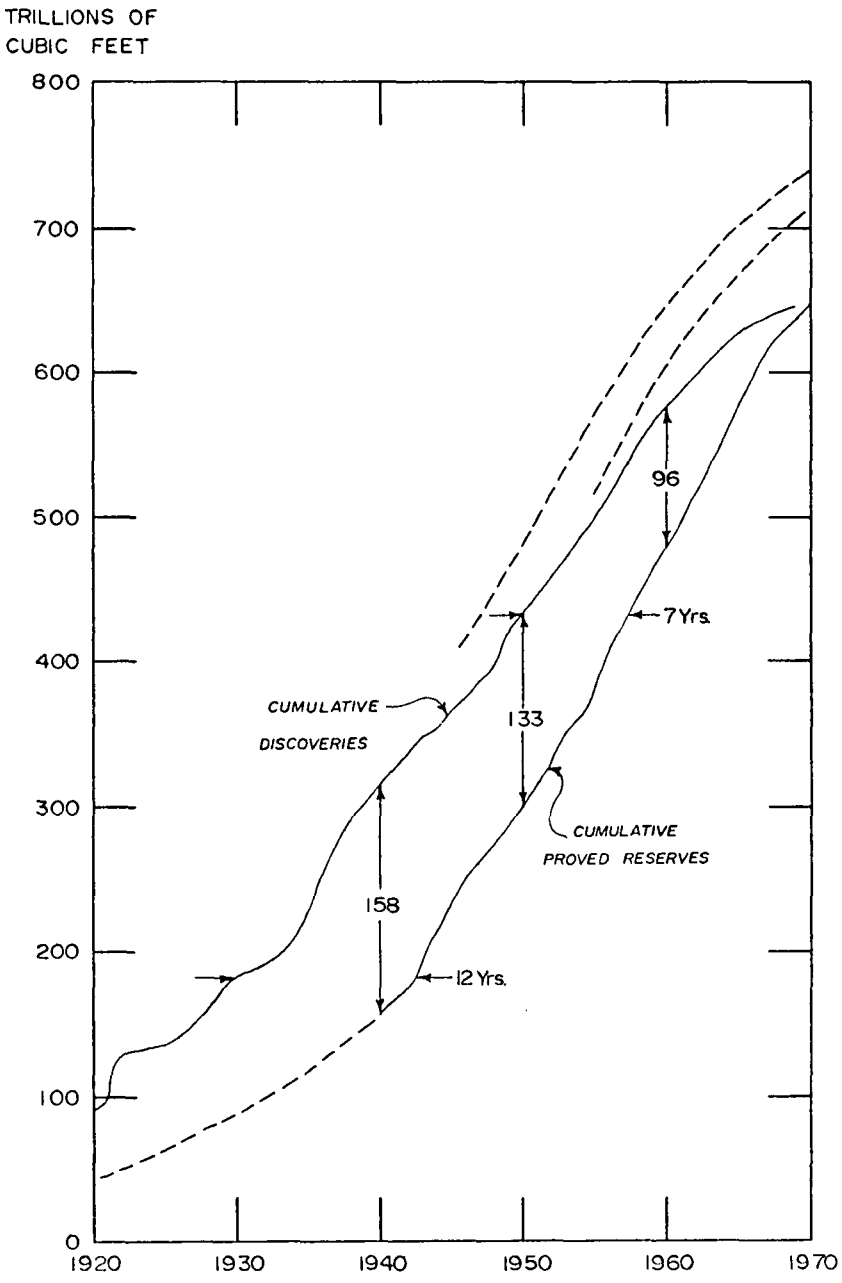

Figure 1. Rates at which natural gas reserves have been discovered and proved in the United States.

the amount of gas at any given time that is now known to have been discovered but had not been proved.

There is, of course, no unproved but discovered gas indicated for 1970 as the cumulative total of discoveries is by premise the same as the cumulative total of proved reserves. However, for previous years there is a gap between the two quantities, and the amount of discovered but unproved gas increases more or less regularly with time to a maximum of nearly 160 trillion cubic feet in the early 1940's. This was approximately fifty percent more than the proved reserves at that time.

Similarly the lag between the time reserves are discovered and the time they are proved is in the range of ten to twelve years for reserves discovered before 1940, but has been steadily shrinking since that time.

Unfortunately the data have a serious weakness in that a substantial amount of gas has undoubtedly been discovered in recent years that is not identified and does not appear in our 1970 record of discoveries. Thus, at least the upper part of the "discoveries" curve will shift upward and to the left with time as these discoveries become known.

The magnitude of this shift and thus the current amount of discovered but unproved gas is, of course, what we would like to know.

In Figure 1 two assumptions as to the future position of the discovery curve are shown. The one farthest to the left is based on an assumption that the average time lag between discovery and proved reserves is ten years; the second curve assumes a time lag of seven years. The vertical distance between the hypothetical curves and the "discoveries" curve measures the amount of future revisions and extensions necessary under the two assumptions as to time-lag.

For the ten year assumption there is indicated to be currently about 100 trillion cubic feet of discovered but unproved gas (740 v. 648). This is, however, not a very reasonable assumption. Approximately 70 trillion feet would be added in fields more than ten years old, and 50 trillion cubic feet in fields more than twenty years old. While revisions do continue to be made in old fields, these fields are for the most part well along in their productive history and such revisions appear to be unreasonably high.

If the time-lag between discovery and proved reserves has stablilized at about seven years the amount of unproved reserves that has already been discovered is indicated to be about 65 trillion cubic feet. Of this about one half would be added in fields more than ten years old.

This interpretation of the existing amount of unproved reserves meets the test of reasonableness far better than that based upon an assumed ten year time-lag. If anything, it is probably optimistic. Much of the gas discovered in the 1930's and early 1940's was found incidental to the search for oil and in areas where a market was not available, and consequently development was delayed. With the extension of pipeline systems into essentially all areas this has become progressively less true and delayed revisions and extensions would seem to be less likely in the more recently discovered fields. Also, recent exploration has been notable for the absence of relatively large discoveries, and as these are the fields in which large revisions occur over a long period, the total of revisions will probably be less than for earlier years. If the time-lag has continued to decrease the amount of unproved but discovered gas is correspondingly less.

It is reasonable to conclude that a maximum of 65 trillion cubic feet of natural gas has been discovered in the United States (except Alaska) that remains unproved, and that more probably the amount is significantly less. This compares with the nearly 160 trillion cubic feet that is nowknown to have existed in 1940.

A corollary conclusion is that for a number of years the gas industry has been in a liquidation position, with its high rate of expansion made possible not by the discovery of new resources but by the progressively more intensive exploitation of old discoveries. Because of the time-lag we have discussed, the decline in exploration which began in the late 1950's has become apparent in reserve statistics only in the past few years. For the same reason we can anticipate dismal reserve statistics for a number of years regardless of whether the decline in exploration is reversed.

There is no suggestion in the data that control of well-head gas prices by the Federal Power Commission led to any systematic delay in the development of gas discoveries. On the contrary the only evident pattern is one of progressively shortening the average interval between discovery and and recognition of proved reserves. The gradual conversion to proved reserves of the large inventory of gas discoveries that had been built up before the advent of the big interstate pipelines obscured the gradual decline in exploration success that was taking place, which became steady and severe after 1957. This, in turn, contributed in a major way to the miscalculation of the adequacy of future gas supplies by gas distributors and the Federal Power Commission, and consequently to a pricing policy which encouraged demand to a level beyond which the producing industry could sustain.