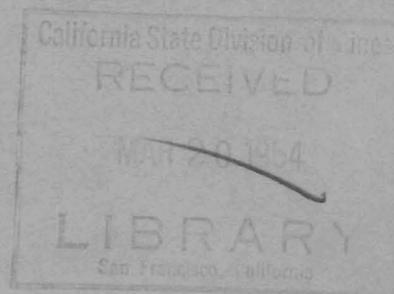


NORTH DAKOTA GEOLOGICAL SURVEY
Wilson M. Laird, State Geologist

NORTH DAKOTA CRUDE OIL INVENTORY AS OF JANUARY 1, 1964

by
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Miscellaneous Series #22



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Remaining reserves of crude oil in North Dakota, recoverable by present technical knowledge, available equipment, and current producing practices, were 634,827,336 barrels of stock tank oil on 1 January 1964.

Of this total, 204,835,000 barrels, or 37.9% will have to be recovered by supplementation of original reservoir pressure. 40,933,620 barrels, or 6.5% of the recoverable reserves underly tracts being drained by marginal, or stripper wells.

During 1963 a total of 59 wildcat, or exploratory wells were drilled in the state resulting in the discovery of eight new oil pools. The reserves added to the inventory by these discoveries totaled only 2½ million barrels.

The initiation of 3 cooperative projects for reservoir energy supplementation added 64½ million barrels, and extensions and revisions of earlier estimates accounted for an additional 14 million barrels.

Thus a total of 81 million barrels were added to the inventory. Production during the year was 25,030,086 barrels of stock tank oil leaving a net increase, in the inventory, of 56 million barrels. The total of 634.8 million was the second highest inventory since the discovery of oil in 1951, being exceeded only by the inventory on 1 January 1960.

The inventory has been tabulated by Marketing District, County, and geologic interval in Tables I, II, and III, respectively.

Method of Estimation

The method followed in making this inventory was exactly the same as that employed in previous estimates and was explained in detail in North Dakota Geological Survey Miscellaneous Series No. 18 entitled, "North Dakota Crude Oil Inventory as of 1 January 1963." As before the estimates reflect technically recoverable reserves and not those that might be classified as economically recoverable. The individual

reader may apply his own economic factor to these estimates from time to time as the economic picture changes.

This approach was deemed most suitable to the purpose since the effects of such things as the Tax Bill, now before Congress, crude price changes and possible changes in the Oil Import Program are difficult to evaluate.

Since the method of estimation remains unchanged the figures herein are comparable to those made in previous years and reported by the Torrey Committee of the Interstate Oil Compact Commission.

The Stripper Well Survey, which is attached to, and made a part of this report, was done in a similar manner. It too, is therefore comparable to earlier reports published by the IOCC.

Current Situation

Had it not been for the Energy Supplementation projects started during the year in the Antelope-Madison Pool (McKenzie County), the Beaver Lodge-Devonian Pool (Williams County), and the Clear Creek-Madison Pool (McKenzie County), there would have been a net reduction in the inventory from that of the previous year since production exceeded the reserves added by new discoveries, extensions, and revisions.

This points up the very acute need for early initiation of additional projects and the absolute necessity of statutory provisions which will prevent such projects from being stymied by a minority of interests in a particular pool, such as occurred in the North Tioga-Madison Unit.

At present such projects must be initiated by the owners of interests in the pool and studies are currently underway in 7 additional pools. If these new projects can be agreed upon and injection started during 1964, they would add another 75 million barrels to the inventory and raise it well above the 700 million figure which was originally estimated, in 1953, before detailed data was available.

The market for these reserves remained relatively stable during 1963. Slight increases were noted in the amount of oil moving west out of Marketing District III. This increase was offset by a slight reduction in crude movements to the east out of District II. The market in District I averaged 43,200 barrels per day during the year and accounted for about 60% of the state's production.

The reduction in crude runs to the Head-of-the-Lakes refining area was the result of a decreased demand during the summer months; attributable in the most part to the reduced fuel oil demand. Excellent fall weather delayed the recovery of this demand and Marketing Districts II and IIIa were under market demand proration from June first to the 15th of December. Market demand proration was in effect throughout the year in Marketing District I while production in District IIIb remained unrestricted.

During the last half of 1963, producing gas-oil ratios in sub-district IIa became excessive and oil production restrictions were imposed in order to conserve the gas, and the reservoir energy which it represents. These restrictions were continued in force after the market recovered in December.

Well-head prices for crude held steady during the year and an increasing interest in exploration was evident during the fourth quarter. A total of 174 permits for the drilling of wells were issued by the Office of the State Geologist in 1963. District II was the center of activity with 135 of these permits issued to operators for the drilling of wells in that area. Fifty of the 59 permits for wildcat wells were issued for District II.

Small, independent operators accounted for most of the drilling activity with 104 of the 174 permits granted. Twelve operators drilled their first well in North Dakota during the year.

The reserves reported here represent 1.84% of the total reserves for the United States as reported by the Oil and Gas Journal on 27 January 1964. This is an increase

over the 1.67% of 1 January 1963 and the 1.375% of 1 January 1962. North Dakota's production during 1963 represented slightly less than 1% of the domestic total. Thus it can be seen that, on the basis of reserves, North Dakota was marketing only 1/2 of its fair share of the domestic supply.

On 1 January, 44% of the 1824 wells capable of production were being subjected to reservoir energy supplementation. The distribution of reserves among the various districts was only slightly altered from that of a year ago. Marketing District I showed an increase of $4\frac{1}{2}\%$, Marketing District II, $1\frac{1}{2}\%$, and Marketing District III was down.

Williams and McKenzie Counties had increases while the other producing counties showed declines. There was no change in the order of rank of the counties with Williams, McKenzie, Bottineau, Burke, and Mountrail accounting for about 90% of the total.

An increase of 50% in Devonian reserves was the outstanding conclusion to be drawn from Table III.

Stripper Well Survey

Table IVa is identical with Table IVb in Miscellaneous Series No. 18. It is included here to provide for comparison.

As expected the number of sub-marginal wells increased during the year as more of the older wells declined below the 10 barrel per day level. The average production per day for these wells likewise declined to 4.18 barrels per day from the previous figure of 5.60 barrels per day.

The three abandonments during 1963 represented an improvement over the five wells that were plugged in 1962. The reserves underlying these marginal wells represented 40.9 million barrels on 1 January 1964, down $\frac{1}{2}$ million barrels from the previous year.

Many of the stripper wells are in Operating Units where they are shut-in and their allowables transferred to the more efficient wells. They may be restored to

production in the future as the effects of energy supplementation reach those areas of the pools. They are, of course, available for emergency use. Some of them may be converted to injection or supply wells in the future.

Acknowledgements

All of the information and data used in making this inventory was obtained from the files and records of the North Dakota State Industrial Commission, at the Office of the North Dakota Geological Survey in Grand Forks.

In addition, to Mr. Anderson, recognition is herewith given to the help and assistance of Mr. Wesley D. Norton and Mrs. Mary Edwards, Ass't. Petroleum Engineers for the Survey, and Mr. F. E. Wilborn, Jr., the Survey's Statistician.