



KANSAS

Mineral Industry Report

MINERAL RESOURCES SERIES I

Kansas Geological Survey

University of Kansas

Lawrence, Kansas

July, 1973

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KANSAS MINERAL INDUSTRY REPORT 1972

Ronald G. Hardy

Mineral Resources Series I
Kansas Geological Survey
University of Kansas
Lawrence, Kansas
July 1973

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Introduction

Nationally, 1972 proved to be a year of strong growth in real output, with the U.S. economy experiencing a strong cyclical rebound, according to the report of the Federal Reserve Bank of Kansas City. New highs in spending in the U.S. in both the private and public sectors of construction occurred during 1972, with an 8-10 percent increase in 1972 over 1971. As the construction business in Kansas reflected the same pattern as the national scene, the non-fuel Kansas minerals used in construction displayed substantial gains in physical volume of production.

The production rates of Kansas fuel minerals showed both gains and losses for 1972 as compared with 1971. Coal production posted a slight gain, probably due to the fact that major Kansas coal producers are operating at or near capacity. Crude oil production slipped markedly, while natural gas production gained slightly. The value of crude oil and natural gas produced in Kansas, \$388,000,000, accounted for 65 percent of the estimated total 1972 Kansas Mineral production value of \$601,409,000.

Highlights of Kansas Mineral Industry Production 1972

Although there were several substantial increases in production and values, there were also several declines. The net result was that the 1972 estimated total value of Kansas production decreased from the 1971 value of \$605,341,000 to \$601,409,000, a 0.65 percent decrease.

A comparison of 1971 and 1972 tonnage and value figures for Kansas materials used primarily in construction, shows modest to strong increases (Table 1). These include portland cement, sand and gravel, and stone. The increases reflect increased demand for these materials due to new highs in both the private and public sectors of construction. This trend is forecast to continue relatively strong in 1973.

Portland cement shipments from U.S. plants reached an all time high in 1972. Since portland cement use is practically 100 percent for construction, its end-use demand can be directly related to new construction (put in place). The National Planning Association has forecast for the U.S. an annual growth rate (compounded) of 4.5 percent for the 1968-2000 period for total new construction. Applying this rate to Kansas cement production would indicate that by 1975 Kansas cement production could reach 13,000,000 bbl (2,440,000 short tons or 2,200,000 metric tons). Present Kansas cement plant capacity is adequate to supply this material.

A new system of reporting cement statistics was started as of January 1972 by the U.S. Bureau of Mines, which converts quantities to short tons instead of barrels. Conversion to metric tons will be a next step. The following conversion factors will apply.

1 (376 lb.) bbl = 0.188 short tons

1 short ton = 5.32 (376 lb) bbls

1 metric ton = 1.10231 short tons

Estimated Kansas sand and gravel production tonnage for 1972 indicates a modest increase over 1971 tonnage. Again as for cement, the use of sand and gravel tended to follow the trend in construction. The Bureau of Mines estimates that the national demand for sand and gravel will have an annual growth rate (compounded) between 3.9 percent and 4.7 percent. The projected demand in Kansas for sand and gravel during the year 1975 could be close to 14.5 million tons, based on the national growth rate.

TABLE 1. Mineral production and value in Kansas 1971 and 1972 Annual Preliminary

COMMODITY	UNIT	1971		1972 ^{1/} (Preliminary)	
		QUANTITY	VALUE \$1000	QUANTITY	VALUE \$1000
Cement: Portland Masonry	1000-376 lb. bbl. 1000-280 lb. bbl.	9,208 355	29,961 1,232	10,400 432	34,700 1,550
Clay and Shale and Products ^{2/}			10,711		10,140
Coal	1000 short tons	1,151	6,579	1,230	7,040
Helium: Refined Crude	1000 CF (14.7 psia; 70°F)	342,000 2,510,000	7,182 30,120	340,000 2,250,000	7,140 27,000
Natural Gas	1,000,000 CF (14.7 psia; 70°F)	885,144	127,267	898,600	128,500 ^{3/}
0 Natural Gas Liquids	1000-42 gal. bbl.	28,602	51,254	30,600	54,835 ^{4/}
Petroleum (Crude Oil)	1000-42 gal. bbl.	78,532	276,433	73,700	259,424 ^{5/}
Salt	1000 short tons	1,240	18,712	1,292	19,880
Sand and Gravel	1000 short tons	11,862	11,351	12,900	13,000
Stone	1000 short tons	14,908	23,697	16,300	27,200
Miscellaneous: Gypsum (raw and calcined), carbon black, salt brine, sulfur, lime, volcanic ash			10,842		11,000
TOTAL VALUE			605,341		601,409

Sources of Information: State Geological Survey of Kansas, Kansas Corporation Commission, Kansas State Department of Labor, U.S. Bureau of Mines.

^{1/}The figures for 1972 are year-end estimates and should not be used as final figures. Final figures for 1972 will be available later in 1973.
^{2/}Clay and shale figures include value of clay and shale products.
^{3/}Gas priced at 14.3¢ per 1000 CF.
^{4/}LPG priced at 1.792 per bbl.
^{5/}Crude oil priced at 3.52 per bbl.

Production of crushed stone in Kansas for 1972, exclusive of the stone produced for portland cement, increased over 1971 by almost 9.5 percent. The national growth rate of crushed stone anticipated by the Bureau of Mines is between 3.5 and 5.1 percent compounded annually. Therefore, stone production in Kansas during 1975 at an assumed 4 percent growth rate would be 18.4 million tons, as compared with this year's 16.3 million tons.

Nationally, the salt industry suffered a slight setback in sales of salt for snow and ice control, due to the mild winter of 1971-72. This, coupled with a carry-over of fairly large inventories, softened prices and curtailed production.

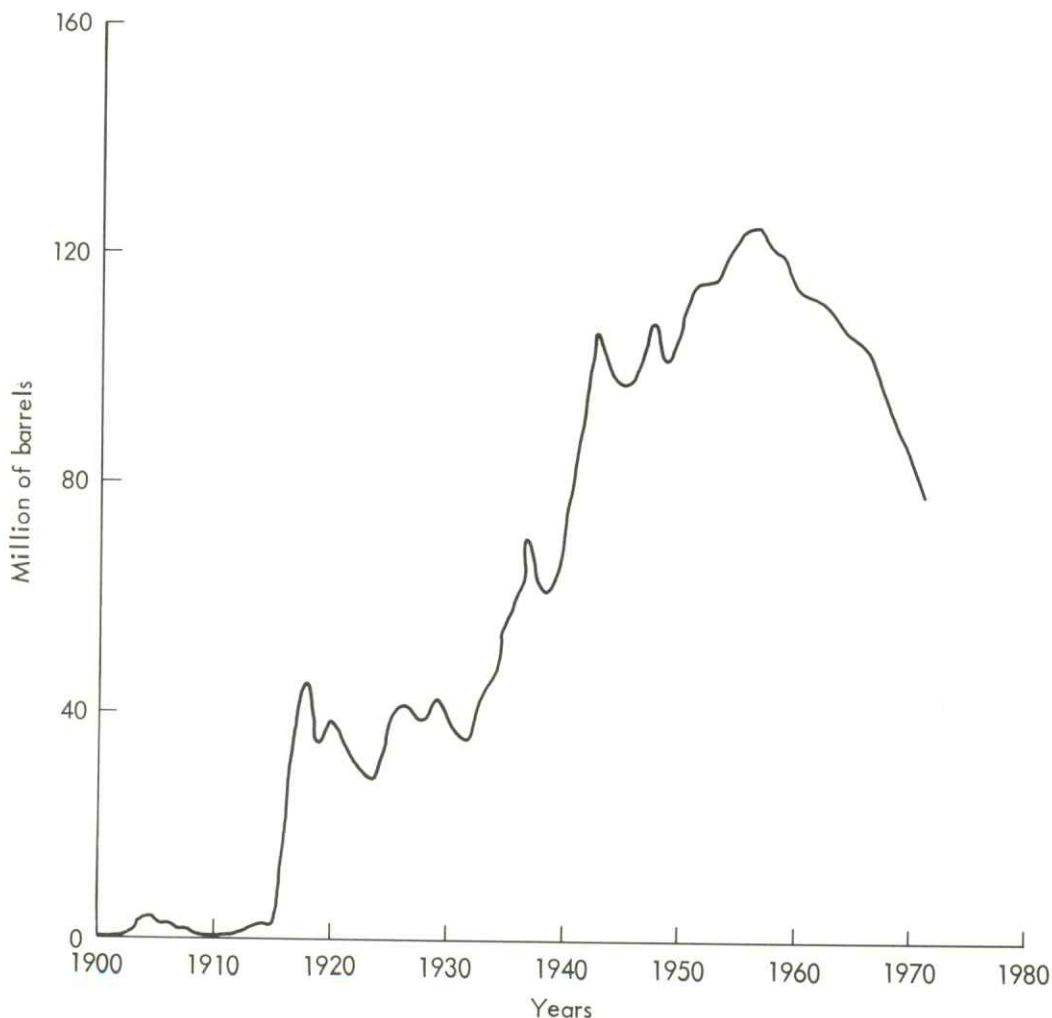


Figure 1.--Kansas Crude Oil Production, 1900-1972.

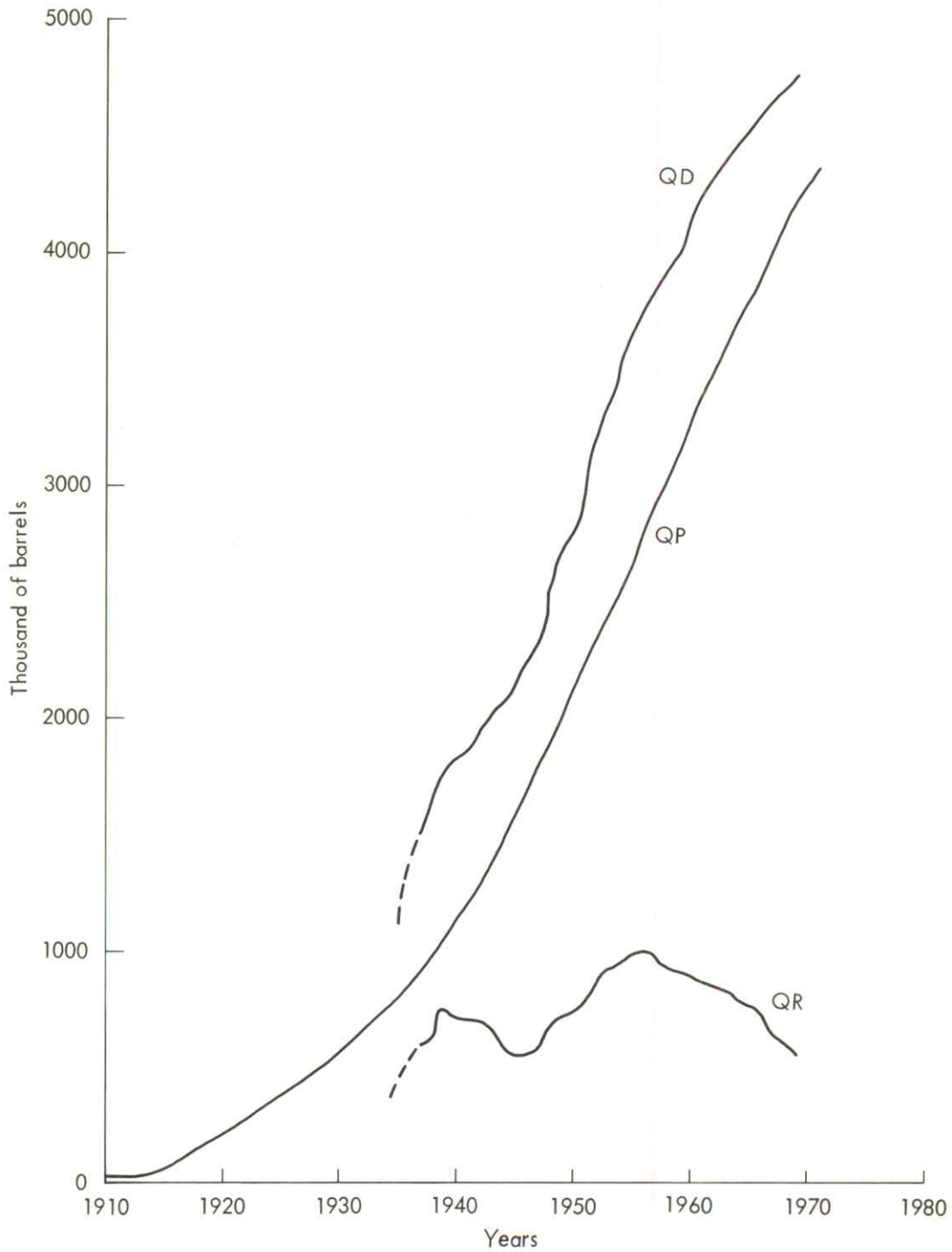


Figure 2.--Cumulative discoveries (QD), production (QP), and proved reserves (QR) of crude oil in Kansas as a function of time. ($QD = QP + QR$)

However, estimated Kansas salt production for 1972 indicates that the Kansas production did not follow this trend but increased by approximately 4 percent. Increased salt production in Kansas reflects the greater regional demand due to increased cattle feeding and slaughter.

Miscellaneous minerals, which include gypsum, lime, and volcanic ash, show an improved trend in value in Kansas. Again, this is mainly a result of real growth in tonnages produced to meet the demands of the increases in the construction industry.

Kansas estimated coal production of 1,230,000 tons for 1972 is an increase of 6.9 percent over 1971. This was almost double the national average percent increase. Coal, the nation's only abundant fuel, must supply the nation's increased energy demands until natural gas or crude oil supplies are either augmented or replaced by nuclear energy. Unrealistic air quality regulations could seriously cripple the coal industry by virtually prohibiting the burning of coal. It is estimated that coal represents 88 percent of known total U.S. fuel reserves, including uranium, and 74 percent of all of our ultimately recoverable reserves.^{1/}

Kansas' most valuable mineral product, crude oil, continues to register declines in output quantity and value (Fig. 1), a trend started in the late 1950's. Proved reserves of crude oil are also declining (Fig. 2).

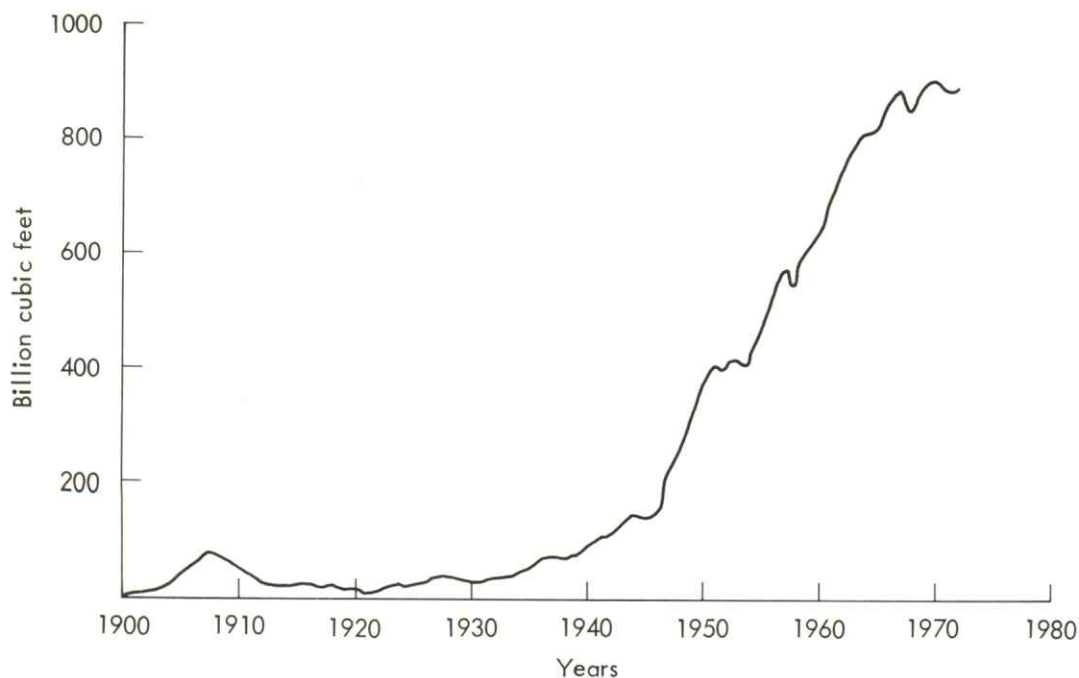


Figure 3.--Kansas Natural Gas Production, 1900-1972.

The second most valuable mineral resource, natural gas, again registered an increase in output volume and value. This trend has been in evidence since 1940. Unfortunately, the increases for the past 15 years have been at the expense of proved reserves which have shown declining values since the late 1950's. Furthermore the production appears to have reached a plateau (Fig. 3). Production is currently on borrowed time insofar as the reserves position is concerned as indicated by Figure 4.

Natural gas liquids production was estimated to be up slightly in 1972 as compared with 1971, approximately 7.0 percent in volume. Crude helium production, which is allied to natural gas processing, declined approximately 10.3 percent in volume in 1972 from 1971.

^{1/}Carl E. Bagge, Bituminous Coal Facts, 1973, National Coal Association, 1130 17th St. N.W., Washington, D.C. 20036.

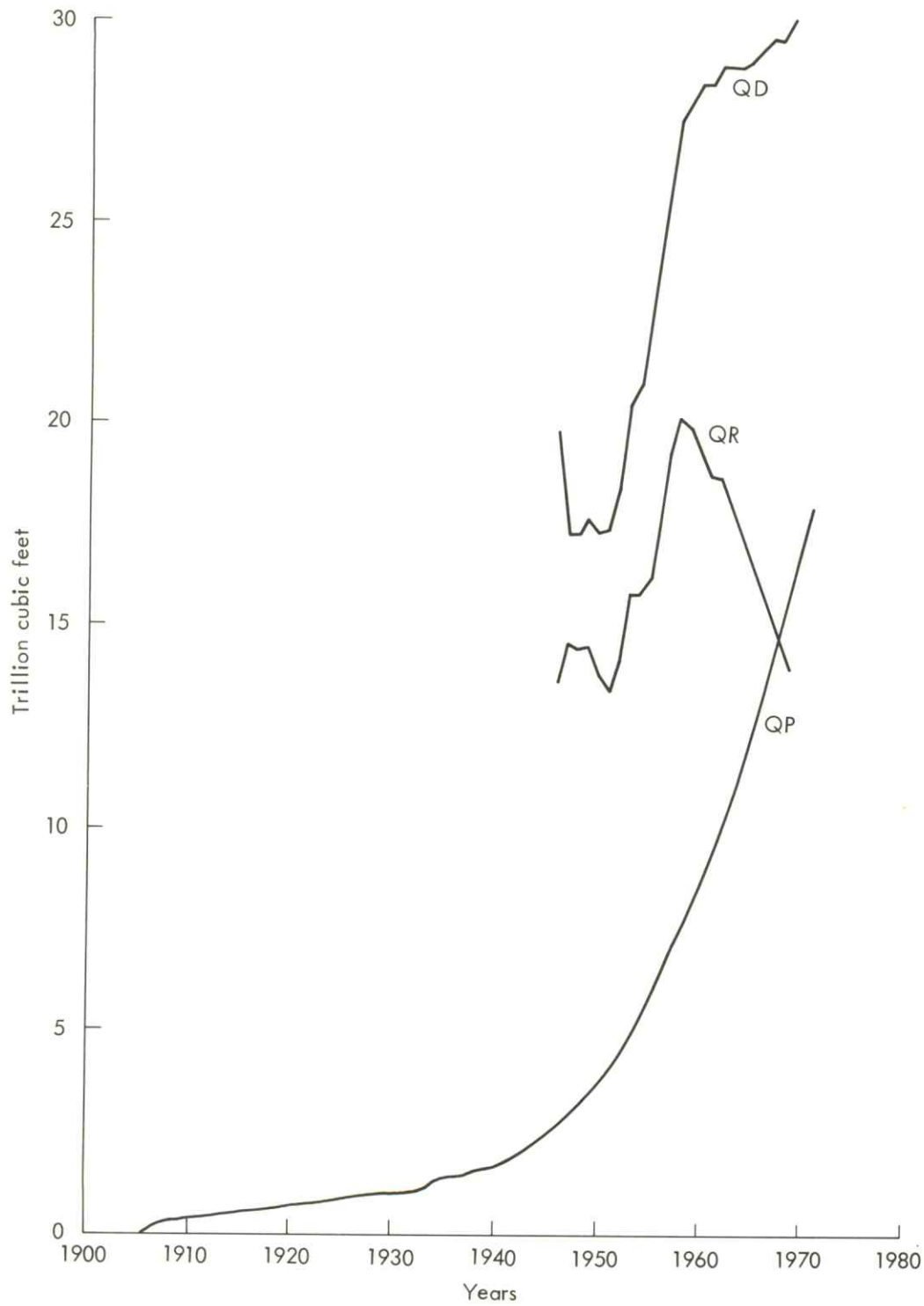


Figure 4.--Cumulative discoveries (QD), production (QP), and proved reserves (QR) of natural gas in Kansas as a function of time. (QD = QP + QR)

The Status of Kansas Fossil Energy Minerals

Kansas is a supplier of fossil energy minerals. These are petroleum, i.e., crude oil and natural gas, and coal. Figure 5 expresses by a common denominator, BTU, the relative proportions of these produced in Kansas.

Kansas energy mineral industries, i.e., coal and petroleum, are of considerable importance to the economy of many regions in Kansas. Instability in these industries will effect the economic position of the public as well as the private sectors by way of employment, tax receipts, sales, and personal incomes. Inasmuch as the petroleum industry generates approximately 80 percent of the Kansas mineral value, or \$500,000,000, significant trends in this industry are particularly noteworthy. Crude oil production for 1960 through 1970 dropped from 113 million barrels produced in 1960 to 85 million barrels produced in 1970. Crude oil produced by secondary recovery methods held at a steady rate of about 20 million barrels per year.

Natural gas production has increased from 633 billion cubic feet in 1960 to 909 billion cubic feet produced in 1970. Natural gasoline and liquid petroleum gas products increased from about 5 million barrels in 1960 to 27 million barrels in 1970. The large upsurge in these latter products is in part the result of processing natural gas for helium extraction.

The Kansas petroleum industry cannot function effectively without a substantial inventory of proved reserves. Unfortunately, the reserves of oil and gas have decreased in the past 15 years. Estimates of total proved recoverable reserves of crude oil, natural gas liquids, and natural gas are presently down, compared with reserves in 1960. This is due largely to the slow-down in drilling in recent years. Crude oil reserves dropped from an estimated 917 million barrels in 1960 to 566 million barrels at the end of 1969. At present rates, this represents 6-1/2 years of production, if no new reserves are found.

Total liquid hydrocarbon reserves are estimated at 835 million barrels. This includes the crude oil reserves plus about 269 million barrels of natural gas liquid reserves. Natural gas reserves also have dropped, from about 20 trillion cubic feet to 14 trillion cubic feet.

Speculation gives rise to the question as to why the petroleum industry has not found more oil or gas. Is it unable to do so? Not necessarily: there is a

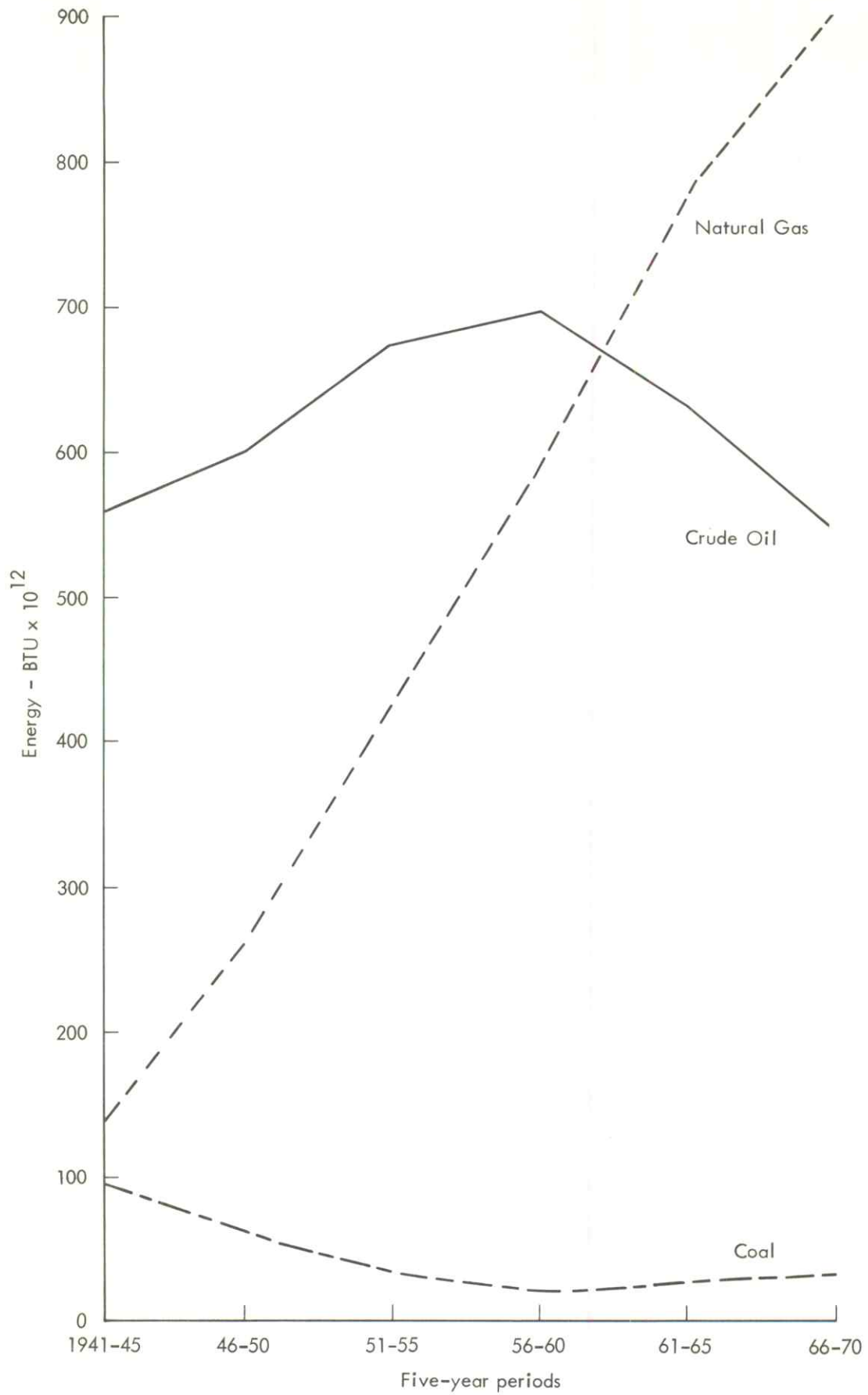


Figure 5.--Energy Produced in Kansas, 1941-1970 (five-year averages). Source: U.S. Bureau of Mines.

question of incentive. There is a consistent relationship between the financial effort allotted to finding new reserves and the amount actually found, and this industry, for whatever reason, has not been spending enough on development. The projections for a significant increase in spending have not been bright. For a variety of reasons, partly regulatory, and without regard to long range economic consequences, there has been an erosion of the industry's incentive to spend enough in the search for new reserves.

There is no shortage of coal reserves; the problem is simply a shortage of coal production. This is brought about by a number of factors such as: the threat of nuclear power which has made coal companies reluctant to expand; the shortage of skilled labor; the problem of sulfur pollution; the effect of the Federal Mine Safety Act; and rising freight rates. As a result, the price of coal has skyrocketed, upsetting the economics of coal use, especially for power generation, the present principal use of coal.

Figure 6 displays the rate of change in the trend of coal mining in Kansas as compared with national production. From 1940 to 1960 coal mining declined rapidly in Kansas and slightly less rapidly in the nation as a whole. Within the past 10 years coal mining in Kansas has increased slightly. Currently, the BTU supplied by Kansas coal is only 1/4 of 1 percent of the U.S. total. However, Kansas does have a fairly substantial quantity of coal reserves, approximately 4 percent of the nation's total (Table 2).

Many of the problems faced by the energy-mineral industry do not involve the technology of production or consumption but rather constraints arising from a number of sources, notably environmental conflicts, national or regional priorities, and taxes. Because of continued, rapid economic growth in this country, a severe stress has been put on those industries that supply energy minerals; in fact, this generally has been recognized as having approached a crisis state. The energy problem is three fold, first, it is a matter of keeping up with the growing need for energy, second, it is one of energy supply, and third, it is one of ecology.

The Secretary of the Interior has summarized the current national situation as follows, "The U.S. is facing grave problems in obtaining an adequate and reliable energy supply, and the outlook is for increased real costs of energy, narrowing of the consumers range of choice among fuels, and mounting dependence upon foreign

energy sources... Those who benefit from the production and consumption of energy will be asked to pay the full tab, and for the first time the user will have some feel for the true cost of the energy he consumes."^{2/}

^{2/} Newsletter American Geological Institute, March 8, 1971.

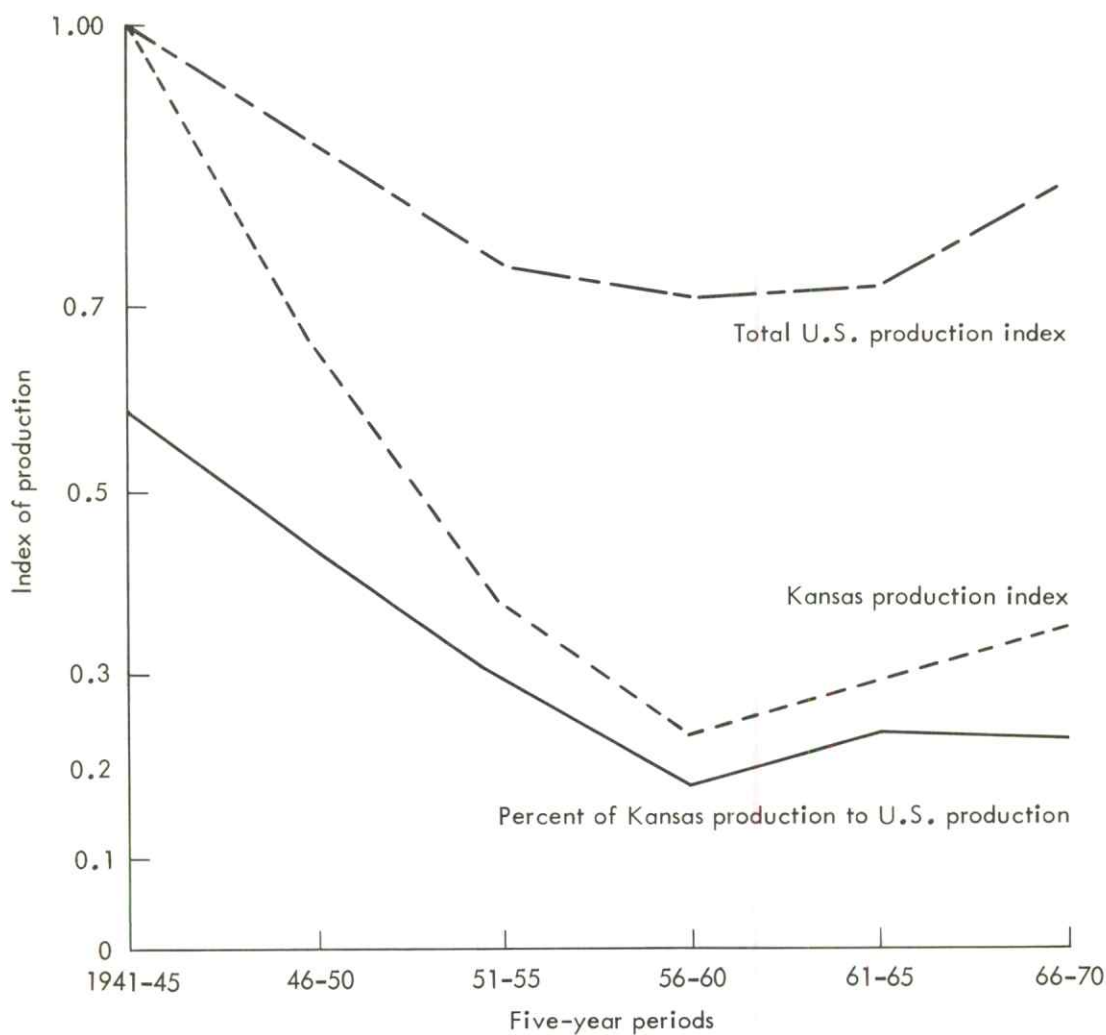


Figure 6.--Trends of Coal Production for the U.S. and Kansas. Kansas production Index is the yearly production divided by the average production 1941-45.

TABLE 2. Bituminous coal tonnage and energy equivalent for the U.S. and Kansas.

Interval	1000 tons	BTU x 10 ¹²	Index ^{1/}	1000 tons	BTU x 10 ¹²	Index ^{1/}	5-Year Average U.S. Production	5-Year Average Kansas Production	Percent of U.S. Coal Energy Sup- plied by Kansas
1941-45	625,040	16,386	1.00	3,656	95.1	1.00			0.58
1946-50	543,640	14,243	.87	2,386	61.6	.65			0.43
1951-55	462,800	12,125	.74	1,364	35.4	.37			0.29
1956-60	446,300	11,693	.71	823	21.4	.23			0.18
1961-65	456,629	11,963	.72	1,064	27.7	.27			0.23
1966-70	548,200	14,363	.83	1,292	33.6	.34			0.23
Estimated Reserves							220 x 10 ⁹ tons	8.8 x 10 ⁹ tons	4.40

^{1/}5-Year Average BTU Produced Divided by 1941-45 Production.

Source: U.S. Bureau of Mines.



Strip-mining for coal using a drag line.

View of a strip-mined coal pit after the overburden has been removed.



Coal being fractured and broken with a bulldozer.

A Kansas Coal and Clay Mining Industry

An industry little known in many sections of Kansas is one where-in a good ceramic grade of clay is uncovered after removal of coal extracted by strip-mining. This clay is then mined and the entire mined area reclaimed for pasture.

The company carrying out this operation is Wilkinson Incorporated, currently managed by Jack Wilkinson, one member of a family long engaged in the coal mining business. A member of the Wilkinson family has been in the coal mining business since 1918 and the clay business since 1953. The present area being worked is in SW1/4, Sec. 17, T32S, R24E, Cherokee County.

The coal being mined is identified as the "Neutral" and occurs in a fairly level layer with a thickness of 12-15 inches. Stripping of 20-30 feet of overburden is accomplished with a 5 cu. yd. drag line. The drag line operator is able to place the spoil in such manner as to distribute the top soil over the tops of the spoil banks. The coal seam is initially fractured and crushed by running a bulldozer equipped with a ripper over it and the coal is then loaded into trucks by a front-end loader for haulage to the screening plant. The coal is classified into standard sizes by screening without washing. The principal market for the product is nearby power plants.

Directly under the coal is a seam of clay that is removed and sold to a variety of ceramic industries. After the coal is removed, the clay surface is scraped clean with a bulldozer and fractured with a ripper, then the clay is loaded directly onto customers' trucks with a 1/2-yard drag line.

The clay is marketed in the ceramic industry for use in the manufacture of face brick, sewer pipe, and stoneware type of pottery. The clay has very good plastic properties when pulverized and mixed with water. This is especially desirable for manufacturing pottery. When the clay is formed into shapes, i.e., brick, pottery, etc. and heated to the proper temperature it develops a strong structure and has a buff color.

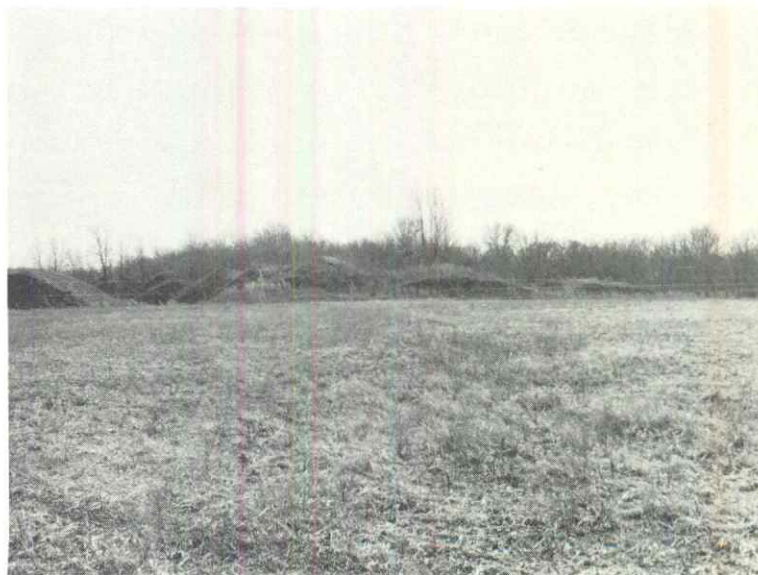
The final phase of the operation consists of leveling the spoil banks with bulldozers, dragging with a heavy I-beam, liming, fertilizing, and then seeding. Wilkinson has made it a practice to restore the land to a virtually level terrain.

Wilkinson has experimented with several types of planting on approximately 20 acre plots; to date these have been red clover, fescue, and lespedeza. With

proper preparation all three types of planting have done very well except under extremely dry weather conditions; where weather conditions have been satisfactory good stands of all crops were obtained.



View of the underclay after removal of the coal.



Reclaimed land planted in red clover with spoil banks in the background.

Optimal Production of Phosphate and Shale Oil from Southeast Kansas Black Shales: A Theoretical Analysis

When looking at any region, an analyst is confronted with many perplexing problems. One problem related to industrial development is to identify specific industries which can individually or in groups operate efficiently and with profit in the region. In this context, a pressing problem for many regions is how to best put to use limited endowments of resources. For example, a region may have only one or two types of mineral resources, or its manpower supply may be limited. How best to utilize these in terms of some predetermined goal?

As a tool for allocating resources, linear programming offers possibilities. "Generally speaking, regional programming pertains to problems in which the objective is to maximize or minimize some linear function, subject to certain linear inequalities. In such situations it purports to answer this kind of question: given a set of limited resources (which may include plant capacities, transportation, and urban facilities, as well as mineral, labor, and other natural and human endowments), given a technology in the form of a set of constant production coefficients, given a set of prices..., how program diverse production activities in order to maximize profits, social gains, total income, per capita income, employment, gross social product, or some other magnitude?"^{1/}

Using this technique a theoretical analysis was made utilizing three resources from Southeast Kansas. These resources were (1) shales containing phosphatic nodules, (2) oil shales, and (3) manpower. The object was to find the combination that would maximize regional personal income.

The results of the analysis in this hypothetical situation demonstrated that over a period of 20 years the optimal quantity of phosphate (P_2O_5) made from the phosphatic shales should be 20,000,000 tons and the quantity of petroleum made from oil shales should be 4,800,000 tons under specified conditions. Under these conditions the maximum contribution to personal income would be \$6,000,000.

The details of the method used for this analysis are available in an open-file report at the Survey office. This study was performed by Bernard J. Marks, Survey econometrician, aided by Russell L. Mehl, graduate student.

^{1/}Walter Isard: Methods of Regional Analysis, The M.I.T. Press, Cambridge, Mass., 1967, pp. 413-414.

New Mining Methods Study

With assistance funds granted by the Ozarks Regional Commission, the State Geological Survey is attempting to conceptualize a coal mining system for thin-seam coals at shallow-depths that will not disturb the environment or, alternatively, will allow the environment to be re-established in improved condition.

Since the unit cost of surface excavation for minerals has been appreciably lower than that of underground excavation, surface excavation technology has received ever-greater consideration. Unfortunately, this has resulted in serious disfiguration of the countryside, lessening of land values, and creation of non-productive acreages. Obviously an ideal solution would require a methodology for tapping mineral resources efficiently and economically without disfiguration of the country side.

The Survey study proposes to search out and conceptualize practical procedures for extracting shallow-lying coals without harmful effects to the surface environment. Essentially what is being sought is a method of continuously mining underground and at fairly shallow depths. It can be inferred from this that excavations of this nature will require a broadening of extraction techniques along with a broadening of both geological and mechanical knowledge as well as environmental control technology.

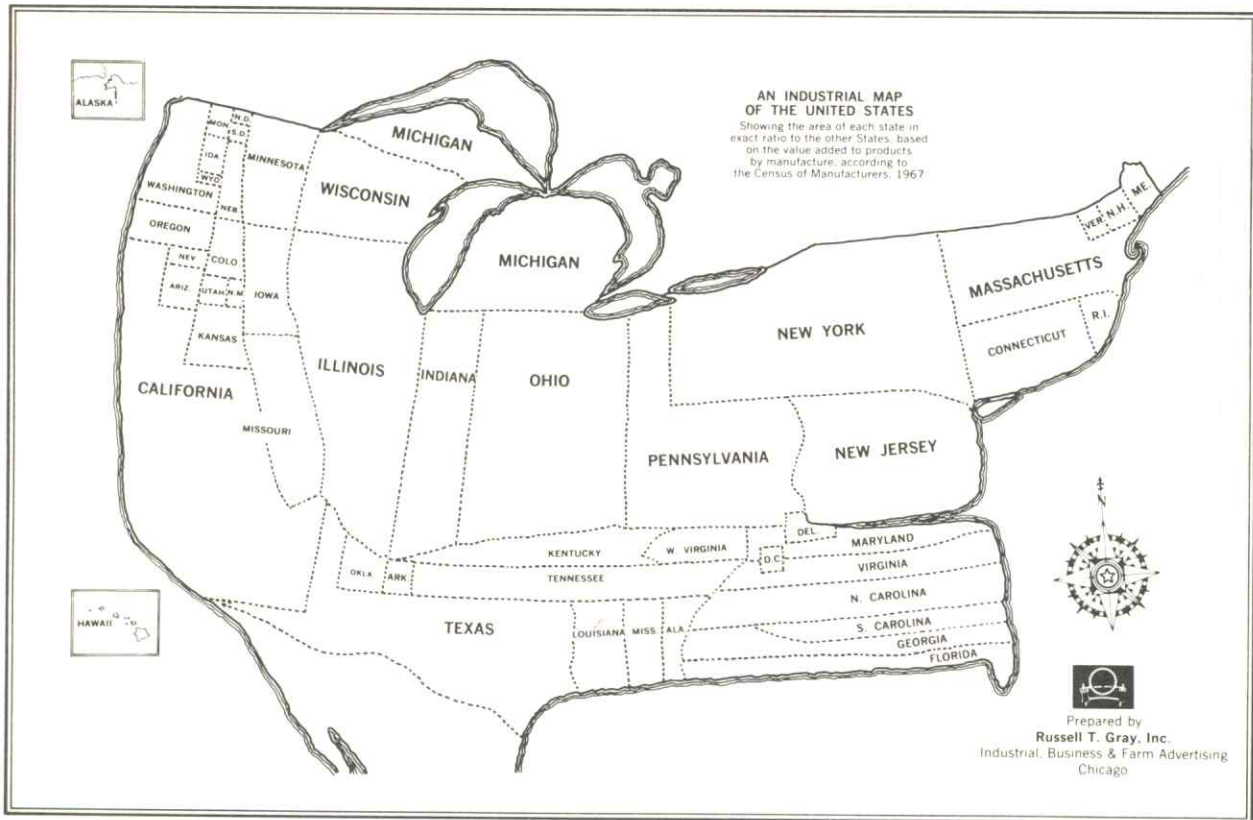
In order to achieve the desired goal of a highly engineered system the following steps are essential:

- (1) development of processes and/or equipment for working in soft to medium-hard rock masses,
- (2) continue the foregoing with the proper equipment for bringing product and/or waste to the surface,
- (3) develop geologic techniques for determining rock and ground water conditions prior to the operation, and
- (4) development of processes and equipment for maintaining adequate environmental quality.

This project is being carried out under a cooperative program of the University of Kansas School of Engineering and the Kansas Geological Survey. One facet of this research is to expose engineering or geology students to problems of the mineral industry, and with this thought, much of the work on this program is being carried out by student research assistants.

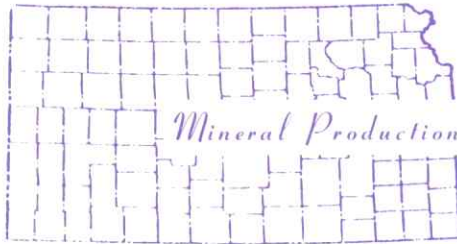
An Industrial Map of the United States

The data illustrated in the map prepared by Russell T. Gray, Inc. are very revealing and worth a multitude of words. Value added in manufacturing is one useful method of evaluating manufacturing activity, thus, this map illustrates the relative amounts of manufacturing in each state. This map is used through the courtesy of Russell T. Gray, Inc.



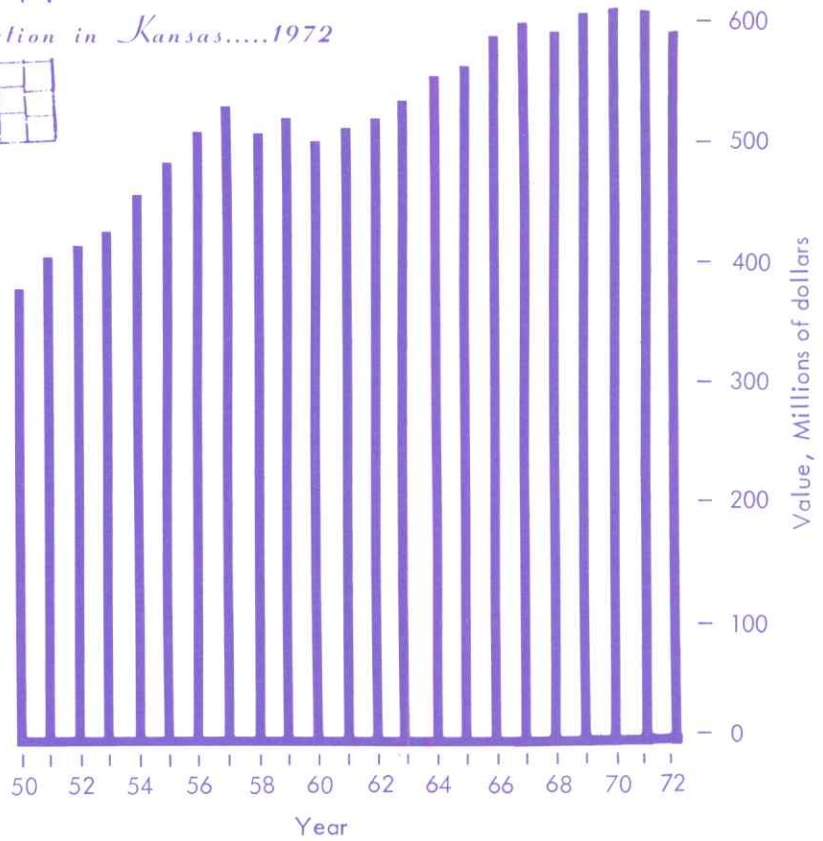
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Mineral Production in Kansas.....1972

*Total \$601,409,000
Estimated 1972 Value*



COMMODITY	1972 ESTIMATED VALUES \$1000	1972 PERCENT OF TOTAL VALUE
Crude Oil	\$259,424	43.1
Natural Gas	128,500	21.7
Natural Gas Liquids	54,835	9.1
Cement	36,250	6.0
Helium	34,140	5.7
Stone	27,200	4.4
Salt	19,880	3.3
Sand and Gravel	13,000	2.1
Miscellaneous Minerals (combined)	11,000	1.8
Clay and Shale	10,140	1.7
Coal	<u>7,040</u>	<u>1.1</u>
TOTAL 1972	\$601,409	100.00
1971	\$605,341	