PETROLEUM RESOURCES

10 October 1957

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GENERAL DISCUSSION 30

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INDUSTRIAL COLLEGE OF THE ARMED FORCES

Washington, D. C.

Dr. Richard J. Gonzalez, Director and Treasurer, Humble Oil and Refining Company, was born in San Antonio, Texas, 17 August 1912. He received his B.A., M.A., and Ph.D. degrees in economics from the University of Texas. As a graduate student he was an instructor in economics. Subsequently, he was assistant professor of economics at the University of New Mexico and the University of Texas. He became associated with the Humble Oil and Refining Company as economist in 1937 and served in that capacity to 1951 when he was elected a director of the company. He has been Treasurer since 1953. He served as a consultant to the Office of Defense Mobilization in 1954 and again in 1956 in connection with the studies of the Task Force for the Presidential Advisory Committee on Energy Supplies and Resources Policy. He has also been a consultant to the Petroleum Administration for Defense, 1951-1953, and chairman of the Economics Advisory Committee to the Interstate Oil Compact Commission, 1946-1949. He has been chairman of the Economics Advisory Committee on Depletion of the Mid-Continent Oil and Gas Association since 1950. He has written numerous articles on the petroleum industry. This is Dr. Gonzalez' second lecture at the College.

PETROLEUM RESOURCES

10 October 1957

COLONEL DAVIS: Today we continue our studies in the National Resources Unit, with discussions this morning and this afternoon on petroleum resources and their connection with national security.

I think the importance of this subject is appreciated by all of you. The great and growing dependence of our economy on energy derived from petroleum and the absolute essentiality of petroleum products to the military system are well known and justify our deep concern with the subject.

Before proceeding with the introduction of the speaker, I would like to present the group discussion leaders who will meet with you in the seminar rooms after the lecture. You have all read their biographies and I am sure you will agree that we have extraordinarily experienced and knowledgeable people to work with us today.

We consider it a privilege that these men have taken time from their busy schedules to help us out. As I introduce the discussion leaders, will you please withhold your applause until I have introduced the last man.

Sirs, will you please rise as I call your names?

Mr. Barton, Department of the Interior
Mr. Walshe, Standard Oil Company of California
Mr. Stewart, Department of the Interior
Dr. McIntyre, California Texas Oil Co., Ltd.
Mr. Anderson, Bureau of Mines, Department of the Interior
Mr. Hodges, Shell Oil Company
Captain Oliver, Office of the Secretary of Defense
Mr. Chapman, Consulting Engineer
Mr. Fentress, Department of the Interior
Mr Jameson, Independent Petroleum Association of America
Commander Stern, USN, Office of the Chief of Naval Operations
Mr. Brown, National Petroleum Council
Colonel Bednarek, USA, Office of the Secretary of Defense
Mr. Watson, Standard Vacuum Oil Company
Mr. Fallin, National Petroleum Association

Our speaker this morning is Dr. Richard J. Gonzalez, Director and Treasurer of the Humble Oil and Refining Company. As you know from his biography, he has been a practicing oil economist for 20 years. He has helped the Government in past emergencies, and we do, indeed, consider him a friend of the College.

Dr. Gonzalez, it is a pleasure to welcome you back to the platform of the Industrial College of the Armed Forces and to introduce you to the Class of 1958. Dr. Gonzalez.

DR. GONZALEZ: Colonel Davis, Gentlemen: I am delighted to be here with you again today. Some of what I have to say this morning will no doubt seem like a repetition for those of you who were here last year, but there may be some new material, and perhaps some of the emphasis will be different, since we deal with a very dynamic subject when we talk about petroleum resources and about the economics of this business.

One of my favorite stories about economics is of the graduate student in economics who had been out of college for 10 years and went back for a reunion of his class, and called on his old professor. In the course of the conversation he asked the professor what questions were being given on examinations. The professor picked up a mimeographed sheet off his desk and handed it to the man. He looked at it a few minutes, and then a puzzled look came on his face, and he said, finally, "Professor, aren't these the same questions that you asked us when I was in college?" The professor said, "Yes, of course they are." Then the man inquired, "Well, don't the students catch on to this after so many years, and know what to answer to these questions?" The professor said, "Of course they do; but we keep changing the answers."

In the field of economics we are constantly faced with changing conditions and dynamic developments that require study on our part for an evaluation of the current status. I need not tell you gentlemen the importance of petroleum, but perhaps a few charts will help us to understand the role that petroleum has come to play in the modern world.

Chart 1, page 4.--This chart shows energy consumption and real gross national product per capita in the United States for a period of time, to show that our physical output of goods and services is greatly influenced by and closely related to our consumption of energy. In other words, the reason we are able to produce more now, with less work on the part of the people who are employed, is because we use inanimate energy to multiply the productive powers of our people.

Chart 2, page 5.--This relation is also true throughout the world. From this chart we see energy consumption and income in different nations, and looking at the left and the righthand scales, we see that there is a fairly general correlation between energy consumption per capita, shown on the left side, and the income per capita, shown on the right side. The United States has the largest energy consumption per capita and also the largest income per capita. Canada ranks second in both respects. As we come down toward the bottom of the scale we see that quite a few countries which have a very small consumption of energy per capita also have a small income per capita.

Chart 3, page 6.--This chart shows United States mineral energy consumption beginning from 1920 and running forward. The major components and the consumption are expressed in trillion British thermal units. We can see, of course, that in the early 1920's we first reached an energy consumption of 20,000 trillion British units, and that we have now approached a level of twice that amount. In a period of approximately 33 years we have doubled our energy consumption. We can also see some material shifts in the role of the various forms of energy, coal having been the dominant form of energy in the early twenties, and oil and gas having become the dominant form now.

Oil and gas supply two-thirds of the energy that is consumed in the United States. The rate of growth is increasing at such a figure that we can expect the consumption of gas probably to double in 15 or 20 years and the consumption of oil in the United States to double in a matter of 20 or 25 years. In other words, we will still need staggering quantities of oil and gas in the future. Even in this age of nuclear-powered submarines and talk about high-energy fuels, we still are in a period where oil and gas will be the principal form of energy, certainly for civilian purposes, and probably for military purposes, as well, at least for our generation.

It is important, therefore, for us to consider the resources for petroleum available to the United States and available through the world. When we talk about resources, it is necessary to distinguish between economic availability and physical existence. Mere physical existence does not make a resource economically useful. We can cite a number of examples. We know that a great deal of oil exists in the shale of the Rocky Mountains and in the tar sands of Canada. In fact, we know that there is far more oil in those deposits than all of the known petroleum resources that we have in the world. Yet that shale oil is not available to us and not economically significant at this time, because we have been unable to devise a technology that can extract those fuels at a reasonable cost that will make them economically useful to us.

Chart 1

ENERGY CONSUMPTION AND REAL GROSS NATIONAL PRODUCT PER CAPITA ARE CLOSELY RELATED

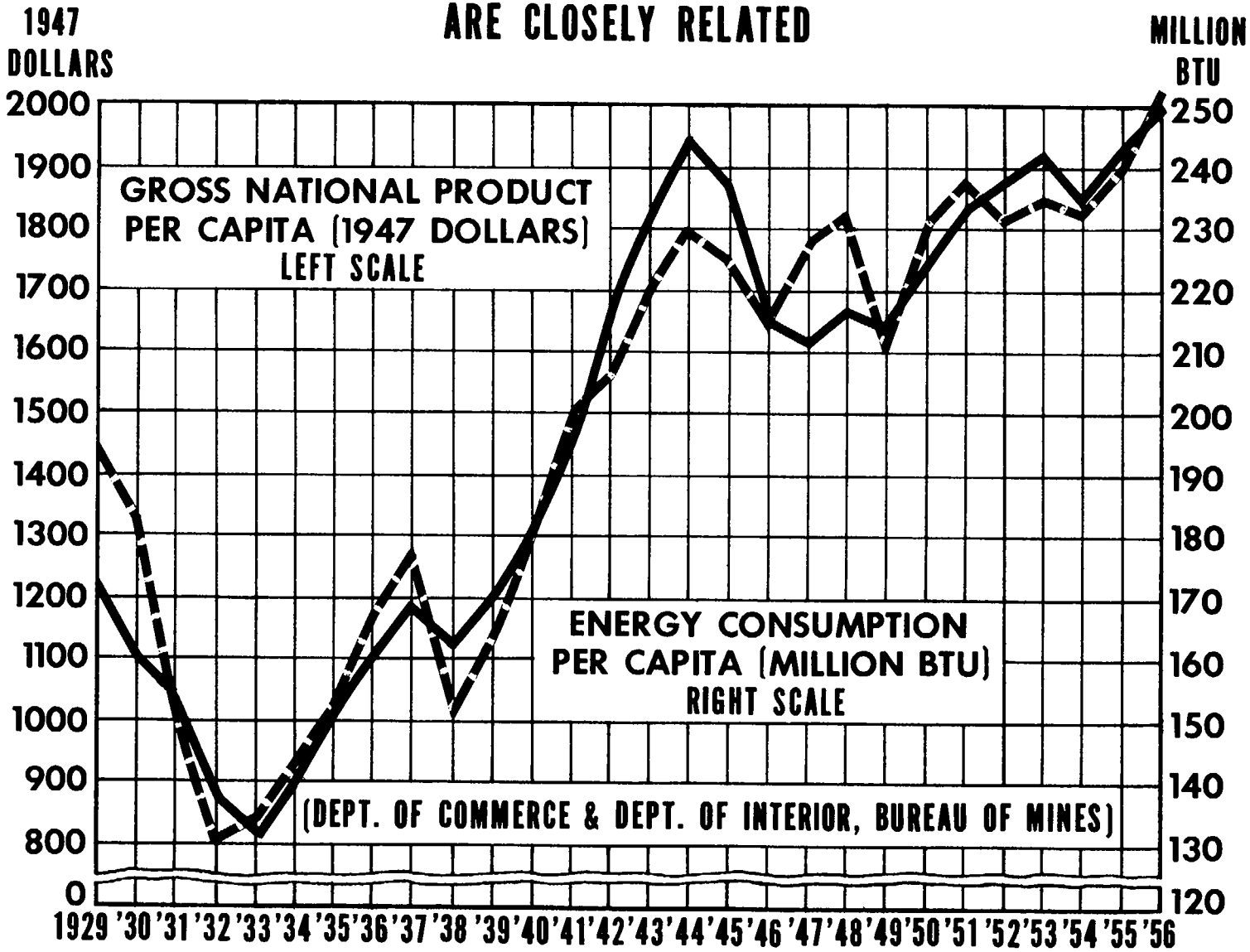
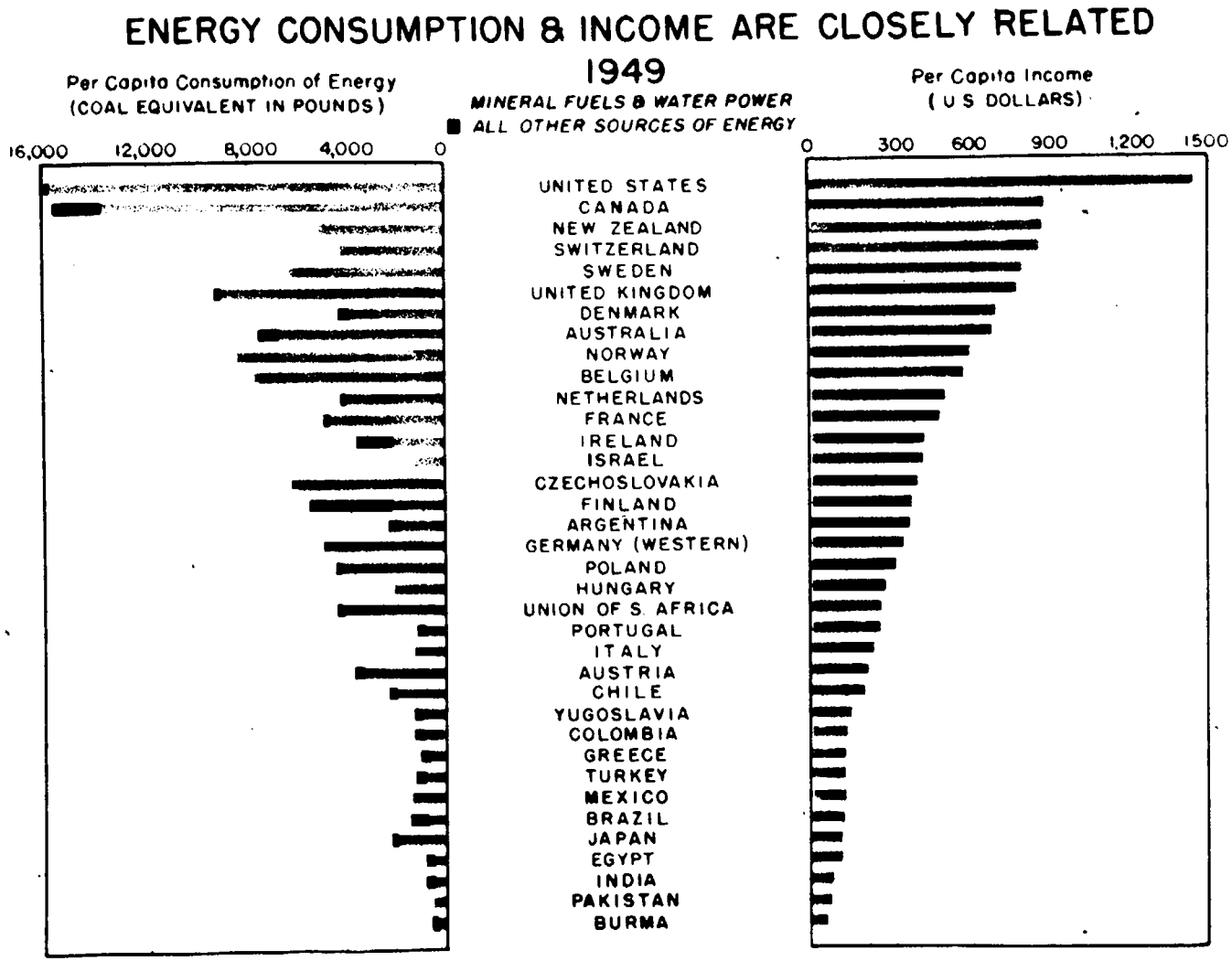


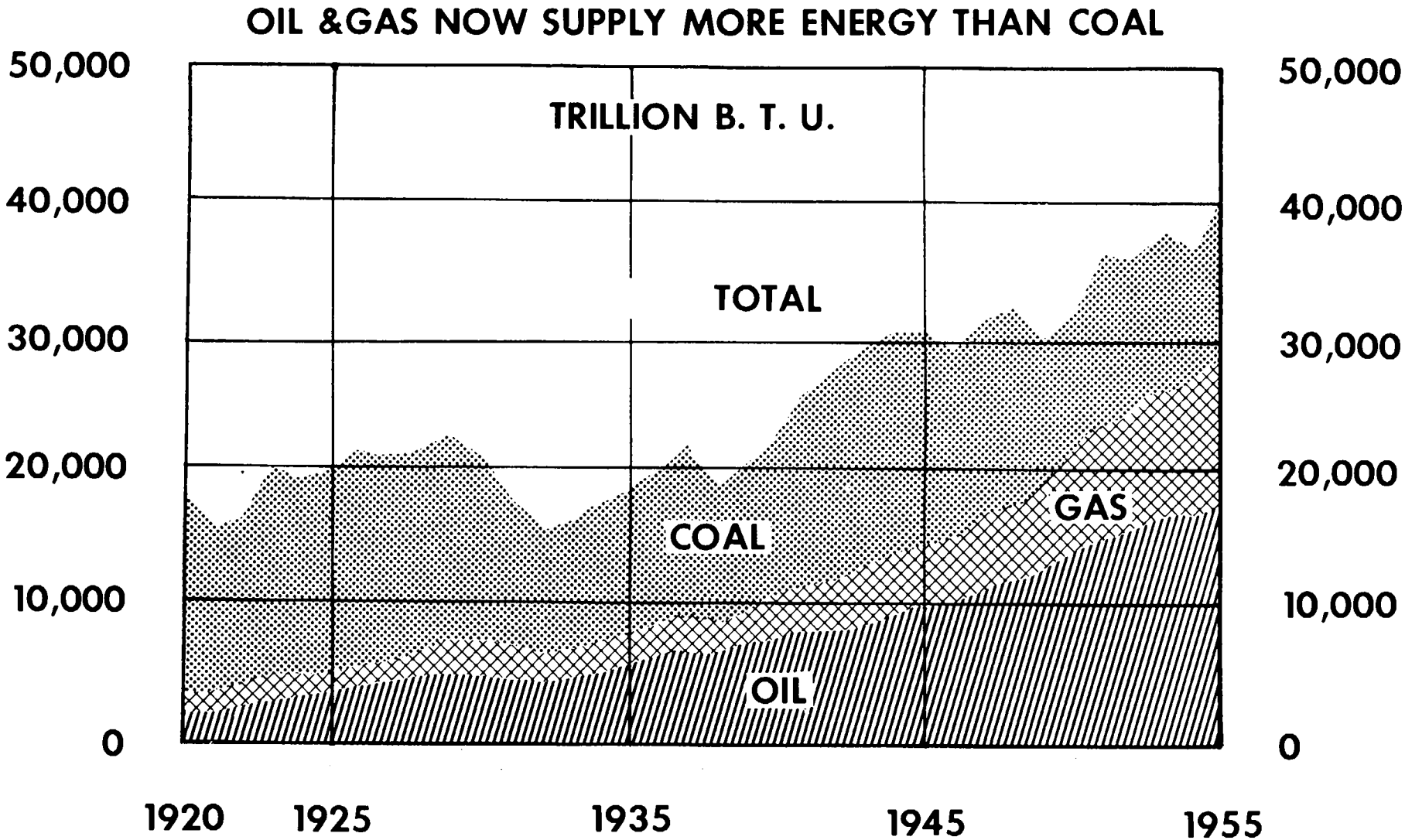
Chart 2



DEWHURST AMERICA'S NEEDS AND RESOURCES, PAGE 904

Chart 3

U. S. MINERAL ENERGY CONSUMPTION



We can take as another example the heat from the sun. Solar energy is, in quantity, far greater than all of the energy from the fossil fuels that we know and have, and it is of course delivered to our very doorsteps; but we have not yet, except in isolated cases, found a way to capture that energy and utilize it effectively for the generation of power that we can convert to useful ends.

Coal is another deposit which we know to exist in tremendous quantities in the United States, but much of these deposits are of limited economic significance because of the cost of mining the coal and making it available.

It is always a surprise to people who think that we are running out of oil in the United States and that our supplies are quite limited to find that oil and gas have come to play such a dominant role in the energy of the United States. Thinking simply in terms of physical resources, everyone would expect that coal would still be far the dominant source of energy in the United States, but in terms of economic availability it has been clearly demonstrated that oil and gas can be delivered to the market at prices that make them more attractive for the consumer than coal.

Now, changing technology may change some of these relationships. The day may come when perhaps many of our military vehicles, particularly in the Navy, may be powered by nuclear energy. The day may come when solar energy can be captured and utilized effectively. But these changes do not happen overnight. They require time. Here, as we see, even in the period of change to the oil and gas economy, coal does not disappear as a fuel. It remains a very important form of energy, although its relative importance is diminishing.

We might, then, turn to some more charts, which will show us this picture of resources throughout the world, particularly, first, in the United States.

Chart 4, page 8.--This chart simply expresses in percentages the increasing proportion of U. S. mineral energy production supplied by oil and gas. We see that, in terms of production, oil and gas have come to supply almost two-thirds of the total in the United States, with gas beginning to approach coal in terms of volume of energy production.

Let us review now the record of the development of crude oil reserves in the United States over the history of the industry, beginning with 1859.

Chart 4

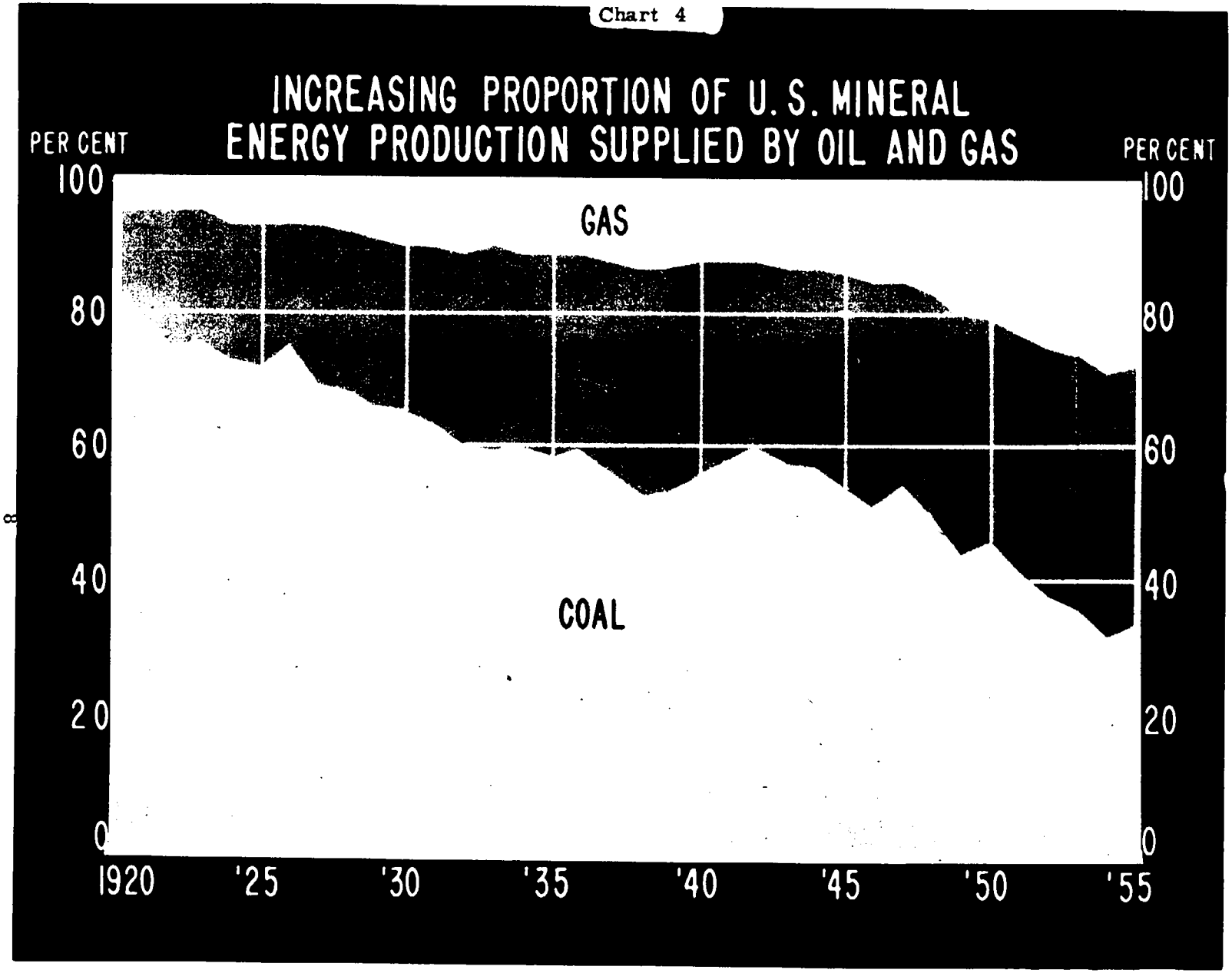

INCREASING PROPORTION OF U.S. MINERAL
ENERGY PRODUCTION SUPPLIED BY OIL AND GAS
PER CENT
100
80
60
40
20
0
GAS
COAL
1920
'25
'30
'35
'40
'45
'50
'55

Chart 5, page 11.--In the long period from 1859 to 1925, the industry found and developed only about 13.2 billion barrels of crude oil, as shown by the first bar and the figure at the top. In that period of time the industry produced 8.7 billion barrels of oil and added to reserves 4.5 billion barrels of oil. In the next 10 years, from 1926 through 1935, the industry found and developed 17.4 billion barrels of oil; considerably more, in fact, in that 10-year period of time than in the entire preceding 66-year period of time.

The production was up to 8.9 billion barrels, and the addition to reserves in this period--the top part of the bar--were 8.5 billion barrels. At the end of 1935 the proved reserves were roughly 13 billion barrels of oil.

In the next 10 years, 1936 through 1945, the United States produced 13.9 billion barrels. In other words, in that 10-year period of time, we produced more than we knew the proven reserves to be at the beginning of the decade. Yet we did not run out of oil. We found and developed 20.8 billion barrels of reserves, and we added 6.9 billion to our proven reserves, bringing the total up to about 20 billion barrels.

Then, in the next 10 years, from 1946 through 1955, we produced 20.8 billion barrels. Again, in 10 years, we have produced just about as much as we thought our proven reserves were at the beginning of the period. And again, we do not run out of oil; we add 10.1 billion barrels to our proven reserves, and we bring our total up, at the end of 1955, to 30 billion barrels.

This is a rather extraordinary sort of development, in which apparently the more oil we use the more oil we find. Looking at the period as a whole, we see that throughout the period we have found and developed, as a rule, about a barrel and one-half for every barrel that we produced. In other words, the very function of producing oil is a stimulus to the search for more new oil and the development of that oil. It is as though the process of searching for oil enables us to unlock different storehouses, and, having learned how to open one, we go on and learn how to open the next.

Chart 6, page 12.--If we look at the relation in this chart of the development of new oil per well, we see at the top of the chart the same figures that we discussed before of the new oil in billion barrels

for different periods of time, and, together with that, the total wells completed and the oil wells completed.

You can see that the rate of drilling has increased in these last 10-year periods, and this of course has a lot to do with the amount of oil that has been developed. On a per-well basis we can see that in the last 30 years the amount of new oil per total well has shown a slight decrease and the amount of new oil per oil well has remained relatively constant by 10-year periods.

In these last 30 years we have developed a great deal more oil per well than we did in the earlier period, because we have learned how to produce fields scientifically, we have learned to control the spacing of wells, and we no longer have the very close spacing that we used to have 50 years ago, when it was common to drill one well, perhaps, to an acre, or a fraction of an acre. Today it is much more common to drill a well to 20 or 40 acres, so we have quite a different pattern of development. We are able to develop reserves per acre that would have been considered marginal in earlier days.

In the past five years there has been some concern that the amount of new oil per well may be declining and that the ratio of development of new oil to production has declined. Whereas over the long period of time that ratio of new oil to production is 1.5 barrels in the last five years it is 1.25 barrels. And, whereas the new oil per oil well over the 10-year period is about 133,000 barrels, it is in the last 5 years closer to 105,000 barrels.

There have been some reasons and explanations for these developments in the sense of technology, particularly the fracturing of sand formations to stimulate production that in earlier days could not have been recovered economically. This has allowed the industry to go back and drill some shallow wells that have relatively small reserves per well. This seems now to have passed its peak, and there has been some decline in the number of wells drilled in shallow areas, particularly in Oklahoma and Illinois, and there has been a shift now towards concentration in some of the deeper areas, particularly off-shore, where we are securing an entirely different kind of well.

Chart 5

NEW CRUDE OIL*
HAS INCREASED IN PROPORTION WITH PRODUCTION

(*DISCOVERIES, EXTENSIONS, AND REVISIONS BASED ON RESERVE ESTIMATES OF FEDERAL OIL CONSERVATION BOARD FOR 1926 AND CRUDE OIL INCLUDED IN A.P.I. REPORTS)

BILLION BARRELS

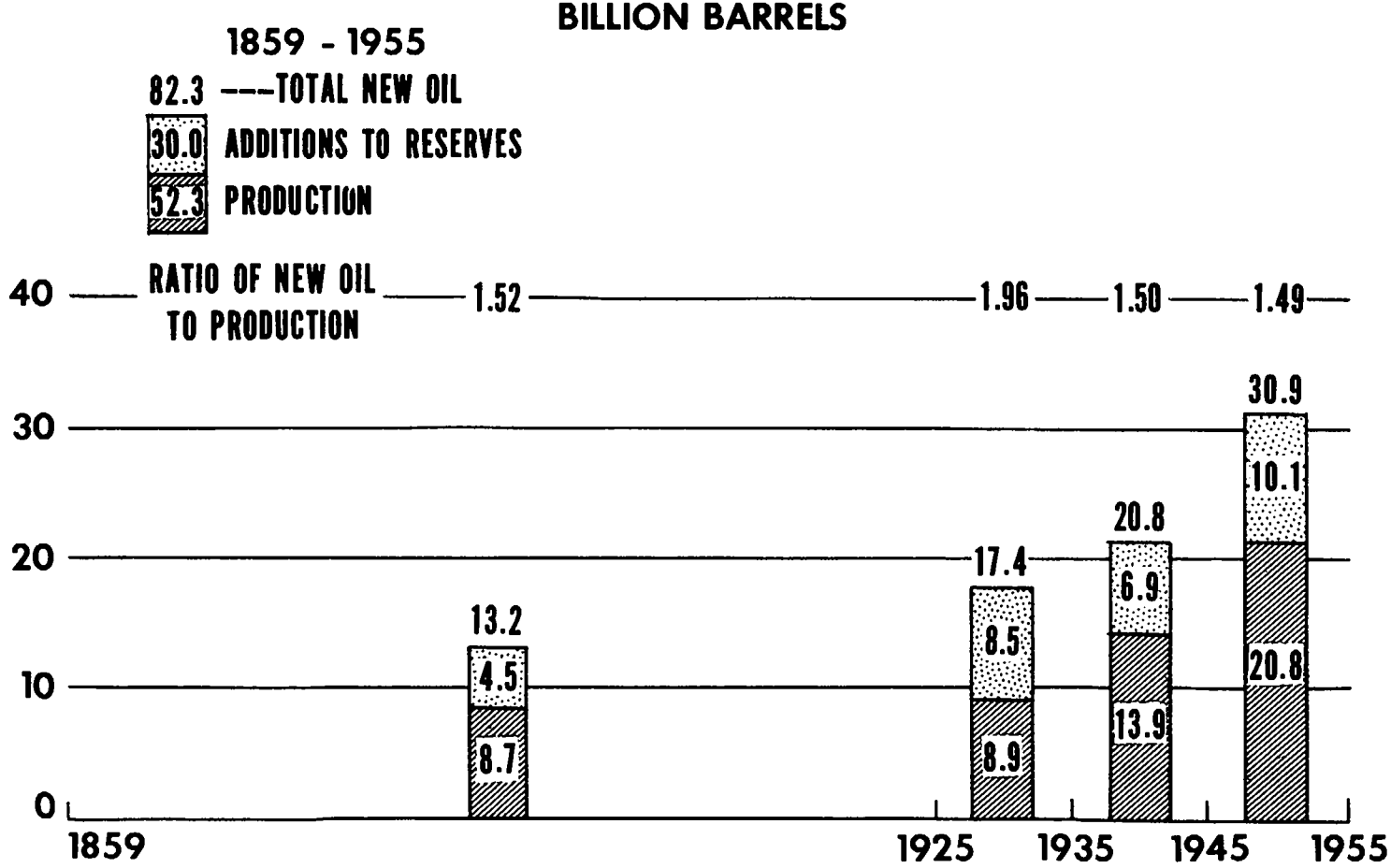


Chart 6

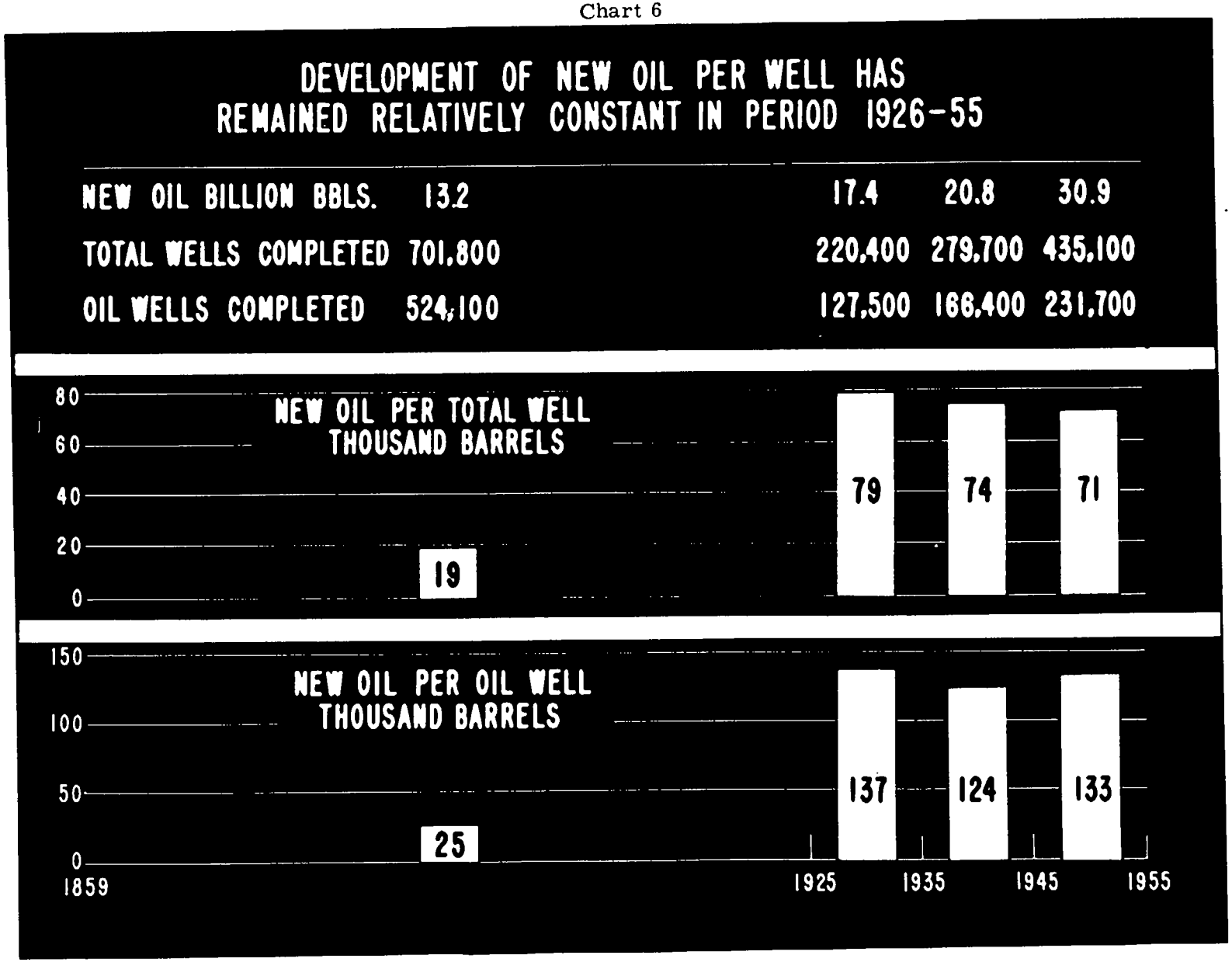

DEVELOPMENT OF NEW OIL PER WELL HAS
REMAINED RELATIVELY CONSTANT IN PERIOD 1926-55
NEW OIL BILLION BBLS. 13.2 17.4 20.8 30.9
TOTAL WELLS COMPLETED 701,800 220,400 279,700 435,100
OIL WELLS COMPLETED 524,100 127,500 166,400 231,700
NEW OIL PER TOTAL WELL
THOUSAND BARRELS
80
60
40
20
0
19
79
74
71
NEW OIL PER OIL WELL
THOUSAND BARRELS
150
100
50
0
25
137
124
133
1859
1925
1935
1945
1955

Chart 7, page 14.--This chart shows the relation between the number of wells drilled and the value of crude oil and natural gas production for the postwar period beginning with 1946. The annual figures follow very closely a straight line. We can see, however, that some fall slightly below, some above, and that the estimate for 1957 is considerably below the line.

Now, we have to keep in mind that in 1957 the industry has stepped up very considerably its drilling of offshore wells, and that an offshore well can easily be the equivalent of 10 onshore wells. If we drill 300 offshore wells, which may cost us around $500,000 each, may be the equivalent of drilling 3,000 onshore, shallow wells, in terms of reserves as well as in terms of cost.

The relationship that we have pictured here between wells and revenue is more properly one between revenue and expenditures on wells. Unfortunately, we do not have a good series on expenditures over a period of time, so we use instead the well number as an approximation to that figure.

Chart 8, page 15.--We have also been concerned about what is happening to the cost of developing domestic resources. I think it is interesting in this connection to look at this chart on wholesale prices for petroleum and products in relation to all commodities. We see the petroleum and products line, the index of wholesale prices, as against the line for all commodities, and the natural gas line.

Coming from the twenties into the thirties, the index of petroleum product prices declines much more sharply than prices generally. About midthirties, prices generally began to turn up, and the petroleum index shows a remarkably parallel course to the price of all commodities in general.

In the very latest years, coming up to 1955 and 1956, the index of petroleum prices has moved slightly ahead of the index of all commodities, but it has not yet departed sufficiently to cause us to feel that there is a change in the long-run relationship. In other words, much of the increase in the price of petroleum is a reflection of the forces of inflation.

Chart 7

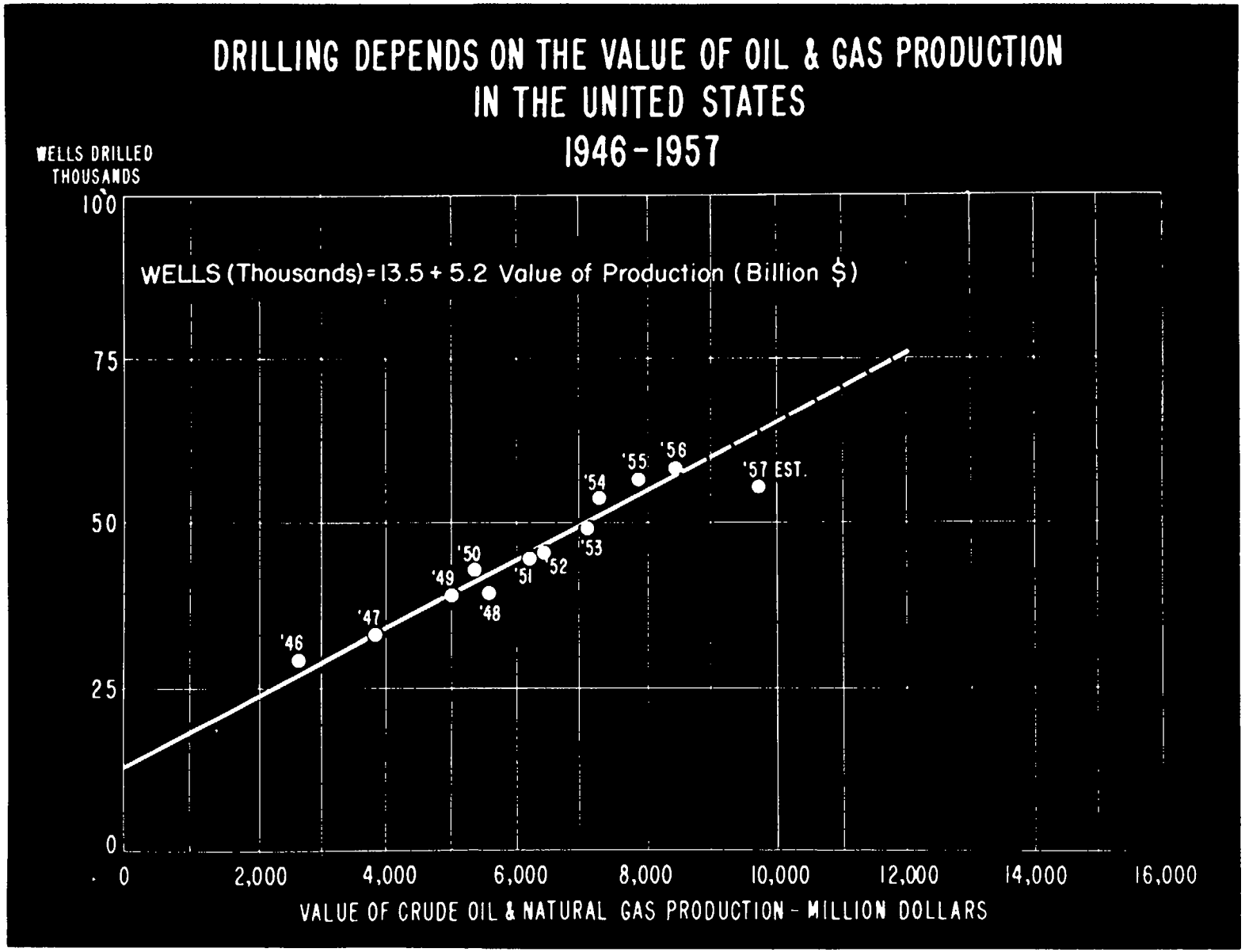
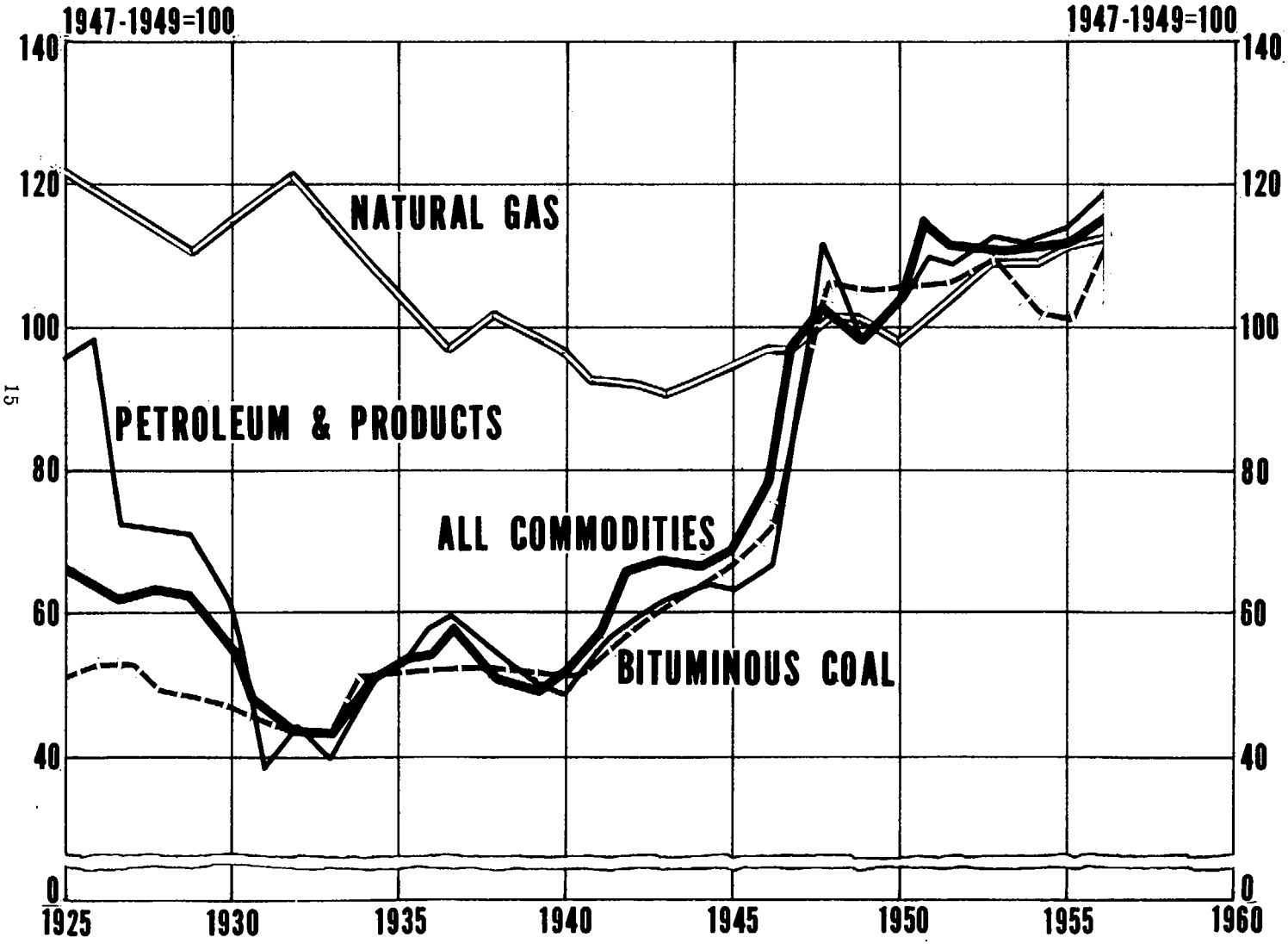

DRILLING DEPENDS ON THE VALUE OF OIL & GAS PRODUCTION
IN THE UNITED STATES
1946-1957
WELLS DRILLED
THOUSANDS
100
75
50
25
0
WELLS (Thousands) = 13.5 + 5.2 Value of Production (Billion $)
'46
'47
'48
'49
'50
'51
'52
'53
'54
'55
'56
'57 EST.
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
VALUE OF CRUDE OIL & NATURAL GAS PRODUCTION - MILLION DOLLARS

Chart 8

WHOLESALE PRICES FOR PETROLEUM AND PRODUCTS HAVE BEEN IN LINE WITH PRICES FOR ALL COMMODITIES



True, there have been some changes in real costs with respect to the industry, but, at the same time that we have been drilling deeper and in more expensive areas, such as the offshore, we have been improving our technology of recovering oil, and this improvement in technology has been a saving factor in enabling the industry to supply its products at reasonable prices.

From this background of development in the United States we may turn now to a consideration of resources throughout the world.

Chart 9, page 18.--We have in this chart world crude oil production, with the figures on the right showing the production in million barrels daily. For the year 1956, world crude oil production was 16.6 million barrels daily. The Russian-dominated areas were estimated to have a production of 1.8 million barrels daily. If we look at the bottom of the chart, we see that United States production was 7.2 million barrels daily in 1956.

The next portion of the chart shows the other Western Hemisphere nations. That production amounted to about 3.5 million barrels daily. The third portion of the chart shows the free Eastern Hemisphere. That production amounted to about 4.1 million barrels daily.

The United States, in other words, is still the dominant producing area in the world, with over 40 percent of the total production. This, of course, is an expression of the availability of oil, the ability to deliver it to market.

In this connection I would like to mention a report which was made by the National Petroleum Council to the Government only last week, in which they stated that the United States, as of last January, could have produced almost 10 million barrels daily of crude oil. In other words, there was a very substantial reserve productive capacity, and that productive capacity could be maintained with the drilling of 41,000 to 50,000 wells annually, or somewhat fewer wells than the current rate of drilling in 1957 of about 53,000 to 54,000 wells.

It is also necessary to call attention to the fact that, while that much oil could have been produced, not all of it could have been delivered to the points of consumption, because of lack of transportation facilities, particularly pipelines, for moving oil from some of the producing areas, such as west Texas, to the refining and consumption

centers. We have demonstrated earlier this year that the United States could produce and deliver to market, with the existing facilities, something of the order of magnitude of 8 million barrels, which still meant a fair cushion against consumption, but not as large a cushion as we could have made available if the transportation facilities had existed.

Chart 10, page 19.--The immediate availability and the future availability, of course, may be different concepts, depending on reserves. We have here a picture of the reserves of liquid hydrocarbons in the free world. This is very much the same figure that we presented to you last year. We'll talk first about the reserve figures, where we have included with the U. S. the reserves of natural gas liquids, as well as crude oil, and we have shown the figure of 35 billion barrels. For other countries in the Western Hemisphere the reserves are 34 billion barrels.

For the Middle East, using the figure that the well-known geologist, Wallace Pratt, provided for the panel on the peaceful uses of atomic energy, we have a reserve estimate of 230 million barrels. For the rest of the Eastern Hemisphere we have a relatively small figure by comparison; but still, the Eastern Hemisphere reserves seem to be of the order of magnitude of 250 billion barrels.

When those figures are taken by themselves, there is an inclination to feel that the reserves of the United States are quite small and that the rest of the world has most of the oil. But they should not be taken by themselves, because, after all, oil is used in relation to people, and we should also look at population.

The second bar in each case on this chart represents the population. The figures are for two years ago, for the sake of making the United States population comparable with what we have for the rest of the world. There the United States population is shown as 164 million. Now it is over 170 million. For the other Western Hemisphere nations it is 213 million, and the Eastern Hemisphere population is 1.584 billion.

You can see here that on a per capita basis our proven reserves of petroleum in the United States are larger than they are in the rest of the world. We know very well that the consumption of energy per capita in the rest of the world must increase if it expects to improve its standard of living and, as it increases, then of course it is going to require supplies of oil from these reserves that we see here in foreign areas.

Chart 9

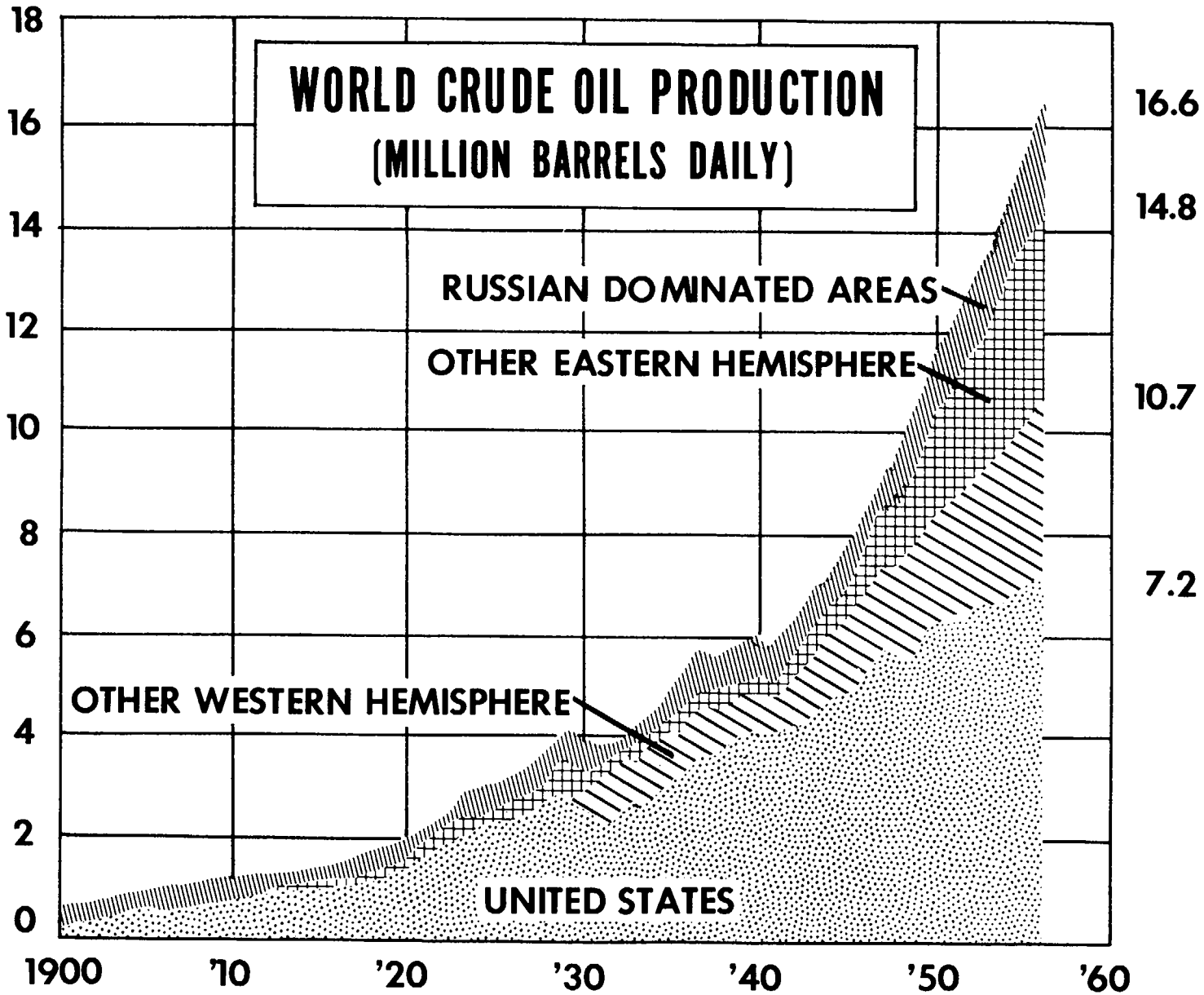

WORLD CRUDE OIL PRODUCTION
(MILLION BARRELS DAILY)
RUSSIAN DOMINATED AREAS
OTHER EASTERN HEMISPHERE
OTHER WESTERN HEMISPHERE
UNITED STATES
18
16
14
12
10
8
6
4
2
0
1900
'10
'20
'30
'40
'50
'60
16.6
14.8
10.7
7.2

Chart 10

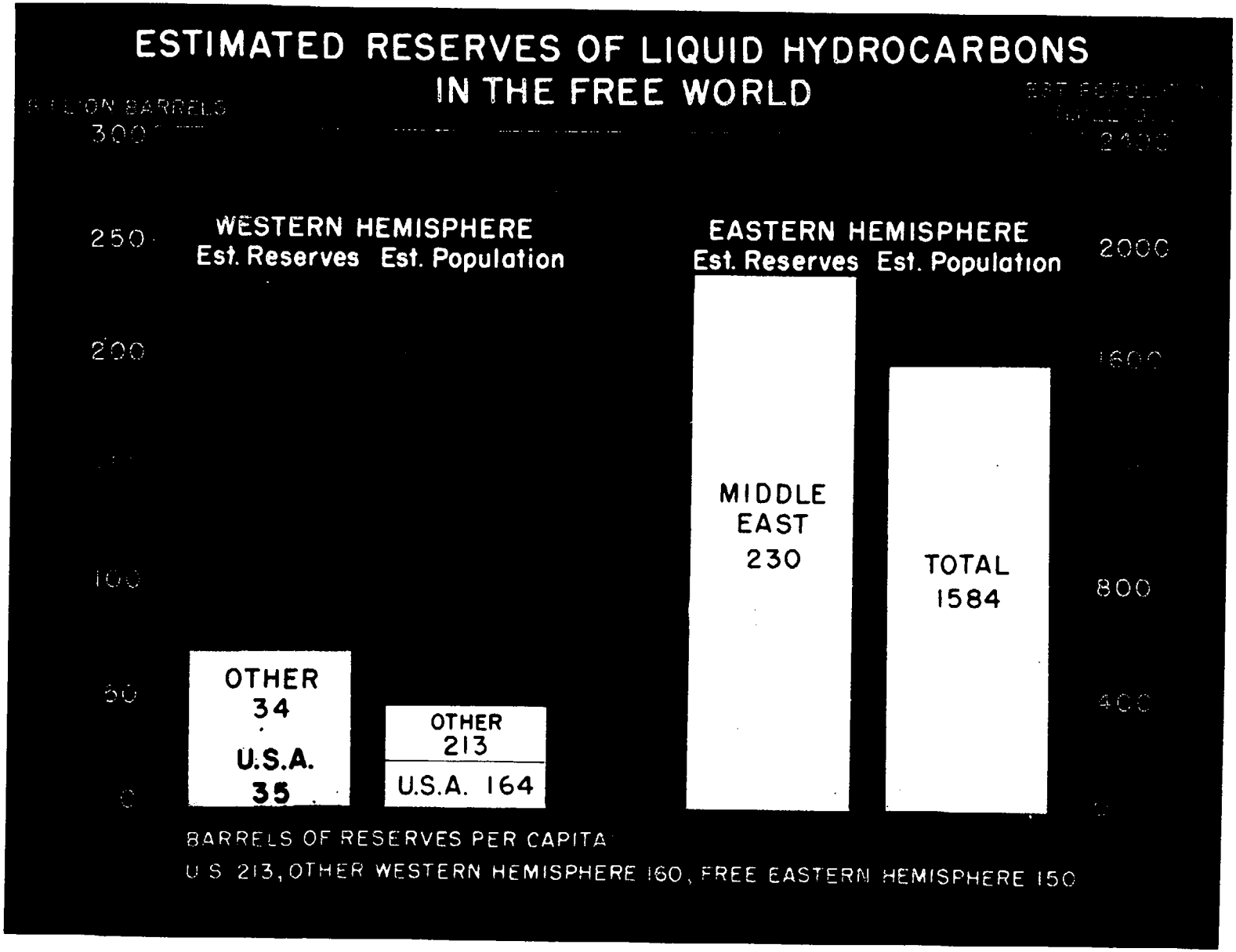

ESTIMATED RESERVES OF LIQUID HYDROCARBONS
IN THE FREE WORLD
BILLION BARRELS
300
250
200
100
50
0
2400
2000
1600
800
400
WESTERN HEMISPHERE
Est. Reserves Est. Population
EASTERN HEMISPHERE
Est. Reserves Est. Population
OTHER
34
U.S.A.
35
OTHER
213
U.S.A. 164
MIDDLE
EAST
230
TOTAL
1584
BARRELS OF RESERVES PER CAPITA
U S 213, OTHER WESTERN HEMISPHERE 160, FREE EASTERN HEMISPHERE 150

Chart 11, page 21.--We have to consider, of course, the consumption of petroleum in the free world. This chart shows us the fact that the United States is a very important consumer of petroleum products. Again we have related consumption to population in the United States, the other Western Hemisphere, and the Eastern Hemisphere. Of course we find immediately that our consumption per capita is very high in the United States by comparison with the rest of the world. We use almost 20 barrels per capita per year as against a figure in the free Eastern Hemisphere of one barrel per capita per year--about 20 times as much oil consumption in the United States per capita as in the Eastern Hemisphere.

Clearly the consumption of oil per capita in these other areas will increase and that will create a tremendous demand for petroleum in the rest of the world. The rate of increase in consumption for petroleum is much higher in the rest of the world than in the United States at the present time.

Chart 12, page 22.--We turn now to a consideration of the international movement of oil. This is a subject that may be of particular interest in case of any war or emergency. Our first chart in this section deals with the major tanker routes, and shows the length of the movement from the major producing areas to the major consuming areas.

We will take, by way of illustration, the movement from the Middle East, particularly from Kuwait, to the various principal consuming points in the world. Kuwait to London, via the Suez Canal is 6,500 miles, but, if you have to go around the Cape, that distance becomes 11,000 miles--almost half way around the world. The distance from Kuwait to Los Angeles is 11,500 miles--all across the Indian Ocean and the Pacific to the west coast of the United States. The distance from Kuwait to Houston is almost 10,000 miles.

If we look at the distance from Venezuela, for example, the Caribbean, to New York or to London, we can see the difference in length of haul as against the movement from the Middle East. To New York from Aruba in the Caribbean is about 1,800 miles, a slightly shorter haul than we have from Houston to New York. To London, the distance from Aruba is 4,300 miles. From Houston it is 5,100 miles.

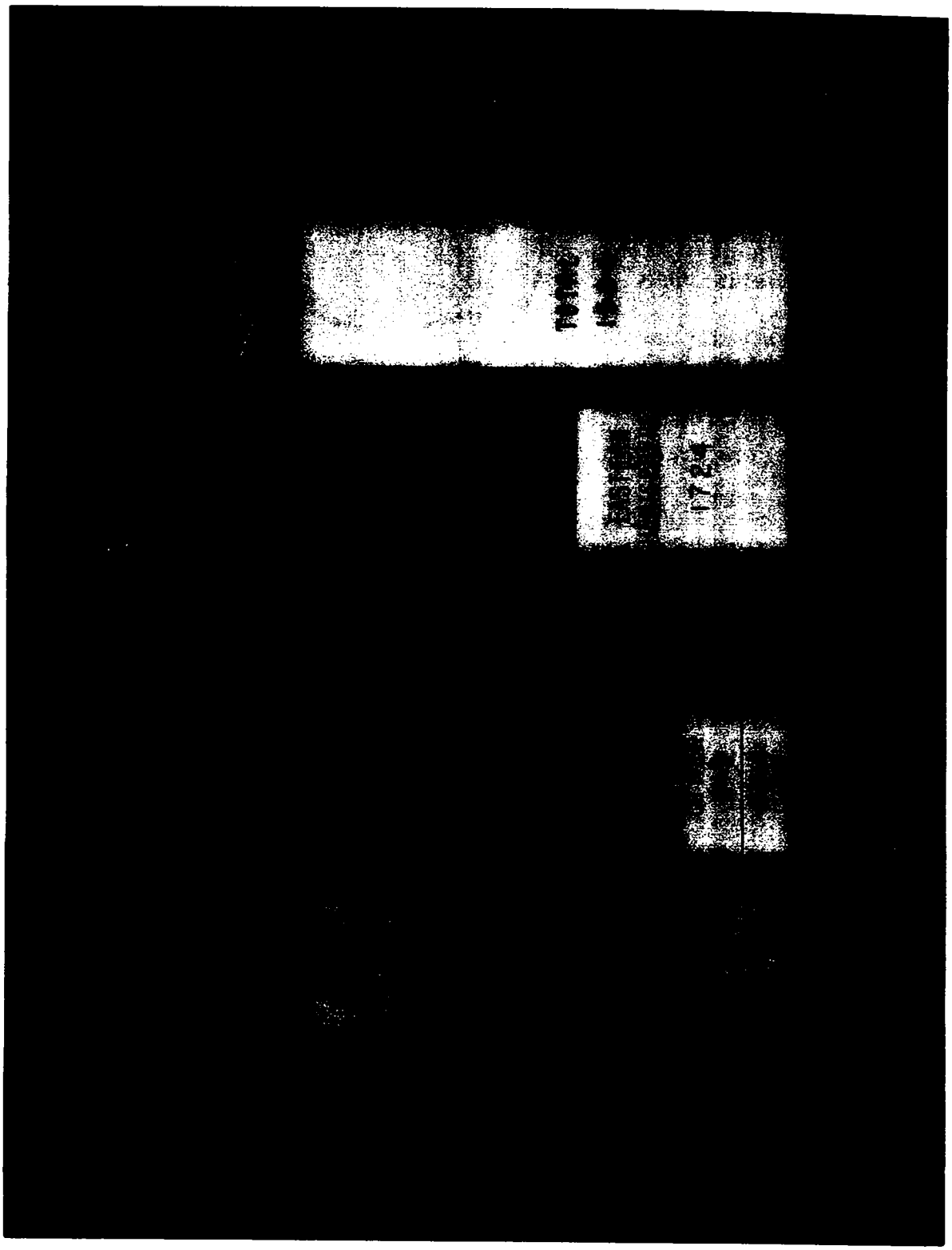
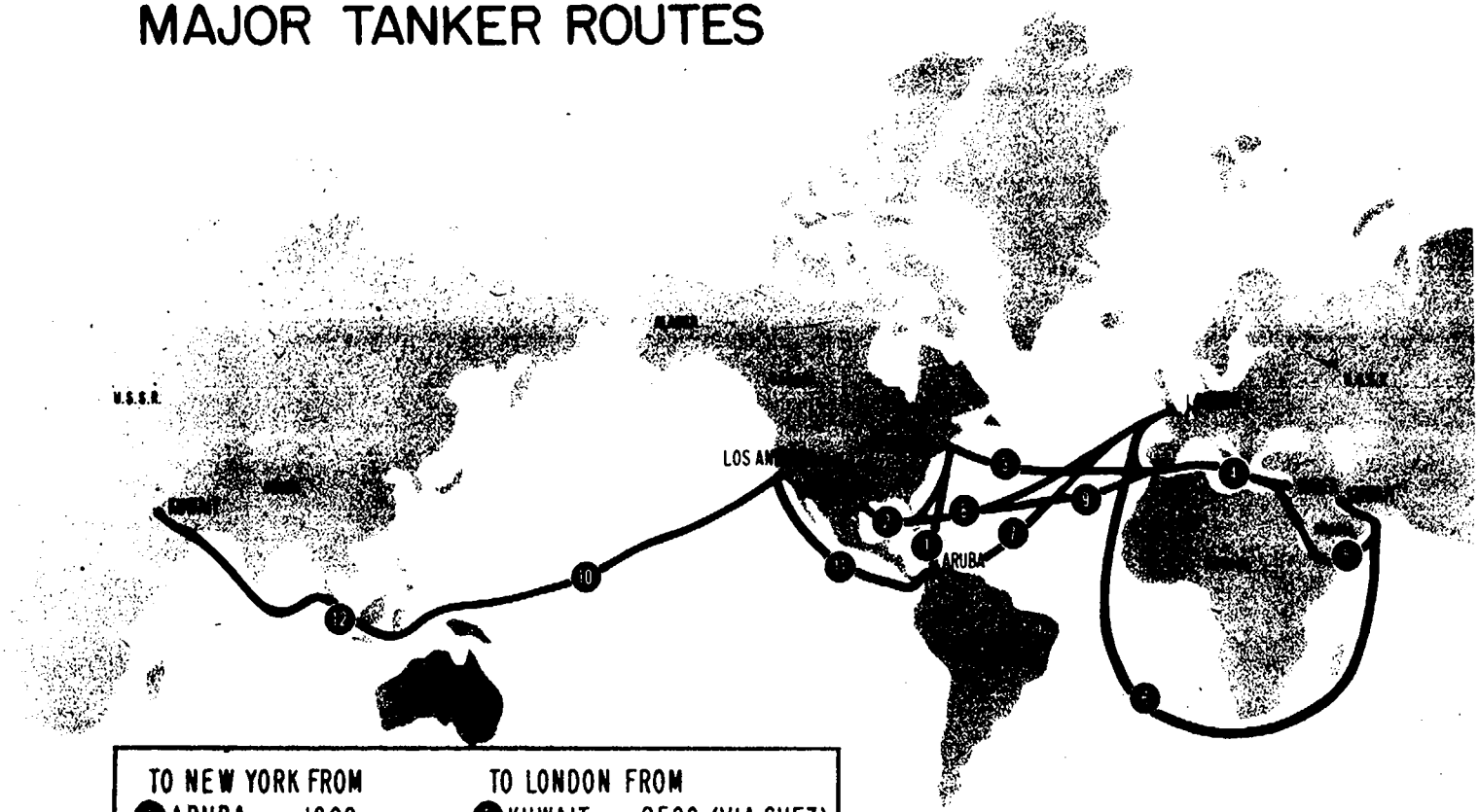


Chart 11

Chart 12

MAJOR TANKER ROUTES



TO NEW YORK FROM		TO LONDON FROM	
ARUBA	- 1800	KUWAIT	- 6500 (VIA SUEZ)
HOUSTON.	- 1900	KUWAIT	- 11,000 (VIA CAPE)
HAIFA	- 5100	ARUBA	- 4300
KUWAIT	- 8600	HOUSTON	- 5100

- TO HOUSTON FROM KUWAIT - 9900
- TO LOS ANGELES FROM KUWAIT - 11,500
- TO LOS ANGELES FROM ARUBA - 3585
- TO LOS ANGELES FROM SUMATRA - 7810

You can see from these comparisons that the length of a haul from Aruba and one from Houston to London is less than half of what it is from Kuwait, if you have to go around the Cape of Good Hope. This has a material bearing on the flow of oil as we experienced when the Suez Canal was closed last year about this time.

Chart 13, page 24.--On this chart we see the movement of oil affecting Europe and North and West Africa, immediately before the Suez, when the flow of oil through Suez and the Mediterranean was approximately 2.5 million barrels daily. Some 325,000 barrels daily of that was coming over to the Western Hemisphere, the United States, and Canada. The majority of it was moving to Europe and Africa.

Chart 14, page 25.--As soon as the Suez Canal was closed, we had a tremendous change in the movement of oil. You will recall that the pipelines through Syria were bombed and cut off, and that the only overland movement was through the Trans-Arabian pipeline, which was capable of moving about 315,000 barrels daily to the east Mediterranean. The rest of the oil moving then from the Middle East had to come around the Cape of Good Hope, and that volume, because of the longer haul, changed to approximately 1 million barrels daily.

You can see that Europe would have been faced with a terrific shortage, equivalent to about 50 percent of its normal supplies, if it had not been for the ability to deliver oil from other sources. Fortunately, it was possible to deliver additional oil from both the United States and the Caribbean area. The net flow of oil was changed, so that the Western Hemisphere was able to provide an additional million barrels daily of oil for Europe, and thereby provide Europe with almost its normal quota of oil; so that it was able to continue its industrial and civilian activities with very little disruption.

The experience of the closing of the Suez Canal emphasized the risks inherent in the use of foreign oil. England became extremely interested in accelerating its development of nuclear energy. France became extremely interested in the development of resources in the Sahara, in Algeria, with the hope that it could have a source west of Suez, from which it could move oil directly across the Mediterranean into its own ports.

Chart 13

OIL MOVEMENTS AFFECTING EUROPE-NORTH AND WEST AFRICA PRE-SUEZ

Thousands of Barrels Daily

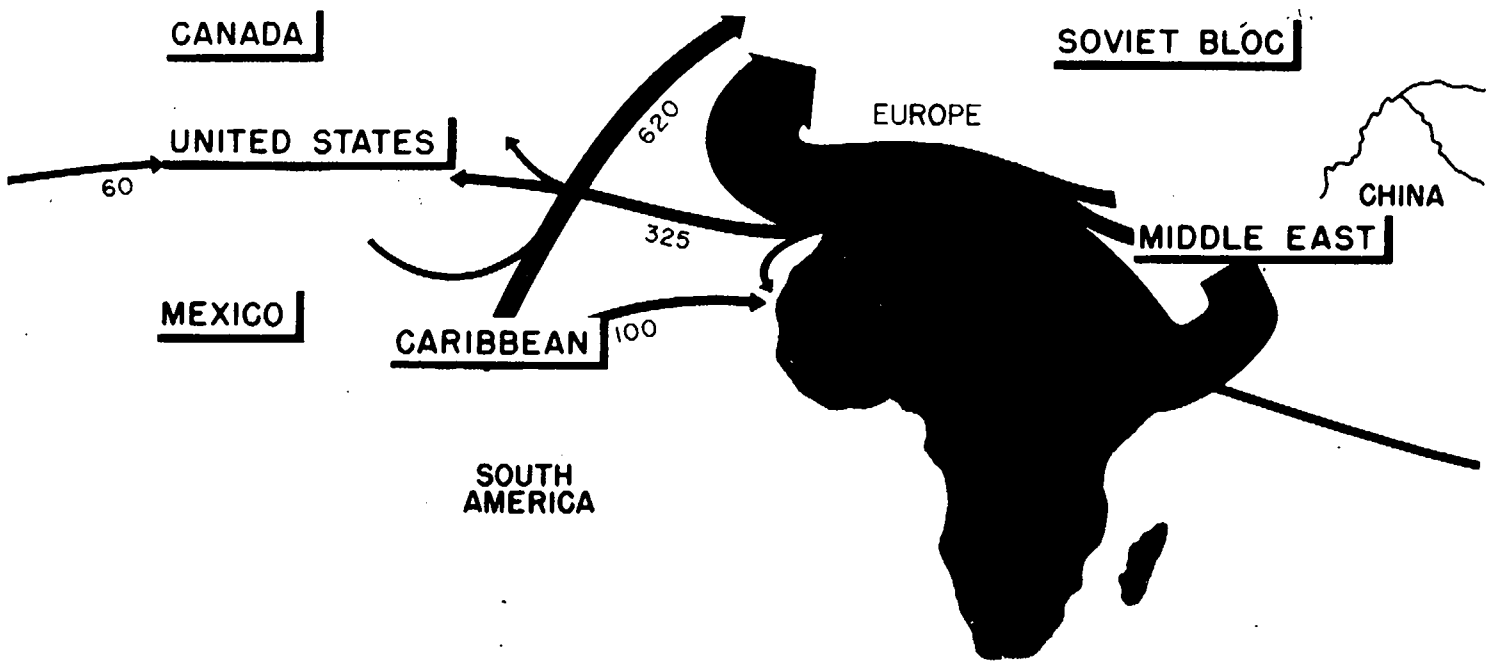
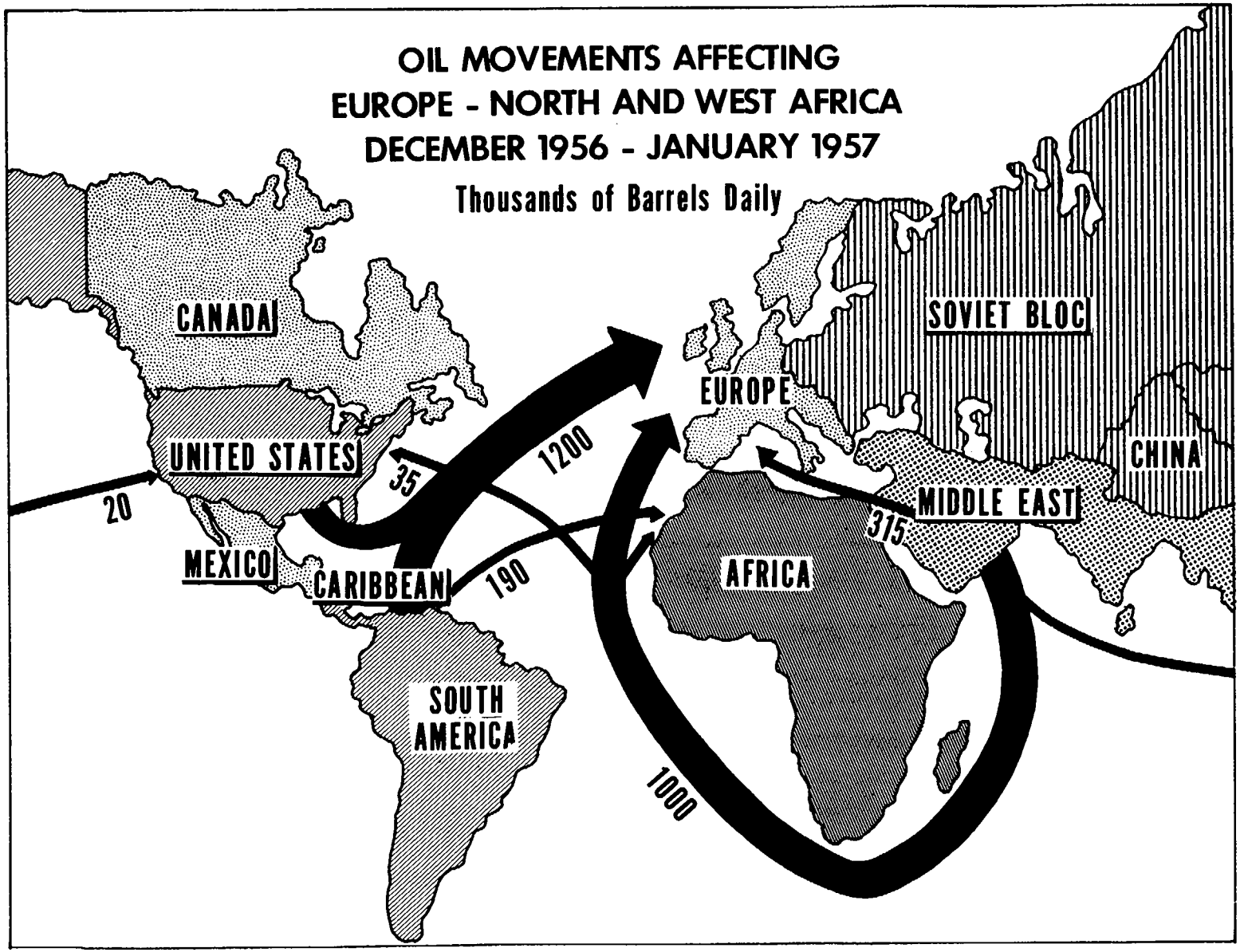


Chart 14


OIL MOVEMENTS AFFECTING
EUROPE - NORTH AND WEST AFRICA
DECEMBER 1956 - JANUARY 1957
Thousands of Barrels Daily
CANADA
UNITED STATES
MEXICO
CARIBBEAN
SOUTH AMERICA
EUROPE
SOVIET BLOC
CHINA
MIDDLE EAST
AFRICA
20
35
1200
190
315
1000

The international oil companies immediately began to talk about a large pipeline through Turkey, which might not be subject to disruption by Syrian activities in case of emergency. The construction of large supertankers was accelerated, so that these supertankers might be able to bypass the Suez Canal completely and go around the Cape of Good Hope economically.

All of these developments show the consciousness of the risks inherent in a high degree of dependence on foreign oil from a relatively concentrated source and with a long, exposed transportation route.

This disruption that we saw on the slides occurred without a full-scale war, and of course the disruptions might have been much more serious in case of war and in case of submarine attacks on shipping. They demonstrated the security risks that are involved when we depend on sources that might be cut off by various types of developments.

In the United States our Government turned increasing attention to the question of the relation of imports to domestic production. The President appointed a special Cabinet Committee to look into this subject, and in July of this year the Cabinet Committee came up with some recommendations with respect to the relation of imports to domestic production and demand that should prevail for reasons of national security. The Cabinet Committee investigated the idea that we ought to use foreign oil now while it is available in order to conserve our own resources. It dismissed this idea as impractical, because the development of our own resources depends on the incentive to carry on exploration and drilling by means of production. In other words, the undiscovered, unknown resources lying underneath the surface of this country are of no value to us. The only way our petroleum resources can be of value is to maintain an incentive for the industry to carry forward a vigorous program of exploration and development.

The Cabinet Committee noted that you could not expect to let this exploration and drilling activity decline sharply and then hope to bring it back in case of an emergency by means of a crash program, because it takes too long to carry out your process of exploration and development. It also considered the interest of consumers, and observed that they are interested in the availability, and assured

availability, as well as in the price, and that, from this standpoint, we had to take into account the possibility that in an emergency consumers might not only have to pay a great deal more for oil but might find it completely unavailable if we become too dependent on foreign oil.

It decided that a relationship of imports to domestic production in the area exclusive of the west coast of about 12 percent was appropriate. This is slightly less than 10 percent of the domestic demand in the area. It decided that, for the time being, the proposed plan of limiting the imports would not apply to the west coast, because the west coast at this time does not have the capacity to produce locally all of its requirements, nor does it have the overland transportation facilities to deliver oil from the rest of the United States to the west coast. It decided on certain suggested amounts of imports by company.

There has been a good deal of difference of opinion in the industry as to whether the suggested amounts are equitable among the different companies. There is, of course, in all of these matters room for differences of opinion. They are very complex subjects, and I am sure the Cabinet Committee did not find it easy to come to its conclusions with respect to the amounts of oil to be imported by different companies.

Nevertheless, there seems to be a general agreement within the industry that some form of limitation of imports is essential for reasons of national security. The level that the Cabinet Committee has decided upon is perhaps as reasonable a solution of the problem as any that the industry could think of at the time. There are, of course, circumstances that may make individual companies feel that they have been discriminated against and that they should have a larger share of the total imports. The Government has held hearings on this, and will no doubt continue to be faced with the problem of dealing with this question.

In your discussions later on I am sure there will be a great deal of analysis of this problem. On the whole, however, I think we must go along with the findings of the Cabinet Committee that we have about reached the limit of how much imports we can bring into this country without affecting our national security. This does not mean that foreign oil is not important to us, because we would hope that it will be helpful to our allies, that it will be used principally in foreign areas, and that it will be available to us in time of war or in time of emergency.

Surely, if we ever have another grave emergency, we would hope to be able to fight away from the shores of the United States, and we would find it extremely valuable to have alternative sources of oil throughout the world. It would be highly advantageous. Nevertheless, the risks in using foreign oil vary. The Cabinet Committee clearly thinks of the North American oil supplies as being the most secure--the United States and Canada--next the rest of the Western Hemisphere, the South American oil supplies--involving the least risk beyond our own. Finally, the Cabinet Committee thinks that the Eastern Hemisphere supplies involve the gravest risk in terms of bringing them to the United States itself.

There is a serious problem in the increasing use of oil in Europe that we must keep in mind in connection with our defense thinking. In the last war Europe was still primarily dependent on coal for energy and on its own internal sources of energy. But, with the availability of oil from the Middle East, Europe is rapidly going through a transition to where it is increasingly dependent on oil, the transition that the United States was going through 35 years ago. As Europe becomes more dependent on oil delivered to it by long tanker routes, we must be concerned with what happens in any emergency that interferes with Europe's oil supplies. We want them to be our allies in such an emergency, but how can we see that they get enough energy to maintain their economy and to be strong and helpful allies?

This is why the problem of maintaining reserve capacity in the Western Hemisphere seems so important for reasons of national security. Surely, we would have the problem of delivering oil by tanker to Europe from the Western Hemisphere, just as we do from the Eastern Hemisphere. Here again we run into the desirability of developments, such as oil in Algeria, which would give another source of supply and a short tanker route to Europe. All of these developments are extremely desirable in providing us with alternatives.

Perhaps the most important lesson that we can draw from these experiences, such as the closing of the Suez Canal and the changing pattern of movements, is the value of alternative sources, of the flexibility of being able to shift from one place to another.

Foreign oil can make a great contribution to the economic progress and to the security of the world, but it is best for all of us that we always have the alternative of moving from one source to another.

We had the experience a number of years ago, when the Iranian Government nationalized oil, of seeing how a large source of foreign oil supply could be cut off, even without any military action whatever. This could happen again, but it won't happen if there are enough alternative sources, so that any one nation in position to control production realizes that its customers have alternative sources of supply.

As I said earlier, oil will continue to be a fuel of prime importance for at least our lifetime. In all probability the volume of oil requirements will double within 20 years in the world. It is going to take a very intense activity on the part of the petroleum industry to provide all of the facilities that are necessary to deliver oil in these fantastic quantities. I think it is fortunate that we know of the existence of large petroleum resources throughout the world. It is fortunate that we have prospects of developing large additional supplies in the United States in offshore fields and in onshore areas. It is fortunate that we are constantly improving our technology of recovering oil from known fields, because this may be one of the most important sources of reasonably priced oil in the United States.

We need to maintain a balanced situation in the world which will allow the domestic industry in the United States to carry forward a substantial part of the development of resources throughout the world. There are many complex problems. In your discussions later today you will no doubt touch on these. There are no easy, final answers in this difficult situation that we face. We do believe that an understanding of all of the ramifications of petroleum supplies will help us to arrive at the best solution in the national interest. We are encouraged that the Government, through the action of the Cabinet Committee, has recognized the existence of some problems and has started forward on a course which appears to provide a solution that the industry can live with.

We hope that this solution will be one that can be complied with voluntarily by the various companies, because that is the best alternative. Otherwise we are no doubt faced with mandatory regulations that will be even less desirable for all of us than the voluntary ones.

The subject that you have for discussion today is an extremely interesting one. My role is merely to start the discussion off, and I am sure the most interesting part of it will be later on in the day as you meet in smaller groups.

It has been a great pleasure to be with you.

DR. GONZALEZ: I understand that it has been arranged to have a few questions now, if you like, before we go into the discussion groups.

COLONEL DAVIS: Dr. Gonzalez is ready for your questions.

QUESTION: Sir, my question has to do with the impact of atomic energy on the petroleum industry. Looking back about 15 or 25 years, the aircraft industry thought that missiles might not become available as soon as they have or important as soon as they have. Some airplane manufacturers, however, went into the missile business and now I am sure they are very glad. I am wondering to what extent the petroleum industry anticipated the severe impact of atomic energy and has invested in or investigated atomic energy as a resource for the petroleum industry itself.

DR. GONZALEZ: Colonel, there are quite a few of the oil companies that have been engaged in looking for uranium, and some of them have made arrangements to have mining companies develop and process their uranium deposits. Others have even gone into the field of high-energy fuels. I think that the oil industry, with its tremendous research facilities, is keenly aware of the changing nature of the use of energy, and would expect that when other forms of energy become more important quite a few companies that are now in the oil business will be principal suppliers of the other forms of energy.

QUESTION: Doctor, will you explain a little more your statement that one offshore oil well is equivalent to about 10 on shore?

DR. GONZALEZ: An offshore well costs about $400,000 to $500,000. Many of the onshore, shallow wells cost about $50,000. I was really thinking in terms of reserves. You may recall the chart that showed that, if we divide the new oil by wells, we come out with 133,000 barrels, on the average, per well. But the offshore wells are going to have to develop the order of magnitude of 1 million, 1.5 million, or perhaps even 2 million barrels in order to make them economically feasible, because they are so much more expensive.

What we are really interested in is not wells, but barrels and deliverability. Therefore, if we can get as much deliverability from 1 offshore well as from 10 onshore wells, it really doesn't make much difference whether we have shifted our activity from the 10 onshore to the 1 offshore.

QUESTION: Sir, your chart that you showed, showed that the price of oil is slightly above the commodity index. Actually it is considerably higher than you show, when you consider that the oil industry is somewhat subsidized by increased allowances, taxes, and so forth. You must take those into consideration, as they do put the prices a little higher than others. This is in the face of improved technology, where you are getting more out of the oil, cheaper processing methods, and so forth. I heard last night that the price of aviation gas just went up two cents; so the price is going up, and that does have quite an effect on the services.

At the same time, you are limiting imports from abroad. Now, aren't we concerned that if we do not take that oil from abroad the nations there will have to sell to Russia, and so forth? I am wondering why we couldn't use a different approach here, in determining how much oil should come into the United States. I think we have two problems--one of taking the oil that is abroad and one of supporting our own industries here. I am wondering if you couldn't, from the commodity index and the tax concessions, and so forth, find out where oil should be on that index--just say it is 5 percent below--and then let imports come into the Nation until the price stabilizes at that point, and then find out how much should rightfully come in, and let the entire Nation benefit from it.

DR. GONZALEZ: Well, that question could easily carry us on to a discussion that would take quite a few minutes. But let me touch on it briefly, because I should have talked about depletion. I assume that you gentlemen know enough about the nature of this business to realize that it is not like the business of investing money and manufacturing refineries, or anything of that kind. Only about 5 percent of the acreage that we lease and explore ever proves productive, and only one well, one wild cat, out of nine finds a new field. Almost 40 percent of all the wells we drill are dry holes. Because of this peculiar investment process, it is very difficult to measure the capital that is invested in productive wells. Congress realized this a long time ago, early in the application of income tax laws, and since 1918 it has allowed for depletion on petroleum on the basis of the value of the oil discovered, rather than on the basis of the cost, because of the difficulty of trying to ascertain costs.

This principle has been maintained under percentage depletion. A lot of people think that it is a tax advantage, or a tax benefit, or, as

you might describe it, a tax subsidy. But bear in mind that the tax laws are not based on the principle that all income is taxed alike, but only that like income is taxed alike, and that differences in circumstances are taken into account in deciding what is equitable treatment.

If this were not so, we would not have graduated income taxes; we would not have exemptions for number of dependents; or for age; we would not have any distinction between capital gains and ordinary income; we would not have distinction in the method of taxation of insurance companies and banks, and timber, and a host of other industries from the normal manufacturing and trade enterprises. We have these distinctions because, if we didn't, we would not attract enough capital into the businesses that we want to encourage; and certainly oil is one of the businesses in which we do want to attract capital.

Therefore, I don't think we can say that the price of petroleum products is subsidized by the tax laws. I think all the tax laws do is to keep us from having to charge a premium as compared with the prices of other commodities.

Now, as for the second part of your question, as to deciding what the price should be, allowing imports to come in in this amount, and then taking whatever we can develop from the domestic resources: This is certainly one course that can be pursued. If all you are interested in is today's price, then there is no question that the sensible thing to do is to use a lot more foreign oil right now. But I think you are interested in more than today's price. I think you are interested in the availability of supplies, the assured availability of supplies at all times, and you are interested in price over a long period of time.

Nothing could put us in a more vulnerable position with respect to price than to let our domestic industry dwindle down and then find that we have to pay whatever prices the foreign nations who supply us think they can get out of us.

QUESTION: Would you care to comment on the feasibility of the Government stockpiling petroleum from foreign sources, and whether this would be feasible without adversely affecting our own oil industry in the manner you described?

DR. GONZALEZ: I suggested to Colonel Davis that all of you might be interested in reading the Cabinet Committee Report. Those of you who have looked at it will remember that before arriving at its conclusions the Cabinet Committee considered and rejected three proposals:

The first one is, import foreign oil and store it in this country within depleted fields or elsewhere. Their reason for rejecting that: The practical problems of cost and the physical problems connected with the storage of crude oil would make this solution impracticable from the standpoint of industry and Government alike.

STUDENT: I read that, and I didn't agree with it.

DR. GONZALEZ: Well, let's take an example of what we are talking about. The last time we had to step up production we had to supply, for military purposes in World War II, something like 2 million barrels a day for a year's time, you have to have the ability to not only put your hands on the oil but to refine it, transport it, and so forth, for a tremendous quantity of oil. The cost of carrying this on a standby basis, as something separate and apart from your normal operations, is extraordinarily high.

Let me try to express it this way: If you can get your spare capacity by operating your plant at 90 percent, or 80 percent of capacity, there is not a terrific amount of cost involved in having that 10 or 20 percent spare. But, if you have to build 100 percent spare that just doesn't operate, you have a fantastically high cost.

QUESTION: Sir, will you tell us the number of major oil companies in the United States and what percentage, or what number, of those companies have foreign interests?

DR. GONZALEZ: That would depend on your definition of a major oil company. But let us say that, if we choose $100 million in assets as a dividing line, we would have, certainly, 30 companies or so of that size. And we would have perhaps half of those with important foreign operations and very substantial foreign operations. If we take the 5 largest companies, every one of those derives more income from its foreign operations than from its domestic operations.

COLONEL DAVIS: Gentlemen, I know there are lots of points you would like to hear discussed, but we will have to defer further questions until the meetings in the seminar rooms, which meetings start at 10:30.

Dr. Gonzalez, you have given us a very useful lecture, and certainly you have gotten us off to a fast start for the day's consideration. Sir, we thank you very much indeed.

DR. GONZALEZ: Thank you.

(23 May 1958--4, 100)O/en:ljt