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PETROLEUM INVENTORIES IN THE UNITED STATES -- CURRENT LEVELS AN--ETC(U)
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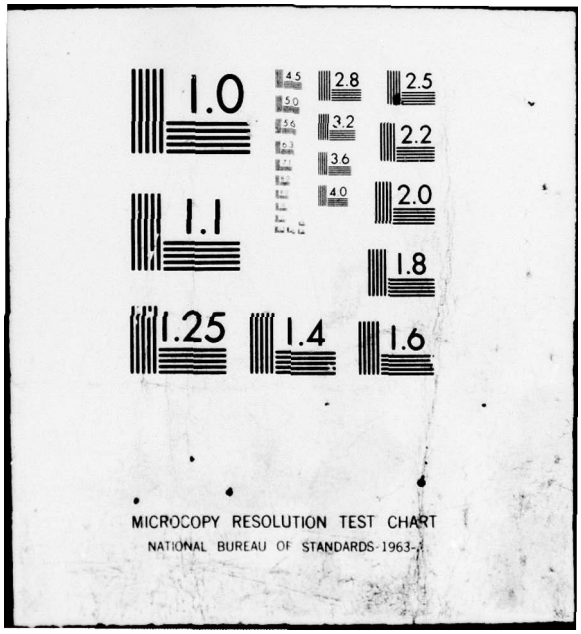
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(6) Research Project: PETROLEUM INVENTORIES IN THE UNITED STATES -- CURRENT LEVELS AND AVAILABILITIES,

BY

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FOR THE U.S. DEPARTMENT OF STATE

(12) 17

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This project was undertaken at the request of the Office of Fuels and Energy in the U.S. Department of State. Its purpose, as stated in your letter of August 20, 1974 is to

--determine the total stocks of crude oil and product maintained by the petroleum industry in the United States under OECD definition of stocks;

--quantify the amount of OECD defined stocks which could be "available" for consumption in an emergency by determining those stocks that are physically unavailable, e.g., in the form of pipeline fill, tank bottoms, etc., and the amount technically "available" but regarded by the petroleum industry as unavailable for drawndown purposes; and,

--calculate the number of days of self-sufficiency represented by "available" stocks based upon the current level of imports.

I. Current U.S. Oil Stocks Adjusted to Conform to OECD Definition

To determine the volume of U.S. oil stocks in terms of the official OECD definition for such stocks, we have used as a basis for our adjustments the Comparison of Reported Petroleum Stocks provided by the Office of Fuels and Energy, as shown on the following page.

Table I

Comparison Of Reported Petroleum Stocks

	AS REPORTED BY			
	US	OECD Europe	EC	Japan
STOCKS INCLUDED:				
Crude Oil, Major Products, and Unfinished Oils held:				
In Refinery Tanks	yes	yes	yes	yes
In Bulk Terminals	yes*	yes	yes	yes
In Pipelines	yes	no	no	no
In Pipeline Tankage	yes	yes	yes	yes
In Barges	yes	yes	yes	yes
In Intercoastal Tankers	yes	yes	yes	yes
In Truck Tank Cars	yes	NA	no	yes
In Oil Tankers in Port	NA	yes	yes	yes
In Seagoing Ships Bunkers	yes	no	no	?
In Inland Ship Bunkers	yes	yes	yes	yes
In Storage Tank Bottoms	yes	yes	yes	yes
In Working Stocks**	yes	yes	yes	yes
STOCKS EXCLUDED:				
Crude Oil, Major Products, and Unfinished Oils held:				
In Service Stations & Retail Stores	yes	yes	yes	yes
By Large Consumers as Required by Law	yes	no	no	no
By Other Consumers	yes	yes	yes	yes
In Tankers at Sea	yes	yes	yes	yes
Military Stocks	yes	yes	yes	yes
Crude Oil Not Yet Produced	yes	yes	yes	yes

* Above 50,000 bbl capacity.
** Minimum quantities for continuous processing, blending, handling, and distribution of crude and products.

In comparing U.S. stock definitions with the OECD and other foreign definitions shown in the Table, the following comments should be kept in mind.

1. Unfinished oil - Stocks of this product are included in the OECD definition. In the U.S. these stocks are reported in the Bureau of Mines' Monthly Petroleum Report and in the Weekly API Statistical Bulletin. They are not included in the FEA's Weekly Petroleum Statistics Report nor in the periodic NPC reports entitled "Petroleum Storage Capacity", despite their large volume.

The reason for the differential treatment of unfinished oil stocks in these reports is that they are functionally different from both crude oil and refined products stocks. Unfinished oils consist mainly of naphtha, gas oil and other feedstock for catalytic cracking and reforming, hydrocracking and other "downstream" units at refineries designed to maximize the output of gasoline and other light products. In effect, they are "Working Stocks" at refineries required for processing and blending. Hence, they would seem to belong in the OECD-defined U.S. stock figures.

However, their magnitude and role is quite different in the U.S. than in most other OECD countries. While no European figures of unfinished oil stocks are available, they may be presumed to be small, relative to crude oil and major products stocks. In the U.S., on the other hand, unfinished oil stocks are very large. At the end of August they amounted to 115 million barrels, equal to 43% of

total U.S. crude oil stocks. The reason for the difference is that U.S. refineries are highly equipped with downstream units requiring unfinished oils as feedstock, whereas, in Europe such units are relatively insignificant. Thus, while in the U.S. catalytic cracking and hydrocracking capacity is equal to 44% of crude oil refining capacity, in Europe the comparable figure is less than 7%.

Since these stocks are really part of a continuous processing operation, i.e. they are the output of one refinery unit and the input of another, they generally do not exceed the volumes needed to keep the various units running smoothly. Hence, these stocks could not be significantly drawn down in any emergency. It may, therefore, be argued that they should not be included in the stock concept under consideration by the ECG. Prior to 1962, when unfinished oil stocks were included in the periodic reports of the NPC's Committee on storage capacity, they were classified as "unavailable". A policy decision on this matter may be desirable since the magnitude of these stocks is such that their exclusion or inclusion substantially affects total U.S. oil stock levels. In this report we show U.S. stocks exclusive of unfinished oils but the effect of including them is discussed in the text, following Table II.

2. Oil in Pipelines

This item accounts for the principal difference, by far, between U.S. and OECD stock definitions for crude oil and light products. (It is not applicable to residual fuel oil which is generally not transported by pipeline). "Oil in pipelines" is similar to the

category "Pipeline Fill" in the NPC Report on Storage Capacity. We have eliminated this category from the U.S. stock data for the purpose of comparability.

3. Oil in Rail Tank Cars and Trunk Tank Cars

These are included in the U.S. stock figures but apparently not in the OECD figures. Available U.S. data lump these stocks together with stocks in other domestic transit such as barges and tankers. They cannot be readily separated. However, the volumes are likely to be small. Total stocks in transit (other than pipelines) reported to the NPC on September 30, 1973 ranged from 1.3% to 1.5% respectively of total gross clean products, residual fuel oil and crude oil stocks reported. Since the bulk of these in-transit stocks is transported by barge and tanker, the rail and tank car stocks included in the total can be no more than a small fraction of 1% of total gross stocks. In Europe this type of stock probably holds a substantially larger share of the total, since rail and road transportation of oil products from refineries to bulk terminals is more frequent there.

4. Oil Tankers in Port

All domestic shipments of oil by tanker are included in the Bureau of Mines' gross U.S. stock figures, both while the oil is in transit and after it has arrived. Shipments from foreign sources are included in U.S. stock figures only after the oil has cleared customs. However, since this is generally done before the tanker arrives in port, most foreign oil in tankers in port is included in the U.S. stock data. Hence, no adjustment would seem to be required for this category.

5. Seagoing Ship Bunkers

According to available information, bunkers are not included in U.S. stock data. There would, therefore, appear to be no conflict in this regard between U.S. and OECD stock definitions.

6. Stocks held by Large Consumers

The only published U.S. statistics on such stocks are for electric utilities which report monthly to the Federal Power Commission. Since about 90% of the oil used by U.S. utilities consists of residual fuel oil and the balance of distillate fuel oil and kerosene, we apportioned utility stocks accordingly between residual fuel oil and light products.

Calculation of Current Stock Levels

The basis of our calculation is the stocks for PAD I-V (the U.S. exclusively of Puerto Rico and the Virgin Islands) as of August 30, 1974, as reported in the FEA's Weekly Petroleum Statistics Report. These stocks differ from the API stocks in that they exclude oil producers' crude oil stocks on leases which are considered unavailable, but include oil stocks held by bulk terminal operators. This last category is probably more comprehensive in other OECD countries than in the U.S. where it includes only the large independent deepwater cargo operators on the East and Gulf Coasts most of whose stocks consist of distillate and residual fuel oil.

Ratio of Stocks to Oil Imports

Table II

U.S. Crude Oil And Products Stocks - 8/30/74
(million barrels)

	U.S. Base (1)	Net Adjustment (2)	OECD Base (3)	Current Daily Imports (4)	Daily Import Equivalents Col. (3) ÷ Col. (4)
Crude	248	-57	191	4.0	48
Light Products	493	-33	460	0.5	920
Subtotal	741	-90	651	4.5	145
Residual Fuel Oil	82	+91	173	1.6	108
Total	823	+ 1	824	6.1	135

Comments on Table II

Column (1): The figures are from the FEA's Weekly Statistics Report. The light products include motor and aviation gasoline, kerosene, distillate fuel oil and jet fuels. Residual fuel oil includes No. 4 oil.

Column (2): The adjustments to put the stocks in Column (1) on an OECD base include a deduction of 57 million barrels and 45 million barrels respectively for crude oil and light products pipeline fill, as shown in the latest NPC Report on Storage Capacity, and an addition of stocks held by utilities of 12 million barrels of light products and 91 million barrels of residual fuel oil, as reported to the FPC.

Column (3) is self explanatory

Column (4): Import figures are the 4-week average reported in

the API Weekly Statistical Bulletin of September 6, 1974, except for the residual fuel oil figure which has been adjusted to eliminate estimated imports from the Virgin Islands. The crude oil imports include plant condensate and unfinished oils both of which are relatively small. The residual fuel oil figures include imports of No. 4 oil.

Last Column: The figures in this column indicate the number of days of imports represented by the OECD-base stocks. The relationship is purely mathematical and does not mean that stocks could actually be drawn down by that many days if all imports ceased. As will be discussed below, the actual number of days that stocks could be drawn down in such a situation is considered by industry experts to be only a fraction of the figures shown in this column.

The inclusion of Unfinished Oil Stocks in the Stock/Import Ratio

Unfinished oil stocks are not reported by the FEA. According to the API Weekly Statistical Bulletin they amounted to 114.8 million barrels on August 30, 1974. Since unfinished oils are not transported by pipeline, they are not subject to any OECD adjustment. Hence, these stocks would have to be added in their entirety to the OECD-adjusted crude and light products total of 651 million barrels, shown in Table II. This would increase these stocks to 766 million barrels. There would be no change in the daily volume of imports. Thus, the stocks would represent 173 days of crude and light products imports instead of the 145 days shown in Table II. The question of

whether or not unfinished oil stocks should be included in the total is discussed earlier in this report.

II. "Available" and Minimum Stocks

The stocks shown in Column (3) of Table II are roughly comparable with those reported by the foreign countries which adhere to the OECD definition. Their ratio of stocks to days of consumption is figured in the same manner, except that their divisor is the figure for consumption while ours is that for imports. Since most OECD countries import the bulk of their petroleum requirements, the difference between consumption and net imports is not large for them. For the U.S., on the other hand, which imports less than 40% of its total oil requirements, the difference is considerable. However, neither the published OECD figures for days of consumption in foreign countries represented by imports nor the figures in the last column of Table I give the true level of stocks available in case of a total cessation of imports, if consumption is to be maintained at a pre-crisis level.

U.S. estimates of "available" inventories, that is, the stocks not required to remain in storage, processing and transportation facilities to maintain normal industry operations, and the "Minimum Operating Level" of stocks, that is, the stock level below which shortages begin to appear at normal levels of consumption, have been worked out by the NPC's Committee on Petroleum Storage Capacity whose latest report was issued on September 10, 1974. The two concepts are

not synonymous. "Available" stocks are considerably larger than Minimum Operating Levels, since the NPC Committee believes that only part of "available" stocks can be drawn down without causing supply interruptions. Thus, the true measure of useable excess stocks at any given time is the difference between Minimum Operating Levels and actual stocks on hand. Discussions with members of the NPC Committee indicate that the Minimum Operating Levels estimated for September 30, 1973 are probably still applicable for the current period. We have, therefore, used these levels as a basis for our calculations.

As the Committee's Report points out, its estimate of Minimum Operating Levels is "somewhat judgmental". In the case of crude oil, the estimate was almost exactly the same as the actual inventory reported by the Bureau of Mines for September 30, 1973. In other words, the industry was assumed to have reached its minimum stock level at that time. However, U.S. refineries operated at an average of 96.5% of capacity in late September and early October of last year, which is several percentage points above normal operating levels, while September-October demand was up 5.5% over the previous year. Since there were no reports of consumer shortages, except in a very few special cases, it would seem that actual crude oil stocks were at least slightly above the real Minimum Operating Level. We have, therefore, reduced the minimum crude oil operating stock level by 3.5% or 8 million barrels from the 227 million barrels figure

(exclusive of lease stocks) estimated by the NPC Committee. For refined products we have accepted the NPC estimates. The following table shows current excess inventories.

Table III

Actual Current Stocks And Estimated Minimum Operating Levels
(000 bbls)

	Actual Primary Stocks (8/30/74)	Minimum Operating Levels	Excess Stocks	Current Daily Import Equivalents*
Crude	248	219	29	7
Light Products	493	469	24	48
Subtotal	741	688	53	12
Residual Fuel Oil	82	50	32	20
Total	823	738	85	14

*Computed by dividing Current Daily Imports -- Column (4) in Table II -- into Excess Stocks.

As can be seen, the Daily Import Equivalents in the above table are only about one tenth of those shown in Table II. For instance, U.S. refinery runs would have to be curtailed to some extent within 7 days after the cessation of all crude oil imports, compared to the 48 day figure shown in Table II.

It should be pointed out that oil operations could of course not come to a halt after the excess stocks shown in Table II have been exhausted. However, some shortages would begin to appear at this point. These shortages are likely to be relatively mild at first but would get progressively worse until all the "available" stocks are used up at which time industry operations at refineries, pipelines and terminals

would come to a complete stop.

The amount by which primary stocks can be drawn down below Minimum Operating Levels is shown in Table IV. The "unavailable stocks" in the table consist of pipeline fill, tank bottoms, oil in refinery lines, domestic cargo in transit, etc. They are physically inaccessible at all times. The "available" stocks are all physically accessible but only the Excess Stocks, computed in Table III, can be readily drawn down without impairing industry operations. The Operating Stocks, though physically available, can only be drawn down at the cost of progressive shortages, leading eventually to the cessation of operations.

No published breakdown exists for the "available" and "unavailable" share of stocks in Europe or Japan. Nor are there published estimates for Minimum Operating Levels in these countries. Such figures would undoubtedly show a substantial difference between total reported OECD-base stocks and useable excess stocks.

Table IV

"Available" And "Unavailable"
U.S. Oil Stocks
(million bbls)

	Total Reported (8/30/74)	"Unavailable" Pipeline Fill	Other	Total "Available"	of which: Excess Stocks	of which: Operating Stocks
Crude	248	57	116	75	29	46
Light Products	493	45	94	354	24	330
Subtotal	741	102	210	429	53	376
Residual Fuel Oil	82	-	15	67	32	35
Total	823	102	225	496	85	411

Note: Excess Stocks can be drawn down fully without affecting industry operability.
Operating Stocks cannot be drawn down without causing progressive reduction in industry operability.

It is extremely difficult to convert Operating Stocks to current daily import equivalents, since this assumes normal consumption levels which, however, could not be maintained once this source of stocks is tapped.

The shortages would probably increase at an accelerating rate, that is, while a 100% draw-down of Operating Stocks would lead to a 100% cessation of operations, a 10% draw-down may only cause a 5% shortage, according to some tentative indications. It can therefore be speculated that a draw-down of Operating Stocks of up to 10% may not cause widespread shortages. Such a draw-down would add approximately the following Daily Import Equivalents to those shown in Table III:

Crude Oil	1
Light Products	66
Subtotal	8
Residual Fuel Oil	2
Total	7 Days of Import Equivalents

Thus, the utilization of all current Excess Stocks plus 10% of Current Operating Stocks might permit the substitution of 21 days (14 + 7) of total oil imports without creating major supply constraints.

Residual Fuel Oil Stocks

The residual fuel oil stocks shown in Tables III and IV exclude the secondary stocks held by utilities, since the NPC does not consider them in its analysis of "available" and "unavailable" stocks and Minimum Operating Levels. These utility stocks are currently (7/1/74) exceptionally large, averaging 74 days of national utility consumption

of this product, compared to 42 days a year ago. However, they are very unevenly distributed throughout the country, ranging from the equivalent of 15-25 days of utility oil consumption in some states to 250-300 days in others. On the East Coast, where virtually all residual fuel oil imports are consumed, the current average utility inventory of residual fuel oil is equivalent to only 32 days of consumption. Thus, while it may be possible to shift these stocks to some extent between East Coast utilities, it is unlikely that other East Coast customers will have access to them in an emergency or that East Coast utilities as a group will be able to curtail their import requirements significantly for more than a brief period without a reduction in electric power generation.*

III. Emergency Increases In Available Domestic Fuel Supplies

a) Crude oil

U.S. crude oil production is currently at the permissible Maximum Efficient Rate (MER), except in a few fields where state agencies have specifically set lower rates for reasons of protecting reservoir pressure and preventing gas flaring. Hence, the industry cannot commercially increase production in the short term (90 days or less) during an emergency. All emergency production increases would require prior special permission of state agencies or the assumption of federal jurisdiction over the establishment of state oil production levels. During the 1973/74 oil embargo neither of these actions were taken, despite some urgings from the industry and federal government agencies.

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*According to an estimate published by the FEA, an inadequate utility inventory level exists if "residual oil stocks are reduced to 15 days (or less) of normal burn days for residual oil and a continued downward trend in stocks is expected."

If MER restrictions were to be lifted in all fields currently operating below MER, the additional deliverable production would initially amount to 275,000 b/d and would rise to 359,000 b/d within about 90 days, according to NPC studies. These Studies estimate the average additional production rate during the 90-day period at 292,000 b/d.

The NPC's additional production estimate includes 23,000 b/d deliverable within 60 days after the start of emergency production from the Elk Hills field (Navel Petroleum Reserve No. 1) in California. However, according to a U.S. Navy estimate, a crash program could increase deliverable production from Elk Hills by 155,000 b/d within 60 days. It should be noted that any increase in Elk Hills production from its current 5,000 b/d level would require prior Congressional approval.

Thus, under the most optimistic assumptions and conditions, deliverable U.S. crude oil production could be raised by about 500,000 b/d within approximately 90 days from the granting of permission for emergency production. This would be equal to 25% of total current crude oil imports.

Coal Conversion

Under existing air pollution regulations, the maximum volume of imported residual fuel oil which could be displaced by coal within a 60-90 day period would be about 100,000 b/d or about 6% of total

residual fuel oil imports. All of the displacement would be limited to electric utilities located in PAD I.

Caribbean Residual Stocks

Any analysis of U.S. residual fuel oil stocks should take into account the existence of such stocks in the Caribbean. Refineries in this area supply primarily the U.S. East Coast. Their stocks can therefore be considered a supplement to U. S. East Coast stocks. Currently, total Caribbean residual fuel oil stocks may be estimated at 55-75 million barrels. To what extent these stocks could be drawn down in an emergency affecting the U.S. is of course an open question. But they are physically available for this purpose.