Oregon Department of Energy

OIL SHORTAGES

Report to Governor Atiyeh

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GASOLINE SUPPLY AND DEMAND

Forecast Summary

May 16, 1979

The Oregon Department of Energy's short-term gasoline supply and demand forecast includes these highlights:

If Oregonians and our out-of-state visitors do not conserve and reduce demand, reductions in supply, coupled with demand growth, will result in May and July shortages from 8 to 12 percent of projected demand, 7 to 10 percent in June and August and 2 to 6 percent in September.

For comparison, Oregons 1973-74 shortage was about 6 percent, but the shortage occurred during the winter when demand for gasoline is at a seasonal ebb and is related more to day-to-day needs. Because summer involves more discretionary driving, summer gasoline demand is higher than in winter. Thus, gasoline will be available for Oregon's basic needs.

Since 1974, total annual gasoline consumption in Oregon has increased by 24 percent to about 1.4 billion gallons in 1978.

The Department's study shows that gasoline usage, on a per capita basis, has increased by more than 3 percent annually since 1974. At the same time, the state's population growth has been about 2 percent annually.

The operating efficiency of passenger cars' has increased about 9 percent from 1974 to 1978.

In preparing the forecast, the Department made these assumptions on gasoline demand in Oregon:

-Population will increase by 2.6 percent in 1979 over 1978.
-The operating efficiency of passenger cars increased 2.7 percent in 1978 and will increase by 3.2 percent in 1979.
-The average monthly price of regular gasoline will increase by 1 cent per month through September and will remain at 80 cents per gallon through the remainder of 1979.
-The rate of increase in per capita real income in 1979 will range from 0 to 2 percent.
-General inflation will be 10 percent for 1979.

The Department's forecast indicates that gasoline consumption will increase by more than 2.6 percent for each 1 percent increase in population growth. Similarly, gasoline consumption will increase by 1 percent for each 1 percent increase in per capita income.

On the other hand, consumption will decrease by three-tenths of 1 percent with each 1 percent increase in real gasoline prices.

The Department's supply projection is based on these observations:

-There is a 4 to 6 percent crude oil deficit in the United States.
-Gasoline stocks are 7 percent below normal.
-The level of gasoline production in U.S. Refineries' this year has not increased over 1978, and may be lower.
-Allocation fractions for Oregon service stations range from 80 to 85 percent of corresponding months last year.
-Under a new U.S. Department of Energy policy, many Oregon service stations will receive upward adjustments of base period allocations.

Projected shortages could be greater if population and per capita income grow faster than assumed, if engine efficiency and gasoline prices do not increase as much as expected and if gasoline availability factors are lower than the Department assumed.

In forecasting an end to any gasoline shortage by October, the Department of Energy does not project that the energy problem will go away. The US's energy problems are more serious than ever. Oil shortages are going to cause unemployment and reduced economic growth. The resulting downturn in economic activity will bring oil and energy markets back into equilibuim for a while. Unless however, the U.S. reduces its dependence on imported oil Oregonian's may face reoccurring and costly cycles of economic expansion followed by energy supply disruptions.

Figure 1

GASOLINE CONSUMPTION IN OREGON

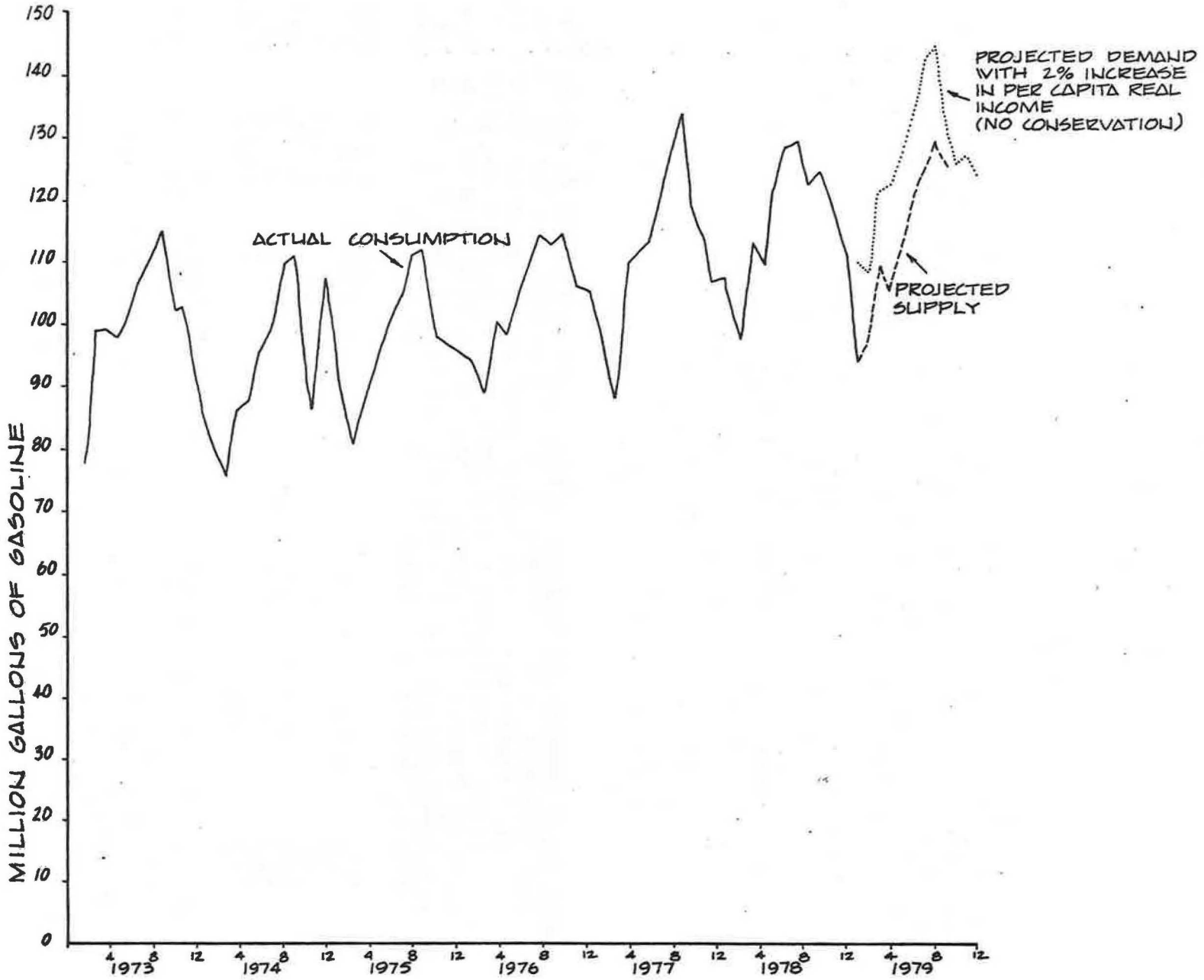

Fig. 2 shows some of the more important factors influencing monthly gasoline usage in Oregon. Note that increases in real prices and the recession 1974-75 prevented an upward shift of the annual pattern. Otherwise, such an upward shift was experienced from 1975 through 1978. The graph shows a causal relationship between gasoline consumption and population and income growth, the operating efficiencies of cars, gasoline prices, conservation characteristics, and the monthly travel plans of the population in general.

Based upon monthly Oregon data from January, 1973 through December, 1977, the Oregon Department of Energy has estimated a short-run gasoline demand relationship. According to this relationship, motor gasoline consumption will increase by over 2.6% if population grows by 1%. Similarly, consumption will rise by approximately 1% if per capita real income increases by 1%. On the other hand, consumption will fall by .3 of 1% as real gasoline price rises by 1%. (See Appendix I for a description of the estimated relationship.)

The analysis also revealed that during the 1973-74 oil embargo, Oregonians managed a 6% reduction in consumption.

In order to forecast gasoline demand in the coming months, it is necessary to make certain assumptions concerning population and income growth, gasoline prices, etc. The following are assumed:

-Population will be up 2.6% from 1978.

-The operating efficiency of the fleet of passenger cars increased 2.7% in 1978, and will increase by 3.2% in 1979.

-The average monthly price of regular gasoline averaged 75¢ per gallon in April, and there will be, in the average, a 1¢ a month increase through September and remains at 80¢ per gallon for the rest of the year.

-The rate of increase in per capita real income in 1979 will range from 0% to 2%.

-General inflation rate at 10% annual rate for 1979.

MONTHLY GASOLINE CONSUMPTION AND ITS DETERMINANTS IN OREGON: ACTUAL & PROJECTED

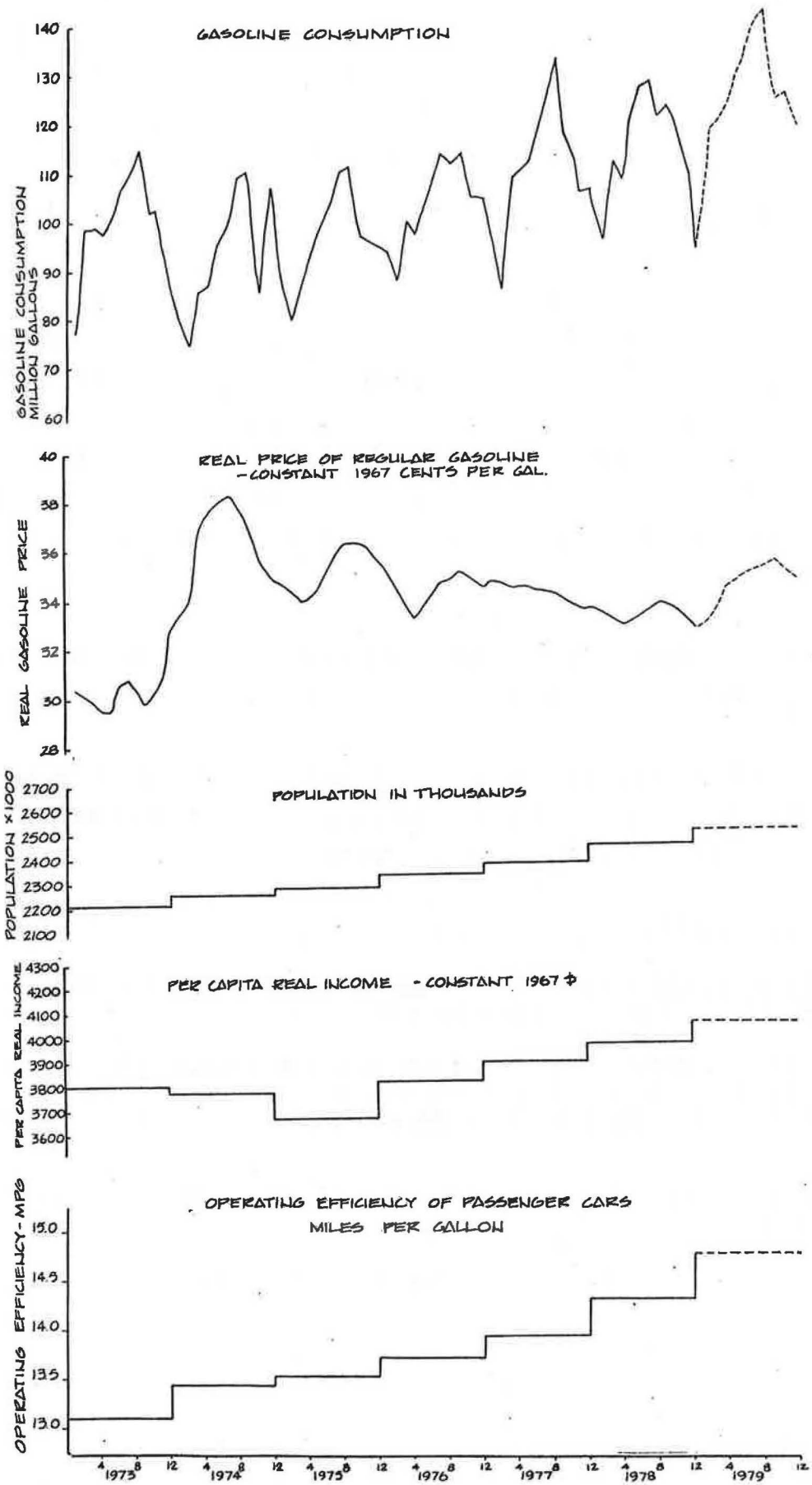

Figure 2

Based upon these assumptions and the estimated relationship, specific forecasts of gasoline consumption by month for 1979 can be derived. In the case of 2 percent increase in real per capita income and no conservation, demand for the rest of 1979 is projected as follows:

Month	Consumption (million gallons)
May	127.3
June	133.7
July	142.2
August	145.0
September	133.2
October	126.5
November	127.6
December	123.4

This forecast is illustrated in Fig. 1. Other cases with different assumptions are discussed after presentation of the supply forecast.

C. Supply Forecast

The forecast of gasoline supply is highly speculative, mostly because it depends on federal policy. By the best estimate at this time, it is projected that supply will be at 92% of the same months in 1978 for May and June, 95% for July, 97% for August, and 100% for September. By October, supply could be expected to rise to levels that would no longer become a constraining factor in the supply and demand picture.

This projection is based upon the following observations:

-There is a 4 to 6% crude oil deficit in the U.S.

-Gasoline stocks are 7% below normal.

-The level of gasoline production at U.S. refineries is no greater than last year's, and could be lower.

-100% of the demand for gasoline by the agriculture sector will be met.

-The allocation fractions for Oregon's service stations are 80 to 85%.

-Under the U.S. DOE's new policy, there will be upward certification of base period allocations for many Oregon dealers.

It should be stressed that current world wide oil production, U.S. refinery runs and inventory stock levels have already determined gasoline availability for May and June. For the remainder of the summer, availability is more speculative. The following are the key assumptions:

-Stability in the international crude oil market will be restored as Iran resumes oil production at or near than 4 million barrels.

-Saudi Arabian crude oil production will continue at 8 1/2 million barrels per day or greater.

-There will be a gradual elimination of the international crude oil deficit through higher prices and a world-wide moderation of economic activity.

-The increase in OPEC's official price in June will be about $2.00 per barrel.

D. Results of the Analysis

Combining the results of the demand and supply forecasts, it is projected that, without conservation, shortages in May and July would be 8% of projected demand on the low side and 12% on the high side. For June and August, it will be in the 7-10% range. It is estimated to be in the range of 2-6% for September.

Table 2 summarizes the result of this projection.

There is, of course, much uncertainty in relation to these projected shortages. On the one hand, if population and income grow faster, improvement in the operating efficiency of cars and increases in gasoline prices are smaller, and gasoline availability factors are lower than have been assumed, then the shortages would be even worse than shown in Table 2. On the other hand, the shortages would be less than indicated if population and income growth are slower than projected, and gasoline prices rise faster, efficiency improvement is more, and gasoline availability is higher than assumed. Gasoline demand could also be lower simply because tourists don't come to Oregon this summer.

Table 2
Projected Shortages of Motor Gasoline in Oregon Under
Different Income and Conservation Assumptions
March through September, 1979

	Assumed Supply		Shortage (-) or Surplus (+) as % of Projected Demand under Different Income and Conservation Assumptions			
	As % of Same Month in 1978 (%)	1,000 Gallons	No Conservation Low	No Conservation High	6% Conservation Low	6% Conservation High
March	97	110,560	-6	-10	0	-4
April	95	104,520	-11	-15	-6	-10
May	92	112,640	-8	-12	-2	-6
June	92	119,510	-7	-10	-1	-5
July	95	124,730	-9	-12	-3	-7
August	97	130,270*	-7	-10	-1	-4
September	100	125,210	-2	-6	4	-0

Sources and Notes:

Energy Planning Program, Oregon Department of Energy. For forecasting equation, see Appendix I. For input assumptions, see text. The "low" case is associated with no growth in per capita real income. The "high" case is associated with 2% growth in per capita real income from the 1978 level.

*Actual consumption in August, 1978 was substantially below normal. Hence, it was not used for deriving this supply figure. Instead, an adjusted estimate was made by applying 2.3% growth rate to the actual July, 1978 estimates. 2.3% is the average difference between the two months for the previous 5 years.

What is important is that the results show that it is necessary for Oregonians in the coming months to practice voluntary conservation of gasoline. Table 2 shows that if we conserve in the same manner as during the 1973-74 oil embargo (i.e., approximately 6%), shortages could be reduced to manageable proportions or completely eliminated. If we do not conserve voluntarily, then we could be facing the attendant consequences of higher prices, long lines at the gasoline pump, and a loss of jobs due to declines in tourism and other important Oregon industries.

In short, conservation is a must in dealing with the present and expected future situation.

Moreover, conservation of gasoline pays.

E. Savings from Gasoline Conservation

In a very real sense, it pays to conserve gasoline. Without conservation, prices would be higher than we are now experiencing. To demonstrate the savings that could be derived from conservation, the estimated demand relationship is used to calculate expected pressures on gasoline prices, as shown in Table 3.

It should be borne in mind that, there are federal price controls. So far, most price increases have been within legal limits. Further price increases are not likely without crude oil price increases which, when they do occur, usually take time to work through. Therefore, the following discussion is theoretical, and it also ignores inventory changes. With price control and no conservation, there would be long lines at the gas pump, as demonstrated by the experience in California in recent weeks.

In March of this year supply was estimated to be at 97% of March, 1978. From Tables 3 and 4, this means that the price for regular gasoline in Portland would have to have risen by over 18¢ per gallon. The actual increase in monthly average price for the month was only 9¢ from a year ago. (Table 4) Therefore, conservation and other non-price adjustments may have the "saved" Oregonian motorists over $9 million dollars in March.

Table 3

Estimated "Demand Pressures" on Gasoline Prices:
Percentage Change in Gasoline Prices Necessary
to Match Demand With Assumed Supply for Any Month in 1979
as Compared to the Same Month in 1978, Assuming
General Inflation of 12% and No Price Control.

Supply of the Month As % of Same Month in 1978	Percent Change in Gasoline Price (%)	
	No Conservation	6% Conservation
97% of Supply		
High	75	41
Low	28	3
95% of Supply		
High	88	52
Low	37	11
92% of Supply		
High	110	70
Low	53	24
90% of Supply		
High	127	83
Low	65	33

Sources and Notes:
Computed by Energy Planning Program, Oregon Department of Energy. See Appendix I for computational equation.

Interpretation of Table 3: If supply for a month is assumed 97% of the supply a year ago the same month (See bracketed panel in Table 3 marked 97% of Supply), average operation efficiency of the fleet of passenger cars is assumed to improve by 3% from the 1978 level, population and per capita real income are assumed to increase respectively by 1% from the 1978 levels, and general inflation rate is assumed to be 12%, then the demand pressures would have forced the "market-clearing prices" to go up by 28% from a year ago with no conservation, and by 3% with 6% conservation. (The low case.)

On the other hand, if operating efficiency, population, and per capita real income were assumed to rise by 1%, 3%, and 3% respectively, then the market price of gasoline would have risen by 75%, and 41% respectively for the cases of 0%, and 6% conservation. (The high case.)

Note that, in deriving these estimates, it was necessary to assume all the adjustments takes place on the price front. If other factors were allowed to change at the same time, then the demand pressures or prices would be lower.

Without conservation, there would be a shortage of 6-10% of projected demand, (Table 2), implying a need for conservation and other non-price adjustments of at least 6%.

The situation in April was similar. Supply for the month was estimated to be at 95% of supply a year ago, Table 3 shows that a "free market" solution to the problem would have led to an increase of price by more than 37% over a year ago. The computed "saving" through voluntary and involuntary conservation for April is estimated at $12 million. The shortage was projected at about 11 to 15% of demand (Table 2), suggesting that there was intensified conservation efforts, non-price adjustments and inventory draw downs.

Table 4

Average Monthly Retail Price of Regular Gasoline in Portland

(¢/gallon in current dollars)

	1976	1977	1978	1979
January	57.0	59.7	63.1	69.6
February	56.4	60.6	63.5	70.5
March	55.5	61.0	63.5	72.3
April	54.5	61.3	63.7	75.0*
May	55.5	61.7	64.9	
June	57.0	62.1	65.9	
July	58.4	62.4	67.0	
August	58.7	62.3	67.9	
September	59.4	62.4	68.6	
October	59.3	62.4	68.6	
November	59.3	62.4	68.9	
December	59.3	62.6	69.2	
Average	57.5	61.7	66.3	

* Preliminary

Sources:

Derived from weekly prices published in Oil and Gas Journal, various issues.

II. Causes of the Shortage

A. International Situation

Even after the 1973-74 oil boycott, some polls have shown that a near majority of Americans did not know that the United States imports oil. Under those circumstances, it is difficult to convince Americans that a major disruption in import supplies triggered an oil shortage and that the shortage is real. The facts are that in 1978 the United States imported 43 percent of the total oil consumed in this country, compared to 29 percent in 1972. Furthermore, the absolute level of oil imports has also increased. In 1972, oil imports were 4,700,000 barrels per day. Oil imports in 1978 were 8,050,000 barrels per day. At times during 1977 and 1978, the level of oil imports exceeded half of the domestic consumption of oil.

Over time, the source of U.S. oil imports has also changed. In 1972, the United States imported much of its oil from Canada and other countries in the western hemisphere. Now a good share of oil imports arriving each day comes from the Middle East and other OPEC nations. In the last few years, this increasing dependence on oil from the Middle East and other unstable parts of the world has created a growing insecurity in the United States.

We now have two illustrations of our oil supply insecurity. The first, of course, was the Arab Oil Embargo of 1973. The second illustration is the loss of Iranian crude oil in early 1979.

Whatever the analysis of the causes of the Iranian problem, several facts are clear. By December, 1978, Iranian oil production, which had been nearly 6 million barrels per day in early 1978 and 1977, declined to almost none, a situation which persisted for more than 70 days. The

shutoff of Iranian oil did not mean that there was a sudden and dramatic shortage worldwide. Normally, it takes 60 to 90 days for oil to be transported from the oil fields of Iran to the refinery centers in Europe and the United States. Consequently, the world is amid a shortage traceable to events which occurred six months ago.

The loss of Iranian crude was compensated somewhat by increases in production in Saudi Arabia and other OPEC countries. However, this still left the world about 2 million barrels of oil per day short. (That is about four percent of the oil consumption in the western industrialized world.)

The world has substantial stocks of oil, and these stocks can be drawn down. The cutoff of Iranian crude oil exports resulted in a total loss of about 200 million barrels of oil. Even with this loss, it is possible, on a worldwide scale, to say that were Iranian oil production to continue at the April 1979 level of 4 million barrels per day, the entire problem could be averted by simply managing inventory stocks. This was possible, but unfortunately, several other events have intervened which complicate the situation.

The most important of these events is the oil policy of Saudi Arabia. In its initial stages, the Iranian revolution caused a great deal of concern not only in Iran, but in the United States and in the Persian Gulf states. The Saudis responded to it by increasing oil production. In December 1978, they increased production to well over 10 million barrels per day. However, the Saudis do not want to continue at this level. Consequently, for the first quarter of 1979, the production level dropped to an average of 9-1/2 million barrels per day. In April, the level was again reduced to only 8-1/2 million barrels per day as an average for the second quarter of 1979. This level of production, given the current 4 million barrels per day of production from Iran, is just sufficient to match world demand and supply, but not to rebuild inventory stocks. The situation is complicated by the uncertainty

surrounding Iran's long-term oil production policy. They have recently announced that they will export only 2-1/2 million barrels per day. This export level is inadequate to meet the world balance of demand and supply given the current Saudi production levels.

The other very important event that has created much confusion and distortion in the international oil market is the spot price for crude oil. The spot market for crude oil, primarily in Rotterdam, is a small but active market. In practice, only about one percent or 500,000 barrels per day of the industrialized world's oil supply gets traded in that market. However, the spot market tends to lead longer term contract prices. In early 1979, with enormous uncertainty about future events in Iran, spot prices of oil went up to $26 per barrel. (This is compared to OPEC's official price of under $14 per barrel.) As in 1973 and 1974, the high spot prices gave OPEC the message that their oil prices were too low. Consequently, in a meeting on March 26, the OPEC ministers decided to raise the official OPEC price from $13.34 to $14.55. That in itself is not a significant increase and could have been absorbed with reasonable ease by the world's industrialized economies. Unfortunately, OPEC also approved official "surcharges" which allowed OPEC members to literally charge what the market would bear. In April 1979, the average OPEC traded price was $16.02 per barrel - a substantial increase from January.

When these factors are combined with the continuing concern over events in Iran, producers and consumers of oil are reluctant to further draw down stocks. As a consequence, minor fluctuation in crude oil production rates can have a substantial impact on refinery output and thus on available refined products.

It is a simple and fairly obvious fact that as long as the United States is dependent on imported crude oil, we will have great difficulty in controlling our domestic market and, therefore, in stabilizing economic development, employment and domestic price levels. The world is not yet running out of oil. Unfortunately, the majority of supplies are located

in portions of the globe where, politically, the United States and other industrialized countries have very little influence or control over future events.

The Persian Gulf, one very small area, provides 45 percent of the oil needed by the western industrialized world. And because it holds 60 percent of oil reserves, the Gulf will continue to be the world's primary supplier. These facts create an enormous world economic imbalance. It is a frightening prospect since the measures that we must take to reduce our dependence on Persian Gulf oil are expensive, environmentally costly and difficult, hard choices. It is possible to make a long list of future events that would disrupt our oil supplies. Consequently, we must brace ourselves for the possibility of reoccurring cycles, in which economic growth and recovery proceeds until the demand for oil exceeds supply, or is distrupted by temporary shortages. The oil market is then brought back into equilibrium primarily through reduced economic growth.

B. Insufficient Refinery Capacity

Before the cutoff of Iranian crude oil exports, the major oil companies stated that there was insufficient refinery capacity in the United States. Consequently, there was danger of gasoline shortages, even with stable crude oil supplies. The oil companies maintained that they could not reasonably expand refinery capacity without additional profit. Federal price control regulations have held refinery profits to 1973 levels, with minor adjustments. While this is a national problem, it is not really significant in this region. Refinery capacity here is probably sufficient over the next few years depending on the percentage of heavy versus light crude oil that is available.

At the moment, national refinery runs are below normal. The latest estimates are that refineries are running at about 84 percent of capacity. Normally at this time of year, they can produce at about 90 percent of capacity. The main problem is a lack of crude oil resulting from the

current international situation and our own regulatory program in the United States.

C. Quality of Crude Oil

In the last few months, both imported and domestic crude oil used by refineries in the U.S. has been of a lower quality. There are several reasons for this decline in crude quality.

The first is that the lost Iranian crude oil is a fairly high quality crude oil, low in sulphur and relatively light.

The second reason relates to the orders given by the Secretary of Energy James Schlesinger to the major oil companies to avoid purchasing highly priced crude oil on the international market. This stance may have some justification but the net effect to our companies has been to prevent them from bidding for light crude oil with low sulphur content. Instead, these better quality oils have gone to other nations. As a result, the refineries in the United States have had to refine a lower quality crude oil. It takes more oil to refine heavy crude oil resulting in less output. More importantly, there is less output of the type of products that are really in demand - gasoline and light diesel.

D. West Coast Oil Glut

It remains a physical fact that the West Coast has more crude oil and more refined product relative to other regions of the country. This is due to the production of Alaskan and Californian crude oil as well as available imports from Indonesia and other exporting countries on the Pacific rim. Even with the Iranian cutoff of crude oil, West Coast refineries had adequate supplies and, by and large, have been running at a very high capacity. This is reflected in Table 8 in Appendix II.

Inventory stocks of gasoline on the West Coast are at the same level as they were a year ago. Refinery runs are higher. On the other hand, there have been substantial stock draw downs of diesel. This is a result of the very long cold winter.

Oregonians may well wish to ask why, if there is a surplus of fuel on the West Coast, are they suffering shortages of important fuels? The answer is, there is a nationwide shortage and existing federal regulations spread the suffering nationwide.

A variety of companies have been attempting to build a pipeline from the West Coast to the Midwest where crude oil is sorely needed. There are two major proposals: one is the Northern Tier Pipeline which would run from Puget Sound across northern Washington, Idaho, Montana and into the Midwest; the second, the SOHIO proposal, would convert an old natural gas pipeline that runs from California to Texas to pump crude oil. Either one of these proposals would help to reduce the West Coast oil glut.

The West Coast oil glut is not a physical glut so much as an economic one. It is always possible to ship crude oil through the Panama Canal or around the Horn, but this is expensive. Given this situation, the product can be refined on the West Coast and moved by trucks and other means to other parts of the country. It is far more efficient, however, to transport the crude oil through a pipeline than it is to transport petroleum products once they have been refined. Diesel, in short supply to Oregon's fishermen, is being used to transport some gasoline East.

E. Federal Regulations

The present regulatory program for oil began with President Nixon's price stablization program. In 1973, the price control authority under the Cost of Living Council was transfered to the newly formed Federal Energy Office. Thus, the regulatory authority was institutionalized in the Federal Energy Administration and its successor, the Department of Energy.

The oil regulatory program is extremely complex, and therein lies much of the problem. There are price controls on crude oil and gasoline. There are standby regulations on all other petroleum products. There are also controls on the physical distribution of oil through "allocations".

In 1973, Congress passed the Emergency Petroleum Allocation Act (EPAA). The Act mandated a voluntary program that was already in place. Over the last six years, the authority over price and distribution of oil has been merged. The program is now administered by the Economic Regulatory Administration (ERA) of the U.S. Department of Energy.

The theory of allocation is fairly simple. In the event of a shortage, everyone is entitled to a set percentage of the petroleum products purchased last year. If there is 5% less gasoline, everyone gets 95% of what they previously purchased.

Unfortunately, allocation in practice is not so simple. Such distribution schemes cannot be carried through to the final consumer. Crude oil producers allocate to refiners who allocate to jobbers (wholesalers) who allocate to retail outlets. But, the general public is left out because all of the small individual purchasers from the year before can not be taken into account. Allocation only works to the retail level, and even then, it has great difficulties. The program is biased against regions that have been growing or where there has been a rapid turnover of retail outlets.

The allocation and price control regulations have been in place or in standby since 1973. During this period, the regulatory framework has created a large number of biases and incentives which are at variance with nationally stated energy goals. Some of the most important problems include:

-Entitlements. This program equalizes crude oil acquisition costs to refineries. Since most U.S. domestic crude oil is priced below the international level, refiners with access to these sources would have an unfair competitive advantage. In order to equalize costs, the entitlements program subsidizes oil imports at about $2.00 per barrel.

-Crude Oil Price Controls. At the beginning of this year, crude oil produced in the U.S. sold for as little as $5.75, about 1/3 of the international price. (There are a variety of prices depending on the conditions under which oil is produced.)

-Refinery Profit Controls for Gasoline. According to the industry, the frozen profit level on gasoline has inhibited the expansion of refinery capacity to produce unleaded gasoline.

No one can deny that oil company profits are high and are increasing. The important point about the present regulatory framework is that it helped bring about these events, because, in general, incentives have been shifted within the industry from production to distribution. The industry is expanding the market for oil products, without expanding oil production.

F. Confusion

There has been a lot of hysteria and unnecessary confusion not only in California, but also in Oregon. Reports get exagerated so that a 3 or 5% shortage can appear to be very substantial. The reduction in crude oil availability has not been smooth and even. It has not been a five percent reduction to every refinery or to every user simultaneously. Rather, most people have all they need and a few have had to really suffer.

When the oil market is tight, traditional relationships between buyers and sellers break down. Concrete information on demand and supply is difficult to get, rumors abound. Consequently, the problem appears much more serious than it really is.

One problem in California concerns the disruption of normal demand patterns. Motorists are staying close to home, competing over scarse gasoline instead of traveling as they normally do. California's shortages

are only in the urban areas. There are surpluses elsewhere in the state. The Allocation program provides gasoline to places where there was demand last year. If demand patterns shift, there may be some problems even without an actual shortage.

G. Hoarding

The hoarding phenomenon is one of the key problems in managing a fuel shortage. Analysis of the situation during 1973/74 indicates that the shortage was not substantial, less than 10%. However, panic and hoarding, made the problem seem far more serious than it actually was.

To deal with the hoarding problem, the best policies are:

-a clear explanation of the problem and estimates of the shortage
-a clear & simple contingency plan
-honesty and credibility
-industry & government cooperation
-an informed public

Unfortunately, the public is not fully convinced of the present problem. Cynicism helps generate gasoline lines.

The experience in California in the last few weeks, and Oregon in 1974, illustrates the pattern very clearly:

-The public is made apprehensive by rumors and the observation of some gasoline lines.
-Each motorist tries to fill up his car.
-The inevitable demand that arises by shifting gasoline from service stations to vehicles creates a severe shortage.
-After most motorists have filled up, and people have postponed vacations, etc., the introduction of a rationing scheme such as odd/even rationing restores order and moderates the situation.

There are about 2 million registered vehicles in Oregon. If each motorist tried to carry an average of 3 extra gallons, the demand for gasoline would increase by nearly 6% during this month.[1] Once hoarding starts, it is uncontrollable until lines get so long that motorists change their driving habits.

There has been hoarding in Oregon, but so far it has been among bulk purchasers. A number of firms that construct large tanks report a large backlog of orders.

One other concern raised by hoarding is the improper or unsafe storage of cans of gasoline which greatly increases the potential for fire and explosion.

H. Mismanagement

A number of actions taken in the last month by the Federal Government have contributed to the mismanagement of the petroleum shortage, and probably caused the panic in California.

First, Secretary Schlesinger asked major U.S. oil companies to not buy high priced crude oil on the international market. As a result, the world-wide deficit, which at present is less than 2%, has strongly impacted the U.S. market. The total deficit amounts to about 4% for the U.S. More importantly, however, this action has resulted in a large proportion of lower priced, heavy, high-sulphur oil imports. Consequently, U.S. refineries cannot produce as large a percentage of light products such as gasoline and diesel which are in demand right now. There is a surplus of residual oil.

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[1] In California, Chevron estimates motorists have increased average car tank holdings by 4 gallons. Exxon estimated the increase at 3 to 7 1/2 gallons.

Secondly, President Carter, himself, has asked Secretary Schlesinger to ensure that U.S. refineries produce additional heating oil at the expense of gasoline. This is being done to ensure that there are adequate supplies next winter. However, the projected demand for diesel in late 1979 and early 1980 is, based on continued economic growth and the possibility of a cold winter. It also may not sufficiently account for the inevitable petroleum price increases.

Thirdly, the Economic Regulatory Administration of the U.S. DOE has implemented a series of regulations governing the allocation of gasoline. Some of these have created a great deal of unncessary confusion on the part of the petroleum industry. In particular, at the end of April, the U.S. DOE issued notice of intended action to allow many service stations an automatic upward adjustment in their base period allocation. This adjustment was to be given to service stations that had experienced a 10% growth in gasoline sales between October 1978 and February 1979. The notice was vague and incomplete. Thus, at the beginning of May, the major oil companies did not know exactly how much extra gasoline they would have to make available during the month. Consequently, most of the companies lowered May's allocations by over 10%. Rumors that allocation fractions dropped 10 to 20% helped create panic buying. From Oregon's point of view, this created a serious management problem. It is now impossible to determine the precise availability of gasoline supplies and which regions may have problems.

The major oil companies have also been responsible for some mismanagement of the supply problem. They have all been on allocation fractions since March 1979. A number of the companies have allowed "over lifting". This means that dealers and jobbers have been able to buy and sell more fuel than their allocated supplies by borrowing against future allotments. Now, most of these companies are asking that the gasoline be "payed back". Consequently, what should be a 4 or 5 % shortage for 7 or 8 months may become a 10 to 12% shortage concentrated in a few months.

Secretary Schlesinger and President Carter have maintained that petroleum stocks are dangerously low. The Department of Energy's data does not, however, fully substantiate this claim. Enclosed in Appendix II are the latest charts from the DOE. They give a visual representation of the problem.

According to the Department of Energy's data, the overall stock situation is not desperately serious. There are, however, problems in both gasoline and diesel. These figures are collabrated by industry statistics Tables 6 to 9 of Appendix II.

The industry figures reveal the difference between the West Coast and the rest of the nation. The demand for middle distillates (diesel) on the West Coast was very substantial in January and February, probably due to the cold weather. On the other hand, gasoline stocks and production have been high. California's current gasoline crisis may have arisen because last year's demand in Southern California was met only by importing extra gasoline from other parts of the U.S. This year that extra gasoline is not available.

Appendix I

Technical Notes on the Monthly Gasoline Demand Model Used in the Analysis

This appendix provides only a brief documentation on the preliminary monthly gasoline demand model used in the analysis presented in this report. Interested readers may contact the Energy Planning Program of the Department for additional details.

The structure of the monthly model is similar to the annual model incorporated into the Department's overall forecasting methodology documented in An Energy Demand Forecasting Model for Oregon (February, 1977), except for the fact that monthly dummies are included to estimate the seasonal patterns. At this time, the parameter values (i.e., elasticities of demand) are estimated from monthly Oregon data for the period, January, 1973 to December, 1977.

The basic forecasting equation (used in Fig. 1 and Table 2) is as follows:

Eq.11 $$QGLM_t=(MPG2_t)^{-1.0}\ (POP_t)^{2.6337}\ (RYPC_t)^{1.0048}\ (RPGLM_t)^{-.2871}$$

$$*(\ .00000133\ (1.0055)^{DQ}\ (.9412)^{DS}\ (.8813)^{D1}\ (.8620)^{D2}\ (.9793)^{D3}\ (.9937)^{D4}\ (1.0328)^{D5}\ (1.0863)^{D6}\ (1.1572)^{D7}\ (1.1812)^{D8}\ (1.0871)^{D9}\ (1.0297)^{D10}\ (1.0360)^{D11}\ )$$

$R^2=.8859$ D.W.=2.374 d.f.=43

(t values are 4.661 for POP, 1.797 for RYPC, -2.130 for RPGL, -2.407 for intercept, .172 for DQ, -2.461 for DS, -3.801 for DI, -4.486 for D2, -.640 for D3, -.191 for D4, .981 for D5, 2.508 for D6, 4.413 for D7, 5.039 for D8, 2.532 for D9, .897 for D10, and 1.085 for D11)

Where QGLM = Monthly gasoline consumption in Oregon in thousand gallons.

MPG2 = Estimated average miles per gallon for passenger cars.

POP = Oregon population in thousands.

RPGLM = Real average monthly gasoline price in Portland in constant 1967 cents per gallon.

DQ = Dummy variable accounting for change in consumption data after January, 1977.

DS = Dummy variable for conservation and supply constraint during the 1973-74 oil embargo.

D1, D2,....D11 = Dummy variables for the months of January, February....November. A dummy is not needed for December because it is taken to the base for comparison with other months.

The computational equation for Table 3 is derived for Eq. (1)

Eq. (2) $RTP_t = ((RTQ_t)^{-1.0} (RTMPG_t)^{-1.0} (RTPOP_t)^{2.6337}$
$(RTRYPC_t)^{1.0048} (CON\ SER))^{(1/.2871)} * (RTCPI)$

Where RTP_t = Ratio of gasoline price in a month to that of the same month a year ago.

RTQ_t = Ratio of demand for gasoline, which is forced to equal to the assumed or constrained supply for the month, to that of the same month a year ago.

$RTMPG_t$ = Ratio of miles per gallon for the average fleet of passenger cars.

$RTPOP_t$ = Ratio of population.

$RTRYPC_t$ = Ratio of real per capita personal income.

CON SER = Conservation assumption; = 1.0 with no conservation and = .94 with 6% conservation.

RTCPI = Ratio of consumer price index; = 1.12 with 12% general inflation rate.

Appendix II

Oil Data

Table 5
Imports

(1000 barrels per day)

	Gasoline			Dist.			Crude		
	78	79	%	78	79	%	78	79	%
Jan 12/13	133	228	+71	136	245	+80	5659	6776	+20
Jan 19/20	134	216	+61	157	212	+35	5854	6478	+11
Jan 26/27	102	258	+153	115	191	+66	5791	5613	-3
Feb 9/13	179	222	+24	182	226	+24	5576	6840	+23
Feb 23/24	189	142	-25	181	139	-23	5597	6315	+13
Mar 2/3	203	120	-41	276	105	-62	5813	6515	+12
Mar 9/10	168	157	-10	308	180	-42	6110	6636	+9
Mar 16/17	185	200	+8	155	155	0	5695	6716	+18
Mar 23/24	135	146	+8	116	155	+34	6071	57876	-5
Mar 30/31	142	145	+2	130	171	+32	5896	5834	-1
Apr 7/6	173	134	-23	128	116	-9	5191		
Apr 14/13	185	146	-21	133	111	-17	5743		
Apr 21/20	131	177	+35	124	125	+1	5177		
Apr 28/27	166	199	+20	110	96	-13	5494		
May 6/5	187			105			4868		
May 12/11	155			129			5571		
May 19/18	243			129			6116		

Source: American Petroleum Institute

Table 6
Gasoline Stocks

1000 barrels per day

	Nation			West Coast		
	1978	1979	%	1978	1979	%
Jan 12/13	258,787	245,635	-5	27,348	28,901	+6
Jan 19/20	266,962	252,031	-6	28,915	30,015	+4
Jan 26/27	274,312	260,750	-5	29,125	30,693	+5
Feb 9/13	274,384	265,695	-3	27,044	31,695	+17
Feb 23/24	274,857	259,635	-6	27,119	29,765	+10
Mar 2/3	270,855	255,675	-6	26,363	28,851	+9
Mar 9/19	270,672	252,331	-7	25,841	28,203	+9
Mar 16/17	273,539	246,387	-10	26,647	27,958	+5
Mar 23/24	NA	243,675	NA	NA	27,298	NA
Mar 31	265,741	242,912	-9	23,871	26,217	+10
Apr 7	263,285	--	-	24,546	25,959	+6
Apr 14	260,174	234,863	-10	24,462	--	-
Apr 21	255,793	233,347	-9	24,192	24,660	+2
Apr 28	252,891	231,773	-7	24,756	24,257	-2
May 6	248,740			24,994		
May 12	246,062			24,737		
May 19	240,732			24,331		

Source: American Petroleum Institute

Table 7
Distillate Stocks

1000 barrels per day

	Nation			West Coast		
	1978	1979	%	1978	1979	%
Jan 12/13	234,965	204,711	-13	13,388	10,011	-25
Jan 19/20	226,436	195,329	-14	13,976	9,495	-32
Jan 26/27	219,773	185,824	-16	14,044	9,330	-34
Feb 9/13	202,973	167,993	-17	13,719	9,684	-29
Feb 23/24	179,699	142,192	-21	14,024	9,590	-32
Mar 2/3	167,651	128,425	-23	13,691	8,981	-34
Mar 9/19	160,710	123,402	-23	13,365	9,720	-27
Mar 16/17	152,341	119,311	-22	13,417	9,191	31
Mar 23/24	NA	116,606	NA	NA	9,353	NA
Mar 31	140,387	114,977	-18	12,590	9,480	-25
Apr 7	137,564	--	--	11,577	9,798	-15
Apr 14	137,174	112,490	-18	11,710	--	--
Apr 21	137,627	114,442	-17	12,533	10,114	-19
Apr 28	137,477	115,460	-16	12,143	9,971	-18
May 6	136,843			12,495		
May 12	137,774			12,486		
May 19	138,644			11,711		

Source: American Petroleum Institute

Table 8
Gasoline Output

1000 barrels per day

	Nation			West Coast		
	1978	1979	%	1978	1979	%
Jan 12/13	7,153	7,322	+3	939	1,135	+21
Jan 19/20	7,140	7,332	+3	1,013	1,102	+9
Jan 26/27	6,815	7,362	+8	937	1,104	+18
Feb 9/13	6,753	7,049	+4	895	1,038	+16
Feb 23/24	6,666	6,942	+4	930	1,017	+9
Mar 2/3	6,840	6,725	-2	880	1,042	+18
Mar 9/10	6,742	6,648	-1	936	973	+4
Mar 16/17	6,846	6,881	+1	948	1,023	+8
Mar 23/24	NA	6,717	NA	NA	983	NA
Mar 30/31	6,989	6,656	-5	922	1,004	+9
Apr 7	6,730	6,474	-4	1,001	970	-3
Apr 14/13	6,638	6,801	+2	995	1,015	+2
Apr 21	6,627	6,981	+5	971	1,042	+7
Apr 28	6,832	6,743	-1	1,061	1,015	-4
May 6	6,848			1,051		
May 12	7,038			1,059		
May 19	7,186			1,031		

Source: American Petroleum Institute

Table 9
Distillate Output

1000 barrels per day

	Nation			West Coast		
	1978	1979	%	1978	1979	%
Jan 12/13	3,242	2,972	-8	292	298	+2
Jan 19/20	3,163	3,127	-1	264	329	+25
Jan 26/27	3,114	3,211	+3	224	308	+38
Feb 9/13	3,031	3,110	+3	268	337	+26
Feb 23/24	2,970	2,918	-2	271	307	+13
Mar 2/3	3,022	2,979	-1	274	336	+23
Mar 9/10	3,095	3,017	-3	284	336	+18
Mar 16/17	3,223	3,024	-6	292	289	-1
Mar 23/24	NA	3,068	NA	NA	353	NA
Mar 30/31	2,910	3,029	+4	244	285	+17
Apr 7	2,890	2,895	0	299	291	-3
Apr 13/14	2,957	3,049	+3	281	327	+16
Apr 21	2,926	3,063	+5	302	325	+8
Apr 28	2,840	2,991	+5	293	286	-2
May 6	3005			318		
May 12	3,086			313		
May 19	3,177			315		

Source: American Petroleum Institute

Table 10
West Coast Consumption by Months
(excludes imports)

1000 barrels per day

	1979	1978	%
Gasoline			
Jan	32,731	28,076	+17
Feb	30,700	25,475	+21
Mar	33,789	31,058	+9
Apr	(32,817*)	30,000	+9
	130,037	114,609	+13
Distillate			
Jan	10,342	7,404	+40
Feb	9,110	7,241	+26
Mar	9,414	9,579	-2
Apr	(7,844*)	7,721	+2
YTD	36,710	32,125	+14

* Based on limited data.

Source: American Petroleum Institute

Table 11
National Consumption by Months
(including imports)

1000 barrels per day

	1979	1978	%
Gasoline			
Jan	219,741	206,404	+6
Feb	207,030	193,018	+7
Mar	225,807	221,558	+2
Apr	(220,865)	216,509	+2
YTD	873,443	837,489	+4
Distillate			
Jan	122,344	117,368	+4
Feb	116,889	112,370	+4
Mar	111,922	101,044	+11
Apr	(95,700)	90,810	+5
YTD	446,855	421,592	+6

Source: American Petroleum Institute

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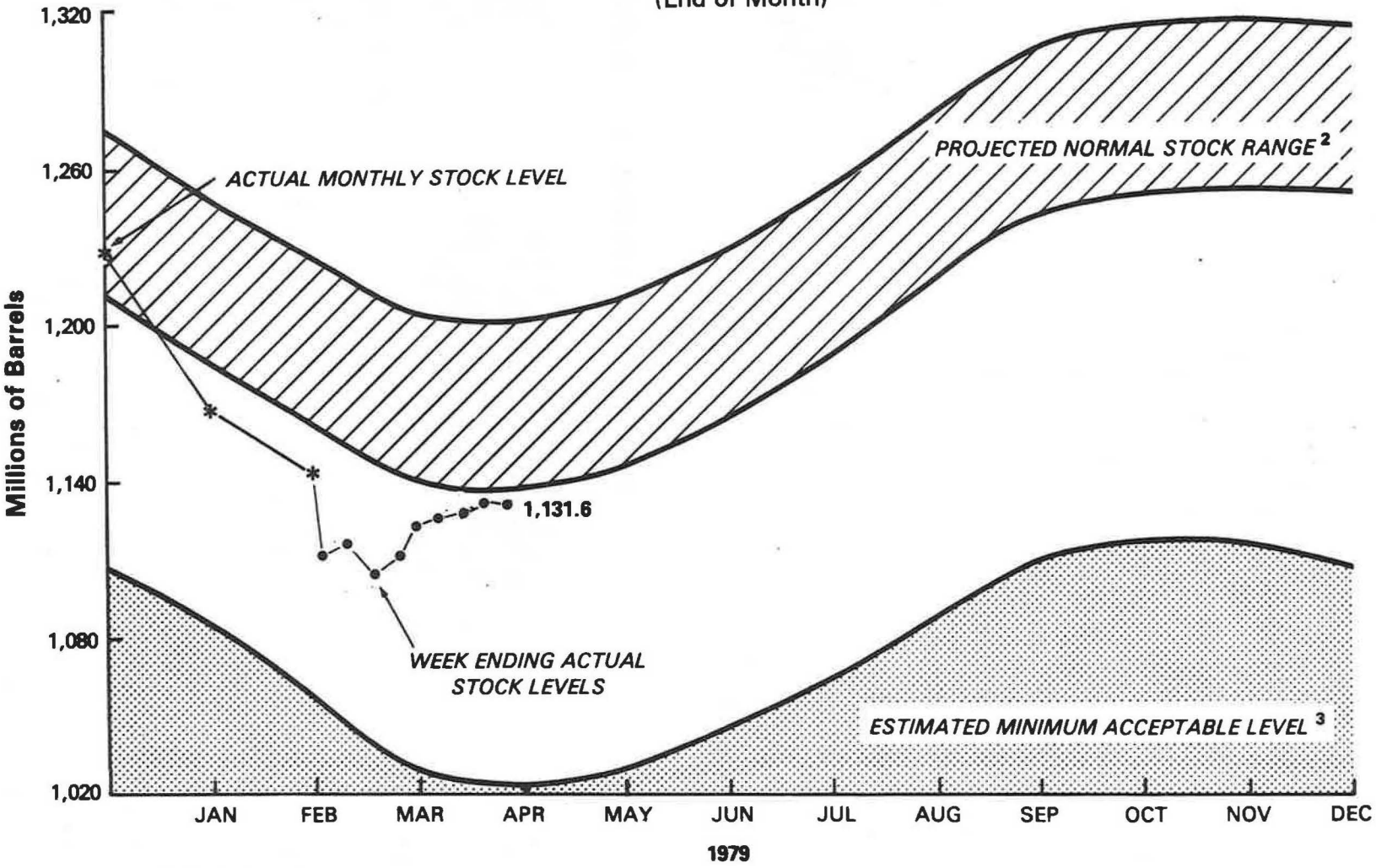
as of April 27, 1979

U.S. Petroleum Stocks at Primary Level (Crude and Major Products)[1]

(End of Month)



1 Product Stocks at the Primary Level include those held at refineries, in pipelines, and at major bulk terminals. Crude Stocks at Primary Levels include those held at refineries, in pipelines, and in lease tanks.

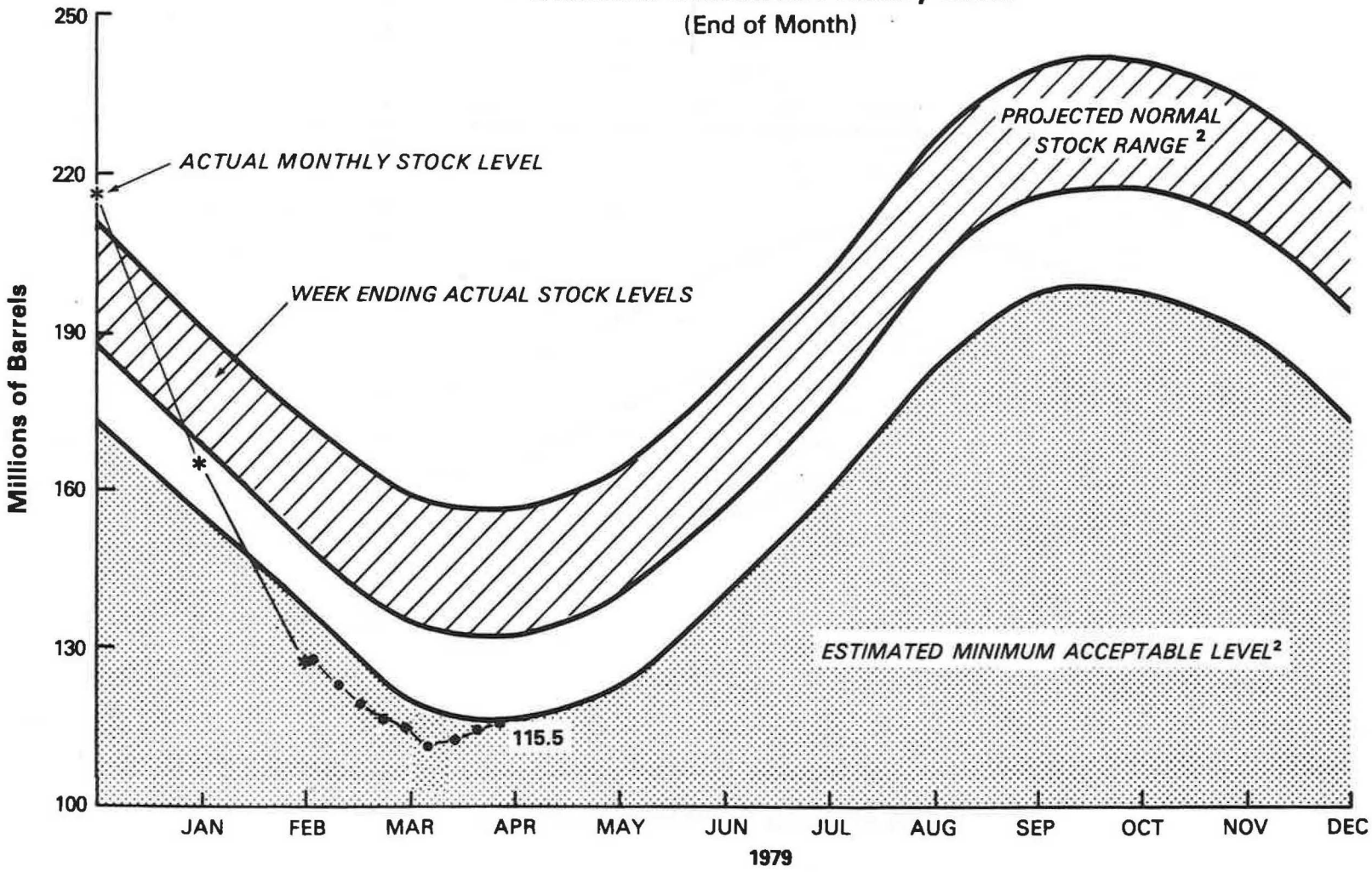
2 Projected Normal Stock Range—projections are based upon trends and seasonal patterns inherent in Bureau of Mines and DOE Actual Monthly Data from 1972-1978. The band shown indicates a range of plus or minus one standard error. That is, extrapolations would fall inside the band approximately ⅔ of the time.

3 Estimated Minimum Acceptable Level— the level that stocks can fall to without disruption of consumer deliveries or the creation of spot shortages. This level is based upon the frequency with which stocks have fallen below normal patterns as determined from Bureau of Mines and DOE Actual Monthly Data from 1972-1978 and upon recent analysis of inventory requirements for efficient operation.

Source: Week ending average data: American Petroleum Institute (API), "Weekly Statistical Bulletin"; projections and estimates through 1979: DOE Emergency Policy Committee, Iranian Response Plan. Actual Monthly Data (December 1978 through February 1979): EIA "Monthly Petroleum Statistics Report."

Distillate Stocks at Primary Level[1]

(End of Month)



1 Product stocks at the Primary Level include those held at refineries, in pipelines, and at major bulk terminals.

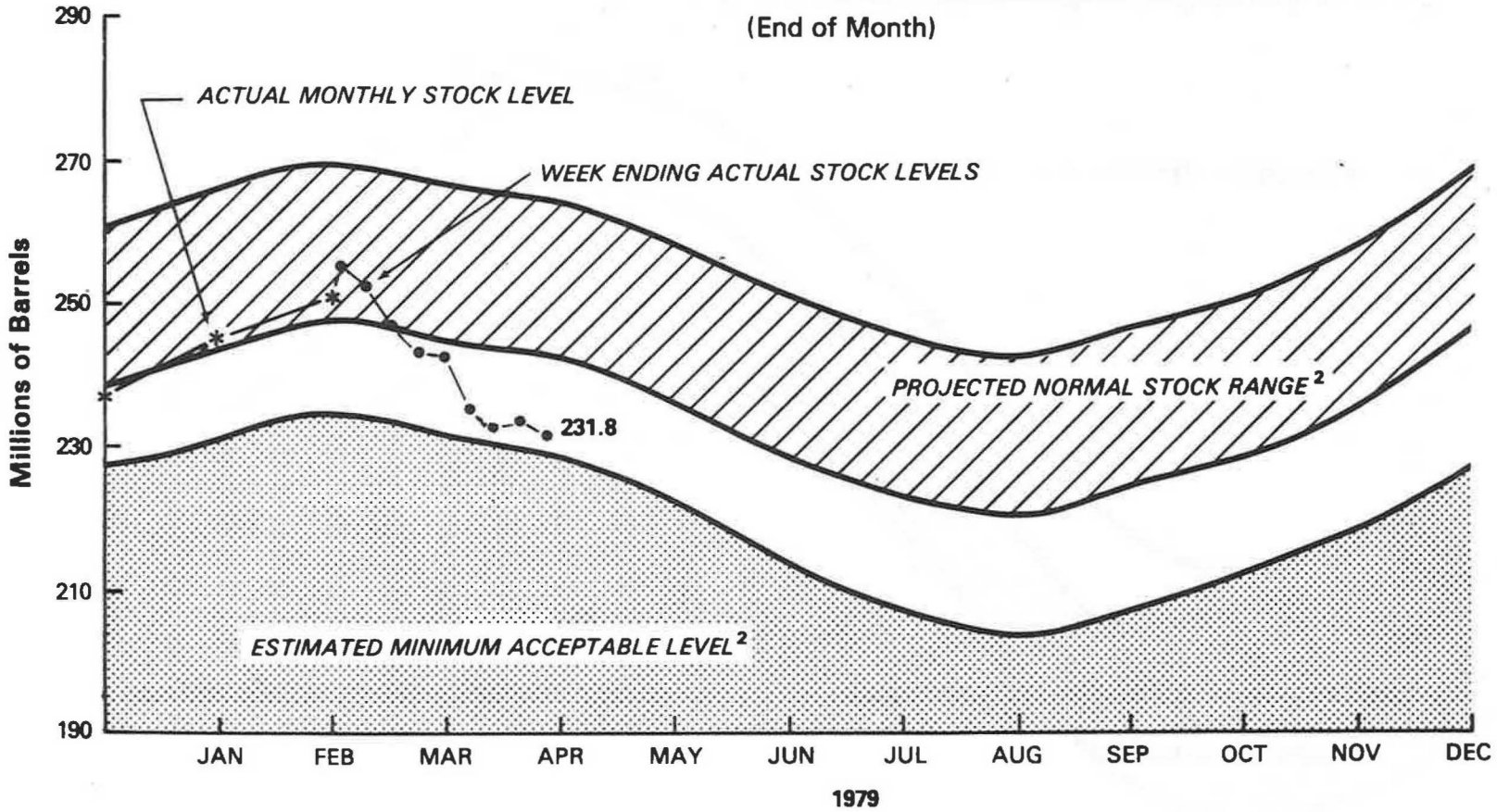
2 See notes 2 and 3 of U S Petroleum Stocks at Primary Level

Source Week ending average data American Petroleum Institute (API), "Weekly Statistical Bulletin projections and estimates through 1979: DOE Emergency Policy Committee, Iranian Response Plan Actual Monthly Data (December 1978 through February 1979): EIA "Monthly Petroleum Statistics Report."

as of April 27, 1979

Gasoline Stocks at Primary Level [1]

(End of Month)



1 Product stocks at the Primary Level include those held at refineries, in pipelines, and at major bulk terminals.

2 See notes 2 and 3 of U.S. Petroleum Stocks at Primary Level.

Source: Week ending average data: American Petroleum Institute (API), "Weekly Statistical Bulletin"; projections and estimates through 1979: DOE Emergency Policy Committee, Iranian Response Plan. Actual Monthly Data (December 1978 through February 1979): EIA "Monthly Petroleum Statistics Report."