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MOTOR GASOLINE: AN OUTLOOK FOR SUPPLY AND DEMAND TO 1981

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I. INTRODUCTION AND SUMMARY OF FINDINGS

A. Background

The debate over whether existing price controls on gasoline should be continued or abolished has been going on for at least three years.

In one form or another and for one reason or another gasoline has been under direct or indirect federal price supervision since 1971. The existing controls were authorized in late 1973 during the Arab oil embargo which had caused a temporary physical shortage of gasoline and other oil products due to insufficient crude oil supplies from foreign sources. The supply insufficiency disappeared in the spring of 1974 and U.S. domestic products supplies, together with normal import patterns, have been adequate to meet demand ever since. A number of oil products were decontrolled in recognition of the fact that the special events which had necessitated the controls had ceased to exist. However, gasoline has, so far, not been among these products.

B. Support for Decontrol

Advocates of gasoline price decontrol include all U.S. refiners as well as most gasoline distributors. Their position is strongly supported by the Department of Energy ("DOE"). In addition, the Bureaus of Competition and of Economics of the Federal Trade Commission ("FTC") have supported DOE's view that under continued price control a shortage of domestic supplies of unleaded gasoline is a strong possibility after 1980.* The DOE also finds that the real price

*Dougherty, Comanor, et al., "Comments of the Bureau of Competition and the Bureau of Economics of the Federal Trade Commission Concerning the Draft Environmental Impact Statement on Gasoline Deregulation," reprinted in Final Environmental Impact Statement, Vol. II, Public Comments, DOE/EIS-0039, p. 186 ff. Referred to hereinafter as "Federal Trade Commission" or "FTC" Comments.

increase resulting directly from decontrol will be modest.*

C. Opposition to Decontrol

The principal opponents of gasoline price decontrol are consumer advocates who are generally opposed to any action likely to result in higher costs to consumers. They also question whether the refining industry really requires additional price incentives to increase its output of unleaded gasoline. In addition, environmentalists fear that decontrol may increase the existing price spread between leaded and unleaded gasoline and, thus, cause consumers to switch from the unleaded to the leaded product. This shift would increase auto emissions and delay the attainment of national ambient air quality standards.

D. Summary of Findings

In the following pages we present our own assessment of the gasoline price decontrol issue. We have relied on some data from other published sources, but we have also developed some figures of our own. The study begins with a brief analysis of leaded and unleaded gasoline demand for the period 1978-81 and then addresses itself to the question of how this demand can be met.

Our conclusions are generally similar to those of the DOE:

1) If the existing price controls are continued in their present form, spot shortages of unleaded gasoline are a distinct possibility during the peak driving season of 1980 and a probability during the peak season of 1981.

*See for instance, Motor Gasoline Deregulation and the Tilt, Final Environmental Impact Statement, Vol. I, DOE/EIS-0039, January 1979.

2) Existing facilities which produce unleaded gasoline are inadequate to meet the rapidly growing demand for that product and it is uneconomical for refiners to expand these facilities under current price controls.

3) Certain factors which helped to ease the transition from leaded to unleaded gasoline in the last three years are unlikely to be present in the next three years, thus adding to the difficulties of meeting future requirements of the unleaded product.

4) The possibilities of increasing the share and volume of unleaded gasoline through means other than capacity expansion (such as imports or the use of different crude feedstock) are limited, very expensive, and could cause a substantial rise in the average cost of gasoline even if price controls are maintained. Furthermore, some of these measures could raise the cost of other refined products.

5) The gasoline refining and marketing industry is sufficiently competitive to keep any price increases resulting from decontrol approximately within the limits of actual cost increases (over time), including adequate rates of return on investment.

6) It must be recognized that the long term imposition of price controls has created market distortions. These distortions will not disappear overnight. It is therefore possible for spot shortages of gasoline to develop over the next twelve to eighteen months even with decontrol. Relaxation of the lead phasedown regulations would at least help to minimize these spot supply problems.

7) The recent change in the pricing regulations permitting a "tilt" in the passthrough of increased costs from other products to gasoline can be expected to improve the incentive for gasoline production from existing facilities, but is not designed to encourage, directly, capital investment in the expansion of these facilities.

8) Further, if a shortage of unleaded gasoline occurs, it could cause a significant switch from unleaded to leaded gasoline. This switch would not result from an increase in the price differentials but from a general unwillingness of the public to curb vehicle use or to undergo the inconveniences of obtaining scarce supplies for the "abstract" purpose of maintaining ambient air quality standards.

II. TOTAL GASOLINE DEMAND, 1978-81

Our gasoline demand projection to 1981 is shown in the following table.

GASOLINE DEMAND BY USE AND QUALITY, 1975-81

(Thousands of Barrels Daily)

				Estimated				Percentage Increase From Previous Year					
	1975	1976	1977	1978	1979	1980	1981	'76	'77	'78	'79	'80	'81
Passenger Cars	4,958	5,100	5,233	5,326	5,434	5,462	5,438	2.9	2.6	2.5	1.3	0.5	-0.1
Trucks, Vans and Other Uses	1,717	1,878	1,943	2,028	2,093	2,099	2,126	9.4	3.5	4.4	3.2	0.3	1.3
Total	6,675	6,978	7,176	7,390	7,527	7,561	7,584	4.5	2.8	3.0	1.9	0.5	0.3
Share of Unleaded Gasoline (%)	13	22	28	34	42	50	57						

We expect total gasoline demand to increase by 2.6% between 1978 and 1981. This compares with an increase of 10.7% in the previous three-year period (1975-78). We project a steady decline in the annual demand increase from 3% attained in 1978 to 0.3% in 1981. After 1981 gasoline demand is expected to decline for the following several years.

The leveling off in demand growth over the next three years is due primarily to mandated improvements in the fuel efficiency of passenger cars from the 1978 model year on. We have assumed that the miles per gallon estimates of vehicle performance published by the Environmental Protection Agency ("EPA") over this period will not be fully achieved under actual driving conditions. On the basis of published data and discussions with fuel experts at automobile companies, we assume that the published EPA estimates will be downgraded by about 18%, i.e., new cars will use 18% more gasoline per mile on average during the next three years than is shown on the official EPA stickers for the various models.

We have also assumed a 10.5% increase in the number of passenger cars on the road between 1978 and 1981 and a small increase (about 2%) in the average annual miles traveled per vehicle. As the table shows, the growth in passenger car gasoline consumption will level off by 1980 under these assumptions.

Among gasoline uses for other than passenger cars, by far the most important are the requirements of single unit trucks (including

vans). In 1977 and 1978 they accounted for most of total non-passenger car gasoline consumption. The fuel efficiency of these vehicles is relatively low--about 10 miles/gallon. However, starting with the 1979 model year, trucks and vans up to 6,000 pounds gross vehicle weight rating ("GVWR") are required to attain a fuel efficiency of 17.2 miles/gallon. In the 1980 model year the requirements will be extended to units of up to 8,500 pounds GVWR with a lower standard to account for the heavier vehicles. As a result of these requirements, we expect gasoline demand for all non-passenger car uses to grow by less than 5% during the next three years, compared to 18% in the last three years.

The share of unleaded gasoline shown in the table is based on our projected increase in passenger cars and light duty trucks required to use this type of fuel. Its growth will be rapid throughout the period, notwithstanding the leveling off in total gasoline consumption. This was shown in 1978 when total gasoline consumption rose by 3%, while that of unleaded gasoline went up by 25%. In 1981, when total gasoline consumption will show almost no growth, unleaded gasoline demand is expected to rise by 14%. Thus, whatever problem may exist in meeting future gasoline demand would be concentrated on the unleaded portion of the product. This question will be discussed in the next section of this study.

III. GASOLINE SUPPLIES

Between 1978 and 1981, U.S. average annual refinery operating capacity can be expected to rise by about 7%, or from 17.0 to 18.2 million barrels per day (MM B/D). Crude run capacity utilization can rise from the 86% rate in 1978 to at least 90% in 1981, if required. Thus, total refinery output could increase from 14.6 to 16.4 MM B/D, or by 12.3% over the three-year period. Yet, as we have seen, our short term (1978-81) gasoline demand forecast shows an increase of less than 3% for the entire period and the demand for other major products is unlikely to increase faster than the possible 12.3% increase in total crude runs over the three-year period. Thus, over the next three years, at least, existing and reasonably firmly projected U.S. refining capacity is more than sufficient to meet the volume of our gasoline requirements disregarding quality problems.

There is much less certainty, however, as to the ability of the U.S. refining industry to meet the octane quality and grade requirements of anticipated gasoline demand over the next three years. It if cannot do so, either the octane quality standards will have to be changed or a gasoline shortage may develop.

A. Gasoline Requirements by Octane Quality and Grade

The principal reason for the potential quality problem is the soaring growth in demand for unleaded gasoline. This problem has been further compounded by the mandated lead phasedown and the ban on additives such as MMT. In the last three years the demand for unleaded gasoline has grown as follows:

UNLEADED GASOLINE REQUIREMENTS

	Volume (M B/D)	Share of Total Gasoline Demand (%)
1975e	900	13.5
1976	1,508	21.6
1977	1,976	27.5
1978e	2,513	34.0

AVERAGE ANNUAL GROWTH RATE 1975-78	
Unleaded Gasoline	40.8%
Total Gasoline	3.5%

(e) Estimated

As the above figures show, the demand for unleaded gasoline grew twelve times as fast during this period as that for total gasoline. The reason for this growth stems from the introduction, beginning with the 1975 model year, of the catalytic converter in most cars to meet the mandated reduction in automotive emissions. Since lead deactivates these converters, cars equipped with them are required by law to be fueled only with unleaded gasoline. Thus, up to the 1975 model year no automobile in the U.S. required unleaded gasoline and the discretionary volume of this product sold in the U.S. was probably below 5% of the total gasoline sales.

The purpose of adding lead to gasoline is to raise its anti-knock quality as measured by its octane number. Gasoline of low

octane quality performs poorly in modern engines. This is usually evidenced by engine knocking or "pinging," a form of abnormal combustion. Knocking is annoying to the motorist and if severe or prolonged can lead to serious engine damage. The average "clear" (i.e., non-leaded) octane number of the gasoline stream in a simple refinery is below the required minimum quality for acceptable engine performance. Various complex refining processes, such as catalytic reforming, alkylation and isomerization are used to increase the octane number of the clear gasoline pool. In the 1971-74 period about 2-2.5 grams of lead per gallon of gasoline were added to the pool. Since then the average lead content in the gasoline pool has steadily dropped to 1.3 grams/gallon in 1978 mainly because catalytic converters created a need for unleaded gasoline beginning in 1975 and most recently because of EPA's lead phasedown requirements.

In order to partially offset the impact of the lead reduction, the industry raised the utilization and capacity of its octane boosting downstream facilities. Currently, these are presumed to operate at about 92% of capacity (on an annual average) which is close to their sustainable operating ceiling. These facilities are producing at this rate primarily to meet the aforementioned soaring requirement for unleaded gasoline in the post-1974 automobile models. The research octane number ("RON") for this type of gasoline averages about 93, or 2 RON higher than the EPA's minimum requirement for unleaded gasoline.

Up to now the switch from leaded to unleaded gasoline has been significantly facilitated by two simultaneous developments:

- the rapid decline in the demand for premium leaded gasoline; and
- the production of unleaded gasoline with a lower RON than its leaded counterpart.

Between 1975 and 1978, demand for premium gasoline (whose clear RON is slightly lower than that of unleaded gasoline), dropped by an estimated 450,000 B/D. During the same period, demand for unleaded regular gasoline rose by 1.6 million B/D. Thus, about 28% of the increase in unleaded gasoline requirements could be satisfied by the switch from premium gasoline.

The production of unleaded product with a somewhat lower clear RON than that of the leaded grade gasoline replaced has enabled gasoline refiners to reduce their average (pool) octane rating which in turn helped them in meeting the changing requirements. The table on the following page illustrates these changes.

For a variety of reasons, the increase in unleaded gasoline requirements over the next three years will be helped much less by the two factors described above than was the case in the last three years.

As discussed earlier in our demand section, gasoline demand may peak in 1981 at about 7.6 MM B/D of which about 57% will be unleaded. This increase would require a corresponding increase of 1.9 MM B/D from 1978 to 1981 in the volume of unleaded gasoline. During the same period the decline in leaded premium gasoline demand

U.S. MOTOR GASOLINE DEMAND AND AVERAGE RESEARCH OCTANE NUMBER ("RON"): 1975 AND 1978

	Volume (M B/D)	Share (%)	Pump RON	Lead (g/gal)	Clear(Non-leaded) RON
1975					
Grade:					
Premium Leaded	1,262	18.9	98.9	2.2	91.4
Regular Leaded	4,546	68.1	93.4	1.7	82.9
Unleaded	867	13.0	92.2	-	92.2
Total	6,675	100.0	-	1.6	85.7
1978*					
Grade:					
Premium Leaded	811	11.0	98.8	2.4	91.1
Regular Leaded	4,057	55.0	93.2	1.9	82.4
Unleaded	2,508	34.0	92.9	-	92.9
Total	7,376	100.0	-	1.3	86.9

*PIRINC estimate

will continue, but at a considerably slower rate, reflecting a leveling off process as demand moves to a temporarily irreducible minimum for vehicles designed to run on high-octane gasoline. The DOE's Analysis Memorandum, 1980 Motor Gasoline Supply and Demand, assumes in its Base Case that by 1980 8% of U.S. gasoline demand will consist of leaded premium.* By 1981, the share can be expected to be slightly lower. But unlike the 1975-78 period, when conversion from premium provided 28% of supplies to meet the growth in unleaded gasoline, in the 1978-81 period the drop in premium demand is expected to equal only about 14% of unleaded demand growth.

At the same time, the octane quality of unleaded gasoline will probably have to be raised over the next three years through the more widespread marketing of unleaded premium gasoline. Moves in this direction were already discernible in 1978. The reasons for them are that: (1) an increasing number of consumers are dissatisfied with the performance of regular unleaded gasoline at its current octane level and are seeking an unleaded product with a higher octane rating and are willing to pay a higher price for it; (2) as vehicles get older they apparently require higher octane ratings to maintain performance; and (3) automobile manufacturers have been meeting mandated increases in fuel efficiency standards by raising engine

*Tukenmez, et al., 1980 Motor Gasoline Supply and Demand, Analysis Memorandum AM/ES/79-12, Department of Energy, Energy Information Administration, December 8, 1978, p. 29.

compression ratios, which require higher octane unleaded gasoline to operate properly.*

Thus, by 1981 we estimate the gasoline demand levels and octane ratings shown in the following table.

U.S. MOTOR GASOLINE DEMAND AND AVERAGE RESEARCH OCTANE NUMBER ("RON"): 1981

Grade	Volume (M B/D)	Share (%)	Pump RON	Lead (g/gal)	Clear(Non-leaded) RON
Premium Leaded	0.6	7.5	97.0	1.1	91.5
Regular Leaded	2.6	35.0	92.5	1.4	82.9
Unleaded	4.4	57.5	-	-	93.4
Of Which: Regular	(2.9)	(37.5)	(91.5)	-	(91.5)
Premium	(1.5)	(20.0)	(97.0)	-	(97.0)
Total, All Grades	7.6	100.0	-	0.57	89.6

Our projections assume a decline in the quality of leaded motor fuels and an increase in the quality of unleaded motor fuels for the reasons discussed above. Specifically, we expect the shares of unleaded premium gasolines to expand significantly over the next three years, following their highly successful introduction in 1978.

B. Supply Outlook

It should be noted that the scenario shown in the table is not the only possible one. The demand for the premium leaded grade

*Testimony by John F. O'Leary, Deputy Secretary of Energy, December 11, 1978, p. 10.

could well be smaller and that for the premium unleaded grade correspondingly larger because the difficulties connected with the marketing of four grades of gasoline may cause an accelerated phase-out of the premium leaded grade, forcing consumers of premium gasoline to buy more of the unleaded grade. This would increase the total clear RON of all gasoline grades in 1981 from that shown in the table and, consequently, would require an even greater effort than assumed to meet the projected volumes and quality of unleaded gasoline over the next three years.

That effort will be rendered still more difficult by two EPA regulations: the banning of MMT in unleaded gasoline last October, and the scheduled reduction of the lead content in the total U.S. gasoline pool this October.

MMT, a magnesium compound, had been used with increasing frequency as an octane enhancer in unleaded gasoline. The additive was banned on similar grounds as lead in motor fuels for new automobiles: there was some evidence that it could deactivate the catalytic converters. Prior to its prohibition, MMT boosted the octane level of unleaded gasoline by at least one number. The DOE's Energy Information Administration has determined that continuation of the 1978 maximum allowable level of MMT per gallon of gasoline "would be equivalent to...200,000 B/D additional gasoline production of the pool average gasoline quality projected for 1980."*

*Department of Energy, Motor Gasoline Supply and Demand Through 1980, Analysis Memorandum AM/ES/78-19, August 1978, p. 31.

The scheduled lead phasedown would reduce the lead per gallon in the total U.S. gasoline pool from the current level of 1.3 grams to an average of 0.59 grams in 1980--a reduction of more than 50%. The effect would be equivalent to a reduction in gasoline manufacturing capability of about 500 M B/D of the quality of gasoline required by 1980, according to an EIA analysis.* (It should be noted that the lead phasedown, which will of course only affect the leaded gasoline grade, will accelerate the "natural" reduction of lead emission from gasoline resulting from the growing share of unleaded gasoline in the pool. As we have seen, this share will approach 60% of total U.S. motor gasoline consumption by 1981. Hence, lead emissions would be substantially reduced over the next several years even without the scheduled lead phasedown.)

The combination of the recent ban on MMT and the prospective reduction in the lead content of gasoline can be expected to significantly reduce the output of gasoline in 1980. While the impact of EPA's decisions will not be additive, the reduction in gasoline supplies will be in excess of 500,000 B/D. EPA's recent permission to utilize MTBE, an ether, as an octane enhancer is unlikely to improve the supply situation markedly, partly because manufacturing capability for this additive is limited. For 1980 and even more so, for 1981, meeting both the volume and quality (octane) requirements, in the face of these mandatory reductions in the use of octane-boosting additives, will be a difficult and costly task, requiring

*Tukenmez et al., op. cit., p. 3.

additional octane-improving gasoline processing facilities at the earliest possible time.

Most government and industry analyses seem to agree that the unleaded requirements for 1979 of about 3.14 MM B/D can be met from existing sources, although some consumers may have to accept a lower quality unleaded gasoline than desired. There is much less agreement about the ability to meet demand in 1980 when estimated unleaded gasoline requirements will be running at nearly 3.8 MM B/D. The DOE's most recent evaluation which contains a series of supply and demand scenarios concludes that:

> "While some adjustments by the industry will be required to satisfy even the low demand level in 1980, the high range of demand projections can only be satisfied with a combination of products imports and major adjustments by U.S. refiners." (Emphasis added).*

Several other forecasts conclude that 1980 demand can be met if the lead phasedown scheduled for October 1979 is postponed or, at least, ameliorated by permitting a somewhat higher lead level than is presently proposed. For 1981 no numerical evaluations of supply adequacy for unleaded gasoline are available. But since unleaded demand will be some 600,000 B/D higher in 1981 than in the previous year, it stands to reason that if supplies are tight and supply constraints possible in 1980, supplies will be tighter and constraints probable in 1981, unless additional imported supplies can be secured or processing facilities added.

Let us first look at the prospects for import availability. There is very little unleaded gasoline produced outside the U.S., Puerto Rico, and the U.S. Virgin Islands. Thus, the import supply

*Ibid., p. 39

for this product would have to be created. Technically, this would not be difficult, since a number of foreign refineries in export areas have downstream facilities capable of producing unleaded gasoline or the feedstock for it. However, the volume of gasoline, regardless of quality, available for export to the U.S. is very limited. In this regard, foreign export capability for gasoline differs essentially from that for residual fuel oil and, to a lesser extent, middle distillates. Traditional export supplies for both of the latter are located in the non-U.S. Caribbean islands, Venezuela, Northwestern Europe and Italy. The Caribbean refineries are fuel-oriented, produce little or no gasoline and would probably not be capable of making unleaded gasoline without major additional investment. In Venezuela domestic gasoline demand is rising so rapidly that the country has difficulties meeting its internal demand from its domestic refineries. In Northwestern Europe and Italy, gasoline and naphtha demand is rising at a fairly rapid rate while fuel oil demand has generally been declining. Thus, European refiners are not particularly interested at this time, or in the near future, in increasing their gasoline production for export purposes as this would produce nearly two extra barrels of fuel oil for each additional barrel of gasoline.

Since any incremental U.S. gasoline import requirements would be a function of prevailing U.S. government policy rather than the reflection of a long-term structural need, it is unlikely that foreign refiners would make any significant investment in order to

serve the U.S. market. Furthermore, the requirements of strict segregation of unleaded gasoline from all leaded grades, both in storage facilities and in tankers, may make it unattractive to supply this product in small quantities or on a spot basis, except at relatively high prices. For all these reasons, foreign volumes of unleaded gasoline are unlikely to provide more than a marginal addition--probably no more than 50,000 B/D--to U.S. supplies over the next three years, except at substantial price premiums. Under existing price controls U.S. gasoline marketers might well be able to pay such premium prices, since the controls permit an automatic pass through of all direct products costs. Hence, the high cost of incremental volumes of foreign gasoline could be rolled in with the lower price of controlled domestic gasoline, thereby raising the average price of all gasoline by an unknown amount, depending on the volume and price of the imported product. This development must be considered in evaluating the effectiveness of gasoline price controls under conditions of inadequate domestic supplies.

Given the limited availability and relatively high cost of foreign gasoline, the bulk of our incremental unleaded and low leaded gasoline requirements must come from domestic sources--that is, domestic gasoline must be upgraded to the desired octane level without the use of additives. The principal refinery unit to do this is the catalytic reformer which converts low-octane naphtha to a high-octane aromatic blending stock called "reformate." When the reformate is blended with clear gasoline it raises the octane rating of the latter.

From the beginning of 1975 to the beginning of 1978 the capacity of catalytic reformers rose by 320 M B/D to about 3.8 MM B/D. By 1980 it will have risen to 4.1 MM B/D, according to a DOE survey.*

In view of the very rapid growth rate in the demand for unleaded gasoline plus the scheduled lead phasedown, the planned capacity additions appear to be insufficient for 1980 and even more so for 1981, assuming a continuation of the 1975-80 growth rate in capacity additions. Since reformers and other gasoline upgrading units can be built in fifteen to twenty-five months, (assuming no undue delays in obtaining necessary permits) there is still time for additional units to come on stream by the 1981 peak driving season (3rd quarter) and, possibly, even for the later part of the 1980 season.

However, the oil refining industry has insufficient economic incentive to build these units, since under existing gasoline price control regulations refiners cannot earn an adequate rate of return on such new investment. The disincentive of this particular regulation on the construction of gasoline-making equipment has been frequently recognized by the DOE. For instance, Deputy Energy Secretary John F. O'Leary said in testimony before Congress on December 11, 1978 on the subject of gasoline price controls and allocations:

*Ibid., p. 27

> "The most serious aspect of the problem is that seven years of price controls and general regulatory uncertainty have inhibited investment in the refinery expansions and improvements needed to make unleaded gasoline, or to make gasoline-range material out of heavy and high sulfur domestic crude oils. Refiners are allowed to depreciate new investments, but may not recover a return on all investments greater than the total amount they realized as of May 15, 1973. Refiners assert this has discouraged investment in the gasoline manufacturing capacity needed now to produce the high octane blending stocks for unleaded gasoline. This seems to be borne out by the general lack of major refinery expansions and improvements scheduled for the next two years."

The regulation referred to by Secretary O'Leary has of course the same negative impact on the construction of other gasoline octane upgrading facilities such as alkylation and isomerization units. Thus, if this particular regulation is maintained over the near term, its subsequent removal would have no effect whatever on the available capacity of these units in 1980 and only very little effect in 1981.

The recently permitted "tilt" in gasoline pricing will not change this situation, since it does not eliminate the existing restrictions on earning a return on investment for new capital expenditures. The tilt is designed to restore the established industry practice of assigning a larger share of refining costs to gasoline than would be warranted by the volumetric share of this product in total refined products output. This reflects the fact that a disproportionately large share of these costs are related to the plant's gasoline producing capacity. This practice was allowed during the period when all major products were under price control. However, the exemption of virtually all other products from the regulations forced a cessation of the practice because refiners were

not permitted to reallocate to gasoline any part of the volumetrically apportioned costs from the exempted products. The new "tilt" regulation has permitted a limited restoration of this reallocation pattern.

There are still other ways in which gasoline price controls may act as a constraint on supply expansions. The expected higher octane requirements of unleaded gasoline as well as the mandated reduction in lead content will have to be met to a large extent by increasing the "severity" of reforming or by the deconversion of low octane components. This will reduce the output of the reformate per unit of feedstock input and increase the output of lower-value products, such as refinery gases. Given the limitations of the "tilt" regulations, a refiner is unlikely to be able to adjust the price of gasoline fully for this increase in lower-value products caused by the higher severity of the reforming process. This will act as a disincentive to raising the octane rating of gasoline when required, though the tilt relief will somewhat alleviate this disincentive.

Still another regulatory deterrent to higher-octane gasoline manufacture could derive from the demand for aromatics by the petrochemical industry. About 10% of the aromatics produced in catalytic reformers is sold to the petrochemical industry at prevailing market prices, which have risen substantially in the recent past. The present gasoline price regulations could therefore

encourage a refiner to maximize sales or inter-affiliate transfers of aromatics as petrochemical feedstock, leaving less for the upgrading of gasoline. Alternatively, the petrochemical industry may find itself short of feedstocks. In the same context, the removal of the existing economic disincentive to reformer capacity additions would benefit the petrochemical industry, since it would increase their potential access to domestic supplies of this feedstock.

Refiners might be able to increase the clear (non-leaded) octane rating of gasoline through the use of crude oil which yields gasoline of comparatively higher octane. Some African crudes, for instance, have such a quality advantage over Arab light or medium crudes. But they are higher priced in accordance with this differential. A refiner purchasing the more expensive crude to obtain a higher octane level for his gasoline may have to raise the price of all other products made from this crude to reflect its higher cost.

IV. CONCLUSIONS

We have not precisely calculated the cost to consumers of removing or relaxing the existing gasoline price regulations. Our analysis strongly suggests that such a change is required, whatever its true cost, for if the present regulations are continued for even a limited period, spot shortages of unleaded gasoline are a possibility during the peak driving season of 1980 and a probability during the peak driving season of 1981.

If that were to occur, one could expect a growing switch from unleaded to leaded gasoline, since all car engines designed for unleaded gasoline can be run on leaded product. The only result would be deactivation of the catalytic converter, which does not affect vehicle driving performance. Since it must be assumed that the public will put its private convenience or need for automobile travel above the abstract concept of air pollution reduction, there can be little doubt that such action would be taken on a large scale if unleaded gasoline supplies are tight. This would reverse Congress' and the Administration's environmental goals in this regard in addition to ruining several hundred million dollars worth of catalytic conversion equipment.

It should be pointed out in this context that environmentalists and economists concerned with environmental issues have long argued that the "externalities" of air pollution--or conversely, the cost of reducing or eliminating it--should be paid by the users of the polluting product. Yet, present gasoline price regulations

are inconsistent with this principle. The refining industry has been required to provide a "cleaner" and hence, more costly, gasoline than it has heretofore to reduce air pollution. But consumers are insulated from the full cost of expanding supplies of this new product to projected demand levels.

The fears that this cost might become exorbitant because of profiteering are hardly warranted by the available evidence. The DOE in its Final Environmental Impact Statement on gasoline deregulation (January 1979) estimated that under full deregulation the price of gasoline will be about 3.8¢/gallon (including 0.4¢/gallon in dealer margins) higher in 1980 than under the then existing regulations.* This is likely to amount to less than 5% of the average retail price (including tax) by then--hardly an exorbitant increase over a two-year period. However, in a critique of the DOE's Draft Environmental Impact Statement, the Federal Trade Commission considered this estimate of the price differential between controlled and uncontrolled gasoline possibly too high and stated that "under reasonable assumptions about the behavior of refiners, the controlled price could be as high as the decontrolled price, and in the extreme case the controlled price could be even higher than under decontrol."**

Of course, these estimates and conclusions assume implicitly a state of effective competition in the gasoline industry. There is considerable evidence that this is and will continue to be

*Gasoline prices will of course rise by more than this amount. Dollar-for-dollar passthrough of crude oil price increases alone will raise the price by 5-6¢/gallon by 1980, assuming no increases in world oil prices beyond those announced last December by OPEC.

**Federal Trade Commission Comments, op. cit., page 2.

the case. The gasoline refining industry consists of 22 large integrated and non-integrated companies, and over 100 small refiners (less than 175,000 B/D), all of which compete vigorously and none of which holds a market share of more than 7.5%. Furthermore the market share of the largest seller has declined for the last several years and the market share of the 14 largest integrated companies has also slightly declined from 74.1% of total motor gasoline distribution in 1973 to 71.3% in the first eight months of 1978. Among the largest companies, also, there is constant changing of rank and position. Given these facts, it is reasonable to assume that in the absence of price controls, competition will effectively regulate profit margins on unleaded gasoline.

Some gasoline dealers have expressed concern that under gasoline decontrol their individual supplies will be insecure. However, DOE's proposed "Special Rule No. 4," an adjunct to the decontrol proposal of August 1977, would provide a transition period of one year during which supplier/purchaser relationships could be continued or re-established at the purchaser's request. This "transition regulation" was the subject of an exchange of letters between Federal Energy Regulatory Commission Chairman Charles Curtis and Secretary O'Leary.* The policy enunciated in these letters should provide retailers with reasonable assurance of supply for one year.

*Contained in Federal Energy Regulatory Commission, Proposed Exemption of Motor Gasoline..., Analysis and Recommendations, (Docket No. EA78-1), March 29, 1978.

V. GASOLINE CONTROLS AND IRANIAN OIL EXPORTS

The unavailability of Iranian oil exports from the end of December 1978 until early March 1979 and their limited availability since, with growing impact on foreign crude oil prices and supplies, have given rise to arguments that U.S. gasoline prices should remain under control until this situation has improved. If acceptance of this argument results in continuation of the existing gasoline regulation for several more months, it would greatly increase the likelihood of future shortage of unleaded gasoline, as was discussed earlier in this report.

If the current international crude oil supply situation is deemed to make immediate decontrol of gasoline politically unpalatable, a policy of gasoline decontrol at an early fixed date, enunciated and approved now, will have a positive impact on refiner decisions to build the required capacity. If events in Iran or elsewhere should cause a significant crude oil shortage in the U.S., it may be necessary to put all major oil products under some form of governmental controls. Until such time, it does not seem logical to single out gasoline for continued regulation. The DOE seems to agree with this view, since it decontrolled aviation fuels in February 1979, some seven weeks after the cessation of Iranian oil exports.