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THE CONVERSION OF RETAIL FUEL PUMP COMPUTERS TO SALE BY THE LIT--ETC(U)
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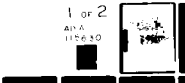

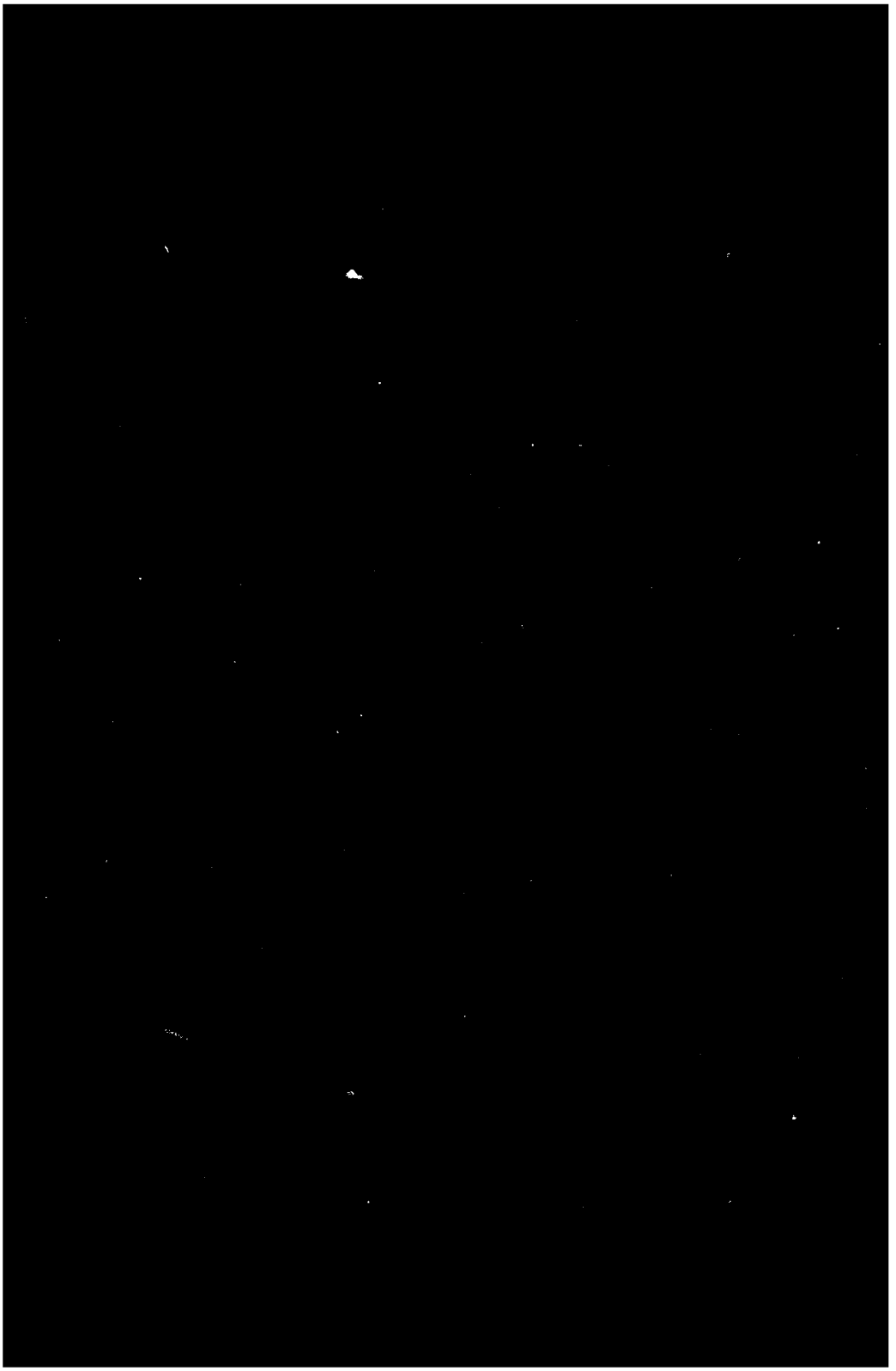

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Investigation of the conversion of retail fuel pump computers to sale by the liter is documented in this report. This study is based on (1) information presented and developed at public hearings held by the U.S. Metric Board (USMB) on May 2 and 3, 1979, and (2) USMB staff investigation and detailed economic impact analysis. This effort arose out of the steady rise in early 1979 of gasoline prices to the level of $1 per gallon (and above), coupled with the general inability of gasoline pumps to compute and dispense gasoline at such unit costs.

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#20. The conclusions showed a national cost advantage in favor of a metric conversion and a series of conclusive statements representing the outcome of the hearings. A resolution of the USMB is shown as the concluding event in the subsequent deliberations of the Board on the issue.

# THE CONVERSION OF RETAIL FUEL PUMP COMPUTERS TO SALE BY THE LITER

## Report of Hearing and Subsequent Action

## EXECUTIVE SUMMARY

### BACKGROUND

The steady rise in early 1979 of gasoline prices toward the level of $1 per gallon (and above), coupled with the general inability of gasoline pumps to compute and dispense gasoline at such unit costs raised the **issue of whether the potential existed to gain a national savings by converting gas pumps to dispense by the liter.**

During the April 4-5, 1979 meeting of the U.S. Metric Board (USMB) in Washington, D.C., it was voted to hold public hearings within 30 days to investigate this question.

Hearings were held May 2 and 3 with testimony received from 23 sources, representing oil companies (6), consumer groups (6), state weights and measures representatives (3), industry associations (3), manufacturers (2), metric groups (2), and a Federal agency (The Department of Energy).

The following information is based on (1) testimony presented at the public hearings as well as subsequent written comments and material submitted for the record and (2) USMB staff investigation and detailed economic impact analyses.

### CONCLUSIONS

It was concluded, based upon subsequent study of the available testimony and economic analyses, that a national cost advantage in favor of a metric conversion was at least $94 million.

Other significant issues resolved by the hearings included:

- Gasoline prices will continue to rise rapidly and will go over $1.00 per gallon.
- The great majority of gas pump computers existing in the U.S. cannot compute a total retail price when the unit price of gasoline goes over $1.00 per gallon.
- Five options were confirmed as primary options. These five options are: (1) convert the computer to calculate price per gallon at $1.00 or more; (2) convert the computer to calculate price per half-gallon; (3) convert the computer to calculate price per liter; (4) convert the computer to calculate price per quart; and (5) convert the computer to calculate whole number prices, dropping the tenths. Options (1) and (3) are strongly predominant in their feasibility.

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DISTRIBUTION STATEMENT A

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- Industry participants are not opposed to converting retail pumps to metric dispensing. However, they will not take unilateral action to do so because of perceived market disadvantages.

- In all probability, a constructive and universal (as opposed to disruptive and fragmented) metric conversion of gas pumps cannot take place without a triggering mechanism. The practical choice of a triggering mechanism is small and may only consist of (a) a mandate or (b) coordinating leadership.

- Technology and available inventories will allow the conversion of gas pump computers to liter sales or to over $1.00 per gallon pricing; however, the transition period for mechanical change-over would range from about one and a half to three years depending upon the option chosen and the proportion of dual capability pumps in the market at the time.

- Those who anticipate the problem (primarily the major oil companies) have generally opted to install dual capability computers (i.e., over $1.00 per gallon or liter dispensing) as current equipment wears out. This, while introducing individual corporate flexibility, also provides two drawbacks: (a) a more expensive replacement than called for unless the useful life of each option is exhausted, and (b) a disparate degree of preparation due to differing replacement policies and policy initiation dates among organizations should a metric conversion option become a reality.

- There are no significant legal barriers to the sale of fuel by the liter, but officials of all states and some Federal officials would undoubtedly require consultation to ensure informed participation on behalf of those jurisdictions should a metric option become a reality.

- State Weights and Measures officials agree that the interim "half-pricing" measure is an undesirable long-term option.

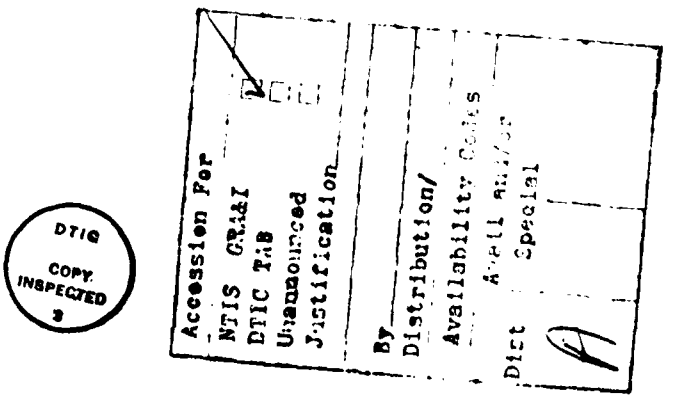
- There must be adequate information at the pump allowing unit price comparison as well as other available preliminary information that will ensure consumer protection, understanding and acceptance of any pump conversion to liter dispensing. This is of sufficient necessity to surpass in importance any potential cost savings accruing from metric pump conversions.

- o The interested parties were willing to participate and contribute in the hearing process. That mechanism was successful in airing their views in public and providing information to allow the USMB to continue its deliberations on the matter.

RESULT OF BOARD DELIBERATIONS

The Executive Committee of the U.S. Metric Board placed the issue on the June 21, 1979 agenda of the Board at its Boston, Mass. meeting. At that meeting, following a presentation summarizing the material in this report and discussion pertaining thereto, the Board issued the following declaration by a vote of 13 for, 1 opposed (three Board Members being absent):

> The Petroleum Retailing industry generally indicates a willingness to dispense gasoline by the liter.
>
> Several states are taking independent action in requiring or recommending liter dispensing.
>
> Therefore, the United States Metric Board declares that:
>
> > This is an opportune time for the development of a planned and coordinated voluntary program of dispensing gasoline by the liter and the Board urges all affected parties to participate in the planning process.
> >
> > It calls attention to the need for adequate public information in connection with liter dispensing.
>
> Without taking this action, metric usage is likely to proceed in a haphazard fashion leading to public confusion, disparate end results and a negation of the positive cost advantage that a nationally planned and coordinated program offers.



# PREFACE

This report has been compiled by the United States Metric Board to provide an analysis of the hearings held in Washington, D.C., May 2 and 3, 1979.

The abstracted testimony and cost analysis included in this report are intended to be a fair and objective utilization of documentary information presented for the record.

The schedule of events included thirty-six days for the preparation of this report between the completion of the hearings and the circulation of the report on June 11, 1979 to members of the U.S. Metric Board to be used as a reference document for their subsequent deliberations at a Board meeting held in Boston, Mass., on June 21, 1979.

If it becomes necessary to examine the details of the hearings more closely than this document allows, the verbatim transcript, submissions for the record and the minutes of the Board meeting of June 21, are available at the Metric Board offices, 1815 North Lynn Street, Arlington, Virginia 22209, telephone--703-235-2820.

## ABSTRACT

Investigation of the conversion of retail fuel pump computers to sale by the liter is documented in this report. This study is based on (1) information presented and developed at public hearings held by the U.S. Metric Board (USMB) on May 2, and 3, 1979, and (2) USMB staff investigation and detailed economic impact analysis. This effort arose out of the steady rise in early 1979 of gasoline prices to the level of $1 per gallon (and above), coupled with the general inability of gasoline pumps to compute and dispense gasoline at such unit costs. The conclusions showed a national cost advantage in favor of a metric conversion and a series of conclusive statements representing the outcome of the hearings. A resolution of the USMB is shown as the concluding event in the subsequent deliberations of the Board on the issue.

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## 1.0 BACKGROUND

1.1 In late 1973, the nation was deprived of crude oil and motor fuel for the first time in history. The country was demonstrably vulnerable to outside political pressure from the Organization of Petroleum Exporting Countries (OPEC). The shortage caused the cost of petroleum-based products to increase dramatically, creating a number of unforeseen problems. One very serious problem faced the domestic petroleum industry at the retail sales level. The price of gasoline began to approach 49.9 cents per gallon. At least twenty percent of the total number of dispensers in service at that time did not have the mechanical ability to accept price-posting values in excess of this amount or to show total sales in excess of $9.99.

1.2 It is ironic in retrospect that gasoline selling at fifty cents a gallon was not a triggering mechanism for retail conversion planning given OPEC's pricing proclivities.

1.3 In 1974, the Veeder-Root Company and others were invited to make a presentation to the National Conference of Weights and Measures on the "Gasoline Dispensing Problem."

1.4 Following that meeting the dispensing problem was temporized with a recommendation by the Conference addressing the short-term problem and recommending a course of action over the long run. In essence, the recommendations were:

1.4.1 The Office of Weights and Measures' memorandum of December 6, 1974 recommended setting the variator price per gallon indicator at one-half the unit price until modifications could be made. Known as the "half pricing" option, this method caused the displayed sales amount to be one-half of the actual amount.

1.4.2 The appropriate modification of gasoline dispensers would be to extend the variator[1] capability to 99.9 cents and a four-wheel ($99.99) total transaction indication.

1.4.3 The Conference's long-range recommendation was and still is to encourage the American Petroleum Institute to initiate necessary action to foster the adoption of the metric system throughout the petroleum industry.

1.5 The first two options were implemented. One-half gallon pricing was applied on an interim basis until the four-wheel, full range computer could be installed.

1.6 By 1979, one-half gallon pricing had been virtually eliminated by equipment conversion and station shut-downs. However, the proposed long-range solution was another matter.

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[1]Variator: the price setting mechanism of the computer.

1.7 Although the American Petroleum Institute had been urged to take immediate steps to initiate the use of the metric system throughout the industry, there were circumstances that made such unilateral action impractical. The most obvious factor inhibiting the use of the metric system was the uncertain cost of total conversion and concern that such action might be construed as a violation of the anti-trust laws. Also, there was little public understanding or concern that gasoline would ever reach one dollar per gallon.

1.8 The American Petroleum Institute began as early as 1974 to evaluate plans for an industry-wide metric conversion. However, planning for a change on the scale of metric conversion proceeded slowly. The complexity of the change inhibited progress and the spectre of public suspicion, supply disruptions and competitive pressures led to divergent priorities among API's member companies.

1.9 The world political situation again destabilized crude oil prices in late 1978. A civil war in Iran halted the export of crude. OPEC acted to limit production and to recover income lost through inflation.

1.10 Thus, the cost of a gallon of gasoline again reflected the harsh reality that fifty percent of America's oil was imported. Prices escalated in all consuming countries, with the United States seeing about a thirty percent increase in gasoline cost over five months.

1.11 Among the first states to become alarmed over the prospect of one dollar a gallon gasoline were California and Hawaii. The California Metric Conversion Council met in Sacramento on March 30, 1979, with members of the petroleum industry, petroleum dispensing equipment manufacturers, the press, state government officials and others in attendance to discuss the possibility of sale of motor fuel by the liter.

1.12 Information was presented which suggested that the cost of conversion of older pumps to dispense by the liter was fifty dollars ($50.00) per hose, while conversion to dispense by the gallon at prices to $1.999 per gallon was approximately two hundred fourteen dollars ($214.00) per hose.

1.13 The outcome was a six to five vote by the members of the Council recommending conversion to liter pricing of all of the state's gasoline dispensers. Industry representatives were also asked to validate the data presented and to return on April 10 with additional information.

1.14 On April 4, 1979, an emergency meeting of the United States Metric Board's Executive Committee (USMB) was held. It was agreed that the issue of conversion and California's efforts to deal with it should be placed before the full U.S. Metric Board during its April 5th meeting in Washington, D.C. and examined as an issue of imminent, national importance.

1.15 It was further decided that staff of the USMB would attend the scheduled April 10th meeting of California's Division of Measurement Standards to be held in Sacramento.

1.16 On April 5th, when the U.S. Metric Board opened discussion on the issue, the situation was as follows:

1.16.1 The price of gasoline had increased to over $1.00 per gallon in at least two areas (Chicago and Honolulu) and might reach that level in other locations in the near future.

1.16.2 With the exception of newer electronic, digital read-out pumps, most service station pumps in the country required equipment conversion to compute fuel sales at prices in excess of 99.9 cents per gallon. Various sources quoted a Wall Street Journal article estimated that there were approximately one million of these older type pumps in service.

1.16.3 While accurate sales of gasoline at the retail level are a responsibility of State weights and measures authorities and State revenue authorities (sales and state gasoline tax), the actual retail price and allocation of supplies are controlled by the U.S. Department of Energy's Federal Energy Regulatory Commission (DOE-FERC).

1.16.4 Whenever the retail price exceeds 99.9 cents per gallon, as seems probable, the following dispensing alternatives are theoretically possible for older pumps equipped with mechanical registers:

1.16.4.1 Pricing by one-half gallon units. This procedure, which requires all displayed prices to be multiplied by two by the attendant and consumer, was used several years ago when pumps were unable to meter in excess of $10.00 or a unit price in excess of 49.9 cents per gallon. Most states feel that this was an unsatisfactory procedure and if permitted to occur again it should only be allowed as a temporary expedient.

1.16.4.2 Conversion of the pumps to sell by the liter.

1.16.4.3 Conversion of the pumps to sell by the gallon at prices in excess of $1.00.

1.16.4.4 Conversion of pumps to sell by the quart.

1.16.4.5 Convert the computer to calculate whole number prices, dropping the tenths.

1.17 After examining this background, the Board then had to make a final policy judgment as to whether the situation was of local or national importance. If of national significance, then the situation should engender the Board's involvement in carrying out the national policy, as stated in Public Law 94-168, the Metric Conversion Act of 1975, "to coordinate the voluntary conversion to the metric system." To do this the Board is authorized to hold hearings and provide an opportunity for interested groups to submit comments.

1.18 The USMB decided that a national issue existed which had definite metric ramification, and scheduled hearings to be held in Washington, D.C. on May 2 and 3. The purpose of the May hearings was to gather pertinent information from the broadest possible spectrum of interested persons and groups so as to inform the public concerning the options for modifying retail gasoline pumps throughout the nation as retail prices exceed the 99.9 cent per gallon pump registration limitation.

1.19 The hearings were held in a non-adversary style with testimony received from twenty-three witnesses who represented industry associations, equipment manufacturers, the Department of Energy, oil companies, wholesalers, retailers, weights and measures spokespersons, and consumer organizations.

1.20 This report summarizes testimony presented and evaluates pertinent data and information derived from the hearings. This report was prepared for consideration by the United States Metric Board at its forthcoming 22-23 June meeting in Boston, Massachusetts.

2.0 WITNESS SELECTION

2.1 Despite initial indications that conversion to metric units of sale (liters) appears cost beneficial, the Board was concerned that there was a very low level of public awareness of the underlying technical issues for immediately dealing with the situation.

2.2 The Board also felt that the advantages and disadvantages of each technically feasible conversion option would be viewed differently by different interest groups. With this in mind, the Board directed the staff to invite testimony from representatives of all affected parties at hearings to be held within thirty days of the resolution. Subsequent invitations were provided to the major oil companies, gasoline distributors, retail gasoline station operators, pump equipment manufacturers, state and federal regulatory agency officials and domestic and international representatives of the consuming public.

2.3 The witnesses were grouped to facilitate orderly understanding of their constituency interest. In some cases prospective witnesses declined to accept the invitation to testify. All scheduled witnesses were invited to submit information for the public record. The invitation to testify for the record was given broad dissemination through news releases, a public hearing announcement published in the Federal Register and through public notices published in major newspapers.

2.4 INDUSTRY ASSOCIATIONS

2.4.1 The American Petroleum Institute, a non-profit national trade association, was asked to provide an overview of the petroleum industry marketing elements which would be impacted by metric conversion at the retail level, with emphasis on status and outlook for metric conversion.

2.4.2 The American National Metric Council, a private, non-profit organization which serves as the focal point for industry coordination in metric conversion, was asked to testify in order to identify potential impediments to conversion, establish the current status of metric conversion activity broadly across the petroleum and natural gas sectors, and to outline plans and interfacing problems envisioned in metric conversion.

2.5 EQUIPMENT MANUFACTURERS

2.5.1 Representatives of the nation's major fuel dispenser manufacturers and the dominant manufacturer of computing

mechanisms for dispensing units were invited to testify and provide detailed data concerning the cost of modifying pumps, estimated life cycle of existing equipment, capabilities of new equipment being marketed, installation costs and lead-time requirements, production capacity of the manufacturing companies, equipment sales trends and other information relevant to any conversion.

2.6 FEDERAL AGENCIES

2.6.1 All federal agencies were notified of the Public Hearing and asked to provide testimony or information for the record. Special efforts were made to obtain testimony from those agencies whose responsibilities or regulations directly or indirectly stimulate or restrain conversion of retail pumps to metric. Agencies having major impact included the Department of Energy, Federal Trade Commission, Small Business Administration, Environmental Protection Agency and the U.S. Office of Consumer Affairs. The Metric Commission CANADA was also invited to provide information about the ongoing conversion of retail dispensing from Imperial gallons to liters in Canada.

2.7 OIL COMPANIES

2.7.1 To gain balanced perspective from the industry on how pump modification might occur and how various options might affect their operations, a representative cross-section of national and regional petroleum marketing companies was invited to testify. The oil companies were asked about the cost-effectiveness of conversion, public acceptance, lead-time requirements, accounting and inventory considerations, and the implications of conversion on market acceptance and competition.

2.7.2 Included among the witnesses were two oil companies with nationwide marketing operations (Exxon and Shell), an East Coast company with unique experience in metric marketing (Sunoco), a West Coast company with immediate proximity to the dollar-plus pricing dilemma (Chevron) and a Mid-West company with information about consumer attitudes toward marketing motor fuel in liters (Amoco).

2.7.3 Other companies which were unable to participate were invited to submit written testimony for the record.

2.8 WHOLESALER/RETAILER

2.8.1 Representatives of organizations whose members directly retail petroleum products to the consumer, such as jobbers,

branded and unbranded dealers, independent marketers and operators of retail chains were invited to discuss the impact of pricing at levels exceeding one dollar ($1.00) per gallon. They assessed such issues as customer reaction, employee training costs, posting practices, competitive considerations, capital costs and other factors that might impinge on the operations of small business

2.8.2 Several principal retail/wholesale dealer associations did not supply witnesses because they had insufficient time to arrive at a consensus among their members. They were encouraged to submit written testimony for the record.

2.9 WEIGHTS AND MEASURES

2.9.1 Because state and local laws and regulations govern the retail dispensing of gasoline, representatives of the National Conference of Weights and Measures (an organization of state and local Weights and Measures officials) and representatives of the states of Hawaii and California were invited because of imminent dollar-per-gallon pricing. The Board specifically requested testimony from Hawaii because that state has recently eliminated impediments to metric measurement at the retail level. California, which has permitted gasoline to be sold both by the gallon and the liter since 1976, held recent public meetings on the consensus issue. All other states were invited to submit comments for the record.

2.10 CONSUMER ORGANIZATIONS

2.10.1 Consistent with the policy of seeking participation by consumer organizations in metric conversion programs, the Board invited major national-interest groups to offer testimony. These included the President's Office of Consumer Affairs, consumer affairs offices of government agencies, and groups representing automobile owners, farmers, trade unions, truckers, and others. A representative of a Canadian Consumer Group was also invited to review current liter fuel dispensing experience. In addition, advertisements were placed in newspapers in major cities throughout the United States to announce the hearings and to solicit written comment from consumers and other interested parties not able to attend. The Board allocated travel funds to encourage participation by consumer representatives.

2.10.2 A number of consumer organizations were unable to attend due to their active involvement with other energy issues. These groups were, however, invited to submit written testimony for the record.

## 3.0 AGENDA

3.1 The following material presents the hearing agenda verbatim. An alphabetical identification follows the corporate witness listing. This letter is used to identify the witness testimony analysis and summary included in this report.

**UNITED STATES METRIC BOARD**

Suite 600
1815 North Lynn Street
Arlington, Virginia 22209

United States Metric Board Public Hearing
Auditorium, Office of Personnel Management
1900 E Street, N.W., Washington, D.C.
May 2-3, 1979

AGENDA

May 2, 1979

| | |
|---|---|
| 9:00-9:15 a.m. | Opening Remarks<br><br>United States Metric Board:<br>Chairman Louis F. Polk |
| 9:15-9:45 a.m. | American Petroleum Institute: (see "A")<br>Mr. Brice Cecil, Director of Marketing |
| 9:45-10:15 a.m. | American National Metric Council: (see "B")<br>Mr. Roy P. Trowbridge, Member, Board of Directors |
| 10:15-10:45 a.m. | The Gasoline Pump Manufacturing Industry: (see "C")<br>Mr. Walter Gerdom (Tokheim Corporation)<br>Chairman, Weights and Measures Committee<br><br>Mr. George Swick (Bennett Pump Company)<br>Chairman, Technical Committee |
| 10:45-11:15 a.m. | Veeder-Root Company: (see "D")<br>Mr. R. Huckman, Vice President and General Manager, Petroleum Division<br>Mr. Alfred C. Evans, Director of Engineering, Petroleum Products<br>Mr. Robert Nix, Marketing Department |
| 11:15-11:45 a.m. | U.S. Department of Energy: (see "E")<br>Mr. James Kelly, Deputy Assistant Administrator for Regulations and Emergency Planning, Economic Regulatory Administration |
| 11:45 a.m.-<br>12:15 p.m. | Chevron, U.S.A.: (see "F")<br>Mr. Glenn W. Billman, Manager, Operations, Planning and Analysis-Marketing Operations |

| | |
|---|---|
| 12:15-2:00 p.m. | Recess |
| 2:00-2:30 p.m. | Exxon Company, U.S.A.: (see "G")<br>Mr. Alexander Ada, Distribution and Engineering Manager-Marketing |
| 2:30-3:00 p.m. | Mobil Oil Company: (see "H")<br>Mr. J. B. (Joe) Hinton, General Manager, Planning and Financial Analysis-Marketing |
| 3:00-3:30 p.m. | Amoco: (see "I")<br>Mr. Ronald H. Berlind, Director, Marketing, Planning and Evaluations |
| 3:30-4:00 p.m. | Shell Oil Company: (see "J")<br>Mr. C. L. Van Inwagen, Staff Engineer, Retail and Commercial Engineering Marketing |
| 4:00-4:30 p.m. | Sunmark Industries: (see "K")<br>Mr. Stewart W. Nystrom |
| May 3, 1979 | |
| 9:00-9:15 a.m. | Opening Remarks<br><br>United States Metric Board:<br>Chairman Louis F. Polk |
| 9:15-9:45 a.m. | Independent Gasoline Marketers Council: (see "L")<br>Mr. Jack Blum, Blum and Nash |
| 9:45-10:15 a.m. | Society of Independent Gasoline Marketers: (see "M")<br>Robert Cavin, Executive Director |
| 10:15-10:45 a.m. | U.S. Office of Consumer Affairs: (see "N")<br>Mr. Rodney Leonard, Deputy Director |
| 10:45-11:15 a.m. | International Association of Machinists: (see "O")<br>Ms. Barbara Shailor, Legislative Representative |
| 11:15 a.m.-1:00 p.m. | Recess |
| 1:00-1:30 p.m. | New York City Department of Consumer Affairs: (see "P")<br>Mr. Bruce C. Ratner, Commissioner |
| 1:30-2:00 p.m. | Conference of Consumer Organizations: (see "Q")<br>Mr. Louis S. Meyer, Chairman, Steering Committee |
| 2:00-2:30 p.m. | Suffolk County (N.Y.) Department of Consumer Affairs: (see "R")<br>Mr. Anthony F. Apollaro, Commissioner |

| | |
|---|---|
| 2:30-4:00 p.m. | National Conference on Weights and Measures: (see "S")<br>Mr. Kendrick J. Similia, Chairman |
| | State of California: (see "T")<br>Mr. Ezio Delfino, Chief, Division of Weights and Measures |
| | State of Hawaii: (see "U")<br>Mr. George E. Mattimoe, Deputy Director, Division of Measurement Standards |
| 4:00-4:30 p.m. | Metric Commission Canada: (see "V")<br>Mr. Cliff Leon, Petroleum Sector Chairman |
| 4:30-5:00 p.m. | Consumers Association of Canada: (see "W")<br>Mr. Nicholas Murray |

4.0 SUMMARY OF TESTIMONY: GASOLINE PUMP CONVERSION

4.1 American Petroleum Institute ("A"). (Mr. Brice Cecil, Director of Marketing.)

4.1.1 API reports that a consensus does not exist on the issue of gasoline pump conversion among its 7,500 members, of whom more than 700 are primarily interested in petroleum marketing. These include dealers, oil jobbers, independent marketers and commission agents, as well as integrated oil companies. API does, however, support voluntary conversion to the metric system under Public Law 94-168.

4.1.2 There are more than 170,000 service stations whose primary business is retailing gasoline, and over 300,000 total locations where gasoline is sold. Approximately 3.5 percent of these are owned and operated by major refining companies. Tens of thousands of individual owners will be affected by any conversion of gasoline pumps to metric measurement.

4.1.3 Tax laws, weights and measure laws, price posting laws, and other federal, state and local regulations may inhibit any conversion, since most existing regulations are based on gallon measurement.

4.1.4 In the absence of any economic incentive to undertake conversion, the inconvenience seems unjustified.

4.1.5 API expressed no preference for a single conversion option. Gasoline may be marketed by as many as three different options at the same time.

4.1.6 About three years may be needed for conversion to any preferred system.

4.2 Analysis of testimony (API).

4.2.1 Mr. Cecil's testimony addressed only the structure of API and the petroleum marketing hierarchy. He identified the known problem areas concerning gallon laws and regulations for additional study.

4.2.2 Mr. Cecil declined to comment on any option preference and avoided any direct statement beyond briefly explaining the API policy on metrication. Discussion of method of pricing was avoided, as Mr. Cecil alluded to concern that API members might indirectly be drawn into violation of anti-trust law.

4.3 American National Metric Council ("B"). (Mr. Roy Trowbridge, First Vice Chairman of the Board.)

4.3.1 ANMC believes that metrication is everybody's business, that it requires consensus by the organizations that must implement the conversion, and that the affected organizations should make the decisions on the timing and extent of these conversions.

4.3.2 No rash action should be taken in this area; coordinated plans for a long-range solution that will maximize benefits and minimize undesirable effects are of paramount importance. Several months will be required to develop such plans, and an interim solution such as half-pricing will be required. Thorough study of these issues and the impact of conversion on affected parties is essential.

4.3.3 Myriad taxing regulations and weights and measure laws must be identified, studied and changed as necessary, a prodigious task since as many as 1,300 laws may be involved.

4.3.4 A program to assure public understanding of metric conversion in this area will be vital to consumer acceptance.

4.3.5 The ANMC could expand its current capabilities in this area to prepare such a plan, working with all the affected parties. ANMC believes a progress report on this effort could be made to the U.S. Metric Board in six to nine months.

4.3.6 Five options exist: sale of gasoline by liters, quarts or half-gallons; deletion of tenth's of a cent on the price; and conversion of pumps to register prices above $1.00 per gallon.

4.3.7 As a personal opinion, Mr. Trowbridge stated conversion to liters will occur eventually, and that ANMC should be working in that direction at the present time.

4.4 Analysis of Testimony (ANMC).

4.4.1 Mr. Trowbridge spoke about a plan he thought could be developed by a broadened ANMC sector committee. No details of the plan were presented. (See 4.3.5)

4.4.2 Given the rate of increase of gasoline prices to near (or over) the $1.00 per gallon level, the study would appear likely to be concurrent with the over $1.00 per gallon pricing level. The ANMC umbrella structure would certainly add legitimacy to such a study and plan.

4.4.3 The testimony revealed a willingness on the part of ANMC to cooperate fully with USMB and assist in any further studies.

4.5 Gasoline Pump Manufacturers Association ("C"). (Mr. Walter Gerdom, Chairman, Weights and Measures Committee, Gasoline Pump Manufacturers Association, and Manager of Technical Services, Tokheim Corporation; Mr. George Swick, Chairman, Technical Committee, GPMA, and Director of Engineering, Bennett Pump Company.)

4.5.1 Tokheim, as a supplier of dispensers, has no formal position for or against metrication. It supplies equipment able to measure in either metric or customary units.

4.5.2 There is increasing interest in electronic digital computers for gasoline pumps. These are able to record prices up to $9.99 per gallon. Technology and cost may preclude this solution.

4.5.3 When customers request metric gear conversion boxes on new production pumps, as they have increasingly during the past year, these are being supplied. There are, however, models currently in use which cannot effectively be converted. If the model is of recent vintage, conversion is usually possible.

4.5.4 There is no conversion kit for half-gallons or quarts at the present time, to the best of Tokheim's knowledge.

4.5.5 There are seven companies in the Gasoline Pump Manufacturers Association that supply from 80,000 to 100,000 hose outlets (individual hoses, regardless of the number of cabinets) each year in the United States. The average life of these systems is about eight to ten years, depending on use and maintenance.

4.6 Analysis of testimony (GPMA).

4.6.1 Mr. Gerdom prefaced his formal remarks by stating that his comments reflected the viewpoint of his company, rather than the GPMA, due to an inability to obtain a timely consensus poll. His formal remarks consisted only of a statement concerning his company's position as sales-oriented, and that it would fulfill customer needs, metric or otherwise. Mr. Swick reiterated Mr. Gerdom's choice of a neutral position. Both individuals, as representatives of sales-oriented

companies, stated willingness to cooperate as necessary or requested with regard to problem solution. Answers to questions concerning preference of options, numerical data on hose population and conversion capability of devices were avoided. The seven-member GPMA is a non-concensus organization on this hearing issue, as are the two companies represented.

4.7 Veeder-Root Company ("D"). (Mr. Robert Huckman, Vice President and General Manager.)

4.7.1 Veeder-Root manufacturers mechanical computers used to post prices and calculate transactions on retail gas pumps. About 400,000 such computers can be manufactured annually at present in the United States, and the company is increasing its production capacity. It also produces computers overseas for international markets, and the company participated in planning and providing equipment for the metric conversion now taking place in Canada.

4.7.2 Computers capable of handling prices above $1.00 a gallon are available now. Over 100,000 such computers are in the field already, and an additional 400,000 to 500,000 can be produced to meet market demand within the next twelve months.

4.7.3 About three years would be required to replace all of the computers in use with models able to calculate prices up to $1.999 per gallon.

4.7.4 A metric conversion gearbox is also available for these new computers and for four-wheel computers now in use. About thirty percent of existing pumps have three-wheel computers (showing only $9.99 or $14.99 total sale) and cannot use this conversion gearbox. Conversion of these computers would require additional modification to the computer mounting plate, which is part of the gasoline pump.

4.7.5 A computer which can calculate above $1.00 per gallon prices and which can be converted to metric measurement offers the best solution for both the short and the long term.

4.7.6 Because a large number of computers can be delivered to high price areas in a short period of time, Veeder Root believes that only a limited use of half-price posting will be required.

4.7.7 The primary role of Veeder-Root is that of an equipment supplier. The company will be willing to develop and manufacture any equipment that is necessary to meet an industry need, if this equipment is within its production capability.

4.7.8 The list price of the new VR-2002 computer (able to register prices up to $1.99 per gallon) is one hundred eighty-four dollars ($184.00); the metric gearbox conversion lists at twenty-four dollars ($24.00).

4.8 Analysis of testimony (Veeder-Root).

4.8.1 Veeder-Root has resolved the pricing and/or metric problems by designing and producing computers with $1.99 unit pricing and metric conversion capability. This capability was in response to customer requests.

4.8.2 Testimony cautioned against "quick fixes" for any conversion and rejected, as too involved, the options for half-gallon, quart or whole-cent pricing.

4.8.3 Preference for solution was to convert for both above dollar a gallon pricing and metric conversion capability. This selection reflects the greatest utilization of Veeder Root manufacturing capability which was reported as also being production demand.

4.8.4 Willingness to participate in an expanded ANMC petroleum sector committee was indicated.

4.9 U.S. Department of Energy ("E"). (Mr. James Kelly, Deputy Assistant Administrator for Regulation and Emergency Planning, Economic Regulatory Administration.)

4.9.1 To sell gasoline in liters, amendments to petroleum price and allocation regulations scheduled to expire on September 30, 1981, would be required. A number of petroleum products have already been deregulated, however, and deregulation of gasoline may occur before the expiration date. Because an interim change to liter pricing would require an increase in paperwork, industry and government may resist such a move. These regulations are complex.

4.9.2 Legal gasoline prices in the United States are not likely to exceed $1.00 per gallon on a general basis in 1979.

4.9.3 DOE information-gathering people would like to have dual reporting for a period of time, as part of any transition to metric measurement.

4.9.4 Dual reporting and computation may be viewed as unduly burdensome by some in industry.

4.9.5 DOE could contribute by review and possible modification of present regulation features which could act as barriers to metric conversion.

4.9.6 Information to define geographic areas associated with the price crisis was requested, and what data DOE has available was promised to be furnished.

4.10 Analysis of testimony (DOE).

4.10.1 Mr. Kelly was restrained in answering questions of Board members following the formal testimony. He claimed to be at the hearings in an informational capacity only, in order to field questions that might in any way relate to a policy decision or elsewhere within the Department.

4.10.2 The cost of DOE regulation changes might be considerable (see page 92 of the transcript). It was clear that no work on this issue has been done within DOE to date.

4.10.3 The Department of Energy area of responsibility is price and allocation control. If instructed to help on the conversion process, it appears they will cooperate.

4.10.4 The DOE metric policy exists only in draft form and has not been officially approved.

4.11 Chevron, U.S.A. (domestic arm of Standard Oil Company of California) ("F"). (Mr. Glenn W. Billman, Manager of Operations, Planning and Analysis.)

4.11.1 The total costs of metrication are greater than the discreet labor and material costs that are incurred in converting the pumps in the station. Further, if metrication at the station level forced metrication further up the product distribution chain, such extension would cause major problems for Chevron and increase the costs involved.

4.11.2 Changing equipment to accommodate liter pricing cannot occur in isolation, but requires many changes and actions, each with its own costs. This change will, for example, affect the way Chevron U.S.A. collects and accounts for taxes, invoices its dealers, reports its operations to government agencies and carries out many of its other activities. The sum total of these charges is most significant, involving customers, dealers, employees, etc. They will require thought, planning, training and implementation, all coordinated with a public relations and education effort to minimize adverse reaction.

4.11.3 Half-price posting at the pumps appears to be a practical interim solution to the industry's pricing problem. That would provide time for rational decision-making with regard to the best long-term solution for both public and industry interests.

4.11.4 Mr. Billman stated that Chevron studies confirm that converting station pumps to liter measurement is the least costly alternative of which they are aware.

4.11.5 The conclusions of the aforementioned studies, according to Mr. Billman, rest on three basic assumptions, the significance of which was explained (see 4.11.6, below).

4.11.5.1 That justification exists for selecting the liter as the unit volume for sales rather than some even gallon fraction;

4.11.5.2 That metrication will not be required further up the distribution chain; and

4.11.5.3 Passage of mandatory (Mr. Billman's emphasis, see page 110 of the testimony) federal or state legislation requiring metric sale of petroleum products through service stations after a given date, and uniformly for suitable geographic areas.

4.11.6 The first assumption is of import because a quart or a half-gallon conversion would cost about the same as a liter and would involve even more simple ancillary charges. The second would minimize changeover activities and expense. The special significance of this assumption relates primarily to the large costs and difficulties, and small benefits of modifying complex computer programs; and the third is considered by Chevron U.S.A. to achieve greater customer acceptance and minimize any changeover inequity to the parties involved.

4.11.7 Mr. Billman believes that adequate lead time will be needed before establishing a cutoff date to permit orderly conversion preparation in terms of (a) equipment availability, (2) appropriate tax adjustments, and (3) education of all affected parties.

4.11.8 Chevron U.S.A. would limit the impact of station metrication by providing expanded dealer invoicing, as required, prior to the switch date (presentation of dual units).

4.11.9 Mr. Billman added, during the question-answer period, several comments to his prepared testimony:

4.11.9.1 (1) One additional method for handling the gas pump price limitation would be to set the meter to read only the cents per gallon (i.e., no dollar amount), then add the number of dollars that correspond to the gallons. There would, he commented, have to be some understanding of this additional element. (No mention was made of problems that might occur when fractional gallons were metered.)

4.11.9.2 (2) Conversion costs, clearly a "nonproduct cost," would ultimately be borne by the consumer.

4.11.9.3 (3) Chevron Canada, Ltd., a subsidiary of Chevron U.S.A., is involved in the Canadian metrication program, during which they had a substantial program of customer education. Standard Oil Company of California also operates through Caltex in Australia.

4.11.9.4 (4) Estimated that twenty-five percent of their customers (no details given on this statistic) would prefer pricing purchase in customary units, which is why he believes any conversion should be mandatory for fairness' sake.

4.11.9.5 (5) Given no mandatory conversion to liter gasoline sales, Chevron U.S.A. would probably continue gallon sales as long as possible. Subsequently, they would probably choose an even fractional gallon volume unit.

4.12 Analysis of testimony (Chevron).

4.12.1 Testimony was directed primarily to the liter conversion option and the identification of problems that would certainly be encountered with metrication.

4.12.2 A consumer awareness program established for the metric conversion in Canada included mailers in credit card billings to customers and seminars for Chevron, Ltd. dealers, agents and employees.

4.12.3 It was emphasized that there was no intent on the part of Chevron U.S.A. to act as a leader for metrication, but rather a willingness to go second or third if conversion is voluntary.

4.12.4 A portion of the testimony dealt with the extensive costs of accounting records, stock and inventory control systems and management reporting systems which are computerized on the gallon basis. The desire for metrication not to reflect back from the service station level was expressed.

4.13 Exxon Corporation U.S.A. ("G"). (Mr. Alexander Ada, Distribution and Engineering Manager-Marketing.)

4.13.1 Mr. Ada concluded his written statement with a rather concise summary. After evaluating the potential equipment conversion alternatives and their assessment of lead time, consumer impact and economics, Exxon began installing dual capability computers starting late in 1978. Mechanical computers can meter in gallons, but are equipped for later liter conversion. New computers will be installed on a normal replacement basis

to meet future needs. Exxon sees the opportunity to use the available lead time of up to five years to amortize existing investments, prepare the consumer for metrication and allow for change in existing laws and regulations. The corporation believes that only minimum use of half-pricing will result from this plan.

4.13.2 Testimony mentioned relevant aspects of the Metric Act (Public Law 94-168) which Exxon believes should be implemented prior to conversion of gasoline sales to liter measurement, viz., (a) timely amendment of existing laws and regulations by DOE, the Office of Weights and Measures, and federal, state and local tax agencies, (b) coordination of conversion plans implementation, and (c) assistance to the public in preparation for metrication.

4.13.3 The three key issues pertinent to retail gasoline sales' metric measurement are (a) conversion lead time, (b) anticipated consumer reaction, and (c) the economic aspects of such conversion.

4.13.4 Exxon, on advice from suppliers and installation contractors, estimates a minimum of three to five years to acquire and install requisite conversion equipment. This range takes into account (a) supplier and contractor need, (b) time for laws and regulations amendment, (c) taxing considerations, and (d) impact on upstream measurement practices. Half-pricing appears to be the most practical alternative for the interim transition period.

4.13.5 Consumer reaction must be handled very carefully. According to Mr. Ada, a recent Gallup poll indicates lack of consumer preparation for a successful conversion. In the current environment, the consumer might view the change as a concealed price increase.

4.13.6 Exxon's metric conversion studies indicate an added cost of about seventy-five dollars ($75.00) per new pump computer to continue gallon pricing but provide for liter sales. This estimate assumes (a) upgrading of existing computers during normal maintenance replacements, (b) a cost of one hundred dollars ($100.00) for installed metric conversion kits (including $50.00 extra for calibration, and pump face and price sign modification), and (c) non-convertibility of some older model pumps, requiring computer replacement. Also, existing computers running at high speeds may fail prematurely or require excessive maintenance compared to newer-model computers.

4.13.7 During the question-answer period following the formal testimony presentation, Mr. Ada made it even more clear

(see pages 139-140 of the testimony) that this country would have to be much more prepared before Exxon would start moving to metric sales of gasoline. The corporation does not view liter measurement as a short-term solution for the equipment limitation (i.e., inability to post prices over $1.00 per gallon) currently predicted. Exxon believes it is (a) too costly, (b) the public is not ready, and (c) it would be clearly unproductive to the metric movement. Its plan is to keep going in gallons (see page 141 of the testimony).

4.14 Analysis of testimony (Exxon).

4.14.1 Mr. Ada's testimony emphasized that metrication can only be a long-term conversion process and should not be considered to be a solution to the current problem of greater than a dollar per gallon prices of gasoline. Half-pricing, with subsequent manual doubling of the amount of sale, was viewed as an acceptable transitional fix to provide the time needed for orderly equipment replacement or modification.

4.14.2 The seventy-five dollar ($75.00) cost associated with equipment modification for over dollar unit pricing and metric conversion is based on orderly replacement as required rather than a crisis situation.

4.15 Mobil Oil Corporation ("H"). (Mr. J. B. Hinton, General Manager, Planning and Financial Analysis-Marketing, U.S. Marketing and Refining Division.)

4.15.1 Mobil believes that metric conversion at the gasoline pump is a questionable short-term solution to the immediate pricing of over 99.9 cents per gallon gasoline. The corporation also believes that government regulations should permit various optional interim solutions to this problem until retail pump computers can be replaced with an orderly program which would include units able to price at more than $1.00 per gallon.

4.15.2 Any crash program to convert to metric now at the gas pump could add to gasoline costs, confuse the public and even cause objections by dealers. Further, if the oil industry does convert to metric eventually, Mobil does not believe that pump pricing in liters is the appropriate vehicle to bring about this change.

4.15.3 Mobil's position is based on six considerations, viz.: (a) to maintain a consistent measurement and pricing unit, metric pricing would have to be nearly simultaneous at

all service stations in any given market, (b) computer replacement in a staggered fashion, as dollar per gallon prices arrive, would extend the conversion time, (c) contractor availability will limit the conversion of pump computers, (d) metric conversion cost advantages are more complex than fifty dollars ($50.00) for a metric gearbox compared with two hundred dollars ($200.00) for a new computer, (e) public and dealer acceptance problems will take time and patience to overcome, (f) state and local regulations pertaining to pricing and taxation of gasoline would have to be converted to metric.

4.15.4 Details of each of these six considerations are discussed at length on pages 152-157 of the testimony. Of special significance was Mr. Hinton's estimate, on page 153, that nearly one-half of the 1.3 million computers in the U.S. retail outlets today are too obsolete to justify the cost of modification.

4.15.5 Mobil does not anticipate passage of federal preemptive legislation mandating metric conversion of retail gasoline pricing as a viable solution to this problem. Instead, the corporation feels that metrication is being facilitated by installation of equipment such as the Veeder Root 2002, with optional metric pricing capability, so the industry will be ready when metric becomes the national standard.

4.15.6 The question of gasoline pump contractor resources and their availability market by market was discussed. Details of obtaining information were left to staff interaction later with Mr. Hinton. Mobil also responded to another question by stating that by the end of 1981 their own conversion program would be completed. It was started in 1978 and they now have 4,000-5,000 Veeder Root 2002 units in place. Large additional orders have been and will continue to be placed. They do not wait until their computers wear out.

4.16 Analysis of testimony (Mobil).

4.16.1 The Mobil testimony reflects a desire to preserve the current gallon measurement through equipment conversion/ replacement to accommodate the over-a-dollar gallon price.

4.16.2 Concern was indicated for a crash metric conversion which would create increased gasoline costs, public confusion and dealer objections. Additionally, the spread of metric back to the wholesale terminal and bulk plant loading racks, at least, is considered inevitable.

4.16.3 The half-pricing option is considered as a temporary measure which would be preferable during the transition

period. This transition period is orderly, scheduled replacement biased only by market demand or priority.

4.17 Amoco ("I"). (Mr. Ronald H. Berlind, Director, Marketing, Planning and Evaluation.)

4.17.1 Amoco's testimony addressed three areas: (a) cost differentials between alternate solutions, (b) consumer acceptance, and (c) initiation of the change. These are discussed below, and at length in Amoco's presentation.

4.17.2 Regarding cost estimates, Amoco's are fairly consistent with previously published figures (not cited specifically). However, Amoco estimates that cost penalties stemming from metric deferral beyond a few years are about one-third higher than currently projected. At current prices they estimate a $13 million surcharge in order to make a two-stage conversion, as compared to a direct metric change alone.

4.17.3 Concerning consumer acceptance, Amoco's marketing research studies (not detailed further) show that seventy percent of the population is aware of the U.S. shift to metric. However, due to their lack of familiarity with metric units, they oppose gasoline sales conversion. The ratio of opposition is greater than four to one (see pages 172-173 of the testimony). Amoco studies also indicate that the gallon unit is not critical, or even significant, since most gasoline purchases (ninety to ninety-seven percent) are made in dollar amounts or fillups. This observation is reinforced by the recent successful metric conversion of Amoco's Australian affiliate.

4.17.4 Amoco's analyses led them to believe that the conversion task is too big for any one company or industry association to convert unilaterally, especially in light of the government, consumer and weights and measures units involved. In the absence of such leadership, companies such as Amoco will continue to implement higher cost solutions during the interim period prior to full adoption of the metric system. Amoco is now retrofitting pumps that permit over $1.00 per gallon pricing and which also have potential for metric conversion.

4.17.5 During the question-answer period following the formally presented testimony, Mr. Berlind indicated the following: (a) Amoco, at its present pace, believes they would be in a position to support a national metric policy (if adopted) by the end of 1981 based on their current installation rate of the Veeder-Root 2002 units, (b) Amoco stresses that a centrally coordinated effort is necessary to a successful

conversion program, (c) everyone must change at the same time, and (d) consumer education would probably involve a joint government and industry responsibility.

4.18 Analysis of testimony (Amoco).

4.18.1 Irrespective of any short-term strategy, Amoco assumes that there will eventually be a conversion to metric. They have, through a planned replacement program, implemented equipment conversion for over-a-dollar pricing and metric capability.

4.18.2 Leadership and a centrally coordinated effort are mandatory to a successful metric conversion program at the retail gasoline sales level. Education, customer acceptance, governing legislation and other considerations prevent any one company from undertaking the metrication conversion unilaterally.

4.18.3 Amoco would certainly be willing to participate in a coordinated effort leading to metric conversion.

4.19 Shell Oil Company ("J"). (Mr. C. L. Van Inwagen, Staff Engineer, Retail and Commercial Engineering Marketing.)

4.19.1 In February, 1976, Shell Oil Company started installing new electromechanical pumps and dispensers and replacement computers, with the metric gearbox added as a standard. This was done based on inflationary trends and an estimate of 1980 gasoline prices of over $1.00 per gallon. The company has continued to purchase the most modern equipment with a metric option as it becomes available. By January 1, 1980, through normal equipment maintenance programs, about fifty percent of Shell's approximately 65,000 computers will have the metric gear change box. Only about ten percent will have the Veeder Root 2002 computer.

4.19.2 Advantages and disadvantages of employing the metric system over the 2002 computer system were noted. The advantages were: (a) lower initial cost, and (b) a quicker time by a factor of two for conversion to metric. The limiting factor to make the change for either method will probably be the amount of contract labor available to do the work. The disadvantages of employing the metric system were: (a) change in financial systems (i.e., up the distribution chain, although Mr. Van Inwagen observed that this did not have to occur), (b) gear speedup in the computer leading to maintenance and calibration problems (Mr. Van Inwagen was not sure this problem would eventuate, either), and (c) conflicting state and local laws relating to metric sales.

4.19.3 Shell believes that metric conversion is inevitable, either at a $2.00 per gallon price for gasoline or following legislated metrication. Shell has strongly supported gasoline pump metric conversion in the past and continues to do so. They may not choose to make this change, however, if they are put at a competitive disadvantage because others are continuing sales in gallons.

4.19.4 During the question-answer period, Mr. Van Inwagen noted several different analyses of the current situation, but on one issue all seemed to agree, and that regarded the availability of contractors and equipment during a massive, short-term changeover.

4.19.5 Mr. Van Inwagen agreed with Exxon U.S.A. testimony that on a normal replacement basis the changeover incremental cost is not significant. Only in a crash or accelerated program do the costs approach those that people are discussing at these hearings.

4.19.6 Mr. Van Inwagen is of the opinion that if conversion were not mandated it could only happen by a coordinated industry effort. He believes that might present a significant problem in light of anti-trust problems (see page 211 of the testimony).

4.19.7 Mr. Van Inwagen also indicated strongly (see page 211 of the testimony) that if Shell dealers went metric independently they would probably be at a competitive disadvantage. His understanding, relative to this issue, was that in Canada independent gasoline dealers were going to wait until the last possible minute to go metric.

4.19.8 Mr. Van Inwagen doubts that the metric conversion could be accomplished either through ANMC, or as an industry or private marketing decision (see page 212 of the testimony) due to legal considerations.

4.20 Analysis of testimony (Shell).

4.20.1 The hardware is being put in place to allow for approximately fifty percent of the Shell-owned dispensing equipment to accept metric conversion by January, 1980. Only approximately ten percent would allow pricing up to $2.00 per gallon. This company strongly supports a coordinated, planned conversion to metric at retail gasoline outlets. The advantages for metric conversion outweigh the disadvantages and the accelerating costs and inflation are shortening the timeframe in which something has to be done.

4.21 Sunmark Industries (Division of Sunmark Company of Pennsylvania) ("K"). (Mr. Stewart W. Nystrom, Manager, Plants and Terminals.)

4.21.1 A series of tests conducted during 1974 in Philadelphia and Florida to test a Sunmark product called a "hundred-cent wheel" was discussed. Developed to solve the problem of the three-wheel gasoline computer that only registered to a maximum of $9.99, the "hundred-cent wheel" was a righthand wheel that read from 0 to 99 cents. Thus, the middle wheel of the computer would be the dollar wheel and the lefthand wheel the ten-dollar wheel.

4.21.2 In the tests described, a U.S. customary, as well as a metric, location was surveyed at each of four locations. During the test period, Opinion Research Corporation of Princeton, New Jersey was under contract to survey consumer reaction using polls of these conventional and metric-modified pumps. Polls were taken (a) a few weeks prior to the conversion, and (b) immediately following the switch and, in the case of the Pennsylvania locations, sometime later.

4.21.3 The most significant results of the polls relating to the liter tests were summarized by Mr. Nystrom as follows: approximately eighty percent of the people purchasing gasoline at the liter pump didn't care about, or favored, the change. For those disliking the change, the reasons cited were (a) confusion, (b) lack of knowledge about the metric system, and (c) occasional comments to the effect that "it's communistic" or some similar remark, but these are exceptional attitudes.

4.21.4 In the question-answer period following the formal testimony these points were brought out: (a) considerable advertising appeared in the local press, as well as at the service station, during the test, so some customers may have been attracted by the publicity, (b) no tests have been conducted since these, and (c) their Canadian marketers plan to delay the switch to metric as long as possible due to considerable consumer resistance to the metric system; they feel this change would result in a marketing disadvantage for them.

4.21.5 Sunmark Company of Pennsylvania has a unique pump, a blend pump, and the data presented this day relating to other oil companies does not apply to Sun and the blend pump. The conversion to metric for Sun equipment costs two hundred dollars ($200.00) because of the blend pump. Veeder Root is now in the process of finalizing a design for Sun for both over-a-dollar pricing and the metric conversion.

4.22 Analysis of testimony (Sunmark).

4.22.1 The unique blend pump (20,000) of Sun may make it unlikely that metric conversion could answer the question in pricing over $1.00 a gallon.

4.22.2 Questions regarding major preferences were not raised with this witness, but the preference for metric conversion for major projects was mentioned but was qualified: metric conversion would occur if there were little or no cost difference involved.

4.22.3 Testimony concerning the tests reflects little consumer resistance to metrics but did reflect dealer resistance in the Canadian market due to the disadvantage represented by consumer objections.

4.23 Independent Gasoline Marketers Council ("L"). (Mr. Jack Blum, General Counsel, Blum & Nash; chain station owners.)

4.23.1 Mr. Blum was against conversion at pumps (liter sales) due to the dampening effect on suppliers' price swings. He believes motorists respond to absolute price differences advertised, irrespective of volume unit (e.g., 2¢/gallon would lure them across the street; 1/2¢ per liter would not).

4.23.2 To drop 2¢ per liter below the majors would ruin their (independent) segment of the industry (i.e., 8¢ per gallon would be a disaster).

4.23.3 Mr. Blum canvassed members for opinions on this issue. They believe that there are other, better ways to solve the problem in that alternative solutions from independent tinkerers, who do not work for pump manufacturers and who have vested interests, may develop the best ideas.

4.23.4 Many small points were made, but Mr. Blum's bottom line for the many independent marketers he represents is this: the final solution should be gallons as the unit volume so the absolute price difference/unit volume appears to be relatively large.

4.23.5 If liter conversion is adopted, retailers should be required to post prices in gallons for several years at the minimum.

4.23.6 IGMC does not wish to be involved or assist in the problem of obtaining agreement on any approach to metrication due to anti-trust and other problems that were not ment-

4.23.7 Savings of $250 million in perspective of overall dollar costs for this industry are trivial. One cent per gallon is equivalent to $1 billion, approximately, annually. In the context of this industry, pump cost is essentially part of overall operating overhead.

4.23.8 Mr. Blum would like any conversion to be accomplished in a very short timeframe or, better yet, simultaneously, based on many factors (e.g., inventory control, stealing, poor employee quality, etc.).

4.24 Analysis of testimony (IGMC).

4.24.1 IGMC is against metric conversion at pumps in general. If it must be done, signs should be required which show gallon pricing also.

4.24.2 Mr. Blum's constituents compete by price. Only absolute price differential counts. Liter conversion would decrease this value to only one-fourth of the figure that is now shown.

4.24.3 Mr. Blum hopes this period of shortage will pass and that the price differential between independents and majors, which has recently vanished, will reappear.

4.25 Society of Independent Gasoline Marketers of America ("M"). (Mr. Robert Cavin, Executive Director.)

4.25.1 SIGMA members price gasoline under amount charged by major oil companies. They do not offer their own credit cards or national advertising. Their need is for uniformity in pricing. They would not pioneer in metric conversion. They feel consumers would buy gallons versus liters, leaving those selling at the latter volume at a competitive disadvantage.

4.25.2 They would support a uniform change to the metric system.

4.25.3 They do not favor a voluntary metric conversion, feeling it would lead to inconsistency, consumer confusion and further mistrust of the petroleum industry.

4.25.4 Additional pump maintenance or more frequent replacement costs associated with liter metering may make metric conversion costs higher and therefore closer to the costs of gallon metering, if gasoline sells over $1.00 per gallon.

4.25.5 Liter metering would eliminate the new sign costs associated with gallon pricing of gasoline over $1.00 per gallon, but it should also be borne in mind that there will be a cost associated with production of signs saying "liter."

4.25.6 Questionnaires were sent to the SIGMA membership regarding gas pump metric system pricing. The majority (60-65 percent) favored converting gas pumps to price per liter. However, they also favored amending existing regulations to allow retailers to pass through the costs of converting gasoline pumps. No details were given by Mr. Cavin, and none were requested, concerning the questionnaire.

4.25.7 If retail sales are in liters, Mr. Cavin recommends that purchases by the retailers (i.e., his constituency) also be in liters to minimize recordkeeping calculations for sales and purchases.

4.25.8 SIGMA membership represents 14,000-16,000 stations, with an average of 6-9 pumps per station.

4.26 Analysis of testimony (SIGMA).

4.26.1 There appears to be unresolved inconsistency in this testimony. On page 259, the speaker testifies that a substantial majority of SIGMA members (60-65 percent of those responding to a poll) favor converting the pumps to metric. The key to conversion is uniformity and consistency among states, federal government and the oil industry.

4.26.2 On page 260 of the testimony, in response to a question posed by Dr. Polk, Mr. Cavin states that as long as there is uniformity, he thinks that over the long term, from a maintenance and cost factor, they would be better off converting to the $1.99 per gallon program.

4.26.3 Perhaps in sub-paragraphs 4.26.1 and 4.26.2, above, one should distinguish between Mr. Cavin and the membership for which he is purportedly speaking. However, on page 263, in responding to a question by Mr. Nishimura, he states that he (as well as the SIGMA membership?) supports liter conversion, but only if it is based on the ability to pass through the costs of pump conversion. If that ability were not present, Mr. Cavin states he would take a different position.

4.27 The testimony of the five groups listed below, which represent the consumer, was studied and analyzed as a unit because its prime focus, as well as the constituency represented in each case, was the consumer. These groups are: (a) U.S. Office of Consumer Affairs, (b) International Association of Machinists and Aerospace Workers, (c) New York City Department of Consumer Affairs, (d) Conference of Consumer Organizations, and (e) Suffolk County (New York) Department of Consumer Affairs. The testimony of a sixth, non-American, consumer group, Consumers Association of Canada, appears separately starting at 4.46 on page 44. Testimony of individual representatives is reported after this unit analysis and commences at paragraph 4.27.6.

4.27.1 The testimony of these representatives of six consumer-related groups resulted in response to the gasoline pump metric conversion option ranging from quite positive to very negative, with intermediate attitudes. More specifically, the IAM representative was opposed to metric conversion, the New York City and Suffolk County spokespersons are opposed for the present, the Conference of Consumer Organizations is barely in favor, the U.S. Office of Consumer Affairs spokesman is clearly in favor, and the Consumers Association of Canada has, inasmuch as this is a U.S. issue, no comment on the advisability of the metric option.

4.27.2 Nearly all agree that metric education is a vital concern for a successful conversion; those opposed to the metric option, however, feel that consumer awareness is too underdeveloped to be considered, at least for the present. Those favoring the conversion option, whether now or in the near future, stress the emphasis that must be place on consumer education and training.

4.27.3 All consumer-oriented witnesses seem to be aware of the rough dimensions of the costs (and potential cost savings) involved in a metric conversion. For those opposed to conversion, these costs are stated in terms of a fraction of a penny per gallon, from 1/20¢ to 1/4¢, depending on whether or not capitalized. These costs were found to be insignificant when compared to the benefits of continuing gallon sales. These would maintain the price standard, encourage the likelihood of greater price competition, enhance the difficulty of corresponding percentage price rise and, further, it is easier to compute fuel economy, etc., in gallons. Those favoring conversion state the cost savings would be millions of dollars and minimize the attendant costs.

4.27.4 Finally, those opposing the metric conversion option cite the inopportune timing as reasons, as follows: (a) severe inflation, particularly in fuel pricing, and (b) consumer hostility or antipathy to change, with emphasis on big-government or big-company mandates, etc., and the potential for a consumer "rip-off" in a seller's market in the light of minimal metric education; a situation on which all agreed. Those favoring the conversion use these identical rising costs data to justify the need for the conversion savings (even if relatively small, they are substantial in absolute terms), particularly in association with appropriate consumer education.

4.27.5 A case for or against the gasoline pump metric conversion could be developed by arguments of these witnesses. It appears that the central issue is economic. The cost savings of $150 million are probably maximally stated and for a limited time only. They may occur now, but all pumps will require replacement within five to ten years. The costs are more difficult to state quantitatively and, it appears, could easily exceed the 1/20¢ to 1/4¢ per gallon cited if significant consumer deception or other untoward sales practices occurred with any frequency.

4.27.6 U.S. Office of Consumer Affairs ("N"). (Mr. Rodney Leonard, Deputy Director and Deputy Special Assistant to the President for Consumer Affairs; Mr. Charles R. Cavagnaro, Office of the Deputy Director.)

4.27.6.1 The main points of Mr. Leonard's testimony are:

4.27.6.2 (1) Most people argue that adding an unfamiliar measure (i.e., liter volumes) to an already unpopular action, which is dollar-plus gasoline) will make matters worse. The relevant facts should be studied. In Mr. Leonard's view these are: (a) most consumers purchase gasoline either in dollar amounts or by the tankful; in neither case is the unit of measure of utmost importance, (b) conversion to metric could avoid costs up to $150 million, which would otherwise be passed along to the consumer, (c) use of metric measurement is growing, and the country will eventually adopt this system, (d) the potential for abuse does exist (note the extremely unpopular wine and liquor industry metric conversion), and (e) even though metric conversion could be less expensive than other options, it is still a conversion; and it would minimize the appearance of price increases and price differences, thereby resulting in incorrect price signals.

4.27.6.3 (2) Based on the above facts, Mr. Leonard suggests the following minimum consumer safeguards if the U.S. Metric Board, as a result of the hearings, does recommend the conversion currently under study. Relevant considerations are as follows: (a) gasoline should be priced and sold by an even liter, although the meaning

of this proposal is not yet clear, (b) unit pricing of gasoline by the gallon, well displayed and well policed, plus prominent disclosure of the price per liter, (c) the 1/10¢ per gallon price increment will require customer attention (refer to page 273 of the testimony), and (d) information and education for consumers should be available to disclose fully to the public why such a massive change is required in the sale of such a visible product.

4.27.6.4 (3) With the consumer safeguards enumerated in (2), above, Mr. Leonard believes consumers could support metric conversion of gasoline. He urges the Board to gather all the facts and recommend action along these lines to the policy-makers (see page 274 of the testimony). Of the five options listed by Dr. Polk, he believes evidence points to conversion to the metric system as expeditiously as possible.

4.27.6.5 (4) The fact that metrication is occurring throughout the economy today with relatively minor problems indicates that the American consumer will support it, particular if the individual sees the potential benefits and understands the process. With effective consumer education, the time problem should not be very difficult.

4.27.6.6 (5) The Office of Consumer Affairs would be very happy to work with the Board in developing the kind of a program that would offer the Board all the support and assistance this office could provide.

4.27.6.7 (6) Mr. Leonard believes that, while gasoline prices tend to be very inelastic, they still do respond to economics. Based on this view, he does not visualize 4¢ per gallon price increases (i.e., 1¢ per liter) as a serious problem.

4.27.6.8 (7) Mr. Leonard spoke about a voluntary versus a legislated change. He stated that he does not think Congress would alter the legislation. Further, he stated that if consumers do not strongly object to liter sales, it can be done comfortably.

4.27.6.9 Mr. Leonard agrees with Board members that the sale of gasoline by the liter would be a major contribution to the Board's responsibility to educate the public about the metric system.

4.28 Analysis of testimony (USOCA).

4.28.1 Messrs. Leonard and Cavagnaro, particularly the former, indicated hopefully that gasoline prices still "...do respond to economics...."

4.28.2 A belief was extended that effective consumer education is the answer to potential gasoline metrication problems.

4.28.3 One witness believes that the expeditious conversion of liter sales of gasoline is the best current option despite negative public reaction on various metric issues exclusive of the alcohol conversion.

4.28.4 One witness was strongly convinced that (a) Congress will not legislate a mandatory gas pump conversion, and (b) the consumer could support metric conversion.

4.29 International Association of Machinists and Aerospace Workers (IAM) ("O"). (Ms. Barbara Shailor, Legislative Representative, testifying on behalf of the IAM president.)

4.29.1 Every poll that Ms. Shailor is familiar with indicates skepticism and anger between the public and the oil industry.

4.29.2 Following review of the basic arguments for voluntary conversion, Ms. Shailor stated that she was shocked that anyone would take seriously the argument that this conversion would save consumers $150 million. This, she said, must be put in the proper perspective of recent gasoline price increases (8¢ per gallon in the past three months, equivalent to approximately $8 billion in one year), whereas this "savings" is considerably less than 1/4¢ per gallon. The consumer savings rationale presented by the Board will not fly, she said.

4.29.3 The most damaging psychological impact of a metric conversion would be to completely camouflage the relative price, historically, of this basic commodity. Consumers would also have difficulty evaluating vehicle fuel economy.

4.29.4 Further, she believes that price competition would be affected negatively: a 1¢ per gallon differential would become 1/8¢ per liter (did she mean 1/4¢ per liter?). This is not a perceived savings for a consumer sufficient to cause him to travel to another gas station.

4.29.5 Ms. Shailor suggests that there are ways of beating the pump problem. She suggested elimination of the 1/10¢

pricing, but also that it be done by the government. In other words, let action be taken by the President, the Department of Energy or the Congress.

4.29.6 Ms. Shailor strongly suggests that additional consumer groups be allowed to testify before the Board. She had noted only one, among twenty-three witnesses, testifying at these hearings.

4.29.7 The IAM will offer no assistance in this effort because it is strongly opposed to this conversion. However, IAM can offer more detailed testimony to explain precisely the feelings of its one million members.

4.29.8 Ms. Shailor explained that her group's opposition to the metric conversion is based primarily on its relationship to the energy issue. First, they feel that the oil companies would take advantage of the situation. Second, IAM feels that consumers could not easily judge the relative cost of gasoline.

4.30 Analysis of testimony (IAM).

4.30.1 Ms. Shailor's testimony consisted of points made both clearly and in a straightforward manner. None seemed to be effectively challenged by any of the Board members during the question-answer period following her testimony. Ms. Shailor is on record, as the representative of her union, and to the extent she can speak for the Citizen-Labor Energy Coalition of which Mr. Winpisinger is president, as strongly opposed to this metric conversion.

4.30.2 The reasons stated for this position by Ms. Shailor are: (a) the claimed monetary savings of 1/4¢ per gallon are trivial, particularly when compared to recent gasoline price rises, the cost of loss of an historical price standard and the negative impact on price competition, (b) gasoline pump conversion would camouflage the relative historical price for this commodity, and (c) gasoline pump conversion to liters would have a negative impact on price competition.

4.31 New York City Department of Consumer Affairs ("P"). (Mr. Bruce C. Ratner, Commissioner, and Director of Weights and Measures for New York City.)

4.31.1 Mr. Ratner opposes conversion of gasoline pumps to metric conversion, at least for the present. Such a conversion

now would cause confusion and disruption, considering the rapid increase in gasoline prices, with particular emphasis on increases since the Iranian crisis.

4.31.2 Costs of metric conversion alternatives to registering gasoline at over $1.00 per gallon are possibly exaggerated. The real costs of these alternatives are worth the benefit of avoiding the confusion and deception-potential of hiding high prices (and price increases) in such an unfamiliar measure.

4.31.3 In his testimony, Mr. Ratner elaborated at some length on the following areas: (a) price comparisons would be more difficult since all gasoline stations would not be converting simultaneously, (b) liters could be used to camoflage price increases since a 1¢ rise in the liter price would be equal to nearly 4¢ per gallon, (c) his surveyors indicated to him a much greater degree of anger (true and real, not merely irritation or hostility) than normally observed in people responding to questions unrelated to the metric system. This observation related to all metric-associated questions, not just those touching on the sensitive topic of gasoline conversion, (d) consumers may buy more 26¢ per liter gasoline than $1.00 or more per gallon fuel, in the belief that a three-digit price hanging over a gasoline pump does not represent a deterrent; this misguided behavior is clearly undesirable, (e) the rounding off (to 9/10¢) practice could cost consumers an additional $120-140 million annually (see Mr. Ratner's computations in his prepared statement), (f) Mr. Ratner made reference to what he called the "metric rip-off" of the wine and spirits industry (referring to a metric rounding down at a price level that remained constant), (g) the costs of converting gas pumps to measure more than $1.00 per gallon are far lower, in the opinion of Mr. Ratner, than claimed; using capitalized pump costs over a five-year period, he estimated the capitalized costs at only about 1/20¢ per gallon, (h) the 1/20¢ per gallon is a small price to pay, in the opinion of Mr. Ratner, to retain the capability to make wise price comparisons at a time of rapidly rising prices; even the 1/20¢ per gallon cost may be overstated since many of the present computers would have to be replaced in any case, and (8) he claimed that great general confusion would be caused by a gasoline metric conversion now.

4.31.4 A metric conversion at the pumps, at the present time, would leave most of the remainder of the oil industry still in customary units. Gas pump conversion should proceed in concert with the remainder of the industry.

4.31.5 Additional conversion costs are those related to changes necessitated by appropriate federal, state and local regulations. Even if these costs are paid with tax dollars, they are still costs.

4.32 Analysis of testimony (NYC Consumer Affairs).

4.32.1 Mr. Ratner defended his contention that this is not the time for gasoline pump conversion to the metric system. His arguments related to the negligible per-gallon savings from such conversion, the resultant consumer confusion and disruption, the potential for future price increases greater by the liter than by the gallon and other disadvantages.

4.32.2 Mr. Ratner's presentation was partially quantitative, partially qualitative and, in both cases, not easily refutable in the question-answer period following his formal testimony.

4.32.3 While Mr. Ratner did not claim full prescience relating to this issue, he made a strong final argument in suggesting that with even a low-to-moderate probability (twenty to fifty percent) of the events he feared would occur, an inordinate risk would be incurred by converting now. In opinion, this is a high-risk, low-payoff situation.

4.33 Conference of Consumer Organizations (COCO) ("Q"). (Mr. Louis S. Meyer, *Chairman, Steering Committee.*)

4.33.1 The Conference of Consumer Organizations is a national organization of state and local consumer groups, government and industry consumer affairs personnel. COCO activities were briefly described by the witness. For the most part, COCO states its attitudes on issues to its constituent organizations. These, in turn, take their own positions.

4.33.2 Mr. Meyer commented at length on the status of metric education in the U.S. In addition to stressing the general desire of many people not to change, he stated the opinion that people are concerned about the process of being "ripped off."

4.33.3 Mr. Meyer suggested that while gasoline pump metric conversion is a natural option in many respects, it may well be viewed by many as a vehicle for further oil company price gouging. He discussed at length the negative aspects of the liquor industry conversion, which he felt were relevant to this gas pump conversion under investigation by the Board, as well as marketplace deception more generally.

4.33.4 Mr. Meyer believes that metric conversion is upon us and will occur not by 1980, probably not by 1985, but it will occur. In the particular case of the gasoline pump conversion, his comments seemed desultory (see pages 338-341 of the testimony), touching on the consistency and quality of the data presented at these hearings, the consumer education process, the authority and mechanism to propel a metric conversion forward and the timeframe during which it might occur.

4.33.5 Mr. Meyer seemed to be in favor of a metric conversion, but with many caveats. He doubted whether the metric system would be adopted soon voluntarily in the U.S.

4.34 Analysis of testimony (COCO).

4.34.1 The only representative at these hearings from a private, non-governmental consumer organization was COCO.

3.34.2 In general, Mr. Meyer's testimony deplored consumer "rip-offs" (see pages 344 and 346 of the testimony), argued for a massive infusion of economic ethics and morality (see page 335 of the testimony) and suggested that "conversion banditry" be dealt with harshly and immediately (see page 341 of the testimony).

3.34.3 Mr. Meyer asked many questions about any future metric conversion. He was clearly concerned with the current status of metric information and education.

4.34.4 This testimony is in favor of the gasoline pump metric conversion. How many constituents, or constituent groups, of COCO would agree is unknown (see page 353 of the testimony). The reasons given by Mr. Meyer for favoring the conversion were: (a) cost, and (b) inevitability.

4.35 Suffolk County (N.Y.) Department of Consumer Affairs ("R"). (Mr. Anthony F. Apollaro, Commissioner, and also Director of Weights and Measures for Suffolk County.)

4.35.1 Mr. Apollaro testified that he was appearing in opposition to gasoline pump metrication. He represents Long Island, Suffolk County, with a population of 1.3 million.

4.35.2 The primary objection expressed to the gasoline pump conversion is economic, on the contention that such conversion would be inflationary. Mr. Apollaro believes that this conversion will lead to others, and that the total effect will be to cause a general rise in those prices affected.

4.35.3 Mr. Apollaro reported on a survey of 316 consumers that took the form of incoming calls to his staff members on May 2, 1979. Each was asked whether he or she was prepared for metric conversion. Sixty-eight percent responded in the negative, he said, citing inability to understand the concept, the confusion of conversion and the impossibility of computing miles per gallon figures by the consumer. Mr. Apollaro stressed that a sixty-eight percent negative reply did not imply a thirty-two percent affirmative response, since part of this group might be strongly neutral.

3.35.4 Mr. Apollaro stated that he was not opposed to metrication, generally. However, at this time and in the context of a "finely-tuned" economy, he is very fearful of consumer "rip-offs". He cited examples of recent fraudulence and cheating during the vacation months, primarily, in his county in order to substantiate those comments relating to gasoline purchases.

4.36 Analysis of testimony (N.Y. Suffolk County).

4.36.1 Mr. Apollaro's testimony was brief, straightforward and to the point. He expressed opposition to gasoline pump metrication at this time for two inter-related reasons, viz., (a) the potential for adverse economic effects on consumers during the metrication process, and (b) inadequate consumer awareness and education/ information regarding the metric system in general and this pump conversion in particular.

4.36.2 His reasons for opposing metric conversion at the gas pump at this time appear to be primarily qualitative, but based on a substantial body of data relating to actions adverse to consumers in the U.S.

4.37 Analysis of testimony of representatives of the National Conference on Weights and Measures (NCWM), with that of representatives of California and Hawaii, is presented as a unit. The groups (three from NCWM, one from California and one from Hawaii) have several elements in common: (a) the views presented, (b) the conclusions reached, and (c) the constituencies each represented appear to have much in common. In addition, they were clearly identified in the testimony transcript (pages 369-370) as representatives of the NCWM and of individual states. The witnesses were: (a) Mr. Kendrick J. Simila, Chairman, NCWM; Mr. James R. Bird, Chairman, Specifications and Tolerances Committee, NCWM, and Deputy State Superintendent on Weights and Measures, State of New Jersey; and Mr. Richard Thompson, past Chairman, NCWM, State of Maryland (appearing as "S"), (b) Mr. Ezio Delfino, Chief, Division of Weights and Measures, State of California (appearing as "T"), and (c) Mr. George E. Mattimoe, Deputy Director, Division of Measurement Standards, State of Hawaii (appearing as "U").

4.37.1 All of these gentlemen, testifying in two separate groups in the interest of time and in the order shown above, seemed to favor the metric solution to over-a-dollar per gallon gasoline metering and price posting difficulties presently being experienced.

4.37.2 In testimony that was characterized by consistency, these witnesses spoke at times from the perspective of weights and measures administrators, while at other times they spoke from the viewpoint of appointed representatives attuned to the problems of their individual states.

4.37.3 In their role as weights and measures administrators, they strongly and consistently stress the economic benefits of liter metering. It is noteworthy, however, that they fail to emphasize, in presenting the NCWM position on this issue, the relatively minor cost per gallon of gasoline represented by other solutions to the problem.

4.37.4 In their role as state representatives, they discussed the current situation and its unique aspects within their own states, and alternative solutions to this problem in the same context.

4.38 National Conference on Weights and Measures (NCWM) ("S"). (Mr. Kendrick J. Simila, Chairman; also comments by Mr. Bird, Chairman of the Specifications and Tolerances Committee, NCWM, and Deputy State Superintendent on Weights and Measures, State of New Jersey; and Mr. Richard Thompson, former Chairman of NCWM, State of Maryland.)

4.38.1 A brief discussion was given of NCWM structure, operations, membership, etc. Also described were the diversity of organizational and performance of weights and measures programs in the fifty states, the District of Cclumbia and Puerto Rico.

4.38.2 NCWM is on record as recommending that the long-range solution to retail meter fuel dispensers with obsolete unit price-computing capability is conversion to, or replacement with, metric-capable equipment.

4.38.3 NCWM considered four alternative approaches, and chose the metric based on several considerations: (a) cost savings, (b) motorists' fuel purchasing habits, (c) the legal status of metric conversion, and (d) weights and measures test equipment and procedures.

4.38.4 Hurdles which will be encountered in converting to metric include: (a) planning and agreement on timetables to accomplish changeover, (b) education of all parties to the changeover, (c) coordination to minimize confusion and the duality period, (d) the need for a short-range solution with an appropriate cut-off date, and (e) possible federal legislation to bring the long-term solution closer to implementation.

4.38.5 NCWM claims metric conversion will help allay inflation (see pages 380 and 381 of the testimony), and that economic considerations on this issue are clearcut.

4.38.6 Mr. Simila indicated that NCWM is a consensus organization and that there are those within NCWM who differ with this consensus. Further, NCWM members do not necessarily reflect the views of the population from which they are drawn. NCWM positions are not elective.

4.38.7 NCWM has been on record as supporting voluntary metric conversion since 1971, when the metric study authorized by Congress was completed.

4.39 Analysis of testimony (NCWM).

4.39.1 NCWM, as represented by three members of its staff, seems to be clearly pro-metric. They favor the liter metering and posting of gasoline at the retail level.

4.39.2 The reasons given for advocating a metric solution to this problem appear mainly to rest on the cost benefit.

4.39.3 The suggestion (see pages 380 and 381 of the testimony) that the metric option at the gas pump would contribute in a significant way to the "battle against inflation" in the U.S. seems contradictory to other testimony offered at these hearings (e.g., independent oil dealers, consumer groups).

4.40 State of California ("T"). (Mr. Ezio Delfino, Chief, Division of Weights and Measures.)

4.40.1 Mr. Delfino's Division began planning for $1.00 per gallon gasoline several months ago. In hindsight, the planning should perhaps have been commenced a year or more ago. His Division will again, as in 1973-1974, have to allow half-pricing of gasoline, which they have found to be a quite unsatisfactory situation.

4.40.2 With regard to the various alternative sale methods, all except liter or over-a-dollar pricing will involve mechanically changing all gasoline dispensers affected.

4.40.3 Of the two viable alternatives, there is no question with regard to which is more nearly cost-effective. Over-a-dollar pricing per gallon of gasoline involves a minimum cost of two hundred dollars ($200.00) per nozzle, whereas liter conversion would cost approximately one-fourth that amount. In California, this difference represents an aggregate total of approximately $15 million and involves 100,000 pumps.

4.40.4 In California, individual industry members are being polled in order to determine their preferences. While information being returned is not yet conclusive, one trend is clear: virtually all small industry (less than one hundred pumps) prefers to change to metric sales due to the lower costs which would be incurred. Some small operators have indicated that the entire computer in each of their pumps must be replaced under alternative solutions.

4.40.5 If there is a clear consensus in California that the petroleum industry is willing to change to metric, the Division of Weights and Measures would assume the role of coordinator and would begin working with the affected industries, as well as consumer groups, to obtain input regarding the best means of proceeding during the changeover process. No decisions have yet been reached.

4.41 Analysis of testimony (California).

4.41.1 Based on cost considerations with regard to the gasoline dispenser price and preliminary results from individual industry members (particularly small business), Mr. Delfino believes that metric gasoline sales are preferable to those made at over $1.00 per gallon.

4.41.2 Future action by this Department will be based on their assessment of the desires of both industry and consumers in the State of California. No data is yet available upon which action can be based; no implementation decisions have yet been planned.

4.42 State of Hawaii ("U"). (Mr. George E. Mattimoe, Deputy Director, Division of Measurement Standards.)

4.42.1 In mid-March, 1979, the Hawaii Division of Measurement Standards was petitioned by the Hawaiian Automotive Retail Gasoline Dealers Association to be permitted to go metric at the retail level. Hawaii is responding to this petition.

4.42.2 Mr. Mattimoe is in a state that will see over-a-dollar prices sooner than elsewhere, although this is becoming progressively more common. Recalling the untoward 1973-1974 experience (violence, half-price sales, gas lines, etc.), he stated his belief that any move now should be made unambiguously, and with speed and finality.

4.42.3 In Hawaii, Mr. Mattimoe observed, the cost of the Veeder Root 2002 fix will not be two hundred dollars ($200.00) per hose, but will perhaps exceed three hundred dollars ($300.00), and possibly reach four hundred dollars ($400.00) for stations in remote areas.

4.43 Analysis of testimony (Hawaii).

4.43.1 The Hawaii Division of Measurement Standards recommends conversion of delivery of gasoline in liters on a programmed basis. Otherwise, he thinks the same issues will be discussed again in the near future when the price of gasoline approaches $2.00 per gallon. (Evidently, Mr. Mattimoe thinks that pump replacement will occur at some point after gasoline reaches $2.00 per gallon, but not before gasoline reaches $1.00 per liter.)

4.44 Metric Commission of Canada ("V"). (Mr. Cliff Leon, Chairman, Petroleum Sector.)

4.44.1 Canada's conversion program had four phases: investigation (completed in 1975), planning (completed in 1976), scheduling (completed in 1977) and implementation (scheduled for substantial completion in 1980).

4.44.2 Since prices in some areas of Canada have been above $1.00 per gallon for several years, half-gallon pricing was in use.

4.44.3 A task force composed of pump manufacturers, consumers and members of the Metric Commission Sector Committee found that a substantial amount of time would be required for the conversion of pumps to measure by the liter. As early as 1975, new pumps were ordered with metric conversion gearboxes installed. By early 1979, approximately eighty percent of the Canadian pumps had metric gearboxes.

4.44.4 The cost of conversion ranged from a low of thirty dollars Canadian ($30.00C) for conversion units ordered with new pumps to approximately three hundred dollars Canadian ($300.00C) per hose for older models requiring new computers. No subsidies were provided for these conversions.

4.44.5 In order to avoid a haphazard conversion, a law was published which required that pump conversion begin on January 1, 1979 and be completed, with certain exceptions, by the end of 1980. Retail dealers selling fewer than 100,000 gallons per year in remote areas may continue to sell gasoline by the gallon or half-gallon until they can economically make a conversion to metric measurement.

4.44.6 To accommodate tax collection, business systems were required to be modified, a process which entailed significant lead time and expense.

4.44.7 A public awarenes program was conducted, including enclosures with oil company credit card statements, handout cards from service stations and a pamphlet from the Metric Commission. There was no adverse consumer reaction to the use of liters at the gas pump. Highway signs had previously been converted (September, 1977) as had temperature reports (1974).

4.44.8 Both antifreeze and oil were converted to liter measures in January, 1979. Over the next two years, conversion from the refinery gate will be completed, with oil companies making the changes based on their own schedules.

4.44.9 Both industry and the government are discouraging the use of dual signs. When the station converts to liters, this should be accompanied by liter signs.

4.45 Analysis of testimony (Metric Commission of Canada).

4.45.1 Apart from some slight conflict (see pages 436 versus 448-449 of the testimony) over whether "independent" oil retailers are likely to change to liters early in the conversion, Mr. Leon has straightforward testimony to present, viz.: (a) the Canadian petroleum metric conversion was well planned and implementation was expected to be smooth; the start date was January, 1979 and, with a few exceptions, the expected date of completion is December 31, 1980, (b) tax problems were minimal because system difficulties were minimized by planning, and consumer reaction was essentially non-existent. It should be noted (see pages 433-434 of the testimony) that in order for the conversion to take place, Canada's "voluntary" conversion required legislation.

4.46 Consumers Association of Canada (CAC) ("W"). (Mr. Nicholas Murray)

4.46.1 The Consumers Association of Canada is similar, in the opinion of the witness, to the Consumers Union in the U.S., which is a private, non-profit national organization dedicated to consumer awareness and consumer protection.

4.46.2 The Canadian changeover has been described as a non-event. Mr. Murray and those for whom he speaks believe that the U.S. experience would not correspond to that noted in Canada, due primarily to what he perceives as the substantially less trusting American public. This is particularly true, in the opinion of Mr. Murray, vis-a-vis the petroleum industry.

4.46.3 A general description of various aspects of the metric changeover was given by Mr. Murray, with particular reference to experiences in Nova Scotia (his home is in Halifax, Nova Scotia).

4.46.4 Mr. Murray concluded his testimony with a few general observations and comments, viz.: (a) his dissatisfaction with the consumer awareness program, especially in conjunction with metric service at gas and service centers, (b) his belief that Canada's two-year petroleum sector changeover is overly long, and (c) gas and oil metric

conversion must be identified as a national program with extensive point-of-sale information.

4.46.5 The following points were developed and elaborated upon by Mr. Murray and members of the U.S. Metric Board during the question-answer period following Mr. Murray's formal statement: (a) one should be very careful how one relates the Canadian (or any other) metric experience to those responses anticipated in the contiguous forty-eight states; very significant differences may often be noted from one place to another; the Nova Scotia experience was dissimilar to that noted in Ontario; Hawaiian and Canadian respect for governmental authority may be greater than in the majority of the United States, and (b) the Metric Commission Canada, the Canadian Department of Consumer and Corporate Affairs and oil companies may not be set up to gauge consumer reaction.

4.47 Analysis of testimony (CAC).

4.47.1 During Mr. Murray's testimony, and with the aid of questions posed by Board members, two very interesting points were developed regarding the Canadian petroleum industry metrication experience and its relevance to the United States, viz.: (a) the extent to which petroleum sector metrication, particularly at the retail level, was a "non-event" may be based on a generally much more amiable public/oil company relationship in Canada; this despite a public information campaign that Mr. Murray believes to have been inadequate, and (b) the "non-eventful" nature of the Canadian metrication experience may have resulted from the lack of a national focus for complaints; Mr. Murray believes that any significant difficulties would have been much more likely to be aired, in Canada, at a local or provincial level, and would not have been in evidence at the level of the Metric Commission Canada, large oil company board rooms or the Canadian Department of Consumer and Corporate Affairs.

4.47.2 Mr. Murray would expect a much stronger consumer reaction in the U.S. for a host of reasons which are primarily qualitative but still, apparently, significant: (a) many U.S. national consumer focuses on discontent, (b) oil company/public antipathy, and (c) a more defensive, or certainly non-complacent, public, among other considerations.

## 5.0 SYNOPSIS OF ALL TESTIMONY

| ID No. | Group Testimony | Constituency | Salient Points | Metric Option Position Pro | Con | Neutral |
|---|---|---|---|---|---|---|
| A | American Petroleum Institute (API) | Industry association | No consensus of pump conversion among members; supports voluntary conversion under P.L. 94-168 | | | A |
| B | American National Metric Council (ANMC) | Non-profit establishment organization | Feels affected organizations should make the decisions on timing and extent of conversions. Willing to cooperate on metric conversion plan. | A | | |
| C | Gasoline Pump Manufacturers Association (GPMA) | Industry association | Willingness to cooperate. GPMA is a non-consensus organization on this hearing issue | | | A |
| D | Veeder-Root Company | Manufacturer | Anticipate three years required to replace all the computers. Primary role: equipment supplier | | | A |
| E | U.S. Department of Energy (DOE) | Federal government | Prefer dual reporting/computation for a period of time. Could contribute by review of present regulations | B | | |

Key: A - Positive
B - Qualified

| ID No. | Group Testimony | Constituency | Salient Points | Metric Option Position Pro | Con | Neutral |
|---|---|---|---|---|---|---|
| F | Chevron U.S.A. | Oil company | Support liter conversion if (a) metrication inevitable, (b) limited to pumps, (c) mandatory | A | | |
| G | Exxon Corporation U.S.A. | Oil company | Key issues: (a) conversion lead time, (b) consumer reaction, (c) economics | | B | |
| H | Mobil Oil Corporation | Oil company | Main difficulties relate to (a) conversion contractor availability, (b) complexity of cost, (c) consumer acceptance | | B | |
| I | Amoco Oil Company | Oil company | Consumer acceptance is critical; conversion task difficult. Metric in U.S. is inevitable over long term | | | A |
| J | Shell Oil Company | Oil company | Upgrading equipment for metric since 1976, and will be 80% completed on January 1, 1980 | A | | |
| K | Sunmark Industries | Oil company | Metric test at retail pumps. Consumer study cited confusion or lack of knowledge of metric | | | A |

Key: A - Positive
B - Qualified

| ID No. | Group Testimony | Constituency | Salient Points | Metric Option Position Pro | Con | Neutral |
|---|---|---|---|---|---|---|
| L | Independent Gasoline Marketing Association | Industry association | Against metric conversion at the pumps. Prefer any conversion to be accomplished in short time frame | | A | |
| M | Society of Independent Gasoline Marketers of America (SIGMA) | Industry association | Would support uniform change to metric. Do not favor voluntary approach: would produce feeling of inconsistency, consumer confusion and mistrust | B | | |
| N | U.S. Office of Consumer Affairs | Federal government | Economic reasons compel much education needed for consumer | A | | |
| O | International Association of Machinists and Aerospace Workers | Labor union | Loss of price standard would have negative impact on competition | | A | |
| P | New York City Department of Consumer Affairs | City establishment | Savings negligible. Consumer confusion and disruption potentially high. | | B | |
| Q | Conference of Consumer Organizations | Non-profit private organizations | Metric cheaper, inevitable despite poor consumer education and possible deceptions. | B | | |

Key: A - Positive
B - Qualified

| ID No. | Group Testimony | Constituency | Salient Points | Metric Option Position | | |
|---|---|---|---|---|---|---|
| | | | | Pro | Con | Neutral |
| R | Suffolk County (NY) Department of Consumer Affairs | County establishment | Education of consumer not presently adequate for conversion: rip-off potential | | B | |
| S | National Conference of Weights and Measures | Non-profit private organization | Chose metric based on (a) cost savings, (b) purchasing habits of motorist, and (c) legal status of metric conversion W&M procedures | A | | |
| T | State of California, Division of Weights and Measures | State government | Trend of small industry: prefers to change to metric sales due to labor costs | A | | |
| U | State of Hawaii, Division of Measurement Standards | State government | Petitioned by dealers association to be permitted to go metric; looking at short/long term ramifications | A | | |
| V | Metric Commission of Canada | Industry association | Canadian experience may not be relevant to U.S. | | | A |
| W | Consumers Association of Canada | Industry association; non-profit, private organization | Expects stronger consumer reactions in U.S. than Canada | | | A |

Key: A - Positive
B - Qualified

## 6.0 ECONOMIC IMPACT ON THE RETAIL OIL INDUSTRY

### 6.1 Scope.

6.1.1 This section analyzes the economic impact of the five technical options identified by the U.S. Metric Board to surmount dispenser limitations encountered whenever retail motor fuel prices exceed 99.9 cents per gallon. To the extent possible this analysis will be quantitative, but where the information necessary to quantitative evaluation is unavailable, the impact will be evaluated in qualitative terms. One such example is the effect on the competitive position of retailers forced by circumstances to adopt different options during an interim period.

6.1.2 The five technical options evaluated are:

6.1.2.1 Convert the computer to calculate price per gallon at $1.00 or more.

6.1.2.2 Convert the computer to calculate price per half-gallon.

6.1.2.3 Convert the computer to calculate price per liter.

6.1.2.4 Convert the computer to calculate price per quart.

6.1.2.5 Convert the computer to calculate whole number prices, dropping the tenths.

6.1.3 These options result from mechanical limitations inherent to current dispensing equipment whenever the price per gallon exceeds 99.9 cents.

### 6.2 Discussion of the options.

6.2.1 Most computers in gas pumps are mechanical. A measuring device in the pump activates a rotating shaft. The number of rotations is proportional to the volume of gasoline dispensed. This shaft then drives a series of gears and display registers which indicate (a) total volume of liquid dispensed, (b) total value of the sale, and (c) a preset value of posted price per unit volume.

6.2.2 The posted price register is manually set by the service station operators. The volume dispensed is mechanically multiplied by the posted price to compute and display the total sale value.

6.2.3 Currently, a significant majority of the installed computers display only three digits on the posted-price register (variator). Thus, when the price per gallon

exceeds 99.9 cents, there is no direct method of entering a four-digit multiplier, and therefore the total sale value cannot be accurately computed or displayed.

6.2.4 Production of mechanical computers appears to be dominated by the Veeder-Root Company. This company also provides gears and other parts to rebuilders, installers and maintenance personnel. Since 1978, Veeder-Root has marketed a computer which can accept a four-digit posted-price entry of up to $1.999. Although many of these units have been installed, with more on order, a rough calculation indicates that replacement of all existing computers with the new model would require almost three years' production capacity.

6.2.5 The installation of any new computer usually requires either a new facing or adding a window in the pump facing to display additional digits.

6.2.6 In comparison, most new electronic (digital) computers are designed to display a four-digit posted price either without change or with a small adjustment. However, the number of electronic computers installed appears relatively small because they have been more expensive than the mechanical type.

6.2.7 No testimony was presented suggesting the introduction of new mechanical computers by other manufacturers.

6.2.8 Considering the operational characteristics of existing mechanical computers, an alternative to changing the price per unit volume is to change the unit volume itself. This would involve changing the gear-ratio between the volume register and the posted-price register (variator).

6.2.9 Three candidates for a reduced unit of volume were included in the options: (a) the liter, (b) the quart, and (c) the half-gallon.

6.2.10 Change to liters and to quarts are options 3 and 4. A gearing change to half-gallons was not discussed by witnesses as an option at the hearings.

6.2.11 Rather, option 2, change to the half-gallon, might more accurately be termed "half-pricing." This concept was introduced in 1974 without changing gear-ratios in the computer. A price per half-gallon was entered into the posted-price register, which then caused the sales register to display one-half the transaction price. The attendant and the consumer then manually doubled the displayed value to

determine the actual, total sale. The volume delivered was correctly displayed in gallons on the quantity register. This expedient was introduced because most dispensers were then limited in that (a) they could not accept a posted-price in excess of 49.9¢ per gallon, and (b) they could not display total sales in excess of $9.99.

6.2.12 Since both of these specific limitations have generally been surmounted, option two has been re-examined and technically evaluated as comparable to options three and four within this report.

6.2.13 As a result of information presented at the hearings, supplemented by additional evidence solicited from witnesses and other affected sources, the technical viability of the five options are:

6.2.13.1 Option 1. A permanent solution (keeping in mind, however, that current mechanical computer designs will only allow a maximum price of $1.999 per gallon) in which small past or current computer equipment investments have been made. In other words, relatively less purchasers of new equipment are opting for a computer which solely computes gas prices to $1.999 per gallon. The purchasing trend has been for the dual purpose computer that will dispense at over $0.999 per gallon and with liter dispensing.

6.2.13.2 Option 2. A temporary solution due to a $1.999 per gallon limitation, attractive possibly to low-volume, obsolete dispenser applications confronted with immediate $1.00 per gallon or higher pricing.

6.2.13.3 Option 3. A permanent solution in which substantial investment in the number of computers capable of liter conversion has been made.

6.2.13.4 Option 4. A permanent solution in which no capital investment has been made, and which would require a second retrofitting by the dispenser population falling under Option 3.

6.2.13.5 Option 5. A temporary solution in which little capital investment has been made because reliability and accuracy are generally sacrificed.

6.2.14 Options one and three, change of computers to handle either dollar prices or liters, or both, are viable permanent solutions. A considerable investment has already been made in these solutions. The larger investment has been made in the conversion to dual or liter-only capability. The current investment in only dollar pricing capability is small.

6.2.15 Option four, quart pricing, is technically and from a cost standpoint equivalent to liter-pricing (option three).

6.2.16 From a consumer point of view, option four might encounter less resistence than liter pricing. For those states requiring gallon dispensing, changes in regulations would

still be required. Equivalent changes in pricing displays and invoicing will be required as for liters, the factor being four rather than approximately 3.8.

6.2.17 The most significant disadvantage is that no investment has been made in this option, so that the considerable investment in options one and three referred to above would have to be written off, and some additional development expenses incurred.

6.2.18 Option five, whole penny pricing with a computer speed-up by a factor of ten, has mechanical and economic disadvantages: (a) the tendency to incrementally add to fuel prices and taxes, (b) the considerable question whether the computers could reliably maintain accuracy, and (c) the greater cost of conversion compared to conversion to liters and quarts.

6.2.19 For the reasons outlined above, a detailed cost analysis will be performed only for options one and three. The cost of quart pricing will be derived from that for liter pricing by adding the slight cost of metric or dual capability. Costs will not be calculated for options two and five because of their temporary status.

6.2.20 Finally, displaying price per half-gallon and half the cost of the transaction, as in 1974, may be a transitional need without capital cost. It is evident that this method will not be acceptable as permanent either by the public or by weights and measures authorities.

6.2.21 The structure of the retail oil industry used in this analysis is presented in Table 1. It displays the total number and average number of nozzles per owner, by owner. Testimony was also received from API regarding the structure of the industry. Much of the content of this testimony was referred to as quoted from the ADL[1] report, however, API used different designators to refer to industry segments than those used in the ADL study and in this report. A correspondence between the two sets of designators is provided at paragraph 6.23.2.

6.3 *Criteria used for quantitative costing.*

6.3.1 The three criteria used in evaluating the economic impact are: (a) timing, (b) cost, and (c) equity. A brief discussion of these criteria and their inter-relationships follows below.

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[1] Mawn, Paul E., The Economic Impact of Vapor Recovery Regulations on the Service Station Industry, Arthur D. Little, Inc., for the Environmental Protection Agency, EPA-450/3-78-029, July, 1978.

Table 1. Estimated Total and Average Number of Nozzles per Owner, by Owner, in 1981

| Station Owner | Number of Owners | Number of Nozzles | Average Number of Nozzles per Owner* |
|---|---|---|---|
| Majors | 17 | 295,400** | 17,400 |
| Regional Refiner | 21 | 93,600 | 4,500 |
| Super Jobber | 270 | 225,600 | 836 |
| Small Jobber | 9,000 | 136,300 | 15 |
| Open Dealer | 50,000 | 362,000** | 7 |

*Rounded

**Appendix C, on the basis of a subsequent oil co. survey gives these numbers as: 650,000 and 300,000 respectively, which also would change column 3. See par. 6.27.5 for more explanation of effect of nozzle assumptions.

6.3.2 The timing of changes so as to minimize the impact on the competitive positions of different sectors of the industry is important to the economic impact analysis.

6.3.3 The cost of a competitive disadvantage (i.e., lost sales or reduced loyalty, if any occurs) are borne by the operators of the station, in the first line, and in the second line by the supplier of the station. However, the competitive loss to the supplier is averaged over all stations supplied.

6.3.4 The cost to the station owner is a second criterion. Again, this cost and its effect on the owner's financial position will differ for various sectors of the industry.

6.3.5 The cost is evaluated in the broadest sense. The first cost is the out-of-pocket expense associated with the change-over. Some of this will be returned in the form of reduced taxes.

6.3.6 The cost of adapting the mechanism of a pump to dollar gas will be borne by the owner of the pump.

6.3.7 Finally, if this cost is allowed as a passthrough expense, it may, additionally, be returned in the first year as increased revenue.

6.3.8 In both cases, there will be a further effect on the price of gas (i.e., to the consumer), but this effect will be shown to be very small indeed.

6.3.9 Equity is interrelated with the cost and timing considerations. Equity requires that suggested changes be such as to minimize the change in competitive position of different sectors of the industry. In particular, equity requires protection of the position of the financially weakest sector of the industry, which is comprised of the independent owners and small jobbers.

6.4 Economic Impact on the Retail Oil Industry.

6.4.1 Overview of expenditure analysis.

6.4.2 The two major options to be analyzed in detail are: (a) acquisition of computers able to handle dollar/gallons and ancillary costs (signs), and (b) change of retail sales to liters, requiring an adaptation of most computers, and additional changes.

6.4.3 As will be shown below, the direct equipment costs to the station owners of the liter alternative are considerably less than that of the first alternative. In addition, the other criteria, timing and equity, show advantages to the second option. Table 2, on the following page, displays the identified cost elements for the cost centers. The table identifies those cost elements of each cost center that would possibly be impacted by the two options.

6.4.4 Authorities in the following areas can be affected: (a) regulation of supplies, (b) price controls, (c) tax agencies at all levels, to include legislatures, administrators and enforcement, and (d) weights and measures, to include federal, state, local, city or county. The effect of these groupings will be discussed separately.

6.4.4.1 Regulation of supplies is vitally affected by any change that impacts on the data collection process. If retail marketing were to be converted to metric measurement the reporting process may also have to be revised to assist those individuals in the marketplace. Such a change would result in costs for report revision.

6.4.4.2 Price controls would be affected by a metric conversion in that all regulations would have to be revised to reflect liter pricing. Probably a soft converwion would adequately serve in an interim period.

6.4.4.3 Tax agencies are an area of highly visible impact in that it has been reported in these hearings that the major impediment to metric conversion for gasoline at retail might

Table 2
Cost Elements of Options (a) and (b)

| Cost Center | Table of Expenditures: Option (a) Over $/gal. | Table of Expenditures: Option (b) Liter conversion | Remarks |
|---|---|---|---|
| Public authorities | Calibration | Calibration<br>Legislative action<br>Change in regulations, weights and measures, and tax<br>Adapation of computer programs<br>Public awareness | The same for either option.<br>There are activities needed at the governmental level to change to metrics. They need not be large-scale in any one jurisdiction. |
| Supplier | | Soft conversion of invoice information | |
| Pump-owner, new computer with metric gear | Price sign postings<br>Calibration | Auxiliary expenses<br>Switch on metric gear* | Most new computers appear to have been equipped with the metric gear. |
| Pump-owner, new computer without metric gear | Calibration | Auxiliary expenses<br>Purchase and installation of gear* | |
| Pump-owner, adaptable computer with metric gear | Purchase and install new computer<br>Calibration | Auxiliary expenses<br>Switch on metric gear* | |
| Pump-owner, adaptable computer without metric gear | Purchase and install new computer calibration | Auxiliary expenses<br>Purchase and installation of gear* | |
| Pump-owner, non-adaptable computer | Purchase and install new computer,* with or without metric gear sign change<br>Calibration | Auxiliary expenses<br>Purchase and install new computer with metric gear* | Have option under (b) of purchasing 101, 2001 or 2002. |

*Includes calibration.

be the existing tax laws. Again, where weights and measures law allows, a soft conversion is quite feasible. Where it is not legal to dispense in liters, possible emergency measures could be implemented by the various legislatures and/or governing bodies and a soft conversion used in an interim period. Ultimately, however, the tax laws would require change to provide a consistent system. This could promote some problem unless taxing increments were also changed in the process. (Historically, states tax to the nearest one-half cent.) A table was prepared to evaluate the tax problem in the various states and is included in Appendix B.

6.4.4.4 Weights and measures could be impacted by any conversion that would change the unit volume measure. Reporting methods, examination procedures, regulations, and test equipment would require revision, modification or replacement. The equipment replacement (test measures) should be minimal in that an adjustment of approximately 4.5 cubic inches on the neck scale would provide a nineteen-liter field test measure for checking gasoline dispensers. Equipment replacement could then be by attrition.

6.5 With all groups, training of personnel would be a significant effort.

6.6 Additional indirect costs could also be incurred if alternative (b) is chosen. These costs include possible adaptation of computer programs, forms and other business-system components and cost of public awareness activities.

6.7 An analysis of how the petroleum distribution system operates shows clearly that the conversion of suppliers' own operations to liters is an internal choice, not forced by the unit of volume used at the pump.

6.8 The soft conversion of invoicing information to liters is sufficient for the operator's purposes. No overt cost for that task will be included in the analysis.

6.9 Operators of leased stations will incur some minor costs which will be analyzed as cost items, under the owner's costs. These are principally the changing of signs, if these are station-owned, and the inconvenience of having to learn to calculate prices in liters rather than in gallons. Soft conversion is entirely adequate to this process, but the station operator would possibly have to undergo some training.

6.10 The cost of signs will be included on this analysis as costs to the owner of the pumps. It must be realized that in some instances these may actually be borne by the lessee. The major cost impact of either option will accrue to the owner of the gasoline pump.

6.11 The accommodation the owner makes to dollar pricing is to obtain and install a computer which can handle gasoline prices in excess of $1.00 per gallon. Such computers are currently available, and are being installed in many pumps by several of the majors. No evidence was presented regarding other classes of owners.

6.12 Option (b), liter sales, requires, for mechanical computers, the installation of adapter-gears.

6.13 The market leader in mechanical computers is the Veeder-Root Company of Hartford, Connecticut. Evidence provided by this company to the Board discussed in some detail the products marketed by the corporation.

6.14 The most current Veeder-Root computer is the VR-2002, which can accommodate gallon prices up to $1.999 per gallon. The next most recent computer is the VR-2001, which has a top price per gallon of $0.999. Both of these computers have been designed to resolve problems of excessive wear attendant to the sudden increase in gas prices of 1974: the higher the price, the faster the wheel must turn.

6.15 Another Veeder-Root computer, the VR-101, has been in service since about 1970, and a yet older model, the VR-56, has a "total sale" capacity of only $9.99. Some of the older models, still in service in remote locations, are limited to a price per gallon of $0.499.

6.16 The Veeder-Root Company supplies a metric conversion package which can be attached to any computer purchased since 1974. This package is optional equipment on new computers, and most have been sold with this package attached and now have dual capability. The conversion to metrics on these packages, both original equipment and post-fitted, is achieved by pulling a lever. An estimate of the number of dual capability computers currently installed has been developed, and has been included in this discussion.

6.17 Veeder-Root markets its new equipment through distributors, who may also be installers. In addition to new equipment the firm also supplies replacement parts of all kinds, among which is the metric adaptive gear itself, to repairmen, installers and rebuilders of gasoline pump computers.

6.18 There is a market in rebuilt computers. At this writing the supply capability of this market remains undetermined. Provisional estimates for the size of this market will be made.

6.19 Evidence developed at the hearing emphasized that it might be "uneconomical" to rebuild or modify old computers.

This evidence was provided by major oil companies who are accustomed to minimizing integrated lifetime system costs, taking into account, for instance, the cost of future repair.

6.20 For less highly capitalized owners, particularly for "open" dealers and small jobbers, immediate cash outlay may often be a major consideration. The less immediate cost of rebuilding, coupled with availability, will make this an attractive option for at least some "open" dealers and small jobbers.

6.21 For option (b), liter dispensing, auxiliary expenses will include the acquisition of decals, and perhaps other signs, to inform the public that pricing is per liter. In addition, conversion tables may have to be posted to enable the public to continue comparison shopping.

6.22 Finally, some effort will be required from the station operator, as opposed to the owner, to reconcile his inventory in liters and establish his prices. This is a soft conversion, and though requiring some effort, should not entail any additional expense. These considerations are summarized in Table 2.

6.23 Quantitative Cost.

6.23.1 The quantitative cost analysis is contained in the following eight tables. The method of deriving each table and the source of information are discussed in the proximity of each table.

6.23.2 The supplier categories used in the tables of this report are those of the ADL study. These correspond to those used in API testimony, as follows:

| Supplier Terminology Used in this Report | Corresponding API Terminology | Corresponding ADL Terminology |
|---|---|---|
| Major | Major Branded Refiner | Major |
| Regional Refiner | Smaller Branded Regional Refiner | Regional Refiner |
| Super Jobber | Branded Jobber | Super Jobber |
| Small Jobber | Private Branded Retailer | Small Jobber |

These four categories of suppliers supply gasoline to various types of retail gasoline stations. The distribution of the gasoline is made under various types of arrangements with the individual station and can be categorized by the contractual

arrangement that exists between the supplier and the station operator. The contractual arrangements can be categorized into four areas as follows: (1) Direct Operated Stations, (2) Convenience stores (C-stores), (3) Branded Lessee Dealers, and (4) Open Dealers or Branded Contract Dealers (as labeled by API). For these categories, the ownership of the nozzle is by one of the four types of suppliers of gasoline to the stations. The supplier is generally the owner of the nozzles for the first three categories of stations while the open dealer generally owns his station's nozzle.

6.23.3 For the Direct Operated Station, the supplier owns all facilities and the station is operated by an employee of the supplier. For the convenience store, the supplier provides all the facilities and gasoline while the operator of the convenience store station supervises the operation (self-service) in exchange for a fixed fee per gallon. For the Branded Lessee Dealer Stations, the supplier of the gasoline usually owns the facilities, including the nozzles. The supplier leases the station to the operator. The operator of the Branded Lessee Dealer Station is usually an independent businessman who sets his own retail price.

6.23.4 The Open Dealer is the fourth type of station. The Open Dealer owns his facilities including the nozzles and generally has a long-term contract with a supplier of gasoline for his gas.

6.23.5 The four suppliers will own the nozzles for the three types of stations (i.e., direct, "c" store and lessee) while the open dealer will own the nozzles.

6.24 Table 3 is the fundamental table from which to start the economic analysis of the impact of change on the retail industry. It identifies the universe of computers that are affected by the change in terms of who must pay for changing them. Table 3 displays the number of nozzles by supplier, type of station and by the size (thousands of gallons throughput per station per month).

6.25 Additionally, the ADL table estimates the number of stations expected to go out of business and the number of convenience outlets expected to be added by 1981 by type of station. First, the 1977 table was converted from percent to number of stations. Then the "number of stations" in the table was adjusted to 1981 by subtracting and adding the stations in the change-table. In order to do this it was necessary to allocate the changes to the different size stations in a group.

6.26 This allocation was made on the basis of the analysis of profitability in the ADL study, deleting principally the smaller stations. Industry experts assisted in this.

6.27 Finally, the ADL study contained an estimate of the average number of nozzles per station by size and type. Cross-multiplying the two tables yields Table 3 in terms of nozzles.

6.27.1 The ensuing number of nozzles used in the cost analysis is probably low. The number was arrived at on the basis of the ADL Report by removing the nozzles of closed stations altogether. This leaves the increased (since 1977) flow of gasoline unaccounted for in terms of nozzles.

6.27.2 The reason this was done, was to obtain a conservative estimate of the cost advantages of the metric solution; in addition, no basis for allocating the additional nozzles was available.

6.27.3 The number of nozzles affects the cost estimate in predictable fashion by increasing the cost differential which is favorable to a metric conversion. One side effect that must be noted, however, is that there is a danger of misleading readers who may choose to extract data or reference this report with regard to an estimate of the total nozzles in the U.S. For instance, estimates of the logistical difficulty of scheduling mechanical conversions would be understated if the relevant data of this report were extracted to make those estimates.

6.27.4 Opinions have subsequently been advanced that the total number of nozzles currently in operation may be 300,000-400,000 larger than the estimate used for the purpose of this cost analysis. Appendix C contains the result of a survey by one of the majors supporting the higher estimate and is included for reference purposes.

6.27.5 The effect of the larger number of nozzles on the ensuing analysis of this report are as follows:

a) Cost estimates in favor of metric conversion will be larger, roughly proportionately.

b) The time to implement both options will be longer, perhaps more than proportionately, because of increased supply bottlenecks.

Affected numbers resulting from a higher count for the majors are footnoted in tables 1, 3, 4, 5, 6, 8 and 9. It may well be that these higher numbers more nearly represent current conditions, especially with regard to estimating logistical (as opposed to cost) impacts of a conversion. The lower nozzle estimates deliberately used in this analysis yielded a conservative cost advantage to the metric solution.

Table 3. Number of Nozzles by Station Throughput, Supplier and Type of Station, Estimated for 1981 (thousands of gallons per month)

| Supplier/ Retail Outlet | ≤10 | 11-25 | 26-50 | 51-100 | >100 | Total |
|---|---|---|---|---|---|---|
| Major: | | | | | | |
| Direct | 848 | 210 | 6,690 | 29,496 | 19,656 | 56,900 |
| "C" Store | - | 3,334 | - | - | - | 3,334 |
| Lessee | 9,352 | 90,870 | 53,664 | 71,290 | 9,982 | 235,158 |
| Subtotal | 10,200 | 94,414 | 60,354 | 100,786 | 29,638 | 295,392* |
| Open Dealer | - | 90,402 | 76,344 | 16,090 | - | 182,836 |
| Regional Refiner: | | | | | | |
| Direct | - | 774 | 6,460 | 17,052 | 14,644 | 38,930 |
| "C" Store | - | 834 | - | - | - | 834 |
| Lessee | 2,432 | 7,908 | 15,400 | 23,110 | 4,984 | 53,834 |
| Subtotal | 2,432 | 9,516 | 21,860 | 40,162 | 19,628 | 93,598 |
| Open Dealer | - | 4,148 | 8,296 | 1,850 | - | 14,294 |
| Super Jobber: | | | | | | |
| Direct | - | 2,346 | 14,640 | 87,468 | 60,144 | 164,598 |
| "C" Store | - | 31,500 | - | - | - | 31,500 |
| Lessee | 824 | 3,702 | 6,584 | 10,820 | 7,588 | 29,518 |
| Subtotal | 824 | 37,548 | 21,224 | 98,288 | 67,732 | 225,616 |
| Open Dealer | - | 4,122 | 1,368 | 1,830 | - | 7,320 |
| Small Jobber: | | | | | | |
| Direct | - | 4,056 | 13,530 | 17,856 | 5,170 | 40,612 |
| "C" Store | - | 4,332 | - | - | - | 4,332 |
| Lessee | 2,448 | 26,322 | 37,544 | 25,050 | - | 91,364 |
| Subtotal | 2,448 | 34,710 | 51,074 | 42,906 | 5,170 | 136,308 |
| Open Dealer | 2,680 | 34,182 | 99,200 | 21,470 | - | 157,532 |
| Open Dealer, total | 2,680 | 132,854 | 185,208 | 41,240 | - | 361,982* |
| Sum of subtotals | 15,904 | 176,188 | 154,512 | 282,142 | 122,168 | 750,914 |
| Totals | 18,584 | 309,042 | 339,720 | 323,382 | 122,168 | 1,112,896* |

Sources: (1) A.D. Little Report; (2) Basic Resource Services Inc.; (3) private sources.

* Appendix C on the basis of a major oil co. survey gives these numbers respectively as 650,000, 300,000 and 1.4 million.

6.28 Table 4 advances the analysis by providing estimates of the number of different kinds of operating computers currently in use.

6.28.1 The table was constructed by allocating the known total of equipment (1,112,900) and aggregating the equipment types by owner.

6.28.2 Impact of change on a station depends on the equipment currently installed there. The hearings identified four basic equipment types in terms of metric and dollar/gallon capability.

6.28.2.1 Dual 2002. The new Veeder-Root 2002 computer can accept pricing of up to $1.999 per gallon. A metric conversion box which converts the computer to liter dispensing is available with the computer and evidence was given that substantially all these sold are so equipped. The total of 100,000 dual capacity was established from testimony evidence and the majority has been allocated to the majors who testified to ongoing programs of modernization and

Table 4. Number of Computers by Owner and Computer Type, 1981 Estimates (rounded)

| Owner of Nozzle | Dual (2002) | 2001/101 With Metric | Adaptable to Metric | Old | Total |
|---|---|---|---|---|---|
| Major | 85,000 | 21,200 | 189,200 | - | 295,400 |
| Regional Refiner | 5,000 | 5,000 | 74,800 | 8,800 | 93,600 |
| Super Jobber | 10,000 | 10,000 | 187,400 | 18,200 | 225,600 |
| Small Jobber | - | - | 113,800 | 22,500 | 136,300 |
| Open Dealer | - | - | 284,500 | 77,500 | 362,000 |
| Total | 100,000 | 36,200 | 849,700 | 127,000 | 1,112,900 |

Sources: (a) A.D. Little Report, adjusted for ADL attrition figures;
(b) Basic Resource Services Inc. (BRS) estimates.
(c) An alternate allocation with larger totals is provided in Appendix C, based on a major oil co. survey.

acquisition of dual capacity. The balance was allocated to the Regional Refiner and Super Jobber.

6.28.2.2 2001/101. The Veeder-Root 2001 can also accept the metric conversion box. Total number , 36,200, was established by projecting the number reported at the hearings by the ratio of nozzles reported to those owned.

6.28.2.3 Old computers. A number of thirty percent was extensively mentioned for the fraction of computers which are not so adaptable. This is in terms of 1977 totals. In deleting smaller stations to obtain the 1981 estimates in Table 1, proportionately more old computers were deleted. Industry experts were consulted on this allocation process. The result is that only 127,000 "old" computers are assumed to be in service.

6.28.2.4 Adaptable to metric. The total number of "adaptable" computers was obtained by subtraction of the sum of Dual 2002/ 2001/101 and the old computers from the grand total of 1,112,900 and allocated to nozzle owners.

6.28.3 Tables 5 and 6 deal with the supply and demand for adaptive equipment. The types of adaptation possible respective to dollar/gallon (Table 5) and liter dispensing (Table 6) were brought out at the hearings.

6.28.4 Dollar/gallon dispensing.

6.28.4.1 The only possible adaptation is to obtain a computer that can accept a multiplier (price of gas per gallon) of up to $1.999.

6.28.4.2 The VR-2002 computer produced by the Veeder-Root Company is such a computer, and purchase of this computer is one option. The company testified, however, that production is expected to be limited to 400,000 per year.

6.28.4.3 The representative of IGMC testified that his members, chiefly "small jobbers," would be more likely to obtain their supply from local "rebuilders" of equipment. A telephone survey by BRS confirmed the existence of this capability. A projection from states contacted indicates that there were perhaps as many as thirty firms in this business. It was estimated that their combined capacity might be about 140,000 computers per year.

6.28.4.4 This is the supply side of the equation. It is evident that the supply of computers will determine the speed with which a change can be made since approximately one million are needed.

6.28.4.5 A second half of the table allocates the available annual supplies to different classes of owners. Again, this allocation has been made in conjunction with BRS.

6.28.4.6 Since testimony indicates that major oil companies tend to purchase on the basis of equipment policy, and testimony also shows that their purchase policies favor newer equipment, scheduled replacement, and a concern for lower maintenance cost in the long term, half the new computers have been allocated to the majors. This assumption is not to be construed as an indication of preferential treatment or favoritism by equipment manufacturers. The remaining half has been allocated roughly proportionately, except that the "small jobbers" share has been reduced on the basis of SIGMA's testimony regarding the natural predilection of this sector. The rebuild capacity has been allocated proportionately to all sectors except the majors who have testified to a preference for low maintenance equipment. This has been interpreted as a preference for new equipment.

6.28.4.7 The "years to completion" for the sectors have been obtained by dividing the allocated supply, by sector, into the demand. These are the shortest possible times given the allocation. The assumption is an absence of all supply bottlenecks and no preemption of one sector by another beyond that which is implicit in the allocation.

Table 5. Supply Allocation Matrix: Dollar-per-Gallon Pricing, Minimum Time Allocation Function

| | | Disposal to Owner of Nozzle | | | | |
|---|---|---|---|---|---|---|
| Option | Equipment | Number Available Per Year | Major * | Regional Refiners & Super-Jobbers | Small Jobbers | Open Dealer |
| Dollar-Pricing (gallons) | Manufactured | 400,000 | 200,000 | 100,000 | 32,000 | 68,000 |
| | Rebuilt | 140,000 | - | 40,000 | 20,000 | 80,000 |
| Total Supply Allocation per Year | | 540,000 | 200,000 | 140,000 | 52,000 | 148,000 |
| Total Number of Nozzles to be Replaced/Rebuilt for $1.00 per Gallon or Higher Pricing | | | 210,400 | 304,200 | 136,300 | 362,000 |
| Years to Completion, by Owner (Number of Nozzles to be Replaced Divided by Supply Per Year) | | | 1.1 years* | 2.2 years | 2.6 years maximum | 2.4 years |

*The higher estimate for major nozzles in Appendix C would increase this number to 2.8 years.

6.29 Liter dispensing.

6.29.1 Table 6 addresses the same problem as does Table 5 for the option of liter dispensing, but the situation here is very different. In the first place, there are four basic methods to adapt to this change: (a) the VR-2002 with metric box; the supply capability of that is still 400,000 per year, (b) a rebuilt VR-2001/101 with metric gear; this is mechanically a simpler job than to rebuild to $1.999 dispensing, however, the same capacity of 140,000 per year has been assumed; this is very conservative since the widespread installation of VR-2002's will initiate a supply of used VR-2001/101's which can readily be rebuilt and supplied with a metric gear, (c) installation of the metric converter (factory built) on VR-2001's; no production capacity has been obtained for these units but the supply appears to be very large, and (d) a survey of computer mechanics by BRS indicated that these mechanics are quite capable of installing a metric gear at the pump instead of the factory converter kit; this supply, too, is assumed to be very large.

Table 6. Supply Allocation Matrix: Metric Conversion Pricing, Minimum Time Allocation Function

| | | Disposal to Owner of Nozzle | | | | Total Number of Nozzles to be Replaced/Rebuilt for Metric Conversion |
|---|---|---|---|---|---|---|
| Metric Conversion Equipment Option | Number Available Annually | Major* | Regional Refiner & Super Jobber | Small Jobber | Open Dealer | |
| New Equipment with Metric Gear | 400,000 | 189,200 | 100,000 | 37,400 | 73,400 | 400,000 |
| Rebuild Computer with Metric Gear | 140,000 | - | 25,000 | 25,000 | 50,000 | 100,000 |
| Metric Adaptor (Factory) | Not available | - | 144,200 | 23,900 | 138,600 | 276,700 |
| Metric Modification at Pump | 300,000 | - | 50,000 | 50,000 | 100,000 | 200,000 |
| Total Number of Nozzels to be Replaced/Rebuilt for Metric Conversion Pricing | | 189,200 | 289,200 | 136,300 | 362,000 | 976,700 |
| Minimum Estimated Number of Years Required to Satisfy Sector Demand for this Allocation (Number of Nozzles to be Replaced Divided by Supply per Year) | | ≤1 year* | ≤1 year | ≤1 year | ≤1 year | |

*This time span may be impacted by the higher nozzle count of Appendix C.

6.30 The underlying assumption is that one million of the metric gears will be available in one form or another. This assumption may encompass other sources of supply.

6.31 Concern was raised at the hearing about the availability of mechanics to install the equipment. In an attempt to investigate the concern, a telephone survey was conducted by BRS by contacting officials in 7 states where mechanics who service and calibrate gas pumps and allied equipment must be registered. In these states, the overall ratio was one mechanic to 147 nozzles. Even though this sample involved 25% to 30% of estimated total nozzles, it is doubtful that sufficient information resulted to resolve the issue. The ratio of nozzles per mechanic ranged from 83 to 690, as shown in the following table:

| State | No. Nozzles | No. of Registered Mechanics | Nozzles per Reg. Mechanic |
|---|---|---|---|
| Florida | 66897 | 650 | 103 |
| New Jersey* | 27000 | 100 | 270 |
| Texas | 106000 | 515 | 206 |
| Wisconsin | 31746 | 46 | 690 |
| Illinois | 34844 | 400 | 87 |
| Nebraska* | 12500 | 150 | 83 |
| California* | 140000 | 1000 | 140 |
| TOTAL | 418987 | 2861 | 147 average |

*Indicates estimate provided

In addition, a personal estimate was also made by a representative of a major oil company that the national ratio would be as high as 750. If actual ratios are of this magnitude, then the time-frame of installation logistics are a valid concern and must be carefully planned for a metric conversion. The dollar/gallon conversion being more labor-intensive would be more seriously impacted.

6.32 The annual capacity for supplying metric changeovers is larger than the total needed. The only constraint on adaptations is that the "old" computers must be replaced with either new or rebuilt computers. Here, too, the annual supply is greater than this (minimum) demand, which was given as 390,000 in 1977 and 127,000 under the 1981 estimates.

6.33 Once initiated, the whole changeover process to metric computers could be completed within a year. This does not imply that it would be necessary to do so, but it does establish that, if an orderly change process were to be initiated, it would not be constrained by equipment availability.

6.34 Again, in Table 6, the available supplies of equipment have been allocated to the different sectors in line with assumed preferences. The allocation, however, is not critical to the implementation schedule since the supply is ample. Only if there is a great demand for new equipment and owners refuse to entertain alternate solutions may the limited supply of these cause a delay in the completion of the conversion process.

6.35 Table 7 establishes the cost per computer option.

6.35.1 The cost elements are those directly associated with the change of equipment; indirect cost elements have been qualitatively discussed elsewhere in this report.

6.35.2 Numbers were obtained from evidence submitted by respondents, the Veeder-Root Company and several oil companies. These have been supplemented by the BRS telephone survey for rebuilt equipment. Where respondents' numbers differed, which was by small amounts, a mode has been assumed.

Table 7. Cost Matrix for Dollar-per-Gallon Pricing and Metric Conversion, by Conversion Option

| Options: | Dollar-per-Gallon Pricing | | Metric Conversion Pricing | | | |
|---|---|---|---|---|---|---|
| Cost Item: | New Computer | Rebuilt Computer | New Computer | Rebuilt Computer | Factory Adaptor | Metric Modification at Pump |
| Equipment | $184* | $160 | $208* | $105 | $28 | $15 |
| Installation, Labor | 22 | 22 | 22 | 22 | 22 | 22 |
| Change to Computer Face | 40 | 40 | 40 | - | - | - |
| Recalibration | 15 | 15 | 15 | 15 | 15 | 15 |
| Display Signs (Add Digit) | 10 | 10 | - | - | - | - |
| Decals, etc. | - | - | 7 | 7 | 7 | 7 |
| (Less Salvage Value) | (20) | - | (20) | - | - | - |
| Total | $251 | $227 | $272 | $149 | $72 | $59 |
| Range | $210-295 | $165-255 | $230-290 | $135-205 | $55-90 | $40-90 |

*Evidence at hearing: Veeder Root 2002 computer lists at $184; the Veeder Root quick change metric gearbox lists at $24; the total cost is $208.

6.35.3 Ranges were obtained by taking extreme values from respondents on the high side and on the low side by taking mechanics' solutions, which were sometimes cheaper. Each element is discussed, as follows: (a) the costs of the VR-2002 and the Adapter are list prices quoted by the Veeder-Root correspondent; the cost of the metric adapter has not been included in the dollar/gallon option since it is not needed; Table 7 also displays the estimated cost of the equipment for the other types of fixes (i.e., rebuild computer and metric modification at the pump), (b) the twenty-two dollar ($22.00) installation labor charge is a low quotation from respondents. The low quotation was chosen since the telephone survey indicated fifteen dollars ($15.00) as a more common charge, (c) the forty-dollar ($40.00) charge for the extra window in the pump-face required to show the extra price digit of the VR-2002 was quoted by respondents; it represents the cost of a new pump-face and its installation; a cost of five dollars ($5.00) for cutting an additional window in an existing face was quoted over the telephone; (d) recalibration is required when a computer is maintained or changed; a charge of fifteen dollars ($15.00) was the consensus of the evidence, (e) the large signs which display the price will have to be modified to accept an additional digit if the unit price goes to four digits (e.g., $x.xxx); a price of ten dollars ($10.00) was quoted by respondents; this change is not required if the unit is liters since the liter price will remain at three digits; if the operator wishes to display a price per gallon while dispensing in liters, however, the change will be required, (f) under a change to liters, decals and tables will be required by the station owner to aid the consumer and the operator; the cost of these has been quoted at seven dollars ($7.00) and (g) the trade-in value of twenty dollars ($20.00) for a replaced computer core is a common figure quoted by all respondents.

6.35.4 Tables 8 and 9, finally, present the costs of either option. Table 8 presents the aggregate cost by sector for the country, as well as an aggregate range by sector and for the country. Table 9 presents the average cost of the conversion to pump owners within each sector.

6.35.5 Table 8 was obtained by multiplying the demand matrices by the matrix cost per hardware choice. Table 9 was obtained by dividing the quantities in Table 8 by the estimated number of owners by class.

6.36 Summary: Cost.

6.36.1 Tables 8 and 9 indicate the relative costs of the two options to the country as a whole, to each class of owners, and on the average, to individual owners.

6.36.2 The cost difference to the country, $94 million*, in favor of the metric conversion is smaller than that estimated prior to the hearings. This is due to two factors. The first is that the number of nozzles estimated for 1981 is some 200,000 less than the 1977 ADL figures commonly quoted. The other is that the figures commonly quoted did not take into account rebuild possibility which costs essentially the same for metric and dollar-pricing options.

*See Table 8

6.36.3 The difference is nevertheless significant, especially if is remembered that the estimated number of nozzles may be low so that the difference might be larger.

6.36.4 Of particular interest is the difference in cost to the last two classes of owners. Though the absolute dollar differences are small, the ADL study shows that many "open" stations operate below their economic break-even point and that the small jobbers are likely also to operate on a fairly tight cash basis. Under these circumstances, the cost saving of some five hundred ($500) to one thousand dollars for an independent owner and of several thousand for a small jobber may make it easier to accomplish the conversion than originally anticipated. Table 10 illustrates the range of costs that are involved for the two smaller types of owners rather than the average cost shown in Table 9.

Table 8. Estimate and Range of Total Cost by Sector and by Option

| Option: / Sector: | Dollar-per-Gallon Pricing | | Metric Conversion Pricing | |
|---|---|---|---|---|
| | Total Estimated Costs | Range (millions of $) | Total Estimated Costs | Range (millions of $) |
| Majors | $52,810,000** | $44.2-62.1 | $51,462,000** | $43.5-54.9 |
| Regional Refiners and Supper Jobbers | 77,928,000 | 62.9-90.5 | 42,097,000 | 34.7-48.9 |
| Small Jobbers | 32,952,000 | 26.3-36.5 | 18,569,000 | 15.3-22.6 |
| Open Dealers | 86,162,000** | 67.2-99.0 | 43,294,000** | 35.3-53.0 |
| Total | $249,852,000* | $201-288 | $155,422,000* | $129-179 |

*cost difference of approximately $94 million by subtraction

**Appendix C a major oil co. estimates these numbers as: $125,000,000, $72,000,000 and $297,000,000 for$/gal. and $54,000,000, $28,000,000 and $111,000,000 respectively for the metric pricing which gives a difference of $186,000,000 in favor of metric conversion.

Table 9. Estimated Owner Cost by Sector, by Option and by Minimum Time to Satisfy All Demands, by Option

| Sector: | Number of Firms by Sector | Estimated Average Cost per Firm, by Option | |
|---|---|---|---|
| | | Dollar-per-Gallon Pricing | Metric Conversion Pricing |
| Majors | 17 | $3,106,471* | $3,027,177* |
| Regional Refiners | 21 | 1,079,859 | 579,335 |
| Super Jobbers | 270 | 204,633 | 110,855 |
| Small Jobbers | 9,000 | 3,661 | 2,063 |
| Open Dealers | 50,000 | 1,723 | 866 |
| Minimum Time, Expressed in Years, to Satisfy Total Demand for All Sectors | | 2.6** years | ≤ 1** year |

*The higher nozzle estimate in Appendix C would increase these numbers.
**The 2.6 years would increase to 2.8 years under the count of Appendix C and the ≤ 1 year would have to be reconsidered.

Table 10. Range of Number of Pumps and Conversion Costs for an "Open Station" and a "Small Jobber"

| | Open Stations | | | Small Jobbers | | |
|---|---|---|---|---|---|---|
| | Low | Average | High | Low | Average | High |
| Number of pumps | 4 | 7 | 12 | 10 | 15 | 100 |
| Cost of conversion | $984 | $1,723 | $2,952 | $2,440 | $3,660 | $24,400 |
| Cost of liter conversion | 496 | 866 | 1,488 | 1,380 | 2,070 | 13,800 |
| Difference | 488 | 857 | 1,464 | $1,060 | $1,590 | $10,600 |

6.36.5 Finally, the additional cost of quart-pricing can now be discussed. The cost of implementing this solution depends on the availability of quart conversion gear.

6.36.6 If these are as readily available as are the liter conversion gears, and if a quart conversion package is marketed by Veeder Root in the same way and stocked to the same extent as the metric conversion package, then the cost of this conversion, will be the same as the liter conversion, except that an amount of approximately $2.5 to $3 million as the value of current metric or dual installations will have to be scrapped. The availability of the equipment is, however, doubtful, since quart-dispensing would cause almost as many changes in other systems as liter dispensing, and it remains a secondary possibility.

6.37 Summary: Timing.

6.37.1 The possibilities available on timing a changeover were one of the criteria on which to evaluate the two adaptive options.

6.37.2 It has been shown that equipment is probably available to accomplish a change to liter-dispensing within a year time-frame, while equipment constraints will probably draw out any changeover to dollar-pricing in excess of two years.

6.37.3 These two estimates were calculated on the basis of a steady supply of equipment and services being delivered within the owner's choice at the time they were required. In other words, the computation presupposes a uniform flow of equipment to the pumps. In practice, this probably will not happen. With supplies tight, an owner who wishes to convert may find that his supplies are not available, while in other locations, there is an oversupply.

6.37.4 An addition of thirty percent to the required time would be a reasonable estimate of how long it might really take to accomplish the changeover to dollar-dispensing. The differential time frame advantage will still accrue to the metric conversion, however.

6.37.5 The best timing for all concerned is one where a change can be planned and prepared for but in which the actual transition period is as short as possible.

6.37.6 From this point of view, the metric option appears advantageous. The amount of planning and accommodation needed is much larger but it at least offers the opportuntiy of a faster transition once the plans are made.

6.38 Equity Considerations.

6.38.1 Equity in this context means equity in the marketplace. The choice should put the least possible strain on the weaker sectors of the retail gasoline trade. In this respect, through both cost and timing considerations, the metric option has a clear advantage.

6.38.2 The cost differences per owner for "open" stations and for "small jobbers," though not large, absolutely, are significant for units, many of which are, according to the ADL study, actually operating below their break-even point.

6.38.3 The relative strengthening of these two sectors will also be advantageous to consumers in that it will help to maintain competition in price and services offered when such competition again becomes feasible. The two sectors benefiting the most from the metric option are traditionally the leaders in competition: the "open" stations in service, and the "small" jobber in price.

6.38.4 This effect must be balanced against the inconvenience and psychic loss that consumers will suffer in switching to a new unit. These undesirable characteristics will be examined in some detail below.

6.39 Consumer impact. A number of other considerations need to be taken into account in analyzing the impact of alternative options for dealing with gas at over $0.999 per gallon. These are considerations which are not directly quantifiable and are therefore analyzed separately from the quantifiable costs. They are, however, at least of equal concern with the out-of-pocket expense.

6.39.1 It must be stressed that only the economic impact on the consumer is examined. If option three is chosen for a permanent solution there will be, for many consumers, a psychic loss in the form of loss of familiar language and measures. This cost is very real.

6.39.2 People have been subjected to a great many changes, not necessarily for the better. The present dilemma originates from an accelerated increase in the price of gasoline, which represents a loss of real income. Under the circumstances, losing the gallon as well as the ability to afford an extra gallon of gas may be perceived as an additional cost.

6.39.3 To balance this psychic loss, evidence was presented to show that gallons are little used in deciding how much gas to buy, as distinct from comparative pricing, so that the feeling of loss about the gallon, though severe for some individuals, may be absent in many.

6.39.4 The discomfort from switching to units of measurement in any area cannot in any way be quantified. Other consequences of the situation can be examined in a quantitative fashion. The trade-offs between discomfort and economic factors is one that can most properly be made by representatives of the political process.

6.39.5 The economic impact on consumers of the option chosen has been divided into two categories by witnesses: (a) the direct effect on the price of gasoline, and (b) the effect on the consumer's ability to do "comparison shopping." Testimony has put the direct cost of any situation at 1/4¢ per gallon for a one year period.

6.39.6 If, for instance, a passthrough is not allowed on computers owned by the major oil companies, then they will have to recoup their investment through depreciation, which can be passed through. The net result will be that the "cost" to the consumer of any alternative will be on the order of 1/5 of 1/4¢ per gallon annually for five years.

6.39.7 It must be stressed that, though the effect of any conversion on the price of gasoline will be small, the cost may be quite significant to independent dealers and small jobbers who own stations and equipment. If a disorderly implementation of change were to reduce the number of these outlets, which are the principal stations engaging in price-competition, the net effect on consumer prices could be very serious indeed.

6.40 Impact on Comparison Shopping.

6.40.1 The relative effect of different situations on the consumer's ability to respond to price-competition, and his response to generating competition, must next be considered.

6.40.2 At this point the relative scarcity of gas becomes an issue. The President has stated that a shortage of gasoline may be expected for the next five years, and it has been argued that during a shortage there will be no price-competition.

6.40.3 This is one possible situation. It is by no means the only possible one, but the implications relative to that chosen for dealing with dollar gas need to be explored.

6.40.4 It is likely that each individual divides personal transportation requirements into three classes: (a) essential, which should include driving to work, where there is no convenient public transportation option, (b) highly desirable (e.g., church, groceries, laundry and whatever else is personally considered essential, and (c) optional.

6.40.5 For any one person, any one of these classes might be void, depending upon habits, circumstances and personal priorities.

6.40.6 If one aggregates each person's classification over an allocation district, the demand for gasoline in that district can also be divided into the same three classes.

6.40.7 The reasoning that "the shortage" will lead to the abandonment of price competition is equivalent to the assumption that the amount of gasoline available is less than, and probably considerably less than, the aggregate of "highly desirable" requirements. With allocation in the 90-95 percent range this seems unlikely. It must also be conjectured that as the price of gasoline increases (and the shortage persists) people will be re-examining their personal classification.

6.40.8 Unless the shortage becomes very much more severe than is currently predicted, some people may engage in comparison shopping. The number of people who feel that it is worth their while to do so will increase or decrease as the shortage becomes more or less severe, and the total number will increase as the price of gas increases. Individuals on the margin will rearrange possible uses of gas among their personal priority classes.

6.40.9 Therefore, the prospective gas shortage cannot rationally be used to dismiss comparison shopping as a positive factor for consumers.

6.40.10 Alternatives regarding the availability of gas depend on the impact of the acceleration in gas prices upon the total demand (as opposed to the rearrangement of classification within a fixed demand). This effect, the price elasticity of the demand for gas, has in the past always proved to be small. However, the present increase, coupled with double-digit inflation and an economic slow-down, may result in much larger elasticity, in which case there may not in fact be an economic shortage. This is the alternative.

6.40.11 Under either the ability to compare gas prices between stations will remain an important consumer benefit, for some customers under the first set of conditions, and for others under the second.

6.40.12 If gasoline continues to be sold in gallons, no change in the present circumstances will occur. The temporary inconvenience of doubling the face amount on the meter to determine the amount of the sale will undoubtedly be unpopular, but will not affect the consumer's ability to shop for the best price.

6.40.13 If gas is eventually to be sold in liters, then there are two possible alternatives: a simultaneous shift in a particular market, or a station-by-station shift as equipment becomes available and is put into use using dual capability computers.

6.40.14 Consider first the effect of the permanent solution, i.e., the effect of dispensing all gasoline in liters. Roughly, price differences of 2¢ per gallon will show up as differences of 1/2¢ per liter. Witnesses before the Board expressed the fear that consumers would fail to pay attention to price differences as small as 1/2¢. Undoubtedly, at present few consumers do so. If the second option is chosen, part of the public awareness campaign that will be necessary will have to address itself to this issue. There seems little doubt that consumers who are price conscious will soon accustom themselves to looking at the tenth digit as well as the penny indicator.

6.40.15 The positive side of this same phenomenon is that the price will be finer-calculated by a factor of four. Once consumers accustom themselves to looking at the tenth digit, dealers who wish to do so can make price-concessions more easily than they do now.

6.40.16 The effect of liter dispensing on the capability to compare prices is small. The consumer will have to learn to look at the last digit as well as the penny indicators. Once he does so, he is likely to benefit from increased price competition.

6.40.17 When the two transition measures are considered, it is soon realized that the preferred alternative, simultaneous change in a market, will not offer any new considerations.

6.40.18 The other, in which each pump or dealer changes to liter dispensing at the option, or capability, of the dealer will be very confusing to the consumer. Witnesses have asserted that this will generate a feeling of being "ripped-off." Will this feeling be justified?

6.40.19 It is reasonable to assume that a consumer who is shopping for gas and passes offerings in the cents-per-liter and cents-per-gallon categories, and being unable to manipulate his computer while driving, will ignore the liter offerings and compare only the gallon quotations.

6.40.20 There are now three possibilities: (a) the best price, the one an individual is looking for, is among those quoted in gallons, (b) the best price is quoted in liters, or (3) the lowest prices among each group are equal. In the first and last cases, when the lowest available price is quoted in gallons, he will not be "ripped off." In the second case, if it were allowed to stand, he would be.

6.40.21 Consider, however, the second case from the dealer's standpoint. Here is a dealer who is trying to generate trade by offering price concessions. Is it likely that this price concession would be downplayed by displaying it in hard-to-compare terms? No. The equipment may force the dealer to dispense in liters, but his display is not so limited. Undoubtedly, the display would proudly advertise the fact that gas is offered at two cents per gallon less than next door.

6.40.22 "The final conclusion then is supportive of the testimony showing concern for consumer assistance during transition phases of a retail conversion. Aids for comparison shopping in gallons and liters would allow purchase decisions to be made with nominal inconvenience."

6.41.1 For a permanent adaptation, uniform dispensing in either liters or gallons would occur. An interim adaptation would be comprised of two possible elements. If the permanent unit is to be gallons, half-gallon dispensing would occur at each pump until the pump computer is adapted. If the permanent unit is to be liters, there are two possibilities: (a) half-gallon dispensing until all pumps in a market area are converted, and a simultaneous change to liters occurs, or (b) half-gallon dispensing would occur until all of a dealer's computers are modified, and the dealer would switch to liters when he is able and willing.

6.41.2 Consumer discomfort is a real consideration if liter dispensing is to be the permanent adaptation. As detailed in the next section, this consideration is balanced by the fact that liter-dispensing will lessen the burden of adaptation for independent and privately-branded dealers, which are precisely those sectors of the industry that have traditionally offered the most price competition.

6.42 Summary.

6.42.1 The most viable options for adapting gas-pumps to gas prices of over $0.999 per gallon were reduced to two: (a) convert the computer to higher unit price, dispensing in gallons, and (b) convert the computer to dispense in liters.

6.42.2 It was shown that the metric option has an edge in all quantifiable aspects: (a) it has a significant edge in cost, which will be particularly valuable to independent ("open") gas-station operators, and privately branded wholesalers (small jobbers), and (b) the transition period can be shorter by about a year and two-thirds.

6.42.3 Qualitatively, on the other hand, the metric option represents a psychic cost to some section of the public, and will also cause some costs and difficulties in the public sector.

6.42.4 The analysis shows that the metric option represents a reasonable choice to the public, in its support of competition and protection of the smaller retailers, against cost of trouble and change.

## 7.0 CONCLUSIONS

7.1 A dominant issue that led to scheduling these hearings was whether the potential existed to gain a national savings for consumers by converting gas pumps to dispense by the liter. It was determined that, at present, a cost differential of at least $94 million exists favoring the metric conversion option as opposed to the greater than $1.00 conversion option. This differential concerns just the mechanical conversion cost and other ancillary costs (see Section 6, Table 7 for elements of cost).

7.2 Three related, very significant issues for which resolution was sought at these hearings were: (1) gasoline prices and their propensity to continue over $1.00 per gallon; (2) gasoline pump computers and their mechanical limitations which generally prevent them from handling unit costs over $1.00 per gallon; and (3) gas pump dispensing options and whether the difficulties embodied therein could be countered by other than the five alternatives* stated at the hearings. These issues were resolved by the hearings as follows:

7.2.1 The gasoline price issue. Gasoline prices will continue to rise and will go over $1.00 per gallon (see Appendix A).

7.2.2 The pump computer limitation issue. The great majority of gas pump computers existing in the U.S. cannot compute a total retail price when the unit price of gasoline goes over $1.00 per gallon (see Section 6, Table 4).

7.2.3 Available alternatives. The five options originally identified constitute all reasonable options. Two options are predominant in their feasibility. They are: (a) convert the computer to calculate prices per gallon at $1.00 or more, and (b) convert the computer to calculate prices per liter (see paragraph 6.2.1-6.2.21).

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* o Convert the computer to calculate price per gallon at $1.00 or more.
  - o Convert the computer to calculate price per half-gallon.
  - o Convert the computer to calculate price per liter.
  - o Convert the computer to calcu'ate price per quart.
  - o Convert the computer to calculate whole number prices, dropping the tenths.

7.3 The aforementioned pre-existing issues and their resolution serve as one constructive aspect of the hearing. A second aspect is new knowledge gained as a result of the hearing process. This knowledge can be framed by the series of conclusive statements that follow:

7.3.1 Industry participants are not opposed to converting retail pumps to metric dispensing. However, they will not take unilateral action to do so because of perceived market disadvantages.

7.3.2 In all probability, a constructive and universal (as opposed to disruptive and fragmented) metric conversion of gas pumps cannot take place without a triggering mechanism. The practical choice of a triggering mechanism is small and may only consist of (a) a mandate, or (b) coordinating leadership.

7.3.3 Technology and available inventories will allow the conversion of gas pump computers to liter sales or to over $1.00 per gallon pricing; however, the transition period for mechanical changeover would range from about one and a half to three years depending upon the option chosen and the proportion of dual capability pumps in the market at the time.

7.3.4 Those who anticipate the problem (primarily the major oil companies) have generally opted to install dual capability computers (i.e., over $1.00 per gallon or liter dispensing) as current equipment wears out. This, while introducing individual corporate flexibility, also provides two drawbacks: (a) a more expensive replacement than called for unless the useful life of each option is exhausted, and (b) a disparate degree of preparation due to differing replacement policies and policy initiation dates among organizations should a metric conversion option become a reality.

7.3.5 There are no significant legal barriers to the sale of fuel by the liter, but officials of all states and some federal officials would undoubtedly require consultation to ensure informed participation on behalf of those jurisdictions should a metric option become a reality.

7.3.6 State Weights and Measures officials agree that the interim "half-pricing" measure is an undesirable long-term option.

7.3.7 There must be adequate information at the pump allowing unit price comparison as well as other available preliminary information that will ensure consumer protection, understanding and acceptance of any pump conversion to liter dispensing. This is of sufficient necessity to surpass in importance any potential cost savings accruing from metric pump conversions.

7.3.8 The interested parties were willing to participate and contribute in the hearing process. That mechanism was successful in airing their views in public and providing information to allow the USMB to continue its deliberations on the matter.

8.0 SUBSEQUENT ACTION OF THE U.S. METRIC BOARD

8.1 The Executive Committee of the USMB meeting on May 18, 1979, placed the issue on the agenda of the next regular scheduled Board meeting to be held June 21, 1979 in Boston, Massachusetts.

8.2 Discussion among the Board ensued and the declaration below was issued. The vote was 13 for, 1 opposed. Three Board Members were absent at the time of the vote.

The Petroleum Retailing industry generally indicates a willingness to dispense gasoline by the liter.

Several states are taking independent action in requiring or recommending liter dispensing.

Therefore, the United States Metric Board declares that:

> This is an opportune time for the development of a planned and coordinated voluntary program of dispensing gasoline by the liter and the Board urges all affected parties to participate in the planning process.
>
> It calls attention to the need for adequate public information in connection with liter dispensing.

Without taking this action, metric usage is likely to proceed in a haphazard fashion leading to public confusion, disparate end results and a negation of the positive cost advantage that a nationally planned and coordinated program offers.



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APPENDIX A

A.0 PETROLEUM SUPPLY PROJECTIONS

A.1 One uncertainty in evaluating the need for conversion of retail service station dispensers is the long-term demand and long-term price prospects for motor fuels. Each year the U.S. Department of Energy is required to make a "mid-term" forecast in five-year increments. The latest such report was issued in April, 1979 and offers pricing and demand projections for 1985, 1990 and 1995.

A.2 Since motor gasoline accounts for 60-75 percent of total fuel used for transportation purposes in the period 1962-1995, data relating to its behavior was extracted and is presented in the following tables, which omit taxes: Table 3 - 1962-1995 Median Supply, Demand and Costs; Table 5 - 1985 Prices (five scenarios); Table 7 - 1990 Prices (five scenarios); Table 9 - 1995 Prices (five scenarios); chart - Market Share Percent, 1962-1995; Table 14 - Energy Consumption by Fuel Type, 1962-1995.

A.3 From these projections we can summarize the following. Table 14 suggests that demand for motor gasoline will drop slightly in 1980 and 1985 (compared to 1977) and will return to about the same level in 1995. Thus, service station growth is, at best, nominal and the dispenser population could in fact shrink slightly in the nearer term. Table 3, which requires adjustment for inflation, suggests that the cost of gasoline continues to increase well beyond the current dollar per gallon assumption for the remainder of the century. Tables 5, 7 and 9, also in 1978 dollars but with five different scenarios, suggest that the extreme low-end cost of 0.85 cents per gallon in 1990 and high-end costs of $1.28 per gallon in 1995 ensure that dollar per gallon retail pricing is inevitable through the year 2000.

A.4 We therefore infer from DOE's projections the following conclusions, which are contradictory to testimony offered by certain witnesses.

A.4.1 The dispenser population has either stabilized or will further shrink in the next five years.

A.4.2 The possibility of gasoline retailing, with federal, state and local taxes included, to less than $1.00 per gallon appears to be nil.

A.4.3 The desirability of considering temporary or interim solutions is not well founded except in balancing public acceptance of modified equipment against investment capital and timing to carry out modification across the complete spectrum of retail dispensers.



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Order No. 476

Analysis Report

# Energy Supply and Demand in the Midterm: 1985, 1990, and 1995

April 1979

**U.S. Department of Energy**
Energy Information Administration
Assistant Administrator for Applied Analysis

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Table 3. U.S. Energy Prices;
History and Series C Projections, 1962-1995
Medium Supply, Demand, and Costs
(1978 Dollars)

| | Historic | | | | Projected | | |
|---|---|---|---|---|---|---|---|
| | 1962 | 1967 | 1972 | 1977 | 1985 | 1990 | 1995 |
| **Supply Prices (Minemouth or Wellhead)** | | | | | | | |
| Coal ($/ton) | | | | | | | |
| Bit., High Sulfur-West VA | 9.65 | 8.91 | 11.67 | 22.01 | 26.46 | 29.81 | 33.45 |
| Sub-Bit., Low Sulfur-WY | * | * | * | * | 8.87 | 9.54 | 11.16 |
| Oil ($/barrel) | | | | | | | |
| Texas | 6.45 | 5.79 | 5.29 | * | 15.09 | 18.83 | 23.83 |
| Imported-Landed U.S. | 4.55 | 4.29 | 4.05 | 14.40 | 15.00 | 18.50 | 23.50 |
| Avg. Refinery Acqu. Cost | * | * | * | 12.85 | 14.82 | 18.15 | 23.19 |
| Natural Gas ($/million Btu) (Marginal price) | | | | | | | |
| Southwest | * | * | 0.47 | 1.94 | 2.18 | 2.40 | 2.96 |
| **Demand Prices** | | | | | | | |
| Residential | | | | | | | |
| Electricity (cents/kWh) | 5.10 | 4.16 | 3.50 | 4.00 | 4.19 | 4.34 | 4.43 |
| Distillate ($/gallon) | 0.29 | 0.28 | 0.27 | 0.47 | 0.51 | 0.60 | 0.74 |
| Natural Gas ($/million Btu) | 2.14 | 1.94 | 1.80 | 2.42 | 3.47 | 3.85 | 4.27 |
| Transportation | | | | | | | |
| Distillate ($/gallon) | 0.45 | 0.46 | 0.45 | 0.63 | 0.63 | 0.72 | 0.86 |
| Gasoline ($/gallon) | 0.64 | 0.63 | 0.55 | 0.67 | 0.86 | 0.95 | 1.07 |
| Jet Fuel ($/gallon) | 0.24 | 0.23 | 0.22 | 0.39 | 0.54 | 0.62 | 0.74 |
| Industrial | | | | | | | |
| Electricity (cents/kWh) | 2.10 | 1.87 | 1.90 | 2.50 | 2.98 | 3.17 | 3.38 |
| Resd. Fuel Oil ($/barrel) | 7.48 | 6.98 | 7.61 | 15.40 | 17.85 | 21.53 | 25.94 |
| Coal ($/ton) | 24.30 | 20.30 | 23.85 | 33.98 | 39.07 | 41.47 | 44.19 |
| Natural Gas ($/million Btu) | 0.71 | 0.66 | 0.73 | 1.47 | 2.63 | 3.12 | 3.87 |
| Industrial Surcharge ($/million Btu) | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.24 | 0.53 |
| Raw Materials | | | | | | | |
| Natural Gas ($/million Btu) | * | * | * | * | 2.45 | 2.81 | 3.27 |
| Average Price ($/million Btu) | | | | | | | |
| All Fuels - All Demand Sectors | * | * | * | * | 5.06 | 5.61 | 6.27 |

* Not Available

Table 5. U.S. Energy Prices;
Projection Series A-E for 1985
(1978 Dollars)

| Assumptions | Historic 1977 | Projected A | B | C | D | E |
|---|---|---|---|---|---|---|
| Supply Curve | | High | Low | Mid | High | Low |
| Demand Curve | | High | High | Mid | Low | Low |
| **Supply Prices (Minemouth or Wellhead)** | | | | | | |
| Coal($/ton) | | | | | | |
| Bit., High Sulfur-West VA | 22.01 | 23.50 | 30.33 | 26.46 | 22.74 | 28.62 |
| Sub-Bit., Low Sulfur-WY | * | 7.99 | 9.68 | 8.87 | 7.99 | 9.68 |
| Oil($/barrel) | | | | | | |
| Texas | * | 15.09 | 21.58 | 15.09 | 15.08 | 17.09 |
| Imported-Landed U.S. | 14.40 | 15.00 | 21.50 | 15.00 | 15.00 | 17.00 |
| Average Refinery Acqu. Cost | 12.85 | 14.71 | 21.14 | 14.82 | 14.68 | 16.78 |
| Natural Gas($/million Btu) (Marginal price) | | | | | | |
| Southwest | 1.94 | 2.03 | 3.01 | 2.18 | 2.02 | 2.43 |
| **Demand Prices** | | | | | | |
| Residential | | | | | | |
| Electricity(cents/kWh) | 4.00 | 4.02 | 4.60 | 4.19 | 3.98 | 4.41 |
| Distillate($/gallon) | 0.47 | 0.51 | 0.66 | 0.51 | 0.50 | 0.56 |
| Natural Gas($/million Btu) | 2.42 | 3.37 | 3.71 | 3.47 | 3.38 | 3.49 |
| Transportation | | | | | | |
| Distillate($/gallon) | 0.63 | 0.63 | 0.79 | 0.63 | 0.62 | 0.68 |
| Gasoline($/gallon) | 0.67 | 0.87 | 1.03 | 0.86 | 0.86 | 0.90 |
| Jet Fuel($/gallon) | 0.39 | 0.54 | 0.70 | 0.54 | 0.52 | 0.58 |
| Industrial | | | | | | |
| Electricity(cents/kWh) | 2.50 | 2.80 | 3.38 | 2.98 | 2.76 | 3.20 |
| Resd. Fuel Oil ($/barrel) | 15.40 | 17.84 | 24.20 | 17.85 | 17.08 | 19.99 |
| Coal($/ton) | 33.98 | 35.09 | 42.26 | 39.07 | 35.03 | 41.24 |
| Natural Gas($/million Btu) | 1.47 | 2.47 | 3.13 | 2.63 | 2.49 | 2.68 |
| Industrial Surcharge($/million Btu) | 0.00 | 0.08 | 0.30 | 0.09 | 0.08 | 0.12 |
| Raw Materials | | | | | | |
| Natural Gas($/million Btu) | * | 2.36 | 2.76 | 2.45 | 2.35 | 2.53 |
| Average Price($/million Btu) | | | | | | |
| All Fuels - All Demand Sectors | * | 4.94 | 5.96 | 5.06 | 4.90 | 5.38 |

* Not Available

Table 7. U.S. Energy Prices; Projection Series A-E for 1990 (1978 Dollars)

| Assumptions | Historic 1977 | Projected A | B | C | D | E |
|---|---|---|---|---|---|---|
| Supply Curve | | High | Low | Mid | High | Low |
| Demand Curve | | High | High | Mid | Low | Low |
| **Supply Prices (Minemouth or Wellhead)** | | | | | | |
| Coal($/ton) | | | | | | |
| Bit., High Sulfur-West VA | 22.01 | 26.15 | 35.06 | 29.81 | 25.07 | 32.05 |
| Sub-Bit., Low Sulfur-WY | * | 8.58 | 10.45 | 9.54 | 7.99 | 9.68 |
| Oil($/barrel) | | | | | | |
| Texas | * | 16.32 | 23.83 | 18.83 | 15.34 | 21.36 |
| Imported-Landed U.S. | 14.40 | 16.00 | 23.50 | 18.50 | 15.00 | 21.00 |
| Average Refinery Acqu. Cost | 12.85 | 15.80 | 23.19 | 18.15 | 14.78 | 20.63 |
| Natural Gas($/million Btu) (Marginal price) | | | | | | |
| Southwest | 1.94 | 1.99 | 3.27 | 2.40 | 2.01 | 2.79 |
| **Demand Prices** | | | | | | |
| Residential | | | | | | |
| Electricity(cents/kWh) | 4.00 | 4.09 | 4.75 | 4.34 | 3.98 | 4.61 |
| Distillate($/gallon) | 0.47 | 0.53 | 0.73 | 0.60 | 0.52 | 0.69 |
| Natural Gas($/million Btu) | 2.42 | 3.57 | 4.28 | 3.85 | 3.60 | 3.99 |
| Transportation | | | | | | |
| Distillate($/gallon) | 0.63 | 0.66 | 0.84 | 0.72 | 0.64 | 0.81 |
| Gasoline($/gallon) | 0.67 | 0.89 | 1.08 | 0.95 | 0.85 | 0.99 |
| Jet Fuel($/gallon) | 0.39 | 0.57 | 0.74 | 0.62 | 0.54 | 0.70 |
| Industrial | | | | | | |
| Electricity(cents/kWh) | 2.50 | 2.91 | 3.58 | 3.17 | 2.81 | 3.44 |
| Resd. Fuel Oil ($/barrel) | 15.40 | 19.04 | 26.77 | 21.53 | 18.07 | 24.96 |
| Coal($/ton) | 33.98 | 37.76 | 44.69 | 41.47 | 37.02 | 43.76 |
| Natural Gas($/million Btu) | 1.47 | 2.63 | 3.94 | 3.12 | 2.66 | 3.48 |
| Industrial Surcharge($/million Btu) | 0.00 | 0.12 | 0.52 | 0.24 | 0.09 | 0.39 |
| Raw Materials | | | | | | |
| Natural Gas($/million Btu) | * | 2.51 | 3.35 | 2.81 | 2.53 | 3.02 |
| Average Price($/million Btu) | | | | | | |
| All Fuels - All Demand Sectors | * | 5.14 | 6.41 | 5.61 | 5.01 | 6.04 |

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Table 9. U.S. Energy Prices; Projection Series A-E for 1995 (1978 Dollars)

| Assumptions | Historic 1977 | Projected A | B | C | D | E |
|---|---|---|---|---|---|---|
| Supply Curve | | High | Low | Mid | High | Low |
| Demand Curve | | High | High | Mid | Low | Low |
| **Supply Prices (Minemouth or Wellhead)** | | | | | | |
| Coal ($/ton) | | | | | | |
| Bit., High Sulfur-West VA | 22.01 | 28.02 | 52.05 | 33.45 | 26.41 | 38.27 |
| Sub-Bit., Low Sulfur-WY | * | 9.50 | 21.77 | 11.16 | 8.58 | 11.16 |
| Oil ($/barrel) | | | | | | |
| Texas | * | 19.78 | 31.81 | 23.83 | 16.80 | 25.82 |
| Imported-Landed U.S. | 14.40 | 19.50 | 31.50 | 23.50 | 16.50 | 25.50 |
| Average Refinery Acqu. Cost | 12.85 | 19.34 | 31.24 | 23.19 | 16.31 | 25.17 |
| Natural Gas ($/million Btu)* (Marginal price) | | | | | | |
| Southwest | 1.94 | 2.13 | 3.96 | 2.96 | 2.01 | 3.33 |
| **Demand Prices** | | | | | | |
| Residential | | | | | | |
| Electricity (cents/kWh) | 4.00 | 4.18 | 5.30 | 4.43 | 4.04 | 4.81 |
| Distillate ($/gallon) | 0.47 | 0.63 | 0.93 | 0.74 | 0.55 | 0.79 |
| Natural Gas ($/million Btu) | 2.42 | 3.79 | 4.92 | 4.27 | 3.71 | 4.56 |
| Transportation | | | | | | |
| Distillate ($/gallon) | 0.63 | 0.75 | 1.05 | 0.86 | 0.67 | 0.90 |
| Gasoline ($/gallon) | 0.67 | 0.98 | 1.28 | 1.07 | 0.90 | 1.11 |
| Jet Fuel ($/gallon) | 0.39 | 0.65 | 0.94 | 0.74 | 0.57 | 0.79 |
| Industrial | | | | | | |
| Electricity (cents/kWh) | 2.50 | 3.02 | 4.18 | 3.28 | 2.89 | 3.66 |
| Resd. Fuel Oil ($/barrel) | 15.40 | 22.26 | 34.96 | 25.94 | 19.42 | 28.84 |
| Coal ($/ton) | 33.98 | 39.46 | 60.13 | 44.19 | 38.44 | 46.84 |
| Natural Gas ($/million Btu) | 1.47 | 2.86 | 4.86 | 3.87 | 2.73 | 4.12 |
| Industrial Surcharge ($/million Btu) | 0.00 | 0.19 | 0.67 | 0.53 | 0.11 | 0.45 |
| Raw Materials | | | | | | |
| Natural Gas ($/million Btu) | * | 2.70 | 4.05 | 3.27 | 2.60 | 3.58 |
| Average Price ($/million Btu) | | | | | | |
| All Fuels - All Demand Sectors | * | 5.59 | 7.71 | 6.27 | 5.21 | 6.72 |

* Not Available

FIGURE 7

# REFINED PETROLEUM PRODUCTS
# MARKET SHARE AND TOTAL CONSUMPTION

## HISTORIC AND PROJECTED SERIES C

## 1962 - 1995

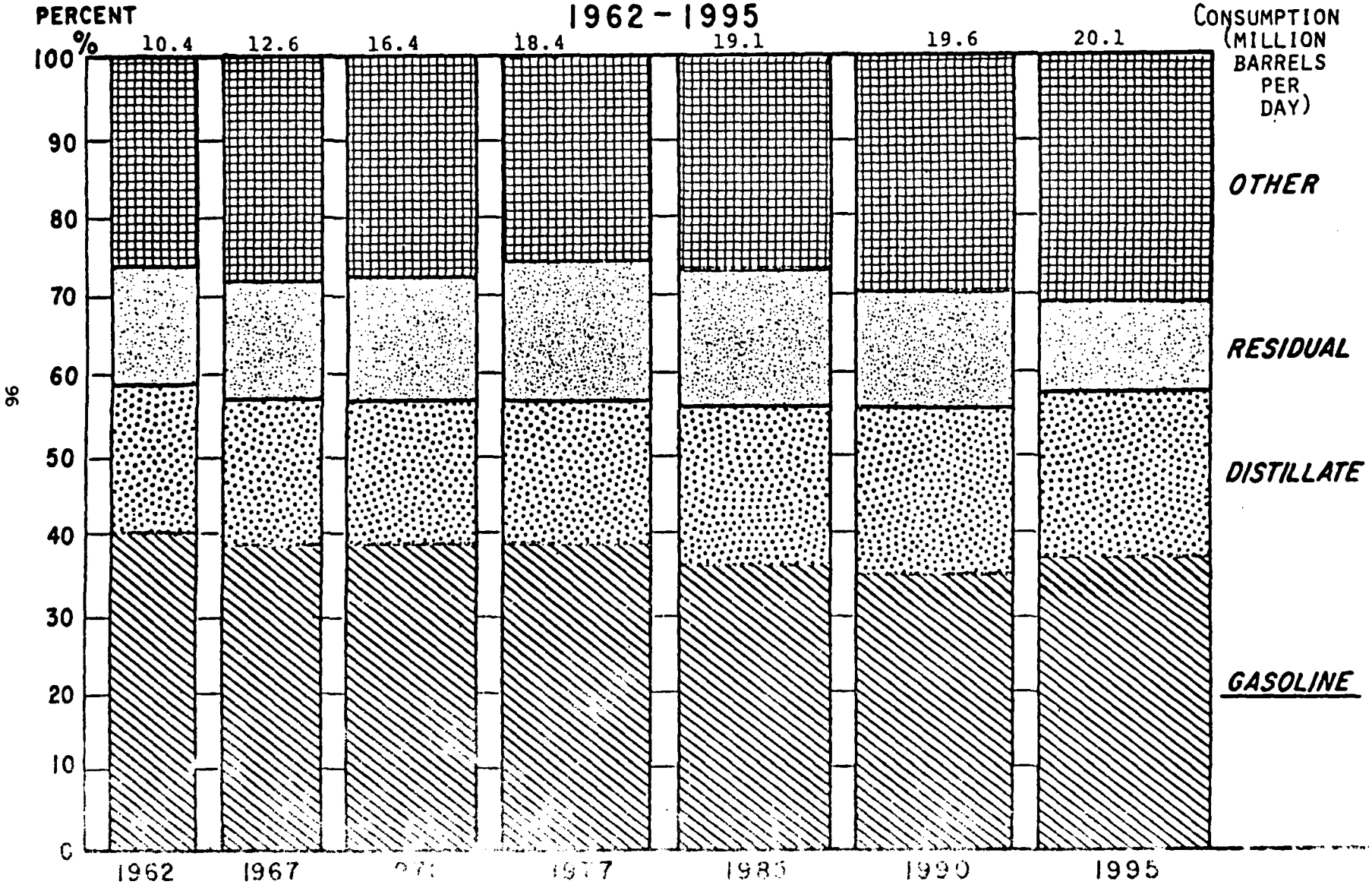

Table 14. Sectoral Energy Consumption by Fuel Type; History and Series C Projections for 1962 - 1995 (Quadrillion Btu Per Year)

| | Historic | | | | Projected | | |
|---|---|---|---|---|---|---|---|
| | 1962 | 1967 | 1972 | 1977 | 1985 | 1990 | 1995 |
| Residential | 7.75 | 9.05 | 10.54 | 10.29 | 10.77 | 11.38 | 11.99 |
| Electricity | 0.77 | 1.13 | 1.74 | 2.23 | 2.83 | 3.34 | 3.81 |
| Distillate | 2.40 | 2.55 | 2.60 | 2.38 | 2.24 | 2.17 | 2.06 |
| Liquid gas | 0.40 | 0.53 | 0.71 | 0.62 | 0.49 | 0.43 | 0.37 |
| Natural gas | 3.59 | 4.45 | 5.29 | 4.98 | 5.16 | 5.41 | 5.74 |
| Other[a] | 0.59 | 0.38 | 0.20 | 0.08 | 0.05 | 0.03 | 0.02 |
| Commercial | 4.72 | 6.28 | 7.77 | 7.87 | 7.55 | 7.91 | 8.33 |
| Electricity | 0.58 | 0.97 | 1.44 | 1.83 | 2.61 | 3.09 | 3.50 |
| Distillate | 0.88 | 0.93 | 1.05 | 1.12 | 0.71 | 0.55 | 0.47 |
| Residual | 0.79 | 1.11 | 1.20 | 1.07 | 0.73 | 0.57 | 0.51 |
| Natural gas | 1.24 | 2.02 | 2.69 | 2.58 | 2.27 | 2.37 | 2.44 |
| Other[b] | 1.22 | 1.25 | 1.38 | 1.27 | 1.23 | 1.33 | 1.40 |
| Industrial | 17.16 | 19.99 | 22.63 | 22.15 | 27.90 | 32.89 | 39.11 |
| Electricity | 1.28 | 1.66 | 2.18 | 2.58 | 3.96 | 5.02 | 6.38 |
| Distillate | 0.31 | 0.39 | 0.49 | 0.81 | 0.62 | 0.60 | 0.58 |
| Residual | 1.32 | 1.12 | 1.23 | 1.46 | 1.94 | 2.50 | 3.55 |
| Liquid gas | 0.14 | 0.17 | 0.28 | 0.44 | 0.53 | 0.63 | 0.70 |
| Coal | 4.51 | 5.27 | 4.32 | 3.82 | 5.13 | 6.64 | 9.74 |
| Natural gas | 6.56 | 8.00 | 9.65 | 8.24 | 9.41 | 9.98 | 9.29 |
| Other[c] | 3.06 | 3.37 | 4.47 | 4.80 | 6.32 | 7.52 | 8.87 |
| Transportation | 11.25 | 14.19 | 18.15 | 20.15 | 21.00 | 21.89 | 23.31 |
| Distillate | 1.20 | 1.50 | 2.20 | 2.78 | 4.12 | 4.95 | 5.47 |
| Residual | 0.79 | 0.80 | 0.65 | 0.93 | 0.60 | 0.61 | 0.63 |
| Gasoline | 7.87 | 9.60 | 12.54 | 13.96 | 13.25 | 13.23 | 14.09 |
| Jet fuel | 0.97 | 1.66 | 1.92 | 1.89 | 2.45 | 2.56 | 2.62 |
| Other[d] | 0.42 | 0.63 | 0.83 | 0.58 | 0.57 | 0.53 | 0.51 |
| Total end-use consumption | 40.88 | 49.52 | 59.08 | 60.47 | 67.22 | 74.07 | 82.75 |
| Electric utilities[e] | 6.39 | 9.35 | 13.65 | 15.86 | 22.33 | 27.17 | 31.95 |
| Conversion Losses[f] | * | * | * | * | 0.34 | 0.29 | 0.32 |
| Total primary consumption[g] | 47.28 | 58.87 | 72.73 | 76.32 | 89.88 | 101.53 | 115.03 |

## APPENDIX B

B.0 GALLON/LITER PRICE AND TAX COMPARISON TABLE

B.1 Explanation:

Column 1 - This data was presented on May 14, 1979 in the Oil and Gas Journal and reflects prices as of May 8, 1979.

Column 2 - Column 1 divided by 3.785412 liters per gallon to yield price per liter.

Column 3 - Conventional rounding of Column 2.

Column 4 - Per gallon state and federal tax rate.

Column 5 - Column 4 divided by 3.785412 liters per gallon to yield tax per gallon (rounded to nearest .5¢).

Column 6 - This data was presented in the May 14, 1979 issue of Oil and Gas Journal and reflects prices as of May 8, 1979.

Column 7 - Column 3 plus Column 5.

Column 8 - Column 6 divided by 3.785412 liters per gallon to yield price per liter (rounded to nearest .1¢).

Column 9 - Column 7 multiplied by 3.785412 liters per gallon to yield equivalent price per gallon. Algebraic sign included to indicate increase or decrease in price.

B.2 Note: The states have consistently taxed motor fuels in increments of 0.5¢ per gallon. It was assumed that modification of the tax table would remain in increments of 0.5¢ per liter. Alternatively, the states could adopt an increment of 0.1¢ per gallon.

## Gasoline Price Comparison
(Approximate Prices for Major-Brand Regular)

| Location | Price ex.tax (gal) | Price ex. tax (Liter) Calc. | Price ex.tax (Liter) Rounded | Tax (gal) | Approx. Tax (Liter) | Pump Price (gal) | Est. Price (Liter) | Calc. Price (Liter) | Calc. Price (gal) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | |
| Albany | 68.0 | 17.96 | 18.0 | 12.0 | 3.0 | 80.0 | 21.0 | 21.1 | 79.5 | (-) |
| Albuquerque | 60.6 | 16.01 | 16.0 | 11.0 | 3.0 | 71.6 | 19.0 | 18.9 | 71.9 | (+) |
| Amarillo | 63.9 | 16.88 | 16.9 | 9.0 | 2.5 | 72.9 | 19.4 | 19.3 | 73.4 | (+) |
| Atlanta | 62.7 | 16.56 | 16.6 | 11.5 | 3.0 | 74.2 | 19.6 | 19.6 | 74.2 | |
| Baltimore | 67.0 | 17.70 | 17.7 | 13.0 | 3.5 | 80.0 | 21.2 | 21.1 | 80.3 | (+) |
| Birmingham | 67.0 | 17.70 | 17.7 | 11.0 | 3.0 | 78.0 | 20.7 | 20.6 | 78.4 | (+) |
| Boston | 61.7 | 16.30 | 16.3 | 13.0 | 3.5 | 74.7 | 19.8 | 19.7 | 75.0 | (+) |
| Buffalo | 67.0 | 17.70 | 17.7 | 13.0 | 3.5 | 80.0 | 21.2 | 21.1 | 80.3 | (+) |
| Charlotte | 66.1 | 17.46 | 17.5 | 13.0 | 3.5 | 79.1 | 21.0 | 20.9 | 79.5 | (+) |
| Cheyenne | 66.6 | 17.59 | 17.6 | 11.0 | 3.0 | 77.6 | 20.6 | 20.5 | 78.0 | (+) |
| Chicago | 66.0 | 17.44 | 17.4 | 13.0 | 3.5 | 79.0 | 20.9 | 20.9 | 79.1 | (+) |
| Cleveland | 64.8 | 17.12 | 17.1 | 11.0 | 3.0 | 75.8 | 20.1 | 20.0 | 76.1 | (+) |
| Corpus Christi | 64.4 | 17.01 | 17.0 | 9.0 | 2.5 | 73.4 | 19.5 | 19.4 | 73.8 | (+) |
| Dallas | 64.4 | 17.01 | 17.0 | 9.0 | 2.5 | 73.4 | 19.5 | 19.4 | 73.8 | (+) |
| Denver | 66.0 | 17.44 | 17.4 | 11.0 | 3.0 | 77.0 | 20.4 | 20.3 | 77.2 | (+) |
| Des Moines | 62.7 | 16.56 | 16.6 | 12.5 | 3.5 | 75.2 | 20.1 | 19.9 | 76.1 | (+) |
| Detroit | 63.4 | 16.75 | 16.8 | 13.0 | 3.5 | 76.4 | 20.3 | 20.2 | 76.8 | (+) |
| Fort Worth | 64.4 | 17.01 | 17.0 | 9.0 | 2.5 | 73.4 | 19.5 | 19.4 | 73.8 | (+) |
| Houston | 64.7 | 17.09 | 17.1 | 9.0 | 2.5 | 73.7 | 19.6 | 19.5 | 74.2 | (+) |
| Indianapolis | 65.8 | 17.38 | 17.4 | 12.0 | 3.0 | 77.8 | 20.4 | 20.6 | 77.4 | (-) |
| Jacksonville | 65.0 | 17.17 | 17.2 | 12.0 | 3.0 | 77.0 | 20.2 | 20.3 | 76.5 | (-) |
| Kansas City | 66.9 | 17.67 | 17.7 | 11.0 | 3.0 | 77.9 | 20.7 | 20.6 | 78.4 | (+) |
| Little Rock | 62.2 | 16.43 | 16.4 | 12.5 | 3.5 | 74.7 | 19.9 | 19.7 | 75.3 | (+) |
| Louisville | 63.8 | 16.85 | 16.9 | 13.0 | 3.5 | 76.8 | 20.4 | 20.3 | 77.4 | (+) |
| Los Angeles | 69.2 | 18.28 | 18.3 | 11.0 | 3.0 | 80.2 | 21.3 | 21.2 | 80.7 | (+) |
| Memphis | 64.0 | 16.91 | 16.9 | 11.0 | 3.0 | 75.0 | 19.9 | 19.8 | 75.3 | (+) |
| Miami | 63.6 | 16.80 | 16.8 | 12.0 | 3.0 | 75.6 | 19.8 | 20.0 | 75.0 | (-) |
| Milwaukee | 64.8 | 17.12 | 17.1 | 11.0 | 3.0 | 75.8 | 20.1 | 20.0 | 76.1 | (+) |
| Minnesota-St. Paul | 61.7 | 16.30 | 16.3 | 13.0 | 3.5 | 74.7 | 19.8 | 19.7 | 75.0 | (+) |

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Newark | 66.2 | 17.49 | 17.5 | 11.0 | 3.0 | 77.2 | 20.5 | 20.4 | 77.6 | (+) |
| New Orleans | 65.0 | 17.17 | 17.2 | 12.0 | 3.0 | 77.0 | 20.2 | 20.3 | 76.5 | (-) |
| New York | 67.1 | 17.73 | 17.7 | 13.0 | 3.5 | 80.1 | 21.2 | 21.2 | 80.3 | (+) |
| Norfolk | 60.2 | 15.90 | 15.9 | 13.0 | 3.5 | 73.2 | 19.4 | 19.3 | 73.4 | (+) |
| Oklahoma City | 64.3 | 16.99 | 17.0 | 10.5 | 3.0 | 74.8 | 20.0 | 19.8 | 75.7 | (+) |
| Omaha | 62.3 | 16.46 | 16.5 | 13.5 | 3.5 | 75.8 | 20.0 | 20.0 | 75.7 | (-) |
| Philadelphia | 65.0 | 17.17 | 17.2 | 13.0 | 3.5 | 78.0 | 20.7 | 20.6 | 78.4 | (+) |
| Phoenix | 69.8 | 18.44 | 18.4 | 12.0 | 3.0 | 81.8 | 21.4 | 21.6 | 81.0 | (-) |
| Pittsburgh | 65.0 | 17.17 | 17.2 | 13.0 | 3.5 | 78.0 | 20.7 | 20.6 | 78.4 | (+) |
| Portland (Oregon) | 68.1 | 17.99 | 18.0 | 12.0 | 3.0 | 80.1 | 21.0 | 21.2 | 79.5 | (-) |
| Salt Lake City | 63.1 | 16.67 | 16.7 | 13.0 | 3.5 | 76.1 | 20.2 | 20.3 | 76.5 | (+) |
| San Antonio | 61.9 | 16.35 | 16.4 | 9.0 | 2.5 | 70.9 | 18.9 | 18.7 | 71.5 | (+) |
| San Diego | 68.3 | 18.04 | 18.0 | 11.0 | 3.0 | 79.3 | 21.0 | 21.0 | 79.5 | (+) |
| San Francisco | 68.0 | 17.96 | 18.0 | 11.0 | 3.0 | 79.0 | 21.0 | 20.9 | 79.5 | (+) |
| Seattle | 66.8 | 17.65 | 17.7 | 15.0 | 4.0 | 81.8 | 21.7 | 21.6 | 82.1 | (+) |
| Spokane | 65.7 | 17.36 | 17.4 | 15.0 | 4.0 | 80.7 | 21.4 | 21.3 | 81.0 | (+) |
| Springfield (Illinois) | 61.2 | 16.17 | 16.2 | 13.0 | 3.5 | 74.2 | 19.7 | 19.6 | 74.6 | (+) |
| St. Louis | 67.7 | 17.88 | 17.9 | 11.0 | 3.0 | 78.7 | 20.9 | 20.8 | 79.1 | (+) |
| Tampa | 63.5 | 16.77 | 16.8 | 12.0 | 3.0 | 75.5 | 19.8 | 19.9 | 75.0 | (-) |
| Texarkana | 65.0 | 17.17 | 17.2 | 9.0 | 2.5 | 74.0 | 19.7 | 19.6 | 74.6 | (+) |
| Tulsa | 63.4 | 16.75 | 16.8 | 10.5 | 3.0 | 73.9 | 19.8 | 19.5 | 75.0 | (+) |
| Wichita | 63.8 | 16.85 | 16.9 | 12.0 | 3.0 | 75.8 | 19.9 | 20.0 | 75.3 | (-) |
| Wichita Falls | 62.9 | 16.62 | 16.6 | 9.0 | 2.5 | 71.9 | 19.1 | 19.0 | 72.3 | (+) |

# APPENDIX C.

## EXCERPTS FROM A COMMUNICATION FROM SHELL OIL CO.

June 27, 1979

Mr. Stanley R. Parent
Director, Research Coordination and Planning
United States Metric Board
Suite 600
1815 North Lynn Street
Arlington, Virginia 22209

Dear Mr. Parent:

* * *

In the revised tables and cost estimates, I have taken the liberty of modifying your statistical analysis of computers to include 650,000 nozzles for major oil companies. Also, I have reduced the net figures for conversions by an estimate of the number of new dispensers that will be purchased to replace obsolete dispensers during the next 12 months. Also shown is an additional 125,000 computers to be replaced by major oil due to obsolescence. You will note that the major difference in cost to the industry is in the major oil column which results in an estimated total cost advantage to metric of $186 million.

* * *

We believe that the total nozzle count is too low for now and 1981. Survey of all states by NBS showed 1.4MM plus. We do not believe that this will diminish to a 1.1MM level. A current survey, as attached, shows 594M for 12 major oil companies, twice that shown for 17 in the table. We therefore estimate 650M for these 17 majors. As some of these are in dealer owned stations, it appears that 300M nozzles would be a better number for this group. Current projections for maintaining a static total volume through a decreasing number of service stations shows a relatively static total number of nozzles. Supporting this also are the following factors:

a. The State of California is limiting dispenser flow rates to 8 gpm for vapor balance systems, down from a normal 10-12 gpm.

b. The increasing number of small cars is reducing the average gallons per sale down from 12-13.

* * *

Shell appreciates the opportunity of working with you. If we can be of any further assistance, please do not hesitate to ask.

Very truly yours,

C. L. Van Inwagen,
Staff Engineer
Retail & Commercial Engineering
Marketing Engineering

Attachments

## NOZZLE SURVEY OF 12 MAJOR OIL COMPANIES

| MAJOR OIL COMPANY | NO. OF NOZZLES/ COMPUTERS OWNED | CONTACT |
|---|---|---|
| Shell | 65,000 | (own) C. L. Van Inwagen 713-241-6973 |
| Exxon | 80,000 | H. Harris - Houston 713-656-6170 |
| Mobil | 60,000 | J. Petrelli - New York 212-883-5204 |
| Texaco | 65,000 | J. Sandell - Houston 713-225-2233 |
| Gulf | 85,000 | Ed Hood - Houston 713-750-2000 |
| Phillips | 15,000 | L. Stevenson 918-661-7012 |
| Getty | 15,000 | W. Grosshauser 918-560-6000 |
| Chevron | 56,000 | Jack Tuomy 415-894-3495 |
| Arco | 27,000 | Chas Connors 213-486-2280 |
| Union | 41,000 | Bill Myers 312-885-5144 |
| Amoco | 71,000 | Bob House 312-856-5879 |
| Sohio | 14,000(40% metric) | Ross Pillari 216-575=4251 |
| 12 "Majors" | 594,000 | |

Survey By: C. L. Van Inwagen
Shell Oil Company
June 18-19, 1979

Projected Nozzles for 17 Majors - 650,000

Notes from H. Harris, A. D. Little Report, used as reference, was for a vapor recovery study. Major Oil was shown as 520,000 nozzles responsibility. Apparently this number was too low for 1977, based on above.

Table 1 Revised. Estimated Total and Average Number of Nozzles Per Owner by Owner -- 1980

| Nozzle Owner | Number of Owners | Number of Nozzles | Average Number of Nozzles/Owner |
|---|---|---|---|
| Major Oil Co. | 17 | 650,000 | 38,235 |
| Regional Refiner | 21 | 94,000 | 4,475 |
| Super Jobber | 270 | 224,000 | 830 |
| Small Jobber | 9,000 | 136,000 | 15 |
| Open Dealer | 43,000 | 300,000 | 7 |
| Total | -- | 1,404,000 | -- |

Table 4 Revised. Thousands of Computers by Owner and Computer Type -- 1980

| Nozzle Owner | 2002 W/Metric | 2001/101 W/Metric | Adaptable to Metric | Old | Total |
|---|---|---|---|---|---|
| Major Oil Co. | 85 | 85 | 290 | 190 | 650 |
| Regional Refiner | 5 | 5 | 75 | 9 | 94 |
| Super Jobber | 10 | 10 | 186 | 18 | 224 |
| Small Jobber | -- | -- | 114 | 22 | 136 |
| Open Dealer | -- | -- | 222 | 78 | 300 |
| Total | 100 | 100 | 887 | 317 | 1,404 |

## A. Estimated Cost of Metric Conversion

| Computer Analysis By Type of Owner | Major Oil Co. | Regional Refiner | Super Jobber | Small Jobber | Open Dealer | Total |
|---|---|---|---|---|---|---|
| Total Computers (thousands) | 650 | 94 | 224 | 136 | 300 | 1,404 |
| Computers With Metric Quick Change Gear Box | 170 | 10 | 20 | -- | -- | 200 |
| Conversion Required | 480 | 84 | 204 | 136 | 300 | 1,204 |
| Less 1 Year's Normal Dispenser Purchases | 65 | 9 | 18 | -- | -- | 92 |
| Net Conversions Required | 415 | 75 | 186 | 136 | 300 | 1,112 |
| Conversion Options | | | | | | |
| 1. Add Gear Box or New Gears to Existing | 290 | 75 | 186 | 114 | 222 | 887 |
| 2. New Computer With Metric Gear Box | 125 | -- | -- | -- | -- | 125 |
| 3. Rebuilt Computer With Metric Gear Box | -- | -- | -- | 22 | 78 | 100 |

| Conversion Option | Unit Cost | Cost in Millions of Dollars | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | 70 | 20 | 5 | 13 | 8 | 16 | 62 |
| 2. | 270 | 34 | - | -- | - | -- | 34 |
| 3. | 150 | -- | - | -- | 3 | 12 | 15 |
| Total Cost-Metric | | 54 | 5 | 13 | 11 | 28 | 111 |

B. Estimated Cost of $1.99/Gallon Conversion

| Computer Analysis By Type of Owner | Major Oil Co. | Regional Refiner | Super Jobber | Small Jobber | Open Dealer | Total |
|---|---|---|---|---|---|---|
| Total Computers (thousands) | 650 | 94 | 224 | 136 | 300 | 1,404 |
| $1.99/Gallon Computers | 85 | 5 | 10 | -- | -- | 100 |
| Conversion Required | 565 | 89 | 214 | 136 | 300 | 1,304 |
| Less 1 Year's Normal Dispenser Purchases | 65 | 9 | 18 | -- | -- | 92 |
| Net Conversions Required | 500 | 80 | 196 | 136 | 300 | 1,212 |
| Conversion Options | | | | | | |
| 1. Replace With New 2002 Computer | 500 | 80 | 100 | 80 | 140 | 900 |
| 2. Replace With Rebuilt Computer | -- | -- | 96 | 56 | 160 | 312 |
| Conversion Option / Unit Cost | | | | | | |
| 1. 250 | 125 | 20 | 25 | 20 | 35 | 225 |
| 2. 230 | -- | -- | 22 | 13 | 37 | 72 |
| Total Cost $1.99/ Gallon | 125 | 20 | 47 | 33 | 72 | 297 |

C. Estimated Cost Advantage of Metric Conversion

| Millions of Dollars | Major Oil Co. | Regional Refiner | Super Jobber | Small Jobber | Open Dealer | Total |
|---|---|---|---|---|---|---|
| $1.99/Gallon Cost | 125 | 20 | 47 | 33 | 72 | 297 |
| Metric Cost | 54 | 5 | 13 | 11 | 28 | 111 |
| Metric Advantage | 71 | 15 | 34 | 22 | 44 | 186 |



GPO 943-087