13 Oct 1977

Federal Automobile Fuel Economy Standards -- A Status Report

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FEDERAL AUTOMOBILE FUEL ECONOMY STANDARDS - A STATUS REPORT

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NOTE: The views expressed in this paper are those of the author, and do not necessarily represent the policy or position of the National Highway Traffic Safety Administration or the Department of Transportation

Abstract

The Energy Policy and Conservation Act (EPCA) was enacted into law in December 1975 and is an important part of our national energy program. A section of the EPCA is concerned with "Improving Automotive Efficiency" and delegates various rulemaking responsibilities to the Department of Transportation relating to both passenger automobiles and nonpassenger automobiles. The scope of this paper is limited to a discussion of passenger automobile fuel economy standards for model years 1981 and beyond. A review of the background and rationale for the rulemaking to date and plans for the future are included.

1. INTRODUCTION

The theme of this year's conference is "Energy Crisis - Where do we go from here?" The fundamental reality with which we are faced is that this Nation has entered a new era in which energy resources previously abundant will remain in short supply, retarding our economic growth and necessitating an alteration in our life's habits and expectations. The Arab oil embargo of 1973-1974 raised public consciousness of energy problems and underscored more effectively than could any other event the need for policy decisions at the national level. Until the recent past, our economy has been based on the continued availability of cheap energy resources. We have been profligate in their use to the point that per capita consumption in the United States is roughly twice that consumed on a per person basis in West Germany (although our standard of living is roughly equivalent).

Fuels consumed for transportation are virtually 100 percent derived from petroleum and account for some 52 percent of all petroleum used in the United States. The automobile plays a critical role in the United States transportation scheme. It is and will continue to be for the foreseeable future the most universally accepted form of personal transportation, currently accounting for 90 percent of all personal travel.

Transportation is not only a substantial energy consumer, but also has a significantly lower efficiency of energy use (approximately 25 percent overall efficiency as compared to 60 percent for the industrial sector and 53 percent for the residential and commercial sector) than any other energy consuming sector of the United States economy. Highway vehicles (automobiles, trucks and buses) in the aggregate consume over 75 percent of the total transportation fuels, with automobiles consuming more than twice as much fuel as any other transportation mode. Any increase in the efficiency of the automobile's use of petroleum would thus have an almost immediate visible impact because of the relatively high vehicle turnover rate and the high degree of concentration of the industry.

The major role of the transportation sector as a necessary consumer of energy, and the critical role of petroleum in fulfilling that need is shown in Figure 1 and Figure 2. As previously noted, over half of all petroleum consumed in the United States is for transportation use.

Figure 2 shows the relative importance of highway transportation, and particularly the automobile in our petroleum consumption.

The increasing dependence of this Nation on uncertain foreign oil supply is depicted in Figure 3. Total imports of petroleum products have grown from some 20 percent of our requirements in 1970 to nearly 50 percent in 1977. During this period, the middle-East imports have soared from 2 percent to 19 percent and our dependence on foreign oil is predicted to rise even higher in the future.

2. THE ENERGY POLICY AND CONSERVATION ACT

In response to the critical situation outlined above, the Congress enacted into law in December 1975 the Energy Policy and Conservation Act (EPCA). An important part of this Act relates to "Improving Automotive Efficiency" and delegates various responsibilities to the Secretary of Transportation relating to both passenger automobiles and nonpassenger automobiles. The scope of this paper is limited to a discussion of passenger automobile fuel economy standards for model years 1981 and beyond. The EPCA mandated passenger car average fuel economy standards of 18, 19, and 20 mpg respectively for model years 1978, 1979, and 1980. These values are the fleet average composite fuel economy that each manufacturer is required to meet. The composite fuel economy is an harmonically weighted average of 55 percent of the urban driving fuel economy and 45 percent of the highway driving fuel economy obtained by EPA during their annual certification test for all significant vehicle configurations.

The Energy Policy and Conservation Act did not stop with the establishement of fuel economy standards for 1978 through 1980. It required that the Secretary of Transportation set standards for model years 1981 through 1984, and it set forth statutory criteria for determining the standards for that time period as shown in Figure 4.

In determining the maximum feasible value for fuel economy standards, it is incumbent upon the Department of Transportation to give consideration to the technological feasibility and economic practicability of the proposed standard, the effect of other Federal motor vehicle standards, and the need for the Nation to conserve energy.

In addition to these four factors, it is necessary to insure that the standards selected result in steady progress toward the 1985 target, which was tentatively set at 27.5 m.p.g. by the EPCA.

In a real sense, the maximum conservation of energy is the objective of the Act, and the other items enumerated above are constraints. Within the constraints of economic practicability and technological feasibility, selection of the level of a fuel economy standard should be predicated on the most fuel efficient option even if it is not always the most cost effective one. For a given fuel economy improvement to be technologically feasible, the technology necessary to achieve that improvement must be capable of commercial applicability in the period to which the standards apply. If the Department can reasonably project that the technology will become commercially applicable to large-scale production in a specified model year, its use is "technologically feasible" for that model year.

With respect to "economic practicability" the Department requires that the fuel economy standards be set at levels within the financial capability of the industry, but not so stringent as to threaten substantial economic hardship for the industry. A cost-benefit analysis is deemed useful as a supplemental evaluation, but sole reliance on such an analysis is contrary to the intent of the Act.

The other Federal standards which have been considered are those relating to emission levels, occupant safety, vehicle damageability and vehicle noise. The need for the Nation to conserve energy is considered to be paramount such that energy conservation is deemed the primary factor in deciding among feasible alternatives.

Non-compliance for a manufacturer will result in civil penalties of $5 multiplied by the total year's production of passenger automobiles for each 0.1 m.p.g. which a company falls short of the standard. However, credits can be carried forward and backward for one year, thereby allowing manufacturers flexibility in meeting the rule.

The normal rulemaking procedures were used in establishing this rule. An Advanced Notice of Proposed Rulemaking (ANPRM) was issued on September 15, 1976, for publication in the Federal Register. A Notice of Proposed Rulemaking (NPRM) was issued on February 15, 1977. Public hearings were held beginning on March 22, 1977. Participation of five public interest groups was supported in part by a DOT program to fund such participation in important rulemaking activities. Additional information was obtained from a number of sources by the use of "special orders" requiring response to specific questions. The final rule which established the standards was issued on June 27, 1977.

This schedule of the important steps of the

rulemaking process is summarized in Figure 5.

3. DETERMINING THE 1981-1984 AVERAGE FUEL ECONOMY STANDARDS

The responsibility for performing the supporting analysis and recommending standards was delegated by the Secretary of Transportation to the National Highway Traffic Safety Administration (NHTSA). I should like to review briefly the highlights of the supporting analysis. First, it was necessary to consider the options which are available to the automobile manufacturers for improving fuel economy. These are shown on Figure 6. Figure 7 depicts the assessment by NHTSA of the improvement in fuel economy which is attainable as a consequence of various technology improvements.

The final selection of the 1981-1984 average fuel economy standards was based on a number of considerations (Figure 8). These include the rapid but not unreasonable introduction of technology, a reduction in the average acceleration of 10 percent and allowing a wide range of technical and marketing options by the industry to achieve the standard. Large shifts in the mix of automobile sizes are not required to meet the standard, nor is massive introduction of diesel engines, although both of these could be used by the industry if desired. The analysis performed by DOT assumes that the percentage of cars in each size class will remain constant at 26 percent standard, 32 percent intermediate, 28 percent compact and 14 percent subcompact during the 1981-1984 time period. The weights of each size will come down, however.

Based upon the rationale outlined above, the standards for 1981, 1982, 1983, and 1984 were set at 22, 24, 26 and 27 m.p.g. respectively. In arriving at these standard values, the government has suggested a number of changes that can be made relative to the 1977 fleet. These include significant weight reduction, a modest reduction in vehicle acceleration capability, the phasing into production of advanced transmissions, improved lubricants, reduced loads for accessories and reduced aerodynamic drag and rolling resistance. Among the fuel economy improvements which could be applied in this time frame, but which were not included in the Department's projections, were the application of diesel and other advanced engine types, and the use of "mix-shift," that is, an increased percentage of smaller cars.

Until 1974, there was a long-term trend in the fuel economy of new cars towards lower values. In 1967, the new car fleet averaged 14.8 m.p.g., and in 1974 this had decreased to 12.8. Starting in 1975, this trend has been reversed with an increase to 17.8 in 1977. Starting in 1978, there will be government standards which will require this upward trend to continue, as shown in Figure 9. It is possible that the fuel economy of the production fleet may be higher than the government standard in the early eighties.

Figure 10 shows the steps used by NHTSA to determine the feasible fuel economy schedules.

The most important means to improve the fuel economy is by reducing the weight of the vehicle. All of the manufacturers are expected to have a much lower average weight by 1984. By model year 1981 the average weight of automobiles produced by U. S. manufacturers is expected to drop 750 lbs from the estimated 4200 lbs of the 1977 models. The average inertia weight could decrease by another 350 lbs by the 1985 model year. The large decrease in average weight by 1981 is due to the downsizing programs that the U. S. automobile manufacturers now have underway. The decrease to an average weight of 3100 lbs in the 1985 model year is due to the expected completion of the downsizing programs and the substitution of aluminum, plastics, and high strength steel for heavier materials. These estimates of average inertia weights are based on today's mix of car sizes.

The analysis conducted by NHTSA for each domestic manufacturer predicts weight reductions as shown in Figure 11. These detailed projections are based upon considerations of time phased introduction of weight reduction technology.

More information relating to the detailed procedures and analysis used by the Department of Transportation is contained in the "Rulemaking Support Paper Concerning the 1981-1984 Passenger Auto Average Fuel Economy Standards" dated July 1977, copies of which may be obtained from the Department of Transportation.

The net result of the DOT analysis is that the three largest domestic manufacturers are expected to be at or above the standard between 1981 and 1984. American Motors will have to add more of the available technology from 1982 to 1984 in order to meet the standards, and AMC's new president recently stated that his company would be able to meet the 27.5 m.p.g. standard in the early 1980's. All of the manufacturers are expected to be able to meet the current 1985 standard of 27.5 m.p.g. with most expected to be above 28. The projected average fuel economy by model year for each of the domestic manufacturers is shown in Figure 12.

4. PREDICTED IMPACT OF 1981-1984 FUEL ECONOMY STANDARD

This rule will have an effect on the consumer, the industry and the Nation. The main consumer impact will be the availability of more fuel efficient automobiles. There is not expected to be a major change in the consumers' freedom of choice. The industry has already started a program to "downsize" cars, that is, to make cars lighter in weight and smaller in outside dimensions, but without any change in utility (same comfort, same passenger and luggage space).

Consumers can expect the impact of the fuel economy standards to save them money over the long-term when compared to 1977 values. With the improved fuel economy, the cumulative gasoline cost savings will increase from $634 in 1981 to $957 in 1984. Similarly, the improved automobiles will have lower maintenance costs, resulting in a cumulative saving ranging from $151 in 1981 to $183 by 1984. The cumulative change in price of new cars is expected to decrease by $86 in 1981 and to be a $49 increase by 1984. In total, the consumer can expect a cumulative saving between $871 in 1981 and $1091 by 1984 as a result of the fuel economy standards.

However, the overall price may increase as a consequence of changing emission levels and safety requirements. But the overall economic effect to the consumer of the fuel economy standard is expected to be a net savings, due to the better fuel economy and anticipated reduced maintenance over the life of the automobile.

The automobile industry and its suppliers are not predicted to experience major economic changes. The total sales of automobiles are expected to rise due to natural demand factors. It is not expected that capital availability will be a limiting factor.

Each year the automobile manufacturers invest billions of dollars in annual model changes and general product improvement. Some additional investment can be expected due to the imposition of the average fuel economy standards. DOT estimates that by 1981 the U. S. manufacturers would have had to spend about $4.6 billion more than they would in the normal course of business, increasing to a cumulative $6.7 billion in 1984.

The impact of retail price increases on sales has been evaluated with the use of the Wharton Econometric Demand Model. The dotted curve in Figure 13 shows the effect of a cumulative price increase of 8 percent or about 400 dollars by 1985. This is close to the upper bound that may be justified with unadjusted capital requirements.

The most significant national impact will be the reduction in the need to import oil.

The 1981-84 Average Fuel Economy Standards will result in savings of 590,000 barrels/day in 1985 and 1.2 million barrels per day in 1995 compared to holding the 1980 average fuel economy standard at 20 m. p. g. By 1995 this will mean a cumulative savings of 4.3 billion barrels which is about half of the oil reserves in Northern Alaska. When discounted to 1980, this oil is worth about $24 billion.

Figure 14 shows that, without the 1981-1984 fuel economy standards, the total consumption of gasoline would experience a slight dip from the current value of 74 billion gallons per year to about 71 billion gallons in 1985. It would then begin to rise about 1990 and be at about 82 billion gallons in the year 2000. The fuel economy standards will cause the gasoline consumption to decrease to 54 billion gallons in 1991 and remain below current levels until beyond the year 2000. The post-1985 estimate assumes that fuel economy will remain constant at 27.5 m. p. g.

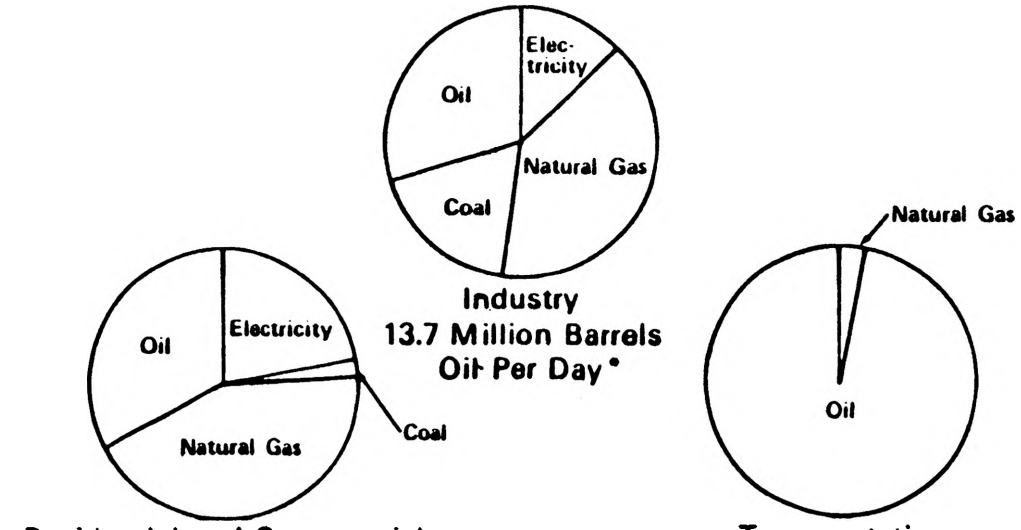
5. FUEL ECONOMY STANDARDS FOR 1985 AND BEYOND

While the Department of Transportation has completed an important task by setting fuel economy standards for the 1981-1984 time period, another important goal remains to be accomplished While the Energy Policy and Conservation Act set the 1985 level tentatively at 27.5 m. p. g., it was recognized that the maximum feasible level for 1985 needed to be analyzed and reviewed in the light of technological and economic developments. Thus, the EPCA also requires that the Secretary of Transportation review the feasibility of 27.5 m. p. g. as the "maximum feasible" level for 1985, and report the results to Congress by January 1979.

Based upon the analysis performed in conjunction with the determination of 1981-1984 standards, it appears probable that the standard for 1985 could be greater than the 27.5 m. p. g. set by Congress. The Department plans to start proceedings in the near future in order to assess the maximum feasible fuel economy standards for model year 1985 and thereafter. Concurrently, the Department will also review the standard set for model year 1984 in light of the latest available developments and information.

FIGURE 1

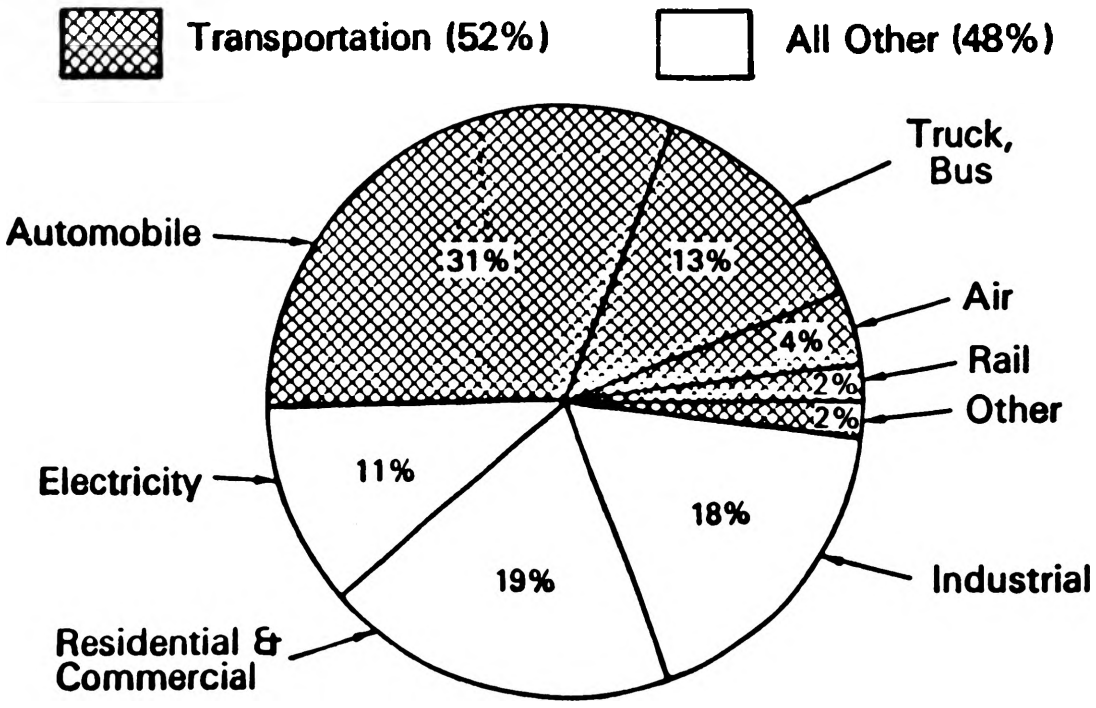
U.S. Energy Consumption By Sector, 1976



*Oil Equivalent
(Electricity Losses Allocated)
Source: Federal Energy Administration.

FIGURE 2

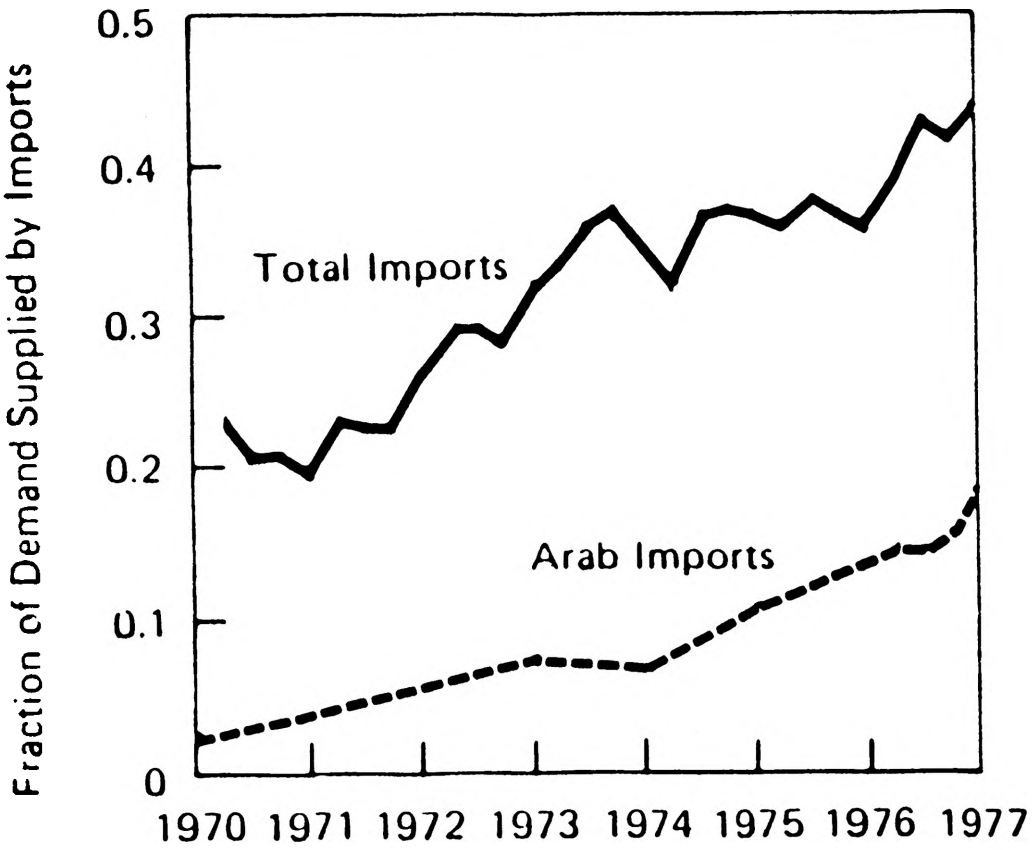
U.S. Petroleum Consumption by Sector



Source: Draft report by the Federal Task Force on Motor Vehicle Goals Beyond 1980. May 1976.

U.S. Dependence on Petroleum Imports

FIGURE 3



Statutory Criteria

FIGURE 4

- ***Maximum Feasible***
  - — Technological Feasibility
  - — Economic Practicability
  - — Effect of Other Motor Vehicle Stds
  - — Need to Conserve Energy
- ***Result in Steady Progress Toward 1985 Standard***

Milestones Schedule

FIGURE 5

- Enactment of E.P.C.A. - Dec. 22, 1975
- ANPRM Issued - Sept. 15, 1976
- NPRM & Public Hearing Notice - Feb. 17, 1977
- Public Hearings - March 22-24 , 1977
- Rule to be Issued - by July 1, 1977

Options Available for Improving Auto Fuel Economy

FIGURE 6

- Weight Reduction
  - Downsize
  - Material Substitution
- Engine Improvements
- Improved Transmissions
- Alternative Engines
  - Diesel
  - Stratified Charge
  - Variable Displacement
- Other Technological Advances
  - Aerodynamics
  - Lubricants
  - Accessories
  - Rolling Resistance
- Mix Shift
- Reduced Acceleration Performance

Percent Improvement In Fuel Economy For Various Technologies

FIGURE 7

Technology Improvement	Percent Improvement
Automatic Transmission	10
Manual Transmission	5
Lubricants	2
Accessories	2
Aerodynamic Drag	4
Rolling Resistance	3
Diesel (or Equivalent)	25

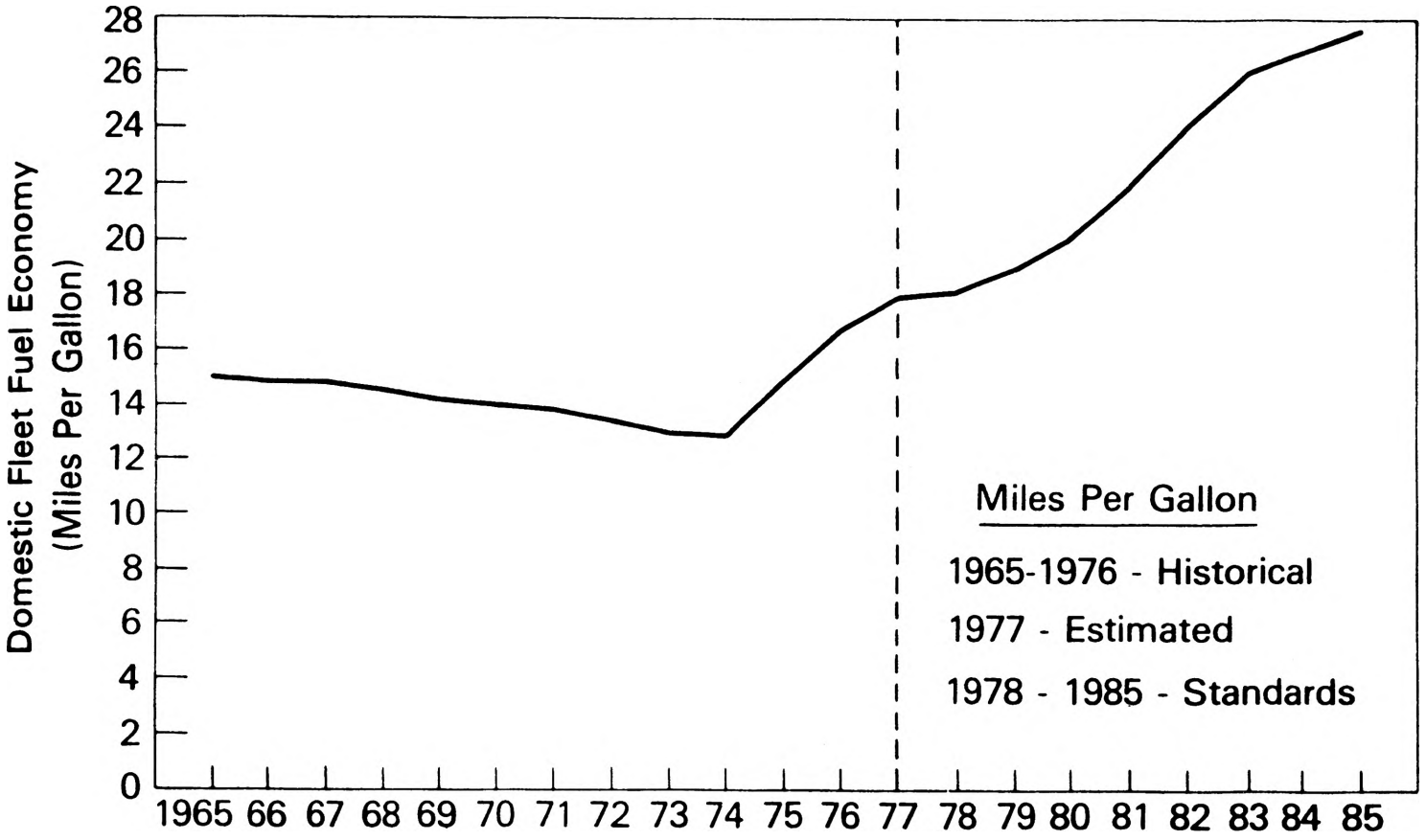
Rationale for 1981-1984 Average Fuel Economy Standards

FIGURE 8

- Rapid, But Not Unreasonable, Introduction of Technology
- 10% Reduction in Acceleration Capability Deemed Acceptable
- Large Shifts in Size Mix Not Required
- Diesel Engines Not Required
- Permits Technical and Marketing Alternatives to Achieve Fuel Economy Standards

New Car Fleet Average Fuel Economy

FIGURE 9



Procedure for Determining Feasible Fuel Economy Schedules

FIGURE 10

- Determine Minimum Feasible Fleet Averaged Inertia Weight
- Select Minimum Feasible Fleet Averaged Acceleration Performance
- Determine Maximum Fuel Economy at 1977 Technology and Emissions Levels
- Select Schedule for Other Technological Improvements
- Consider Effects of Other Federal Standards

FIGURE 11

Projected Fleet Average Inertia Weight by Model Year

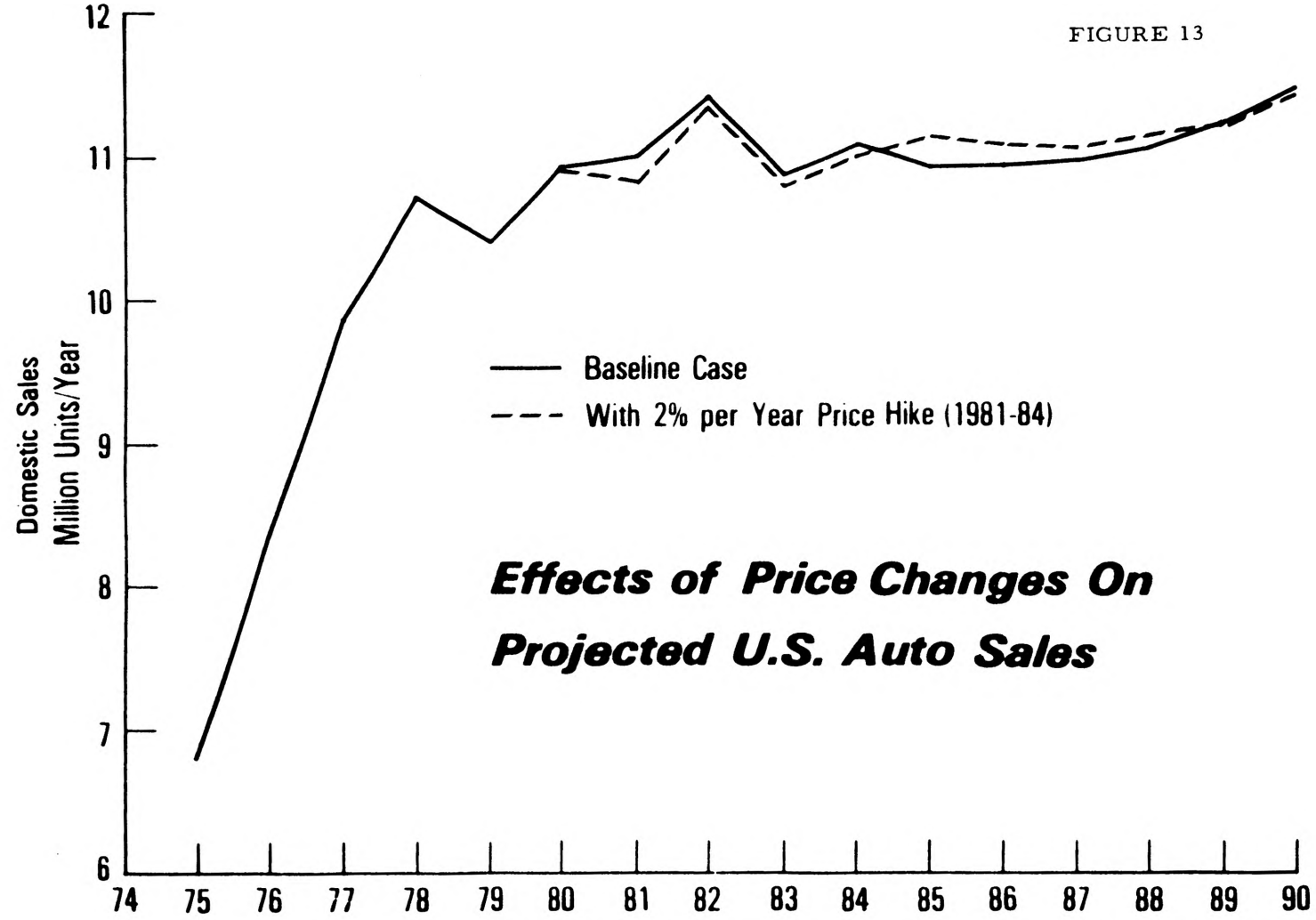
	1977	1981	1982	1983	1984	1985
G.M.	4200	3550	3500	3300	3100	3100
Ford	4270	3360	3290	3170	3090	3070
Chrysler	4260	3258	3232	3145	3145	3145
A.M.C.	3540	3122	3122	3122	3067	2834

FIGURE 12

Projected Average Fuel Economy Of Domestic Manufacturers (in Miles Per Gallon)

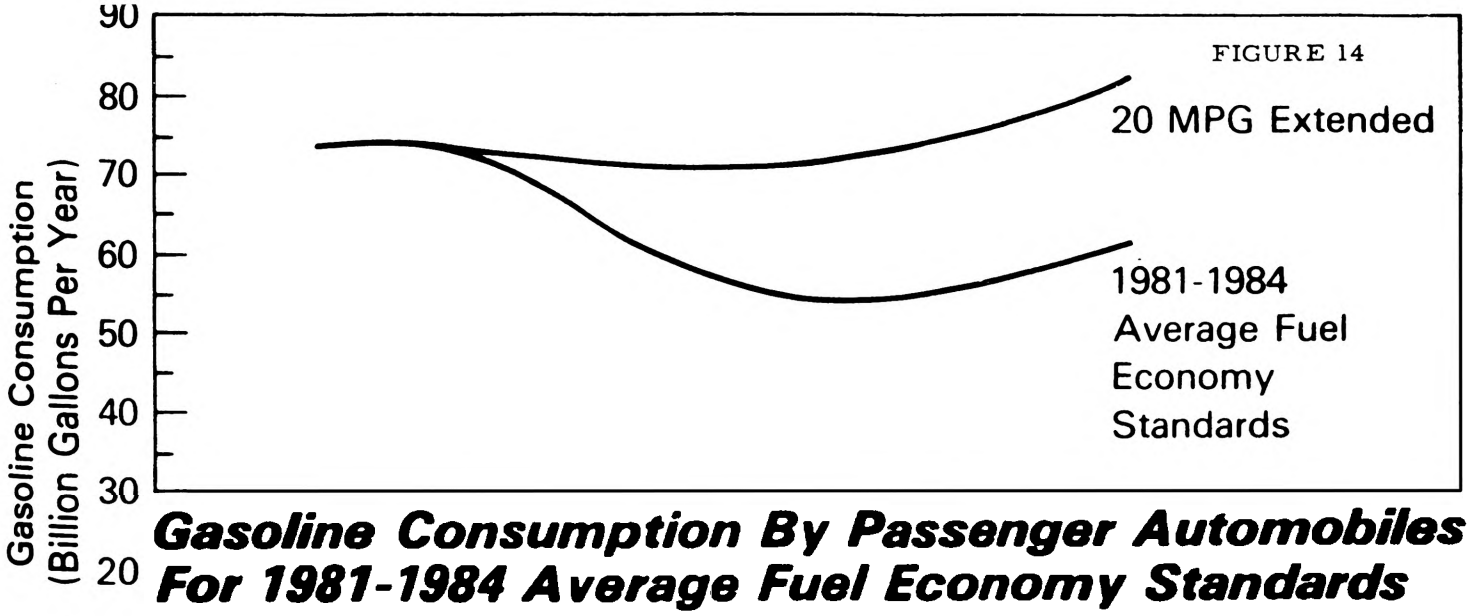
	Model Years				
Manufacturers	1981	1982	1983	1984	1985
G.M.	23.3	24.2	26.5	28.8	28.9
Ford	23.4	24.5	26.1	27.0	27.9
Chrysler	23.8	25.1	26.3	28.1	28.7
AMC	22.2	22.6	23.1	24.7	28.7

FIGURE 13



Effects of Price Changes On Projected U.S. Auto Sales

FIGURE 14



Gasoline Consumption By Passenger Automobiles For 1981-1984 Average Fuel Economy Standards