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BY THE COMPTROLLER GENERAL

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Report To The Congress

OF THE UNITED STATES

Policy Conflict--Energy, Environmental, And Materials: Automotive Fuel-Economy Standards' Implications For Materials

The demands for energy conservation, environmental protection, and stable raw material supplies and prices are strongly competitive, and the complexity of this relationship has not been recognized in forming Federal policy.

The means for resolving conflicts through coordinated economic and policy analysis is lacking, and implications for potentially affected materials industries, inadequate.

A comprehensive policy for reconciling these competing goals is still far away, as this case study of automobile fuel-economy standards illustrates.

UNITED STATES GENERAL ACCOUNTING OFFICE

EMD-80-22

FEBRUARY 5, 1980

B-118678

To the President of the Senate and the
Speaker of the House of Representatives

This report is part of our continuing effort to illustrate the complexity of relationships among national energy, environmental, and materials goals--goals which often conflict with each other. The report focuses on the automobile industry's fuel-economy (energy conservation) efforts and their impact on the materials industry. The report indicates that implementation of fuel-economy standards may have severe effects on supplies and prices of aluminum and rhodium and on employment in the steel industry.

In the future, we intend to draw from this and other reports in process to make recommendations for a forward-looking, consistent approach to balancing the tradeoffs of Federal policies with materials implications.

We are sending copies of this report to the Secretaries of the Departments of Commerce and Transportation.

Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

POLICY CONFLICT--ENERGY, ENVIRONMENTAL, AND MATERIALS: AUTOMOTIVE FUEL-ECONOMY STANDARDS' IMPLICATIONS FOR MATERIALS

D I G E S T

The possible effects on the supplies and prices of four basic industrial materials--iron and steel, aluminum, plastics, and rhodium--were never explicitly evaluated by the Government before the automobile fuel efficiency standards were adopted. The standards, enacted to reduce expensive oil imports, may result in increased aluminum imports of greater dollar value than can be saved by reducing oil imports.

Thus, the U.S. balance-of-trade deficit may suffer rather than benefit. Furthermore, to meet fuel-economy and environmental (air quality) standards at the same time, automobile pollution control devices may require more rhodium than will be available and force the price of this scarce metal drastically higher.

Both of these consequences contribute to unstable, inflationary materials markets. Neither was foreseen when the standards were enacted because the Government made no systematic appraisal of their impact on materials.

On the whole, the complex and competitive relationship among national goals for energy, the environment, and materials has not been recognized in Federal policy formulation. Therefore, a means for resolving policy conflicts, which may be brought to light through coordinated economic and policy analysis, is needed.

MOTOR VEHICLE FUEL ECONOMY STANDARDS AND THEIR POTENTIAL EFFECTS ON MATERIALS

The fuel-economy standards were established to reduce the adverse effects of heavy U.S.

EMD-80-22

reliance on imported crude oil from Organization of Petroleum Exporting Countries. The Energy Policy and Conservation Act of 1975--the ~~first major~~ "energy crisis" legislation, enacted after the oil embargo of 1973-74 required the automobile industry to almost double the fuel economy of passenger cars, raising average fuel economy from slightly less than 14 miles per gallon for 1974 model year to 27.5 miles per gallon by the 1985 model year. The act also required the Secretary of Transportation to establish light truck fuel economy standards beginning with the 1979 model year.

Because weight reduction is the cornerstone of the auto manufacturers' strategy to meet the fuel economy standards, the quantity of materials and how they are used in automobiles and light trucks will change significantly. The average 1985 car will weigh about 1,100 pounds less than its 1975 counterpart; light-duty trucks will be at least 250 pounds lighter. Major weight reductions began with the 1977 model cars through minimizing the exterior dimensions of cars without sacrificing passenger and load-carrying capacity.

Reduced new car weight in the 1980s will be achieved primarily by replacing components and parts normally made of iron and steel with similar items made of lighter materials, for example, aluminum, plastics, and high-strength, low-alloy steel. Also, an advanced catalytic converter to reduce emissions without sacrificing fuel economy will require greatly expanded use of a precious metal, rhodium.

Changing material consumption patterns for automobiles and light trucks could result in supply and economic disruptions. The materials industries most affected are iron and steel, aluminum, and noble metals. Higher prices, loss of jobs, and more imports are among the possible consequences. For instance, reduced demand for iron and steel may result in reduced job growth. At the same time, the increased demand for aluminum may require increased imports and result in a net increase in the U.S. balance-of-payments deficit.

EVALUATIONS NOT STRUCTURED TO ASSESS EFFECTS ON MATERIALS

Feasibility studies for fuel-economy legislation were concerned with reducing fuel consumption through improved vehicle fuel economy. They were also concerned with the relationships among fuel economy, automobile safety, pollution control, and employment in the automobile industry. The standards' possible effects on materials supplies and prices were not initially considered.

Later feasibility studies for interim fuel economy standards for cars and light trucks of the 1980s focused on the technical and economic practicability of meeting the proposed standards. Again, potential effects on materials industries and conflicts between the fuel economy standards and stable materials supplies and prices were not evaluated.

Agency and industry comments

The Environmental Protection Agency did not respond to GAO's request for comments on this report.

The Department of Commerce agrees that there is a need to give greater consideration to raw materials questions when setting environmental and energy policy goals. Also agreeing that the fuel-economy standards are likely to increase prices and imports of aluminum and other raw materials, Commerce endorses the idea of explicit evaluation of the costs and benefits of alternative standards to reach a balance among public goals.

The Department of the Interior also agrees that the effect on mineral supply and demand caused by proposed Federal activities should be evaluated. The Department's Bureau of Mines has been attempting to include such factors in supply-and-demand forecasts.

The Department of Transportation expressed belief that existing mechanisms for coordination are adequate for balancing the tradeoffs among energy, environmental protection, and materials issues. According to Transportation, regulatory agencies are supposed to coordinate regulatory activities and consider specifically the economic consequences for proposed and final regulations.

GAO doubts the effectiveness of existing procedures. The essential inadequacy identified in this report is the lack of a means of resolving policy conflicts which may be brought to light through coordinated economic and policy analysis. Feasibility studies made prior to enactment of the fuel economy standards did not contain detailed analyses of the implications for potentially affected materials industries, most notably aluminum. Therefore, early policy decisions could not possibly have included balancing among the issues. This balance is still elusive, however, because merely investigating the unfolding consequences of the standards will not necessarily result in regulatory adaptation.

General Motors, Ford, and Chrysler Corporations reviewed the draft of this report and generally concurred that the complexity of relationships among energy, environmental protection, and materials issues is not recognized by Federal policies. All three companies, however, object to the idea of an institutionalized materials policy and planning process, foreseeing such an activity as a prelude to another Federal controlling or regulatory body.

GAO believes that additional regulation itself is not justified by this case study of the automobile fuel economy standards. The precise nature of a policy-balancing mechanism to ameliorate the current parochialism in national policy formulation remains to be worked out. For the present, this GAO case study and others in process are simply intended to illustrate the complexity of, and to stimulate thought and debate on, the problem. While GAO is not making any specific recommendations to the Congress at this time, it may in the future, after additional examination of the problem and potential solutions.

Contents

ABBREVIATIONS

EPA	Environmental Protection Agency
GAO	General Accounting Office
HSLA	high-strength, low-alloy steel
HSS	high-strength steel
OMPRA	Office of Minerals Policy and Research Analysis
PVC	polyvinyl chloride

CHAPTER 1

PERSPECTIVE

> "There must be, somewhere, a mechanism for looking at a problem as a whole, for keeping track of changing situations and the interrelation of policies and programs." 1/

Materials--iron, steel, aluminum, copper, wood, and chemicals--are vital to America's health and future well-being. We believe that the pursuit of our most important national goals will require that we become more concerned about materials, and that we make an effort to develop an enlightened materials policy.

Materials availability and prices will affect our success in trying to reach a full-employment economy. Materials are essential to our goal of balanced economic growth. Their prices can aid, or hinder, our efforts to reduce inflation, and they will have a significant effect on our balance of trade. Our use of materials will continue to have profound effects on the environment and may ultimately determine our success in reaching sustainable levels of production and consumption. Our materials needs also have an important influence on our future relations with developing nations all over the world.

Yet, despite their importance, there is a tendency to regard materials problems as subordinate to other national concerns. Consequently, the materials implications of many Government policies--for example, those designed to conserve energy, protect the environment, and safeguard worker health and safety--tend to be overlooked. This report is one in a series of GAO case studies to illustrate that tendency and its important, but unintended, side effects on the materials sector of our economy.

The focus of this report is the fuel-economy standards for new cars and light trucks and how these regulations may indirectly affect the future price and availability of certain key materials used by American industry. They are aluminum, iron and steel, plastics, and rhodium.

1/The President's Material Policy Commission, "Resources for Freedom," Washington (U.S. Government Printing Office), 1952, Vols. 1 to 5. As quoted in Materials Policy Handbook, Washington, (Government Printing Office), 1977, p. 26.

The Energy Policy and Conservation Act of 1975, the first major "energy crisis" legislation enacted after the oil embargo of 1973-74 required the automobile industry to almost double the fleet-average fuel economy of passenger cars over the 1975 to 1985 decade, raising it from slightly less than 14 miles per gallon for the 1974 model year to 27.5 miles per gallon by the 1985 model year. The Secretary of Transportation was required to establish maximum feasible passenger-car, fuel-economy standards for 1981 through 1984 and light-truck, fuel-economy standards beginning with the 1979 model year. Light-truck, fuel-economy standards have been established through model-year 1981. The fuel-economy standards established for cars are as follows:

Model year	Cars--miles per gallon, fleet-average
1978	18.0
1979	19.0
1980	20.0
1981	22.0
1982	24.0
1983	26.0
1984	27.0
1985	27.5

This report is not intended to be a criticism of motor-vehicle, fuel-economy standards *per se*. Rather, we hope this report will help to foster a better appreciation of the relationships among energy, environmental goals, and materials supplies and prices. Competing demands that can result from pursuing conflicting policies give rise to the need for explicitly considering all potential consequences when formulating policies.

Chapter 2 of this report discusses how the change in materials used in cars and light trucks may affect iron and steel, aluminum, rhodium, and plastics industries. Changing materials composition of cars and light trucks brought about because of the fuel economy standards may have a significant effect on the demand and supply of the aforementioned materials.

Chapter 3 shows that Government evaluations before enactment of the standards were concerned only with the technical feasibility of increasing automobile fuel efficiency. Accommodating highway safety and environmental protection were the only criteria of that feasibility.

Agency and industry comments are discussed in chapter 5.

Appendix I discusses the changing quantities of materials and how they are used in automobiles and light trucks to reduce the weight and, thereby, increase their fuel efficiency. Automobile companies may greatly reduce the amount of iron and steel used in these vehicles and increase the use of such lighter weight materials as aluminum and plastics. Further, demand for rhodium will be substantially increased to meet emission control standards without sacrificing fuel economy.

SCOPE OF REVIEW

In performing this case study, we reviewed past and pending legislation; congressional hearings related to the materials industry; auto industry responses to Department of Transportation data requests; Government studies, impact assessments, and environmental statements related to the fuel economy program; current long-range weight reduction goals of the auto industry; and related data, studies, and published statements. During the course of the study, we contacted officials of the Department of Transportation, the Bureau of Mines, the Environmental Protection Agency, (EPA), the major domestic auto companies, and various materials producers and associations.

Copies of our draft report were submitted to EPA, the Deparments of Commerce, the Interior, and Transportation; and the big three automobile companies--General Motors, Ford Motors, and the Chrysler Corporation--for comment. With the exception of EPA, all of the above organizations submitted formal comments on the draft report. (See apps. I through VI.)

CHAPTER 2

EFFECTS ON MATERIALS

SUPPLIES AND PRICES

Increasing the fuel economy of new cars and light trucks by weight reduction will cause changes in the demand and availability of certain materials. Demand will decline for iron and steel and increase for aluminum, plastics, and platinum-group metals, possibly resulting in higher prices, loss of future job opportunities, greater imports, and environmental damage. An analysis of the changes in the demand for materials is not intended to be an overall evaluation of the materials involved but rather to demonstrate (1) the relationship among energy, environmental, and materials issues and (2) how changes in one could produce changes in the others. (See app. I for details on automobile downsizing.)

FUTURE IRON AND STEEL DEMAND

The automotive industry, traditionally one of the biggest steel users, is downsizing cars and using substitute materials in cars and trucks to meet future fuel economy standards. Therefore, the iron-and-steel industry may lose a large share of its potential automotive market.

Decreasing automotive requirements for iron and steel may have significant adverse economic consequences. Decreased demand may mean a decrease in potential sales and revenues, and potential new jobs. Furthermore, such consequences may be extremely localized, affecting the Great Lakes States (Pennsylvania, Illinois, Indiana, Michigan, and Ohio). These States have over 70 percent of the U.S. domestic iron and steel industry and are already burdened with unemployment.

Profile of the iron and steel industry

Few industries are as basic to the U.S. economy as steel. The American steel industry in 1977 had an output of 126 million tons and iron castings' production of 16 million tons, valued at $41 billion. The industry is made up of about 100 iron and steel producers, employing about 761,000 people.

Investment in the iron and steel industry during the last decade has not been attractive because of its low earnings and inadequate return on investment. Federal Trade Commission data show that industry profits (after taxes) peaked in 1974 at $3.1 billion. Profits declined through 1977 when they were $838 million. Preliminary data indicates that 1978 profits will be higher than 1977's but only about one-half of the 1974 record profit level. The Council on Wage and Price Stability attributed the poor profit performance to extraordinary increases in production costs and low utilization of capacity.

Potential decreased demand implications

Instead of the automotive requirements for iron and steel increasing as annual new car and light truck sales increase, downsizing and materials substitution may actually prevent demand growth. We estimate that, in the absence of offsetting demands, potential growth in automotive requirement for iron and steel by 1985 will be reduced by 10.2 million tons. This represents a decreased iron and steel demand of 11.3 million tons offset by the anticipated increased demand for high-strength, low-alloy steel of 1.1 million tons, or a net 10.2 million tons.

In computing the automotive industry's anticipated material requirements for the 1985-model-year passenger car and light trucks and the potential problems that could arise due to this shift, we considered the following information:

--Data from three domestic automobile manufacturers showing the material content of their average 1975 passenger car and 1977 light truck and the material composition goals for their average 1985 counterpart.

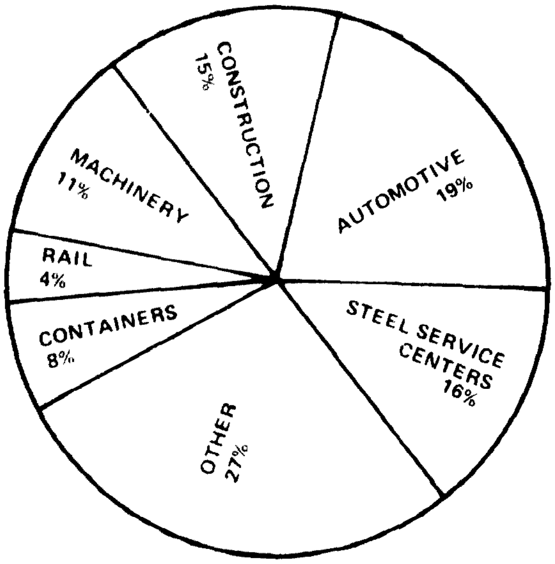
--Data from steel industry officials relating to scrap and replacement part rates and job opportunities per ton of steel produced.

--Statistics from the Department of Transportation showing 1975 model year sales for cars and 1978 model year sales for trucks and both of their projected sales for 1985.

--Statistics from the Council on Wage and Price Stability for the price of steel.

The significance of a potential 10.2-million-ton decrease is better understood when viewed in the light of total steel shipments. In 1975, shipments to the automotive industry amounted to 15.2 million tons, or 19 percent of the 80 million tons shipped to all markets. A reduction of 10.2 million tons would represent about 13 percent of the total steel shipped to all industries in 1975 and nearly 67 percent of the steel shipped to the automotive industry.

Distribution of the Domestic Steel Demand in 1975



Source: GAO data.

For the past several years, the steel industry has encountered difficulty in raising the capital needed for plant alteration to meet environmental requirements and to modernize older facilities to compete with foreign steelmakers. Difficulty in raising capital reflects its low profit and return on investment in relation to other industries. If industry profit levels cannot be maintained, the industry could encounter additional difficulty in attracting new capital. Sudden decreases in markets could adversely affect industry profits and restrict the ability to develop new products.

Reduced use of steel in automobiles and light trucks could have important employment ramifications. The steel industry estimates that about 5,500 jobs are directly associated with each 1 million tons of steel produced. If domestic iron and steel automotive requirements are reduced by 10.2 million tons, direct job opportunities possibly lost in the steel industry could be about 56,100 in 1985. An additional 67,320 job opportunities in other industries could be lost as well. A study by the Academy for Contemporary Problems, completed for the U.S. Department of Commerce, stated that for each direct job lost in the steel industry, an additional 1.2 jobs are lost in other industries located in the approximate geographical area. Considering both direct and indirect employment, reduced steel requirements by the auto industry could result in the loss of 123,400 potential jobs.

ALUMINUM DEMAND WILL GROW

In contrast to potential decreases in auto industry steel demand, the demand for aluminum may increase significantly. The consequences of such a shift could be substantial price increases, increased imports, and significant displacement of existing aluminum users. Energy may simply not be available at the right price to expand domestic capacity to meet the growing need for aluminum.

The world production of primary aluminum in 1977 was 14.7 million tons, concentrated in North America, Europe, and Japan. In that year, the United States produced 4.5 million tons of primary aluminum in addition to importing 835,000 tons, and recycling 531,000 tons. Domestic industries consumed 5.3 million tons of aluminum. Consuming industries were: building and construction, 25 percent; containers and packaging, 22 percent; transportation, 21 percent; electrical, 11 percent; consumer durables, 9 percent; and other uses, 12 percent.

The basic raw material used to make aluminum is alumina, which is principally derived from bauxite ore. The United States imports virtually all its bauxite requirements and about 30 percent of its alumina requirements.

Estimated increased demand

In 1975, automotive demand for aluminum was 500,000 tons, or about as much metal as the United States imports. According to data provided by the auto industry, 1985 cars will contain an average of 214 lb. of aluminum, and aluminum shipments must average over 290 lb. per car to meet this requirement. This projected 1985 demand indicates the auto industry would need about 2.2 million tons of aluminum, an increase of 1.7 million tons over 1975 needs.

Aluminum industry officials are more optimistic about future aluminum demand than auto manufacturers. They claim that the amount of aluminum in 1985-model cars may be twice that estimated by the auto manufacturers. Realization of this forecast would mean the United States could face major aluminum shortfalls and price increases unless auto and light truck sales significantly decrease by 1985.

Energy availability

Much uncertainty exists among domestic aluminum manufacturers as to the cost and availability of energy in this country. The conventional process by which alumina is smelted to produce aluminum is highly energy-intensive. Therefore, plans are limited for expanding and/or building new smelting capacity in the United States.

During 1977, a significant part of the total U.S. aluminum-producing capacity was closed due to hydroelectric power curtailments in the Pacific Northwest caused by drought conditions and other problems. Furthermore, the Bonneville Power Administration, the primary energy supplier in the Pacific Northwest, notified the six primary aluminum producers in this region that (1) by the 1980s, projected electric power-generating capacity in the area would not be sufficient to meet expected demand and (2) existing contracts with aluminum producers for power, which expire in the mid-1980s, would not be renewed. In 1977, this region represented 31 percent of the U.S. domestic production capacity. Continued operation of aluminum plants in the Pacific Northwest after the 1980s will be contingent on satisfactory allocation of available power among industrial, commercial, and residential users and on development of additional energy sources in the area.

Two smelting plants in Texas, previously shut down because of high energy costs, were to be reopened in 1979. However, a proposed expansion project was cancelled due to the inability to secure a firm power contract from the local utility.

The U.S. aluminum industry's share of world aluminum producing capacity has fallen from 42 percent in 1960 to 29 percent in 1977. Further, given current concerns about energy availability and price, most of the growth in primary aluminum capacity probably will continue to take place in other countries.

Possible tensions between competing public policy objectives

Slow growth in domestic aluminum production capacity and increased automotive demand are likely to transform aluminum usage. As prices increase in response to large demand and limited supply, many existing users of aluminum will be forced to substitute cheaper or more readily available materials. The implications of growing aluminum prices and resulting substitutions, which may be significant for the national economy, will be the by-product, not the goal, of Federal policy.

The automobile industry's estimated requirements for 1985 are 2.2 million tons of aluminum. This figure represents substantially more than 48 percent of 1977 capacity for producing primary aluminum in the United States.

Projected aluminum imports for 1985 are estimated at 1.6 million tons. This estimate, if correct, almost equals the projected net increase in automotive aluminum requirements. At 1977 list prices, such imports would cost about $1.6 billion. Assuming around 10 percent real price increase in constant dollars for aluminum, imports might cost about $1.8 billion. If energy savings from aluminum substitution in automobiles saved only 50 million barrels of imported oil, at $19 per barrel in constant 1977 dollars, our annual balance of trade deficit on this exchange might increase $850 million as a result of improving gasoline mileage in 1985 automobiles. Yet the assumptions about energy savings and costs of mandatory fuel conservation requirements have never been critically examined or modified by the Government agencies involved.

PLASTICS DEMAND

Increased automotive plastics and landfill

Like aluminum, the use of plastic materials in automobiles will increase substantially by 1985. The amount of plastics used in 1985 automobiles will be about 1.5 million tons, three times the amount used in 1975. This increase will result in some additional problems in both the scrapping and disposing of solid waste.

Scrapped automobiles are one of the most recycled post-consumer products. Historically, 6 to 8 million cars have been scrapped per year of which 80 percent are recycled for their metal and material content. Vehicles are generally scrapped after 7 to 13 years of service. The primary economic incentive for recycling scrapped cars has been the recovery of iron and steel. However, these economic incentives have not existed for recovery of plastic materials. As a result, plastic materials have gone into sanitary landfills where, along with other waste, they are compacted and covered with soil to allow eventual re-use of the land.

Crushed or ground plastics, in minuscule amounts, mix well with soil, acting as an inert soil conditioner, and actually improve the soil agriculturally. Large amounts of plastics, however, may be a problem.

A Department of Transportation study indicated that the projected increased use of plastics in automobiles may worsen any solid waste disposal problem. The concern primarily was that plastics do not readily decompose.

Now it seems that the additional plastics to be used in automobiles may be a major disposal problem only in areas where landfill space already is scarce and any increase in fill is undesirable.

Burning plastics as an energy source

An alternative to disposing of plastic materials in landfill is to recover the energy and basic feedstocks locked inside the plastic. Such recovery could be accomplished by use of the technique of pyrolysis and advanced incineration techniques. Pyrolysis breaks down plastic materials into gases that can be used again to make new plastics. Incineration is burning scrapped plastic materials to generate steam for conversion to electricity. Incineration is the most effective use of plastics scrap.

Though one type of plastic, polyvinyl chloride (PVC), emits poisonous fumes when burned, most plastics do not. Air pollution from incinerating plastics is controllable. However, emissions of polyvinyl chloride could pose significant environmental problems if the levels grow in the future. EPA is concerned and determined to keep PVC burning at a low level and will monitor the industries' production.

Automotive plastics' future

If the value of the plastic in automobiles is high enough for recovery, auto scrappers will collect plastic scrap as well as metals. However, if the value of plastics is too low to make recovery profitable, auto scrappers will dispose of plastics by burning or by landfill, whichever is the most economical. In general, the increase in automotive plastic is not expected to be a major problem.

RHODIUM DEMAND MAY EXCEED AVAILABILITY

The demand for rhodium will significantly increase with the use of the 3-way catalytic converter on 1981 cars. Though few catalytic converters now contain rhodium, most will in 1981. The Bureau of Mines estimates that the automobile industry could use as much as 50,000 troy ounces in 1981-model-year cars. The Ford Motor Company projects industry demand at only 22,000 troy ounces. The Bureau's estimate equals almost 30 percent of the 1977 estimated worldwide rhodium production of 177,000 troy ounces.

Rhodium is a member of the very scarce platinum metal group which includes platinum, ruthenium, iridium, and osmium. It is a by-product from platinum ore mining and refining operations and is not mined alone.

In 1977, 92 percent of U.S. platinum-metal-group consumption (2.5 million troy ounces) were imported. The Republic of South Africa provided about 49 percent of U.S. imports. The remainder came from the Soviet Union and the United Kingdom, which imports most of its platinum metals from South Africa. According to the Bureau of Mines, sizable domestic deposits of platinum group metals exist but are undeveloped, poorly defined, and subeconomic at current prices. The price of rhodium would have to approach $2,000 to $3,000 per troy ounce to make U.S. resources economic. Therefore, imports will continue to be required to meet the needs of domestic industries.

Rhodium is refined at a ratio of about 19 parts platinum to 1 part rhodium. General Motors Phase II converter, sold in some 1978 model cars in California, used a platinum to rhodium ratio of 2.5 to 1. According to General Motors officials, continuing experimental work may reduce the amount of rhodium used in the 3-way converters. As a matter of fact, current Department of the Interior data indicates that catalytic converters for 1981- and 1982-model cars are expected to require very near the mine ratio.

Even if the automobile industry develops a 3-way converter consistent with the mine ratio, a demand for 50,000 troy ounces of rhodium in 1981, as forecast by the Bureau of Mines, could cause undesirable supply and price alterations. The auto industry's needs for rhodium may have to be met by increased production of platinum group metals to meet both automotive and other industry needs. In the United States, the chemical, glass, electrical, and jewelry industries also require rhodium. A recent increase in glass industry demand is keeping rhodium in short supply at present. In 1979, the auto industry began buying large amounts of the metal, perhaps to stockpile the rhodium necessary to meet its 1981-model year requirements.

The supply situation for rhodium could be further complicated in the mid-1980s when the platinum/palladium in current catalytic converters is recycled. Recycling these two metals may reduce demand for newly mined platinum group metals. A problem will arise if growing demand for rhodium can be met only by mining the platinum group ore. Platinum producers are not likely to increase production for rhodium alone.

Short supply of a material generally drives its price up. Rhodium prices have, in fact, increased dramatically in the last year, from $530 a troy ounce in September 1978 to $800 a troy ounce in August 1979. According to the Canadian Ministry of Natural Resources, the emergence of rhodium as a vital component of auto-emission devices of the near future is precisely what drove up the price of rhodium so dramatically in 1977 and 1978. The Ministry further states that many sources anticipate even higher prices, primarily because the amount of rhodium available to the U.S. auto industry from South Africa may be limited. The Bureau of Mines platinum group metal specialist expects the price of rhodium to exceed $1,000 a troy ounce in 1980.

If the production of platinum or palladium were increased just to produce more rhodium, the market for these two precious metals would be glutted, substantially driving down the price of platinum or palladium (making them unprofitable to produce) and increasing the price of rhodium to make up for depressed prices of the other metals.

Under such circumstances, either (1) the United States might not be able to obtain enough rhodium or (2) the metal's price may increase tremendously. This is especially important when one realizes that, by now, little can be done to change 1981/1982 catalytic converter designs.

CHAPTER 3

GOVERNMENT EVALUATIONS NOT STRUCTURED

TO ASSESS MATERIALS IMPLICATIONS

Heretofore, the Government, when establishing and implementing various energy and environmental policies, has done so without adequately recognizing the potential impacts on materials availability and the basic domestic material industries. This situation is illustrated by various Government studies and evaluations of the vehicle fuel-economy standards. These assessments were chiefly concerned with the technical feasibility of achieving improved fuel economy and the resulting reduction in fuel consumption. The evaluations took into consideration the fact that the materials used in cars of the future would change but did not fully assess the impact of these changes.

The Government evaluations were not structured to assess the materials implications of the fuel-economy standards since the Department of Transportation's prime responsibility was to evaluate the feasibility of these standards. But, the Congress was not provided information by the regulatory agency as to potential effects these fuel-economy standards could have on the aluminum, rare metals, and iron and steel industries. These are increased aluminum imports, potential supply problems associated with rare metals used in new car emission controls, and the employment implications of diminished iron and steel requirements. Further, the Congress was not alerted to the need for a continuing analysis of potential adverse impacts or the need to develop current or future alternative strategies to reconcile competing policy objectives.

EVALUATIONS OF REDUCING FUEL CONSUMPTION

Feasibility studies for fuel-economy standards were concerned with (1) reducing fuel consumption through improved vehicle fuel economy, (2) the relationships between fuel economy and automotive safety and between fuel economy and emission control, and (3) the impact of such standards on auto industry employment.

A joint report by the Department of Transportation and the Environmental Protection Agency sent to the Congress in October 1974--1 year before enactment of the fuel-economy legislation--found that improved automobile fuel economy was practical and feasible. Its major findings were that:

--A 20-percent fuel economy improvement in the new model automobile fleet of 1980 compared to 1974 could be achieved with little price increase. The full range of potential improvement is 40 to 60 percent.

--Fuel economy improvements obtained while simultaneously achieving interrelated objectives such as low emissions and occupant safety would involve competition for capital, expertise, and resources. Impacts, some of which may require compensating action, include:

1. A 40-percent fuel economy improvement over 1974 would increase the price of new cars up to 10 percent. Savings in operating and maintenance costs, however, would more than offset these price increases.

2. A shift to the more fuel-efficient small cars, without concurrent upgrading of their crash-worthiness or increased utilization of effective passenger restraints, would result in more serious injuries and deaths on the highway.

3. Achievements of the statutory emission standards for hydrocarbons and carbon monoxide with substantial fuel economy improvement was feasible in the new car fleet of 1980 compared to 1974.

4. Dramatic savings in petroleum could result from these fuel economy improvements.

The Department of Energy and EPA recognized that a vehicle weight reduction of up to 1,000 lb. in 1980 for large and mid-size cars was possible through downsizing and material substitution. The study pointed out that the aluminum and plastics industries may experience increased demand, while the comparative lightness of future cars meant using less iron, steel, and a few other materials.

Another report entitled, "Fuels and Materials Resources for Automobiles in the 1980-1990 Decade," published in March 1976, but in draft form prior to enactment of the fuel economy standards, identified the changing quantities in materials to achieve vehicle weight reductions. The report showed that:

--The weight of automobiles would decrease between 500 and 1,000 pounds by 1980 primarily due to reduced weight of carbon steel and common steel components.

--An aluminum capacity expansion rate of 6 percent would be adequate to cover incremental aluminum demands up to 300 pounds per automobile until the late 1980s without a significant increase in price.

--Up to 300 additional pounds of plastics per vehicle could be included in automobiles in 1985.

--The long-run supply situation for high-strength, low-alloy (HSLA) steel was adequate.

The report concluded that most materials used in the automobile would be available in adequate supplies at low enough costs to allow normal growth of the automobile industry.

When establishing interim fuel-economy standards for cars and light trucks in mid-1977 and early 1978, the Department of Transportation focused on the practicality--technical and economic--of the domestic automobile industry's meeting proposed fuel standards. Transportation's assessments for cars during 1981-84 and light trucks during 1980-81 showed that materials substitution would decrease the normal automotive demands for iron and steel, but demand for aluminum, plastics, and HSLA steel would increase. Transportation officials stated that these changes in demand were insignificant in relation to total U.S. consumption in 1975. For example, the increase in aluminum demand was less than 10 percent of 1975 consumption. They concluded, then, that the fuel-economy program would not significantly affect the various domestic materials industries.

Another Transportation official stated that the studies mentioned above were primarily concerned with establishing the feasibility of the automotive industry's increasing fuel economy and identifying the potential fuel savings. Further, this official stated that materials analysis was restricted to the overall availability of materials to achieve fuel economy goals.

Aluminum

The various Department of Transportation analyses and reports to the Congress on possible use of more aluminum to achieve greater fuel economy in new cars concluded that this increased use could be accomplished with relative ease and minimal effect on the aluminum industry. Our analyses of the possible impacts of increased use of aluminum identified several potential problems with regard to supply and cost that we believe should have been brought to the attention of the Congress.

When initially establishing fuel-economy standards, a Department of Transportation evaluation concluded that the projected aluminum capacity expansion rate of 6 percent would be adequate to cover increased automotive demand without a significant price increase. In the 1979 annual report to the Congress, the Department further pointed out that the increased use of aluminum could substantially increase employment in the aluminum foundries.

Our analysis indicated that the shift to the use of more aluminum in new cars could result in possible adverse consequences that could be of equal importance to reducing the imports of petroleum. For instance, about the same time as the Transportation study concluded that a sufficient supply of aluminum would be available to meet future automotive requirements, two independent assessments 1/ of the availability of aluminum clearly showed that the United States would have to import more aluminum in the near future as domestic demand outstrips domestic production capacity. One study showed a similar trend and also indicated a potential national and worldwide shortage of aluminum in the early 1980s.

Further, as we point out in chapter 2, the need to import aluminum to meet increased demand could actually increase the U.S. balance-of-payment deficit, since the savings in the dollar value of petroleum imports could be less than the dollar value of increased imports of aluminum.

Furthermore, while immediate action may not be necessary, the Congress would have had a basis for requesting the Department of Transportation to make a continuing analysis of the situation. That analysis would address the overall balance-of-payments deficit problem if aluminum demand became a more significant problem than energy conservation. The Congress would thus be in a more knowledgeable position to direct remedial action.

Iron and steel

In discussing the impact of the fuel-economy standards on the iron and steel industry, the Department of Transportation's 1979 annual report pointed out that the industry did not need to expand capacity to meet the future demands of the auto industry. Increased iron and steel demand to meet the

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1/Statement of the president of Kaiser Aluminum and Chemical Corporation before the U.S. Senate Committee on Energy and Natural Resources, April 15, 1978; and "Long Range Aluminum Mobilization Outlook 1985-1990," Federal Preparedness Agency, General Services Administration, February 1978.

projected increase in new car sales would be offset by the use of less iron and steel in the new cars. The report concluded that the demand for iron and steel by the auto industry in 1985 would be about the same as it was in 1977.

Given the highly sensitive employment implications resulting from differing auto sales projections, it is important that the Department of Transportation's estimates for automotive steel requirements be carefully and periodically reviewed.

Rhodium

The auto industry has committed its resources to a specific technological solution, the 3-way catalytic converter, to meet air emission requirements. This approach to the emission problem may entail dependence on precious metals resources that are simply not present in the required quantities. Whether or not the United States will be able to obtain adequate rhodium for automobiles, or face significant rhodium price increases, may depend on temporary adjustments of the emissions standards. No serious analysis of these trade-offs has ever been considered.

CHAPTER 4

CONCLUSIONS AND DISCUSSION OF AGENCY AND INDUSTRY COMMENTS

Supplies and prices of four basic industrial materials are likely to be affected by implementation of the automobile fuel efficiency standards--iron and steel, aluminum, plastics and rhodium. The potential effects, discussed in chapter 2 range from uncertain, in the case of iron and steel, to probably significant, in the case of aluminum. Yet, none of these possible effects was explicitly evaluated before the standards were adopted.

Furthermore, decisions regarding implementation of the auto fuel-efficiency standards--such decisions as schedules for compliance, acceptable technology, resolutions of conflicts with other national goals--can either magnify or reduce the economic side effects of the standards. Originally, decisions to create the standards were made without benefit of detailed evaluations of potential materials implications, and current decisions continue to be made in an essentially single-priority atmosphere.

Though the Department of Transportation now gathers materials-related information, the Federal Government, as a whole, still lacks an administrative mechanism to balance the tradeoffs among energy, environmental, social, and economic issues implicit in regulatory decisions. As priorities change to accommodate new circumstances, regulatory flexibility becomes essential. The fuel-economy standards portend increased aluminum imports. However, the Department of Transportation's primary goal for the fuel-economy standards will continue to be reducing automotive petroleum consumption.

This case study illustrates the need for a balanced policy formulation approach, most recently advocated by the National Commission on Supplies and Shortages in 1976:

> "Some means must be found to integrate the * * * information produced by the agencies and departments into a comprehensive picture of how Government policies combine to affect basic industry and beyond that, the broad National interest. Means also must be found to alert high-level decision-makers to the possible consequences of events which separately may be of little concern, but together can foreshadow major problems."

We concur that there is a need for an institutionalized policy and planning process to mitigate or avoid future, significant problems of materials availability. The basis for our position is set forth in a recent report, "Learning to Look Ahead: The Need for a National Materials Policy and Planning Process," (EMD-79-30, April 19, 1979).

We believe that the minimum goal that must be pursued was correctly expressed by Leonard Fischman of Resources for the Future:

> "Any one Federal decision is likely to be multi-faceted, impacting on the public welfare and the mix of individual welfares in many direct and indirect ways. It is not at all clear that consistency of Federal decision with regard to their impact on materials costs and supplies will lead to consistent results in terms of optimization of either the general or particular welfares. What is important is only that the way in which <u>any</u> kind of decision impacts on welfare <u>by way</u> of an impact on materials not be inadvertently overlooked or slighted and that one such decision not inadvertantly detract from another such decision." [Emphasis in the original.] 1/

<u>Agency and industry comments</u>

EPA did not respond to our request for comments on this report.

The Department of Commerce agrees that there is a need for greater consideration to raw materials questions when setting environmental and energy policy goals. Also agreeing that the fuel-economy standards are likely to increase prices and imports of aluminum and other raw materials, Commerce endorses the idea of explicit evaluation of the costs and benefits of alternative standards to reach a balance among public goals.

The Department of the Interior also agrees that the effect on mineral supply and demand caused by proposed Federal activities should be evaluated. Current attempts by the Bureau of Mines to include such factors in their mineral supply and demand forecasts are examples of its efforts to do

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1/Fischman, Leonard L., "Materials Information Systems for Federal Policy Making," as quoted in <u>Government and the Nation's Resources</u>, The National Commission on Supplies and Shortages, Washington, D.C., 1976, pp. 110 and 111.

so. Interior believes that steel demand would probably have fallen despite the fuel-economy standards because the auto companies would have produced lighter vehicles in response to consumer demands.

The Department of Transportation, however, expresses the belief that existing mechanisms for coordination are adequate for balancing the tradeoffs among energy, environmental protection, and materials issues. According to Transportation, regulatory agencies are supposed to coordinate regulatory activities and consider specifically the economic consequences for proposed and final regulations.

We doubt the effectiveness of existing procedures. The essential inadequacy we identify in this report is the lack of a means of resolving policy conflicts that may be brought to light through coordinated economic and policy analysis. Feasibility studies made prior to enactment of the fuel-economy standards did not contain detailed analyses of the implications for potentially affected materials industries, most notably aluminum. Therefore, early policy decisions could not possibly have included a balance among the issues. This balance is still elusive, however, because merely investigating the unfolding consequences of the standards will not necessarily result in regulatory adaptation. Furthermore, recent experience suggests that future regulatory changes, when made, will probably be in response to crises rather than as part of an effort to anticipate future needs.

General Motors, Ford, and Chrysler reviewed the draft of this report and generally concurred that the complexity of relationships among energy, environmental protection, and materials issues is not recognized by Federal policies. All three companies, however, object to the idea of an institutionalized policy and planning process, foreseeing such an activity as a prelude to another Government controlling or regulatory body.

We believe that additional regulation by itself is not justified by this case study of the automobile fuel economy standards. The precise nature of a policy-balancing mechanism to ameliorate the current parochialism in national policy formulation remains to be worked out. For the present, this case study and others in process are simply intended to illustrate the complexity of the problem and to stimulate thought and debate. While we are not making any specific recommendations to the Congress at this time, we will in the future, after additional examination of the problem and potential solutions.

SIGNIFICANT CHANGES IN

MOTOR VEHICLES

The quantity of materials, primarily iron and steel, aluminum, plastics, and rhodium, used in the average automobile and ligh truck is changing significantly under ongoing weight-reduction programs of automobiles. They are being designed to achieve a substantial portion of the federally mandated fuel-economy standards, established in 1975. The Federal Government's fuel economy program, which establishes mileage standards for automobiles and light trucks with a gross vehicle weight rating up to 8,500 pounds, is one of the many programs directed at attaining national energy goals. The goals include increased domestic supplies of energy, reduced growth in energy demand, and protection from future energy embargo or energy emergencies.

Weight reduction is the cornerstone of auto manufacturers' strategy to meet the Government's mandated fuel economy standards. The average 1985-model car could weigh about 1,100 pounds less than it 1975 counterpart, while light trucks may be about 250 pounds lighter. Weight reduction is being accomplished by downsizing and substituting light weight for heavy materials. Major weight reductions from downsizing began with the 1977 model cars. Most downsizing will be completed in 1981-model-year cars. Increased use of substitute materials will account for most of the additional weight reductions up to 1985-model-year cars.

LESS WEIGHT

Data furnished by the three largest domestic automobile manufacturers indicates that the steel and iron content of each 1985-model car will be nearly cut in half while quantities of more weight-efficient materials--aluminum, plastics, and high-strength, low-alloy (HSLA) steel 1/ --will replace iron and steel as illustrated:

1/HSLA is steel to which small quantities of alloys are added to increase it strength/weight ratio.

Average car

Materials	1975	1985	Change Pounds	Change Percent
	(pounds)	(pounds)		
Iron	657	310	-347	- 53
Steel	2,468	1,388	-1,080	- 44
HSLA steel	82	254	172	+210
Aluminum	90	214	124	+138
Plastics	150	281	131	+ 87
Other materials (note a)	356	257	- 99	- 28
Total weight	3,803	2,704	-1,099	- 29

a/Includes such materials as lead, glass, zinc, and rubber, and so forth.

The material composition of light trucks will also shift. By 1981, the average light-duty truck will contain 492 lb. fewer of traditional iron and steel, and 241 lb. more aluminum, plastics, and HSLA steel. The trucks will be at least 250 lb. lighter.

FLEXIBILITY IN MATERIALS SUBSTITUTION

Materials substitution will increase in cars and trucks of the 1980s. The average 1975 domestic car contained over 300 lb. of aluminum, plastics, and high strength, low-alloy (HSLA) steel. By 1985, the amount of these materials used in the average car will more than double; an increase of about 241 lb. will be used in light trucks. These substitute materials will, at the same time, reduce the quantity of iron and steel used.

Material substitution is a flexible strategy that allows different manufacturers to use different materials to meet their particular goals. For example, car bumpers recently have been made out of aluminum ('78 Buick Century), plastic ('79 Ford Mustang), and HSLA steel ('79 Mercury Marquis). Automobile manufacturers choose materials based on such factors as weight savings, manufacturability, and price. Many components and parts for future cars are already being considered for a substitute material. While final decisions on specific materials to use for components are usually made at least 18 months before a new car is introduced, procurement and tool construction times after engineering release (including materials specification) often far exceed 18 months.

The various substitute materials have different weight-saving characteristics. For example, aluminum can be substituted for iron and steel at a 50-percent weight savings. For every 50 lb. of aluminum that go into a passenger car or light duty truck, 100 lb. of iron or steel are eliminated. HSLA steel usually substitutes for iron and steel at 30-percent weight savings. Weight savings by the use of plastics varies from 40 to about 80 percent, depending on which one of the wide variety of plastics is used.

The ease of manufacturability will affect the automobile industry's choice of which particular substitute material to use. Forming, joining, surface, and durability aspects of substitute materials are different from iron and steel. For example, manufacturers, in turning to aluminum components and parts, anticipate that

--new dies and designs will be required in most cases because the gauge of aluminum components and parts must be thicker to provide adequate strength;

--spot welding of aluminum will require significant changes in welding equipment, procedures, and electrical capacity; and

--special processes must be established to control corrosion where a part interfaces with steel.

Plastics, too, will offer their own manufacturability considerations:

--Efficient processes for forming large plastic parts will require completely different types of tools, equipment, and facilities from those used for steel.

--New bonding processes need to be developed for plastics.

--Exterior surface conditions (sink marks, pits, porosity) of plastic sheet applications must be improved to assure customer acceptance.

Even HSLA steel, with its more traditional properties, will require some changes in the manufacturing process--forming, welding, and painting.

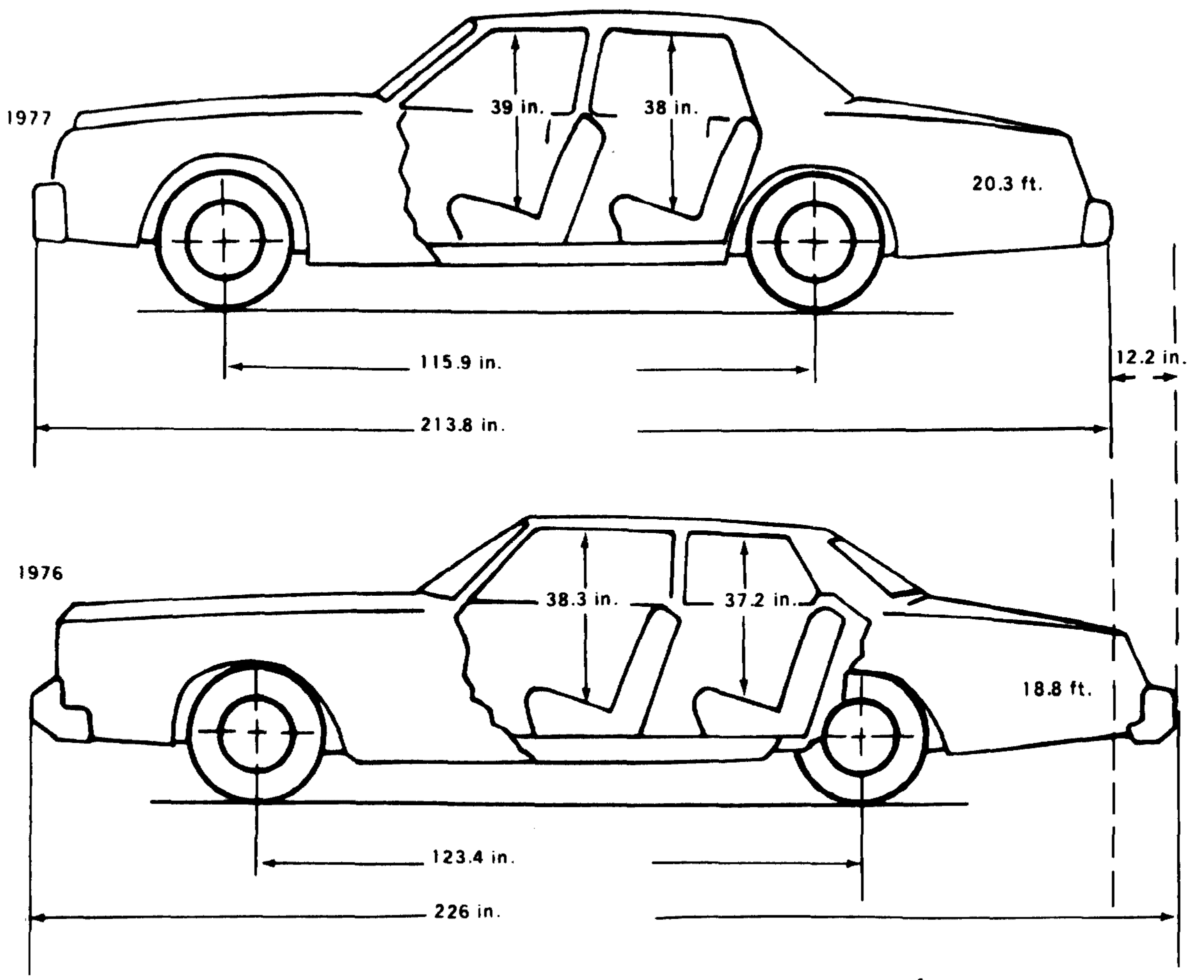
In addition to the maunfacturability of substitute materials, auto manufacturers will also be virtually concerned with the range of prices of the various substitute materials. At the low end is HSLA steel sheet, which, as of 1977, sold for an average of $0.18 per lb. Aluminum prices in 1977 were much higher, ranging from $0.53 per lb. for ingot to $1.32 for flat sheet. During this period, the prices of plastics in their various shapes and forms ranged from $0.36 per lb. for sheet molding compound to $20.00 per lb. for advanced, graphite-reinforced plastics.

Virtually every component and part of the car and light truck are given consideration by the automobile manufacturers or material suppliers for substitute materials. These range from such small items as hinges, air cleaners, intake manifolds, brake drums, and brake cylinders to such larger components as hoods, bumpers, trunk lids, and wheels. One domestic automobile manufacturer and its suppliers are experimenting with a 5-piece car body made of plastics, reinforced with graphite and glass fibers.

LESS STEEL AND IRON USED IN DOWNSIZED CARS

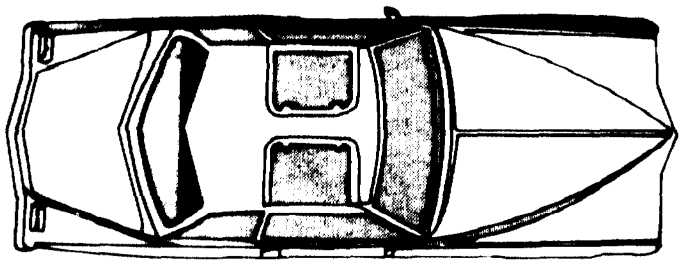
Downsizing will eliminate an essential 750 lb. of iron and steel from the average car by 1981. Downsizing reduces the exterior dimensions of a vehicle without significantly affecting its passenger or load-carrying capacity.

The following drawing of a 1976 full-size car and its 1977 downsized counterpart shows that the interior dimensions of the 1977 model are greater though the exterior is a foot shorter. The 1977 model is 738 lb. lighter.

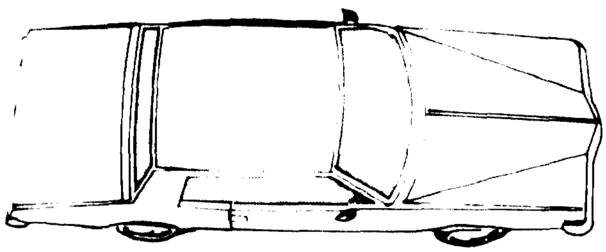


Downsizing is more vividly shown through an overhead view of another 1977 car and its 1978 version, after 689 lb. were eliminated through downsizing. (See next page.)

1977
Model
Car



1978
Model
Car



General Motors was the first domestic manufacturer to begin downsizing to reduce weight. Beginning in model-year 1977, General Motors reduced the length and width of its full-size models, saving approximately 700 lb. per car. This weight reduction helped boost fuel economy from 15 miles per gallon to 18 miles per gallon. General Motors' 1978 intermediate cars were also downsized and weights were reduced by 975 lb.

The other manufacturers have also downsized parts of their fleets. For example, Ford's model-year-1979, full-size Ford LTD and Mercury Marquis were redesigned to eliminate 900 pounds for each. Chrysler also redesigned some of its 1979 full-size cars. The weights of the New Yorker, Newport, and Dodge St. Regis were each reduced by 800 lb.

As another part of the strategy to produce lighter weight cars, Chrysler and American Motors have phased out some of their full-size cars. For example, Chrysler no longer produces large Plymouth model cars, and American Motors discontinued the production of its Matador model.

CATALYTIC CONVERTER

National air pollution control standards for 1975 required automobile manufacturers to reduce hydrocarbon and carbon monoxide exhaust from cars. To do so, the automobile companies developed an oxidation converter to change these pollutants to carbon dioxide and water. The most effective catalysts for producing this conversion are noble metals, i.e., platinum and palladium.

More stringent air pollution standards, to reduce nitrous oxides in auto exhausts, will be added to existing standards in 1981. Meeting the 1981 standard will require a catalytic converter using rhodium, r noble metal in the platinum group. Most passenger cars will probably have a three-way converter to simultaneously control carbon monoxide, hydrocarbons, and nitrous oxides.

In addition to reducing air pollution, use of the catalytic converter in 1975 reversed an 8-year trend of declining auto fuel economy. Mileage had slipped from an average of 15.5 miles per gallon in 1967 to 13.9 miles per gallon in 1975. The catalytic converter allowed manufacturers to retune engines and to reduce exhaust emissions, resulting in an average 15.6 miles per gallon in 1975 cars.

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Policy
Washington, D.C. 20230

July 6, 1979

Mr. Henry Eschwege
Director, Community and Economic
Development Division
U. S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Eschwege:

The Report entitled, "Policy Process Needed to Recognize Interrelationship Between Materials, Energy, and the Environment: A Case Study on the Automotive Fuel Economy Standards,"*which was prepared by your staff, makes a strong argument for giving greater attention to raw materials questions when setting energy and environmental policy goals. The automotive fuel economy standards provide an apt case for study.

We agree with you that there are tradeoffs between fuel economy and other public goals. Materials policy goals are among the set of national goals that must be balanced with fuel economy objectives. Increased demands for aluminum and other automobile components required to meet miles-per-gallon standards are likely to raise both prices and import levels of these commodities. The proper balance of these competing objectives should be determined by explicit consideration of the benefits and costs of alternative, feasible fuel economy standards.

We appreciated the opportunity to review your draft report.

Sincerely,

Jerry J. Jasinowski
Assistant Secretary for Policy

*/GAO note: The title of our draft report was changed to "Policy Conflict--Energy, Environmental, and Materials: Automotive Fuel-Economy Standards' Implications for Materials."

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

JUL 12 1979

Mr. J. Dexter Peach
Director, Energy and Minerals
Division
General Accounting Office
Washington, D.C. 20548

Dear Mr. Peach:

We have the following comments on the GAO Draft Report, "Policy Process Needed to Recognize Interrelationship Between Materials, Energy, and the Environment: A Case Study on the Automotive Fuel Economy Standards"* (EMD-79-72):

1. We agree that the Government should evaluate the impact of proposed legislation, regulations, and programs on mineral supply and demand. At present, the Bureau of Mines does attempt to include the impact of such factors when it forecasts minerals supply and demand. For example, in the past 11 years, the Bureau has made substantial downward revisions in its estimate of U.S. primary aluminum demand in the year 2000: in 1968, the Bureau forecast demand at 28 million tons; by 1976, the forecast had been trimmed several times to 18 million tons.

2. In addition, the Bureau has ongoing research programs directed towards the alleviation of impending problems. Regarding automobile-related problems, the Bureau is working alone or with industry participants to recover plastics from junked cars, provide for smokeless incineration of such automobiles, recover aluminum and precious metals (from used catalytic converters) from scrapped cars.

3. Furthermore, the Office of Minerals Policy and Research Analysis (OMPRA) feels that the particular case study presented -- the impact of mileage standards on steel use -- may not be a good example. In the absence of price controls on gasoline and oil, U.S. consumers would have demanded more fuel-efficient vehicles. This would have led the U.S. auto industry to produce smaller and

*/See GAO note, p. 30.

lighter vehicles, which use less steel, in order to compete effectively with fuel-efficient imports. As a result, steel use would probably have fallen.

4. The Environmental Law Division of the Solicitor's Office suggests that a section on specific environmental ramifications of mileage and air quality standards would strengthen the overall report.

5. The Bureau of Mines has made some typographical corrections and has updated information on the attached pages of the draft report. The most significant change is a large reduction in the demand for rhodium in 1981 model cars.

Sincerely,

Larry E. Meierotto
Assistant Secretary
Policy, Budget, and Administration

Enclosures

GAO note: The title of our draft report was changed to "Policy Conflict--Energy, Enviromental, and Materials: Automotive Fuel-Economy Standards' Implications for Materials."

OFFICE OF THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

ASSISTANT SECRETARY
FOR ADMINISTRATION

July 31, 1979

Mr. Henry Eschwege
Director
Community and Economic
Development Division
U. S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Eschwege:

We have enclosed two copies of the Department of Transportation's (DOT) reply to the General Accounting (GAO) draft report, "Policy Process Needed To Recognize Interrelationship Between Materials Energy, and the Environment: A Case Study on The Automotive Fuel Economy Standards."*

The GAO report argues for a national "policy process" to examine and coordinate the sometimes conflicting policies relating to materials, energy, and the environment. We do not object to this goal although we do have concerns over whether yet another "process" will aid the Government in considering the consequences of its actions. In this sense, we believe that existing mechanisms for coordination should and do provide the necessary framework for considering the interrelations among materials, energy, and the environment that GAO desires. For example, Executive Order 12044, "Improving Government Regulations," and the corresponding implementing DOT directive (FR Vol - 44, No. 33, pg. 11034, February 26, 1979) require that the economic consequences of proposed and final regulations be fully considered. We believe this is being adequately done.

If we can further assist you, please let us know.

Sincerely,

Edward W. Scott, Jr.

Edward W. Scott, Jr.

Enclosures

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*/GAO note: The title of our draft report was changed to "Policy Conflict--Energy, Environmental, and Materials: Automotive Fuel-Economy Standards' Implications for Materials."

SPEED LIMIT 55
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CHRYSLER
CORPORATION

S L TERRY
VICE PRESIDENT
PUBLIC RESPONSIBILITY
AND CONSUMER AFFAIRS

July 17, 1979

Mr. J. Dexter Peach
Director
Energy and Minerals Division
U.S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Peach:

In response to your request I have reviewed the draft of your proposed Report to the Congress entitled "Policy Process Needed to Recognize Interrelationship Between Materials, Energy, and the Enviornment: A Case Study on the Automotive Fuel Economy Standards." **[See GAO note 1, p. 34.]**

Using motor vehicle fuel economy standards as a case study, your report does an excellent job of highlighting the complex relationships existing between materials, energy, and environmental programs in the U.S. economy. And although you clearly state that the report is not intended as a criticism of motor vehicle fuel economy standards, the report demonstrates the competing demands that result from the pursuit of counterproductive national policies in the energy and environmental areas and resultant negative impacts on our material resources.

Your report states that "The auto efficiency standards case illustrates this type of situation which the nation, as a whole, has yet to adequately understand." We in the auto industry wholeheartedly agree with this assessment. I have been in constant communication with legislators, administrative agencies, and consulting study groups since the regulatory onslaught heated up in the late 1960s, all in an effort to apprise them of the major risks to the U.S. economy and potential dislocation to the auto and supplier industries created by the unnecessarily stringent auto fuel economy, emissions and safety regulations.

As a result of the auto industry experience with the regulatory environment I cannot agree with the conclusions of your study that to cope with critical materials problems a need exists for an institutionalized policy and planning process supported by legislative actions. Let me briefly explain why I concur with the analysis contained within your study, but do not agree with the suggested solution.

P O BOX 1919 DETROIT MICHIGAN 4828[illegible]

Mr. J. Dexter Peach
July 17, 1979
Page 2

Chapter 2 of the report "Significant Changes Taking Place in the Motor Vehicle"* correctly identifies weight reduction as a corner-stone of the auto manufacturers' strategy to meet fuel economy standards. This implies major changes in the quantities and types of materials which will be used on both passenger cars and trucks in the future.

Chapter 3 of your study, "Possible Effects on Materials"** identifies many of the potential changes in material usage which will occur as a result of the major redesign and mix of products that will be produced by the auto industry in the future. The subsection outlining the fact that rhodium demand may exceed availability is an excellent example of the kinds of problems which Chrysler anticipated and identified to the EPA when they established emission standards forcing the use of catalysts on American cars. The statement that "It appears that more wishful thinking than hard analysis has gone into the possibility that (1) the U.S. might not be able to obtain adequate rhodium for its automobiles or (2) the price of rhodium would literally explode by up to almost 700%" is quite true. It is further true that the government when establishing and implementing various energy and environmental policies has done so without adequately recognizing the impacts on materials availability and the basic domestic material industries. Again, this aspect of the regulatory environment seems to be well identified in Chapter 4 of your report.

There is no doubt that the potential materials problem is real. A recent article in Business Week magazine stated "That America's industrial might - already threatened by the deepening energy mess - is in for another resource crunch." The article suggested that growing U.S. dependence on foreign supplies of vital materials, almost entirely imported from unstable or potential hostile nations, is most ominous. Some experts warn that we may be dangerously dependent on foreign sources for a significant portion of our materials requirements in the future. Further, they point out that the U.S. is already a major importer of materials and that the U.S. mineral trade deficit could approach $100 billion by the year 2000. Inflation, ever-increasing layers of environmental and safety regulations, price controls, low-cost foreign producers, and emerging cartels are all cited by industry sources as reasons for increasing foreign dependence. All of this is reminiscent of the current petroleum/energy dilemma. I believe one lesson we should have learned by now is that more controls and more regulations will not produce one more barrel of oil or one more ounce of rhodium.

Controls are a disaster. No matter how good our intentions as a nation, what models we use, or how ingeniously we design regulations, controls can never efficiently replace the millions of economic decisions that are necessary in the marketplace to adjust to changing conditions of supply and demand. It is not possible in our infinitely complex domestic and world economy to have enough information to do an intelligent job of planning and control. Real pricing and supply signals are the best way to communicate the need for increasing capacity, substitution, or new development.

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*/See GAO note 2, p. 34.

**/See GAO note 3, p. 34.

Mr. J. Dexter Peach
July 17, 1979
Page 3

I am encouraged that the 1979 Joint Economic Committee Report of the Congress is beginning to recognize our basic problem. It points out that the Arab oil embargo and the subsequent behavior of the OPEC cartel suddenly and dramatically began to force the attention of the country and its economic experts on the supply side of the economy. The report emphasizes the need to stimulate jobs creating new investment and recommends consideration of incentives to encourage industrial research and development. It calls for a more rational and effective regulatory system. All of these recommendations are designed to advance the theory that expanding the capacity of the economy to produce goods and services efficiently is the most effective policy to combat major economic imbalances.

In summary, we agree that the complex regulations and controls that have been put in place in the past several years in energy, safety and environmental areas are having a major adverse impact on the resources of this nation. We believe your report makes a major contribution in identifying and recognizing this negative impact. However, we hope that by now we have learned that the cure for these ills is not more regulation and more controls, which stifle the supply side of our economy and exacerbate our basic problems.

Very truly yours,

CHRYSLER CORPORATION

S. L. Terry
Vice President
Public Responsibility and
Consumer Affairs

/ms

GAO note 1: The title of our draft report was changed to "Policy Conflict--Energy, Environmental, and Materials: Automotive Fuel-Economy Standards' Implications for Materials."

GAO note 2: The title of this chapter was changed to "Significant Changes in Motor Vehicles."

GAO note 3: The title of this chapter was changed to "Possible Effect on Materials."

Ford Motor Company

The American Road
Dearborn, Michigan 48121

July 25, 1979

Mr. J. Dexter Peach
Director, Energy and Materials Division
United States General Accounting Office
Washington, D.C. 20548

Dear Mr. Peach:

Thank you for the opportunity to comment on the General Accounting Office draft study of the interrelationships among materials, energy and the environment resulting from automotive fuel economy standards. Your letter to Mr. George A. Ferris and the study were referred to me for reply.

We are pleased that GAO is attempting to understand the side-effects and full implications of government regulation, in this case fuel economy standards, and report them to the Congress. As our specific comments indicate, the materials issues are being dealt with adequately. We would hope that GAO's analysis functions would continue, but that permanent institutionalizing of areas studied, such as materials, would not follow. Materials management has and is working well under free enterprise, and there is no apparent reason why that won't continue to work well. Comments on the study follow.

The study may overstate future requirements for lightweight materials due to a downsizing assumption and the omission of secondary aluminum. Rhodium and platinum production requirements may also be overstated. For example,

- Vehicle downsizing will likely continue past 1981 as manufacturers seek to remove weight and improve fuel economy. Since relative cost will be the decisive factor in determining the extent of downsizing versus materials substitution, the study's heavy emphasis on materials substitution after 1981 may be overstated.

- In addition to downsizing and material substitution, component redesign (i.e., thin glass and thin walled castings) plays an important role in reducing vehicle weight.

- Secondary (recycled) aluminum is a major materials source not mentioned in the report. The average 1985 Ford car is forecast to contain 115 pounds of cast aluminum, and about half of automotive cast aluminum is from secondary sources.

- Ford projects rhodium requirements of 22,000 Troy ounces for 1981. This does not support GAO's projection of 180,000 Troy ounces for the industry or the estimate of a 700 percent price increase.

Although the use of precious metals in catalysts presents some supply difficulties, the mine ratio problem discussed might not require the excessive platinum production indicated in the study. While three-way catalysts do require rhodium in excess of the mine ratio, many cars will use a conventional oxidation catalyst using platinum following the three-way catalyst, and conventional catalysts will be used on trucks. Therefore, the overall platinum/rhodium ratio will be closer to the mine ratio. EPA's light duty truck emission standards for 1983 will have considerable impact if three-way catalysts are required.

Information on rhodium availability can be obtained from Englehard Industries and Matthey Bishop Inc. There is a stockpile of rhodium, reducing the likelihood of a short-term rhodium shortage or platinum surplus. It appears doubtful that the excessively high prices of these metals projected in the study for the early 1980's will occur.

The iron and steel industries are separate and distinct, and we recommend GAO discuss them separately. Ford projects flat requirements for steel through 1985, with per unit reductions offset by unit volume growth. On the other hand, cast iron usage on the average Ford car is projected to decline 48% by 1985. The loss of potential jobs from reduced iron and steel usage should be compared with increased jobs created by increasing demand for plastics and aluminum. It would be contradictory to reduce vehicle size and weight while maintaining yesterday's levels of iron and steel usage. These transitions have happened before without undue disruption when driven by market forces, as when steel replaced wood as a major automotive material. Unfortunately, the pace of change directed by government regulation often complicates transitions instead of facilitating them. Had gasoline prices risen to move the market toward small cars on a more evolutionary basis, the transitions might have been more orderly.

HSLA steel is a category of high strength steel (HSS). The alloying elements increase the strength-to-weight ratio, not "increase its strength while reducing its weight" (page 4).* The amount of HSS steel projected for the average 1985 Ford car is substantially above the estimate reflected in the study. HSS is currently our most cost effective lightweight material substitution.

The statement on page 6 about materials decisions being made at least 18 months before new car introduction may mislead a reader into assuming unrealistically short lead times. Procurement times and tool construction times after engineering release (including material specification) often far exceed 18 months. For example, procurement times for transmission cases are 36 months and are up to 50 months for engines.

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*/See GAO note, p. 37.

Mr. J. Dexter Peach - 3 - July 25, 1979

The materials planning process now underway includes periodic meetings with suppliers to give them usage requirements and discuss materials trends. This information flow alerts suppliers to the need for capacity changes and encourages development of new usages and markets. The system is informal, flexible and efficient. Institutionalizing any of this with a government department would likely reduce flexibility and efficiency, and complicate transitions and adjustments. Periodic studies of specific issues, such as this one, should be more than adequate.

In principle, it is desirable to assess the materials-energy-environment interrelationships and balance conflicts in the legislation. In practice, however, it is doubtful that the true impact of materials changes could have been predicted when the 1975 Energy Act was passed. Downsizing, materials substitution and component redesign are evolving situations, and even today, forecasts for the mid-1980's are still uncertain.

While a national materials policy is not justified due to government impacts on materials, there is a need for proper study of policies and programs affecting "critical" materials -- those materials essential to either national security or the economy for which we are dependent upon foreign availability. While there may be proposals for information systems to provide early warning, it is our opinion that the spot markets and futures markets represent the best answer to that need.

If we may be of further assistance, please let us know.

Sincerely,

J R Maroni

J. R. Maroni
Director
Environmental Research
and Energy Planning

GAO note: Page references in this appendix were changed to correspond with those of this final report. The language of the cited reference was clarified in this final report.

GENERAL MOTORS CORPORATION
GENERAL MOTORS BUILDING
DETROIT, MICHIGAN 48202

ROBERT F MAGILL
VICE PRESIDENT

July 6, 1979

Mr. J. Dexter Peach
Director
U.S. General Accounting Office
Energy and Minerals Division
Washington, D.C. 20548

Dear Mr. Peach:

We have reviewed the GAO draft report on the interrelationship between materials, energy and the environment which you sent us on June 12.

The data relating to car weights and shifts in material content from steel and cast iron, for example, to more aluminum and plastics seems reasonable.

Furthermore, we concur with the need to evaluate national policies for their impact on material use and consumption. Whether the results of the study will indicate that further government involvement in the area of material usage would be necessary, of course, remains in question. Certainly, there is room for improvement where standards are established that cause an unwarranted shift to lighter, more costly materials or those that must be imported.

Thank you for the opportunity to review the draft.

Sincerely,

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