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Final Report

Industrial Energy Study Of The Motor Vehicles Industry

Contract No. 14-01-0001-1671 for

U.S. Department of the Interior

Bureau of Mines

July, 1974

Prepared by

Kearney: Management Consultants

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July 26, 1974

Mr. J. E. McElroy
Construction and Forest
Products Division
Bureau of Domestic Commerce
Room 2112
U.S. Department of Commerce
Washington, D. C. 20230

Subject: Contract No. 14-01-0001-1671
Energy Study of Motor
Vehicles Industry

Dear Mr. McElroy:

In accordance with the requirements of the subject contract, we submit 50 copies of our final report covering an Energy Study of the Motor Vehicles Industry. One unbound copy is included for reproduction purposes.

We appreciated the opportunity of conducting this study for the Federal Energy Office and are prepared to offer any further assistance which is required.

Respectfully submitted,

A. T. Kearney, Inc

cc: Mrs. L. Ross

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INDUSTRIAL ENERGY STUDY OF
THE MOTOR VEHICLES INDUSTRY

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ABSTRACT

This document presents the findings of a study by A. T. Kearney, Inc. of the Industrial Energy Study of the Motor Vehicles Industries. The scope of the study is limited to establishments in Standard Industrial Classification (SIC) 371 and its 4-digit subindustries: motor vehicles and passenger car bodies (SIC 3711); truck and bus bodies (SIC 3713); motor vehicle parts and accessories (SIC 3714); and truck trailers (SIC 3715). Industries which produce raw materials and certain components which are used for production of motor vehicles are covered by other SIC groups, and were not therefore included in this study.

The material contained herein serves to: characterize industry energy consumption by process and subprocess, by type of energy, and by geographic pattern of use; document the dynamics of energy supply in the industry; identify and describe potential for energy substitutions and conservation of petroleum fuels; determine factors affecting energy consumption efficiency within the industry; and, identify key constraints limiting the productive capacity of the industry.

PREFACE

The attached is the Contractor's Final Report. It includes the technical information and conclusions regarding energy consumption in the Motor Vehicles and Equipment Industry. This report is not an official FEO publication nor has it been reviewed by the Government.

Certain data presentation conventions have been followed for the convenience of the Government. The following abbreviations and symbols occur frequently in the text, tables and exhibits:

NA	Not available
X	Not applicable
Z	Negligible
n.e.c.	Not elsewhere classified
n.s.k.	Not specified by kind
BTU	British Thermal Unit
KWH	Kilowatt-hour
ASM	Annual Survey of Manufactures
CIR	Current Industrial Reports
SIC	Standard Industrial Classification
(Zero field)	Any data field left blank equals zero

Further, certain data presentations were required by the Government. The required illustrations (Tables 1-12 for each 4-digit SIC subindustry) are integrated with other Exhibits and are found at the end of the Section in which they were introduced. Exhibits that are presented and were required carry the respective table notation requested by the Government in parenthesis.

A. T. Kearney, Inc. has pledged to maintain confidentiality of the individual company and plant data collected in the course of this study. This data will not be transmitted to Federal Government or exchanged with public or private interest groups. All published data contained herein is in summary or statistical form only so as to honor its confidential nature. Any data withheld was done so only for the purpose of maintaining confidentiality and was so noted.

We gratefully acknowledge the cooperation and assistance of the following trade associations and their member companies: Motor and Equipment Manufacturers Association; Motor Vehicles Manufacturers Association; Recreational Vehicle Institute; Truck Body and Equipment Association; the Truck Trailer Manufacturers Association; and the Automotive Parts and Accessories Association.

We also are espeically appreciative of the assistance and contributions of the U.S. Department of Commerce.

EXECUTIVE SUMMARY

The objective of this study was to determine the economic impact of potential energy shortages in the Motor Vehicle and Equipment Industry by characterizing industry energy consumption in terms of manufacturing process, geographic pattern of use, types of energy, supply dynamics, use efficiencies, and options for substitution and conservation.

As a result of this study the following observations can be made:

1. The Motor Vehicle and Equipment Industry is the second largest in terms of value of shipments and the largest in terms of employment. The passenger car portion of the industry is by far the most significant product, accounting for about 70 percent of the total value of shipments.

2. Although motor vehicles are themselves the greatest user of petroleum products, the Motor Vehicles Industry is not directly an energy intensive industry for manufacturing, although supplier industries are major energy consumers. Energy consumption has represented only a small factor in terms of direct manufacturing costs, accounting for only 1/2 percent of value of shipments.

3. While there were individual examples of situations where energy shortages occurred, the industry was able to maintain production throughout the shortage period by conservation measures, by using substitute forms of energy wherever possible, and because of reduced production schedules. Although a prolonged

embargo and its subsequent energy shortage would have ultimately had a direct impact on production in the Motor Vehicles Industry, there is no evidence that the embargo in 1973-74 actually did have such an effect.

4. Because the industry is so heavily dependent on supplier industries, an isolated shortage in a supplier industry curtailing production of some critical parts could conceivably shut-down an entire assembly line.

5. The relatively small part of the manufacturing cost which involved energy costs, averaging about 0.5 percent, had never offered an attractive area for major cost reduction measures. The principal area where energy conservation was possible was for building heating, lighting and services.

6. Other, longer-range energy conservation measures are being studied in many plants. These include use of recuperators or heat exchangers to salvage waste heat from furnaces for use in preheating air for combustion, or for use in process heating.

7. The opportunities offered in the area of using substitute materials have been relatively limited in this industry. There has been an increasing trend toward use of plastics and aluminum to replace steel, both for cost and for lightness. While the value of reducing the weight of automobiles as a means of improving gasoline mileage performance is well known, the reduced availability of plastics and increased weight due to federal safety requirements may reverse this trend.

8. There are several possibilities that exist in the longer run for changing of processes to either conserve energy or to convert from oil or gas fired equipment to coal or electric power heated equipment. However, these changes in process cannot be quickly or cheaply made in most cases.

9. Capital expenditures not related to new plant construction or increases in productivity are expected to be high in 1974. These will be caused by necessity for retooling for production of smaller sizes of cars and for expenditures for the means of reducing dependency on fuel oil and natural gas by building coal fired boiler houses or converting oil or gas fired boilers to coal. Additionally, expenditures for environmental control and for health and safety control are expected to continue unabated.

10. Of great concern to the industry is the rapid and extensive decrease in consumer demand which took place due to the scarcity and high price of gasoline. Purchasing of new automobiles dropped off sharply during the energy crisis and is still continuing. Those customers that remain in the market have demonstrated buyer resistance to the traditional, larger family-size auto and are shopping for gas economy in smaller vehicles.

I - INTRODUCTION

The Federal Energy Office (FEO) was created to identify solutions to potential and/or real energy shortages in the United States. The need to make timely and intelligent recommendations for the allocation of scarce energy resources requires an understanding of the energy supply-demand relationship.

In addition, then, to quantifying the supply or inventory of energy resources, the FEO is charged with characterizing the demands by energy consumers on these resources. Since the largest business use of energy is in the industrial sector (it uses about 43 percent of the Nation's energy budget), the consumption patterns and requirements of key industries must be identified. The Motor Vehicles and Equipment Industry, the subject of this study, is indeed a key industry in that besides providing all of the vehicles for motor transportation, the industry ranks second in the U.S. in value of shipments.

The remaining pages of this Section will serve to identify the objectives of this study, the general approach and methodology employed, and the study scope and limitations.

PURPOSE OF THE STUDY

The intent of the study is to determine the economic impact of potential energy shortages in the motor vehicle and equipment industry. More specifically, the objectives are to:

1. Characterize industry energy consumption by subindustry and manufacturing process, by type of energy, and by geographic pattern of use.

2. Document of the dynamics of energy supply in the industry.

3. Identify and describe potential for energy substitutions and conservation of petroleum fuels.

4. Determine factors affecting energy consumption efficiency within the industry.

5. Identify key constraints, and their impacts, which limit the productive capacity of the industry.

METHODOLOGY

(a) General Approach

The operating characteristics of the Motor Vehicles and Equipment Industry were analyzed on a primary (first-level analysis) basis by its 4-digit Standard Industrial Classification (SIC) subindustries. A secondary analysis (second-level analysis) required for the characterization of energy consumption patterns, was performed by basic manufacturing processes*. Manufacturing processes which utilize thermal or electrical energy vary widely, but generally include the following, many of which are found in various combinations in the larger plants.

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* It is evident that this requirement was intended for use in process-type industries, such as iron and steel, petroleum refining, cement, pulp and paper, aluminum and similar industries. However, the motor vehicles industry is not a process-type industry and is not easily classified by manufacturing process, or even by products, as related to energy consumption.

Table I-1

Motor Vehicle Manufacturing Process

Process	Type of Energy Consumed
Foundry	Coke, Oil, Gas, Electric
Forging	Oil, Gas, Electric
Heat Treating	Oil, Gas, Electric
Metal Finishing	Oil, Gas, Electric
Machining	Electric
Press Forming & Stamping	Electric
Welding	Electric
Assembly	Gas, Electric

Source: A. T. Kearney, Inc.

These operations and their energy requirements, are further discussed in a subsequent part of this Section.

Given the time constraints of the study, an analysis of energy consumption by vehicle component or subassembly would be futile considering that a typical vehicle may have 18,000 individual components and 75 subassemblies. Further, although many of the components can be produced in one operation, such as stamping or machining, most of them require multiple operations. Typical sequences might include: iron casting, machining, cleaning, painting, subassembly; or forging, machining, heat treating, subassembly; or press forming, welding, subassembly, painting. Energy consumption is spread through all parts of these operations, including use of fuels for melting, heating, paint drying, wash solution heating, forging, heat treating; and use of electric power for all of these operations plus machining, welding, press forming and stamping,.

and assembly. In addition, the size, type and quantity of components and subassemblies vary from one builder to another, and often from one model of vehicle to another for the same builder.

The principal source of published statistical data regarding the Motor Vehicles Industry was the Census of Manufacturers reports issued by the U.S. Department of Commerce in 1967 and 1972. Because of the fact that the 1972 Census Report has not yet been issued in its complete version, it was necessary to use the last complete census study of 1967 for certain of the detail regarding materials consumption and energy use in the industry. The most current energy consumption data came from the 1972 Census of Manufactures special report on fuels and electric energy consumed. This report identified 1971 fuel and electric power consumption for the total industry and 1971 fuel consumption on a 4-digit SIC basis. A literature search was conducted to gather available information regarding energy consumption, motor vehicle manufacturing, make-up of materials in vehicles, and industry problems. Several studies were found which had previously analyzed energy consumption for transportation and for automobile production and operation. A list of the important reference sources which were used is given in Exhibit I-1.

In the course of the study, visits were made to the headquarters of the major motor vehicle manufacturers and to individual plants of producers in each 4-digit SIC subindustry. Over two dozen such visits were made as shown in the table on the following page.

Table I-2

Field Visits by 4-Digit SIC

SIC Group	Number of Visits
3711	5
3713	9
3714	9
3715	5
Total	28

These companies and plants were selected to provide the best possible cross-section of the industry. These field visits provided real-world data to verify theoretical calculations of per unit process energy and provided valuable information regarding fuels used, electric energy purchased, purchasing practices, policies regarding fuel stores, problems related to energy shortages, and energy-production relationships for various production processes.

(b) Energy Estimation Methodology

As noted earlier, the limited time and budget for this study did not permit a detailed or even a partial analysis of energy consumption on a component or subassembly basis. To this extent, a more efficient method was chosen for analyzing energy consumption in the industry. The method employed involved the identification and analysis of basic energy consuming processes used in motor vehicle and component production. The relevant manufacturing processes included:

- Iron casting
- Aluminum casting
- Zinc die casting
- Steel forging
- Steel heat treating
- Electroplating
- Press forming
- Stamping
- Machining
- Welding
- Painting
- Assembly

These processes in various combinations are used to produce all components, and are used for final assembly of motor vehicles. Although it was recognized that there is no such thing as an average or standard energy consumption for all of the thousands of components and scores of subassemblies which use these processes, a typical process energy requirement was developed which could be used to categorize energy consumption. These calculations were based on accepted metallurgical and processing procedures and on use of typical equipment and methods. For example, production of iron castings included the following energy consuming operations:

- Cupola Melting
  (Electric arc melting alternate)
- Molding and Sand Preparation
  Coremaking
  Cleaning
  Material Handling

The fuel and electric power consumptions for each of the processes, and the total KWH equivalent for each process, are given in Exhibit I-2.* These process energy requirements vary proportionately with production activity.

While not involved directly in the production process, energy for building utilities such as heating, lighting, air conditioning, and ventilation, represent about 30 percent of that consumed

*See pages III-3 through III-6 for detailed discussion.

in the plant. Energy consumption for these building utilities is a function of plant square footage under roof, not production units. Assuming an average number of degree-days heating and four air changes per hour, the average heating load is about 30 KWH equivalent per square foot per year. Energy requirements for lighting average about 6 KWH per square foot per year. In order to estimate the square footage of plant and office space in service in the industry, the number of square feet needed to generate a million dollars of shipments was calculated for a number of companies.* Further, since plant area cannot be expected to vary directly with production volume, industry square footage and hence, energy for building utilities, was assumed based on average of industry responses to vary 25 percent with production. That is to say, if production doubles in any given time period, the building energy consumption would increase by 25 percent in the same period.

These theoretical per unit process energy requirements were then used in the performance of the following tasks for each 4-digit SIC subindustry:

1. Develop production unit volume (as a measure of manufacturing activity) for the years 1967-1974 to be used as the independent variable in the energy equation.

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*Although value added by manufacturing is a more accurate indicator of actual industry activity, this data was not always available.

2. Identify and describe the energy consuming process and subprocess.

3. Determine the energy consumption by process using the field-tested theoretical per unit energy consumption equation.

4. Summarize the process energy consumption and verify with available published energy consumption data.

5. Determine the energy consumed by type or "energy mix" using published industry data, field data, and knowledge of typical process requirements.

SCOPE AND LIMITATIONS

The scope of this study is by definition limited to the industries in SIC 371, Motor Vehicles and Motor Vehicle Equipment. Raw materials and components purchased by SIC 371 industries from other SIC-defined industries are excluded. More specifically, the energy consumed in the manufacture of materials by other SIC industries for purchase and use in the motor vehicle and equipment industry is not considered within the scope of this study. For the most part, these materials would be covered by similar studies of their industries of basic origin.

These material exclusions can be categorized into two groups: raw materials and components or subassemblies. The table on the following page shows a list of raw material supplier industries illustrative of the type of items specifically excluded.

Table I-3

Raw Material Supplier Industries Excluded

SIC Group	Material
3312	Iron and Steel
3323	Iron and Steel Castings
3361	Aluminum Castings
3369	Zinc Castings
3391	Steel Forgings
2851	Paints
3079	Plastics
3211	Glass
2396	Fabrics
3461	Stampings
3451	Screw Machine Products

The table below includes examples of component supplier industries outside the study scope.

Table I-4

Components Supplier Industries Excluded

SIC Group	Product
3011	Tires
3069	Fabricated Rubber Products
3321	Instruments
3621	Electric Motors
3641	Electric Lamps
3651	Radios
3691	Batteries
3694	Ignition Systems
3129	Hardware
3493	Springs
3519	Diesel Engines
3585	Air Conditioners
3599	Carburetors, etc.

Finally, published statistical data on the 4-digit SIC industry, Passenger Car Bodies (SIC 3712), has since 1967 been integrated with data for Motor Vehicles (SIC 3711). Since the integrity of the base line data for this subindustry was lost in this transfer, it was not possible to prepare a complete separate analysis for the Passenger Car Body Industry. However, wherever relevant data was available it was presented and discussed as a part of the motor vehicles 4-digit SIC group.

PRELIMINARY NATURE OF THE STUDY

The limited time and budget available for preparation of this study did not permit the Contractor to conduct the type of in-depth analysis of all factors and problems relating to energy consumption for motor vehicle production which are required for a definitive analysis. Therefore, this study should be considered as preliminary in nature and its use should be limited in keeping with this situation.

FEDERAL ENERGY OFFICE

REFERENCE SOURCES

U.S. GOVERNMENT PUBLICATIONS

1967 Census of Manufactures, Bureau of the Census, U.S. Dept. of Commerce

1972 Census of Manufactures, Bureau of the Census, U.S. Dept. of Commerce

"Fuels and Electric Energy Consumed in 1971," 1972 Census of Manufactures, Bureau of the Census, U.S. Department of Commerce

"Selected Materials Consumed," 1967 Census of Manufacturers, U.S. Dept. of Commerce, 1972

STUDIES OF ENERGY CONSUMPTION

"Energy Analysis of Production of Automobiles," Berry and Fels, University of Chicago, 1972

"Total Energy Demand for Automobiles," Hirst and Herendeen, Society of Automotive Engineers, 1973

"The Energy Cost of Automobiles," Berry and Fels, Science & Public Affairs, 1973

"How Much Energy is Needed to Produce an Automobile," McGowan and Kirchhoff, Automotive Engineering, 1972

MATERIALS MAKE-UP IN AUTOMOBILES

"King Steel Resists Challenges of Plastics, Lighter Metals," Wards Automotive Yearbook, 1972

"Mineral Facts and Problems," U.S. Department of Interior, 1970

"Determining the Effects of Gasoline Price on Use of Metals in Automobile Manufacture," Bureau of Mines, 1974

"What's a Car Made Of," Automotive Information, 1968

"Dismantling a Typical Junk Automobile to Produce Quality Scrap," Bureau of Mines, 1969

MOTOR VEHICLES STATISTICS

Wards Automotive Yearbook, 1973

Automotive News 1974 Almanac Issue

1972 Automobile Facts & Figures, Motor Vehicles Manufacturers Association

FEDERAL ENERGY OFFICE

SUMMARY OF ENERGY REQUIREMENTS BY PROCESS OF MANUFACTURE PER TON OF PRODUCT

Product	Energy Form: Coal-Pounds	Coke-Pounds	Fuel Oil-Gallons (Alternate for Gas)	Natural Gas-CF	Propane-Gallons	Electric Power-KWH	KWH Equivalent
Iron Castings							
Cupola Melting	-	440	(8)	2,125	-	280	2,595
Electric Melting	-	-	-	340	-	1,130	1,235
Aluminum Castings							
Fuel Melting	-	-	(24)	3,600	-	60	1,150
Electric Melting	-	-	-	345		895	1,000
Zinc Die Castings	-	-	-	1,650	-	60	560
Steel Forgings	-	-	(25)	3,500	-	1,000	2,060
Heat Treated Steel							
Quench and Temper	-	-	(15)	2,100	-	50	685
Carburizing	-	-	(22)	3,000	-	50	960
Induction Hardening	-	-	-		-	40	40
Annealing	-	-	(15)	2,000	-	50	650
Painting	-	-	-	5,000	-	75	1,545
Electroplating	-	-	-	500	-	275	425
Welding	-	-	-	-	-	200	200
Machining	-	-	-	-	-	190	190
Stamping	-	-	-	-	-	50	50
Press Forming	-	-	-	-	-	250	250
Assembly	-	-	-	-	-	100	100

Note: These figures were not confirmed in all cases by industry sources, but represented the best concensus of information which was available.

Source: A. T. Kearney, Inc. Calculations.
See Appendix D for details.

EXHIBIT I-2

II - OVERALL STUDY CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

The Motor Vehicles Industry

The Motor Vehicles Industry (SIC 371) consists of establishments which perform the following functions:

3711 Manufacturing or assembling passenger cars, trucks, commercial cars and buses.

3712 Manufacturing chassis or passenger car bodies.

3713 Manufacturing truck and bus bodies.

3714 Manufacturing motor vehicle parts and accessories.

3715. Manufacturing truck trailers.

This industry is the second largest in terms of value of shipments, and the largest in terms of employment. In 1972, the last U.S. Census of Manufactures year of record, the industry consisted of 3,320 establishments, employing 808,000 people, and with a value of shipments of $63 billion. It is the largest consumer of steel products, iron castings, rubber tires, and storage batteries, and among the largest consumers of plastics, glass, fabrics, radios, air conditioners, fasteners, bearings, electric motors, and other products.

Energy Requirements

Although the industry is not among the major consumers of energy for manufacturing, the automobiles, truck and other vehicles produced by the industry constitute the largest consumer of petroleum products. In 1971 the industry consumed 72.9 billion KWH equivalents of all types of fuels and electric power in its manufacturing processes. However, this only amounted to 1.9 percent of the total energy consumption for manufacturing in 1971, and the industry ranked 31st of 190 industries surveyed, in energy consumption.

From a production viewpoint, the passenger car portion of the industry is by far the most important, accounting for 9.67 million vehicles, versus 3.01 million trucks and other vehicles in 1973, and about 70 percent of the value of shipments. Similarly, the consumption of energy for manufacturing and the consumption of petroleum products for operation of vehicles, is predominantly concentrated in the passenger car portion of the industry. Energy consumption for manufacturing while high in total quantity consumed, represents only a minor factor in terms of total manufacturing costs. In 1972 it represented $339 million of $63 billion value of shipments, or 0.5 percent of the total. Of this quantity of energy, petroleum products represented less than 10 percent of total cost, or about 0.05 percent of the total value of shipments for the industry.

Impact of the Energy Shortage

Although there were individual examples of situations where energy shortages occurred, the industry was able to maintain production throughout the shortage period by conservation measures, by using substitute forms of energy wherever possible, and because of reduced production requirements due to drop in sales.

Although a prolonged embargo and its subsequent energy shortage would have ultimately had a direct impact on production in the Motor Vehicles Industry, there is no evidence that the embargo in 1973-74 actually did have such an effect. Cut-backs in direct production due to lack of fuels for heating and processing were not reported. However, in a prolonged situation, fuel consuming services and processes such as building heating, melting, forging, heat treating and finishing could have been affected in individual cases. Due to the widespread use of suppliers for components and accessories, an isolated shortage that curtailed production of some critical parts could conceivably shut-down an entire assembly line. There were no reports, however, that this actually did occur.

Many of the materials and components used in motor vehicles production are made in other industries by energy intensive processes or from petroleum-based feedstocks. Here again, no reported shortages occurred which curtailed production, but in a prolonged energy shortage situation, this could well have occurred.

Prices of almost all raw materials and parts used for motor vehicle production increased generally in accordance with the change in price indices. The net result was to cause a similar cost increase in vehicle production. Although energy costs increased far greater than commodity costs, the relatively low cost of energy used in vehicle production did not result in overall cost increases for manufacturing in excess of those for all commodities.

By far the most significant impact on the sales, production and earnings of the Motor Vehicles Industry was felt in the passenger car segment due to the rapid and drastic shift in consumer demand for automobiles. The specter of unavailability and skyrocketing prices of gasoline had an almost immediate reaction among the buying public. Purchases of new cars dropped sharply and continued to drop as the length of time and the effect of the oil embargo increased. At the same time, buyer preferences shifted toward the smaller cars, both domestic and imported, which offered improved performance in terms of miles per gallon of gasoline. Although this trend had been in evidence for several years, the rapidity and the magnitude of the shift caught most of the major American automobile producers by surprise, and unprepared to produce the types and quantities of automobiles which the public demanded. Major changes in models of automobiles do not take place quickly, and it will be a year or more before the necessary shift in production can take place from the larger vehicles to the smaller ones. Those companies who were best prepared for production of small cars with good gasoline performance have maintained high levels of performance, while others who were not prepared sustained the greatest drops in sales.

Importance of Supplier Industries

The Motor Vehicles Industry is the largest consumer of such raw materials as steel and iron castings, and products as batteries and rubber tires; and is one of the largest consumers of glass, plastics, fabrics, radios, air conditioners, fasteners, electric motors, bearings and gauges. Although some shortages have occurred in the production of these raw materials and components, the one of which was of major significance to the Motor Vehicles Industry was iron castings. The potential implications of the oil embargo did not actually result in material shortages, although there is no doubt that these would eventually have been felt had the embargo continued. This would have been particularly true in the supplies of plastics, synthetic rubber, and tires, for which petroleum based feedstocks are the primary raw material.

Manufacturing Costs

Manufacturing cost increases which have occurred in automobile and truck products have in general been caused by the continuing effect of inflation and rising prices for raw materials and components used in vehicle production, and requirements for safety and emission controls to meet federal standards. The low relationship of cost of energy, and particularly petroleum products, used in manufacturing of motor vehicles, has not translated itself into significant price increases for motor vehicles. However, many of the raw materials used in motor vehicle manufacturing, particularly steel, plastics, rubber, aluminum, glass and fabrics, are energy intensive in their original production, and some use petroleum feedstocks as raw material. Increases in costs of energy and petroleum products will ultimately have the effect of increasing raw materials prices, and consequently manufacturing costs for vehicles. In 1972, the costs of materials for motor vehicle manufacturing represented 66 percent of total value of shipments. Even a minor increase in the costs of these materials would have a direct and significant impact on total manufacturing costs, and a major increase in costs of materials would have a serious effect on total costs. Costs of raw materials and components rose in approximate relationship to the rise in the commodity price index. Although costs of energy, particularly petroleum products, rose much more sharply, their impact on manufacturing costs was minimal. This was caused by the relatively small percentage of costs which are chargeable to energy, 0.5 percent of value of shipments for total energy costs for manufacturing, and 0.05 percent for total petroleum fuel costs. The total cost of energy per average motor vehicle rose from $28.67 in 1971, to $32.17 in 1973, and to $40.61 in 1974 (based on first half estimates). Although the percentage raise for energy from 1973 to 1974 was 25 percent, the overall impact on manufacturing costs was less than 0.1 percent.

Of far greater significance was the rapid increase in price of gasoline which greatly affected both volume of sales and buyer preference for smaller, lower priced cars.

Conservation and Substitution of Fuels

The relatively small part of the manufacturing costs which involved energy costs had never offered an attractive area for major measures of cost reduction. Additionally, in the past, there were no significant shortages of energy that prompted the companies in the industry to take drastic conservation measures. Therefore, the industry was not prepared to take such measures when the energy shortage fell upon them. Since the industry is not energy intensive, there were no obvious areas to which attention could be directed. Most of the manufacturing energy consumption was directly related to production, and consequently reductions in energy use in these areas was likely to also reduce production. The principal area where conservation was possible was for building heating, lighting and services. Industry surveys indicated that approximately 30 percent of total fuel and electric power is used in these areas. By reducing temperatures of buildings, closing all openings through which heat could escape, turning-off lights in buildings not in use, and by general improvement in housekeeping, savings of up to 25 percent of the heating and lighting energy load were achieved in some plants. This translated itself into reductions of from 5 to 10 percent of total energy consumption for manufacturing. These measures, while small in total amount, will probably be maintained as good manufacturing practice.

Other, longer-range energy conservation measures are being studied in many plants. These include use of recuperators or heat exchangers to salvage waste heat from furnaces for use in preheating air for combustion, or for use in process heating. These measures had in the past been considered as offering too low a return-on-investment to be economically feasible. However, the higher prices for energy, coupled with the shortages of many forms of energy, have resulted in a re-evaluation of the pay-back on some of these energy saving devices.

The opportunities offered in the area of using substitute materials to conserve energy or petroleum based raw materials, have been relatively limted in this industry. There has been an increasing trend toward use of plastics to replace steel, both for cost and for lightness. While the value of reducing weight of automobiles as a means of improving gasoline mileage performance is well known, the reduced availability of plastics may reverse this trend. An additional problem in this industry is the relative long lead time required to make changes in design or materials, which has effectively prevented substitutions from being made in a short period of time.

Note has already been made of the major change which is now taking place in the automobile industry, where smaller, lighter weight cars are being produced to provide improved gasoline performance. The impacts of this change are threefold: first, the savings in gasoline which will result in use of the smaller cars; second, the reduced weight of materials which will result in reduced energy consumption by those industries which supply these materials, such as steel, foundry, rubber; and third, the reduced energy estimated to be required for manufacturing small cars versus large cars, which although small, is nevertheless another area of savings.

There are several possibilities that exist in the longer run for changing of processes to either conserve energy, or to convert from oil or gas fired equipment to coal or electric power heated equipment. A reversal has taken place in plant design in which the coal fired boiler is once again being used to supply steam for plant heating and for some processing. In some cases boilers which are now oil or gas fired, are being converted to coal. Heating and melting furnaces do not lend themselves to conversion from oil or gas to coal, but can be replaced by electric powered furnaces. Electric arc and electric induction furnaces are being used for melting in foundries in place of cupolas and fuel fired furnaces. Electric induction and electric resistance heating is being used to replace fuel fired furnaces for forging and heat treating.

These changes in process cannot be quickly or cheaply made in most cases. Boiler house construction is costly, and in many cases, conversions from gas to coal cannot be made without replacement of boilers and additions of coal handling and storage facilities. Similarly, changing from fuel fired furnaces to electric heating always requires a new installation replacing the old furnaces with new ones. The major problems in these conversions, however, involve the environmental aspects and the availability of electric power. Increased use of coal will reverse the environmental improvement by releasing sulfur oxide gases to the atmosphere. Major increases in use of electric power will require new power plants to be built, which will both time consuming and costly. In addition, where coal boilers are used, the environmental problem also exists.

CONCLUSIONS

Relationship of Energy and and Motor Vehicles

Motor vehicles are principally consumers of energy in their use rather than in their production. This fact led to an immediate reduction in purchases of vehicles particularly automobiles, when gasoline became expensive and hard to obtain. However, even through energy costs account for only about 0.5 percent of total cost of manufacturing and sales of motor vehicles, the availability of the required quantities and types of energy in the various manufacturing establishments in the industry remains a critical and essential factor in maintenance of the viability of the industry. Furthermore, the supplier industries which provide raw materials and components to the Motor Vehicles Industry are in many cases energy intensive, making their continued operation even more dependent on supplies of the needed forms and quantities of energy.

This interrelationship between the various segments of the Motor Vehicles Industry and the supplier industries creates a situation of dependence which must not be understated. The lack of any of the 18,000 or more components which make up a motor vehicle can shut-down an assembly line. This lack can be created by scarcity of a raw material or by unavailability of a critical fuel at a component manufacturing plant. All of this implies that the vast Motor Vehicles Industry and its equally vast supplier industries cannot be treated statistically with the assumption that shortages of critical materials, parts or fuels can be made up by averaging allocations on an industry basis. This treatment could easily result in situations where shortages of strategic items may occur which might have the effect of shutting-down entire assembly lines.

The importance of the Motor Vehicles Industry to the U.S. economy must also not be overlooked. In addition to being the largest employer, it is the producer of the means of transportation of a major portion of the people and goods in this country. A major disruption of this industry will therefore have the combined effect of reducing employment and slowing down the wheels on which the nation moves.

Areas for Further Study

The extremely short time and low budget allowed for this study did not permit an adequate analysis of the energy situation as related to the Motor Vehicles Industry to be made. A subject of this importance requires a study of sufficient depth to provide the development of the information regarding the relationship of energy use and production for all aspects of the industry. This necessarily requires cooperation of the major producers in the industry which can only be obtained if sufficient time is provided to permit them to properly gather all necessary information.

Many companies have established energy departments which are studying the problems of use of energy in their manufacturing operations and gathering data regarding energy consumption in their operations. Unlike the Steel Industry where this subject has long been a matter of corporate concern in every company, the Motor Vehicles Industry is only now beginning to become aware of this situation in their industry.

A long-range study program should be sponsored by the Federal Energy Office in which industry, government, and the contracting study firm become a team to adequately investigate the problems related to energy consumption in motor vehicles manufacturing and to develop programs for properly managing the use and allocation of energy, and for conservation and substitution of energy and materials. A development program should preceed such a study during which the needs for the study program will be determined and a plan developed for carrying out the detailed study.

III - GENERAL REVIEW OF THE MOTOR VEHICLES AND EQUIPMENT INDUSTRY

INDUSTRY STRUCTURE

The Motor Vehicles and Motor Vehicles Equipment Industry as defined by Standard Industrial Classification (SIC) 371, is composed of the following five categories:

SIC 3711 - Motor Vehicles

*SIC 3712 - Passenger Car Bodies

SIC 3713 - Truck and Bus Bodies

SIC 3714 - Motor Vehicle Parts and Accessories

SIC 3715 - Truck Trailers

A description of the nature of the establishments in each category is given in Exhibit III-1, with further detailed descriptions of these industries provided in following sections.

General statistical data relating to the Industry, as reported by the U.S. Department of Commerce in census reports, are given in Exhibit III-2, for the years 1967, 1971, 1972 and 1973. The Industry is one of the largest, with 3,320 establishments employing 808,000 people in 1972, and with a value of shipments of $63 billion. Although the principal concentration of establishments in the Industry has traditionally been in the states bordering the Great Lakes, plants belonging to the Industry are found in all parts of the country, particularly on the east and west coasts.

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* After 1967, SIC 3712 was integrated with SIC 3711.

The Industry is a major user of raw materials and finished goods, being the largest consumer of steel products, iron castings, rubber tires, and storage batteries, and one of the largest consumers of plastics, glass, fabrics, radios, fasteners, bearings, and electric motors. Although the three largest automobile manufacturers are highly integrated, with capability of producing most of the components for vehicles in their own plants, a large percentage of the materials and components which are used in vehicles are actually purchased from supplier companies. Some of these companies are classified in SIC 3714, Motor Vehicle Parts and Accessories, while many others are classified in other SIC groups. This fact, which will be discussed in greater detail in a subsequent part of this section, is particularly important in assessing the energy requirements for production of motor vehicles, since a large part of the energy used to produce a complete vehicle is actually shown in census reports, to be consumed by other SIC groups.

Motor vehicle production, which accounts for more than 95 percent of total Industry shipments, is shown on Exhibit III-3, for the period of 1967 through 1973. The number of vehicles produced, which included automobiles, trucks, and buses, fluctuated from 8 to over 12 million per year, reaching the all time peak of 12,682,000 in 1973. There has been an increasing trend toward production of smaller automobiles. This trend, plus increased use of nonferrous metals and nonmetallic materials, accounted for the reduction in consumption of steel per average vehicle, as shown in Exhibit III-3, from 3,650 pounds in 1967 to 3,230 pounds in 1972. This trend was reversed in 1973, with 3,670 pounds used per average vehicle.* This reversal was caused by the requirements for steel for safety and environmental devices.

OVERALL ENERGY USE

Energy consumption, in the form of fuels and electric power, have been reported in census data in 1967, and in a special report Fuels and Electric Energy Consumed, for 1971 (See Exhibit III-4). The overall industry data are given in Exhibit III-5 for 1967, 1971 and estimated for 1973. Total energy consumption, expressed in terms of KWH equivalent per average vehicle produced, decreased from 7,595 in 1967 to 6,852 in 1971. This decrease is partially attributable to the reduction in steel used per average vehicle, but also to more reduced use of energy directly by the Industry as motor vehicle production increases. The latter factor is caused by more efficient use of facilities, and also to higher quantities of components purchased from firms in other industry classifications, when vehicle production increases.

Although ranking among the largest industry groups in terms of value of shipments and employment, the Motor Vehicles

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* Variations in product mix from year to year preclude any concept of an "average vehicle." The term was used only to establish long-range trends in the industry in steel and energy consumption.

Industry is not a major energy consumer. In 1971, the Industry consumed 72.9 of 3,850.2 billions of KWH equivalent which were consumed by all industries, or only 1.9 percent of the total. It ranked 31 of some 190 industries listed in the survey. In terms of importance within the industry, expenditures for fuel and electric power amounted to only $305 million out of $57,456 million in value of shipments in 1971, or about 1/2 percent.

The industry uses relatively little energy for processing because it is basically a manufacturing, rather than a processing industry. Further, requirements for building services, including heating, lighting, air conditioning, ventilation and other non-productive purposes, consume a large part of the energy used. Based on an analysis of about 55 companies, involving more than 250 plants, a relationship was established between plant size and energy consumption for heating and lighting. Plant area requirements were also established for various types of facilities, based on the relationship between total manufacturing area, and value of shipments. Areas ranged from 10,000 to 14,000 square feet per million dollars of shipments. Average heating load amounted to 31 KWH equivalent per square foot per year, and average lighting requirement was 6 KWH per square foot per year. This resulted in an average of 30 percent of fuel energy used for building heating, and 27 percent of electrical energy used for building lighting. To this extent, only about 70 percent of the energy consumed is for manufacturing; 30 percent is being used just for space heating and lighting.

As was recognized earlier in Section I the process analysis of energy use, based on developing typical conditions for each process, is not the most accurate way of presenting the energy utilization in the Motor Vehicles Industry. However, in the time and budget available, it has been developed as the only practical way in which an energy breakdown by manufacturing process can be presented. As a coarse means of checking or validating the order of magnitude accuracy of the theoretical per unit process energy consumptions discussed in Section I and presented in Exhibit I-2, these process requirements were applied to the manufacture of an average automobile as shown in Exhibit III-6. As indicated, the total energy estimated to be consumed in manufacturing an average automobile is 4,100 KWH equivalent. This includes all manufacturing operations, but does not include the energy required to produce steel, wrought aluminum, plastics, or purchased components such as batteries, tires, ignition systems, air conditioners, and similar items. It also does not include an allowance for building heating and lighting. Since building heating and lighting consumes about 30 percent of total energy used in manufacturing in this industry, the total energy requirement including heating and lighting is about 5,900 KWH equivalent per average automobile. By comparison, the data presented in Exhibit III-5 gave average energy consumption per motor vehicle produced from 1967 to 1974, reported to be about 6,800 KWH in 1973. However, this includes energy used for trailers, replacement parts and other purposes not directly included in motor vehicle production statistics. It also includes energy used for heavy truck production which is higher than that used for automotive production. Assuming that 10 percent of the reported energy use is not for vehicle production, the average reported use is about 6,100 KWH equivalent per average vehicle. This is only 4 percent higher than the calculated figure and can be accounted for by the higher use for truck and bus production.

As a further means of verifying the calculated energy uses for each process, data was obtained from various plants in the industry which essentially were involved in a single process or a combination of processes. These plants included iron foundries, machine shops, assembly plants, and press shops. The data obtained involved total energy consumption and production in tons of product. The energy used for building heating and lighting was deducted from the total, and the resultant figures were converted to total energy consumption per ton of output. Adjustments were made, where necessary, in the calculated figures to make them more closely related to actual experience figures.

ENERGY CONSUMPTION BY TYPE

The use of coal has dropped steadily during the past ten years, leveling off after 1972 to an estimated 2.2 million tons per year. Coal is used entirely in boilers for generation of steam for plant space heating, and for process heating of solutions for washing, plating, painting, and other coatings. Until about 10 years ago, most plants in the Motor Vehicles Industry were constructed with boiler houses, and used steam for space and solution heating. Fuel used in these boiler houses was almost entirely coal. During the past decade, most plants were constructed without boiler houses, utilizing gas fired space heaters for building heating, and for process heating. In those cases where boilers were used, the trend was for use of package boilers which were gas or oil fired. The requirements for clean discharges from the existing boilers led, in some cases, to conversion from coal to oil or gas. The net result was a decline in the use of coal in the Motor Vehicles Industry. However, in 1971 coal still accounted for 25 percent of the total energy, and 32 percent of the fuel energy used in the Industry.

Fuel oil is used for firing of boilers, in those plants which have oil fired boilers, and for heating of furnaces for forging, in foundries, and in heat treating shops. When used in boilers the heavier grades of oil, such as No. 6, are commonly used. When used for heating of furnaces, lighter grades are more commonly used. The use of fuel oil in the Motor Vehicles Industry increased rapidly until 1971, but has tended to level off since then. Fuel oil accounted for only 8 percent of total energy, and 10 percent of the fuel energy used in the Industry in 1971.

The use of natural gas has grown rapidly, from 33 percent of total energy consumed in 1967, to 40 percent in 1971, and an estimated 50 percent in 1973. Many plants, particularly those built during the past 10 years, are based entirely on the use of gas as a fuel. In some cases, where gas contracts provide for interruption of service in winter months, stand-by fuels are provided. Fuel oil or propane are the most commonly used fuels used for this purpose. Where at one time fuel oil was the most common stand-by fuel, in recent years the trend has been to use propane, because of its ability to be used in combustion systems designed for natural gas.

Coke is used only in iron foundries where cupolas are utilized for melting of iron. Coke accounts for only a small portion of total energy use, under 1 percent, and even this may decline still further as more iron foundries convert to electric melting of iron.

Electric power use has had a relatively direct relationship to production in the Industry, and to total energy consumption. It has accounted for 19 to 22 percent of total energy consumption, with the percentage tending to increase slightly in recent years. About 25 to 30 percent of the electric energy is used for building lighting, air conditioning, ventilation, and other nonproductive purposes.

In addition to the direct usage of fuels for heating purposes, there is a significant use of petroleum based products for other purposes in the Motor Vehicles Industry. This includes the following:

- Gasoline and propane for in-plant transportation.
- Gasoline and diesel oil for prefilling vehicle tanks before shipment.
- Lubricating and hydraulic oils for production equipment.
- Lubricating and hydraulic oils for prefilling vehicle tanks before shipment.
- Cutting oils used in machine tools.
- Quenching oils used in heat treating.
- Core oils used in foundries.
- Grease used in machines and vehicles.
- Solvents used for cleaning.

Gasoline is a major item of use, with approximately 250 million gallons used in 1971 for prefilling of motor vehicle tanks, and for in-plant transportation, with about 60 percent used for the former, and 40 percent for the latter. The quantity of gasoline used for prefilling tanks of motor vehicles dropped greatly in 1973, during the energy crisis, and the present trend is to use a minimum quantity for this purpose.

Hydraulic and lubricating oils are also used in large quantities for production purposes in machine tools, and for prefilling of vehicles prior to shipment. Approximately 250 million gallons of these materials were used in 1971, with about 60 percent used for production purposes, and 40 percent for prefilling of vehicles.

Lesser quantities of other petroleum products, such as greases, solvents, cutting oils, core oils, diesel oil, and quenching oil were also used for production purposes. Total quantities were relatively small however, with from 20 to 30 million gallons being used for these purposes for the entire industry in 1971.

Although the Motor Vehicles Industry is not a process industry consuming large quantities of petroleum based feedstocks, there are nevertheless significant quantities of feedstocks used in component manufacturing, insulation and trim. These go into plastic parts, synthetic fabrics, synthetic rubber, and insulating foam and fiber. Reported value of materials shipped to the Motor Vehicles Industry in 1967 included $900 million rubber and miscellaneous plastic products. In 1970 reported shipments of plastics to the industry amounted to 250,000 tons, while rubber including synthetic rubber, amounted to 450,000 tons.

Electric energy consumption was previously described as accounting for about 20 percent of total energy consumption. All electric power used in the Industry is purchased, since none of the establishments have their own generating facilities. Similarly there are no captive sources of fuel in the Industry, resulting in all fuels being purchased.

Electric power and natural gas are purchased by contract under established, published rates, from utility companies. Solid and liquid fuels are purchased from coal and oil companies, generally under short-term contracts. Storage of solid and liquid fuels is provided, with quantities ranging from a few days supply to a month or more.

While there seems to have been no significant service interruption or discontinuation, most users report abnormal price escalations for all energy. That this price increase over the last few years is real is shown in the following table by the wholesale price index of major forms of energy.

Table III-1

Wholesale Price Index for Energy
(1967 = 100)

Year	Petroleum Products	Gaseous Fuels	Coal	Electric Power
1969	99.6	93.3	112.6	101.8
1970	101.1	103.6	150.3	105.9
1971	106.8	108.0	181.8	113.6
1972	108.9	114.1	193.8	121.5
1973	151.4	126.1	218.1	129.3
1974(Mar)	293.4	148.6	259.3	148.9

Source: Survey of Current Business

This indicates that petroleum-derived fuels have trebled in price in less than four years while coal prices have doubled in a like period. Also, gas and electric utility costs have risen less in total, but have experienced significant increases in the last 15 months.

PLANT VARIATIONS

The 3,320 establishments included in the Motor Vehicles Industry range in size from shops employing fewer than 5 people to large plants employing more than 10,000 people. Sixty-eight percent of the establishments employ under 50 people, 18 percent from 50 to 249, 8 percent from 250 to 999, and only 6 percent over 1,000 people. However, 76 percent of the industry employment and 77 percent of value of shipments come from the establishments with employment over 1,000 people.

In general the smaller plants are single purpose type of establishments, producing a single product or a narrow range of products. As the plants become larger, the productive facilities and products become more varied. The largest establishments are complex facilities, producing components and subassemblies ranging from engines, transmissions, and bodies, to complete assembled vehicles.

As the operations become larger and more complex, the uses of energy also become more varied. Many of the small plants are single fuel users, generally natural gas, while the large plants use multiple fuels in combination, often including every type covered in this study. All plants regardless of size, are users of electric energy.

SUPPLIERS TO MOTOR VEHICLES INDUSTRY

The Motor Vehicles Industry is highly integrated, and produces much of the manufactured components and materials used in vehicles and in the replacement market. However, an analysis of total use of materials and of actual materials shipped directly to establishments in the industry, has revealed that a large part of the components and materials used in complete vehicles actually are shipped into the industry from industries in other SIC groups. Some of the examples of this are obvious, such as tires, glass, paints, batteries, electric lamps, while others are not as obvious, and include items such as castings and stampings which are equally produced by establishments in SIC 371, and in other SIC groups. Exhibit III-7 lists major components which are largely or entirely shipped into the industry by other industrial groups.

This exhibit also shows the energy consumption in these supplier industries and indicates the percentage of output which is shipped into the Motor Vehicles Industry, and the energy consumption used for the automotive portion of the output. A comparison with the reported total energy use by the Motor Vehicles Industry in 1967, as shown in Exhibit III-5, shows that the energy required to produce major materials and components shipped into the industry, estimated at 115.0 billion KWH equivalent, is almost double that actually used by the industry to produce vehicles, estimated at 68.2 billion KWH equivalent. In fact, if all items and material purchased by the industry were taken into account, the total energy consumption for these would be more than double that used directly by the industry for motor vehicles and components manufacturing.

The principal metallic materials consumed by the Motor Vehicle Industry are identified in Exhibit III-8. In this exhibit, an attempt has been made to distinguish between those materials which are shipped into establishments in the Industry for fabrication into components directly by the Industry and those materials which are shipped to establishments in other SIC industry groups for fabrication into components which are then shipped to motor vehicles producers for assembly into motor vehicles. Of the major materials, 45 percent of steel, 43 percent of iron and steel castings, 50 percent of steel forgings, 40 percent of aluminum, and 25 percent of copper are fabricated by other industries for shipment to the Motor Vehicles Industry. The energy used for fabrication of these materials into components which are used by the Industry is only partially accounted for in the figures in Exhibit III-6. The additional energy required for fabrication of all of the components by other industry groups, for use by the Motor Vehicles Industry, also adds considerably to the total nonautomotive manufacturing of motor vehicles components.

In addition to the energy required for manufacturing of components destined for shipment to the Motor Vehicles Industry, certain of the raw materials which are used are petroleum based feedstocks, which consume energy indirectly in that petroleum is used as a raw material to produce the feedstocks. In particular, plastics, synthetic rubber materials, and synthetic fabrics fall into this category. The cumulative total of these materials which are used in motor vehicle production requires a significant portion of the petroleum production which is not used for producing gasoline, diesel and heating oils.

Although the consideration of the energy requirements for these industries which provide raw materials and components to the Motor Vehicles Industry is outside the scope of this study, it is recognized that the energy used directly for motor vehicle manufacturing represents only a portion of the total energy represented by a completed motor vehicle. In fact, in a study prepared at the University of Chicago in 1972, only 25 percent of the total energy charged against manufacturing of an automobile was attributed directly to fabricating and assembling of a vehicle. Seventy percent was used for manufacture of metallic materials, 2 percent for manufacture of other materials and 3 percent for transportation of materials and finished vehicles.

It becomes evident from this that even if the Motor Vehicles Industry were able to purchase all of the fuel and electric power which they require, a curtailment in any of the supplier industries could have a direct effect on production of motor vehicles.

GENERAL INDUSTRY PROBLEMS

Like most industries, the Motor Vehicles Industry is beset by problems, some of which are similar to those in other industries, while others are peculiar to the Motor Vehicles Industry. Although it is beyond the scope of this study to go into the details of all of these problems, they are discussed broadly in this section because many of them are inter-related, with impacts being felt from the energy shortage. The problems of the Industry which are discussed fall into several broad categories: those related to the gasoline shortage; those related to potential shortages in supplies of raw materials and components; those related to U.S. Government regulations; and those related to facilities and operations. This is not necessarily an inclusive list, but does include those areas which relate to this study.

Problems Related to Gasoline Shortage

The largest single use of petroleum products is in the transportation sector, and more particularly the motor vehicles. The vast number of automobiles, trucks, buses and other vehicles, numbering in the order of 100 million in 1972 and projected to increase by 25 percent by 1980, and the incredibly high mileage accumulated each year by these vehicles (estimated at about 100 billion in 1972), has made this area the most significant in terms of potential aavings of petroleum products. Even a small increase in average miles per gallon of motor fuel will result in savings of hundreds of millions, or even billions of gallons per year. Therefore, efforts are being made by the Government to push for legislation which will force an increase in average miles per gallon of fuel; by the Industry to make changes in vehicle design which will accomplish this purpose; and by the public in their buying habits to purchase automobiles with greater fuel economy. The results of these efforts have been:

1. A reduction in number of automobiles sold, with 1974 showing a 32 percent decline as compared with 1973. (First quarter each year).

2. A switch to purchase of smaller automobiles with compacts increasing in market penetration by 28.5 percent and subcompacts by 6.5 percent, while standards declined 20.6 percent during the first quarter of 1974 versus 1973.

3. An increase in imports of small, foreign made automobiles, with a 4 percent improvement in market penetration during the first quarter of 1974.

4. Design changes in engines and carburetors, and reduction in weight, to improve miles per gallon of fuel performance.

Problems of Shortages in Raw Materials and Components

It was previously noted that the Motor Vehicle Industry is the largest consumer of many basic raw materials, including steel, iron castings and rubber, and is among the largest consumers of fabrics, plastics, aluminum and glass. It is also the largest consumer of many components and products including batteries, tires, electric lamps, small electric motors, and bearings. In fact a typical automobile is composed of from 14,000 to 18,000 individual components, and from 3,000 to 5,000 pounds of total materials and parts.

In 1973 the Industry consumed more than 23 million tons of steel, or about 20 percent of total steel output. Studies of the Steel Industry have shown that with the Industry operating at full capacity in 1973, and with no plans announced for major expansion, there will be a widening gap between steel capacity and demand. Although imports in the past have more than made up this deficiency, an expected world wide steel shortage may result in steel shortages in the U.S. which cannot be made up by imports.

This continuing scarcity of steel, plus the desire to lighten weight of automobiles, is expected to result in a trend toward increasing use of steel substitutes such as aluminum and plastics. However, in view of the tremendously high production of automobiles each year, even a moderate increase in use of these materials will result in a heavy increased demand on the Aluminum and Plastics Industries. This will require increased productive capacity to be built, and increased supplies of raw materials to be provided for these industries. Most of the bauxite from which aluminum is produced is imported, while the feedstocks for plastics come from petroleum products. Therefore, these substitute materials may also be in short supply if imports of bauxite or petroleum are curtailed.

The producers of completed motor vehicles are particularly vulnerable to potential shut-downs due to lack of supply of critical components. Although the two largest automobile producers are largely integrated, with capability of producing all or part of most of the components which go into vehicle production, even these companies depend on outside manufacturers for part or all of many of the component parts which they use. The smaller automobile and truck producers have an even greater dependence on outside manufacturers for much of their component requirements. Many companies have had an increasing degree of difficulty in obtaining such items as iron castings, brakes, and engine parts, due to closure of many iron foundries. When consideration is given to the fact that an entire assembly line can be shut-down if even one of the thousands of component parts is not available, the problems associated with availability of materials and parts can be truly appreciated.

Although the Motor Vehicles Industry is not considered to be an energy intensive industry, the fuels and electric power which it does use are essential to maintain production. This is true not only for the principal vehicle producers but also for the component manufacturers and suppliers of raw materials and services. In fact, severe curtailments of fuel for even an isolated producer of some small part can result in a domino effect in which an entire assembly line may be ultimately shut down.

Problems Related to
Government Regulations

An important, but sometimes overlooked, fact of life for the Motor Vehicles Industry is the increased impact of Federal Government regulations on design, production and operation of vehicles. Environmental regulations regarding emissions from vehicles have resulted in design changes which have added components and weight; safety regulations for vehicles have also resulted in design changes which have added components and weight; environmental requirements for plant operation have required changes in plant and equipment design and operations, and in use of certain fuels such as high sulfur coal and oil; regulations relating to occupational health and safety (OSHA) have required many changes in plant and equipment design and operation to eliminate health and safety hazards. The most recent of these regulations covers allocations for critical fuels and has resulted in shortages, at individual plants, of natural gas, fuel oil, and propane. This has caused a change in plant design, with most recent plants being designed with coal-fired boiler houses, and using steam for plant heating and process heating. For the ten year period prior to the advent of energy shortages, most plants had been designed without boiler houses, and had used gas for plant and process heating.

FEDERAL ENERGY OFFICE

DESCRIPTION OF INDUSTRY COVERAGE

SIC 371 - MOTOR VEHICLES AND MOTOR VEHICLE EQUIPMENT

SIC 3711 - Motor Vehicles

Establishments primarily engaged in manufacturing or assembling complete passenger automobiles, trucks, commercial cars and buses, and special purpose motor vehicles.

SIC 3712 - Passenger Car Bodies

Establishments primarily engaged in manufacturing chassis or passenger car bodies.

SIC 3713 - Truck and Bus Bodies

Establishments primarily engaged in manufacturing truck and bus bodies, for sale separately, or for assembly on purchased chassis.

SIC 3714 - Motor Vehicle Parts and Accessories

Establishments primarily engaged in manufacturing motor vehicle parts and accessories, but not engaged in manufacturing complete motor vehicles or passenger car bodies.

SIC 3715 - Truck Trailers

Establishments primarily engaged in manufacturing truck trailers, truck trailer chassis for sale separately, detachable trailer bodies for sale separately, and detachable trailer chassis for sale separately.

Source: 1967 Standard Industrial Classification Manual

FEDERAL ENERGY OFFICE

MOTOR VEHICLE INDUSTRY STATISTICS
SIC-371

Year and Source	Number of Motor Vehicles Produced (Millions)	Number of Establishments	Number of Employees	Cost of* All Labor (Millions)	Value Added by Manufacture (Millions)	Cost of* Materials, Fuels, Etc. (Millions)	Cost of Fuel and Power (Millions)	Value of Industry Shipments (Millions)	Capital Expenditures (Millions)	Gross Value Fixed Assets (Millions)
1967 (Census)	8.98	2,675	739,400	$5,919.9	$13,666.1	$26,053.1	$224.2	$39,625.9	$848.2	N.A.
1971 (ASM)	10.64	N.A.	775,900	8,271.9	20,557.8	35,766.0	305.1	57,455.9	766.0	$12,185.3
1972 (Census)	11.27	3,320	807,900	9,457.3	22,213.0	41,216.3	339.0	62,768.3	N.A.	N.A.
1973 (Estimate)	12.68	N.A.	935,000	11,180.0	26,200.0	48,600.0	407.9	74,000.0	N.A.	N.A.
1974 (Projection)	11.0	N.A.	806,500	10,200.0	23,900.0	44,400.0	446.7	67,500.0	N.A.	N.A.

Note: * Includes replacement parts.

Sources: 1972 Census of Manufactures, Preliminary Report.
Automobile Manufacturers Association
A. T. Kearney, Inc. estimates.

EXHIBIT III-2

FEDERAL ENERGY OFFICE

STEEL CONSUMED IN MOTOR VEHICLE PRODUCTS

Year	Vehicles Produced	Total Steel Used-Tons	Average Pounds Steel Per Vehicle**
1967	8,976,226	16,487,800	3,650
1968	10,718,236	19,269,400	3,590
1969	10,146,894	18,276,400	3,600
1970	8,239,257	14,475,200	3,500
1971	10,637,738	17,482,900	3,280
1972	11,270,745	18,216,800	3,230
1973	12,682,000	23,252,000	3,670
1974*	11,000,000	19,250,000	3,500

Notes: * Estimated.
* Includes replacement parts. Includes mix of automobiles, buses, trucks and other vehicles.

Sources: Automotive News.
American Iron & Steel Institute.
A. T. Kearney, Inc. Estimates.

Quantity and Cost of Purchased Fuels Used for Heat and Power by Industry Group and Industry: 1971

Code	Industry group and industry	Kilowatt hours equivalent (billions) Col. A	Total cost (million dollars) Col. B	Fuel oil: Total: Quantity (1,000 barrels) Col. C	Fuel oil: Total: Cost (million dollars) Col. D	Fuel oil: Distillate: Quantity (1,000 barrels) Col. E	Fuel oil: Distillate: Cost (million dollars) Col. F	Fuel oil: Residual: Quantity (1,000 barrels) Col. G	Fuel oil: Residual: Cost (million dollars) Col. H	Bituminous coal, lignite and anthracite: Quantity (1,000 short tons) Col. I	Bituminous coal, lignite and anthracite: Cost (million dollars) Col. J	Coke and breeze: Quantity (1,000 short tons) Col. K	Coke and breeze: Cost (million dollars) Col. L	Natural gas: Quantity (billion cu. ft.) Col. M	Natural gas: Cost (million dollars) Col. N	Other fuels (million dollars) Col. O	Fuels not specified by kind (million dollars) Col. P
371	Motor vehicles and equipment	57.1	119.0	3,137.6	13.4	1,685.2	7.6	1,452.4	5.8	2,182.1	29.1	(S)	3.2	96.0	56.4	12.4	4.5
3711	Motor vehicles	26.3	57.2	1,552.1	6.7	790.3	3.7	761.8	3.0	1,060.2	14.0	(S)	.5	44.9	26.7	9.2	0.1
3712	Passenger car bodies																
3713	Truck and bus bodies	2.3	3.9	224.9	.9	63.9	.3	161.0	.6	.5	(Z)	-	-	4.0	1.8	.1	1.1
3714	Motor vehicle parts and accessories	27.8	56.5	1,338.8	5.7	820.4	3.6	518.4	2.1	1,104.4	14.9	(S)	2.7	45.7	27.2	3.0	2.9
3715	Truck trailers	.8	1.4	21.8	.1	10.6	(Z)	11.2	.1	17.1	.2	-	-	1.4	.8	.1	.4

Fuels and Electric Energy Used for Heat and Power by Industry Group: 1971

Code	Major industry group and industry	Purchased fuels and electric energy: Kilowatt hours equivalent[1] (billions)	Purchased fuels and electric energy: Total cost (million dollars)	Total cost of purchased fuels (million dollars)	Electric energy: Purchased: Quantity (billion kw.-hrs.)	Electric energy: Purchased: Cost (million dollars)	Electric energy: Generated less sold (billion kw.-hrs.)
371	[illegible]	72.[illegible]	305.[illegible]	119.0	15.8	186.1	(S)

Note: Detailed figures may not add to totals due to independent rounding.

- Represents zero. (S) Withheld because the estimate did not meet publication standards, either on the basis of the associated standard error of the estimate or on the basis of a consistency review. (Z) Less than 50 million kw.-hrs. (NA) Not available.

[1]Represents the kilowatt-hours equivalent of all fuels used for heat and power plus the quantity of purchased electricity.

Source: 1972 Census of Manufactures
Fuels and Electric Energy Consumed

EXHIBIT III-4

FEDERAL ENERGY OFFICE

ENERGY CONSUMPTION - MOTOR VEHICLE PRODUCTION
SIC-371

Type Of Energy	Unit Of Measure	1967		1971		1973		1974 (Projected)	
		Quantity	Cost (Millions)	Quantity	Cost (Millions)	Quantity	Cost (Millions)	Quantity	Cost (Millions)
Fuel Oil	1,000 Barrels	2,423.5	$ 7.0	3,137.6	$ 13.4	4,427.1	$ 19.4	4,114.3	$ 34.9
Coal	1,000 Tons	2,777.3	23.3	2,182.1	29.1	2,313.8	42.3	2,195.6	47.8
Coke	1,000 Tons	57.4	2.1	68.0	3.2	(NA)	(NA)	(NA)	(NA)
Natural Gas	Billion CF.	74.3	38.5	96.0	56.4	106.7	70.1	95.6	73.6
Other Fuels	Not Specified	-	22.7	-	16.9	(X)	(X)	(X)	(X)
Total Fuels	Billion KWH Equivalent	55.2	93.6	57.1	119.0	67.7	172.8	61.0	201.4
Electric Power	Billion KWH	13.0	130.6	15.8	186.1	18.1	235.1	16.4	245.3
Total Energy	Billion KWH	68.2	224.2	72.9	305.1	85.8	407.9	77.4	446.7
Cost per KWH Equivalent	Dollars	-	$0.0033	-	$0.0042	-	$0.0048	-	$0.0058
Motor Vehicle Production	Million Units	8.98	-	10.64	-	12.68	-	11.00	-
Average Per Motor Vehicle	KWH Equivalent	7,595	$24.97	6,852	$28.67	6,800	$32.17	7,000	$40.61
Average Weight Steel Per Motor Vehicle	Pounds	3,650		3,280	-	3,670	-	3,500	-

Source: 1972 Census of Manufactures, Special Report "Fuels and Electrical Energy Consumed." A. T. Kearney, Inc.

EXHIBIT III-5

FEDERAL ENERGY OFFICE

SUMMARY OF ENERGY REQUIREMENTS BY PROCESS OF MANUFACTURE
PER TON OF PRODUCT

Product	Energy Form: Coal-Pounds	Coke-Pounds	Fuel Oil-Gallons (Alternate for Gas)	Natural Gas-CF	Propane-Gallons	Electric Power-KWH	KWH Equivalent	Weight Per Average Vehicle -Pounds	KWH Equivalent Per Average Vehicle
Iron Castings									
Cupola Melting	-	440	(8)	2,125	-	280	2,595	750	900
Electric Melting	-	-	-	340	-	1,130	1,235		
Aluminum Castings									
Fuel Melting	-	-	(24)	3,600	-	60	1,150	75	40
Electric Melting	-	-	-	345		895	1,000		
Zinc Die Castings	-	-	-	1,650	-	60	560	60	20
Steel Forgings	-	-	(25)	3,500	-	1,000	2,060	200	200
Heat Treated Steel									
Quench and Temper	-	-	(15)	2,100	-	50	685	400	160
Carborizing	-	-	(22)	3,000	-	50	960		
Induction Hardening	-	-	-		-	40	40		
Annealing	-	-	(15)	2,000	-	50	650		
Painting	-	-	-	5,000	-	75	1,545	2,800	2,160
Electroplating	-	-	-	500	-	275	425	100	20
Welding	-	-	-	-	-	200	200	1,000	100
Machining	-	-	-	-	-	190	190	1,100	100
Stamping	-	-	-	-	-	50	50	1,000	25
Press Forming	-	-	-	-	-	250	250	1,500	190
Assembly	-	-	-	-	-	100	100	4,000	200
									4,115

Source: A. T. Kearney, Inc. calculations
See Appendix D for details

EXHIBIT III-6

FEDERAL ENERGY OFFICE

ENERGY CONSUMED IN VEHICLE PRODUCTS SIC-371

SIC	Product	Total Production (Million Dollars)	Total Energy Consumed (Million KWH)	Shipments To Auto Industry Percent	Energy Used In Other Industries Or Auto Industry (Million KWH)
3011	Tires	3,133.5	20,483.8	50.0	10,242
3691	Batteries	579.4	1,983.1	16.5	327
3694	Ignition Systems	1,220.2	N.A.	35.0	N.A.
3621	Electric Motors	2,319.0	4,459.1	6.3	280
3211	Glass	810.9	15,647.3	40.0	6,259
3079	Plastics	5,789.0	22,157.8	10.0	2,216
2851	Paints	2,703.8	5,645	7.0	395
2396	Fabrics	797.4	14,900	64.0	9,536
3069	Fabricated Rubber Products	2,927.6	17,464.8	15.0	2,620
3323	Iron and Steel Castings	4,367.3	45,769.7	20.5	9,383
3312	Iron and Steel	19,620.6	272,171.1	19.7	53,600
3361	Aluminum Castings	885.4	6,590.9	40.0	2,636
3369	Zinc Castings	551.3	3,935	37.5	1,476
3391	Steel Forgings	1,550.7	15,527.6	50.0	7,764
3321	Instruments	1,369.4	1,582	10.0	158
3461	Metal Stampings	5,525.2	10,838.2	57.5	6,244
3641	Electric Lamps	2,309.3	3,373.2	20.0	675
3452	Fastners	1,613.1	3,417	14.5	495
3562	Bearings	1,292.2	4,302.0	15.0	645
3651	Radios	3,568.2	N.A.	6.0	N.A.
	Total				114,951

Source: 1967 Census of Manufactures

EXHIBIT III-7

FEDERAL ENERGY OFFICE

METALLIC MATERIALS USED IN VEHICLE PRODUCTION
SIC-371 MOTOR VEHICLES
NET TONS-1967

Item Description	Reported Purchases or Produced By SIC Group	Percent	Reported Shipped By Other SIC Groups	Percent	Total Consumption	Source Of Material Purchased By SIC Group	Sources Of Material Shipped By Other SIC Groups
Steel Products							
Bars and Bar Shapes	1.383,300	55.0	1,137,300	45.0	2,520,600	3312-Steel Mills	3391-Steel Forgings; -Screw Machine Product;
Sheet and Strip	6,614,900	52.8	5,915,300	47.2	12,530,200	3312-Steel Mills	3461-Metal Stampings;
Plates	417,100	100.0	-	-	402,000	3312-Steel Mills	-
Structural Shapes	109,500	86.0	16,100	14.0	125,600	3312-Steel Mills	-
Wire and Wire Products	231,600	100.0	-	-	204,500	-	-
Pipe and Tubing	289,300	40.5	425,900	59.5	174,400		
Other Steel					540,800	3312-Steel Mills	3391-Steel Forgings;
Stainless Steel	45,800					3312-Steel Mills	
Total Steel	9,091,500	55.0	7,494,600	45.0	16,488,100		
Iron and Steel Castings	1,863,400	56.7	1,420,700	43.3	3,283,100	371-Motor Vehicles	3323-Iron and Steel Foundries
Steel Forgings	488,500	50.5	478,800	49.5	967,300	371-Motor Vehicles	3391-Steel Forgings
Aluminum Alloys							
Castings	-	-	214,900	100.0	214,600	-	-Aluminum Foundries
Forgings	-	-	24,100	100.0	23,900	-	-
Wrought Products	143,400	100.0	-	-	143,400	-Aluminum Mills	-
Total Aluminum	143,400	60.0	239,000	40.0	381,900		
Cooper Alloys							
Castings	-	-	8,200	100.0	8,200		-Cooper Foundries
Wrought Products	127,000	78.5	34,500	21.5	161,500		-Cooper Mills
Total Cooper	127,000	75.0	42,700	25.0	169,700		

Source: 1967 Census of Manufactures

EXHIBIT III-8

IV - MOTOR VEHICLE AND PASSENGER CAR BODIES (SIC 3711 and SIC 3712)

INDUSTRY STRUCTURE

The Motor Vehicles Industry, SIC 3711, and the Passenger Car Bodies Industry, SIC 3712, have been combined in this report into a single group covering the Motor Vehicles and Passenger Car Bodies Industry. The combining of SIC 3711 and SIC 3712 has been necessary in order to conform with the Department of Commerce method of presenting data for this industry. Bureau of the Census data has been in the combined form since the 1967 Census of Manufactures, and because this report has drawn heavily from the 1967 and 1972 Census data, combining SIC 3711 and SIC 3712 was the only feasible way to present the data. Additionally, data collected by the Motor Vehicles Industry is always in the combined form with no separation between body production and vehicle assembly.

The Motor Vehicles and Passenger Car Bodies Industry contains establishments which primarily manufacture and/or assemble complete passenger cars, trucks, buses, motor vehicle chassis, and special purpose motor vehicles. A detailed description of the products included in the Industry is given in Exhibit IV-1.

General statistical data relating to the Industry, as reported by the U.S. Department of Commerce in census reports, is given in Exhibit IV-2, for the years 1967, 1971, 1972 and 1973. The Industry had 340,400 employees in 1972, and a value of shipments of $42,970.1 million with $12,026.4 million of value added. In 1973 there were 380,870 employees, and a value of shipments of $48,827.6 million with $13,655.8 million of value added in a record year for both car and truck production.

Table IV-1 shows the total value of $41,112 million for all shipments of motor vehicles and passenger car bodies in 1972. Of this amount, 99 percent or $40,531 represented shipments from establishments in SIC 3711 and SIC 3712.

Table IV-1

Value of Shipments of Motor Vehicles and Passenger Car Bodies, 1972

	Value of Shipments (Millions)
Motor Vehicles and Passenger Car Bodies Manufactured by All Industries	$ 41,112
Motor Vehicles and Passenger Car Bodies Manufactured by SIC 3711 and SIC 3712	40,531
Other Products and Activities in SIC 3711 and SIC 3712	2,439
Total Value of Shipments in SIC 3711 and SIC 3712	42,970

Source: Preliminary Report of the 1972 Census of Manufactures

The products primary to the Industry can be divided into two major groups. The larger group includes passenger car bodies, passenger car chassis, and final assemblies of all motor vehicles with passenger car chassis, if the chassis is of the company's own manufacture. The remainder of the products primary to the Industry are trucks, truck tractors, truck chassis, buses, fire department vehicles, and combat vehicles. Motor vehicles manufactured with a chassis made by another company are not included but are covered by the Truck and Bus Bodies Industry, SIC 3713, in Section V of this report. Exhibit IV-4 (Table 1a) shows that the portion of the total value of shipments of the Industry in 1973 in the passenger car category was 70 percent, the portion for truck chassis and other motor vehicles on truck chassis was 25 percent, and the remaining 5 percent was shipments of products primary to other industries.

The principal energy consuming processes for both of the major product groups are body assembly, chassis assembly, and final assembly. The total energy use for SIC's 3711 and 3712 in 1973 was 47.2 billion kilowatt-hours equivalents. This was approximately half of the energy used for the Motor Vehicles and Equipment Group, SIC 371. A major use of energy in the Motor Vehicles and Passenger Car Bodies Industry is building heating, lighting and air conditioning which account for 42 percent of the use of fuels and electricity. The remaining energy use is in process related consumption and in new vehicle lubrication and tank prefills. The major energy consuming processes are material handling, welding, painting, baking ovens, and various powered assembly operations. The baking ovens and painting are, by far, the most energy intensive of these operations, consuming 55 percent of the process related energy.

The materials used by the Industry are primarily those items manufactured in the Motor Vehicle Parts and Accessories Industry, SIC 3714, which is included in this report. Other industries which supply the Motor Vehicles and Passenger Car Bodies Industry are the Steel Industry, SIC 3312; the Storage Batteries Industry, SIC 3691; the Metal Stamping Industry, SIC 3461; and the Tires and Inner Tubes Industry, SIC 3011. Also, there are glass, fabric, aluminum and plastic parts used in the Industry which are manufactured by establishments not included in the Motor Vehicle Parts and Accessories Industry.

The four largest companies in the Industry account for over 90 percent of the total value of shipments and the 20 largest companies include over 99 percent of the total shipments. The Industry is highly automated with a high capital investment. The large amount of investment in equipment and tooling requires a high level of sales for an individual company to be competitive, with the result that small companies account for an insignificant portion of the Industry's shipments.

The Industry has been in a slow period since the latter part of 1973 due to the gasoline shortage. There is now a major effort to retool for increased small car production. The truck portion of the Industry has not been affected as much by the current downturn as the passenger car portion. The estimated 1974 production change from 1973 is a 15 percent decrease for passenger cars and a 5 percent decrease in truck production.

One-third of the manufacturing is in the State of Michigan, one-third is concentrated in other states of the North Central Census Region, and the remaining one-third is spread over 13 states roughly as a function of population. There has not been any significant shift to or from any geographic area over the past three years. The present trend to small cars has increased the production of plants making these models, with Ohio and Wisconsin showing the greatest overall increase.

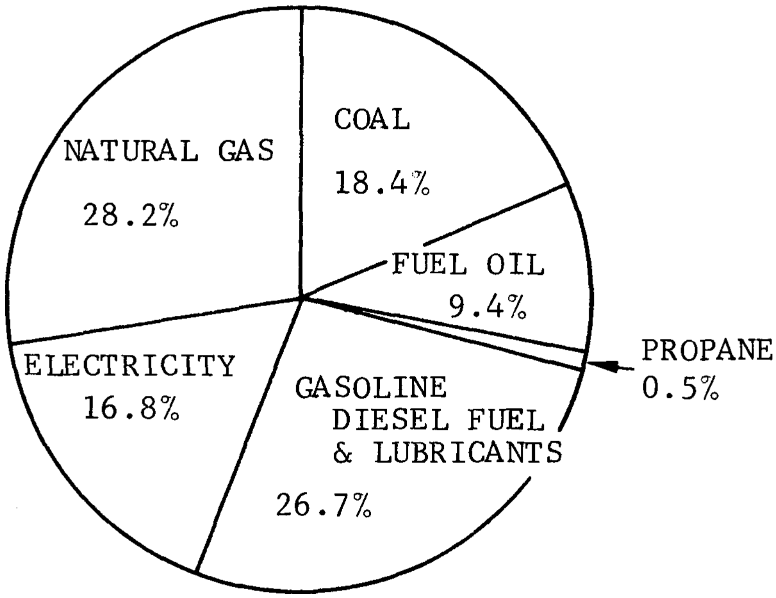
ENERGY USE

The total energy consumption in the Motor Vehicles and Passenger Car Bodies Industry is shown in Exhibit IV-3 for the years 1967, 1971, 1973 and 1974. The 1967 and 1971 statistics were obtained from Bureau of the Census reports, the 1973 statistics were obtained from company data representing over 90 percent of the Industry, and the 1974 usage was based on automobile industry estimates. The energy use for the industry in 1973 was 40.2 billion killowatt-hour-equivalents. This did not include gasoline and diesel fuel for prefilling the tanks of new vehicles or lubricants used in manufacturing and for new vehicles. The total use of gasoline, diesel fuel, and lubricants for new vehicles in 1973 was 7.0 billion kilowatt-hour-equivalents.

The largest source of energy for the Industry was natural gas which provided 28.3 percent of the energy consumed in 1973. Coal provided 18.4 percent of the energy, electricity provided 16.8 percent, and fuel oil accounted for 9.4 percent of the Industry's use of energy. The energy use, by type is shown in Table IV-2 on the following page.

Table IV-2

Energy Used in 1973, By Type
SIC 3711 and SIC 3712 -
Motor Vehicles and Passenger Car Bodies



Total Energy Use, 1973 - 161×10^{12} BTU

Source: A. T. Kearney Estimates.

The 1973 production for the Industry was 19 percent greater than the production in 1971. However, the production related energy usage in 1973 was only 5 percent greater than the 1971 usage. This was because of the decrease in energy required per unit of production with increased production, in the short-run, and also the effect of other factors, to be discussed later, which reduced energy use for the Industry in 1973. Almost half of the energy used in the Industry is for heating, lighting, and air conditioning. When plants are running at less than full capacity the energy required for heat, lighting and air conditioning is not reduced in proportion to the change in the rate of production. This resulted in a decrease in energy used per vehicle during the record production year of 1973. Plants must be kept at 55° F. when not operating, and offices usually continue in operation during shut-downs. General Motors' energy conservation director stated that some northern plants require 50 percent as much energy on weekend days as is used during operating days. Other major factors which reduced the energy requirements per vehicle were the trend toward small car production and measures undertaken to conserve fuels and electrical energy. The increase in small cars decreased the energy required for painting and most other production operations. Since painting and baking ovens require energy on roughly a basis of weight of product, these high energy using operations consume a considerably lesser amount of energy in making smaller cars.

The austerity measures undertaken by the Industry in 1973 were basically administrative rather than engineering changes. Some facilities reported reductions in energy consumption of up to 25 percent. However, most of these energy conservation programs were initiated in the last quarter of 1973 and their overall effect on 1973 consumption was estimated to have represented only a few percentage points of savings in total energy consumption. The combined effect of the increased production in 1973, the greater percent of small car production, and energy conservation measures was determined from actual usage statistics. The trend in energy required per unit of production based on a projected increase in small car production for 1974 of 50 percent, a decrease in total car and truck production from 12.68 million units in 1973 to 11 million units in 1974, and a continued effort to conserve energy gave a total estimated energy use of 36.5 billion killowatt-hour equivalents for the Industry in 1974, excluding petroleum products used in new vehicles for fuel and lubrication.

The Industry used less natural gas in 1973 than 1971 because gas was curtailed for short periods of time in some areas. Coal also decreased in usage relative to units of production, from 1971 to 1973, although more coal was used by the Industry in 1973. The trend to use less coal was the result of environmental protection efforts since high sulfur coal emits more pollutants than other principal fuels or electricity. Fuel oil use in 1973 was increased by more than 60 percent over 1971. Electricity, which is more costly than other sources of energy, increased slightly in usage relative to the total use of energy in the Industry from 1971 to 1973.

The trend in 1974 is expected to change very little from the pattern in 1971 to 1973, with the exception that conversions from coal to other fuels will stop and, where possible, plants will revert back to coal. In the long-run, electricity is expected to become more attractive as its price becomes more competitive relative to other energy sources and as its availability is more assured.

Because of the low cost of energy (less than 1 percent of cost of goods sold for the Motor Vehicles Industry) it was impractical from a cost standpoint for the Motor Vehicles Industry to undertake many energy conserving steps until the gas shortage called their attention to the situation so dramatically. Sales for the Motor Vehicles Industry may have been affected by the rising retail price of gasoline over the past year and because of pessimistic attitudes over the future price. Although the gasoline shortage has not had any significant effect on Industry's ability to manufacture, the shortage has affected their sales more drastically than any other major U.S. industry. The price of gasoline to the consumer increased by 34 percent in the 14 months from December, 1972 to February, 1974. The future price behavior of gasoline and fuel oil will determine the demand for the Industry's products. Also, the size of passenger cars produced will depend on the price and/or availability of gasoline. Therefore, the energy consumed in manufacturing for the Industry is sensitive to a demand which is determined by the availability of petroleum products.

The energy consuming processes and subprocesses for passenger car assembly and truck assembly are essentially the same. They have been grouped into four basic categories in determining the energy used by subprocess. The subprocesses are:

1. Building, heating, lighting and air conditioning.

2. Baking ovens and painting.

3. All manufacturing operations other than baking ovens and painting.

4. Tank prefills and lubrication for new vehicles, fuel for company owned fleets, and lubricants for production equipment.

Washing, drying and baking operations require large amounts of energy. The drying and baking operations usually use natural gas or electricity because of their need for a clean energy source. The wash solution, if heated, may derive its heat from the plant's boiler or, if the plant does not have a central boiler system, from gas or oil. Electricity is used in many of the manufacturing operations such as assembly tools and powering the assembly line. Also, welding is a major user of electrical energy. The major fuel sources for the heating of plants are coal, oil and natural gas. Heating uses 90 percent of the coal, 95 percent of the oil, and 15 percent of the natural gas used in the Industry. Electricity usage for lighting and air conditioning accounted for 40 percent of the Industry's consumption and the remaining 60 percent was used in manufacturing processes. Most of the gasoline, diesel fuel, lubricating oils and greases used in the Industry are for lubricating and prefilling the fuel tanks of new vehicles. Lubricants are required in direct proportion to the number of vehicles produced, but the quantity of gasoline and diesel fuel used to fill the fuel tanks of new vehicles dropped sharply during 1973. The average number of gallons placed in new cars dropped for some companies from 11 to 13 gallons in early 1973 to about 5 gallons in late 1973 because of the difficulty companies in the Industry were facing in obtaining gasoline.

The portion of the total energy use for the Industry in 1973 which was used for each process and subprocess, is given in Exhibits IV-5 through IV-15 (Table set 2a). Building heating, lighting and air conditioning consumed 43 percent of the total energy for the Industry, painting and baking ovens used 27 percent, other manufacturing processes used 16 percent, and the remaining 14 percent was used to fuel and lubricate new vehicles and company owned fleets. Of the total fuels used, 74 percent was for car assembly and 26 percent was for truck assembly. Energy usage is shown by energy type for each process and subprocess in BTU's and kilowatt-hour equivalents in Exhibits IV-16 through IV-37. (Table sets 3a and 4a).

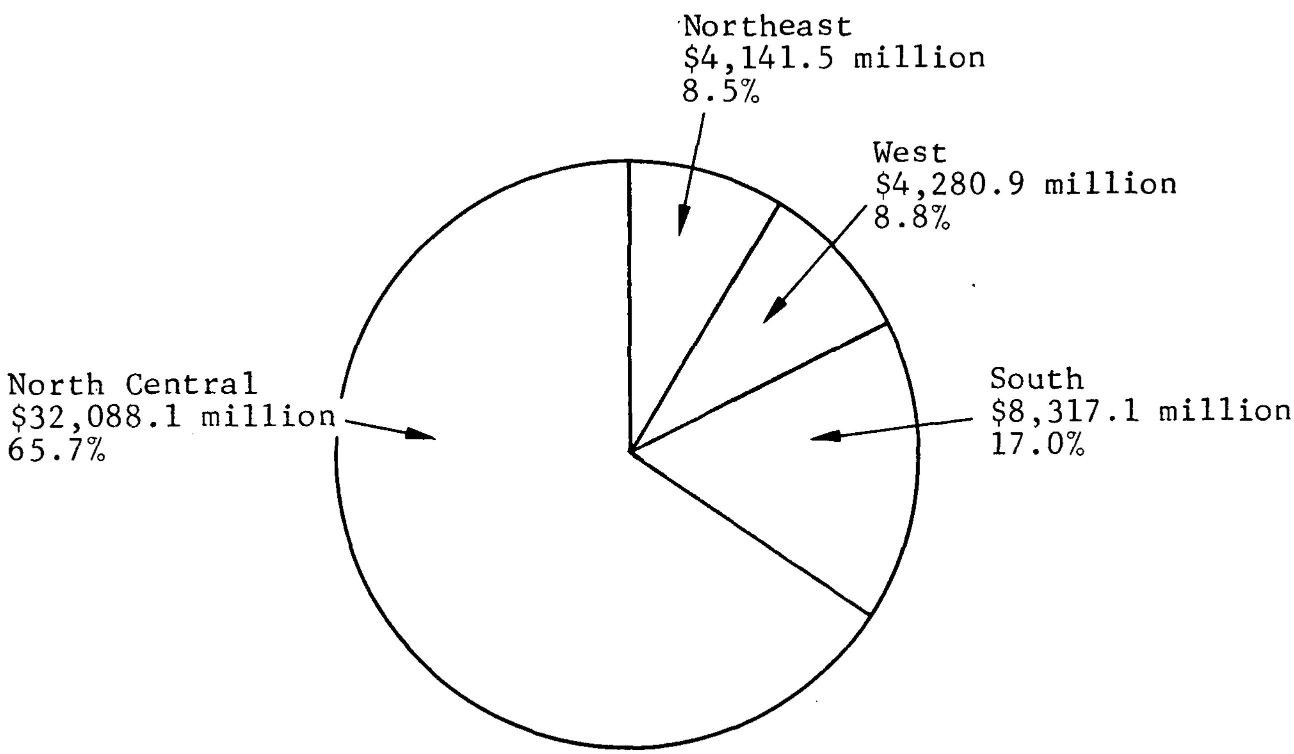
The consumption of fuels, petroleum products and energy by type for 1971, 1973, and 1974 is given in Exhibit IV-38 (Table 5a). The total energy use increased by 10 percent from 1971 to 1973. The estimated 1974 use of energy will be 10 percent less than the 1973 consumption, based on predicted 1974 car and truck production of 11 million units.

The amount of fuel oil and electric energy used per vehicle increased during the period from 1971 to 1973 while the coal and natural gas used per vehicle decreased. This was because of the trend away from the use of high sulfur coal and because of interruptions in the supply of natural gas on interruptable contracts. The total use of natural gas for the Industry in the Detroit and Eastern Michigan Area, which has almost one-third of the total production, declined by 9 percent from 1971 to 1973 due primarily to interruptions in supply in 1973.

The consumption of fuels, petroleum products, and energy is given by type for each state, Census Bureau District, and Census Bureau Region in Exhibits IV-39 and IV-40 (Tables 6a and 7a) for 1971 and 1973, respectively. The data on energy use by state were not obtainable for the majority of the industry and in cases where actual data were available, there were only one or two establishments represented in the geographical unit, and publishing the data would have revealed information of a confidential nature. Therefore, the energy usage by geographic unit was estimated to be a direct function of the value of shipments from the state, district, or region. The value of shipments for each geographic unit are shown in Exhibit IV-41 (Table 8a). In 1973, the North Central Region had 65.7 percent of the total value of shipments for the Industry, the Central Census District produced 54 percent of the Industry's shipments, and Michigan alone had 38 percent of the total shipments. Table IV-4 shows the value of shipments for each of the Census Bureau Regions and their percentage of the total Industry in 1973.

Table IV-4

Value of Shipments by Census Bureau Region, 1973



Total Value of Shipments: $48,827.6 million

Source: Census of Manufactures
A. T. Kearney Estimates

Exhibit IV-41 also shows employment by state, district and region for 1971 and 1973. The total employment for the Industry in 1973 was 380,870, an increase of 12 percent from 1971.

The use of energy by season in 1973 is shown in Exhibit IV-45 (Table 12a) for each energy source. The demand for energy is affected by the cyclical production rate for the industry which typically drops during the summer as the annual model changeover is made. Also, and of particular importance, is the effect of the weather, since building heating is a very large part of the demand for energy. There is only 25 percent as much use of coal in the summer as there is in the winter months. Since natural gas use is 85 percent process related, its usage is more related to the rate of production than any other factor. Electricity is used mainly for lighting, manufacturing processes, and air conditioning. The varying requirements for lighting and air conditioning over the year and the decreased manufacturing activity in the summer tend to offset each other in terms of their electricity consumption and the usage of electricity by the Industry is fairly constant throughout the year. Fuel oil is used primarily as a fuel and consumption of residual is much higher during the colder months since it is used entirely for building heating. Because propane and fuel oil are used as substitutes for natural gas, their usage is also increased when there are interruptions in natural gas service which normally occur only during winter.

The use of gasoline and diesel fuel is normally a direct function of production but in the last quarter of 1973, the gasoline shortage accounted for the use of less gasoline per vehicle produced. Lubricants are used in direct proportion to the number of units produced.

PLANT VARIATIONS

There are very few variations in production methods between establishments within the Industry which significantly affect energy consumption. Motor vehicle assembly plants are among the largest of all manufacturing plants and smaller plants account for a very small amount of total shipments in the Industry. The method of assembling motor vehicles does not vary significantly between companies. More significant is the degree of automation and new plants are generally the most automated. More automated equipment requires a greater use of electrical energy but newer, more automated plants are apt to be more efficient in other energy using areas.

SUPPLY SITUATION

Under the currently prevailing conditions, all energy sources used by the Industry are subject to interruptions and curtailments. The Industry is particularly concerned about natural gas and electricity supplies. Low sulfur coal supplies have recently become short and unreliable and companies are concerned over the potential impact of the shortage of low sulfur coal on electricity suppliers.

Interruptions in the supply of natural gas reduced its use considerably during 1973. Petroleum products, particularly gasoline, have not been available to companies in quantities which they have normally required.

The supply of most fuels is typically assured by annual contracts, although price is not fixed and may be increased by the supplier during the contract period. The days of supply of fuels held by the Industry, by type of fuel, are shown in Exhibit IV-42 (Table 9a) for different periods from December 31, 1971 to March 31, 1974. The supplies held by the Industry vary considerably from establishment to establishment and factors such as strikes and price discounts during the summer affect the Industry's position on desired levels of stocks of fuel. The general trends that can be identified in the stocks of fuel since 1971 are a decrease in coal reserves in the last two years, and an increase in reserves of petroleum products. The shortage of low sulfur coal has caused the decline in stocks of that fuel and many companies use coal directly from railroad cars. The increased liklihood of interruptions in natural gas service has necessitated an increase in reserves of propane and fuel oil to use as substitutes.

As is shown in Exhibit IV-43 (Table 10a), there is no captive energy production within the Industry. Exhibit IV-44 (Table 11a) shows that petroleum products are purchased from either the refineries or from wholesalers with the larger companies purchasing a larger percentage of their petroleum products from refineries than do the smaller companies. Coal is purchased directly from mining companies or through wholesalers. Electricity and natural gas are supplied by the local utility companies.

SUBSTITUTABILITY AND CONSERVATION

Over the past three years, there has been a general trend to change from coal as a heat source to other fuels, particularly natural gas and oil. This was in response to Governmental efforts to reduce the amount of high sulfur coal burned. The present trend due to shortages of other fuels is to burn coal wherever possible. The increasing difficulty in obtaining noninterruptable natural gas in most areas of the country is limiting the increase in use of that fuel. Presently, the uncertainty in the energy situation is causing many establishments to wait for more information regarding the energy sources which will be best for them before making commitments for any major capital expenditure programs involving energy source changes.

Most petroleum product consuming operations could use electric power. In many cases the capital costs for conversion would make the change highly impractical and the cost for electrical energy at the present time is greater than that for coal, gas, and petroleum products. Coal and natural gas, where available, are the most practical substitutes for petroleum products.

New processes are being developed which consume less energy. The high energy requirement for heating makeup air in paint booths is being reduced in many plants by the electro-coating process for prime coat painting, which uses a water base paint that eliminates the venting of paint fumes. Newly developed powder paints will reduce the makeup air now required for acrylic painting on finish coats. The development and use of adhesives in assembly operations will reduce the use of welding which accounts for about 5 percent of the electrical energy now consumed. More automated assembly lines, which will require more electrical energy, will be installed in new plants.

The increasing trend toward smaller cars will result in less energy consumed per unit manufactured. Far more significant than the savings in energy used in manufacturing is the savings in gasoline consumption made possible by producing smaller and lighter cars.

Simple conservation measures are possible and have been used in some plants and offices to reduce the overall energy consumption. An example of the effect of conservation measures is pointed out by General Motors' reported reductions in energy use of 16 percent at their headquarters building in Detroit, and a 25 percent reduction at the General Motors Building in New York City.

Some of the initial efforts in eliminating waste of energy which have been undertaken in the industry are listed below:

1. Fix leaks - air, water, steam, etc.
2. Repair windows, doors, seals, etc.
3. Turn off lights and equipment when not in use.

4. Discontinue display and esthetic lighting - retain only lighting for safety and security.

5. Turn down heating thermostats and turn up air conditioning thermostats.

6. Reduce lighting to the lowest practical level.

There are many other energy conservation practices which part or all of the establishments in the Industry are now using. With the rapidly increasing cost of fuels relative to labor and other materials, it is becoming more important to the Industry to investigate these potential savings. The Industry's sales have been affected so much by the shortage of gasoline that they are particularly alert to energy problems.

In the event of severe reductions in energy sources, the amount of energy reduction which would be possible before the Industry's output would decrease is hard to quantify. It is conceivable that energy consumption could be reduced in a period of severe shortage by 10 to 15 percent through such drastic measures as cutting the heat to a minimum of 60° in the winter and by other severe austerity measures. Any further reduction in energy usage would cause a larger percentage reduction in production than the percentage of savings in energy since the heating, lighting, and certain process related energy usages are fixed and most of the manufacturing processes use energy in direct proportion to the rate of production.

The total capital expenditures planned for 1974 for the Industry decreased slightly as a result of actual and expected shortages of petroleum products, gas and electricity. The increase in investment in facilities for the production of small cars partially offset a reduction for large cars. The total change in 1974 capital expenditures in the entire Motor Vehicles Industry (SIC 371) as a result of the energy situation was a 2 percent decrease from the originally planned expenditures for 1974 of $2.86 billion, according to a recent survey conducted by the U.S. Department of Commerce, Bureau of Economic Analysis.

The investment change in the Motor Vehicles and Passenger Car Bodies Industry can be assumed to be proportional to that for the entire Motor Vehicles Industry.

KEY CONSTRAINTS

The major restraint on the Industry at the present time is the reduction in demand for large automobiles as a result of the increased price of gasoline. The Industry's sales are presently so much lower as a result of the shortage of gasoline that the total consumption of energy in manufacturing has been significantly reduced.

The direct effect of fuel shortages on the Industry's manufacturing activities has been to cause shifts in type of fuels or energy used and to emphasize the need for conservation of energy. In addition to immediate austerity measures, most of the companies have established programs and have increased their staffs to investigate long-range energy policy and possible changes to conserve scarce energy resources. There have been fuel shifts to coal from gas or oil, as mentioned previously, and a trend toward increased use of electricity, where possible. The conversion to electrical power is hampered by a particularly long lead time required for electrical equipment of typically one year. The capital expenditures are not usually economically justifiable unless the equipment must be replaced anyway, or if it is for a new facility.

The main reason for the trend toward use of electricity is its availability in the North Central Region where two-thirds of the industry is located. The feeling in the Industry is that electricity will be the most easily obtained energy source in the long-run because it is obtained from coal and nuclear power in the North Central Region and is not as likely to be subject to curtailments as are petroleum and natural gas.

The Motor Vehicles and Passenger Car Bodies Industry is an assembly industry and depends on the input of products from a large number of other industries. In fact, there are very few segments of the economy which do not supply the automotive industry with materials or parts which ultimately reach the assembly plants. Therefore, if any major supplier is affected by energy shortages to the point where output is reduced, it could have an effect on the output of the Motor Vehicles and Passenger Car Bodies Industry. In this respect, the effect of energy shortages is very critical, because if the output of the Industry is restricted due to the unavailability of energy in another industry, the input of all other industries supplying this Motor Vehicles and Passenger Car Bodies Industry would be reduced proportionately. Of course, there are substitute goods which could be developed in time if energy shortages were to restrict production in one particular industry, but the time to develop and tool-up could have a highly detrimental effect on the economy if the reduction in production had not been anticipated. Also, some materials used in the Industry, such as steel, do not have satisfactory substitutes.

There is no indication at the present time that the Industry will have any shortfalls in supply of energy sources to the extent that production will be affected. The mandatory petroleum allocation regulations have not affected the Industry's ability to meet the demand for its products and there is no indication that the regulations will constrain production in the future.

However, there is a possibility that there may be curtailments of natural gas supplies to automobile assembly plants next winter (1974-5) severe enough to force production cutbacks if they cannot obtain sufficient quantities of substitute fuels, specifically propane and fuel oil. Also, there might be a strike in the coal mining industry which could result in a cutback of electric power as well as coal and coke, which might cause restrictions on production.

FEDERAL ENERGY OFFICE

DESCRIPTION OF INDUSTRY COVERAGE

SIC 3711 AND SIC 3712 - MOTOR VEHICLES AND PASSENGER CAR BODIES

Establishments primarily engaged in manufacturing or assembling complete passenger automobiles, trucks, commercial cars and buses (except trackless trolleys--Industry 3743) and special purpose motor vehicles. This industry also includes establishments primarily engaged in manufacturing chassis or passenger car bodies. Such establishments may also manufacture motor vehicle parts, but establishments primarily engaged in manufacturing motor vehicle parts except chassis and passenger bodies are classified in Industry 3714. Establishments primarily engaged in manufacturing truck and bus bodies and assembling them on purchased chassis are classified in Industry 3713; motorcycles in Industry 3751; wheel tractors, except contractors' off-highway types, in Industry 3523; tracklaying and contractors' off-highway tractors in Industry 3531; combat tanks in Industry 3795; and stamped body parts for passenger cars in Industry 3465.

- Ambulances (motor vehicles)
- Amphibian motor vehicles
- Assembling complete automobiles, trucks, commercial cars, and buses
- Automobiles
- Bodies, passenger automobile
- Brooms, powered (motor vehicles)
- Cars, armored
- Chassis, motor vehicle
- Fire Department vehicles (motor vehicles)
- Flushers, street (motor vehicles)
- Hearses (motor vehicles)
- Mobile buses, except trackless trolley

- Motor trucks, except off-highway
- Motor vehicles, including amphibian
- Patrol wagons (motor vehicles)
- Personnel carriers (motor vehicles)
- Reconnaissance cars
- Road oilers (motor vehicles)
- Scout cars (motor vehicles)
- Snowplows (motor vehicles)
- Station wagons (motor vehicles)
- Street sprinklers and sweepers (motor vehicles)
- Taxicabs
- Tractors, truck: for highway use
- Universal carriers, military

FEDERAL ENERGY OFFICE

INDUSTRY STATISTICS
SIC 3711 AND SIC 3712 - MOTOR VEHICLES
AND PASSENGER CAR BODIES
(All Dollars Are in Millions)

Year	1967	1971	1972	1973
Car and Truck Production (Millions)	9.0	10.6	11.3	12.7
Number of Establishments	181	N.A.	231	N.A.
Number of Employees	321,200	340,800	340,400	380,870
Cost of Labor	$ 2,699.9	$ 3,893.8	$ 4,314.7	$ 4,798.9
Value Added	$ 7,353.6	$11,679.7	$12,026.4	$13,655.8
Cost of Materials	$19,964.7	$28,526.1	$30,991.9	$35,161.8
Value of Shipments	$27,296.0	$40,306.5	$42,970.1	$48,827.6
Capital Expenditures	$ 263.2	$ 315.5	$ (s)	N.A.
Gross Value of Fixed Assets	N.A.	$ 4,995.4	N.A.	N.A.

Notes: N.A. - not available.
(s) Withheld because the estimate did not meet publication standards.

Source: 1967 data - 1967 Census of Manufactures.
1971 data - 1970-1971 Annual Survey of Manufactures (A.S.M.).
1972 data - Preliminary Report of the 1972 Census of Manufactures.
1973 data - Estimated, based on production statistics.

Note: 1973 estimates were based on proportionate projections from prior years, adjusted for inflationary factor.

EXHIBIT IV-2

FEDERAL ENERGY OFFICE

ENERGY CONSUMPTION

SIC 3711 AND SIC 3712 - MOTOR VEHICLES AND PASSENGER CAR BODIES

Type of Energy	Unit of Measure	1967	1971	1973*	1974*
Fuel Oil	1,000 Barrels	1,406.7	1,552.1	2,499.2	2,324.3
Coal	1,000 Short Tons	1,492.1	1,060.2	1,131.7	1,052.5
Coke	1,000 Short Tons	(D)	(S)	NA	NA
Natural Gas	Billion C.F.	37.0	44.9	44.0	40.9
Gasoline and Diesel Fuel	1,000 Barrels	NA	NA	3,621.4	2,829.2
Other Fuels	1,000 Barrels	(D)	NA	209.4	194.7
Total Fuels	Billion KWH Equivalents	28.0	26.3	32.3	29.2
Electric Power	Billion KWH	5.7	6.9*	7.9	7.3
Non-Fuel Petroleum Products	Billion KWH Equivalents	NA	NA	7.0	6.1
Total Energy	Billion KWH Equivalents	33.7	26.3	47.2	42.6
Car and Truck Production	Millions	8.98	10.64	12.68	11.00

(D) Withheld to avoid disclosing figures for individual companies.
(S) Estimate did not meet publication standards.
(NA) Not available.

* Kearney estimates based on unit rates from prior years adjusted for changes in availability of fuel oil and natural gas.

Note: Totals are not comparable from 1967 and 1971 to 1973 and 1974. It appears that some portion of petroleum products were not included in the 1967 and 1971 census data, possibly the gasoline and lubricants used in new vehicles.

Sources: 1967 statistics are from the 1967 Census of Manufactures.
1971 statistics are from the Fuels and Electrical Energy Consumed Special Report of the 1972 Census of Manufactures.
1973 energy use was estimated based on Industry data with 90% of the Industry reporting their usage.
1974 energy use was estimated based on Industry forecasts.

EXHIBIT IV-3

FEDERAL ENERGY OFFICE

PROPORTION OF INDUSTRY OUTPUT ACCOUNTED FOR BY EACH MAJOR PROCESS, 1973

SIC 3711 and 3712 Industry Motor Vehicles and Passenger Car Bodies

Process and Major Products	Percent of 1973 Shipments Value	Percent of 1973 Production Volume (Units)
Assembly - Body, Chassis and Final		
- Passenger Cars (including all vehicles with a passenger car chassis)	70% ($34,179.3 million)	10,335,300
- Truck Tractors, Truck Chassis, Trucks, Buses (except trolley buses), Fire Department Vehicles and Combat Vehicles. (Chassis of own manufacture)	25% ($12,206.9 million)	2,935,700
- Products primary to other Industries.	5% ($2,441.4 million)	Not Applicable
Total Industry (Percent) (Actual)	100.0 $48,827.6 Million	

Source: Production volume is based on Department of Commerce, Bureau of the Census, 1972 volume statistics adjusted to reflect a 9.51% increase in passenger car production in 1973 and a 21.69% increase in truck production as reported by Automotive News, 1974 Almanac Issue. Shipment values were based on 1972 dollars per unit from the preliminary Report of the 1972 Census of Manufactures, adjusted to reflect the increase in production and an increase in price level of .8% over 1972.

EXHIBIT IV-4 (Table 1a)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess Building Heating, Lighting and Air Conditioning

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures	1,000 barrels	74.7			74.7	62.8			62.8
2	Middle distillates	1,000 barrels	532.8			532.8	850.4			850.4
3	Residual fuel oil	1,000 barrels	555.7			555.7	895.2			895.2
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total	1,000 Barrels	1,163.2			1163.2	1808.4			1,808.4
7	Coal	1,000 s.tns.	705.1			705.1	753.4			753.4
8	Natural gas	billion cu. ft.	4.9			4.9	4.9			4.9
9	Fuels, n.e.c., total									

EXHIBIT IV-5
(Table 2a/1a)

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	million KWH	2.1			2.1	2.4			2.4
12	GRAND TOTAL									

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess Baking Ovens and Painting

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	75.0			75.0	83.8			83.8
2	Middle distillates	1,000 barrels	51.5			51.5	101.3			101.3
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total	1,000 barrels	126.5			126.5	185.1			185.1
7	Coal									
8	Natural gas	billion cu. ft.	22.7			22.7	22.2			22.2
9	Fuels, n.e.c., total									

EXHIBIT IV-6
(Table 2a/1b)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	million KWH	.9			.9	1.1			1.1
12	GRAND TOTAL									

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess All Manufacturing Operations Except Painting and Baking Ovens

			1971				1973			
	Type of Energy or Material	**Unit of Measure**	**Heat and Power**	**Material**	**Other**	**Total**	**Heat and Power**	**Material**	**Other**	**Total**
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total									
7	Coal	1,000 s. tns.	80.3			80.3	84.3			84.3
8	Natural gas	billion cu. ft.	5.6			5.6	5.5			5.5
9	Fuels, n.e.c., total									

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	million KWH	2.1			2.1	2.5			2.5
12	GRAND TOTAL									

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess Petroleum Products Used for Company Owned Fleets, New Vehicle Tank Prefills and Lubrication, and Production Equipment Lubrication

			1971				1973			
	Type of Energy or Material	**Unit of Measure**	**Heat and Power**	**Material**	**Other**	**Total**	**Heat and Power**	**Material**	**Other**	**Total**
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products	1,000 barrels								
	Gasoline	"	2,583.7			2583.7	2,632.3			2,632.3
	Diesel Fuel	"	40.0			40.0	47.6			47.6
	Lubricants	"			2,446.9	2446.9			2,916.0	2,916.0
6	Petroleum products total	1,000 barrels	2,623.7		2,446.9	5070.6	2,679.9		2,916.0	5,595.9
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									

EXHIBIT IV-8
(Table 2a/1d)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL	1,000 barrels	2,623.7		2,446.9	5070.6	2,679.9		2,916.0	5,595.9

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess All subprocesses

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures	1,000 barrels	145.7			145.7	146.6			146.6
2	Middle distillates	1,000 barrels	584.3			584.3	951.7			951.7
3	Residual fuel oil	1,000 barrels	555.7			555.7	895.2			895.2
4	Chemical feedstocks									
5	Other petroleum products	1,000 barrels								
	Gasoline	"	2,583.7			2583.7	2,632.3			2,632.3
	Diesel Fuel	"	40.0			40.0	47.6			47.6
	Lubricants	"			2,446.9	2446.9			2,916.0	2,916.0
6	Petroleum products total	1,000 barrels	3,909.4		2,446.9	6356.3	4,673.4		2,916.0	7,589.4
7	Coal	1,000 s. tns.	785.1			785.1	837.7			837.7
8	Natural gas	billion cu. ft.	33.2			333.2	32.6			32.6
9	Fuels, n.e.c., total									

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	million KWH	2,628.8			2628.8	2,685.9			2,685.9
12	GRAND TOTAL									

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY TYPE AND MAJOR PROCESS AND SUBPROCESS IN 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess Building Heating, Lighting and Air Conditioning

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures	1,000 barrels	24.9			24.9	20.9			20.9
2	Middle distillates	1,000 barrels	188.8			188.8	302.8			302.8
3	Residual fuel oil	1,000 barrels	206.1			206.1	320.6			320.6
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total	1,000 barrels	419.8			419.8	644.3			644.3
7	Coal	1,000 s. tns.	248.1			248.1	264.1			264.1
8	Natural gas	billion cu. ft.	1.7			1.7	1.7			1.7
9	Fuels, n.e.c., total									

EXHIBIT IV-10
(Table 2a/2a)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	million KWH	.7		.7	.8				.8
12	GRAND TOTAL									

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess Baking Ovens and Painting

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	24.9			24.9	41.9			41.9
2	Middle distillates	1,000 barrels	17.2			17.2	28.9			28.9
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total	1,000 barrels	42.1			42.1	70.8			70.8
7	Coal									
8	Natural gas	billion cu. ft.	8.0			8.0	7.8			7.8
9	Fuels, n.e.c., total									

EXHIBIT IV-11
(Table 2a/2b)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	million KWH	.3			.3	.3			.3
12	GRAND TOTAL									

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess All Manufacturing Operations Except Painting and Baking Ovens

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total									
7	Coal	1,000 s. tns.	26.7			26.7	29.9			29.9
8	Natural gas	billion cu. ft.	2.0			2.0	1.9			1.9
9	Fuels, n.e.c., total									

EXHIBIT IV-12
(Table 2a/2c)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	million KWH	.8			.8	.8			.8
12	GRAND TOTAL									

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess Petroleum Products Used For Company Owned Fleets, New Vehicle Tank Prefills And Lubrication, and Production Equipment Lubrication.

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products	1,000 barrels								
	Gasoline	"	907.8			907.8	924.8			924.8
	Diesel Fuel	"	14.0			14.0	16.7			16.7
	Lubricants	"			859.7	859.7			1,024.5	1,024.5
6	Petroleum products total	1,000 barrels	921.8		859.7	1,781.5	941.5		1,024.5	1,966.0
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									

EXHIBIT IV-13
(Table 2a/2d)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL	1,000 barrels	921.8		859.7	1,781.5	941.5		1024.5	1,966.0

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess All subprocesses

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures	1,000 barrels	49.8			49.8	62.8			62.8
2	Middle distillates	1,000 barrels	206.0			206.0	331.7			331.7
3	Residual fuel oil	1,000 barrels	206.1			206.1	320.6			320.6
4	Chemical feedstocks									
5	Other petroleum products	1,000 barrels								
	Gasoline	"	907.8			907.8	924.8			924.8
	Diesel Fuel	"	14.0			14.0	16.7			16.7
	Lubricants	"			859.7	859.7			813.4	813.4
6	Petroleum products total	1,000 barrels	1,383.7		859.7	2,243.4	1,656.6		813.4	2,470.0
7	Coal	1,000 s. tns.	274.8			274.8	294.0			294.0
8	Natural gas	billion cu. ft.	11.7			11.7	11.4			11.4
9	Fuels, n.e.c., total									

EXHIBIT IV-14
(Table 2a/2)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	million KWH	1.8			1.8	1.9			1.9
12	GRAND TOTAL									

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process All processes

Subprocess

			1971				1973			
	Type of Energy or Material	**Unit of Measure**	**Heat and Power**	**Material**	**Other**	**Total**	**Heat and Power**	**Material**	**Other**	**Total**
1	Propane, butane and mixtures	1,000 barrels	195.5			195.5	209.4			209.4
2	Middle distillates	1,000 barrels	790.3			790.3	1,283.4			1,283.4
3	Residual fuel oil	1,000 barrels	761.8			761.8	1,215.8			1,215.8
4	Chemical feedstocks									
5	Other petroleum products	1,000 barrels								
	Gasoline	"	3,491.5			3,491.5	3,557.1			3,557.1
	Diesel Fuel	"	54.0				64.3			64.3
	Lubricants	"			3,306.6	3,306.6			3,940.5	3,940.5
6	Petroleum products total	1,000 s. tns.	5,293.1		3,306.6	8,599.7	6,330.0		3,940.5	10,270.5
7	Coal	1,000 s. tns.	1,059.9			1,059.9	1,131.7			1,131.7
8	Natural gas	billion cu. ft.	44.9			44.9	44.0			44.0
9	Fuels, n.e.c., total									

EXHIBIT IV-15
(Table 2a)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	million KWH	2,630.6			2,630.6	2,687.8			2,687.8
12	GRAND TOTAL									

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess Building Heating, Lighting, and Air Conditioning

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		300			300	300			300
2	Middle distillates		3,100			3,100	4,900			4,900
3	Residual fuel oil		3,500			3,500	5,600			5,600
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		6,900			6,900	10,800			10,800
7	Coal		18,500			18,500	19,700			19,700
8	Natural gas		5,100			5,100	5,000			5,000
9	Fuels, n.e.c., total									

EXHIBIT IV-16
(Table 3a/1a)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		23,600			23,600	24,700			24,700
11	Electrical energy (Purchased only)		7,000			7,000	7,900			7,900
12	GRAND TOTAL		37,500			37,500	43,400			43,400

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess Baking Ovens and Painting

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		300			300	300			300
2	Middle distillates		300			300	600			600
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		600			600	900			900
7	Coal									
8	Natural gas		23,300			23,300	22,800			22,800
9	Fuels, n.e.c., total									

EXHIBIT IV-17
(Table 3a/1b)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		23,300			23,300	22,800			22,800
11	Electrical energy (Purchased only)		3,100			3,100	3,600			3,600
12	GRAND TOTAL		27,000			27,000	27,300			27,300

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess All Manufacturing Operations Except Painting and Baking Ovens

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total									
7	Coal		2,100			2,100	2,300			2,300
8	Natural gas		5,800			5,800	5,700			5,700
9	Fuels, n.e.c., total									

EXHIBIT IV-18
(Table 3a/Ie)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total		7,900			7,900	8,000			8,000
11	Electrical energy (Purchased only)		7,300			7,300	8,400			8,400
12	GRAND TOTAL		15,200			15,200	16,400			16,400

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess Petroleum Products Used for Company Owned Fleets, New Vehicle Tank Prefills and Lubrication, and Production Equipment Lubrication.

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		13,400			13,400	13,800			13,800
	Diesel Fuel		200			200	300			300
	Lubricants				14,800	14,800			17,700	17,700
6	Petroleum products total		13,600		14,800	28,400	14,100		17,700	31,800
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									

EXHIBIT IV-19
(Table 3a/1d)

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		13,600		14,800	28,400	14,100		17,700	31,800

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess All Subprocesses

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		600			600	600			600
2	Middle distillates		3,400			3,400	5,500			5,500
3	Residual fuel oil		3,500			3,500	5,600			5,600
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		13,500			13,500	13,800			13,800
	Diesel Fuel		200			200	300			300
	Lubricants				14,800	14,800			17,700	17,700
6	Petroleum products total		21,200		14,800	36,000	25,800		17,700	43,500
7	Coal		20,600			20,600	22,000			22,000
8	Natural gas		34,200			34,200	33,500			33,500
9	Fuels, n.e.c., total									

EXHIBIT IV-20
(Table 3a/1)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		54,800			54,800	55,500			55,500
11	Electrical energy (Purchased only)		17,400			17,400	19,900			19,900
12	GRAND TOTAL		93,400		14,800	108,200	101,200		17,700	118,900

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess Building Heating, Lighting, and Air Conditioning

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		100			100	100			100
2	Middle distillates		1,100			1,100	1,800			1,800
3	Residual fuel oil		1,300			1,300	2,000			2,000
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		2,500			2,500	3,900			3,900
7	Coal		6,500			6,500	6,900			6,900
8	Natural gas		1,800			1,800	1,800			1,800
9	Fuels, n.e.c., total									

EXHIBIT IV-21
(Table 3a/2a)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		8,300			8,300	8,700			8,700
11	Electrical energy (Purchased only)		2,400			2,400	2,900			2,900
12	GRAND TOTAL		13,200			13,200	15,500			15,500

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess Baking Ovens and Painting

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		100			100	100			100
2	Middle distillates		100			100	200			200
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		200			200	300			300
7	Coal									
8	Natural gas		8,200			8,200	8,100			8,100
9	Fuels, n.e.c., total									

EXHIBIT IV-22
(Table 3a/2a)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total		8,200			8,200	8,100			8,100
11	Electrical energy (Purchased only)		1,100			1,100	1,300			1,300
12	GRAND TOTAL		9,500			9,500	9,700			9,700

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess All Manufacturing Operations Excluding Painting and Baking Ovens

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total									
7	Coal		700			700	800			800
8	Natural gas		2,100			2,100	2,000			2,000
9	Fuels, n.e.c., total									

EXHIBIT IV-23
(Table 3a/2c)

EXHIBIT IV-23
(Table 3a/2c)

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		2,800			2,800	2,800			2,800
11	Electrical energy (Purchased only)		2,600			2,600	2,900			2,900
12	GRAND TOTAL		5,400			5,400	5,700			5,700

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess Petroleum Products Used for Company Owned Fleets, New Vehicle Tank Prefills and Lubrication, and Production Equipment Lubrication.

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		4,800			4,800	4,900			4,900
	Diesel Fuel		100			100	100			100
	Lubricants				5,200	5,200			6,200	6,200
6	Petroleum products total		4,900		5,200	10,100	5,000		6,200	11,200
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									

EXHIBIT IV-24
(Table 3a/2d)
Page 1 of 2

EXHIBIT IV-24
(Table 3a/2d)

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		4,900		5,200	10,100	5,000		6,200	11,200

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess All Subprocesses

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		200			200	200			200
2	Middle distillates		1,200			1,200	2,000			2,000
3	Residual fuel oil		1,300			1,300	2,000			2,000
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		4,800			4,800	4,900			4,900
	Diesel Fuel		100			100	100			100
	Lubricants				5,200	5,200			6,200	6,200
6	Petroleum products total		7,600		5,200	12,800	9,200		6,200	15,400
7	Coal		7,200			7,200	7,700			7,700
8	Natural gas		12,100			12,100	11,900			11,900
9	Fuels, n.e.c., total									

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		19,300			19,300	19,600			19,600
11	Electrical energy (Purchased only)		6,100			6,100	7,100			7,100
12	GRAND TOTAL		33,000		5,200	38,200	35,900		6,200	42,100

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process All Processes

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		800			800	800			800
2	Middle distillates		4,600			4,600	7,500			7,500
3	Residual fuel oil		4,800			4,800	7,600			7,600
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		18,300			18,300	18,700			18,700
	Diesel Fuel		300			300	400			400
	Lubricants				20,000	20,000			23,900	23,900
6	Petroleum products total		28,800		20,000	48,800	35,000		23,900	58,900
7	Coal		27,800			27,800	29,700			29,700
8	Natural gas		46,300			46,300	45,400			45,400
9	Fuels, n.e.c., total									

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		74,100			74,100	75,100			75,100
11	Electrical energy (Purchased only)		23,500			23,500	27,000			27,000
12	GRAND TOTAL		126,400		20,000	146,400	137,100		23,900	161,000

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess Building Heating, Lighting and Air Conditioning

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		87.9			87.9	73.8			73.8
2	Middle distillates		908.3			908.3	1,452.1			1,452.1
3	Residual fuel oil		1,025.5			1,025.5	1,648.9			1,648.9
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		2,021.7			2,021.7	3,174.8			3,174.8
7	Coal		5,420.5			5,420.5	5,783.5			5,783.5
8	Natural gas		1,494.3			1,494.3	1,476.7			1,476.7
9	Fuels, n.e.c., total									

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total		6,914.8			6,914.8	7,260.2			7,260.2
11	Electrical energy (Purchased only)		2,051.0			2,051.0	2,338.1			2,338.1
12	GRAND TOTAL		10,987.5			10,987.5	12,773.1			12,773.1

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess Baking Ovens and Painting

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		87.9			87.9	98.4			98.4
2	Middle distillates		87.9			87.9	172.3			172.3
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		175.8			175.8	270.7			270.7
7	Coal									
8	Natural gas		6,826.8			6,826.8	6,694.2			6,694.2
9	Fuels, n.e.c., total									

EXHIBIT IV-28
(Table 4a/1b)
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	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total		6,826.8			6,826.8	6,694.2			6,694.2
11	Electrical energy (Purchased only)		908.3			908.3	1,058.3			1,058.3
12	GRAND TOTAL		7,910.9			7,910.9	8,023.2			8,023.2

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess All Manufacturing Operations Except Painting and Baking Ovens

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total									
7	Coal		615.3			615.3	689.1			689.1
8	Natural gas		1,699.4			1,699.4	1,673.6			1,673.6
9	Fuels, n.e.c., total									

EXHIBIT IV-29
(Table 4a/1c)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total		2,314.7			2,314.7	2,362.7			2,362.7
11	Electrical energy (Purchased only)		2,138.9			2,138.9	2,461.1			2,461.1
12	GRAND TOTAL		4,453.6			4,453.6	4,823.8			4,823.8

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess Petroleum Products Used for Company Owned Fleets, New Vehicle Tank Prefills and Lubrication, and Production Equipment Lubrication

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		3,926.2			3,926.2	4,043.4			4,043.4
	Diesel Fuel		58.6			58.6	87.9			87.9
	Lubricants				4,336.4	4,336.4			5,186.1	5,186.1
6	Petroleum products total		3,984.8		4,336.4	8,321.2	4,131.3		5,186.1	9,317.4
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									

EXHIBIT IV-30
(Table 4a/1d)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		3,984.8		4,336.4	8,321.2	4,131.3		5,186.1	9,317.4

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Passenger Car Assembly - Chassis, Body and Final

Subprocess All subprocesses

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		175.8			175.8	172.2			172.2
2	Middle distillates		996.2			996.2	1,624.4			1,624.4
3	Residual fuel oil		1,025.5			1,025.5	1,648.9			1,648.9
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		3,926.2			3,926.2	4,043.4			4,043.4
	Diesel Fuel		58.6			58.6	87.9			87.9
	Lubricants				4,336.4	4,336.4			5,186.1	5,186.1
6	Petroleum products total		6,182.3		4,336.4	10,518.7	7,404.6		5,186.1	12,590.7
7	Coal		6,035.8			6,035.8	6,472.6			6,472.6
8	Natural gas		10,020.5			10,020.5	9,844.5			9,844.5
9	Fuels, n.e.c., total									

EXHIBIT IV-31
(Table 4a/1)

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total		16,056.3			16056.3	16,317.1			16,317.1
11	Electrical energy (Purchased only)		5,098.2			5,098.2	5,857.5			5,857.5
12	GRAND TOTAL		27,336.8		4,336.4	31,673.2	29,751.4		5,186.1	34,937.5

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess Building Heating, Lighting and Air Conditioning

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		29.3			29.3	24.6			24.6
2	Middle distillates		322.3			322.3	516.8			516.8
3	Residual fuel oil		380.9			380.9	590.7			590.7
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		732.5			732.5	1,132.1			1,132.1
7	Coal		1,904.5			1,904.5	2,042.7			2,042.7
8	Natural gas		527.4			527.4	516.8			516.8
9	Fuels, n.e.c., total									

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total		2,431.9			2,431.9	2,559.5			2,559.5
11	Electrical energy (Purchased only)		703.2			703.2	836.8			836.8
12	GRAND TOTAL		3,867.6			3,867.6	4,528.4			4,528.4

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess Baking Ovens and Painting

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		29.3			29.3	49.2			49.2
2	Middle distillates		29.3			29.3	49.2			49.2
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		58.6			58.6	98.4			98.4
7	Coal									
8	Natural gas		2,402.6			2,402.6	2,362.7			2,362.7
9	Fuels, n.e.c., total									

EXHIBIT IV-33
(Table 4a/2d)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total		2.402.6			2,402.6	2,362.7			2,362.7
11	Electrical energy (Purchased only)		322.3			322.3	369.2			369.2
12	GRAND TOTAL		2,783.5			2,783.5	2,830.3			2,830.3

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess All Manufacturing Operations Excluding Painting and Baking Ovens

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline									
	Diesel Fuel									
	Lubricants									
6	Petroleum products total									
7	Coal		205.1			205.1	172.3			172.3
8	Natural gas		615.3			615.3	590.7			590.7
9	Fuels, n.e.c., total									

EXHIBIT IV-34
(Table 4a/2c)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		820.4			820.4	763.0			763.0
11	Electrical energy (Purchased only)		761.8			761.8	861.4			861.4
12	GRAND TOTAL		1,582.2			1,582.2	1,624.4			1,642.4

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess Petroleum Products Used for Company Owned Fleets, New Vehicle Tank Prefills and Lubrication, and Production Equipment Lubrication

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		1,406.4			1,406.4	1,435.7			1,435.7
	Diesel Fuel		29.3			29.3	29.3			29.3
	Lubricants				1,523.6	1,523.6			1,816.6	1,816.6
6	Petroleum products total		1,435.7		1,523.6	2,959.3	1,465.0		1,816.6	3,281.6
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									

EXHIBIT IV-35
(Table 4a/2d)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		1,435.7		1,523.6	2,959.3	1,465.0		1,816.6	3,281.6

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLION), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process Truck Assembly - Chassis, Body and Final

Subprocess All Subprocesses

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		58.6			58.6	73.8			73.8
2	Middle distillates		351.6			351.6	556.0			556.0
3	Residual fuel oil		380.9			380.9	590.7			590.0
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		1,406.4			1,406.4	1,435.7			1,435.7
	Diesel Fuel		29.3			29.3	29.3			29.3
	Lubricants				1,523.6	1,523.6			1,816.6	1,816.6
6	Petroleum products total		2,226.8		1,523.6	3,750.4	2,685.5		1,816.6	4,502.1
7	Coal		2,109.6			2,109.6				
8	Natural gas		3,545.3			3,545.3	3,470.2			3,470.2
9	Fuels, n.e.c., total									

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		5,654.9			5,654.9	3,470.2			3,470.2
11	Electrical energy (Purchased only)		1,787.3			1,787.3	2,067.4			2,067.4
12	GRAND TOTAL		9,669.0		1,523.6	11,192.6	10,448.1		1,816.6	12,264.7

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLION), 1971 AND 1973

SIC 3711 and 3712 **Industry** Motor Vehicles and Passenger Car Bodies

Process All Processes

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		234.4			234.4	246.0			246.0
2	Middle distillates		1,347.8			1,347.8	2,180.4			2,180.4
3	Residual fuel oil		1,406.4			1,406.4	2,239.6			2,239.6
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		5,332.6			5,332.6	5,479.1			5,479.1
	Diesel Fuel		87.9			87.9	117.2			117.2
	Lubricants				5,860.0	5,860.0			7,002.7	7,002.7
6	Petroleum products total		8,409.1		5,860.0	14,269.1	10,262.3		7,002.7	17,265.0
7	Coal		8,145.4			8,145.4	6,472.6			6,472.6
8	Natural gas		13,565.8			13,565.8	13,314.7			13,314.7
9	Fuels, n.e.c., total									

EXHIBIT IV-37
(Table 4a)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total		21,711.2			21,711.2	19,787.3			19,787.3
11	Electrical energy (Purchased only)		6,885.5			6,885.5	7,924.9			7,924.9
12	GRAND TOTAL		37,005.8		5,860.0	42,865.8	40,199.5		7,002.7	47,202.2

Source: Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

FEDERAL ENERGY OFFICE

INDUSTRY CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE - 1971, 1973, AND 1974

SIC 3711 and 3712 Industry Motor Vehicles and Passenger Car Bodies

	Type of Energy or Material	Volume: Unit of Measure	Volume: 1971	Volume: 1973	Volume: 1974	Bil. BTU's: 1971	Bil. BTU's: 1973	Bil. BTU's: 1974	Percent Change: 1971-73	Percent Change: 1973-74	Percent of Total BTU's: 1971	Percent of Total BTU's: 197[illegible]
1	Propane, butane, and mixtures	(1,000 barrels)	199.5	209.4	194.7	800	900	800	5	(7)	.5	.5
2	Middle distillates	(1,000 barrels)	790.3	1,283.4	1,193.6	4,600	7,500	7,000	62	(7)	3.1	4.7
3	Residual fuel oil	(1,000 barrels)	761.8	1,215.8	1,130.7	4,800	7,600	7,100	60	(7)	3.3	4.7
4	Chemical feedstocks											
5	Other petroleum products	(1,000 barrels)										
	Gasoline	"	3,491.5	3,557.1	2,773.4	18,300	18,700	14,600	2	(22)	12.5	11.6
	Diesel Fuel	"	54.0	64.3	55.8	300	400	300	19	(13)	.2	.2
	Lubricants	"	3,297.6	3,940.5	3,418.4	20,000	23,900	20,800	19	(13)	13.7	14.8
6	Petroleum products, total	(1,000 barrels)	8,594.7	10,270.5	8,766.6	48,800	59,000	50,600	19	(15)		
7	Coal	(1,000 short tons)	1,060.2	1,131.7	1,052.5	27,800	29,700	27,600	7	(7)	19.0	18.4
8	Natural gas	(billion cu. ft.)	44.9	44.0	40.9	46,300	45,400	42,200	(2)	(7)	31.6	28.3
9	Fuels, n.e.c. total											
10	Other fuels, total					74,100	75,100	69,800	6	(7)		
11	Electrical energy (purchased only)	(billion KWH)	6.9	7.9	7.3	23,500	27,000	24,900	14	(7)	16.1	16.8
12	GRAND TOTAL					146,400	161,100	145,300	10	(10)	100.0	100.0

Sources: 1971 data - Fuels and Electric Energy Consumed, 1972 Census of Manufactures. The usage of gasoline, diesel fuel, and lubricants in 1971 was estimated by A. T. Kearney, Inc.
1973 data - Based on company data with over 90% of the Industry reporting.
1974 data - Estimated by A. T. Kearney, Inc., based on Industry forecasts.
Based on estimates from companies in the Industry. Field tests included data from five SIC 3711-12 manufacturers covering more than 95% of vehicle production.

EXHIBIT IV-38
(Table 5a)

FEDERAL ENERGY OFFICE

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, 1971

SIC 3711 and 3712 Industry Motor Vehicles and Passenger Car Bodies Year 1971

		Petroleum Products						Other Fuels					
	Geographic Unit	Propane Butane, and Mixtures (Thousand Barrels)	Distillates (Thousand Barrels)	Residual (Thousand Barrels)	Feedstocks (Thousand Barrels)	Gasoline, Diesel Fuel and Lubes (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
1	United States	199.5	790.3	761.8		6,852.1	48,800	1,060.2	44.9		74,100	23,500	146,400
2	NORTH EAST	19.3	133.9	149.5		662.0	5,500	98.8	3.6		6,400	2,300	14,200
3	New England	2.4	22.3	22.3		80.7	800	5.7	.5		700	300	1,700
4	Maine												
5	N. H.												
6	Vermont												
7	Mass.	2.2	20.8	20.8		75.1	745	5.3	.4		652	279	1,583
8	R.I.												
9	Conn.	.2	1.5	1.5		5.6	55	.3	.1		48	21	117
10	Middle Atlantic	16.9	111.6	127.2		581.3	4,700	93.1	3.1		5,700	2,000	12,500
11	N.Y.	4.0	26.5	30.1		137.8	1,114	22.1	.7		1,351	474	2,963
12	N.J.	12.4	81.9	93.4		426.7	3,450	68.3	2.3		4,184	1,468	9,175
13	Penn.	.5	3.2	3.7		16.8	136	2.7	.1		165	58	362
14	NORTH CENTRAL	132.9	194.0	202.0		4,567.6	28,700	961.0	27.2		53,200	15,600	97,500
15	E. North Central	108.8	142.5	170.2		3,738.0	23,400	811.8	21.8		43,600	12,800	79,800
16	Ohio	18.2	23.8	28.4		624.2	3,908	135.6	3.6		7,281	2,138	13,327
17	Ind.	2.0	2.6	3.1		67.3	421	14.6	.4		785	230	1,436
18	Ill.	6.5	8.6	10.2		224.3	1,404	48.7	1.3		2,616	768	4,788
19	Mich.	71.9	94.1	112.5		2,470.8	15,467	536.6	14.4		28,820	8,461	52,748
20	Wisc.	10.2	13.4	16.0		351.4	2,200	76.3	2.1		4,098	1,203	7,501

EXHIBIT IV-39
(Table 6a)

		Petroleum Products						Other Fuels					
	Geographic Unit	Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Gasoline, Diesel Fuel and Lubes (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
21	W. North Central	24.1	51.1	31.8		829.6	5,300	149.2	5.4		9,600	2,800	17,700
22	Minn.	1.7	3.6	2.2		58.1	371	10.4	.4		672	196	1,239
23	Iowa	15.2	32.4	20.1		522.6	3,339	94.0	3.4		6,048	1,764	11,151
24	Mis.												
25	N.D.												
26	S.D.												
27	Neb.												
28	Kans.	7.2	15.5	9.5		248.9	1,590	44.8	1.6		2,880	840	5,310
29	SOUTH	32.2	393.9	378.5		1,104.9	11,100		8.3		8,700	3,800	23,600
30	S. Atlantic	25.0	376.7	369.0		857.0	9,500		5.6		5,800	2,900	18,300
31	Del.	7.5	113.0	110.7		257.1	2,850		1.7		1,740	870	5,490
32	Md.	5.7	86.6	84.9		197.1	2,185		1.3		1,334	667	4,209
33	D.C.	1.8	26.4	25.8		60.0	665		.4		406	203	1,281
34	Va.												
35	W. Va.												
36	N.C.												
37	S.C.												
38	Ga.	10.0	150.7	147.6		342.8	3,800		2.2		2,320	1,160	7,320
39	Fla.												
40	S. Central	7.2	17.2	9.5		247.9	1,600		2.7		2,900	900	5,300
41	Ky.	3.7	8.8	4.8		126.4	816		1.4		1,479	459	2,703
42	Tenn.												
43	Ala.												
44	Miss.												
45	Ark.												
46	La.												
47	Okla.												
48	Texas	3.5	8.4	4.7		121.5	784		1.3		1,421	441	2,597

	Geographic Unit	Petroleum Products						Other Fuels				Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
		Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Gasoline, Diesel Fuel and Lubes (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion BTU's)		
49	WEST	15.1	68.7	31.8		517.6	3,600		5.5		5,700	1,800	11,100
50	Mountain												
51	Mont.												
52	Idaho												
53	Wyo.												
54	Colo.												
55	N.M.												
56	Ariz.												
57	Utah												
58	Nev.												
59	Pacific	15.1	68.7	31.8		517.6	3,600		5.5		5,700	1,800	11,100
60	Wash.												
61	Ore.	.2	.7	.3		5.2	36		.1		57	18	111
62	Cal.	14.9	68.0	31.5		512.4	3,564		5.4		5,643	1,782	10,989
63	Alas.												
64	Haw.												

Source: The consumption of fuels, petroleum products and electrical energy for each geographic unit was estimated based on geographical data on the Transportation Equipment Industry (SIC 37) from the 1972 Census of Manufacturers, Fuels, and Electric Energy Consumed.

FEDERAL ENERGY OFFICE

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, 1973

SIC 3711 and 3712 Industry Motor Vehicles and Passenger Car Bodies Year 1973

		Petroleum Products						Other Fuels					
	Geographic Unit	Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Gasoline, Diesel Fuel and Lubes (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
1	United States	209.4	1,283.4	1,215.8		7,561.9	58,900	1,131.7	44.0		75,100	27,000	161,000
2	NORTH EAST	17.8	211.8	192.7		641.4	6,200	86.3	2.8		5,200	2,300	13,700
3	New England	2.8	34.3	28.6		100.7	1,000	13.0	.5		800	400	2,200
4	Maine												
5	N. H.												
6	Vermont												
7	Mass.	2.8	34.3	28.6		100.7	800	13.0	.5		1,000	400	2,200
8	R.I.												
9	Conn.												
10	Middle Atlantic	15.0	177.5	168.6		540.7	5,200	73.3	2.3		4,400	1,900	11,500
11	N.Y.	3.0	35.5	33.7		108.1	1,040	14.7	.5		880	380	2,300
12	N.J.	11.4	134.9	128.2		411.0	3,952	55.7	1.7		3,344	1,444	8,740
13	Penn.	.6	7.1	6.7		21.6	208	2.9	.1		176	76	460
14	NORTH CENTRAL	137.5	285.7	281.5		4,969.5	32,200	1,044.9	27.8		55,800	17,700	105,700
15	E. North Central	113.7	249.6	233.8		4,108.7	26,700	873.4	22.7		46,100	14,600	87,400
16	Ohio	17.1	37.4	35.1		616.3	4,005	131.0	3.4		6,915	2,190	13,110
17	Ind.	2.3	5.0	4.7		82.2	534	17.5	.5		922	292	1,748
18	Ill.	5.7	12.5	11.7		205.4	1,335	43.7	1.1		2,305	730	4,370
19	Mich.	77.2	169.7	158.9		2,793.9	18,156	593.9	15.4		31,348	9,928	59,432
20	Wisc.	11.4	25.0	23.4		410.9	2,670	87.3	2.3		4,610	1,460	8,740

EXHIBIT IV-40
(Table 7a)
Page 1 of 3

	Geographic Unit	Petroleum Products						Other Fuels				Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
		Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Gasoline Diesel Fuel and Lubes (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion BTU's)		
21	W. North Central	23.8	36.1	47.7		860.8	5,500	171.5	5.1		9,700	3,100	18,300
22	Minn.	1.7	2.5	3.3		60.3	385	12.0	.4		679	217	1,281
23	Iowa	19.0	28.9	38.2		688.6	4,400	137.2	4.0		7,760	2,480	14,640
24	Mis.												
25	N.D.												
26	S.D.												
27	Neb.												
28	Kans.	3.1	4.7	6.2		111.9	715	22.3	.7		1,261	403	2,379
29	SOUTH	35.7	728.6	669.6		1,288.0	16,100		6.4		6,700	4,600	27,400
30	S. Atlantic	18.0	711.4	658.5		973.7	14,000		3.1		3,300	3,500	20,700
31	Del.	4.3	170.7	158.0		233.7	3,360		.7		792	840	4,968
32	Md.	4.5	177.8	164.6		243.4	3,500		.8		825	875	5,175
33	D.C.	1.3	49.8	46.1		68.2	980		.2		231	245	1,449
34	Va.												
35	W. Va.												
36	N.C.												
37	S.C.												
38	Ga.	7.9	313.1	289.8		428.4	6,160		1.4		1,452	1,540	9,108
39	Fla.												
40	S. Central	8.7	17.2	11.1		314.3	2,100		3.3		3,400	1,100	6,700
41	Ky.	4.7	9.3	6.0		169.7	1,134		1.8		1,836	594	3,618
42	Tenn.												
43	Ala.												
44	Miss.												
45	Ark.												
46	La.												
47	Okla.												
48	Texas	4.0	7.9	5.1		144.6	966		1.5		1,564	506	3,082

	Geographic Unit	Petroleum Products						Other Fuels				Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
		Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Gasoline, Diesel Fuel and Lubes (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion (BTU's)		
49	WEST	18.4	58.4	66.8		663.0	4,600		7.0		7,200	2,400	14,200
50	Mountain												
51	Mont.												
52	Idaho												
53	Wyo.												
54	Colo.												
55	N.M.												
56	Ariz.												
57	Utah												
58	Nev.												
59	Pacific	18.4	58.4	66.8		663.0	4,600		7.0		7,200	2,400	14,200
60	Wash.												
61	Ore.	.2	.6	.7		6.6	46		.1		72	24	142
62	Cal.	18.2	57.8	66.1		656.4	4,554		6.9		7,128	2,376	14,058
63	Alas.												
64	Haw.												

Source: The consumption of fuels, petroleum products, and electrical energy for each geographic unit was estimated based on geographical data on the Transportation Equipment Industry (SIC 37) from the 1972 Census of Manufacturers, Fuels and Electric Energy Consumed

FEDERAL ENERGY OFFICE

SHIPMENTS, EMPLOYMENT, AND FUELS AND ENERGY CONSUMED BY GEOGRAPHIC UNIT, 1971 AND 1973

SIC 3711 and 3712 Industry Motor Vehicles and Passenger Car Bodies

	Geographic Unit		Value of Shipments ($000,000) 1971	Value of Shipments ($000,000) 1973	Value of Shipments Percent Change	Employment (000) 1971	Employment (000) 1973	Employment Percent Change	Fuels and Energy (Bil. BTU's) 1971	Fuels and Energy (Bil. BTU's) 1973	Fuels and Energy Percent Change
1	United States	(P)	40,306.5	48,827.6	21	(S)340.8	(B)380.9	12	146,400	161,000	10
2	NORTH EAST		3,894.4	4,141.5	6	25.4	25.9	2	14,200	13,700	(4)
3	New England		474.9	650.1	37	3.1	4.1	30	1,700	2,200	29
4	Maine										
5	N.H.										
6	Vermont										
7	Mass.		442.1	650.1	47	2.9	4.1	40	1,606	2,144	33
8	R.I.										
9	Conn.		32.8		(100)	.2		(100)	119		
10	Middle Atlantic		3,419.5	3,419.4	2	22.5	.9	(3)	12,500	11,500	(8)
11	N.Y.		809.8	711.3	(12)	5.3	4.5	(16)	2,941	2,345	(20)
12	N.J.		2,511.3	2,636.5	5	16.5	16.5	-	9,121	8,692	(5)
13	Penn.		98.4	143.6	46	.6	.9	38	35	473	32
14	NORTH CENTRAL		26,867.9	32,088.2	19	251.9	276.4	10	97,500	105,700	8
15	E. North Central	(S)	21,987.9	26,530.2	21	(S)212.6	234.0	10	79,800	87,400	10
16	Ohio	(S)	3,664.2	3,911.2	7	(S) 37.5	34.5	(8)	13,308	12,895	(4)
17	Ind.		395.0	453.3	15	3.9	4.0	2	1,435	1,495	4
18	Ill.		1,321.3	1,262.1	(4)	10.3	11.1	8	4,799	4,161	(14)
19	Mich.	(S)	14,526.6	18,331.1	26	140.1	161.7	15	52,760	60,438	14
20	Wisc.		2,080.8	2,572.4	24	20.8	22.7	9	7,557	8,481	12

EXHIBIT IV-41
(Table 8a)

	Geographic Unit	Value of Shipments ($000,000)			Employment (000)			Fuels and Energy (Bil. BTU's)		
		1971	1973	Percent Change	1971	1973	Percent Change	1971	1973	Percent Change
21	W. North Central (S)	4,880.0	5,558.0	14	(S) 39.3	42.4	8	17,700	18,300	3
22	Minn.	333.0	375.0	13	2.7	2.9	7	1,209	1,236	2
23	Iowa									
24	Mis.	3,091.0	4,440.5	44	24.9	33.9	36	11,226	14,640	30
25	N.D.									
26	S.D.									
27	Neb.									
28	Kans.	1,456.0	742.5	(49)	11.7	5.7	(52)	5,288	4,800	(10)
29	SOUTH	6,499.5	8,317.1	28	42.7	52.1	22	23,600	27,400	16
30	S. Atlantic	5,041.1	6,287.5	25	33.2	39.4	19	18,300	20,700	13
31	Del.	1,487.8	1,496.9	1	9.8	9.4	(4)	5,403	4,935	(9)
32	Md.	1,159.7	1,560.7	35	7.6	9.8	28	4,212	5,145	22
33	D.C.									
34	Va.	350.8	420.7	20	2.3	2.6	14	1,271	1,387	9
35	W. Va.									
36	N.C.									
37	S.C.									
38	Ga.	2,042.7	2,809.2	38	13.4	17.6	31	7,419	9,261	24
39	Fla.									
40	S. Central	1,458.4	2,029.6	39	9.6	12.7	33	5,300	6,700	26
41	Ky.	739.5	1,095.4	48	4.9	6.9	41	2,685	3,611	34
42	Tenn.									
43	Ala.									
44	Miss.									
45	Ark.									
46	La.									
47	Okla.									
48	Texas	718.9	934.2	30	4.7	5.8	24	2,611	3,080	18

	Geographic Unit		Value of Shipments ($000,000)			Employment (000)			Fuels and Energy (Bil. BTU's)		
			1971	1973	Percent Change	1971	1973	Percent Change	1971	1973	Percent Change
49	WEST		3,044.7	4,280.9	41	20.5	26.4	28	11,100	14,200	28
50	Mountain										
51	Mont.										
52	Idaho										
53	Wyo.										
54	Colo.										
55	N.M.										
56	Ariz.										
57	Utah										
58	Nev.										
59	Pacific		3,044.7	4,280.9	41	20.5	26.4	28	11,100	14,200	28
60	Wash.										
61	Ore.		21.9	26.1	19	.2	.2	14	100	100	0
62	Cal.	(S)	3,022.8	4,254.8	41	20.4	26.2	28	10,975	14,028	27
63	Alas.										
64	Haw.										

Sources:

(B) - Estimated from the increase in employment in the Industry from 1971 to 1973, as reported by the U.S. Department of Labor, Bureau of Labor Statistics.

(S) - Survey of Manufactures, 1970-1971.

(P) - Preliminary Report, Census of Manufactures, 1972.

All other sales and employment statistics are based on production per region as reported by Automotive News Almanac, 1972 and 1974 Issues.
The usage of Btu's for each geographic unit was assumed to be in the same proportion to the total Btu's usage as the geographic unit's value of shipments were to the total value of shipments.

FEDERAL ENERGY OFFICE

STOCKS OF FUELS AND PETROLEUM PRODUCTS BY TYPE, 12/31/73 AND 3/31/74

SIC 3711 and 3712 Industry Motor Vehicles and Passenger Car Bodies

	Types of Fuel or Material	Stocks (number of days supply related to average daily requirements in next quarter)					
		As of December 31			As of March 31		
		1971	1972	1973	1972	1973	1974
1	Propane	4	4	7-10	4	4	7-10
2	Butane	(X)	(X)	(X)	(X)	(X)	(X)
3	Propane Butane Mixture	(X)	(X)	(X)	(X)	(X)	(X)
4	Middle Distillates	7-10	7-10	10-14	7-10	7-10	10-14
5	Residual Fuel Oil	7-10	7-10	10-14	7-10	7-10	10-14
6	Chemical Feedstocks	(X)	(X)	(X)	(X)	(X)	(X)
7	Gasoline	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
8	Coal	7-21	1-10	1-10	7-21	1-10	1-10
9	Natural Gas	0	0	0	0	0	0
10	Fuels, nec. total	(X)	(X)	(X)	(X)	(X)	(X)

Notes: (X) - not applicable.
N.A. - not available.

Source: The days of supply were estimated from sources within the Industry. Less than one-half of the Industry provided data on their fuel reserves.

EXHIBIT IV-42
(Table 9a)

FEDERAL ENERGY OFFICE

CAPTIVE PRODUCTION, CONSUMPTION, AND SALES OF FUELS, ENERGY, AND PETROLEUM PRODUCTS, 1973

SIC 3711 and 3712 Industry Motor Vehicles and Passenger Car Bodies

Type of Energy or Material	Volume				Mil. BTU's			KWH Equivalents			Value of Sales ($000)
	Unit of Measure	Produced	Consumed	Sold	Produced	Consumed	Sold	Produced	Consumed	Sold	
None											
			N	O	N E						

Source: Over 90% of the Industry was surveyed to determine if there were any captive energy sources.

EXHIBIT IV-43
(Table 10a)

FEDERAL ENERGY OFFICE

SOURCES OF SUPPLY FOR FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, 1973

SIC 3711 and 3712 Industry Motor Vehicles and Passenger Car Bodies

		Percent of 1973 Consumption Supplied								
	Source of Supplies	Propane, Butane, and Mixtures	Distillates	Residual	Feed Stocks	Other Petroleum Products	Coal	Natural Gas	Other Fuels	Electrical Energy
1	Captive Production									
2	Purchased from:									
3	Refineries	40	70	70		50				
4	Other Manufacturers									
5	Wholesalers	60	30	30		50	40			
6	Importers									
7	Retailers									
8	Utilities									
9	Other Sources						60*	100		100
	TOTAL	100	100	100	0	100	100	100	0	100
	Unit of Measure used to compute percent									

Note: *From mining companies.

Source: Company data on source of supply as reported by over 90% of the Industry.

EXHIBIT IV-44 (Table IIa)

FEDERAL ENERGY OFFICE

SEASONAL USE OF FUELS, PETROLEUM PRODUCTS AND ENERGY BY TYPE, 1973

SIC 3711 and 3712 Industry Motor Vehicles and Passenger Car Bodies

Type of Material or Energy	Percent of Annual Use in 1973 in:			
	January-March	April-June	July-September	October-December
Propane, Butane and mixtures	40	10	10	40
Distillates	35	25	20	30
Residual	35	15	15	35
Feedstocks	(X)	(X)	(X)	(X)
Gasoline	30	25	20	25
Coal	40	15	10	35
Natural Gas	30	20	20	30
Other Fuels	(X)	(X)	(X)	(X)
Electrical Energy (Purchased only)	25	25	25	25

Note: (X) - not applicable.

Source: Company data from less than one-half of the Industry.

EXHIBIT IV-45
(Table 12a)

V - TRUCK AND BUS BODIES (SIC 3713)

The truck and bus body industry is comprised of those establishments primarily engaged in manufacturing truck and bus bodies, for sale separately or for assembly on purchased chassis, (See Exhibit V-1). The 1967 Standard Industrial Classification (SIC) Manual further specifically excludes establishments manufacturing complete vehicles; i.e., chassis and body manufacture and assembly. Since the 1967 classification, demountable cargo containers were deleted, however, the impact of this change is not significant in this study.

The importance of this industry can be gauged by the fact that over 40 percent of truck and bus chassis produced (excluding pickup trucks) are sold or shipped from the chassis manufacturers without bodies. While this industry performs the final manufacturing step that transforms a chassis into a truck or bus, its relative economic position in the Motor Vehicles Industry is quite modest as seen below in Table V-1.

Table V-1

Truck and Bus Body Position in Motor Vehicle Industry, 1972

Criteria	Percent of Total
Value of Shipments	2.4
Value Added	2.8
Cost of Materials	2.2
Fixed Assets (1971)	1.6
Employment	5.2
Establishments	23.0

Source: U.S. Dept. of Commerce, 1972 Census of Manufactures, Preliminary Report.

As indicated, the truck and bus body industry ships only 2.4 percent of the product value with less than 2 percent of the total industry's assets. Significant, however, is the fact that the number truck and bus body establishments represent a disproportionate share of the total industry--about 23 percent.

INDUSTRY STRUCTURE

The following paragraphs will serve to characterize the truck and bus body industry by describing the product mix, operating data, production system, competition, the nature of the market and the projected growth in the industry.

(a) Product

There are a plethora of body types which compose the product mix in the industry. In fact, it is this product heterogeneity which makes the industry so difficult, if not impossible, to deal with as a unit.

Illustrative of the breadth and depth of the body product mix is the table on the following page showing shipments of selected body types in 1972.

Table V-2

Bodies Shipped by Type, 1972

Body Type	Quantity (000)	Value Dollars ($000,000)	Value Percent (%)
Bodies:			
Van	28.4	$ 50.8	3.7
Multistop	28.0	52.0	3.8
Dump	56.3	57.0	4.2
Stake and Platform	49.6	26.5	1.9
Utility	(NA)	62.9	4.6
Tank	2.4	16.5	1.2
Refuse	13.5	85.9	6.3
Bus	26.0	82.3	6.0
Bodies Made on Purchased Chassis:			
Ambulance, Hearse, etc.	3.7	41.4	3.0
Fire Vehicles	1.5	36.8	2.7
Motor Homes	59.6	447.2	32.7
Bus	(NA)	34.9	2.6
Total (SIC 3713)*	(NA)	$1,368.5	100.0%

Note: *Totals do not add because list is not exhaustive.

Source: 1972 Census of Manufactures, Preliminary Report.

This list of products accounts for almost three-fourths of the total industry shipment value. Note that only one truck or bus body type accounts for more than 7 percent of the total; motor homes. In 1972 motor home sales provided almost a third of the industry's sales yet in 1967, few were produced. Motor homes, the fastest growing line in the Recreational Vehicle (RV) Industry, is the only RV type product included in the truck and bus body industry.

It should be noted here that there were occasional discrepancies between the production volume reported by the Bureau of the Census and that reported by the industry trade associations. For example, the Recreational Vehicle Institute (RVI) reports motor home production in 1972 of 116,800 while the 1972 census publishes only 59,600. It is possible that the Census includes only Type A or Conventional motor homes of which according to the RVI, there were 64,600 sold in 1972. Further, the Truck Body and Equipment Association (TBEA) reports higher production for dump, van, tank, and stake bodies than the 1972 Census. However, because of the need to preserve data comparability in this study, Census information was used throughout.

(b) Operating Data

Exhibit V-2 details key operating data from 1967 to 1972 for the truck and bus body industry. These data are summarized in the following table.

Table V-3

SIC 3713 - Operating Data, 1967-1972

	1967	1972	Percent Change
Value of Shipments ($000,000)	706.1	1512.8	114.2%
Value Added ($000,000)	331.7	631.2	90.3
Cost of Materials ($000,000)	376.4	911.1	142.1
Establishments	641	762	18.9
Employment (000)	30.4	42.0	38.2
Value Added/Value of Shipments	47.0	41.7	(11.3)
Payroll/Value Added	27.2	22.9	(15.8)

Source: 1972 Census of Manufactures, Preliminary Report

As indicated, the industry has enjoyed a high growth rate; 114 percent in the five years since 1967. However, over one-half of this growth is due to the ten-fold increase in motor home sales. In 1972, almost 60 percent of sales was used to buy raw materials, consumables, energy and contract work. The remaining 40 percent of sales was value added of which one-quarter was attributable to wages and salaries.

Over 92 percent of the total value of truck and bus bodies shipped in 1972 were produced by plants classified in SIC 3713, the remainder being produced by plants in other industry groups. In addition, of the total manufactured product shipments by SIC 3713, 88 percent was products primary to the truck and bus body industry.

Analysis of some of the key business ratios for the body manufacturers can provide an insight into the industry profitability and capital intensity. Table V-4 presents several measures of business performance for 46 firms in the car, truck and bus body industry for 1972, a generally good year for the industry.

Table V-4

Body Industry Business Ratios, 1972

Ratio	Quartile Lower	Median	Upper
Net Profits/Net Sales (%)	1.16	1.82	3.14
Net Sales/Net Worth (times)	2.46	4.21	6.78
Net Profit/Net Worth (%)	4.21	8.48	14.02
Total Debt/Net Worth (%)	218.6	116.0	47.6

Source: Dun and Bradstreet, "Key Business Ratios," 1972.

These ratios indicate a relatively modest return on equity (8.5%) brought about by a low profit margin and slow turnover of invested capital. Further, the capital position in the industry appears to be low because creditors have more funds in the business than the owners. To this extent, any substantial investments in the industry will probably have to be financed through earnings or the capital market. These funds will be difficult to find, however, because of the low margins and return potential. If margins are depressed further by cost increases that cannot be passed on to the customer, the industry's ability to attract resources will be adversely affected.

(c) Production System

With the exception of motor homes, the manufacturing processes involved in producing any truck or bus body are similar. The processes typically include: shipping and receiving; stamping and forming; welding; assembly; finishing operations; and, in some cases, mounting. The production of castings and forgings, heat treating operations, and plating are not common to this industry. The major raw materials used in these processes include sheet, plate and structural steel, aluminum sheet and extrusions, iron and steel castings and forgings and plywood and hardwoods. Truck equipment and accessories such as pumps, meters, hose, and hoists are purchased.

The production system in the motor home segment of the body industry is itself not homogeneous. The two or three largest manufacturers, accounting for about 60 percent of the market, are extensively integrated vertically, making most all subassemblies and components. About the only major subassembly purchased by these manufacturers is the chassis. For example, aluminum is extruded to make frames for windows and doors, screens, grilles and moldings. Fabrics are fashioned for upholstered seating, pillows, and mattresses and curtains. Lumber and plastics are employed in the fabrication and molding of cabinets, lavatories, holding tanks, wheel wells and sunvisors. The raw materials consumed by these manufacturers are basic forms of steel, aluminum, lumber, plastic and cloth.

The remaining approximate 95 percent of the motor home manufacturers which ship about 40 percent of the RV's, are primarily assemblers. Virtually all components are purchased in finished or semi-finished form. The technology is low, the methods basic, and for the small operations, the capital commitment in fixed assets is minimal.

(d) Competition

With the myriad of product lines and the regional and local nature of the business, no one firm dominates the industry nor even, does any firm have a market share exceeding 10 percent. However, when the market is defined more narrowly, e.g., dump bodies, bus bodies or motor homes, some market concentration begins to appear. Some industry leaders include: for dump bodies, Heil, Peabody-Galion, and Perfection-Coby; for buses, Superior Coach and Flxible; and for motor homes, Winnebago, Champion, Open Road, Coachman and Fleetwood.

Competition is also intense on a regional and local scale. Almost every city of any size has a body manufacturer.

(e) Marketing

The marketing channels in this industry are often lengthy, involving many times two manufacturers, two distributor-dealers and the customer-operator. The following paragraphs will briefly summarize the four most common ways a chassis is combined with a body type and delivered to the ultimate customer:

1. Chassis purchased by chassis dealer from chassis manufacturer. Body purchased by body distributor from body manufacturer. Body resold (and usually mounted) by body distributor to chassis dealer who sells to customer-operator. This is perhaps the most typical channel, especially for small volume truck body buyers.

2. Chassis purchased by dealer from chassis manufacturer and resold to customer-operator. Body purchased by body distributor from manufacturer. Distributor resells (and may mount) body to customer-operator. This is basically an alternate to the above followed by some particularly higher volume buyers.

3. Chassis bought directly from chassis manufacturer by body manufacturer who combines systems and sells, usually direct, to customer-operators. This channel is most common to busses, motor homes, ambulances, and other specialty vehicles.

4. Chassis manufacturer purchases body from body manufacturer and combines systems for sale to customer-operator.

This channel activity is small because most complete vehicles sold by large chassis manufactures have bodies made in-house.

(f) Industry Growth and Trends

The growth in the truck and bus body industry (as well as the chassis industry) is directed by the general activity in the industrial and commercial sectors of the economy. Bodies for lighter vehicles such as vans, multi-stop, walkins and stake and rack, will remain strong because of the high volume of retail trade and farm production. In spite of the fuel shortages and the less bouyant national economy, the truck body market should remain strong in 1974. Because 1973 was a record year for the industry, sales could be off 6 or 7 percent in 1974 and still be a good year.

Sales of all types of motor homes (including Type A) burgeoned to 116,800 units in 1972 from under 10,000 in 1967. However, sales flattened in 1973 and in 1974 are expected to fall significantly short of this level. The prime factor in this downturn is the fuel shortage: the average motor gets but seven miles per gallon of gasoline. Another factor, although a distant second, is the prospect of tighter Government safety regulations on motor home construction.

ENERGY USE

Although 1971 fuel consumption was reported in a special Census series for the truck and bus body industry, the consumption for both fuel and electrical energy was most recently reported in the 1967 Census. In that year, the cost of energy was $5.6 million, less than one percent of the industry's value of shipments and about 1.5 percent of the cost of materials. To this extent, the truck and bus body industry is not a large consumer of energy in either relative or absolute terms.

In the following pages, energy consumption in the trailer industry will be examined by manufacturing process, by type of fuel, and by geographic pattern of use. As a preface to this material is the following discussion of the methodology utilized to develop the energy data for 1971, 1973 and 1974.

(a) Estimation Methodology

The table below shows the energy consumption data published by the Census of Manufactures.

Table V-5

Energy Consumption Data for SIC 3713

	1967	1971
Fuels Consumed ($000,000)	2.3	3.9
(KWH, billions)	1.44*	2.3
Purchased Electric Energy ($000,000)	3.3	(NA)
(KWH, billions)	0.32**	(NA)

Notes: *Obtained by dividing 1967 expenditure by the 1971 cost per KWH discounted to 1967 dollars ($0.0016).

**Obtained by dividing 1967 expenditure by the 1967 cost per KWH for SIC 3714 ($0.0103).

Sources: 1967 Census of Manufactures.
1972 Census of Manufactures, Special Report Series, "Fuel and Electrical Energy Consumed."
A. T. Kearney, Inc.

Of the total 1.76 billion KWH equivalents consumed in the industry in 1967, about 82 percent was supplied by fuels.

Because complete energy consumption data in terms of fuel and electric power exists for only one year, 1967, it is impossible to merely extend this data with any acceptable level of confidence. It was possible, however, to develop the industry energy consumption through induction by examining the energy by individual manufacturing processes.

Theoretical calculations of energy requirements by manufacturing process were developed as noted in Section I and validated or slightly modified for application in the truck and bus body industry by field survey data. Knowing the energy use by process per unit, it was a simple matter to sum the process requirements to get the total consumption.

Unit volume data for Type A motor homes used for estimating energy consumption is as shown in Table V-6 on the following page.

Table V-6

Type A Motor Home Production

Year	Units (000)
1967	7.2 *
1971	38.0
1972	64.6
1973	65.3
1974	30.0 **

Notes: *Type A not reported, prior to 1971. Assumed to be 80% of total motor home sales.

**Estimated

Source: Recreational Vehicle Institute.
A. T. Kearney, Inc.

Because of lack of similarity in product, the Census does not report aggregate unit output for the total industry such as that reported by RVI for motor homes (See Exhibit V-3, Table 1b). To this extent it was necessary to develop an index of output for the remainder (excluding motor homes) of the truck and bus body industry. Real value added, shown in the following table, was employed as the measure of unit activity.

Table V-7

Truck and Bus Body Real Value Added

Year	Value Added, 1967 Dollars ($000,000)
1967	311.0
1971	309.2
1972	424.4
1973	531.6 *
1974	465.2 *

Notes: *Developed based on 10-year correlation with truck chassis sales with 6,000 - 26,000 G.V.W.

Sources: 1972 Census of Manufactures, Preliminary Report.
Motor Vehicles Manufacturers Association.
A. T. Kearney, Inc.

These production "units" for motor homes and truck and bus bodies were then used with the per unit process energy consumption calculations to characterize energy consumption in the total industry.

(b) Energy Consuming Process

For truck and bus bodies, there are four basic processes that require energy: metalworking; finishing; in-plant transportation; and building heating and lighting. These are discussed individually in the following paragraphs.

1. Metalworking. The metalworking processes include stamping, press forming, welding and assembly (riveting and small hand tool operations). Energy to run these pressroom and assembly-type operations is supplied almost universally by electric power.

2. Finishing Operations. Painting is the major finishing operation. This would include washing, baking and drying operations. Other finishing operations could include heat treating, plating, and/or metal cleaning. Typically finishing operations are run by fuels such as natural gas, fuel oils or perhaps one of the liquified petroleum gases (LPG's).

3. In-Plant Transportation. Forklift trucks are the chief users of power for in-plant transportation. Power is usually supplied by gasoline or LPG with a definite trend to the use of LPG to eliminate exhaust fumes. Some companies appear also to be switching to battery-powered electric trucks.

4. Building. Building energy requirements are for utilities such as heating, ventilation, and lighting. Heat is provided typically by fuels, either LPG, fuel oil, natural gas, or coal. Lighting is of course provided by electrical energy.

For motor homes, three energy consuming processes are basic to all manufacturers: assembly; delivery transportation; and building utilities. A fourth, subassembly production, applies to the more vertically integrated manufacturers.

In addition, there are several nonenergy related uses of petroleum and petroleum-derived products in the industry. These include lubricating and hydraulic oils, foams and fibers for insulating refrigerated vans and motor homes, cutting oils, cleaning solvents, and vinyls and molded plastics for motor homes.

(c) Energy Consumption by Process

Energy consumption is developed for each of the four identified processes for truck and bus body and motor homes in the following paragraphs.

1. Metalworking. The energy consumed in the metalworking operations is basically a function of the types and amounts of metal raw materials. The metals consumed by SIC 3713* establishments were detailed in both the 1967 and 1972 Census data.

Note: * Comparatively little tonnage of metals is used in motor home manufacturing so the reported tonnage in 1972 was assumed to be allocatable only to truck and bus body production. Additionally, there were few, if any, motor homes reported in 1967, so all 1967 SIC 3713 data apply only to truck and bus body manufacturing.

As shown in Table V-8, the metal tonnage per production unit was consistent between the two reported years.

Table V-8

Metal Tonnage Per Unit, 1967 and 1972

	1967	1972
Total Metals Consumed (000 tons)	440	543
Real Value Added ($000,000)	311	424
Tons Per Unit (Value Added)	1.4	1.3

Source: Census of Manufactures, 1967 and 1972.

By applying the energy consumption per ton for the appropriate operation (i.e., stamping, forming, welding, etc.) to the tonnage of each metal type (i.e., steel plate, steel sheet, aluminum sheet, etc.), a weighted energy consumption per ton for metalworking can be derived. Multiplying this by the tons per unit gives an energy requirement for metalworking operations as indicated in the table below.

Table V-9

Energy Per Unit for Metalworking

	1967	1972
Energy per ton required (KWH)	451	460
Tons per unit	1.4	1.3
Energy per unit (KWH)	640	598

Source: A. T. Kearney, Inc.

The weight-unit and energy consumption per ton relationships were verified with actual plant data whose energy per unit averaged 675 KWH per million dollars of value added.

2. Finishing Operations. The fuel requirement per ton for painting is 1,500 KWH and the per unit (million dollars value added) consumption of steel was 1.35 in 1967 and 1.18 in 1972. (The substitution of aluminum for steel is thought to be a major factor in the lower per unit tonnage consumption of steel in 1972.) These two factors combine to give a fuel requirement per unit of about 2,000 KWH in 1967 and 1,775 KWH in 1972. Again, the survey data confirmed the order of magnitude accuracy for this estimate. It was not possible from the survey data to estimate consumption per unit for other miscellaneous finishing operations that may be performed in some plants.

3. In-Plant Transportation. From the survey data it was estimated that about 150 KWH are required per unit for in-plant transportation.

4. Building. Energy consumption for building utilities is a function of square footage under roof. In order to estimate the square footage of plant and office space in the industry, the number of square feet to generate a million dollars in sales revenues was calculated for a number of companies. Because of the bulk of the production and its relatively moderate value, truck and bus body manufacturing requires about 30,000 square feet to generate a million dollars of sales. With industry sales of $706.1 million in 1967, there was determined to be about 21.2 million square feet of plant space in that year. It is

expected that the industry square footage of plant space and hence, energy for building utilities, would vary 25 percent with production. That is to say that if production doubles in any time period, the building energy requirement would increase by 25 percent.

Assuming an average number of degree-days heating and four air changes per hour, a range of 30 to 40 KWH per square foot is required to heat a plant. The survey data confirmed this range and an energy requirement of 35 KWH per square foot was assumed.

Requirements for lighting typically are about 1.1 watt-hours per square foot. Assuming lights are in use 18 hours per day, 5.5 days per week, 50 weeks per year, an annual requirement of about 5 KWH per square foot is indicated.

The next four processes apply only to the motor home segment of the industry.

5. Assembly. The assembly of a motor home includes the fabrication of the shell (usually a wood frame, although safety standards and competition are forcing shift to steel studs) and installation of components and accessories, such as carpeting, cabinets, bench seats and beds, etc. Energy is required for small power tools and welding operations. Field survey data indicated a demand of about 150 KWH per unit for this process.

6. Subassembly Production. About 60 percent of the motor homes are produced in plant complexes where the majority of components are made, not purchased. Energy is required for such operations as extruding and anodizing aluminum, molding plastics, woodworking, press rooms, sewing, etc. Because of the proliferation of possible combinations of operations involved, detailed buildup of the requirements was not possible. Based on field data, it is estimated that for the production of 60 percent of the units, 3,000 KWH fuel equivalents and 400 KWH electric power would be consumed per unit.

7. Delivery. Because of their bulk it is not economically feasible to ship motor homes by rail or truck. Thus, they are driven to dealers' lots across the country. The manufacturer normally supplies the first fill (pre-tripping) to power the vehicle in-plant and as a start on the road. An average fill of 20 gallons was assumed for each vehicle.

8. Building. From a knowledge of the square feet in service for the large public motor home producers and space-sales ratios for small producers, it was estimated that 3.2 million square feet were employed in 1971 to make Type A motor homes. As before, a square foot energy requirement of 35 KWH for heating and 5 KWH for lighting was assumed.

9. Process Energy Summary. As a final check of the energy assumptions by process, the per unit energy requirements can be summed for the industry and validated against known

electrical energy consumption in 1967 and known fuel consumption in 1967 and 1971. This is done in the following table.

Table V-10

Reported Versus Calculated Energy Consumption
(Billion KWH)

	1967	1971
For Electrical Energy:		
Reported	0.32	(NA)
Calculated		
Metalworking @ 625 KWH/Unit	0.19	-
Lighting, etc., @ 5 KWH/ft.^{2}	0.11	-
Assembly	(X)	-
Subassembly	(X)	-
Lighting	(X)	-
Variance (Reported less calculated)	0.02	
For Fuels:		
Reported	1.44	2.30
Calculated		
Finishing @ 2,000 KWH/Unit	0.62	0.62
In-Plant Transportation @ 150 KWH/Unit	0.05	0.05
Heating, etc. @ 35 KWH/ft.^{2}	0.74	0.74
Subassembly @ 3,000 KWH/Unit (60%)	(X)	0.05
Delivery @ 750 KWH/Unit	(X)	0.02
Heating, etc., 35 KWH/ft.^{2}	(X)	0.11
Variance (Reported less calculated)	0.03	0.71

Source: A. T. Kearney, Inc.

As indicated, the calculated process-by-process energy consumption for truck and bus body is further validated by the 1967 reported data. The variances are small; 6 percent for electrical, 2 percent for fuels. These residuals were allocated back to metal-working and finishing operations, respectively.

Further, since truck and bus body production in 1967 and 1971 were virtually equal, the difference between reported fuel consumption in 1967 and 1971, 0.86 billion KWH, should be attributable to motor home production. However, as indicated only about 0.18 billion KWH or 21 percent of this difference could be accounted for by motor home consumption. As the field surveys turned up no acceptable explanation for this large difference and since the 1967 data was verifiable, the 1971 Census data is thought to be misreported or inconsistent with either production data or the 1967 energy data.

Knowing these per unit process energy requirements and the energy demand per square foot for building utilities, the SIC 3713 industry energy consumption can be estimated for the period 1971-1974 as shown in Table V-11.

Table V-11

Industry Energy Consumption by Process, 1971-1974 (Billion KWH)

	1971	1972	1973	1974
Truck and Bus Bodies:				
Metalworking	0.21	0.29	0.36	0.31
Finishing	0.65	0.79	0.98	0.86
In-Plant Trans.	0.05	0.06	0.08	0.07
Building Utilities	0.85	0.93	1.00	0.95
Motor Homes:				
Assembly	*	0.01	0.01	*
Subassembly	0.06	0.13	0.13	0.06
Delivery	0.02	0.05	0.05	0.02
Building Utilities	0.13	0.16	0.16	0.13
Total Energy Consumption	1.97	2.42	2.77	2.40

Notes: *Less than 0.01 billion KWH.

Source: A. T. Kearney, Inc.

As indicated in the table, 45 to 50 percent of the energy consumed is for building utilities, and finishing operations require about two-thirds of the energy used in production.

(d) Consumption by Type of Energy

The 1972 Census special report on fuels indicates a fuel use distribution as shown below.

Table V-12

Fuel Consumption by Type, 1971
(Billion KWH)

Fuel	Amount	Percent of Total
Distillate Fuel Oil	0.11	4.8
Residual Fuel Oil	0.30	13.0
Coal	(Z)	-
Natural Gas	1.21	52.6
Other Fuels	0.02	0.9
Fuel, n.s.k.	0.66	28.7
Total Reported	2.30	100.0

Source: 1972 Census of Manufactures, Special Report Series, "Fuels and Electrical Energy Consumed."

Over half of the fuels consumed in 1971 was specifically identified as natural gas, almost three times as much as fuel oils. Unfortunately, a large percentage of fuels reported were not specified by kind.

Using the 1971 reported data, the company surveys and the fuel requirements of certain processes, an approximate energy mix was developed for each process. This energy mix-process matrix is shown in the Table V-13 for truck and bus bodies.

Table V-13

Truck and Bus Body Energy Mix by Process, 1971

Type of Energy	Metal-Working	Finishing	Transportation	Building
Distillate Fuel Oil	- %	7 %	- %	6 %
Residual Fuel Oil	-	18	-	16
Natural Gas	-	75	-	65
Gasoline	-	-	50	-
LPG	-	-	50	-
Electrical	100	-	-	13
Total (Percent)	100 %	100 %	100 %	100 %
Total (Billion KWH)	0.21	0.65	0.05	0.85

Source: A. T. Kearney, Inc.

The energy mix for the motor homes is shown in the following table.

Table V-14

Motor Home Energy Mix by Process, 1971

Type of Energy	Assembly	Sub-Assembly	Delivery	Building
Distillate Fuel Oil	- %	- %	- %	5 %
Residual Fuel Oil	-	-	-	11
Natural Gas	-	60	-	57
Gasoline	-	-	100	-
LPG	-	30	-	12
Electrical	100	10	-	15
Total (Percent)	100 %	100 %	100 %	100 %
Total (Billion KWH)	0.005	0.06	0.02	0.13

Source: A. T. Kearney, Inc.

These mixes were used to develop the specific energy consumption by process shown in Exhibit V-4 (Table 2b/1a) through Exhibit V-36 (Table 4b). Exhibit V-37 (Table 5b) summarizes the total energy consumption by type for the industry. Table V-15 shows the 1971 consumption by energy type for the industry.

Table V-15

SIC 3713, Energy Consumption by Type, 1971

	Consumption Amount (Billion KWH)	Consumption Percent
Distillate Fuel Oil	0.10	5 %
Residual Fuel Oil	0.26	13
Natural Gas	1.15	59
Gasoline	0.04	2
LPG	0.06	3
Electrical	0.35	18
Total	1.96	100 %

Source: A. T. Kearney, Inc.

From the above summary, it is evident that natural gas provides almost 60 percent of the energy demand, with less than a quarter being supplied by petroleum derived fuels.

(e) Geography of Consumption

The geographic pattern of the use of energy in SIC 3713 was developed by examining 1967 Census employment by state for truck and bus bodies and RVI reported 1972 production by state for motor homes (See Exhibit V-38, Table 8b).

Motor home production is concentrated in the Pacific Division of the West Region and the two Divisions of the North Central Region.

Truck and bus body production is also highly concentrated in North Central Region but more than motor homes in the South and Northeast Regions (on a percentage basis). On a total industry basis the North Central Region accounted for about 52 percent of the industry's shipment value, with that Region's East North Central Division having a higher percentage contribution (about 37%) than any other Division. Ohio shipped the most product value with 14.5 percent. States providing at least 5 percent of the industry's shipment value are listed below.

Table V-16

High Dollar Volume States

State	Percent of Shipment Value
Ohio	14.5 %
California	13.3
Iowa	9.8
Indiana	9.6

Source: 1967 Census of Manufactures
Recreational Vehicle Institute
A. T. Kearney, Inc.

Exhibits V-39 (Table 6b) and V-40 (Table 7b) show the energy consumption by type for each state in 1971 and 1973 respectively. This distribution was made for motor homes and truck and bus bodies individually, then summed by state.

PLANT VARIATIONS

Almost any garage can fashion a truck body, and to this extent, establishment sizes range from one and two man shops to plant complexes employing over 1,000. The next few pages will examine plant variances in size, production system, and product line and the implications of these differences for energy consumption.

(a) Plant Variances

The 1967 Census is the most recent and complete source of statistics by size of establishment. The pertinent information has been summarized and presented below in Table V-17.

Table V-17

Selected Plant Statistics by Employment Size, 1967

Employment	Establishments	Employment	Value Added	Shipments
1 - 19	59.7%	8.2%	7.3%	7.7%
20 - 99	30.1	28.6	28.9	29.6
100 - 249	6.4	19.4	16.5	17.9
250 - 499	1.9	14.5	15.1	14.0
500 - 2,499	1.9	29.3	32.2	30.8

Source: 1967 Census of Manufactures.

As evidenced by the table, the truck and bus body industry is for the most part, characterized by the small plant operation. Plants employing less than 250 provide 56 percent of the employment and 55 percent of the industry's shipments.

The smaller plants typically are more like job shops with little, if any, finished goods inventory. They produce specialty bodies, many times to customer specifications, do repair and service work, and remount jobs (the average body can outlast two and sometimes three chassis).

It is somewhat surprising that in this industry small plants are just as labor efficient, if not more so, than large body plants. That is, wages as a percent of shipment and of value added for plants employing over 250 are similar to those for plants with under 250 employees.

Notwithstanding differences in size however, the basic manufacturing processes do not vary significantly except as noted previously in the motor home industry.

(b) Energy Consumption Implications

Because the basic processes and the labor intensities are similar in small and large plants, the unit energy consumptions are thought to be similar also. About the only opportunities for increasing energy efficiency in larger, high-volume plants are where the energy consumption is more or less fixed in the short-term. Examples of this would be building utilities and perhaps drying ovens and hot solution cleaning operations. Since their energy consumption over the shift is somewhat constant, higher volume or a multiple shift operation would increase per unit energy efficiency.

Of course, larger plants tend to be more vertically integrated (especially as noted earlier in the motor home industry) which increases their per unit total consumption of energy.

However, because the opportunities for greater energy efficiency and inapplicability of wholesale automation, the energy efficiency does not vary significantly by size of plant.

SUPPLY SITUATION

Inventory practices and policies in the truck trailer are not of great concern because the major portion (over three quarters) of the energy used is natural gas and electrical energy, both not normally stocked. Those fuels that are stocked, such as fuel oils, LPG, and gasoline, are typically delivered on a weekly or biweekly basis. As seen in Exhibit V-41 (Table 9b), the number of days supply on hand has not changed significantly over the last three years.

It was observed that some of the large users of natural gas have begun to inventory and consume more standby fuel (usually LPG or distillate fuel oil) in recent months because of source interruptions.

In order to determine the use of fuels by quarter shown in Exhibit V-42 (Table 12b), energy consumption for production was assumed constant by quarter. Although no published statistics were available for the total industry, most manufacturers reported somewhat constant production with a slight dip in the winter quarter. The energy consumption rate for building heat for the winter through fall quarters was estimated at 45, 20, 5 and 30 percent respectively.

The major suppliers of energy for the truck and bus body industry as indicated in Exhibit V-43 (Table 11b), are the utility companies in that they supply 100 percent of the natural gas and electrical energy requirements. For fuel oils, LPG, and gasoline, the large plants (over 250 employment) typically are supplied by wholesalers; the small plants by retailers. There is no known captive production of energy in the industry (see Exhibit V-44, Table 10b).

The electrical energy and natural gas are typically supplied under contract at established, published and regulated rates. The fuels are normally supplied under short-term contracts with oil company distributors. There seems to have been no significant service interruption or discontinuation; however, most users report abnormal price escalations for all energy. The magnitude of the fuel price increases in recent years was discussed earlier in Section III.

SUBSTITUTABILITY AND CONSERVATION

The basic manufacturing processes, fuels presently used, and the costs of possible conversions, are factors that discourage fuel substitution as the solution to energy shortages. However, in this industry almost half of the energy is consumed for building utilities. It is here that the greatest sources of energy inefficiency and hence potential conservation, often are. In most plants, energy savings of 15 to 20 percent can be realized by the mere practice of "good housekeeping." This would include such simple energy saving measures as delamping unnecessarily bright areas, turning down thermostats to at least 68°F., and closing overhead yard doors promptly. These measures, already being implemented in many plants, have cut building utility costs at least a third and some, one-half. Recalling that utilities account for 40 to 50 percent of the energy demand in the industry, a savings of a third on utilities could mean a 15 percent savings in total energy consumption.

Besides good housekeeping, better management of the manufacturing process themselves could reduce energy consumption. Energy can be saved by increased attention to production scheduling so that machines in staging areas are not kept running while awaiting work in process and so that cleaning tanks are not constantly idle while hot. Of course, operating a second shift greatly improves energy input-output efficiency by using building utilities and other operations that can't be shut down overnight.

Because little, if any, investment would be required to save 20 percent of fuel consumption, conservation seems to be the most cost effective means to cut fuel use in the industry. Substitution of gas or electric power for fuels would entail a production interruption and a large initial cost. Further, most new plants are using gas with propane or butane as a stand-by or substitute fuel in case of interruption. To this extent, a moritorium on petroleum fuels as a primary fuel for new construction would perhaps be acceptable; immediate wholesale conservation would be unacceptable because of the cost impact, particularly on small operations.

Because of the conservation potential in the industry, most operations could sustain a fuel cutback of 20 percent before production would be materially affected.

There are currently no changes in 1974 investment plans contemplated because of the energy shortages.

KEY CONSTRAINTS

All segments of the truck and bus body industry, except motor homes, are and have been for the last 18 months, producing at record levels. This has placed a strain on chief suppliers of raw materials to the industry. In most demand seems to be castings and forgings and chassis (where they are delivered to the body manufacturer). The small shops seem particularly impacted by the shortage of castings because many of their suppliers (small foundries) chose to close shops rather than invest heavily to meet new, more strict EPA pollution regulations.

Petroleum derived raw materials such as lamp lenses and insulating foams and fibers were reportedly not yet short, but indications are they may be.

Further gasoline is a critical factor in getting finished goods to customers since, as pointed out earlier, manufacturer-mounted bodies are transported by their own power. Many manufacturers were forced to inventory sold goods because they could not be delivered during last fall and winter's gasoline shortage.

Despite these potentials for production curtailments, there is expected to be no short-fall in truck and bus body supply in 1974.

Of course, the key constraint on the motor home industry continues to be consumer demand, down due to gasoline shortages and resultant high per gallon cost at the pump. Many manufacturers, particularly the small assemblers, were shaken out of the market last fall and will not reappear. Some of the larger producers are just now calling workers back to the job and continue to look for diversification opportunities.

EXHIBIT V-1

FEDERAL ENERGY OFFICE

DESCRIPTION OF ENERGY COVERAGE

SIC 3713 - TRUCK & BUS BODIES

Establishments primarily engaged in manufacturing truck and bus bodies, for sale separately or for assembly or purchased chassis. Establishments primarily engaged in manufacturing complete trucks and buses are classified in Industry 3711, stamped body parts for trucks and buses in Industry 3465; and truck trailers and demountable cargo containers in Industry 3715.

Ambulance bodies
Automobile wrecker-truck body
Bodies, dump
Bus bodies (motor vehicles)
Cabs, for agricultural tractors
Cabs, for industrial trucks
Hearse bodies
Truck beds
Truck bodies, motor vehicle
Truck cabs, for motor vehicles
Truck tops

Source: Standard Industrial Classification Manual, 1972.

FEDERAL ENERGY OFFICE

BASIC INDUSTRY STATISTICS, (SIC 3713)

Year	All Employees Number (000)	All Employees Payroll ($Mil.)	Production Workers Number (000)	Production Workers Man-Hours (Mil.)	Wages ($Mil.)	Value Added ($Mil.)	Cost of Materials ($Mil.)	Value of Shipments ($Mil.)	Capital Expenditures ($Mil.)	End-of-Year Inventories ($Mil.)
1967	30.4	192.2	24.6	49.4	138.5	331.7	376.4	706.1	13.0	126.9
1968	32.0	214.1	25.9	49.6	156.1	378.4	431.7	798.4	22.0	149.7
1969	33.8	233.2	26.9	51.5	168.0	399.7	457.0	837.9	19.7	172.6
1970	35.8	255.6	27.7	54.1	176.0	439.1	498.0	938.9	19.0	182.0
1971	34.1	259.9	26.5	52.3	177.0	474.8	575.5	1,031.7	21.2	206.0
1972	42.0	347.1	32.5	65.0	242.0	631.2	911.1	1,512.8	46.6	295.1

Year	Ratio of Value Added to Shipments	Ratio of Inventories to Shipments	Ratio of Payroll to Value Added	Value of Shipments per Production Worker ($000)	Man-Hours per Production Worker (000)	Wage per Production Worker Man-Hour ($)	Value Added per Production Worker Man-Hour ($)	Index of Employment (1967=100)	Index of Value Added (1967=100)	Index of Shipments (1967=100)
1967	.470	.180	.579	28.7	2.008	2.804	6.71	100.00	100.00	100.00
1968	.474	.183	.566	30.8	1.915	3.147	7.63	105.26	114.08	113.07
1969	.477	.206	.583	31.1	1.914	3.262	7.76	111.18	120.50	118.67
1970	.468	.194	.582	33.9	1.953	3.253	8.12	117.76	132.38	132.97
1971	.460	.200	.547	38.9	1.074	3.384	9.08	112.17	143.14	146.11
1972	.417	.195	.550	46.6	2.000	3.720	9.72	138.1	190.4	214.4

Source: 1972 Census of Manufactures, Preliminary Report.

EXHIBIT V-2

FEDERAL ENERGY OFFICE

PROPORTION OF INDUSTRY OUTPUT ACCOUNTED FOR BY EACH MAJOR PROCESS, 1973

SIC 3713 Industry Truck and Bus Bodies

Process and Major Products	Percent of 1973 Shipments Value (Percent)	Production Volume (Units)
Truck and bus bodies (primary)		
Truck and bus bodies	41.0(1)	(X)
Complete vehicles (bodies on purchased chassis):		
Motor Homes	30.0(1)	65,300(2)
Other vehicles (ambulances, hearses, fire, buses, etc.)	12.0(1)	(X)
Other products (secondary)	11.0(1)	(X)
Miscellaneous receipts	6.0(1)	(X)
Total Industry (Percent) (Actual) (Millions)	100.0 $1,838,0(3)	(X)

Sources: (1) 1972 Census of Manufactures, Preliminary Report.

(2) Recreational Vehicle Institute.

(3) A. T. Kearney Inc. (truck and bus body sales based on 10-year correlation with truck (GVW 6,000-26,000 pounds) chassis sales.)

EXHIBIT V-3
(Table 1b)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies

Subprocess Metalworking

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total									
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)	mil. KWH	210			210	360			360
12	GRAND TOTAL	mil. KWH	210			210	360			360

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-4 (Table 2b/1a)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies

Subprocess Finishing Operations

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates	1,000 barrels	26.4			26.4	40.4			40.4
3	Residual fuel oil	1,000 barrels	63.5			63.5	95.5			95.5
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total	1,000 barrels	89.9			89.9	135.9			135.9
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total	bil. cu. ft.	1.6			1.6	2.4			2.4
10	Other fuels, total	bil. cu. ft.	1.6			1.6	2.4			2.4
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		(X)			(X)	(X)			(X)

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-5
(Table 2b/1b)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies

Subprocess In-Plant Transportation

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	21.3			21.3	34.0			34.0
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline	1,000 barrels	16.2			16.2	26.0			26.0
6	Petroleum products total	1,000 barrels	37.5			37.5	60.0			60.0
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL	1,000 barrels	37.5			37.5	60.0			60.0

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-6 (Table 2b/1c)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies

Subprocess Building

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures									
2	Middle distillates	1,000 barrels	30.5			30.5	35.7			35.7
3	Residual fuel oil	1,000 barrels	72.2			72.2	85.2			85.2
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total	1,000 barrels	102.7			102.7	120.9			120.9
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total	billion cu. ft.	1.8			1.8	2.1			2.1
10	Other fuels, total	billion cu. ft.	1.8			1.8	2.1			2.1
11	Electrical energy (Purchased only)	million KWH	110			110	130			130
12	GRAND TOTAL		(X)			(X)	(X)			(X)

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-7
(Table 2b/1d)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies (Summary)

Subprocess All Subprocesses

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	21.3			21.3	34.0			34.0
2	Middle distillates	1,000 barrels	56.9			56.9	76.1			76.1
3	Residual fuel oil	1,000 barrels	135.7			135.7	180.7			180.7
4	Chemical feedstocks									
5	Gasoline	1,000 barrels	16.2			16.2	26.0			26.0
6	Petroleum products total	1,000 barrels	230.1			230.1	316.8			316.8
7	Coal									
8	Natural gas	billion cu. ft.	3.4			3.4	4.5			4.5
9	Fuels, n.e.c., total									
10	Other fuels, total	billion cu. ft.	3.4			3.4	4.5			4.5
11	Electrical energy (Purchased only)	million KWH	320			320	490			490
12	GRAND TOTAL	—	(X)			(X)	(X)			(X)

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-8
(Table 2b/1)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes

Subprocess Assembly

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total									
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)	million KWH	5			5	10			10
12	GRAND TOTAL	million KWH	5			5	10			10

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 2713 manufacturers.)

EXHIBIT V-9
(Table 2b/2a)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes

Subprocess Subassembly Production

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	15.3			15.3	33.2			33.2
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total	1,000 barrels	15.3			15.3	33.2			33.2
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total	billion cu. ft.	0.1			0.1	0.3			0.3
10	Other fuels, total	billion cu. ft.	0.1			0.1	0.3			0.3
11	Electrical energy (Purchased only)	million KWH	7			7	16			16
12	GRAND TOTAL		(X)			(X)	(X)			(X)

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 2713 manufacturers.)

EXHIBIT V-10
(Table 2b/2b)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes

Subprocess Delivery

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline	1,000 barrels	13.0			13.0	32.5			32.5
6	Petroleum products total	1,000 barrels	13.0			13.0	32.5			32.5
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL	1,000 barrels	13.0			13.0	32.5			32.5

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 2713 manufacturers.)

EXHIBIT V-11 (Table 2b/2c)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes

Subprocess Building

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	13.6			13.6	17.9			17.9
2	Middle distillates	1,000 barrels	3.5			3.5	4.1			4.1
3	Residual fuel oil	1,000 barrels	7.6			7.6	9.8			9.8
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total	1,000 barrels	24.7			24.7	31.8			31.8
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total	billion cu. ft.	0.2			0.2	0.3			0.3
10	Other fuels, total	billion cu. ft.	0.2			0.2	0.3			0.3
11	Electrical energy (Purchased only)	million KWH	20			20	20			20
12	GRAND TOTAL	(X)	(X)			(X)	(X)			(X)

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 2713 manufacturers.)

EXHIBIT V-12
(Table 2b/2d)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes (Summary)

Subprocess All Subprocesses

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures	1,000 barrels	28.9			28.9	51.1			51.1
2	Middle distillates	1,000 barrels	3.5			3.5	4.1			4.1
3	Residual fuel oil	1,000 barrels	7.6			7.6	9.8			9.8
4	Chemical feedstocks									
5	Gasoline	1,000 barrels	13.0			13.0	32.5			32.5
6	Petroleum products total	1,000 barrels	53.0			53.0	97.5			97.5
7	Coal									
8	Natural gas	billion cu. ft.	0.3			0.3	0.6			0.6
9	Fuels, n.e.c., total									
10	Other fuels, total	billion cu. ft.	0.3			0.3	0.6			0.6
11	Electrical energy (Purchased only)	million KWH	32			32	46			46
12	GRAND TOTAL	—	(X)			(X)	(X)			(X)

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 2713 manufacturers.)

EXHIBIT V-13 (Table 2b/2)

FEDERAL ENERGY OFFICE

CONSUMPTION USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies (Summary)

Process All Processes

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	50.2			50.2	85.1			85.1
2	Middle distillates	1,000 barrels	60.4			60.4	80.2			80.2
3	Residual fuel oil	1,000 barrels	143.3			143.3	190.5			190.5
4	Chemical feedstocks									
5	Gasoline	1,000 barrels	29.2			29.2	58.5			58.5
6	Petroleum products total	1,000 barrels	283.1			283.1	414.5			414.5
7	Coal									
8	Natural gas	billion cu. ft.	3.7			3.7	5.1			5.1
9	Fuels, n.e.c., total									
10	Other fuels, total	billion cu. ft.	3.7			3.7	5.1			5.1
11	Electrical energy (Purchased only)	million KWH	352			352	536			536
12	GRAND TOTAL	—	(X)			(X)	(X)			(X)

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 2713 manufacturers.)

EXHIBIT V-14 (Table 2b)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies

Subprocess Metalworking

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total									
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)		717			717	1,229			1,229
12	GRAND TOTAL		717			717	1,229			1,229

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-15 (Table 3b/1a)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies

Subprocess Finishing Operations

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates		156			156	235			235
3	Residual fuel oil		399			399	601			601
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total		555			555	836			836
7	Coal									
8	Natural gas		1,666			1,666	2,509			2,509
9	Fuels, n.e.c., total									
10	Other fuels, total		1,666			1,666	2,509			2,509
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		2,221			2,221	3,345			3,345

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-16 (Table 3b/1b)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies

Subprocess In-plant Transportation

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		85			85	137			137
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline		85			85	137			137
6	Petroleum products total		170			170	274			274
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		170			170	274			274

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-17 (Table 3b/1c)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies

Subprocess Building

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates		177			177	208			208
3	Residual fuel oil		454			454	536			536
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total		631			631	744			744
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total		1,894			1,894	2,225			2,225
10	Other fuels, total		1,894			1,894	2,225			2.225
11	Electrical energy (Purchased only)		375			375	444			444
12	GRAND TOTAL		2,900			2,900	3,413			3,413

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-18
(Table 3b/1d)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies (Summary)

Subprocess All Subprocesses

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		85			85	137			137
2	Middle distillates		333			333	443			443
3	Residual fuel oil		853			853	1,137			1,137
4	Chemical feedstocks									
5	Gasoline		85			85	137			137
6	Petroleum products total		1,356			1,356	1,854			1,854
7	Coal									
8	Natural gas		3,560			3,560	4,734			4,734
9	Fuels, n.e.c., total									
10	Other fuels, total		3,560			3,560	4,734			4,734
11	Electrical energy (Purchased only)		1,092			1,092	1,673			1,673
12	GRAND TOTAL		6,008			6,008	8,261			8,261

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-19
(Table 3b/1)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes

Subprocess Assembly

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total									
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)		17			17	34			34
12	GRAND TOTAL		17			17	34			34

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-20 (Table 3b/2a)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes

Subprocess Subassembly Production

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		61			61	133			133
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total		61			61	133			133
7	Coal									
8	Natural gas		123			123	266			266
9	Fuels, n.e.c., total									
10	Other fuels, total		123			123	266			266
11	Electrical energy (Purchased only)		24			24	55			55
12	GRAND TOTAL		208			208	454			454

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-21 (Table 3b/2b)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes

Subprocess Delivery

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline		68			68	171			171
6	Petroleum products total		68			68	171			171
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		68			68	171			171

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-22
(Table 3b/2c)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes

Subprocess Building

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		55			55	72			72
2	Middle distillates		20			20	24			24
3	Residual fuel oil		48			48	61			61
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total		123			123	157			157
7	Coal									
8	Natural gas		252			252	321			321
9	Fuels, n.e.c., total									
10	Other fuels, total		252			252	321			321
11	Electrical energy (Purchased only)		68			68	68			68
12	GRAND TOTAL		443			443	546			546

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-23
(Table 3b/7d)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes (Summary)

Subprocess All Subprocesses

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		116			116	205			205
2	Middle distillates		20			20	24			24
3	Residual fuel oil		48			48	61			61
4	Chemical feedstocks									
5	Gasoline		68			68	171			171
6	Petroleum products total		252			252	461			461
7	Coal									
8	Natural gas		375			375	587			587
9	Fuels, n.e.c., total									
10	Other fuels, total		375			375	587			587
11	Electrical energy (Purchased only)		109			109	157			157
12	GRAND TOTAL		736			736	1,205			1,205

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-24 (Table 3b72)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies (Summary)

Process All Processes

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		201			201	342			342
2	Middle distillates		353			353	467			467
3	Residual fuel oil		901			901	1,198			1,198
4	Chemical feedstocks									
5	Gasoline		153			153	308			308
6	Petroleum products total		1,608			1,608	2,315			2,315
7	Coal									
8	Natural gas		3,935			3,935	5,321			5,321
9	Fuels, n.e.c., total									
10	Other fuels, total		3,935			3,935	5,321			5,321
11	Electrical energy (Purchased only)		1,201			1,201	1,830			1,830
12	GRAND TOTAL		6,744			6,744	9,466			9,466

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-25
(Table 3b)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 and 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies

Subprocess Metalworking

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total									
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)		210			210	360			360
12	GRAND TOTAL		210			210	360			360

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-26
(Table 4b/1a)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 and 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies

Subprocess Finishing Operations

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures									
2	Middle distillates		45			45	69			69
3	Residual fuel oil		117			117	176			176
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total		162			162	245			245
7	Coal									
8	Natural gas		488			488	735			735
9	Fuels, n.e.c., total									
10	Other fuels, total		488			488	735			735
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		650			650	980			980

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-27
(Table 4b/1b)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies

Subprocess In-plant Transportation

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		25			25	40			40
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline		25			25	40			40
6	Petroleum products total		50			50	80			80
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		50			50	80			80

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-28 (Table 4b/1c)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS) 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies

Subprocess Building

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures									
2	Middle distillates		52			52	61			61
3	Residual fuel oil		133			133	157			157
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total		185			185	218			218
7	Coal									
8	Natural gas		555			555	652			652
9	Fuels, n.e.c., total									
10	Other fuels, total		555			555	652			652
11	Electrical energy (Purchased only)		110			110	130			130
12	GRAND TOTAL		850			850	1,000			1,000

Source: A. T. Kearney, Inc. (Based on field tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-29
(Table 4b/1d)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH'S (MILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Truck and Bus Bodies (Summary)

Subprocess All Subprocesses

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		25			25	40			40
2	Middle distillates		97			97	130			130
3	Residual fuel oil		250			250	333			333
4	Chemical feedstocks									
5	Gasoline		25			25	40			40
6	Petroleum products total		397			397	543			543
7	Coal									
8	Natural gas		1,043			1,043	1,387			1,387
9	Fuels, n.e.c., total									
10	Other fuels, total		1,043			1,043	1,387			1,387
11	Electrical energy (Purchased only)		320			320	490			490
12	GRAND TOTAL		1,760			1,760	2,420			2,420

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-30 (Table 4b/1)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS) 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes

Subprocess Assembly

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total									
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)		5			5	10			10
12	GRAND TOTAL		5			5	10			10

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-31
(Table 4b/2a)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Home

Subprocess Subassembly Production

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		18			18	39			39
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total		18			18	39			39
7	Coal									
8	Natural gas		36			36	78			78
9	Fuels, n.e.c., total									
10	Other fuels, total		36			36	78			78
11	Electrical energy (Purchased only)		7			7	16			16
12	GRAND TOTAL		61			61	133			133

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-32
(Table 4b/2b)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes

Subprocess Delivery

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline		20			20	50			50
6	Petroleum products total		20			20	50			50
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		20			20	50			50

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-33 (Table 4b/2c)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS) 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes

Subprocess Building

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		16			16	21			21
2	Middle distillates		6			6	7			7
3	Residual fuel oil		14			14	18			18
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total		36			36	46			46
7	Coal									
8	Natural gas		74			74	94			94
9	Fuels, n.e.c., total									
10	Other fuels, total		74			74	94			94
11	Electrical energy (Purchased only)		20			20	20			20
12	GRAND TOTAL		130			130	160			160

Source: A. T. Kearney, Inc. (Based on field tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-34
(Table 4b/2d)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH'S (MILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

Process Motor Homes (Summary)

Subprocess All Subprocesses

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		34			34	60			60
2	Middle distillates		6			6	7			7
3	Residual fuel oil		14			14	18			18
4	Chemical feedstocks									
5	Gasoline		20			20	50			50
6	Petroleum products total		74			74	135			135
7	Coal									
8	Natural gas		110			110	172			172
9	Fuels, n.e.c., total									
10	Other fuels, total		110			110	172			172
11	Electrical energy (Purchased only)		32			32	46			46
12	GRAND TOTAL		216			216	353			353

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-35 (Table 4b/72)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH'S (MILLIONS), 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies (Summary)

Process All Processes

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		59			59	100			100
2	Middle distillates		103			103	137			137
3	Residual fuel oil		264			264	351			351
4	Chemical feedstocks									
5	Gasoline		45			45	90			90
6	Petroleum products total		471			471	678			678
7	Coal									
8	Natural gas		1,153			1,153	1,559			1,559
9	Fuels, n.e.c., total									
10	Other fuels, total		1,153			1,153	1,559			1,559
11	Electrical energy (Purchased only)		352			352	536			536
12	GRAND TOTAL		1,976			1,976	2,773			2,773

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-36 (Table 4b)

FEDERAL ENERGY OFFICE

INDUSTRY CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE - 1971, 1973, AND 1974

SIC 3713 Industry Truck and Bus Bodies

	Type of Energy or Material	Unit of Measure	Volume 1971	Volume 1973	Volume 1974	Bil. BTU's 1971	Bil. BTU's 1973	Bil. BTU's 1974	Percent Change 1971-73	Percent Change 1973-74	Percent of Total BTU's 1971	Percent of Total BTU's 1973
1	Propane, butane, and mixtures	1,000 barrels	50.2	85.1	58.7	201	342	235	70.1	(31.3)	3.0	3.6
2	Middle distillates	1.000 barrels	60.4	80.2	72.6	353	467	423	32.2	(9.4)	5.2	4.9
3	Residual fuel oil	1,000 barrels	143.3	190.5	172.6	901	1,198	1,085	33.0	(9.4)	13.4	12.7
4	Chemical feedstocks											
5	Gasoline	1,000 barrels	29.2	58.5	35.7	153	308	188	101.3	(39.0)	2.3	3.3
6	Petroleum products, total	1,000 barrels	283.1	414.3	339.6	1,608	2,315	1,931	44.0	(16.6)	23.8	24.5
7	Coal	1,000 s. tns.	(Z)	(Z)	(Z)	(Z)	(Z)	(Z)	—	—	—	—
8	Natural gas	billion cu. ft.	3.7	5.1	4.5	3,935	5,321	4,700	35.2	(11.7)	58.3	56.2
9	Fuels, n.e.c. total											
10	Other fuels, total	billion cu. ft.	3.7	5.1	4.5	3,935	5,321	4,700	35.2	(11.7)	58.3	56.2
11	Electrical energy (purchased only)	million KWH	352	536	461	1,201	1,830	1,573	52.4	(14.0)	17.8	19.3
12	GRAND TOTAL		(X)	(X)	(X)	6,744	9,466	8,204	40.4	(13.3)	100.0	100.0

Source: A. T. Kearney, Inc. (Based on field tested theoretical process energy calculations. Field test included data from eight SIC 3713 manufacturers.)

EXHIBIT V-37
(Table 5b)

FEDERAL ENERGY OFFICE

SHIPMENTS, EMPLOYMENT, AND FUELS AND ENERGY CONSUMED BY GEOGRAPHIC UNIT, 1971 AND 1973

SIC 3713 Industry Truck and Bus Bodies

	Geographic Unit	Value of Shipments ($000,000) 1971	1973	Percent Change	Employment (000) 1971	1973	Percent Change	Fuels and Energy (Bil. BTU's) 1971	1973	Percent Change
1	United States	1,031.7	1,837.6	78.1	34.1	48.7	39.9	6,744	9,466	40.4
2	NORTH EAST	106.3	189.3	78.1	4.1	5.9	43.9	823	1,134	37.8
3	New England	15.5	27.6	78.1	0.6	0.9	50.0	120	165	37.5
4	Maine (a)	5.2	9.2	76.9	0.2	0.3	50.0	42	58	38.1
5	N.H. (a)	-	-	-	-	-	-	-	-	-
6	Vermont (a)	-	-	-	-	-	-	-	-	-
7	Mass.	10.3	18.4	78.6	0.4	0.5	25.0	78	107	37.2
8	R.I. (a)	-	-	-	-	-	-	-	-	-
9	Conn. (a)	-	-	-	-	-	-	-	-	-
10	Middle Atlantic	90.8	161.7	78.1	3.5	5.0	42.9	703	969	37.8
11	N.Y. (b)	40.2	71.7	78.4	1.5	2.2	46.7	304	421	38.5
12	N.J. (b)	-	-	-	-	-	-	-	-	-
13	Penn.	50.6	90.0	77.9	2.0	2.8	40.0	398	549	37.9
14	NORTH CENTRAL	531.3	946.4	78.1	17.5	25.0	42.9	3,465	4,862	40.3
15	E. North Central	377.6	672.6	78.1	13.6	19.4	42.6	2,701	3,754	39.0
16	Ohio	149.6	266.4	78.1	5.8	8.3	43.1	1,163	1,604	37.9
17	Ind.	99.0	176.4	78.2	3.1	4.4	41.9	602	851	41.4
18	Ill.	40.2	71.7	78.4	1.6	2.3	43.8	318	438	37.7
19	Mich.	42.3	75.3	78.0	1.3	1.8	38.5	244	349	43.0
20	Wisc.	46.4	82.7	78.2	1.9	2.7	42.1	372	512	37.6

SHIPMENTS, EMPLOYMENT, AND FUELS AND ENERGY CONSUMED BY GEOGRAPHIC UNIT, 1971 AND 1973

	Geographic Unit	Value of Shipments ($000,000)			Employment (000)			Fuels and Energy (Bil. BTU's)		
		1971	1973	Percent Change	1971	1973	Percent Change	1971	1973	Percent Change
21	W. North Central	153.7	273.8	78.1	3.9	5.6	43.6	763	1,109	45.3
22	Minn.	11.4	20.2	77.2	0.4	0.5	25.0	81	112	38.3
23	Iowa	101.1	180.1	78.1	1.9	2.7	42.1	359	552	57.7
24	Mis.	37.1	66.2	78.4	1.5	2.1	40.0	294	405	37.8
25	N.D.	Z	Z		Z	Z		Z	Z	
26	S.D.	Z	Z		Z	Z		Z	Z	
27	Neb.	Z	Z		Z	Z		Z	Z	
28	Kans.	4.1	7.4	80.5	0.1	0.2	50.0	22	32	45.5
29	SOUTH	229.0	408.0	78.2	8.0	11.4	42.5	1,597	2,226	39.4
30	S. Atlantic	103.2	183.8	78.1	3.8	5.4	42.1	750	1,040	38.7
31	Del.	Z	Z		Z	Z		Z	Z	
32	Md.	5.2	9.2	76.9	0.2	0.3	50.0	42	58	38.1
33	D.C.	Z	Z		Z	Z		Z	Z	
34	Va.	17.5	31.2	78.3	0.7	1.0	42.9	138	190	37.7
35	W. Va.	Z	Z		Z	Z		Z	Z	
36	N.C.	32.0	57.0	78.1	1.3	1.8	38.5	258	355	37.6
37	S.C.	Z	Z		Z	Z		Z	Z	
38	Ga.	37.1	66.2	78.4	1.4	1.9	35.7	271	377	39.1
39	Fla.	10.3	18.4	78.6	0.2	0.3	50.0	39	60	53.8
40	S. Central	125.9	224.2	78.1	4.3	6.1	41.9	848	1,186	39.9
41	Ky.	Z	Z		Z	Z		Z	Z	
42	Tenn.(c)	47.5	84.5	77.9	1.7	2.4	41.1	337	469	39.2
43	Ala.	15.5	27.6	78.1	0.6	0.8	33.3	116	161	38.8
44	Miss.(c)	-	-	-	-	-	-	-	-	-
45	Ark.	17.5	31.2	78.3	0.7	1.0	42.9	138	190	37.7
46	La.	Z	Z		Z	Z		Z	Z	
47	Okla.	2.1	3.7	76.2	0.1	0.2	50.0	22	32	45.5
48	Texas	42.3	75.3	78.0	1.2	1.7	41.7	233	335	43.8

SHIPMENTS, EMPLOYMENT, AND FUELS AND ENERGY CONSUMED BY GEOGRAPHIC UNIT, 1971 AND 1973

	Geographic Unit	Value of Shipments ($000,000)			Employment (000)			Fuels and Energy (Bil. BTU's)		
		1971	1973	Percent Change	1971	1973	Percent Change	1971	1973	Percent Change
49	WEST	168.2	299.5	78.1	4.5	6.5	44.4	883	1,274	44.3
50	Mountain	15.5	27.6	78.1	0.3	0.5	66.7	69	103	49.3
51	Mont.(d)	15.5	27.6	78.1	0.3	0.5	66.7	69	103	49.3
52	Idaho(d)	-	-	-	-	-	-	-	-	-
53	Wyo.(d)	-	-	-	-	-	-	-	-	-
54	Colo.(d)	-	-	-	-	-	-	-	-	-
55	N.M.(d)	-	-	-	-	-	-	-	-	-
56	Ariz.(d)	-	-	-	-	-	-	-	-	-
57	Utah(d)	-	-	-	-	-	-	-	-	-
58	Nev.(d)	-	-	-	-	-	-	-	-	-
59	Pacific	153.0	272.0	77.8	4.2	6.0	42.9	814	1,171	43.9
60	Wash.	6.2	11.0	77.4	0.2	0.3	50.0	45	63	40.0
61	Ore.	9.3	16.5	77.4	0.3	0.5	66.7	66	93	40.9
62	Cal.	137.2	244.4	78.1	3.6	5.2	44.4	703	1,017	44.7
63	Alas.	Z	Z		Z	Z		Z	Z	
64	Haw.	Z	Z		Z	Z		Z	Z	

Notes: a,b,c,d - Data for states marked with these letters withheld to avoid disclosing figures for individual companies. Data for each state noted with a,b,c,or d, is included in state first noted with that respective letter.

Source: A. T. Kearney, Inc. (Geographic distribution based fundamentally on manufacturing activity by state. Index of state manufacturing activity for motor homes based on Recreational Vehicle Institute production data by state. Index of state manufacturing activity for truck and bus bodies based on 1967 Census employment by state.)

FEDERAL ENERGY COMMISSION

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, (1971)

SIC 3713 Industry Truck and Bus Bodies Year 1971

	Geographic Unit	Petroleum Products						Other Fuels				Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
		Propane Butane, and Mixtures (Thousand Barrels)	Distillates (Thousand Barrels)	Residual (Thousand Barrels)	Feedstocks (Thousand Barrels)	Gasoline (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total Billion BTU's)		
1	United States	50.2	60.4	143.3		29.2	1,608	(Z)	3.70		3,935	1,201	6,744
2	NORTH EAST	3.4	7.8	18.4		2.4	187		0.50		487	149	823
3	New England	0.4	1.1	2.7		0.3	27		0.08		71	22	120
4	Maine (a)	0.1	0.4	0.9		0.1	9		0.03		25	8	42
5	N. H. (a)	-	-	-		-	-		-		-	-	-
6	Vermont (a)	-	-	-		-	-		-		-	-	-
7	Mass.	0.3	0.7	1.8		0.2	18		0.05		46	14	78
8	R.I. (a)	-	-	-		-	-		-		-	-	-
9	Conn (a)	-	-	-		-	-		-		-	-	-
10	Middle Atlantic	3.0	6.7	15.7		2.1	160		0.41		416	128	703
11	N.Y. (b)	1.4	2.8	6.7		1.0	69		0.17		179	55	304
12	N.J. (b)	-	-	-		-	-		-		-	-	-
13	Penn.	1.6	3.8	9.0		1.1	91		0.24		236	73	399
14	NORTH CENTRAL	25.9	31.0	73.5		15.0	826		1.90		2,021	617	3,464
15	E. North Central	15	24.8	59.1		9.6	625		1.50		1,587	486	2,701
16	Ohio	4.7	11.0	26.1		3.4	265		0.70		688	210	1,164
17	Ind.	5.4	5.2	12.4		3.0	144		0.30		349	107	602
18	Ill.	1.1	3.0	7.2		0.9	72		0.20		189	58	318
19	Mich.	2.5	2.1	5.0		1.3	61		0.10		140	43	244
20	Wisc.	1.3	3.5	8.4		1.0	84		0.20		221	68	372

EXHIBIT V-39
(Table 6b)
Page 1 of 3

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, (1971)

		Petroleum Products						Other Fuels					
	Geographic Unit	Propane Butane, and Mixtures (Thousand Barrels)	Distil- lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed- stocks (Thousand Barrels)	Gasoline (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
21	W. North Central	10.9	6.2	14.4		5.4	181		0.40		432	131	763
22	Minn.	0.4	0.8	1.8		0.2	19		0.05		47	14	81
23	Iowa	9.2	1.4	5.5		4.2	107		0.19		196	59	359
24	Mis.	1.0	2.8	6.7		0.8	66		0.17		175	54	294
25	N.D.												
26	S.D.												
27	Neb.												
28	Kans.	0.3	0.2	0.4		0.1	6		0.01		13	4	22
29	SOUTH	10	14.6	34.7		6.0	374		0.91		937	287	1,598
30	S. Atlantic	3.9	7.0	16.5		2.5	173		0.42		442	135	750
31	Del.												
32	Md.	0.2	0.4	0.9		0.1	9		0.02		25	8	42
33	D.C.												
34	Va.	0.5	1.3	3.3		0.4	31		0.08		82	25	138
35	W. Va.												
36	N.C.	0.9	2.5	6.0		0.7	58		0.15		153	47	258
37	S.C.												
38	Ga.	1.4	2.5	5.9		1.2	62		0.15		160	49	271
39	Fla.	0.9	0.3	0.6		0.2	12		0.02		22	6	40
40	S. Central	5.8	7.7	18.2		3.5	201		0.48		495	152	848
41	Ky.												
42	Tenn.(c)	1.4	3.1	7.4		1.2	79		0.19		198	61	338
43	Ala.	0.8	1.2	2.6		0.3	27		0.06		68	21	116
44	Miss.(c)	-	-	-		-	-		-			-	-
45	Ark.	1.0	1.3	3.2		0.4	32		0.08		82	25	139
46	La.												
47	Okla.	0.1	0.2	0.4		0.1	5		0.01		13	4	22
48	Texas	1.8	2.0	4.5		1.4	58		0.12		134	41	233

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, (1971)

		Petroleum Products						Other Fuels					
	Geographic Unit	Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Gasoline (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion (BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
49	WEST	11.2	7.3	17.1		5.8	226		0.49		504	153	883
50	Mountain	1.1	0.5	1.2		0.6	19		0.04		39	12	70
51	Mont.(d)	1.1	0.5	1.2		0.6	19		0.04		39	12	70
52	Idaho (d)	-	-	-		-	-		-		-	-	-
53	Wyo.(d)	-	-	-		-	-		-		-	-	-
54	Colo.(d)	-	-	-		-	-		-		-	-	-
55	N.M.(d)	-	-	-		-	-		-		-	-	-
56	Ariz.(d)	-	-	-		-	-		-		-	-	-
57	Utah(d)	-	-	-		-	-		-		-	-	-
58	Nev.(d)	-	-	-		-	-		-		-	-	-
59	Pacific	1.0	6.8	16.0		5.2	207		0.45		465	141	813
60	Wash.	0.3	0.4	1.0		0.2	11		0.03		27	9	47
61	Ore.	0.4	0.6	1.5		0.3	15		0.03		39	12	66
62	Cal.	9.4	5.7	13.0		4.8	182		0.39		400	120	702
63	Alas.												
64	Haw.												

Notes: a,b,c,d - Data for states marked with these letters withheld to avoid disclosing figures for individual companies. Data for each state noted with a,b,c, or d, is included in state first noted with that respective letter.

Source: A. T. Kearney, Inc. (Geographic distribution based fundamentally on manufacturing activity by state. Index of state manufacturing activity for motor homes based on Recreational Vehicle Institute production data by state. Index of state manufacturing activity for truck and bus bodies on 1967 Census employment by state.)

FEDERAL ENERGY OFFICE

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, (1973)

SIC 3713 Industry Truck and Bus Bodies Year 1973

	Geographic Unit	Petroleum Products						Other Fuels				Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
		Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Other (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total Billion BTU's)		
1	United States	85.1	80.2	190.5		58.5	2,315	(Z)	5.10		5,321	1,830	9,466
2	NORTH EAST	5.4	10.4	24.6		4.0	257		0.61		630	229	1,116
3	New England	0.7	1.5	3.6		0.5	37		0.09		93	33	163
4	Maine (a)	0.2	0.5	1.3		0.2	13		0.03		33	11	57
5	N. H.(a)	-	-	-		-	-		-		-	-	-
6	Vermont (a)	-	-	-		-	-		-		-	-	-
7	Mass. (a)	0.5	1.0	2.3		0.3	24		0.06		60	21	106
8	R.I. (a)	-	-	-		-	-		-		-	-	-
9	Conn.	-	-	-		-	-		-		-	-	-
10	Middle Atlantic	4.7	8.9	21		3.5	220		0.52		537	196	953
11	N.Y. (b)	2.4	3.8	9.1		1.7	97		0.23		227	84	408
12	N.J. (b)	-	-	-		-	-		-		-	-	-
13	Penn.	2.3	5.1	11.9		1.8	123		0.30		309	112	544
14	NORTH CENTRAL	43.9	41.1	116.1		30.2	1,290		2.61		2,694	940	4,924
15	E. North Central	25.1	32.9	78.7		17.8	882		2.02		2,085	742	3,709
16	Ohio	7.6	14.6	34.7		5.7	364		0.91		939	324	1,627
17	Ind.	9.2	7.0	16.6		6.2	215		0.47		485	162	862
18	Ill.	1.8	4.0	9.6		1.4	98		0.20		206	89	393
19	Mich.	4.3	2.8	6.6		2.9	90		0.14		144	65	299
20	Wisc.	2.1	4.5	11.2		1.6	115		0.30		310	104	529

	Geographic Unit	Petroleum Products: Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Other (Thousand Barrels)	Total (Billion BTU's)	Other Fuels: Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
21	W. North Central	18.8	8.3	19.1		13	308		0.59		609	198	1,115
22	Minn.	0.6	1.1	2.3		0.4	26		0.06		62	23	111
23	Iowa	16.1	3.0	7.1		10.4	181		0.28		289	85	555
24	Mis.	1.7	3.7	8.9		1.3	91		0.22		227	82	400
25	N.D.												
26	S.D.												
27	Neb.												
28	Kans.	0.4	0.3	0.6		0.3	9		0.03		31	6	46
29	SOUTH	16.3	19.4	46.1		6.9	529		1.20		1,238	437	2,204
30	S. Atlantic	6.4	9.3	22		4.6	243		0.57		588	206	1,037
31	Del.												
32	Md.	0.2	0.5	1.3		0.2	13		0.03		32	12	57
33	D.C.												
34	Va.	0.8	1.8	4.2		0.6	43		0.10		104	38	185
35	W. Va.												
36	N.C.	1.5	3.3	7.8		1.1	80		0.19		198	72	350
37	S.C.												
38	Ga.	2.4	3.4	8.0		1.7	88		0.20		206	75	369
39	Fla.	1.6	0.3	0.8		1.0	20		0.03		32	9	61
40	S. Central	9.9	10.1	24.1		6.8	286		0.63		650	231	1,167
41	Ky. (c)	-	-	-		-	-		-		-	-	-
42	Tenn.	3.1	4.1	9.9		2.2	110		0.25		259	93	462
43	Ala.	0.8	1.4	3.4		0.6	36		0.09		94	33	163
44	Miss.	-	-	-		-	-		-		-	-	-
45	Ark.	0.8	1.8	4.2		0.6	43		0.10		104	38	185
46	La.												
47	Okla.	0.4	0.2	0.5		0.3	9		0.01		11	6	26
48	Texas	4.7	2.6	6.1		3.1	89		0.17		176	61	326

	Geographic Unit	Petroleum Products: Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Other (Thousand Barrels)	Total (Billion BTU's)	Other Fuels: Coal (Thousand Short tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion (BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
49	WEST	19.5	9.6	22.7		12.9	345		0.69		712	231	1288
50	Mountain	2.1	0.7	1.7		1.4	30		0.05		52	18	100
51	Mont. (d)	2.1	0.7	1.7		1.4	30		0.05		52	18	100
52	Idaho (d)	-	-	-		-	-		-		-	-	-
53	Wyo. (d)	-	-	-		-	-		-		-	-	-
54	Colo. (d)	-	-	-		-	-		-		-	-	-
55	N.M. (d)	-	-	-		-	-		-		-	-	-
56	Ariz. (d)	-	-	-		-	-		-		-	-	-
57	Utah (d)	-	-	-		-	-		-		-	-	-
58	Nev. (d)	-	-	-		-	-		-		-	-	-
59	Pacific	17.5	8.9	21.0		11.5	315		0.63		658	213	1186
60	Wash.	0.4	0.6	1.3		0.3	15		0.03		32	13	60
61	Ore.	0.7	0.8	1.9		0.6	22		0.04		43	18	83
62	Cal.	16.7	7.6	17.9		10.6	278		0.55		577	183	1038
63	Alas.												
64	Haw.												

Notes: a,b,c,d - Data for states marked with these letters withheld to avoid disclosing figures for individual companies. Data for each state noted with a,b,c, or d, is included in state first noted with that respective letter.

(Z) Negligible.

Sources: A. T. Kearney, Inc. (Geographic distribution based fundamentally on manufacturing activity by state. Index of state manufacturing activity for motor homes based on Recreational Vehicle Institute production data by state. Index of state manufacturing activity for truck and bus bodies on 1967 Census employment by state.)

FEDERAL ENERGY OFFICE

STOCKS OF FUELS AND PETROLEUM PRODUCTS BY TYPE, 12/31/73 AND 3/31/74

SIC 3713 Industry Truck and Bus Bodies

	Types of Fuel or Material	Stocks (number of days supply related to average daily requirements in next quarter)					
		As of December 31			As of March 31		
		1971	1972	1973	1972	1973	1974
1	Propane						
2	Butane						
3	Propane Butane Mixture	5 - 30	1 - 30	5 - 30	5 - 30	5 - 30	5 - 30
4	Middle Distillates	10	10	10	10	10	10
5	Residual Fuel Oil	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
6	Chemical Feedstocks						
7	Gasoline	8 - 10	8 - 10	8 - 10	8 - 10	8 - 10	8 - 10
8	Coal						
9	Natural Gas	(X)	(X)	(X)	(X)	(X)	(X)
10	Fuels, nec. total						

Source: A. T. Kearney, Inc. (Based on field survey of eight manufacturers.)

EXHIBIT V-41
(Table 9b)

FEDERAL ENERGY OFFICE

SEASONAL USE OF FUELS, PETROLEUM PRODUCTS AND ENERGY BY TYPE, 1973

SIC 3713 Industry Truck and Bus Bodies

Type of Material or Energy	Percent of Annual Use in 1973 in:			
	January-March	April-June	July-September	October-December
Propane, Butane and mixtures	29	24	21	26
Distillates	35	22	15	28
Residual	35	22	15	28
Feedstocks				
Gasoline	25	25	25	25
Coal				
Natural Gas	34	23	16	27
Other Fuels				
Electrical Energy (Purchased only)	25	25	25	25

Source: A. T. Kearney, Inc. (Production assured constant by quarter. Heating requirements for number through fall quarters assumed to be 45, 20, 5 and 35 percent, respectively.)

EXHIBIT V-42
(Table 12b)

FEDERAL ENERGY OFFICE

SOURCES OF SUPPLY FOR FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, 1973

SIC 3713 Industry Truck and Bus Bodies

	Source of Supplies	Percent of 1973 Consumption Supplied								
		Propane, Butane, and Mixtures	Distil-lates	Resi-dual	Feed Stocks	Other Petro-leum Products	Coal	Natural Gas	Other Fuels	Elec-trical Energy
1	Captive Production									
2	Purchased from:									
3	Refineries									
4	Other Manufacturers									
5	Wholesalers	45	45	45		45				
6	Importers									
7	Retailers	55	55	55		55				
8	Utilities							100		100
9	Other Sources									
	TOTAL	100	100	100	100	100	100	100	100	100
	Unit of Measure used to compute percent	KWH	KWH	KWH	KWH	KWH	KWH	KWH	KWH	KWH

Source: A. T. Kearney, Inc. (Based on field survey of eight manufacturers. Assumes that plants employing over 250 buy wholesale plants under 250 employment buy retail.)

EXHIBIT V-43 (Table IIb)

FEDERAL ENERGY OFFICE

CAPTIVE PRODUCTION, CONSUMPTION, AND SALES OF FUELS, ENERGY, AND PETROLEUM PRODUCTS, 1973

SIC 3713 Industry Truck and Bus Bodies

Type of Energy or Material	Volume				Mil. BTU's			KWH Equivalents			Value of Sales ($000)
	Unit of Measure	Produced	Consumed	Sold	Produced	Consumed	Sold	Produced	Consumed	Sold	
NONE											

Source: A. T. Kearney, Inc. (Based on field survey of eight manufacturers.)

EXHIBIT V-44
(Table 10b)

VI - MOTOR VEHICLE PARTS AND ACCESSORIES (SIC 3714)

INDUSTRY STRUCTURE

The industry segment covered by this section of the study is SIC 3714, which is defined as including establishments primarily engaged in manufacturing motor vehicle parts and accessories, but not engaged in manufacturing complete motor vehicles or passenger car bodies. A list of the products produced by this industry group is given in Exhibit VI-1. Sixty-two subassembly product groups are listed. In actuality, however, there are thousands of individual components included in these subassemblies, ranging in size from fractional ounce fasteners to half ton iron castings, and in complexity from piston pins to hypoid gears.

This portion of the industry represents the manufacturing portion, in which raw materials are transformed to finished components by every process of manufacturing. This is evident when the relationships which define the position of this segment in the total industry are analyzed. The statistics relating to this industry group are given in Exhibit VI-2. By comparison with the entire industry, as previously given in Exhibit III-2, the relationships as given in Table VI-1, on the following page, are developed.

Table VI-1

Parts and Accessories Position in Motor Vehicle Industry, 1972

Critiera	Percent of Total Motor Vehicle Industry
Value of Shipments	29.1
Value Added	41.1
Cost of Materials	22.6
Fixed Assets	57.3
Employment	49.7
Establishments	62.9

Source: 1972 Census of Manufactures

This industry segment includes a high percentage of the value added by manufacturing, fixed assets, employment, and number of establishments, while representing a low percentage of value of shipments and cost of materials. The establishments in this group include foundries, forge shops, machine shops, metal finishing shops, and fabricating shops. The nature of the industry as defined by product mix, company size, operating data, production systems, competition, nature of the market, and projected growth, is given in the following paragraphs.

(a) Products

The major subassemblies which are provided by the parts and components industry are defined in Exhibit VI-3. The quantities provided, and value of shipments of 30 product groups are given for 1967 and 1972. Some of the major groups include gasoline engines, transmissions, differentials, frames, and brake and drum assemblies. However, as previously noted, these subassemblies are composed of thousands of individual components, many of which are produced by companies within the Industry, while others come from firms in other industrial groups. It is of further interest to note that many major components used in motor vehicles are produced almost entirely by companies in other industry groups. These include such items as tires, batteries, radios, air conditioners, gauges, and windows. The magnitude of these shipments into the industry becomes evident when it is noted that 72 percent of the value of shipments of motor vehicles is in purchased material, while only 52 percent of value of shipments of parts and accessories is in purchased material. The high value of purchased materials in assembled vehicles includes components purchased from outside the industry.

(b) Operating Data

Operating statistics for the industry group are given in Exhibit VI-2, and summarized in the following table:

Table VI-2

SIC 3714 - Operating Data
1967 - 1972

	1967	1972	Percent Change
Value of Shipments (Millions)	$11,623.8	$18,285.4	56.7%
Value Added (Millions)	5,712.0	9,146.9	60.0
Cost of Materials (Millions)	5,943.1	9,313.3	57.0
No. of Establishments	1,674.0	2,083.0	25.0
Employment (Thousands)	364.9	40.10	10.0
Value Added/Value of Shipments	.48	.50	0.02
Payroll/Value Added	.51	.50	(0.01)

Source: 1972 Census of Manufactures

This portion of the industry is farily representative of the entire industry with regard to growth from 1967 to 1972, although the value added represents a much higher percentage of value of shipments indicating again the higher percentage of components purchased from outside the industry for assembly of motor vehicles. Average employment in the industry was 193 per establishment in 1972, down from the average of 218 per establishment in 1967.

An analysis of financial statements of 135 companies in the Motor Vehicle Parts and Accessories Industry, representing more than $2 billion in sales in 1972, or 11 percent of the total industry, indicated an average net profit before taxes of 7.5 percent of sales, with the smaller establishments averaging 4.0 percent, and the larger establishments 7.7 percent. These figures put these companies above the motor vehicles manufacturers, and near the average for all manufacturers.

(c) Size and Distribution of Establishments

The distribution of size of establishments by number of employees is given in Exhibit VI-4. These figures are from the 1967 Census of Manufactures, and have not yet been published for the 1972 Census. Note was previously made that average number of employees has dropped about 13 percent from 1967 to 1972, while the number of firms increased 25 percent. Distribution by size groups is summarized in the table on the following page.

Table VI-3

SIC 3714 - Distribution of Establishments by Size - 1967

	Under 100 Employees	100 - 500 Employees	500 - 1,000 Employees	Over 1,000 Employees
Percent of Establishments	78	14	3	5
Percent of Employees	6	15	10	69
Percent of Value of Shipments	5	12	9	74

Although composed of many small companies, only 8 percent of the establishments have more than 500 employees each, but account for 79 percent of the total employment, and 83 percent of total value of shipments.

Establishments in this industry group are located in 38 states. The principal concentration, however, is in the states bordering on the Great Lakes, as shown on Exhibit VI-5. These states, Michigan, Ohio, Indiana, Illinois and Wisconsin, accounted for 25 percent of all establishments, with Michigan alone accounting for 281, or 13.5 percent in 1972. This is a drop in concentration from 1967, when 39 percent of the establishments were in the Great Lakes States, and 15.5 percent were in Michigan. The concentration is more evident when employment and value of shipments are compared with the Great Lakes States accounting for 74 percent of value of shipments. Michigan alone accounts for 37 percent of total employment, and 43 percent of value of shipments. The next closest states are Ohio and Indiana, with 20 percent and 11 percent respectively of value of shipments. Thus, a concentration of the industry representing three quarters of the total value of shipments is in three adjoining states.

(d) Production Systems

The more than 2,000 establishments included in SIC 3714, cover almost every type of manufacturing operation. The principal types of plants which are represented are given in Exhibit VI-6, and are summarized below:

Foundries

Ferrous, nonferrous, sand, die

Forge Shops

Presses, hammers, upsetters

Machine Shops

Turning, milling, drilling, shaping, grinding, screw machines

Press Shops

Forming, stamping, blanking

Fabricating Shops

Platework, structural work, welding

Finishing Shops

Heat treating, electroplating, painting, polishing, galvanizing

Assembly Shops

Plastics Molding Shops

The operations which account for the greatest amount of activity include machine shops, tool and die shops and screw machine shops, and account for 37 percent of the total employment, assembly shops which account for 38 percent, and stamping, blanking and forming shops which account for 12 percent. In most cases, the shops are not entirely concerned with a single type of operation, but perform groups of related operations to produce complete parts or subassemblies. For example, an engine plant may have a foundry, machine shop, heat treating shop, forge shop and assembly shop, all of which work as a group to produce complete engine assemblies. Similarly a transmission plant may have a foundry, machine shop, heat treating shop and assembly shop; a wheel plant will have a stamping and forming shop, a roll forming shop, a metal finishing facility, and an assembly and welding facility.

All of the large automobile and truck producers have plants which produce parts and accessories. However, the majority of the establishments in this industry group are independent producers who supply parts and accessories to the original equipment manufacturers, and also produce replacement parts. Some of these independent shops are large, multi-process establishments, similar in operation, size and process to those owned by automotive producers. However, the majority of the independent establishments, as shown in Exhibit VI-4, are small shops, producing a limited range of products, and with relatively few production processes. These shops will typically produce components such as bearings, springs, filters, wheels, brake drums, fasteners, handles, and others of the thousands of components which make up a typical motor vehicle.

Because of the impossibility of analyzing the production processes and energy consumption of each of these thousands of components, or even of the fewer numbers of major subassemblies and parts used in motor vehicles, the analysis instead has been confined to the basic production processes which are used for all component manufacturing. These were defined in Section I, and are repeated here as follows:

Casting
Forging
Heat Treating
Welding
Machining
Press Work
Electroplating
Painting
Assembly

These processes are the principal ones which in various combinations are used to produce almost all motor vehicle components.

The principal materials which are consumed by the Motor Vehicle Parts and Accessories Industry are shown on Exhibit VI-7, for the years 1967 and 1972, as reported by the Census of Manufactures. Almost $9 billion of these materials were consumed in 1972, or 96 percent of the total materials, fuels, and miscellaneous purchased items by the entire industry. Most of the materials, particularly the metallic materials, require processing by the various means described on page VI-7, and are the principal consumers of energy used in motor vehicle production.

(c) Industry Growth and Trends

This portion of the industry is directly related to motor vehicles production, and as a consequence tends to follow the growth patterns of the automobile and truck industries. The only part of the parts and accessories industry group which does not follow this trend is the replacement parts segment. Since business for this segment is dependent on number of vehicles in use, rather than number being produced in any year, it has tended to be a steadily growing part of the industry.

The presence of many independent producers results in some wide swings in production for these companies in times of reduced and of peak automotive demand. This is caused by the tendency of automotive producers to first curtail their orders to suppliers at times of low demand, tending to produce a higher portion of their requirements in their captive operations.

Exhibit VI-12 (Table 1c) covers proportion of industry output accounted for by each major process in 1973, and is found at the end of the Motor Vehicles Parts and Accessories section of this study.

ENERGY USE

Energy consumption for 1967 and 1971 was reported in the Census of Manufactures, and is given in Exhibit VI-8. These figures are summarized in the following table.

Table VI-4

Energy Consumption
Motor Vehicle Parts and Accessories

	1967	1971
Total Fuels - Million KWH Equiv.	24,994	27,800
Total Electric Power - Million KWH	6,734	8,120*
Total Energy - Million KWH Equiv.	31,728	35,920*
Percentage of Total Motor Vehicles Industry:		
Energy Consumption	46.5	49.3
Value Added by Manufacture	41.8	39.5
Value of Shipments	29.4	28.1

*Estimated

Source: Census of Manufactures, 1967, 1971 [71]

The Motor Vehicles Parts and Accessories Industry (SIC 3714), and the Motor Vehicles and Bodies Industry (SIC 3711,12), together accounted for 96 percent of the total Motor Vehicles Industry energy consumption, with the two industry groups being roughly equal. However, the parts and accessories group accounted for only about 28 - 29 percent of the value of shipments, as compared with 68 - 69 percent for the motor vehicles group, indicating the proportionately higher use of energy for parts manufacturing.

It was previously reported in Section III that the entire Motor Vehicles Industry is not a heavy consumer of energy for manufacturing, with only about 0.5 percent of value of shipments representing energy costs. For the parts and accessories industry group, the energy costs represent about 1 percent of the value of shipments, which although double the rate for the entire industry, is still a very small percentage.

The extreme complexity and diversity of the parts and accessories portion of the Motor Vehicles Industry has made analysis of energy consumption by product almost impossible within the time and budget constraints of this study. The products list shown in Exhibit VI-3 provides evidence of this, in that 24 percent of the total value of shipments in 1972 were accounted for by two product groups, gasoline engines and transmissions; 18 percent was accounted for by 25 other product groups which were identified, with each providing from 0.6 to 3.0 percent of the total value; and with 58 percent of the value of shipments covered by the category, "all other parts and accessories." Engine and transmission manufacturing is largely done by the principal motor vehicles manufacturers, and the energy usage for these plants was lumped in with total reported energy use by these companies. Energy consumption for other types of manufacturing was collected from the various manufacturers who were visited during the study, but represented only a small and diversified portion of the total.

(a) Energy Estimation Methodology

In terms of energy consumption per unit of motor vehicle production, the portion which was accounted for by the parts and accessories segment of the industry can be expressed as shown in the table on the following page.

Table VI-5

Energy Consumption Per Motor Vehicle
Parts and Accessories

	1967	1971
Total Motor Vehicle Production	8,976,226	10,637,738
Energy Consumed for Parts and Accessories(SIC 3714)	31,728 Million KWH	35,920 Million KWH
Average Energy Per Motor Vehicle* for Parts and Accessories(SIC 3714)	3,530 KWH	3,380 KWH
Percent of Total Energy Consumption Reported for Motor Vehicles Ind.	46.5 %	49.3 %

Source: 1967 and 1971 Census of Manufactures
A. T. Kearney, Inc.

Of the total reported energy consumption, 79 percent and 77.5 were for fuels in 1967 and 1971 respectively, and 21 percent and 22.5 percent respectively for purchased electric power.

Estimates of energy consumption for production of parts and accessories are also given in Exhibit VI-8, for 1972, 1973 and 1974. Since the energy consumption for these years has not been accumulated by census reports and is not available in total from industry sources, it was necessary to estimate the consumption based on methodology as explained below.

Data for total production of motor vehicles, and value of shipments for the entire industry, was reported in Exhibit III-2. We have assumed that the proportion of this production for parts and accessories remained relatively constant in 1973 and 1974.

*Includes only energy reported for SIC 7414. A large part of energy consumption is for components produced by companies in other SIC industry groups.

as shown in Exhibit VI-2. We have also assumed that the percentage of value of shipments which represented cost of energy consumed, also remained relatively constant, at about 0.95 percent. The distribution between energy used for fuel and energy used for electric power was also assumed to be relatively constant, with about 77 percent of energy units representing fuels, and 23 percent representing electric power.

The types and quantities of fuels which were reported to be used for production of parts and accessories were given in the 1967 and 1972 Census of Manufactures reports on energy consumption, and are repeated in Exhibit VI-9, expressed in terms of energy equivalents and in percents of totals for each form of energy. The 1973 estimates were based on projections of total energy use from 1971 data and for 1973 production of vehicles. The distribution of use of fuels in 1973 was based on an analysis of reported energy consumption by the five largest vehicle manufacturers, representing about 80 percent of total industry energy use.

(b) Energy Consuming Processes

The Motor Vehicle Parts and Accessories Industry group in a sense represents the manufacturing segment of the Motor Vehicles Industry, while the other industry groups are primarily engaged in assembly and finishing of component parts and subassemblies. Almost all manufacturing processes which are in use for metalworking operations, and many also used for nonmetal operations, are utilized for production of parts and accessories for motor vehicles. Since all of these processes use fuels and/or electric power, they can all be considered energy consuming processes. A list of the principal processes and subprocesses used in production of parts and accessories is given in Exhibit VI-10, together with the types of energy used and the products from each process.

Approximately 70 percent of the energy used in this industry group is consumed in the various production processes. The balance of the energy is used for building heating, lighting and air conditioning, and for in-plant transportation and material handling. Building heating in the older plants generally utilizes steam generated in coal, oil or gas fired boilers. This steam, when available, is also used for process heating in the washing and metal-finishing operations. The newer plants, and many of the smaller plants, do not have boiler houses, and utilize gas fired space heaters for plant heating. In-plant transportation involves use of vehicles such as fork lift trucks, tractors, and pick-up trucks. Fuel fired vehicles use gasoline or propane, while battery operated vehicles use electric power for battery charging.

Another use of petroleum based products, not commonly reported in energy reports in the Census of Manufactures, involves use of coolants, cutting oils, lubricants, greases and solvents which are used in the various manufacturing processes. While small in total quantity, by comparison with energy used directly in the manufacturing processes, it is nevertheless an important use of petroleum products.

The final area of use of petroleum based products is in the plastics and synthetics used in motor vehicle parts and accessories. With only a few exceptions, the basic raw materials for plastics are not produced directly by the establishments in the Motor Vehicles Industry. Instead they are purchased from companies in the industrial chemicals and plastics industries. In any event, however, the end usage of plastics and synthetics in motor vehicles production is both important and growing.

(c) Energy Consumption By Process

An analysis of the 100 or more plants operated by the 14 companies which were visited in the Motor Vehicles and Parts and Accessories Industries during this study, revealed some commonality in products and processes produced, but a wide variation in types of energy and detailed equipment employed, even for producing the same product. None of the companies kept detailed figures on the exact quantities and forms of energy which were used for production. Although they did identify total purchases of oil, gas, coal, electric power in individidual plants, they were not able to identify the quantities used for any of the processes listed in Exhibit VI-10.

Accordingly, as a means of assessing the energy consumption in a more detailed manner than was possible with the gross nature of the available information, basic processes were analyzed in terms of theoretical energy consumption. The processes which were evaluated were described in Section III and shown on Exhibit III-6. With the exception of press forming of body parts and final assembly of vehicles, all of the processes shown are carried out in production of parts and accessories.

The energy consumption for each of the processes was calculated based on use of common or average conditions of manufacturing, and on use of the most common forms of energy which are utilized in production. The dangers of using this procedure for more than a conceptual review of the energy consumption by process are evident. Every operation in every plant has variations in equipment, procedures, products made, fuels available, production levels, efficiency, and many other factors, which will make their own consumption of energy for any particular process different than the calculated quantity, and also different than any other plant producing the same products. However, since no other basis for analysis exists, or can be developed in a short period of time, the theoretical approach was used in this study.

The energy use which was calculated for each process was expressed in KWH equivalents per ton of production of the product involved. To use these numbers as a means of analyzing total vehicle energy requirements, it was necessary to determine the make-up of typical motor vehicles in terms of materials of composition which could be identified with the energy using processes. Data was obtained from several of the motor vehicle producers and from this data and published information from various trade journals, the materials make-up of a composite vehicle was estimated. This is shown in Exhibit VI-11. It was necessary to make certain other assumptions to relate the materials in a composite vehicle to energy consumption. For example, it was assumed that cold rolled sheet steel went into bodies and body parts that were press formed, stamped or blanked. All bar steel was assumed to be machined. Alloy bar steel was assumed to be heat treated. All castings were assumed to be machined. Sheet steel was assumed to be painted. Half of the alloy and carbon bar steel was assumed to be made into forgings.

With these assumptions it was possible to apply average weights of each material to the process using energy as shown in Exhibit III-6. The cumulative energy requirements for a composite vehicle were estimated to be 4,115 KWH equivalent. Since this represented about 70 percent of total energy use including building heating and lighting, the total calculated energy requirement for manufacturing amounted to 5,975 KWH equivalent per average vehicle. The energy use for the entire industry in 1973, as shown in Exhibit III-5 averaged 6,800 KWH equivalent per average vehicle. However, since this included allowances for trailers and spare parts, the number can be reduced by about 10 percent to allow for these items. The resultant figure is 6,120 KWH equivalent per vehicle produced, or almost exactly equal to the calculated number.

(d) Consumption by Type of Energy

Consumption of energy by type and quantity of fuel and electric power is given in Exhibits VI-8 and VI-9. Data for 1967 and 1971 were based on Census of Manufactures reported energy consumption. Data for 1973 and 1974 were estimated, based on actual production of motor vehicles in 1973 and projected production in 1974. Total energy projections were based on a continued use of energy at the average rate per vehicle as reported in 1971. Distribution by types of fuel was generally based on the assumption that use of each fuel on the average approached the same percentages as were used in 1971. 1973 fuel distribution by use has been estimated to be as shown in the following tabulation:

Table VI-6

Distribution of Energy by Type

Fuel	Percent of Energy
Fuel Oil	6.8
Coal	22.2
Coke	1.3
Natural Gas	41.6
Other & Nonspecified Fuels	4.9
Total Fuels	76.8
Electric Power	23.2
Total Energy	100.0

Source: Census of Manufactures
A. T. Kearney Estimates

Over a period of years there has been a drop in percent of energy from coal and a sharp increase in percent from natural gas.

Fuel oil has remained relatively constant in percent of energy it represents as has electric power. The recent trends have been to shift back to coal as a fuel for producing steam for building heating and for use in certain processes taking the place of some of the fuel oil and natural gas which was used. There has also been an increased trend toward use of electric power for melting of metals in foundry and for heating processes taking the place of some of the fuel oil and natural gas as well as some of the coke.

(e) Geography of Consumption

The geographic distribution of use of energy in the Motor Vehicle Parts and Accessories Industry was given in Exhibit VI-5 for 1967 and 1972. The distribution of use of energy generally follows the distribution of production in the industry as shown in the following tabulation:

Table VI-7

Geographic Distribution of Use of Energy

Region	Percent of Energy
Northeast	10.0
East North Central	78.0
West North Central	2.0
South Atlantic	2.5
East South Central	3.0
West South Central	1.5
Mountain	-
Pacific	3.0
Total	100.0

Source: Census of Manufactures
A. T. Kearney Estimates

The heavy concentration in the East North Central Region represents the automotive industry states of Michigan, Indiana, Ohio, of which Michigan alone accounts for 43 percent of the total. Although individual state statistics have not been published covering distribution by type of fuel for this segment of the industry, an analysis of the entire Transportation Industry, SIC 37, reveals that the plants in the Great Lakes States of Michigan and Ohio are heavy users of natural gas, with 46 percent of their total fuel use coming from that source, moderate users of coal with 31 percent of total fuel use from that source, and relatively light users of fuel oil with only 6 percent in that category. On the other hand the eastern state of Pennsylvania is a heavier user of oil with 32 percent of total energy use from oil and with reduced percentage uses of coal and natural gas. The western state of California is a heavy user of natural gas (69 percent), and a light user of oil (9 percent) with no coal used.

The data previously discussed relating to energy consumption by process for manufacturing of motor vehicles parts and accessories is presented in the energy tables which are attached to this section of the report. These tables are identified as Exhibit VI-13 (Table 2c/1) through Exhibit VI-43 (Table 8c), and Exhibit VI-47 (Table 12c).

PLANT VARIATIONS

(a) Effect of Plant Size

The distribution of establishments producing parts and accessories was given in Exhibit VI-4. Most of the establishments are relatively small shops with about 78 percent, or 1,299 out of 1,693 (in 1967), having fewer than 100 employees. However, these small establishments account for only 5 percent of the value of shipments and about 5 percent of the energy usage for this industry group. The balance of the establishments representing shops with more than 100 employees account for 22 percent of the establishments (374 in 1967), but account for 95 percent of value of shipments and energy use.

The smaller plants generally have a limited range of products which are produced, usually involving production of small components rather than subassemblies or completed accessories. As a result the operations in these plants are primarily involved with press work and machining, using relatively little fuels except for building heating. The larger plants have more diverse operations which include foundry, forge shop, heat treating, metal finishing, and similar high energy types of processes which use fuels.

The analysis of the records of those plants which were visited revealed practically no differences in efficiency of use of fuels or electric power based on size of plant. The higher degree of automation and mechanized handling systems in the larger plants resulted in a slightly higher electric power consumption per unit of production, but even this difference was not of significant proportions.

Type of plant, as measured by processes employed, is a more significant factor in energy efficiency than is plant size. Note has already been made of the fact that almost every industrial process is represented in this segment of the Motor Vehicles Industry. The variations in use of energy per unit of output from these various processes were given in Exhibit I-2. However, in using this data it must be noted that within each basic process there are numerous variations in equipment, methods, desired results, and requirements which result in a wide range of energy usages. Iron castings can be produced by melting in the cupola or in electric furnaces, with a wide range of energy consumption and wide difference in types of energy used. Heat treating can be performed in a variety of equipment and with different end results, requiring variations in types and quantities of energy used.

Although in some cases it is possible and practical to substitute one subprocess for another, thereby reducing energy consumption and also shifting to more available forms of energy, in general these changes cannot be made without major capital cost and without a time period requirement of at least six months to a year, or longer.

Lacking the ability to rapidly convert fuel fired equipment to electric power or to substantially improve efficiencies of fuel fired equipment, the principal other area of possible improvement is in plant heating, lighting and services. Approximately

30 percent of total energy used for manufacturing is used for plant heating and lighting. By application of plant operating improvement practices such as reducing building temperatures, closing openings in walls and roofs, shutting off venting equipment when not required, turning off lights and machinery when not in use, and similar good housekeeping practices, approximately 25 percent of the plant heating and lighting energy load has been able to be saved in many plants. If this practice were generally followed, as much as 7.5 percent of the total energy load could be saved.

SUPPLY SITUATION

Of the fuels used--coal, fuel oil, propane, and gasoline are normally received in bulk and are stored at plant sites. Purchases are principally made from refineries and from major coal dealers, although at least part of the fuel oil and all of the propane comes from distributors. Use of fuels used for plant heating, coal, residual fuel oil, and some natural gas are seasonal in use, with the greatest portion of the fuel used during the first and fourth quarters of each year. Fuels used for production are relatively constant in use. A reasonable estimate of the seasonal use of fuels is given in the following tabulation.

Table VI-8

Seasonal Use of Energy

Quarter	Energy Use (Percent) Heating	Production	Total
I	12	17.5	29.5
II	3	17.5	20.5
III	3	17.5	20.5
IV	12	17.5	29.5
Total	30	70	100

Storage capacity and policies for storage of fuels vary from plant to plant. However in general, approximately 30 days coal supply, 14 days fuel oil supply, and 7 days propane supply are commonly carried by many companies.

SUBSTITUTABILITY AND CONSERVATION

The relatively small part of the manufacturing cost which involved energy costs had never offered an attractive area for major measures of cost reduction. Additionally in the past there were not significant shortages of energy that prompted companies in this segment of the industry to take drastic conservation measures. Therefore, the industry was not prepared to take such measures when the energy shortage occurred. Since the industry is not particularly energy intensive, there were few obvious areas to which attention could be directed. Since most of the manufacturing energy consumption was directly related to production, reductions in energy use in those areas was likely to also reduce production. The possibilities of energy saving in building heating and lighting has already been discussed, but only amounts to about 7.5 percent of the total.

Other, longer range energy conservation measures are being studied in many plants but few were able to be installed in time to be effective during the energy crisis. Among these measures are:

1. Use of recuperators to salvage waste heat from heating or melting furnaces for use in preheating combustion air.

2. Use of heat exchangers to extract residual heat in discharged water solutions for use in heating make-up water.

3. Use of waste heat from furnaces to preheat products being melted or heated.

In addition to the possibilities of conservation of energy used in existing processes and equipment, considerable efforts are being made to conserve energy or change forms of energy by changing processes or equipment. These are longer run possibilities which will take more time to develop, but which have greater potential for conservation of scarce fuels. A reversal has taken place in plant design in which the coal fired boiler which was being abandoned, is once again being used to supply steam for plant heating and for some processing. In some cases boilers which are now oil or gas fired are being converted to coal. Heating and melting furnaces do not lend themselves to conversion from gas or oil to coal, but can be replaced by electric furnaces.

For example, cupola melting of iron requires coke, natural gas and/or fuel oil and electric power with a resultant energy consumption estimated at 2,500 KWH equivalent per ton of iron castings produced. By comparison electric arc melting of iron principally requires electric power with a small quantity of natural gas for ladle and runner heating, and with a resultant energy consumption of only 1,150 KWH equivalent per ton of castings. Although from an energy consumption viewpoint it would be desirable to convert all iron foundries to electric arc melting, the conversion would require a complete replacement of the melting facility at a cost of about $50 per annual ton of capacity of castings, or about $1 million for a foundry producing 20,000 tons of castings per year.

Similarly, heat treating operations or forging operations using natural gas or fuel oil for heating, could be rebuilt using electric furnaces. However, this would require a complete replacement of furnace equipment at a substantial capital cost.

These changes in process cannot be quickly or cheaply made in most cases. Boiler house construction is costly, and in many cases conversions from gas to coal cannot be made without replacement of boilers. Similarly changing from fuel fired furnaces to electric heating always requires a new installation, replacing the old furnaces with old ones. The major problems in these conversions however involve the environmental aspects and the availability of electric power. Increased use of coal may initially reverse the environmental improvements already made by increasing gaseous and particulate discharges. Major increases of electric power will require new power plants to be built, which will be both time consuming and costly. In addition, where coal fired boilers are used the environmental problem will also be present

Tables identifying the supply situation are given in Exhibit VI-44 (Table 9c), Exhibit VI-45 (Table 10c), and Exhibit VI-46 (Table 11c).

KEY CONSTRAINTS

Since the Motor Vehicles Parts and Accessories Industry subgroup is essentially not a producer of final consumer products, but is instead a producer of components for the Motor Vehicles Industry, it has been directly affected by demands for products from the industry. The reduced demand for automobiles, and the shift in demand toward smaller cars, which occurred as a direct result of the gasoline shortage, also caused a reduced demand for components, and a shift in demand for certain parts.

Although the curtailments of certain types of fuels, particularly natural gas, fuel oil and propane occurred in individual plants, no cases were found in which plant production was actually shut down or seriously curtailed as a result of the energy shortage. Substitute fuels were found in almost all cases to carry the plants through until additional supplies of the scarce fuel could be found. This is not to imply, however, that if the energy shortage had continued for a much longer period of time, a serious curtailment of production might not have occurred.

The most commonly used fuel in this industry group is natural gas, and in some plants, it is the only fuel which is used. Propane and sometimes fuel oil are used as standby fuels in plants which have interruptable natural gas service. However, in some cases, natural gas was interrupted, and both propane and oil were in short supply, making operation of all plant facilities almost impossible.

Plants which are relatively energy intensive, such as iron foundries, were particularly affected, resulting in a worsening of the already critical iron casting supply situation.

The heavy dependence of the Motor Vehicles Parts and Accessories Industry on such raw materials as steel, rubber, plastics, aluminum and other high energy items, would have resulted in shortages of these materials if the energy shortage had continued. Actually, however, very few instances of actual shortages were reported.

The relatively low energy usage in manufacturing of parts and accessories, reported as one percent of total production cost, does not seem to present a serious cost problem in the event of even higher increases in energy costs than have already occurred. However, even this relatively low amount of energy is essential for manufacturing continuity. The high capital cost, and long lead time for making meaningful substitution or conservation programs effective, result in continued dependence on the present energy sources.

Where curtailments are necessary, they must be made in recognition of the problems that may exist if no other fuel can be used, or if the alternate fuel is also being curtailed.

The Parts and Accessories Industry is particularly critical not only to the Motor Vehicle Industry, but also to the general economy. Unavailability of parts will affect production of new automobiles, trucks, buses, trailers, and other vehicles. In addition, this could also affect production of replacement parts for vehicles now in service, which could have even greater consequences for the economy.

FEDERAL ENERGY OFFICE

DESCRIPTION OF INDUSTRY COVERAGE
SIC 3714 - MOTOR VEHICLE PARTS AND ACCESSORIES

Establishments primarily engaged in manufacturing motor vehicle parts and accessories, but not engaged in manufacturing complete motor vehicles or passenger car bodies. Establishments primarily engaged in manufacturing or assembling complete automobiles and trucks are classified in Industry 3711, tires and tubes in Industry 3011, automobile glass in Major Group 32, automobile stampings in Industry 3465, vehicular lighting equipment in Industry 3647, ignition systems in Industry 3694, storage batteries in Industry 3691 and carburetors, pistons, rings and valves in Industry 3592.

Acceleration equipment, motor vehicle
Air brakes, motor vehicle
Automotive wiring harness sets, other than ignition
Axle housings and shafts, motor vehicle
Axles, motor vehicle
Bearings, motor vehicle: except ball and roller
Brake drums
Brakes and brake parts, motor vehicle
Bumpers and bumperettes, motor vehicle
Camshafts, motor vehicle
Choker rods, motor vehicle
Connecting rods, motor vehicle engine
Control equipment, motor vehicle: acceleration mechanisms, governors, etc.
Crankshaft assembiles, motor vehicle
Cylinder heads, motor vehicle
Defrosters, motor vehicle
Differentials and parts, motor vehicles
Drive shafts, motor vehicle
Directional signals, motor vehicle
Engines and parts, except diesel: motor vehicle
Exhaust systems and parts, motor vehicle
Fifth wheels
Filters: oil, fuel, and air--motor vehicle
Frames, motor vehicle
Fuel pumps, motor vehicle
Fuel systems and parts, motor behicle: gas tanks, fuel pipes and manifold

Gas tanks, motor vehicle
Gears, motor vehicle
Governors, motor vehicle
Heaters, motor vehicle
Hoods, motor vehicle
Horns, motor vehicle
Hydraulic fluid power pumps, for automotive
steering mechanisms
Instrument board assemblies, motor vehicle
Lubrication systems and parts, motor vehicle
Manifolds, motor vehicle
Motor vehicle engine rebuilding, on a factory basis
Motor vehicle parts and accessories (except motor
vehicle stampings)
Mufflers, exhaust; motor vehicle
Oil strainers, motor vehicle
Pipes, fuel: motor vehicle
Power tranmission equipment, motor vehicle
Radiators and radiator shells and cores, motor vehicle
Rear axle housings, motor vehicle
Rebuilding motor vehicle engines and transmissions,
on a factory basis
Rims, wheel: motor vehicle
Sanders, motor vehicle safety
Shock absorbers, motor vehicle
Steering mechanisms, motor vehicle
Third axle attachments or six-wheel units for motor vehicles
Tie rods, motor vehicle
Tire valve cores
Tops, motor vehicle: except stamped metal
Transmission housings and parts, motor vehicle
Transmissions, motor vehicle
Universal joints, motor vehicle
Vacuum brakes, motor vehicle
Wheels, motor vehicle
Windshield frames, motor vehicle
Windshield wiper systems, all types
Winterfronts, motor vehicle
Wiring harness sets (other than ignition), automotive

Source: Standard Industrial Classification Manual.

FEDERAL ENERGY OFFICE

MOTOR VEHICLE PARTS AND ACCESSORIES STATISTICS
SIC-3714

Year and Source	Number of Establishments	Number of Employees	Cost of All Labor (Millions)	Value Added by Manufacturing (Millions)	Cost of Materials, Fuels, etc. (Millions)	Cost of Fuel and Power (Millions)	Value of Industry Shipments (Millions)	Capital Expenditures (Millions)	Gross Value of Fixed Assets (Millions)
1967 (Census)	1,674	364,900	$2,890.7	$ 5,712.0	$ 5,943.1	$109.8	$11,623.8	$572.0	N.A.
1971 (ASM)	N.A.	379,800	3,956.5	8,115.5	8,019.3	152.3	16,117.7	429.3	$6,992.8
1972 (Census)	2,083	401,000	4,593.5	9,146.9	9,313.3	172.8*	18,285.4	N.A.	N.A.
1973 (Estimate)	N.A.	464,000*	5,402.0*	10,793.0*	10,990.0*	206.0*	21,576.3*	N.A.	N.A.
1974 (Projection)	N.A.	400,400*	4,940.0*	9,840.0*	10,000.0*	223.5*	19,680.0*	N.A.	N.A.

Notes: N.A. - Not available
* - Estimated

Source: Census of Manufactures - U.S. Dept. of Commerce.

EXHIBIT VI-2

FEDERAL ENERGY OFFICE

QUANTITY AND VALUE OF SHIPMENT OF PRODUCTS

MOTOR VEHICLE PARTS AND ACCESSORIES

Product	1972 Units (Millions)	1972 Value (Millions)	1967 Units (Millions)	1967 Value (Millions)
Gasoline Engines	8.1	$ 2,516.4	7.1	$ 1,770.7
Hub and Drum Assemblies	67.8	600.6	39.1	212.0
Fuel Pump Assemblies	19.3	57.5	16.0	45.1
Water Pump Assemblies	11.6	75.9	4.3	23.2
Mufflers	55.4	235.0	46.8	142.4
Pipes	63.0	165.4	63.7	94.1
Radiators	11.5	312.8	9.6	207.2
Brake Cylinders	101.2	163.7	54.9	81.1
Wheels	68.6	454.9	54.7	258.4
Transmissions	12.6	2,087.0	9.2	1,289.1
Universal Joints	22.2	134.1	N.A.	70.3
Shock Absorbers	175.3	306.3	41.1	105.6
Clutch Assemblies	75.4	107.1	9.9	69.2
Fuel, Air, Oil Filters	350.4	378.0		
Engine Bearings	489.7	83.9		
Oil Pumps	6.5	62.2		
Thermostats	17.0	16.5		
Universal Joint Repair Kits	10.3	19.5		
Windshield Wipers	112.5	123.0		
Camshafts	3.4	25.9		
Rocker Arms and Parts	94.0	22.8	-	6,902.5
Valve Guides, Seats, Tappets	56.2	38.4		
Turn Signal Flashers	38.1	22.3		
Ball Joints	35.9	65.9		
Convertible Tops	1.3	11.1		
Hose Assemblies	N.A.	24.2		
Brake Hose Assemblies	27.5	25.2		
All Other Parts and Accessories	-	10,499.9		
Rebuilt Engines and Parts	-	363.8	-	197.5
Miscellaneous Motor Vehicle Parts and Accessories	-	251.0	-	210.7
Total Motor Vehicle Parts and Accessories	-	$19,250.3	-	$11,735.2

Note: N.A. = Not Available.

Source: 1972 Census of Manufactures
U.S. Dept. of Commerce.

EXHIBIT VI-3

FEDERAL ENERGY OFFICE

MOTOR VEHICLE PARTS AND ACCESSORIES
SIZES OF ESTABLISHMENT
1967

Size of Establishment Number of Employees	Establishments	Number of Employees	Payroll (Millions)	Value Added by Manufacture (Millions)	Cost of Fuels and Materials (Millions)	Cost of Energy (Millions)	Value of Shipments (Millions)
1 to 4	579	900	$ 7.0	$ 11.2	$ 20.2	$ 0.3	$ 31.3
5 to 9	138	900	6.6	11.5	14.1	0.3	26.2
10 to 19	172	2,500	15.7	31.3	28.6	0.7	59.3
20 to 49	262	8,300	52.7	105.8	100.1	1.9	206.2
50 to 99	148	10,600	67.4	141.1	142.2	2.6	278.7
100 to 249	153	24,000	145.9	304.2	306.3	5.7	601.4
250 to 499	87	30,000	188.3	398.4	375.5	7.1	757.5
500 to 999	55	37,600	266.0	568.0	508.0	10.1	1,074.5
1,000 to 2,499	40	60,200	500.5	879.4	997.7	17.7	1,877.0
2,500 and more	40	190,000	1,640.6	3,260.9	3,450.4	63.4	6,711.6
Totals	1,673	364,900	$2,890.8	$5,712.8	$5,943.3	$109.8	$11,623.8

Source: 1967 Census of Manufactures U.S. Dept. of Commerce.

EXHIBIT VI-4

EXHIBIT VI-5

FEDERAL ENERGY OFFICE

MOTOR VEHICLE PARTS AND ACCESSORIES - GEOGRAPHIC STATISTICS

Geographic Area	1972 Establishments	1972 Employees	1972 Payroll (Millions)	1972 Value Added by Manufacture (Millions)	1972 Cost of Materials, Fuels, etc. (Millions)	1972 Cost of Energy (Millions)	1972 Value of Industry Shipments (Millions)
Northeast Region (N.J., Pa., N.Y., Conn., Mass., R.I., N.H.)	312	42,000	$ 462.1	$ 863.0	$ 996.9	$ 17.8	$ 1,843.7
North Central Region	854	309,700	3,762.8	7,311.1	7,488.4	142.2	14,687.0
East North Central Division (Ohio, Ind., Mich., Ill., Wisc.)	713	298,200	3,674.6	7,085.1	7,290.1	138.2	14,269.9
West North Central Division (Mo., Kans., Iowa, Minn.)	141	11,500	88.2	226.0	198.3	4.0	417.1
South Region	445	34,900	254.0	696.6	576.2	12.0	1,239.3
South Atlantic Division (W.V., Del., Md., N.C., Ga., Fla., S.C., Va.)	156	12,000	85.7	248.8	180.5	4.1	420.5
East South Central Division (Tenn., Ala., La., Miss., Ky.)	91	15,800	118.3	317.1	267.8	5.5	570.6
West South Central Division (Ark., Texas, Okla.)	198	7,100	50.0	130.7	127.9	2.4	248.2
West Region	472	14,400	114.6	276.2	251.8	5.0	515.4
Mountain Division (Ariz., Utah, Colo.)	74	1,400	9.4	29.6	18.7	0.5	47.2
Pacific Division (Calif., Oregon, Wash.)	398	13,000	105.2	246.6	233.1	4.5	468.2
U.S.A. Total	2,083	401,000	$4,593.5	$9,146.9	$9,313.3	$177.0	$18,285.4

Geographic Area	1967 Establishments	1967 Employees	1967 Payroll (Millions)	1967 Value Added by Manufacture (Millions)	1967 Cost of Materials, Fuels, etc. (Millions)	1967 Cost of Energy (Millions)	1967 Value of Industry Shipments (Millions)
Northeast Region (N.J., Pa., N.Y., Conn., Mass., R.I., N.H.)	252	45,900	$ 355.6	$ 746.0	$ 744.2	$ 14.1	$ 1,487.3
North Central Region	761	287,900	2,348.4	4,568.8	4,814.8	88.4	9,360.8
East North Central Division (Ohio, Ind., Mich., Ill., Wisc.)	642	277,900	2,287.7	4,465.2	4,706.8	86.4	9,139.1
West North Central Division (Mo., Kans., Iowa, Minn.)	119	9,900	60.7	103.5	108.0	2.0	221.7
South Region	312	22,800	132.2	298.4	271.6	5.3	566.3
South Atlantic Division (W.V., Del., Md., N.C., Ga., Fla., S.C., Va.)	122	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
East South Central Division (Tenn., Ala., La., Miss., Ky.)	63	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
West South Central Division (Ark., Texas, Okla.)	128	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
West Region	348	8,100	53.3	97.9	108.6	2.0	204.4
Mountain Division (Ariz., Utah, Colo.)	51	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Pacific Division (Calif., Oregon, Wash.)	297	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
U.S.A. Total	1,674	364,900	$2,890.7	$5,712.0	$5,943.1	$109.8	$11,623.8

Source: 1972 and 1967 Census of Manufactures, U.S. Dept. of Commerce.

EXHIBIT VI-6

FEDERAL ENERGY OFFICE

MOTOR VEHICLES PARTS AND ACCESSORIES
METALWORKING OPERATIONS

1967

Type of Operation	Number of Establishments	Number of Employees
Ferrous foundry	16	3,834
Nonferrous foundry (except die cast)	9	197
Nonferrous die casting	23	938
Forging--presses, hammers, Upsetters	44	1,504
Electroplating and other plating	98	1,699
Galvanizing and other hot dip coating	20	680
Heat treating of metals	135	3,671
Automatic screw machine department	125	3,457
Machine shop	377	57,438
Tool and die shop	245	12,047
Foundry pattern shop	10	221
Plate or structural fabrication	41	862
Stamping, blanking and forming	311	22,532
Painting, lacquering and enameling	258	1,988
Plastics molding	30	1,514
Assembly of product	456	73,243
Shipping departments	504	9,309
	2,702	195,134

Source: 1967 Census of Manufactures

FEDERAL ENERGY OFFICE

MOTOR VEHICLE PARTS AND ACCESSORIES
MATERIALS CONSUMED

Material	Unit of Measure	1972 Quantity	1972 Delivered Cost (Millions)	1967 Quantity	1967 Delivered Cost (Millions)
Carbon Steel	Thousand Tons	8,300.2	$1,706.7	6,493.9	$1,055.4
Alloy Steel	Thousand Tons	494.7	147.4	378.4	93.4
Stainless Steel	Thousand Tons	32.6	29.2	26.0	24.2
Total Steel	Thousand Tons	8,827.5	$1,883.3	6,898.3	$1,173.0
Insulated Wire and Cable	Million Pounds - Cubic Content	54.5	45.0	27.2	16.0
Copper and Copper-Base Alloy	Million Pounds	411.8	226.3	215.7	110.1
Aluminum and Aluminum-Base Alloy	Million Pounds	63.3	28.5	74.0	37.9
Metal Powders	Million Pounds	57.3	14.0	52.4	15.3
Pig Iron	Thousand Tons	59.2	4.5	76.1	4.6
Aluminum and Aluminum-Base Alloy Refinery Shape	Thousand Tons	36.1	15.9	37.0	16.6
Iron and Steel Scrap	Thousand Tons	431.2	16.2	324.5	9.9
Aluminum and Aluminum-Base Scrap	Thousand Tons		Not Published		
Iron Castings	Thousand Tons	3,877.3	1,423.5	2,593.1	758.5
Steel Castings	Thousand Tons	81.4	41.8	135.8	108.3
Aluminum and Aluminum Alloy Castings	Million Pounds	563.5	310.3	373.1	186.3
Copper and Copper Alloy Castings	Million Pounds	3.6	3.6	16.1	11.4
Iron and Steel Forgings	Thousand Tons	1,508.1	551.2	881.9	392.8
Aluminum and Aluminum Alloy Forgings	Million Pounds	6.3	5.2	47.7	15.5
Fractional Horsepower Electric Motors	Thousand Units	2,461.3	9.0	2,521.6	10.2
Bearings (Ball and Roller)	-	-	164.1	-	127.7
Fabrics (Coated and Uncoated)	Million Linear Yards	46.9	20.3	13.0	6.7
Plastics (Film and Sheeting)	Million Square Yards	2.5	2.5	2.0	1.4
Plastics (Thermoplastic and Thermosetting Resins)	Million Pounds	209.2	55.8	71.4	23.6
Tires and Tubes	Million Tires	7.0	9.6	N.A.	N.A.
All Other Materials and Components	-	-	4,104.5	-	2,664.1
Total Materials, Parts, Containers, Supplies	-	-	$8,948.4	-	$5,727.6

Source: 1972 and 1967 Census of Manufactures U.S. Dept. of Commerce.

EXHIBIT VI-7

FEDERAL ENERGY OFFICE

MOTOR VEHICLE PARTS AND ACCESSORIES

QUANTITY AND COST OF FUELS AND ELECTRIC POWER CONSUMED

		1967		1971		1973 (Estimated)		1974 (Projected)
Type of Fuel or Energy	Unit of Measure	Quantity	Cost (Millions)	Quantity	Cost (Millions)	Quantity	Cost (Millions)	Quantity
Fuel Oil								
Distillate	1,000 Barrels	237.4	$ 0.9	820.4	$ 3.6	1,000	$ 6.2	869
Residual	1,000 Barrels	640.5	2.0	518.4	2.1	556	3.2	580
Total	1,000 Barrels	877.9	2.9	1,338.8	5.7	1,556	9.4	1,449
Coal	1,000 Tons	1,285.2	10.3	1,104.4	14.9	1,160	18.8	1,121
Coke and Breeze	1,000 Tons	57.4	2.1	64.3	2.7	68.29	3.4	59.28
Natural Gas	Million C.F.	34,067.1	17.9	45,700.0	27.2	55,077	38.4	47,807
Other Fuels		(N.A.)	3.8	(N.A.)	3.0	(N.A.)	4.2	(N.A.)
Fuels Not Specified		(N.A.)	3.6	(N.A.)	2.9	(N.A.)	4.0	(N.A.)
Total Fuels	Million KWH Equiv.	24,993.9	40.6	27,800.0	56.5	31,970	78.2	28,734
Purchased Electric Power	Million KWH	6,733.6	69.2	8,120.0	95.8	9,338	147.6	8,383
Total Energy	Million KWH Equiv.	31,727.5	109.8	35,920.0	152.3	41,308	225.8	37,117

Note: (N.A.) - Not available.

Sources: 1967 and 1972 Census of Manufactures.
A. T. Kearney Estimates (1973 and 1974).

1973 and 1974 estimates made by projecting unit rate of use from prior years, adjusted for estimated shift in uses of fuel oil and natural gas, and for increases in prices of fuels.

EXHIBIT VI-8

MOTOR VEHICLES PARTS AND ACCESSORIES DISTRIBUTION OF ENERGY USAGE

Energy Consumption in Million KWH Equivalent Units

	1967				1971				1973 (Estimated)				1974 (Projected)			
	Total Industry		Parts and Accessories		Total Industry		Parts and Accessories		Total Industry		Parts and Accessories		Total Industry		Parts and Accessories	
Type of Energy	Energy	Percent	Energy	Percent	Energy	Percent	Energy	Percent	Energy	Percent	Energy	Percent	Energy	Percent	Energy	Percent
Fuel Oil																
Distillate					2,968	4.1	1,435	4.1	3,531	4.3	1,708	4.2	3,065	4.1	1,483	4.1
Residual					2,680	3.7	975	2.8	2,814	3.4	1,024	2.6	2,721	3.7	990	2.7
Total	4,362	6.5	1,580	5.1	5,648	7.8	2,410	6.9	6,345	7.7	2,732	6.8	5,786	7.8	2,473	6.8
Coal	21,321	31.7	9,866	32.0	16,752	23.3	8,478	24.2	17,590	21.3	8,902	22.2	17,010	22.9	8,609	23.8
Coke and Breeze	437	.6	437	1.4	518	.7	437	1.3	616	.8	520	1.3	534	.7	451	1.3
Natural Gas	22,535	33.5	10,333	33.6	29,117	40.6	13,861	39.6	35,087	42.5	16,705	41.6	30,446	41.1	14,500	40.1
Other Fuels (Propane)	2,345	3.5	800	2.6	1,681	2.4	721	2.1	2,000	2.4	858	2.1	1,736	2.3	745	2.1
Fuels not Specified (Gasoline)	3,259	4.9	1,037	3.4	2,270	3.2	953	2.7	2,701	3.3	1,134	2.8	2,344	3.2	984	2.7
Total Fuels	54,259	80.7	24,053	78.1	55,986	78.0	26,860	76.8	64,339	78.0	30,851	76.8	57,856	78.0	27,762	76.8
Electric Power	13,000	19.3	6,733	21.9	15,800	22.0	8,120	23.2	18,170	22.0	9,338	23.2	16,311	22.0	8,383	23.2
Total Energy	67,259	100.0	30,786	100.0	71,786	100.0	34,980	100.0	82,509	100.0	40,189	100.0	74,167	100.0	36,145	100.0

Source: 1967 and 1972 Census of Manufactures
A. T. Kearney Industry Survey.
1973 and 1974 estimates made by projecting unit rate of use from prior years, adjusted for estimated shift in uses due to shortages of fuel oil and national gas.

FEDERAL ENERGY OFFICE

MOTOR VEHICLE PARTS AND ACCESSORIES
ENERGY CONSUMING MANUFACTURING PROCESSES

Process	Subprocesses	Energy Used	Products
Casting	Cupola Melting	Coke, Gas, Oil, Power	Iron Castings
	Electric Arc Melting	Electric Power	Iron & Steel Castings
	Electric Induction Melting	Electric Power	Iron, Steel, Nonferrous Castings
	Fuel Fired Furnace Melting	Oil, Gas, Power	Nonferrous Castings
	Molding, Sand Preparation	Electric Power	Iron, Steel, Nonferrous Castings
	Die Casting	Electric Power	
	Die Casting	Electric Power	Nonferrous Castings
	Heat Treating	Gas, Oil, Power	Steel, Iron, Nonferrous Castings
	Cleaning & Finishing	Electric Power	Steel, Iron, Nonferrous Castings
	Coremaking	Gas, Oil, Power	Steel, Iron, Nonferrous Castings
Hot Working	Heating	Gas, Oil, Power	Steel, Nonferrous Forgings
	Press, Hammer Forging	Electric Power	Steel, Nonferrous Forgings
	Upsetting	Electric Power	Steel, Nonferrous Forgings
	Extrusion	Electric Power	Steel, Nonferrous Extrusions
Cold Working	Press Forming	Electric Power	Body Components
	Roll Forming	Electric Power	Wheels
	Blanking, Stamping	Electric Power	Body, Frame Components
	Bending	Electric Power	Frames
Machining	Turning, Screw Machines	Electric Power	Machined Components
	Milling, Drilling, Shaping, Broaching, Threading	Electric Power	Machined Components
	Grinding, Polishing	Electric Power	Machined Components

Process	Subprocess	Energy Used	Products
Heat Treating	Fuel Fired Heating	Oil, Gas, Power	Heat Treated Components
	Electric Heating	Electric Power	Heat Treated Components
Metal Finishing	Electroplating	Gas, Electric Power	Bumpers, Trim Parts
	Spray or Dip Painting	Gas, Electric Power	Body Parts & Components
	Electrocoating	Gas, Electric Power	Body Parts, Wheels
	Galvanizing	Gas, Oil, Power	Zinc Coated Components
	Phosphate Coating	Gas, Electric Power	Body Parts, Wheels
	Polishing, Buffing	Electric Power	Finished Components
Fabrication	Platework	Electric Power	Plate Components
	Structural Work	Electric Power	Frames & Structural Components
	Welding	Gas, Electric Power	Body Subassemblies, Wheels
Plastics Production	Injection Molding	Gas, Electric Power	Plastics Components
	Thermosetting Molding	Gas, Electric Power	Plastics Components
Assembly	Subassembly	Electric Power	Transmissions, Engines, Differentials
	Final Assembly	Electric Power	Complete Vehicles

Source: A. T. Kearney, Inc.

EXHIBIT VI-11

FEDERAL ENERGY OFFICE

MOTOR VEHICLE PARTS AND ACCESSORIES

MATERIALS COMPOSITION OF COMPOSITE AUTOMOBILE

Material	Average Weight Per Automobile (Pounds)
Steel:	
Flat Rolled	2,508
Bar	370
Other	128
Total Steel	3,006
Ferrous Castings	694
Aluminum Alloy	74
Copper Alloy	31
Zinc Alloy	47
Plastics	76
Rubber	103
Total Materials	4,031

FEDERAL ENERGY OFFICE

PROPORTION OF INDUSTRY OUTPUT ACCOUNTED FOR BY EACH MAJOR PROCESS, 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process and Major Products	Percent of 1973 Shipments Value ($ Millions)	Percent of 1973 Production Volume
Iron Casting	(X)	(X)
Aluminum and Zinc Die Casting	(X)	(X)
Steel Forging	(X)	(X)
Steel Heat Treating	(X)	(X)
Painting and Electroplating	(X)	(X)
Welding, Machining, Stamping, Press Forming and Assembly	(X)	(X)
Building Heating, Lighting and Air Conditioning	(X)	(X)
Transportation, Engine Testing and Lubrication	(X)	(X)
Total Industry (Percent)	100	100
(Actual)	$20,363.2	(X)

(X) - Not applicable.

Note: The Industry does not maintain records on production volume by process.

EXHIBIT VI-12 (Table 1c)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Iron Casting

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	31.5			31.5	38.0			38.0
2	Middle distillates	1,000 barrels	205.1			205.1	250.0			250.0
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total	1,000 barrels	236.6			236.6	288.0			288.0
7	Coal									
8	Natural gas	Billion cu. ft.	7.8			7.8	9.4			9.4
9	Coke and breeze	1,000 s. tns.	64.3			64.3	68.3			68.3

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	Billion KWH	2.7			2.7	3.1			3.1
12	GRAND TOTAL									

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Die Casting

Subprocess

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures	1,000 barrels	12.8			12.8	15.4			15.4
2	Middle distillates	1,000 barrels	205.1			205.1	250.0			250.0
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total	1,000 barrels	217.9			217.9	265.4			265.4
7	Coal									
8	Natural gas	Billion cu. ft.	3.2			3.2	3.9			3.9
9	Coke and breeze									

EXHIBIT VI-14
(Table 2c/2)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	Billion KWH	0.2			0.2	0.2			0.2
12	GRAND TOTAL									

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Steel Forging

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	12.0			12.0	14.4			14.4
2	Middle distillates	1,000 barrels	205.1			205.1	250.0			250.0
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total	1,000 barrels	217.1			217.1	264.4			264.4
7	Coal									
8	Natural gas	Billion cu. ft.	2.9			2.9	3.5			3.5
9	Coke and breeze									

EXHIBIT VI-15
(Table 2c/3)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	Billion KWH	0.5			0.5	0.6			0.6
12	GRAND TOTAL									

Source: Estimated by A.T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Steel Heat Treating

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	48.3			48.3	58.3			58.3
2	Middle distillates	1,000 barrels	205.1			205.1	250.0			250.0
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total	1,000 barrels	253.4			253.4	308.3			308.3
7	Coal									
8	Natural gas	Billion cu. ft.	12.0			12.0	14.4			14.4
9	Coke and breeze									

EXHIBIT VI-16 (Table 2c/4) Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	Billion KWH	0.2			0.2	0.2			0.2
12	GRAND TOTAL									

Source: Estimated by A.T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Painting and Electroplating

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	61.7			61.7	74.4			74.4
2	Middle distillates									
3	Residual fuel oil	1,000 barrels	77.8			77.8	83.4			83.4
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total	1,000 barrels	139.5			139.5	157.8			157.8
7	Coal	1,000 s. tns.	165.7			165.7	174.0			174.0
8	Natural gas	Billion cu. ft.	15.2			15.2	18.4			18.4
9	Coke and breeze									

EXHIBIT VI-17
(Table 2c/5)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	Billion KWH	0.2			0.2	0.2			0.2
12	GRAND TOTAL									

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Welding, Machining, Stamping, Press Forming and Ass'y.

Subprocess

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total									
7	Coal									
8	Natural gas									
9	Coke and breeze									

EXHIBIT VI-18
(Table 2c/6)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	Billion KWH	1.9			1.9	2.2			2.2
12	GRAND TOTAL									

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Building Heating, Lighting and Air Conditioning

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	16.5			16.5	19.8			19.8
2	Middle distillates									
3	Residual fuel oil	1,000 barrels	440.6			440.6	472.6			472.6
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total	1,000 barrels	457.1			457.1	492.4			492.4
7	Coal	1,000 s. tns.	938.7			938.7	986.0			986.0
8	Natural gas	Billion cu. ft.	4.6			4.6	5.5			5.5
9	Coke and breeze									

EXHIBIT VI-19 (Table 2c/7) Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	Billion KWH	2.4			2.4	2.8			2.8
12	GRAND TOTAL									

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Transportation, Engine Testing and Lubrication

Subprocess

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures	1,000 barrels	20.3			20.3	24.5			24.5
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products	1,000 barrels								
	Gasoline		679.3			679.3	809.5			809.5
	Diesel Fuel	"	79.9			79.9	95.2			95.2
	Lubricants	"			1,685.5	1,685.5			2,009.5	2,009.5
6	Petroleum products total	1,000 barrels	759.2		1,686.5	2,445.7	904.7		2,009.5	2,914.2
7	Coal									
8	Natural gas									
9	Coke and breeze									

EXHIBIT VI-20
(Table 2c/8)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL									

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process All processes

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	203.1			203.1	244.8			244.8
2	Middle distillates	1,000 barrels	820.4			820.4	1,000.0			1,000.0
3	Residual fuel oil	1,000 barrels	518.4			518.4	556.0			556.0
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline	1,000 barrels	679.3			679.3	809.5			809.5
	Diesel Fuel	"	79.9			79.9	95.2			95.2
	Lubricants	"			1,686.5	1,686.5			2,009.5	2,009.5
6	Petroleum products total	1,000 barrels	2,301.1		1,686.5	3,987.6	2,705.6		2,009.5	4,715.1
7	Coal	1,000 s. tns.	1,104.4			1,104.4	1,160.0			1,160.0
8	Natural gas	Billion cu. ft.	45.7			45.7	55.1			55.1
9	Coke and breeze	1,000 s. tns.	64.3			64.3	68.3			68.3

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)	Billion KWH	8.1			8.1	9.3			9.3
12	GRAND TOTAL									

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Iron Casting

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		100			100	200			200
2	Middle distillates		1,200			1,200	1,400			1,400
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		1,300			1,300	1,600			1,600
7	Coal									
8	Natural gas		8,000			8,000	9,700			9,700
9	Coke and breeze		1,700			1,700	1,800			1,800

EXHIBIT VI-22
(Table 3c/1)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		9,700			9,700	11,500			11,500
11	Electrical energy (Purchased only)		9,200			9,200	10,500			10,500
12	GRAND TOTAL		20,200			20,200	23,600			23,600

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Die Casting

Subprocess

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		100			100	100			100
2	Middle distillates		1,200			1,200	1,400			1,400
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		1,300			1,300	1,500			1,500
7	Coal									
8	Natural gas		3,300			3,300	4,000			4,000
9	Coke and breeze									

EXHIBIT VI-23
(Table 3c/2)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total		3,300			3,300	4,000			4,000
11	Electrical energy (Purchased only)		700			700	800			800
12	GRAND TOTAL		5,300			5,300	6,300			6,300

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Steel Forging

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		100			100	100			100
2	Middle distillates		1,200			1,200	1,400			1,400
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		1,300			1,300	1,500			1,500
7	Coal									
8	Natural gas		3,000			3,000	3,600			3,600
9	Coke and breeze									

EXHIBIT VI-24
(Table 3c/3)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		3,000			3,000	3,600			3,000
11	Electrical energy (Purchased only)		1,700			1,700	2,000			2,000
12	GRAND TOTAL		6,000			6,000	7,100			7,100

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Steel Heat Treating

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		200			200	200			200
2	Middle distillates		1,200			1,200	1,400			1,400
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		1,400			1,400	1,600			1,600
7	Coal									
8	Natural gas		12,400			12,400	14,900			14,900
9	Coke and breeze									

EXHIBIT VI-25
(Table 3c/4)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total		12,400			12,400	14,900			14,900
11	Electrical energy (Purchased only)		700			700	800			800
12	GRAND TOTAL		14,500			14,500	17,300			17,300

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Painting and Electroplating

Subprocess

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		200			200	300			300
2	Middle distillates									
3	Residual fuel oil		500			500	500			500
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		700			700	800			800
7	Coal		4,300			4,300	4,600			4,600
8	Natural gas		15,800			15,800	19,000			19,000
9	Coke and breeze									

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		20,100			20,100	23,600			23,600
11	Electrical energy (Purchased only)		600			600	700			700
12	GRAND TOTAL		21,400			21,400	25,100			25,100

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Welding, Machining, Stamping, Press Forming and Ass'y.

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total									
7	Coal									
8	Natural gas									
9	Coke and breeze									

EXHIBIT VI-27
(Table 3c/6)

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)		6,500			6,500	7,500			7,500
12	GRAND TOTAL		6,500			6,500	7,500			7,500

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Building Heating, Lighting and Air Conditioning

Subprocess

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		100			100	100			100
2	Middle distillates									
3	Residual fuel oil		2,800			2,800	3,000			3,000
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		2,900			2,900	3,100			3,100
7	Coal		24,600			24,600	25,800			25,800
8	Natural gas		4,700			4,700	5,700			5,700
9	Coke and breeze									

EXHIBIT VI-28
(Table 3c/7)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		29,300			29,300	31,500			31,500
11	Electrical energy (Purchased only)		8,300			8, 300	9,500			9,500
12	GRAND TOTAL		40,500			40,500	44,100			44,100

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3714 **Industry** Motor Vehicle Parts and Accessories

Process Transportation, Engine Testing and Lubrication

Subprocess

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		100			100	100			100
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		3,600			3,600	4,300			4,300
	Diesel Fuel		400			400	500			500
	Lubricants				10,200	10,200			12,200	12,200
6	Petroleum products total		4,100		10,200	14,300	4,900		12,200	17,100
7	Coal									
8	Natural gas									
9	Coke and breeze									

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		4,100		10,200	14,300	4,900		12,200	17,100

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process All processes

Subprocess

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		800			800	1,000			1,000
2	Middle distillates		4,800			4,800	5,800			5,800
3	Residual fuel oil		3,300			3,300	3,500			3,500
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		3,600			5,600	4,300			4,300
	Diesel Fuel		400			400	500			500
	Lubricants				10,200	10,200			12,200	12,200
6	Petroleum products total		12,900		10,200	23,100	15,100		12,200	27,300
7	Coal		28,900			28,900	30,400			30,400
8	Natural gas		47,200			47,200	56,900			56,900
9	Coke and breeze		1,700			1,700	1,800			1,800

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		77,800			77,800	89,100			89,100
11	Electrical energy (Purchased only)		27,700			27,700	31,800			31,800
12	GRAND TOTAL		118,400		10,200	128,600	136,000		12,200	148,200

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH'S (MILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Iron Casting

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		36.3			36.3	45.4			45.4
2	Middle distillates		351.6			351.6	424.8			424.8
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		387.9			387.9	470.2			470.2
7	Coal									
8	Natural gas		2,351.0			2,351.0	2,834.2			2,834.2
9	Coke and breeze		498.1			498.1	527.4			527.4

EXHIBIT VI-31
(Table 4c/1)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		2,849.1			2,849.1	3,361.6			3,361.6
11	Electrical energy (Purchased only)		2,684.8			2,684.8	3,083.6			3,083.6
12	GRAND TOTAL		5,921.8			5,921.8	6,915.4			6,915.4

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH'S (MILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accesssories

Process Die Casting

Subprocess

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		14.8			14.8	18.5			18.5
2	Middle distillates		351.6			351.6	424.8			424.8
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		366.4			366.4	443.3			443.3
7	Coal									
8	Natural gas		968.1			968.1	1,167.0			1,167.0
9	Coke and breeze									

EXHIBIT VI-32
(Table 4c/2)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		968.1			968.1	1,167.0			1,167.0
11	Electrical energy (Purchased only)		194.1			194.1	222.9			222.9
12	GRAND TOTAL		1,528.6			1,528.6	1,833.2			1,833.2

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH'S (MILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Steel Forging

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		13.8			13.8	17.5			17.3
2	Middle distillates		351.6			351.6	424.8			424.8
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		365.4			365.4	442.1			442.1
7	Coal									
8	Natural gas		885.1			885.1	1,067.0			1,067.0
9	Coke and breeze									

EXHIBIT VI-33
(Table 4c/3)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total		885.1			885.1	1,067.0			1,067.0
11	Electrical energy (Purchased only)		501.4			504.4	575.9			575.9
12	GRAND TOTAL		1,751.9			1,751.9	2,085.0			2,085.0

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH'S (MILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Steel Heat Treating

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		55.8			55.8	69.7			69.7
2	Middle distillates		351.6			351.6	424.8			424.8
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		407.4			407.4	494.5			494.5
7	Coal									
8	Natural gas		3,623.3			3,623.3	4,367.9			4,367.9
9	Coke and breeze									

EXHIBIT VI-34
(Table 4c/4)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		3,123.3			3,623.3	4,367.9			4,367.9
11	Electrical energy (Purchased only)		194.1			194.1	222.9			222.9
12	GRAND TOTAL		4,224.8			4,224.8	5,085.2			5,085.3

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH'S (MILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Painting and Electroplating

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		71.3			71.3	89.1			89.1
2	Middle distillates		145.0			145.0	153.8			153.8
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		216.3			216.3	242.9			242.9
7	Coal		1,270.1			1,270.1	1,336.1			1,336.1
8	Natural gas		4,619.0			4,619.0	5,568.3			5,568.3
9	Coke and breeze									

EXHIBIT VI-35
(Table 4c/5)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		5,889.1			5,889.1	6,904.4			6,904.4
11	Electrical energy (Purchased only)		177.9			177.9	204.3			204.3
12	GRAND TOTAL		6,283.3			6,283.3	7,351.6			7,351.6

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH'S (MILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Assessories

Process Welding, Machining, Stamping, Press Forming and Ass'y.

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline									
	Diesel Fuel									
	Lubricants									
6	Petroleum products total									
7	Coal									
8	Natural gas									
9	Coke and breeze									

EXHIBIT VI-36
(Table 4c/6)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total									
11	Electrical energy (Purchased only)		1,908.5			1,908.5	2,192.0			2,192.0
12	GRAND TOTAL		1,908.5			1,908.5	2,192.0			2,192.0

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH'S (MILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Building Heating, Lighting and Air Conditioning

Subprocess

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		19.7			19.7	24.6			24.6
2	Middle distillates									
3	Residual fuel oil		821.9			821.9	871.7			871.7
4	Chemical feedstocks									
5	Other petroleum products Gasoline Diesel Fuel Lubricants									
6	Petroleum products total		841.6			841.6	896.3			896.3
7	Coal		7,197.5			7,195.5	7,571.1			7,571.1
8	Natural gas		1,382.9			1,382.9	1,667.2			1,667.2
9	Coke and breeze									

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		8,580.4			8,580.4	9,238.3			9,238.3
11	Electrical energy (Purchased only)		2,426.0			2,426.0	2,786.4			2,786.4
12	GRAND TOTAL		11,848.0			11,848.0	12,921.0			12,921.0

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH'S (MILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

Process Transportation, Engine Testing and Lubrication

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		23.4			23.4	29.3			29.3
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		1,054.8			1,054.8	1,259.9			1,259.9
	Diesel Fuel		117.2			117.2	146.5			146.5
	Lubricants				2,988.6	2,988.6			3,574.6	3,574.6
6	Petroleum products total		1,195.4		2,988.6	4,184.0	1,435.7		3,574.6	5,010.3
7	Coal									
8	Natural gas									
9	Coke and breeze									

EXHIBIT VI-38
(Table 4c/8)
Page 1 of 2

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		1,195.4		2,988.6	4,184.0	1,435.7		3,574.6	5,010.3

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH'S (MILLIONS), 1971 AND 1973

SIC 3714 Industry Motor Parts and Accessories

Process All processes.

Subprocess

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		235.1			235.1	293.9			293.9
2	Middle distillates		1,406.4			1,406.4	1,699.2			1,699.2
3	Residual fuel oil		966.9			966.9	1,025.5			1,025.5
4	Chemical feedstocks									
5	Other petroleum products									
	Gasoline		1,054.8			1,054.8	1,259.9			1,259.9
	Diesel Fuel		117.2			117.2	146.5			146.5
	Lubricants				2,988.6	2,988.6			3,574.6	3,574.6
6	Petroleum products total		3,780.4		2,988.6	6,769.0	4,425.0		3,574.6	7,999.6
7	Coal		8,467.6			8,467.6	8,907.2			8,907.2
8	Natural gas		13,829.4			13,829.4	16,671.6			16,671.6
9	Coke and breeze		498.1			498.1	527.4			527.4

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
10	Other fuels, total		22,795.1			22,795.1	26,106.2			26,106.2
11	Electrical energy (Purchased only)		8,086.8			8,086.8	9,288.0			9,288.0
12	GRAND TOTAL		34,662.3		2,988.6	37,650.9	39,819.2		3,574.6	43,393.8

Source: Estimated by A. T. Kearney. "Field investigations included plant data from 9 companies representing about 15% of value of shipments of the industry."

FEDERAL ENERGY OFFICE

INDUSTRY CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE - 1971, 1973, AND 1974

SIC 3714 Industry Motor Vehicle Parts and Accessories

	Type of Energy or Material	Unit of Measure	Volume 1971	Volume 1973	Volume 1974	Bil. BTU's 1971	Bil. BTU's 1973	Bil. BTU's 1974	Percent Change 1971-73	Percent Change 1973-74	Percent of Total BTU's 1971	Percent of Total BTU's 197_
1	Propane, butane, and mixtures	(1,000 barrels)	203.1	244.9	212.5	800	1,000	900	21	(13)	0.6	0.7
2	Middle distillates	(1,000 barrels)	820.4	1,000.0	869.0	4,800	5,800	5,100	22	(13)	3.7	3.9
3	Residual fuel oil	(1,000 barrels)	518.4	556.0	580.0	3,300	3,500	3,600	7	4	2.6	2.4
4	Chemical feedstocks											
5	Other petroleum products----------------	(1,000 barrels)										
	Gasoline		679.3	809.5	702.6	3,600	4,300	3,700	19	(13)	2.8	2.9
	Diesel Fuel		79.9	95.2	82.6	400	500	500	19	(13)	0.3	0.3
	Lubricants		1,686.5	2,009.5	1,743.3	10,200	12,200	10,600	19	(13)	7.9	8.2
6	Petroleum products, total	(1,000 barrels)	3,987.6	4,715.1	4,190.0	23,100	27,300	24,400	18	(11)		
7	Coal	(1,000 short tons)	1,104.4	1,160.0	1,121.0	28,900	30,400	29,400	5	(3)	22.5	20.5
8	Natural gas	(billion cu. ft.)	45.7	55.1	47.8	47,200	56,900	49,300	21	(13)	36.7	38.4
9	Coke and breeze	(1,000 short tons)	64.3	68.3	59.3	1,700	1,800	1,500	6	(13)	1.3	1.2
10	Other fuels, total					77,800	89,100	80,200	15	(10)		
11	Electrical energy (purchased only)	(billion KWH)	8.1	9.3	8.4	27,600	31,700	28,700	15	(10)	21.5	21.4
12	GRAND TOTAL					128,500	148,100	133,300	15	(10)	100.0	100.0

Sources: 1971 data - Fuels and Electric Energy Consumed, 1972 Census of Manufactures. The usage of gasoline, diesel fuel and lubricants in 1971 was estimated by A. T. Kearney, Inc.
1973 data - Based on company data with over 70% of the Industry reporting.
1974 data - Estimated by A. T. Kearney, Inc., based on auto industry forecasts.

EXHIBIT VI-40 (Table 5c)

FEDERAL ENERGY OFFICE

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, 1971

SIC 3714 Industry Motor Vehicle Parts and Accessories Year 1971

	Geographic Unit	Petroleum Products						Other Fuels				Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
		Propane Butane, and Mixtures (Thousand Barrels)	Distillates (Thousand Barrels)	Residual (Thousand Barrels)	Feedstocks (Thousand Barrels)	Other (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Coke and Breeze (Thousands. tns.)	Total Billion BTU's)		
1	United States	203.1	820.4	518.4		2,445.7	23,100	1,104.4	45.7	64.3	77,800	27,600	128,500
2	NORTH EAST	20.4	261.7	156.3		245.5	4,000	86.3	3.6	6.5	6,100	2,800	12,900
3	New England	(NA)	(NA)	(NA)		(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
4	Maine	-	-	-		-	-	-	-	-	-	-	-
5	N. H.	-	-	-		-	-	-	-	-	-	-	-
6	Vermont	-	-	-		-	-	-	-	-	-	-	-
7	Mass.	-	-	-		-	-	-	-	-	-	-	-
8	R.I.	-	-	-		-	-	-	-	-	-	-	-
9	Conn.	-	-	-		-	-	-	-	-	-	-	-
10	Middle Atlantic	-	-	-		-	-	-	-	-	-	-	-
11	N.Y.	-	-	-		-	-	-	-	-	-	-	-
12	N.J.	-	-	-		-	-	-	-	-	-	-	-
13	Penn.	-	-	-		-	-	-	-	-	-	-	-
14	NORTH CENTRAL	163.1	341.3	245.2		1,964.2	15,500	1,016.8	36.4	51.6	65,500	22,200	103,200
15	E. North Central	158.5	329.3	238.8		1,909.0	15,100	1,003.4	35.0	50.2	63,600	21,500	100,300
16	Ohio	(NA)	(NA)	(NA)		(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
17	Ind.	-	-	-		-	-	-	-	-	-	-	-
18	Ill.	-	-	-		-	-	-	-	-	-	-	-
19	Mich.	-	-	-		-	-	-	-	-	-	-	-
20	Wisc.	-	-	-		-	-	-	-	-	-	-	-

	Geographic Unit	Petroleum Products: Propane Butane, and Mixtures (Thousand Barrels)	Petroleum Products: Distil-lates (Thousand Barrels)	Petroleum Products: Residual (Thousand Barrels)	Petroleum Products: Feed-stocks (Thousand Barrels)	Petroleum Products: Other (Thousand Barrels)	Petroleum Products: Total (Billion BTU's)	Other Fuels: Coal (Thousand Short Tons)	Other Fuels: Natural Gas (Billion Cubic Feet)	Other Fuels: Coke and Breeze (Thousand s. tns.)	Other Fuels: Total (Billion BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
21	W. North Central	4.6	12.0	6.4		55.2	400	13.4	1.4	1.5	1,900	600	2,900
22	Minn.	(NA)	(NA)	(NA)		(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
23	Iowa	-	-	-		-	-	-	-	-	-	-	-
24	Missouri	-	-	-		-	-	-	-	-	-	-	-
25	N.D.	-	-	-		-	-	-	-	-	-	-	-
26	S.D.	-	-	-		-	-	-	-	-	-	-	-
27	Neb.	-	-	-		-	-	-	-	-	-	-	-
28	Kans.	-	-	-		-	-	-	-	-	-	-	-
29	SOUTH	13.8	173.4	92.2		165.6	2,600	-	3.9	4.4	4,200	1,900	8,700
30	S. Atlantic	4.6	147.6	79.5		55.2	1,700	-	.5	1.5	600	600	2,900
31	Del.	(NA)	(NA)	(NA)		(NA)	(NA)	-	(NA)	(NA)	(NA)	(NA)	(NA)
32	Md.	-	-	-		-	-	-	-	-	-	-	-
33	D.C.	-	-	-		-	-	-	-	-	-	-	-
34	Va.	-	-	-		-	-	-	-	-	-	-	-
35	W. Va.	-	-	-		-	-	-	-	-	-	-	-
36	N.C.	-	-	-		-	-	-	-	-	-	-	-
37	S.C.	-	-	-		-	-	-	-	-	-	-	-
38	Ga.	-	-	-		-	-	-	-	-	-	-	-
39	Fla.	-	-	-		-	-	-	-	-	-	-	-
40	S. Central	9.2	25.8	12.7		110.4	900	-	3.4	2.9	3,600	1,200	5,800
41	Ky.	(NA)	(NA)	(NA)		(NA)	(NA)	-	(NA)	(NA)	(NA)	(NA)	(NA)
42	Tenn.	-	-	-		-	-	-	-	-	-	-	-
43	Ala.	-	-	-		-	-	-	-	-	-	-	-
44	Miss.	-	-	-		-	-	-	-	-	-	-	-
45	Ark.	-	-	-		-	-	-	-	-	-	-	-
46	La.	-	-	-		-	-	-	-	-	-	-	-
47	Okla.	-	-	-		-	-	-	-	-	-	-	-
48	Texas	-	-	-		-	-	-	-	-	-	-	-

	Geographic Unit	Petroleum Products: Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Other (Thousand Barrels)	Total (Billion BTU's)	Other Fuels: Coal (Thousand Short tons)	Natural Gas (Billion Cubic Feet)	Coke and Breeze (Thousand s. tons)	Total (Billion (BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
49	WEST	5.7	44.7	23.8		68.5	900	.8	1.8	1.8	2,000	800	3,600
50	Mountain	0.5	15.5	9.5		5.7	200	.8	Z	0.2	100	100	300
51	Mont.	(NA)	(NA)	(NA)		(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
52	Idaho	-	-	-		-	-	-	-	-	-	-	-
53	Wyo.	-	-	-		-	-	-	-	-	-	-	-
54	Colo.	-	-	-		-	-	-	-	-	-	-	-
55	N.M.	-	-	-		-	-	-	-	-	-	-	-
56	Ariz.	-	-	-		-	-	-	-	-	-	-	-
57	Utah	-	-	-		-	-	-	-	-	-	-	-
58	Nev.	-	-	-		-	-	-	-	-	-	-	-
59	Pacific	5.2	29.2	14.3		62.8	700	-	1.8	1.7	1,900	700	3,300
60	Wash.	(NA)	(NA)	(NA)		(NA)	(NA)	-	(NA)	(NA)	(NA)	(NA)	(NA)
61	Ore.	-	-	-		-	-	-	-	-	-	-	-
62	Cal.	-	-	-		-	-	-	-	-	-	-	-
63	Alas.	-	-	-		-	-	-	-	-	-	-	-
64	Haw.	-	-	-		-	-	-	-	-	-	-	-

Notes: (NA) - Not available.
Z - Negligible.

Source: The consumption of fuels, petroleum products, and electrical energy for each geographic unit was estimated based on geographical data on the Transportation Equipment Industry (SIC 37) from the 1972 Census of Manufacturers, Fuels and Electric Energy Consumed.

FEDERAL ENERGY OFFICE

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS
AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories Year 1973

	Geographic Unit	Petroleum Products						Other Fuels				Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
		Propane Butane, and Mixtures (Thousand Barrels)	Distillates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Other (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Coke and Breeze (Thousands. tns.)	Total Billion BTU's		
1	United States	244.9	1,000.0	556.0		2,914.2	27,300	1,160.0	55.1	68.3	89,100	31,700	148,100
2	NORTH EAST	24.6	346.8	159.1		293.2	4,800	61.1	4.9	6.9	6,900	3,200	14,900
3	New England	(NA)	(NA)	(NA)		(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
4	Maine	-	-	-		-	-	-	-	-	-	-	-
5	N. H.	-	-	-		-	-	-	-	-	-	-	-
6	Vermont	-	-	-		-	-	-	-	-	-	-	-
7	Mass.	-	-	-		-	-	-	-	-	-	-	-
8	R.I.	-	-	-		-	-	-	-	-	-	-	-
9	Conn.	-	-	-		-	-	-	-	-	-	-	-
10	Middle Atlantic	-	-	-		-	-	-	-	-	-	-	-
11	N.Y.	-	-	-		-	-	-	-	-	-	-	-
12	N.J.	-	-	-		-	-	-	-	-	-	-	-
13	Penn.	-	-	-		-	-	-	-	-	-	-	-
14	NORTH CENTRAL	196.6	458.4	289.5		2,339.6	18,900	1,097.6	42.4	54.8	74,500	25,400	118,900
15	E. North Central	191.0	448.1	286.3		2,272.7	18,400	1,087.7	41.2	53.3	72,400	24,700	115,500
16	Ohio	(NA)	(NA)	(NA)		(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
17	Ind.	-	-	-		-	-	-	-	-	-	-	-
18	Ill.	-	-	-		-	-	-	-	-	-	-	-
19	Mich.	-	-	-		-	-	-	-	-	-	-	-
20	Wisc.	-	-	-		-	-	-	-	-	-	-	-

	Geographic Unit	Petroleum Products: Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Other (Thousand Barrels)	Total (Billion BTU's)	Other Fuels: Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Coke and Breeze (Thousand s. tns.)	Total (Billion BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
21	W. North Central	5.6	10.3	3.2		66.9	500	9.9	1.2	1.6	2,100	700	3,400
22	Minn.	(NA)	(NA)	(NA)		(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
23	Iowa	-	-	-		-	-	-	-	-	-	-	-
24	Missouri	-	-	-		-	-	-	-	-	-	-	-
25	N.D.	-	-	-		-	-	-	-	-	-	-	-
26	S.D.	-	-	-		-	-	-	-	-	-	-	-
27	Neb.	-	-	-		-	-	-	-	-	-	-	-
28	Kans.	-	-	-		-	-	-	-	-	-	-	-
29	SOUTH	16.5	142.5	84.3		196.8	2,500	-	5.6	4.6	5,300	2,100	10,000
30	S. Atlantic	5.6	104.7	66.8		66.9	1,400	-	.5	1.6	1,200	700	3,400
31	Del.	(NA)	(NA)	(NA)		(NA)	(NA)	-	(NA)	(NA)	(NA)	(NA)	(NA)
32	Md.	-	-	-		-	-	-	-	-	-	-	-
33	D.C.	-	-	-		-	-	-	-	-	-	-	-
34	Va.	-	-	-		-	-	-	-	-	-	-	-
35	W. Va.	-	-	-		-	-	-	-	-	-	-	-
36	N.C.	-	-	-		-	-	-	-	-	-	-	-
37	S.C.	-	-	-		-	-	-	-	-	-	-	-
38	Ga.	-	-	-		-	-	-	-	-	-	-	-
39	Fla.	-	-	-		-	-	-	-	-	-	-	-
40	S. Central	10.9	37.8	17.5		129.9	1,100	-	5.1	3.0	4,100	1,400	6,600
41	Ky.	(NA)	(NA)	(NA)		(NA)	(NA)	-	(NA)	(NA)	(NA)	(NA)	(NA)
42	Tenn.	-	-	-		-	-	-	-	-	-	-	-
43	Ala.	-	-	-		-	-	-	-	-	-	-	-
44	Miss.	-	-	-		-	-	-	-	-	-	-	-
45	Ark.	-	-	-		-	-	-	-	-	-	-	-
46	La.	-	-	-		-	-	-	-	-	-	-	-
47	Okla.	-	-	-		-	-	-	-	-	-	-	-
48	Texas	-	-	-									

	Geographic Unit	Petroleum Products: Propane Butane, and Mixtures (Thousand Barrels)	Petroleum Products: Distil-lates (Thousand Barrels)	Petroleum Products: Residual (Thousand Barrels)	Petroleum Products: Feed-stocks (Thousand Barrels)	Petroleum Products: Other (Thousand Barrels)	Petroleum Products: Total (Billion BTU's)	Other Fuels: Coal (Thousand Short tons)	Other Fuels: Natural Gas (Billion Cubic Feet)	Other Fuels: Coke and Breeze (Thousands. tns.)	Other Fuels: Total (Billion (BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
49	WEST	6.9	51.5	23.9		82.6	1,000	1.1	2.1	1.9	2,300	900	4,200
50	Mountain	0.7	17.2	8.0		7.9	200	1.1	Z	0.2	100	100	400
51	Mont.	(NA)	(NA)	(NA)		(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
52	Idaho	-	-	-		-	-	-	-	-	-	-	-
53	Wyo.	-	-	-		-	-	-	-	-	-	-	-
54	Colo.	-	-	-		-	-	-	-	-	-	-	-
55	N.M.	-	-	-		-	-	-	-	-	-	-	-
56	Ariz.	-	-	-		-	-	-	-	-	-	-	-
57	Utah	-	-	-		-	-	-	-	-	-	-	-
58	Nev.	-	-	-		-	-	-	-	-	-	-	-
59	Pacific	6.2	34.3	15.9		74.8	800	-	2.1	1.8	2,200	800	3,800
60	Wash.	(NA)	(NA)	(NA)		(NA)	(NA)	-	(NA)	(NA)	(NA)	(NA)	(NA)
61	Ore.	-	-	-		-	-	-	-	-	-	-	-
62	Cal.	-	-	-		-	-	-	-	-	-	-	-
63	Alas.	-	-	-		-	-	-	-	-	-	-	-
64	Haw.	-	-	-		-	-	-	-	-	-	-	-

Notes: (NA) - Not available.
Z - Negligible.

Source: The consumption of fuels, petroleum products, and electrical energy for each geographic unit was estimated based on geographical data on the Transportation Equipment Industry (SIC 37) from the 1972 Census of Manufacturers, Fuels and Electric Energy Consumed.

FEDERAL ENERGY OFFICE

SHIPMENTS, EMPLOYMENT, AND FUELS AND ENERGY CONSUMED BY GEOGRAPHIC UNIT, 1971 AND 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

	Geographic Unit	Value of Shipments ($000,000)			Employment (000)			Fuels and Energy (Bil. BTU's)		
		1971	1973	Percent Change	1971	1973	Percent Change	1971	1973	Percent Change
1	United States	16,118.4	20,363.2	26	379.8	421.7	11	128,500	148,100	15
2	NORTH EAST	1,625.2	2,053.2	26	39.8	44.2	11	12,900	14,900	16
3	New England	(NA)	(NA)		(NA)	(NA)		(NA)	(NA)	
4	Maine	-	-		-	-		-	-	
5	N.H.	-	-		-	-		-	-	
6	Vermont	-	-		-	-		-	-	
7	Mass.	-	-		-	-		-	-	
8	R.I.	-	-		-	-		-	-	
9	Conn.	-	-		-	-		-	-	
10	Middle Atlantic	-	-		-	-		-	-	
11	N.Y.	-	-		-	-		-	-	
12	N.J.	-	-		-	-		-	-	
13	Penn.	-	-		-	-		-	-	
14	NORTH CENTRAL	12,946.6	16,355.9	26	293.3	325.7	11	103,200	118,900	15
15	E. North Central	12,578.9	15,891.4	26	282.4	313.6	11	100,300	115,500	15
16	Ohio	(NA)	(NA)		(NA)	(NA)		(NA)	(NA)	
17	Ind.	-	-		-	-		-	-	
18	Ill.	-	-		-	-		-	-	
19	Mich.	-	-		-	-		-	-	
20	Wisc.	-	-		-	-		-	-	

	Geographic Unit	Value of Shipments ($000,000) 1971	Value of Shipments ($000,000) 1973	Value of Shipments Percent Change	Employment (000) 1971	Employment (000) 1973	Employment Percent Change	Fuels and Energy (Bil. BTU's) 1971	Fuels and Energy (Bil. BTU's) 1973	Fuels and Energy Percent Change
21	W. North Central	367.7	464.5	26	10.9	12.1	11	2,900	3,400	17
22	Minn.	(NA)	(NA)		(NA)	(NA)		(NA)	(NA)	
23	Iowa	-	-		-	-		-	-	
24	Mis.	-	-		-	-		-	-	
25	N.D.	-	-		-	-		-	-	
26	S.D.	-	-		-	-		-	-	
27	Neb.	-	-		-	-		-	-	
28	Kans.	-	-		-	-		-	-	
29	SOUTH	1,092.4	1,380.1	26	33.1	36.7	11	8,700	10,000	15
30	S. Atlantic	370.7	468.3	26	11.4	12.6	11	2,900	3,400	17
31	Del.	(NA)	(NA)		(NA)	(NA)		(NA)	(NA)	
32	Md.	-	-		-	-		-	-	
33	D.C.	-	-		-	-		-	-	
34	Va.	-	-		-	-		-	-	
35	W. Va.	-	-		-	-		-	-	
36	N.C.	-	-		-	-		-	-	
37	S.C.	-	-		-	-		-	-	
38	Ga.	-	-		-	-		-	-	
39	Fla.	-	-		-	-		-	-	
40	S. Central	721.7	911.8	26	21.7	24.1	11	5,800	6,600	14
41	Ky.	(NA)	(NA)		(NA)	(NA)		(NA)	(NA)	
42	Tenn.	-	-		-	-		-	-	
43	Ala.	-	-		-	-		-	-	
44	Miss.	-	-		-	-		-	-	
45	Ark.	-	-		-	-		-	-	
46	La.	-	-		-	-		-	-	
47	Okla.	-	-		-	-		-	-	
48	Texas	-	-		-	-		-	-	

	Geographic Unit	Value of Shipments ($000,000) 1971	Value of Shipments ($000,000) 1973	Value of Shipments Percent Change	Employment (000) 1971	Employment (000) 1973	Employment Percent Change	Fuels and Energy (Bil. BTU's) 1971	Fuels and Energy (Bil. BTU's) 1973	Fuels and Energy Percent Change
49	WEST	454.3	574.0	26	13.6	15.1	11	3,600	4,200	17
50	Mountain	41.6	52.6	26	1.3	1.5	11	300	400	33
51	Mont.	(NA)	(NA)		(NA)	(NA)		(NA)	(NA)	
52	Idaho	-	-		-	-		-	-	
53	Wyo.	-	-		-	-		-	-	
54	Colo.	-	-		-	-		-	-	
55	N.M.	-	-		-	-		-	-	
56	Ariz.	-	-		-	-		-	-	
57	Utah	-	-		-	-		-	-	
58	Nev.	-	-		-	-		-	-	
59	Pacific	412.7	521.4	26	12.3	13.6	11	3,300	3,800	15
60	Wash.	(NA)	(NA)		(NA)	(NA)		(NA)	(NA)	
61	Ore.	-	-		-	-		-	-	
62	Cal.	-	-		-	-		-	-	
63	Alas.	-	-		-	-		-	-	
64	Haw.	-	-		-	-		-	-	

Note: (NA) - Not available.

Value of shipments were not available by state or for the New England and Middle Atlantic Census Bureau Districts.

Source: The 1971 value of shipments are from the 1970-1971 Survey of Manufactures. The 1973 total value of shipments is based on the 1972 value of shipments of $18,285.4 million, reported in the Preliminary Report of the 1972 Census of Manufactures, with adjustments for the increase in manufacturing activity for the Industry in 1973 and the increase in price level over 1972. The value of shipments for each geographic unit was assumed to be in the same proportion to the total value of shipments in 1973 as it was in 1971. The employment and fuels and energy used in 1971 and 1973 for each geographic unit were assumed to be a direct function of the value of shipments for the geographic unit.

FEDERAL ENERGY OFFICE

STOCKS OF FUELS AND PETROLEUM PRODUCTS BY TYPE, 12/31/73 AND 3/31/74

SIC 3714 Industry Motor Vehicle Parts and Accessories

	Types of Fuel or Material	Stocks (number of days supply related to average daily requirements in next quarter)					
		As of December 31			As of March 31		
		1971	1972	1973	1972	1973	1974
1	Propane	4	4	7 - 10	4	4	7 - 10
2	Butane	(X)	(X)	(X)	(X)	(X)	(X)
3	Propane Butane Mixture	(X)	(X)	(X)	(X)	(X)	(X)
4	Middle Distillates	7 - 10	7 - 10	10 - 14	7 - 10	7 - 10	10 - 14
5	Residual Fuel Oil	7 - 10	7 - 10	10 - 14	7 - 10	7 - 10	10 - 14
6	Chemical Feedstocks	(X)	(X)	(X)	(X)	(X)	(X)
7	Gasoline	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
8	Coal	7 - 21	1 - 10	1 - 10	7 - 21	1 - 10	1 - 10
9	Natural Gas	0	0	0	0	0	0
10	Fuels, nec. total	(X)	(X)	(X)	(X)	(X)	(X)

(X) - Not applicable.
(NA) - Not available.

Source: The days of supply were estimated from sources within the Industry. Less than one-half of the Industry provided data on their fuel reserves.

EXHIBIT VI-44
(Table 9c)

FEDERAL ENERGY OFFICE

CAPTIVE PRODUCTION, CONSUMPTION, AND SALES OF FUELS, ENERGY, AND PETROLEUM PRODUCTS, 1973

SIC 3714 Industry Motor Vehicle Parts And Accessories

Type of Energy or Material	Volume				Mil. BTU's			KWH Equivalents			Value of Sales ($000)
	Unit of Measure	Produced	Consumed	Sold	Produced	Consumed	Sold	Produced	Consumed	Sold	
None					- NONE -						

Source: Over 80% of the Industry was surveyed to determine if there were any captive energy sources.

EXHIBIT VI-45
(Table 10c)

FEDERAL ENERGY OFFICE

SOURCES OF SUPPLY FOR FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, 1973

SIC 3714 Industry Motor Vehicle Parts and Accessories

	Source of Supplies	Percent of 1973 Consumption Supplied								
		Propane, Butane, and Mixtures	Distil-lates	Resi-dual	Feed Stocks	Other Petro-leum Products	Coal	Natural Gas	Coke	Elec-trical Energy
1	Captive Production									
2	Purchased from:									
3	Refineries	40	70	70		50				
4	Other Manufacturers									
5	Wholesalers	60	30	30		50	40		100	
6	Importers									
7	Retailers									
8	Utilities							100		
9	Other Sources						60*			100
	TOTAL	100	100	100	0	100	100	100	100	100
	Unit of Measure used to compute percent									

Note: *From mining companies.

Source: Company data on source of supply as reported by over 70% of the Industry.

EXHIBIT VI-46
(Table IIc)

FEDERAL ENERGY OFFICE

STOCKS OF FUELS AND PETROLEUM PRODUCTS BY TYPE, 12/31/73 AND 3/31/74

SIC 3714 Industry Motor Vehicle Parts and Accessories

	Types of Fuel or Material	Stocks (number of days supply related to average daily requirements in next quarter)					
		As of December 31			As of March 31		
		1971	1972	1973	1972	1973	1974
1	Propane	4	4	7 - 10	4	4	7 - 10
2	Butane	(X)	(X)	(X)	(X)	(X)	(X)
3	Propane Butane Mixture	(X)	(X)	(X)	(X)	(X)	(X)
4	Middle Distillates	7 - 10	7 - 10	10 - 14	7 - 10	7 - 10	10 - 14
5	Residual Fuel Oil	7 - 10	7 - 10	10 - 14	7 - 10	7 - 10	10 - 14
6	Chemical Feedstocks	(X)	(X)	(X)	(X)	(X)	(X)
7	Gasoline	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)
8	Coal	7 - 21	1 - 10	1 - 10	7 - 21	1 - 10	1 - 10
9	Natural Gas	0	0	0	0	0	0
10	Fuels, nec. total	(X)	(X)	(X)	(X)	(X)	(X)

(X) - Not applicable.
(NA) - Not available.

Source: The days of supply were estimated from sources within the Industry. Less than one-half of the Industry provided data on their fuel reserves.

EXHIBIT VI-47
(Table 12c)

VII - TRUCK TRAILERS (SIC 3715)

INDUSTRY STRUCTURE

The 1972 Standard Industrial Classification (SIC) Manual defines SIC 3715 as an industry comprised of those establishments primarily engaged in the manufacture of truck trailers and truck trailer chassis for sale separately (See Exhibit VII-1). The truck trailer industry does not include manufacturers of complete trucks or buses. Since the 1967 classification, demountable cargo containers were added to the definition.

While the products of the truck trailer industry are a critical link in the production-distribution system of the economy, the economic size of the industry is practically insignificant when compared to the total Motor Vehicle Industry. Table VII-1 indicates that in 1972, the truck trailer manufacturers contributed less than 2 percent of the total Motor Vehicle Industry value of shipments and provide about 3 percent of the employment.

Table VII-1

Truck Trailer Position in Motor Vehicle Industry, 1972

Critieria	Percent of Total Motor Vehicle Industry
Value of Shipments	1.7
Value Added	1.8
Cost of Materials	1.7
Fixed Assets	1.6
Employment	3.0
Establishments	7.3

Source: 1972 Census of Manufactures Preliminary Report.

The following paragraphs will characterize the truck trailer industry by describing the product mix, operating data, production system, competition, the nature of the truck trailer market and the projected growth in the industry.

(a) Product

A truck trailer is defined by the Department of Commerce as a property-carrying vehicle or chassis thereof drawn by a truck or truck-tractor and having one or more axles with a rating typically in excess of 10,000 pounds per axle.

The Department of Commerce includes within this definition three primary product lines as follows:

1. Complete Trailers. A complete trailer is a trailer in which the body is permanently attached to the chassis.

2. Detachable Trailer Bodies. A detachable trailer generally is designed to be used with trailer chassis except when transported on ships or rail cars. This would include all trailer bodies that are manufactured with detachable chassis or running gear, or manufactured separately as trailer bodies without chassis or running gear.

3. Detachable Trailer Chassis. Includes all trailer chassis and running gear manufactured for use with detachable trailer bodies, whether or not shipped with such trailer bodies.

The product mix and each product's contribution to industry value of shipments in 1972 in presented in Table VII-2 on the following page.

Table VII-2

Truck Trailers* Shipped by Type, 1972

	Quantity		Value	
	Amount (000)	Percent (%)	Dollars ($000,000)	Percent (%)
Complete Trailers				
Vans	95.3	54.5	$529.4	59.7
Tank	5.3	3.0	67.2	7.6
Bulk Commodity	1.8	1.0	19.8	2.2
Pole and Logging	1.9	1.1	10.1	1.1
Platform	21.0	12.0	83.9	9.5
Low-Bed	3.9	2.2	24.8	2.8
Dump	5.0	2.9	33.1	3.7
Dollies or Converter Gear	2.1	1.2	3.3	0.4
All Other	4.9	2.8	24.1	2.7
Detachable Trailer Bodies	18.2	10.4	51.5	5.8
Detachable Trailer Chassis	15.5	8.9	39.1	4.4
Total	174.9	100.0%	$886.3	100.0%

Note * Trailers with axle ratings of at least 10,000 pounds. Trailers with axle ratings under 10,000 pounds accounted for less than 5% of the value of truck trailer shipments.

Source: Current Industrial Reports, Series M37L (72)-13.

From this analysis it is evident that the van trailer is the high-volume standard product, accounting for over half the quantity and almost 60 percent of the value of shipments.

(b) Operating Data

Key operating data from 1967 to 1972 for the truck trailer industry have been presented in Exhibit VII-2 and summarized in the table on the following page.

Table VII-3

SIC 3715 - Operating Data
1967 - 1972

	1967	1972	Percent Change
Value of Shipments ($000,000)	713.9	1,103.7	54.6 %
Value Added ($000,000)	268.8	408.5	52.0
Cost of Materials ($000,000)	445.8	717.8	61.0
Establishments	179	244	36.3
Employment (000)	22.9	24.5	7.0
Value Added/Value of Shipments	0.38	0.37	(2.6)
Payroll/Value Added	0.55	0.49	(10.9)

Source: 1972 Census of Manufactures, Preliminary Report

This table shows that truck trailer manufacturing is a billion dollar industry, with value of shipments up 55 percent over 1967. Further the industry employs 24,500 in 244 establishments, about 100 employees per facility. Approximately two-thirds of the value of shipments goes for expenses such as raw materials, consumables, energy and contract work, with the remaining one-third accounted for as value added. Of the total value added, one-half was attributable to wages and salaries.

Of the total value of truck trailers shipped in 1972, over 94 percent were shipped by plants classified in SIC 3715, the remainder being shipped by plants classified in other industry groups. Further, of the total manufactured product shipments by

SIC 3715, 94 percent was products primary to the industry; i.e., truck trailers.

Key financial data for the individual truck trailer manufacturers are difficult to agglomerate because most of the larger public manufacturers (e.g., Trailmobile, Gindy and Brown) are operated as divisions of much larger organizations. Further, while Fruehauf is a public corporation almost exclusively in the truck trailer (at least prior to their acquisition of Kelsey-Hayes in August, 1973), it is probably three times the size of its nearest competitor, and to this extent, not at all a "typical" manufacturer. However, using asset information available from the 1971 Annual Survey of Manufactures, it is possible to get an indication of the relative capital intensity of the truck trailer industry as shown below.

Table VII-4

Capital Intensity in SIC 3715, 1971

	Industry	
	Truck Trailer	Motor Vehicles
Fixed Asset Turnover	4.1 (times)	4.7 (times)
Value of Shipment/Fixed Assets plus Inventories	2.3 (times)	3.5 (times)
Fixed Assets per Employee	$9,100	$16,000

Source: 1972 Census of Manufactures, Preliminary Report

These ratios indicate a relatively capital intensive industry with only $2.30 in sales being generated by every dollar in fixed assets and inventories. Indeed, if the value of fixed assets plus inventory is an indication of the capital invested in the industry, then the turnover of 2.3 must be combined with a relatively high profit margin (e.g., 4 to 5 percent) to yield a return on invested capital in excess of 10 percent. Since profit margins are not known to be particularly excessive in this industry with most probably at or below 5 percent, any cost increases that could not be "passed through" to the consumer could materially affect the industry's ability to attract capital.

(c) Production System

Truck trailers are typically manufactured on a product assembly line basis, with subassemblies passing through staging areas and inspection points. The processes usually include: shipping and receiving; stamping and forming; welding, assembly; and finishing operations (painting). Captive foundry and forge operations are not normally found in this industry.

Major raw materials include sheet, plate and structural steel, aluminum sheet and extrusions, iron and steel castings and forgings, and plywood and hardwoods. Purchased components and subassemblies typically include axles, hubs and drums, tires, running gear suspensions, and landing gear.

There is a trend among some of the larger manufacturers to decentralize and vertically integrate manufacturing processes. The tendency is to move to an automotive-type production system where highly automated subassembly plants supply strategically located trailer assembly plants. This, of course, works to lower labor content, increase capital intensity and concomitantly, hopefully, increase operating margins. It also perhaps increases energy intensity. .

(e) Competition

While competition among the 244 establishments within the truck trailer industry is intense, the level of concentration is also high with four largest firms accounting for almost 50 percent of the industry shipments; the eight largest, over two-thirds. Fruehauf alone accounts for over 30 percent of the total U.S. trailer production. Other leaders in the industry in the probable order of decreasing market share are the Trailmobile Division of Pullman, Inc.; Strick; Clark Equipment's Brown Trailer Division; and Budd's Gindy Manufacturing.

(f) Marketing

The majority of the industry's products are sold, or in some cases, leased, direct to fleet owners through company sales personnel. The remaining are sold through independent distributors and dealers. The large, national manufacturers maintain service facilities throughout the country.

Major customer groups for the truck trailers include highway and rail common carriers, contract carriers, private fleets and trailer leasing and rental companies.

The effect of the intense competition on prices in the industry can be seen in the following table of average trailer shipment value.

Table VII-6

Average Value of Trailers Shipped*

Year	Shipments Dollars (Thousands)	Shipments Units	WPI (Motor Vehicles)	Real Value Per Unit (1967)
1963	$420,046	77,585	97.8	$5,536
1964	454,122	86,938	98.3	5,314
1965	541,009	103,756	98.5	5,293
1966	607,075	113,493	98.6	5,425
1967	516,304	96,539	100.0	5,348
1968	580,610	113,928	102.8	4,958
1969	716,784	138,347	104.7	4,948
1970	578,090	105,709	108.5	5,040
1971	585,264	103,784	114.7	4,917
1972	795,548	141,143	118.0	4,777

Note * Complete trailers only

Source: Current Industrial Reports.

The data indicates that the value per unit has declined almost 14 percent in the ten years since 1963.

(g) Industry Growth and Trends

Activity in the truck trailer industry has historically followed cyclical patterns of growth and decline, with production being influenced primarily by general economic conditions. Sharp sales growth has occurred in the last decade, aided by the rising volume of highway freight, demonstrated operating efficiencies, smaller initial costs, and lower maintenance cost of trailers. Further potentials for trailer sales in the near future are enhanced by their increasing load-carrying capacity as state weight and length restrictions continue to be liberalized, mounting use of the piggyback and fishyback methods of handling freight, and the long-range industrial growth projected for the nation's economy.

In 1974 while the motor vehicle industry as a unit suffers set-backs, the backlog of orders in the truck trailer industry for the beginning of 1974 was the largest ever recorded. This backlog may be due in part to the buy stimulus created by the deadline for beginning installation of relatively expensive skid control equipment which by government regulation, was to have been on all truck trailers produced after August 31, 1974. The extension of this deadline to January 1, 1975 and the resultant increase in orders may carry the truck trailer industry to another record-breaking year in 1974.

ENERGY USE

Fuel consumption for 1971 was reported in a special report series, but expenditures for both fuel and electric power in the truck trailer industry were most recently reported in the 1967 Census of Manufactures. In that year, the cost of energy was $3.6 million or about one-half percent of sales and less than 0.8 percent of the cost of materials. Relative to other industries, the truck trailer industry is not a large energy consumer. Further, if the total Motor Vehicle Industry is a minor energy consumer, then the trailer segment is even less so in that while it shipped about 1.8 percent of the Industry's shipment value in 1967, it consumed only 1.6 percent of the energy.

In the next few pages, energy consumption in the trailer industry will be examined by manufacturing process, by type of fuel, and by geographic pattern of use. As a preface to these discussions, the following few paragraphs will serve to summarize the methodology employed in developing the energy data for 1971, 1973, and 1974.

(a) Estimation Methodology

The published energy consumption information for SIC 3715 is shown in Table VII-7.

Table VII-7

Energy Consumption Data for SIC 3715

		1967	1971
Fuels Consumed	($000,000)	1.5	1.4
	(KWH, billions)	0.94*	0.80
Purchased Electric Energy	($000,000)	2.1	(NA)
	(KWH, billions)	0.20**	(NA)

Notes: * Obtained by dividing 1967 expenditure by the 1971 cost per KWH discounted to 1967 dollars ($0.0016)

** Obtained by dividing 1967 expenditure by the 1967 cost per KWH for SIC 3714 ($0.0103)

Sources: 1967 Census of Manufactures
1972 Census of Manufactures, Special Report Series, "Fuels and Electrical Energy Consumed"
A. T. Kearney, Inc.

As indicated, a total of 1.14 billion KWH equivalents of energy were consumed in 1967. Of this total, about 82 percent was supplied by fuels.

Because complete energy consumption data in terms of fuel and electric power exists for only one year, 1967, it is impossible to merely extend this data with any acceptable level of confidence. It was possible, however, to develop the industry energy consumption through induction by examining the energy by individual process.

Theoretical calculations of energy requirements by manufacturing process were developed as noted in Section I and validated or slightly modified for application in the truck trailer industry by field survey data. Knowing the energy use by process per unit, it was a simple matter to sum the process requirements to get the total consumption.

This general approach was particularly valid in this industry because of the following two factors.

1. A homogeneous industry production system with fairly constant technology in recent years.

2. The availability of trailer production volume in units through 1973 as reported in Current Industrial Reports.

While the trailer production volume as reported in the Current Industrial Reports (CIR) Series approximates that of the truck trailer industry defined by SIC 3715, it does differ from Census of Manufactures reports of product shipments in two relatively minor aspects:

1. It does not report truck trailers rated at less than 10,000 pounds per axle (recall that this amounted to less than 5 percent of product shipment value in 1973).

2. It does not attempt to account for all trailer production, especially that for small establishments when production is not specified by kind.

However this discrepancy is not serious because a fairly constant relationship exists between the CIR production value and the Census of Manufactures (and Annual Survey) value of shipments. Using a historical ratio of CIR production value to Census value of shipments of 0.82 and the CIR reported trailer, container and chassis production of $1,109 million (or 198,345 units) in 1973, the industry value of shipments was estimated to be $1,352 million.

It is also known from the 1972 preliminary census report that 5.8 percent of these receipts was for miscellaneous nonproduction activities, and that 4.8 percent was accounted for by secondary (products considered primary to other SIC groups) products. Applying these percentages to the 1973 estimates gives a trailer shipment value of $1,209 million, or 89.4 percent, as seen in Exhibit VII-3 (Table 1d). Using the 1973 CIR reported unit value data, the $1,209 million in trailer receipts converts to about 222,200 production units or equivalents. A similar procedure was followed in developing SIC 3715 production units for 1967, 1971, 1972 and 1974 as shown in Table VII-8 on the following page.

Table VII-8

SIC 3715, Production Units, 1967-1974

Year	CIR Production (Thousand Units)	SIC Production Equivalents (Thousand Units)
1967	124	138
1971	122	136
1972	175	195
1973	198	222
1974	189*	210

Note * Developed based on 10 year correlation with truck-tractor (GVW over 26,000 lbs.) chassis sales.

Source: Current Industrial Reports
A. T. Kearney, Inc.

These production equivalents units were then used in conjunction with the per unit process energy consumption calculations to characterize energy consumption in the truck trailer industry.

(b) Energy Consuming Process

There are four basic processes or operations in the trailer production that require energy: metalworking; finishing; in-plant transportation; and building heating and lighting. These are discussed individually in the following paragraphs.

1. Metalworking. The metalworking processes include stamping, press forming, welding and assembly (riveting and small hand tool operations). Energy to run these pressroom and assembly-type operations is supplied almost universally by electric power.

2. Finishing Operations. Painting is the major finishing operation. This would include washing, baking, and

drying operations. Other finishing operations could include heat treating, plating, and/or metal cleaning. Typically finishing operations are run by fuels such as natural gas, fuel oils, or perhaps one of the liquified petroleum gases (LPG's). Also, if coal is used for building heat (steam), the steam will probably be used for process heating of solutions for washing, plating, painting and other coatings.

3. In-Plant Transportation. Forklift trucks are the chief users of power for in-plant transportation. Power is usually supplied by gasoline or LPG with a definite trend to the use of LPG to eliminate exhaust fumes Some companies appear also to be switching to battery-powered electric trucks.

4. Building. Building energy requirements are for utilities, such as heating, ventilation, and lighting. Heat is provided typically by fuels, either LPG, fuel oil, natural gas, or coal. Lighting is of course provided by electrical energy.

While all plants do not have this exact energy consumption configuration, the majority of the energy consumed in SIC 3715 is for these types of processes.

There are also several nonenergy-related uses of petroleum and petroleum-derived products in truck trailer production. These include lubricating and hydraulic oils, foams and fibers for insulating refrigerated vans, cutting oils, and cleaning solvents.

(c) Energy Consumption by Process

The energy consumption will be developed for each of the four identified processes in the paragraphs below.

1. Metalworking. The energy consumed in the metal-working operations is basically a function of the types and amounts of metal raw materials. The metals consumed by SIC 3715 establishments were detailed in both the 1967 and 1972 Census data. As shown in Table VII-9 the metal tonnage per production unit was quite consistent between the two reported years.

Table VII-9

Metal Tonnage Per Unit, 1967 and 1972

	1967	1972
Total Metals Consumed (000 tons)	371	510
Production Units (000)	138	195
Tons Per Unit	2.69	2.62

Source: Census of Manufactures, 1967 and 1972

By applying the energy consumption per ton for the appropriate operation (i.e., stamping, forming, welding, etc.) to the tonnage of each metal type (i.e., steel plate, steel sheet, aluminum sheet, etc.), a weighted energy consumption per ton for metalworking can be derived. Multiplying this by the tons per unit gives an energy requirement for metalworking operations of about 1,200 KWH per unit as indicated in the table below.

Table VII-10

Energy Per Unit for Metalworking

	1967	1972
Energy per ton required (KWH)	457	484
Tons per unit	2.69	2.62
Energy per unit (KWH)	1,229	1,268

Source: A. T. Kearney, Inc.

The weight-unit and energy consumption per ton relationships were verified with actual plant data. This survey data included three of six largest trailer manufacturers .

2. Finishing Operations. The fuel requirement per ton for painting is 1,500 KWH and the per unit consumption of steel in 1967 and 1972 was two tons. These two factors combine to give a fuel requirement per unit of 3,000 KWH. Again, the survey data confirmed the order of magnitude accuracy for this estimate. It was not possible from the survey data to estimate consumption per unit for other miscellaneous finishing operations that may be performed in some plants.

3. In-Plant Transportation. From the survey data it was estimated that about 300 KWH are required per unit for in-plant transportation.

4. Building. Energy consumption for building utilities is a function of square footage under roof, not production units. In order to estimate the square footage of plant and office

space in the industry, the number of square feet to generate a million dollars in sales revenues was calculated for a number of companies. It has found that about 10,000 square feet would generate sales of $1 million. In the truck trailer industry given sales of $713.9 million in 1967, there was assumed to be about 7.14 million square feet in service in the industry that year. It is expected that the industry square footage of plant space and hence, energy for building utilities, would vary 25 percent with production. That is to say that if production doubles in any time period, the building energy requirement would increase by 25 percent.

Assuming an average number of degree-days heating and four air changes per hour, a range of 30 to 40 KWH per square foot is required to heat a plant. The survey data confirmed this range and an energy requirement of 40 KWH per square foot was assumed.

Requirements for lighting typically are about 1.1 watt-hours per square foot. Assuming lights are in use 18 hours per day, 5.5 days per week, 50 weeks per year, an annual requirement of about 5 KWH per square foot is indicated.

5. Process Energy Summary. As a final check of the energy assumptions by process, the per unit energy requirements can be summed for the industry and validated against known electrical energy consumption in 1967 and known fuel consumption in 1971. This is done in the following table.

Table VII-11

Reported Versus Calculated Energy Consumption
(Billion KWH)

	1967	1971
For Electrical Energy:		
Reported (latest year)	0.20	(NA)
Calculated..		
Metalworking @ 1,200 KWH/Unit	0.165	-
Lighting @ 5 KWH/ft.^{2}	0.035	-
Variance (Reported less calculated)	0	-
For Fuels:		
Reported (latest year)	-	0.80
Calculated..		
Painting @ 3,000 KWH/Unit	-	0.41
In-Plant Transporation @ 300 KWH/Unit	-	0.04
Heating, etc., @ 40 KWH/ft.^{2}	-	0.28
Variance (Reported less Calculated)		0.07

Source: A. T. Kearney, Inc.

As can be seen, the calculated process-by-process energy consumption is further validated by the reported consumption. For electrical energy, the variance is negligible; for fuels, it is less than 9 percent. Further, recall that there were some miscellaneous finishing operations for which no estimate could be made because of lack of information on the degree occurrence in the total industry. The fuel variance of 70 million KWH in 1971 means about 500 KWH per unit. This is not an unreasonable per unit consumption on an industry-wide basis to account for miscellaneous finishing operations other than painting.

Knowing the process energy use per unit for metalworking, finishing and in-plant transportation and the energy demand per square foot for building utilities, the truck trailer industry energy demands can be estimated for the period 1971-1974 as follows.

Table VII-12

Industry Energy Consumption by Process, 1971-1974
(Energy in Billion KWH)

	1971	1972	1973	1974
Production (000 units) *	136	195	222	210
Energy Consumption:				
Metalworking	0.16	0.23	0.26	0.25
Finishing	0.48	0.68	0.77	0.74
In-Plant Transportation	0.04	0.06	0.07	0.06
Building Utilities	0.32	0.36	0.37	0.36
Total Energy Demand	1.00	1.33	1.47	1.41

Note: * Recall that building utilities are 25 percent variable with production; others are 100 percent variable.

Source: A. T. Kearney, Inc.

This table indicates that about 30 percent of the energy used is for other than production; space heating and lighting. Of the energy used in manufacturing, about 70 percent is required for finishing operations, the remaining being required for metalworking (about 24 percent) and for in-plant transportation (about 6 percent).

(d) Consumption by Type of Energy

The 1972 Census special report on fuels indicates a distribution of fuel types as shown below.

Table VII-13

Fuel Consumption by Type, 1971
(Billion KWH)

Fuel	Amount	Percent of Total
Distillate Fuel Oil	0.02	2.5
Residual Fuel Oil	0.02	2.5
Coal	0.13	16.2
Natural Gas	0.42	52.5
Other Fuels	0.02	2.5
Fuels, m.s.k.	0.19	23.8
Total Reported	0.80	100.0

Source: 1972 Census of Manufactures, Special Report Services, "Fuels and Electrical Energy Consumed"

As indicated, over half of the consumption was specifically identified as natural gas, with relatively minor amounts of consumption of other fuels. As a result of company surveys in which no coal consumption was found, it was somewhat surprising to see the fuel oil consumption at only 5 percent while that for coal is over three times that amount. Further, other fuels such as LPG's, gasoline, etc., are unrealistically low. A possible but not specified by kind, almost 24 percent of the total. This category undoubtedly includes some LPG, gasoline, fuel oils, and more natural gas.

Using the 1971 reported data, the company surveys and the fuel requirements of certain processes, a basic order of magnitude energy mix was developed for requirements of each process. This energy mix-process matrix is shown in the following table.

Table VII-14

Energy Mix by Process, 1971

Type of Energy	Metalwkg.	Finishing	Trans.	Building
Distillate Fuel Oil	- %	8%	-%	6%
Residual Fuel Oil	-	3	-	6
Coal	-	12	-	22
Natural Gas	-	72	-	54
Gasoline	-	-	25	-
LPG	-	-	75	-
Electrical	100	-	-	12
Total (Percent)	100%	100%	100%	100%
Total (Billion KWH)	0.16	0.48	0.04	0.32

Source: A. T. Kearney, Inc.

This basic energy mix was used to develop the specific energy consumption by process shown in Exhibit VII-4 (Table 2d/1a) through Exhibit VII-18 (Table (4d/1). Exhibit VII-19 (Table 5d) summarizes the total energy consumption by type for the industry. Table VII-15 on the following page shows the 1971 consumption by energy type for the industry.

Table VII-15

SIC 3715 Energy Consumption by Type, 1971

Type of Energy	Consumption Amount (Billion KWH)	Consumption Percent (%)
Distillate Fuel Oil	0.06	6
Residual Fuel Oil	0.06	6
Coal	0.13	13
Natural Gas	0.51	51
Gasoline	0.01	1
LPG	0.03	3
Electrical	0.20	20
Total	1.00	100%

Source: A. T. Kearney, Inc.

This table indicates that only 16 percent of energy consumed in the truck trailer industry is petroleum derived, with natural gas supplying over half of the total energy requirements.

(e) Geography of Consumption

The geographic pattern of the use of energy in the truck trailer industry was developed by examining employment in the industry by state. The latest, most complete information available for this purpose was the 1967 Census data. While there is manufacturing activity in every Census Region and Division as shown in Exhibit VII-20 (Table 8d), the North Central Region had the most activity (39.0%), with that region's East North Central Division having highest activity (21.2%) of all the Census Divisions. Pennsylvania provided the most manufacturing activity of the states with 21.1 percent.

States providing at least 5 percent of the activity are listed in the following table.

Table VII-16

High Truck Trailer Production States

State	Percent of Total Activity
Pennsylvania	21.1%
Ohio	13.2
Texas	8.8
Indiana	7.4
Alabama	6.6
California	6.1

Source: 1967 Census of Manufactures

Exhibits VII-21 (Table 6d) and VII-22 (Table 7d) show the energy consumption by type for each state in 1971 and 1973, respectively. Except in the case of coal, this distribution by state was made by applying the percent activity per state to the total United States consumption of each energy type. Since coal is not a fuel used in many states, its distribution was limited to the higher volume states in the coal regions, namely Pennsylvania, Ohio and Indiana.

PLANT VARIATIONS

The establishments in the truck trailer industry range in size from those employing less than 5 people to large plants employing over 1,000. The next few pages will examine plant variances in size, production system, and product line and the implications of these differences for energy consumption.

(a) Plant Variances

The 1967 Census is the most recent and complete source of statistics by size of establishment. The pertinent information has been summarized and presented below in Table VII-17.

Table VII-17

Selected Plant Statistics by Employment Size, 1967

Employment	Establishments	Employment	Value Added	Shipments
1 - 19	39.7%	1.7%	1.7%	1.6%
20 - 99	30.2	11.4	10.6	9.2
100 - 249	13.4	15.3	13.1	13.7
250 - 499	11.7	32.3	36.3	38.0
500 - 999	3.4	18.8	18.6	19.2
1,000 - 2,499	1.7	20.5	19.8	18.4

Source: 1967 Census of Manufactures

The concentration among the larger plants (those employing over 250) is evidenced by the fact that while they represent only 17 percent of the plants, they account over three-fourths of the industry's shipment value.

Generally, the smaller plants have less manufacturing sophistication, a lower degree of automation, and as a result, tend to be more labor intensive. As plants increase in size they become more complex in terms of manufacturing operations and more capital intensive. As evidence of this is the fact for plants with over 250 employees, wages represent about 14 percent of sales; for small plants wages average over 18 percent of sales.

Regardless of size, however, the basic manufacturing processes are similar.

(b) Energy Consumption Implications

Although the basic processes in small and large plants are similar, the per unit energy consumptions probably are not. Obviously as labor is removed from the system, at least a portion of that effort must be made up by automated, power-driven machinery. Electric powered overhead cranes, assembly lines and power fabrication equipment add to energy demand. Paint systems can also affect the consumption of fuel depending on the number of coats, the baking process and whether the unit is oven-dried or air dried.

In most plants, energy savings of 15 to 20 percent can be realized by the mere practice of "good housekeeping." This would include such simple energy saving measures as delamping unnecessarily bright areas, turning down thermostats to at least 68^{o}F, and closing overhead yard doors promptly. These measures, already being implemented in many plants have cut building utility costs at least a third and some one-half. Recalling that utilities account for 30 percent of the energy demand in the industry, a savings of a third on utilities could mean a 10 percent savings in total energy consumption.

Besides good housekeeping, energy can be saved by increased attention to production scheduling so that machines in staging areas are not kept running while waiting work-in-process and so that cleaning tanks are not constantly idle while hot. Of course, operating a second shift greatly improves energy input-output efficiency by using building utilities and other operations that can't be shut down overnight.

SUPPLY SITUATION

Inventory practices and policies in the truck trailer are not of great concern because the major portion (over 70%) of the energy used is natural gas and electrical energy, both not normally stocked. Those fuels that are stocked, such as fuel oils, LPG, and gasoline, are typically delivered on a weekly or biweekly basis. As seen in Exhibit VII-23 (Table 9d), the number of days supply on hand has not changed significantly over the last three years.

The use of energy in the truck trailer industry is seasonal and this variation is due almost solely to the influence of the heating season. As seen in the table below, the truck trailer production is fairly constant by quarter.

Table VII-18

Seasonal Use of Energy

	Energy Use For:	
Quarter	Heating (1)	Production (2)
I	45.0%	24.0%
II	20.0	25.5
III	5.0	23.7
IV	30.0	26.8

Sources: (1) A. T. Kearney, Inc.
(2) Current Industrial Reports

These two use distributions combine to give the consumption by quarter for the various types of energy depending on the portions of each used for processing versus utilities (see Exhibit VII-24, Table 12d).

The major suppliers of energy for the truck trailer industry as indicated in Exhibit VII-25 (Table 11d), are the utility companies in that they supply 100 percent of the natural gas and electrical energy requirements. For fuel oils, LPG, and gasoline, the large plants (over 250 employment) typically are supplied by wholesalers; the small plants by retailers. There is no known captive production of energy in the industry (see Exhibit VII-26, Table 10d).

The electrical energy and natural gas are typically supplied under contract at established, published and regulated rates. The fuels are normally supplied under short-term contracts with oil company distributors. While service interruptions and discontinuations are not yet prevelant in the industry, disproportionate fuel price increases are, (see section III for discussion of magnitude of fuel price escalations).

SUBSTITUTABILITY AND CONSERVATION

Since the use of petroleum fuels in the truck trailer industry is almost insignificant, the potential for benefit is small. As indicated earlier, those fuels that are used primarily for building heat and finishing operations. Conservation seems to be the most cost effective means to cut fuel use in the industry in that, as noted in a previous section, no investment would be required to save 20 to 25 percent on fuel consumption. Substitution of gas or electric power for fuels would entail a production interruption and a large initial cost. Further, most new plants are using gas with propane or butane as a stand-by or substitute fuel in case of interruption. To this extent, a moritorium on petroleum fuels as a primary fuel for new construction would perhaps be acceptable; immediate wholesale conversion would be unacceptable because of the cost impact, particularly on small operations.

Because of the conservation potential in the industry, most operations could sustain a fuel cutback of 20 to 25 percent before production would be materially affected.

There are currently no changes in 1974 investment plants contemplated because of the energy shortages.

KEY CONSTRAINTS

With the truck trailer at near capacity now because of record order backlogs, the critical constraint on the industry is the availability of raw materials. Particularly critical is steel but shortages are also evident in supply of castings, forgings, and tires. While not as critical, shortages of petroleum derived raw materials, like insulating foams and fibers, and consumables such as cleaning solvents, could seriously affect capacity level production.

Despite these potentials for production curtailments, there is expected to be no short-fall in truck trailer supply in 1974.

EXHIBIT VII-1

FEDERAL ENERGY OFFICE

DESCRIPTION OF INDUSTRY COVERAGE
SIC 3715 - TRUCK TRAILERS

Establishments primarily engaged in manufacturing truck trailers, truck trailer chassis for sale separately, detachable trailer bodies (cargo containers) for sale separately, and detachable trailer (cargo container) chassis, for sale separately.

Bus trailers, tractor type
Demountable cargo containers
Motor truck trailers
Semitrailers for missile transportation
Semitrailers for truck trailers
Trailers or vans for transporting horses
Trailers, motor truck
Truck trailers

Source: 1972 Census of Manufactures, Preliminary Report.

FEDERAL ENERGY OFFICE

BASIC INDUSTRY STATISTICS, SIC 3715

Year	All Employees Number (000)	All Employees Payroll ($Mil.)	Production Workers Number (000)	Production Workers Man-Hours (Mil.)	Production Workers Wages ($Mil.)	Value Added ($Mil.)	Cost of Materials ($Mil.)	Value of Shipments ($Mil.)	Capital Expenditures ($Mil.)	End-of-Year Inventories ($Mil.)
1967	22.9	147.1	18.3	35.5	105.1	268.8	445.8	713.9	22.3	129.7
1968	25.1	167.1	20.2	39.4	124.2	284.3	531.8	803.8	15.6	155.4
1969	27.4	189.0	21.9	42.7	140.0	353.7	621.5	961.9	21.1	161.6
1970	22.7	162.4	17.4	33.7	114.3	283.0	491.9	776.9	19.7	133.9
1971	21.2	161.7	16.4	31.7	115.3	287.8	500.6	787.2	20.1	143.8
1972	24.5	202.0	19.5	37.2	147.3	408.5	717.8	1,103.7	14.3	189.2

Year	Ratio of Value Added to Shipments	Ratio of Inventories to Shipments	Ratio of Payroll to Value Added	Value of Shipments per Production Worker ($000)	Man-Hours per Production Worker (000)	Wage per Production Worker Man-Hour ($)	Value Added per Production Worker Man-Hour ($)	Index of Employment (1967=100)	Index of Value Added (1967=100)	Index of Shipments (1967=100)
1967	.377	.182	.547	39.0	1.940	2.961	7.57	100.00	100.00	100.00
1968	.354	.193	.588	39.8	1.950	3.152	7.22	109.61	105.77	112.59
1969	.368	.168	.534	43.9	1.950	3.279	8.28	119.65	131.58	134.74
1970	.364	.172	.574	44.6	1.937	3.392	8.40	99.13	105.28	108.82
1971	.366	.183	.562	48.0	1.933	3.637	9.08	92.58	107.07	110.27
1972	.370	.171	.494	56.6	1.908	3.960	10.98	106.99	151.97	154.60

Source: 1972 Census of Manufactures, Preliminary Report.

EXHIBIT VIII-2

FEDERAL ENERGY OFFICE

PROPORTION OF INDUSTRY OUTPUT ACCOUNTED FOR BY EACH MAJOR PROCESS, 1973

SIC 3715 Industry Truck Trailers

Process and Major Products	Percent of 1973 Shipments Value	Percent of 1973 Production Volume
	(Percent)	(Units)
Truck trailers (primary)		
Complete trailers	79.7(1)	177.1(2)
Detachable trailer bodies	5.5(1)	23.2(2)
Detachable trailer chassis	4.2(1)	21.9(2)
Other products (secondary)	4.8(1)	(X)
Miscellaneous receipts	5.8(1)	(X)
Total Industry (Percent)	100.0	
(Actual) (millions)	$1,352.4(2)	(X)

Sources: (1) 1972 census of manufactures, preliminary reports.

(2) A. T. Kearney, Inc.(outputs developed based on 10-year correlation with truck-tractor (GVW over 26,000 lbs.) chassis sales.)

EXHIBIT VIII-3
(Table 1d)

FEDERAL ENERGY OFFICE

- CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers

Subprocess Metalworking

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total									
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)	Mil. KWH	160			160	260			260
12	GRAND TOTAL	Mil. KWH	160			160	260			260

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VII-4 (Table 2d/1a)

FEDERAL ENERGY OFFICE

- CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers

Subprocess Finishing Operations

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates	1,000 barrels	23.4			23.4	35.2			35.2
3	Residual fuel oil	1,000 barrels	21.7			21.7	38.0			38.0
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total	1,000 barrels	45.1			45.1	73.2			73.2
7	Coal	1,000 s. tns.	7.8				11.7			11.7
8	Natural gas	Billion cu. ft.	1.12				1.82			1.82
9	Fuels, n.e.c., total									
10	Other fuels, total	(X)				(X)	(X)			(X)
11	Electrical energy (Purchased only)									
12	GRAND TOTAL	(X)				(X)	(X)			(X)

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VII-5 (Table 2d/1b)

FEDERAL ENERGY OFFICE

- CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers

Subprocess In-Plant Transportation

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	1,000 barrels	25.5			25.5	51.1			51.1
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline	1,000 barrels	6.5			6.5	6.5			6.5
6	Petroleum products total	1,000 barrels	32.0			32.0	57.6			57.6
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL	1,000 barrels	32.0			32.0	57.6			57.6

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VII-6 (Table 2d/1e)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers

Subprocess Building

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates	1,000 barrels	11.7			11.7	11.7			11.7
3	Residual fuel oil	1,000 barrels	10.9			10.9	16.3			16.3
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total	1,000 barrels	22.6			22.6	28.0			28.0
7	Coal									
8	Natural gas	1,000 s. tns.	9.1			9.1	10.4			10.4
9	Fuels, n.e.c., total	billion cu. ft.	0.56			0.56	0.66			0.66
10	Other fuels, total		(X)			(X)	(X)			(X)
11	Electrical energy (Purchased only)	Mil. KWH	40			40	40			40
12	GRAND TOTAL		(X)			(X)	(X)			(X)

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VII-7 (Table 2d/1d)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS, 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers

Subprocess Building

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates	1,000 barrels	11.7			11.7	11.7			11.7
3	Residual fuel oil	1,000 barrels	10.9			10.9	16.3			16.3
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total	1,000 barrels	22.6			22.6	28.0			28.0
7	Coal									
8	Natural gas	1,000 s. tns.	9.1			9.1	10.4			10.4
9	Fuels, n.e.c., total	billion cu. ft.	0.56			0.56	0.66			0.66
10	Other fuels, total		(X)			(X)	(X)			(X)
11	Electrical energy (Purchased only)	Mil. KWH	40			40	40			40
12	GRAND TOTAL		(X)			(X)	(X)			(X)

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VIII-8
(Table 2d/1)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers

Subprocess Metalworking

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total									
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)		546			546	887			887
12	GRAND TOTAL		546			546	887			887

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VII-9 (Table 3d/1a)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers

Subprocess Finishing Operations

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures									
2	Middle distillates		137			137	205			205
3	Residual fuel oil		137			137	239			239
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total		274			274	444			444
7	Coal		205			205	307			307
8	Natural gas		1,160			1,160	1,877			1,877
9	Fuels, n.e.c., total									
10	Other fuels, total		1,365			1,365	2,184			2,184
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		1,639			1,639	2,628			2,628

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VII-10 (Table 3d/Ib)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers

Subprocess In-Plant Transportation

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		102			102	205			205
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline		34			34	34			34
6	Petroleum products total		136			136	239			239
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		136			136	239			239

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VIII-11 (Table 3d/1c)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers

Subprocess Building

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates		68			68	68			68
3	Residual fuel oil		68			68	102			102
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total		136			136	170			170
7	Coal		239			239	273			273
8	Natural gas		580			580	683			683
9	Fuels, n.e.c., total									
10	Other fuels, total		819			819	956			956
11	Electrical energy (Purchased only)		137			137	137			137
12	GRAND TOTAL		1,092			1,092	1,263			1,263

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VII-12
(Table 3d/1d)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN BTU'S (BILLIONS), 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers (Summary)

Subprocess All Subprocesses

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures		102			102	205			205
2	Middle distillates		205			205	273			273
3	Residual fuel oil		205			205	341			341
4	Chemical feedstocks									
5	Gasoline		34			34	34			34
6	Petroleum products total		546			546	853			853
7	Coal		444			444	580			580
8	Natural gas		1,740			1,740	2,560			2,560
9	Fuels, n.e.c., total									
10	Other fuels, total		2,184			2,184	3,140			3,140
11	Electrical energy (Purchased only)		683			683	1,024			1,024
12	GRAND TOTAL		3,413			3,413	5,017			5,017

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VIII-13
(Table 3d/1)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers

Subprocess Metalworking

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures									
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total									
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)		160			160	260			260
12	GRAND TOTAL		160			160	260			260

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VII-14
(Table 4d/1a)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers

Subprocess Finishing Operations

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures									
2	Middle distillates		40			40	60			60
3	Residual fuel oil		40			40	70			70
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total		80			80	130			130
7	Coal		60			60	90			90
8	Natural gas		340			340	550			550
9	Fuels, n.e.c., total									
10	Other fuels, total		400			400	640			640
11	Electrical energy (Purchased only)									
12	GRAND TOTAL		480			480	770			770

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VII-15
(Table 4d/1b)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers

Subprocess In-Plant Transportation

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures	30				30	60			60
2	Middle distillates									
3	Residual fuel oil									
4	Chemical feedstocks									
5	Gasoline	10				10	10			10
6	Petroleum products total	40				40	70			70
7	Coal									
8	Natural gas									
9	Fuels, n.e.c., total									
10	Other fuels, total									
11	Electrical energy (Purchased only)									
12	GRAND TOTAL	40				40	70			70

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VII-16
(Table 4d/1c)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH (MILLIONS), 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers

Subprocess Building

	Type of Energy or Material	Unit of Measure	1971				1973			
			Heat and Power	Material	Other	Total	Heat and Power	Material	Other	Total
1	Propane, butane and mixtures									
2	Middle distillates		20			20	20			20
3	Residual fuel oil		20			20	30			30
4	Chemical feedstocks									
5	Gasoline									
6	Petroleum products total		40			40	50			50
7	Coal		70			70	80			80
8	Natural gas		170			170	200			200
9	Fuels, n.e.c., total									
10	Other fuels, total		240			240	280			280
11	Electrical energy (Purchased only)		40			40	40			40
12	GRAND TOTAL		320			320	370			370

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VII-17
(Table 4d/1d)

FEDERAL ENERGY OFFICE

CONSUMPTION AND USE OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE AND MAJOR PROCESS AND SUBPROCESS IN KWH'S (MILLIONS), 1971 AND 1973

SIC 3715 Industry Truck Trailers

Process Truck Trailers (Summary)

Subprocess All Subprocesses

	Type of Energy or Material	Unit of Measure	1971 Heat and Power	1971 Material	1971 Other	1971 Total	1973 Heat and Power	1973 Material	1973 Other	1973 Total
1	Propane, butane and mixtures		30			30	60			60
2	Middle distillates		60			60	80			80
3	Residual fuel oil		60			60	100			100
4	Chemical feedstocks									
5	Gasoline		10			10	10			10
6	Petroleum products total		160			160	250			250
7	Coal		130			130	170			170
8	Natural gas		510			510	750			750
9	Fuels, n.e.c., total									
10	Other fuels, total		640			640	920			920
11	Electrical energy (Purchased only)		200			200	300			300
12	GRAND TOTAL		1,000			1,000	1,470			1,470

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field test included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VII-18 (Table 4d/1)

FEDERAL ENERGY OFFICE

INDUSTRY CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE - 1971, 1973, AND 1974

SIC 3715 Industry Truck Trailers

	Type of Energy or Material	Volume				Bil. BTU's			Percent Change		Percent of Total BTU's	
		Unit of Measure	1971	1973	1974	1971	1973	1974	1971-73	1973-74	1971	1973
1	Propane, butane, and mixtures	1,000 barrels	25.5	51.1	42.5	102	205	171	101.0	(16.6)	3.0	4.1
2	Middle distillates	1,000 barrels	35.1	46.9	46.9	205	273	273	33.2	0.0	6.0	5.4
3	Residual fuel oil	1,000 barrels	32.6	54.3	48.9	205	341	307	66.3	(10.0)	6.0	6.8
4	Chemical feedstocks											
5	Gasoline	1,000 barrels	6.5	6.5	6.5	34	34	34	0.0	0.0	1.0	0.7
6	Petroleum products, total	1,000 barrels	99.7	158.8	144.8	546	853	785	56.2	(8.0)	16.0	17.0
7	Coal	1,000 s. tns.	16.9	22.1	22.1	444	580	580	30.6	0.0	13.0	11.6
8	Natural gas	billion cu. ft.	1.68	2.48	2.38	1,740	2,560	2,457	47.1	(4.0)	51.0	51.0
9	Fuels, n.e.c. total											
10	Other fuels, total	—	(X)	(X)	(X)	2,184	3,140	3,037	43.8	(3.3)	64.0	62.6
11	Electrical energy (purchased only)	million KWH	200	300	290	683	1,024	990	49.9	(3.3)	20.0	20.4
12	GRAND TOTAL	—	(X)	(X)	(X)	3,413	5,017	4,812	47.0	(4.1)	100.0	100.0

Source: A. T. Kearney, Inc. (Based on field-tested theoretical process energy calculations. Field tests included plant data from 3 of the 6 largest trailer manufacturers.)

EXHIBIT VII-19
(Table 5d)

FEDERAL ENERGY OFFICES

SHIPMENTS, EMPLOYMENT, AND FUELS AND ENERGY CONSUMED BY GEOGRAPHIC UNIT, 1971 AND 1973

SIC 3715 Industry Truck Trailers

	Geographic Unit	Value of Shipments ($000,000)			Employment (000)			Fuels and Energy (Bil. BTU's)		
		1971	1973	Percent Change	1971	1973	Percent Change	1971	1973	Percent Change
1	United States	787.2	1,352.4	71.8	21.2	28.8	35.8	3,413	5,017	47.0
2	NORTH EAST	179.5	308.4	71.8	4.8	6.6	37.5	778	1,144	47.0
3	New England	3.2	5.4	68.8	0.1	0.1	-	14	20	42.9
4	Maine (a)	3.2	5.4	68.8	0.1	0.1	-	14	20	42.9
5	N.H. (a)	-	-	-	-	-	-	-	-	-
6	Vermont (a)	-	-	-	-	-	-	-	-	-
7	Mass. (a)	-	-	-	-	-	-	-	-	-
8	R.I. (a)	-	-	-	-	-	-	-	-	-
9	Conn. (a)	-	-	-	-	-	-	-	-	-
10	Middle Atlantic	176.3	302.9	71.8	4.8	6.5	35.4	764	1,124	47.1
11	N.Y.									
12	N.J.	10.2	17.6	72.5	0.3	0.4	33.3	44	65	47.7
13	Penn.	166.1	285.4	71.8	4.5	6.1	35.6	720	1,059	47.1
14	NORTH CENTRAL	307.0	527.4	71.8	8.3	11.2	34.9	1,331	1,957	47.0
15	E. North Central	214.0	367.9	71.9	5.8	7.8	34.5	928	1,365	47.1
16	Ohio	103.9	178.5	71.8	2.8	3.8	35.7	450	662	47.1
17	Ind.	58.3	100.1	71.7	1.6	2.1	31.2	253	371	46.6
18	Ill.	24.4	41.9	71.7	0.7	0.9	28.6	106	156	47.2
19	Mich.	7.1	12.2	70.8	0.2	0.3	50.0	31	45	45.2
20	Wisc.	20.5	35.2	71.7	0.6	0.8	33.3	89	130	46.1

EXHIBIT VII-20
(Table 8d)

SHIPMENTS, EMPLOYMENT, AND FUELS AND ENERGY CONSUMED BY GEOGRAPHIC UNIT, 1971 AND 1973

	Geographic Unit	Value of Shipments ($000,000)			Employment (000)			Fuels and Energy (Bil. BTU's)		
		1971	1973	Percent Change	1971	1973	Percent Change	1971	1973	Percent Change
21	W. North Central	92.9	159.6	71.8	2.5	3.4	36.0	403	592	46.9
22	Minn.	10.2	17.6	73.5	0.3	0.4	33.3	44	65	47.7
23	Iowa	24.4	41.9	71.7	0.7	0.9	28.6	106	156	47.2
24	Mis.	24.4	41.9	71.7	0.7	0.9	28.6	106	156	47.2
25	N.D.									
26	S.D.									
27	Neb.	24.4	41.9	71.7	0.7	0.9	28.6	106	156	47.2
28	Kans.	10.2	17.6	73.5	0.3	0.4	33.3	44	65	47.7
29	SOUTH	217.3	373.3	71.8	5.9	8.0	35.6	942	1,385	47.0
30	S. Atlantic	52.0	89.3	71.7	1.4	1.9	35.7	225	331	47.1
31	Del. (b)	17.3	29.8	72.2	0.5	0.6	20.0	75	110	46.7
32	Md. (b)	-	-	-	-	-	-	-	-	-
33	D.C. (b)	-	-	-	-	-	-	-	-	-
34	Va. (b)	-	-	-	-	-	-	-	-	-
35	W. Va. (b)	-	-	-	-	-	-	-	-	-
36	N.C. (b)	-	-	-	-	-	-	-	-	-
37	S.C. (b)	-	-	-	-	-	-	-	-	-
38	Ga.	24.4	41.9	71.7	0.7	0.9	28.6	106	156	47.2
39	Fla.	10.2	17.6	73.5	0.3	0.4	33.3	44	65	47.7
40	S. Central	165.3	284.0	71.8	4.5	6.1	35.6	717	1,054	47.0
41	Ky.	10.2	17.6	73.5	0.3	0.4	33.3	44	65	47.7
42	Tenn.	10.2	17.6	73.5	0.3	0.4	33.3	44	65	47.7
43	Ala.	52.0	89.3	71.7	1.4	1.9	35.7	225	331	47.1
44	Miss.									
45	Ark.									
46	La.	10.2	17.6	73.5	0.3	0.4	33.3	44	65	47.7
47	Okla.	14.2	24.3	71.1	0.4	0.5	25.0	61	90	47.5
48	Texas	69.3	119.0	71.7	1.9	2.5	31.6	300	442	47.3

SHIPMENTS, EMPLOYMENT, AND FUELS AND ENERGY CONSUMED BY GEOGRAPHIC UNIT, 1971 AND 1973

	Geographic Unit	Value of Shipments ($000,000)			Employment (000)			Fuels and Energy (Bil. BTU's)		
		1971	1973	Percent Change	1971	1973	Percent Change	1971	1973	Percent Change
49	WEST	82.7	142.0	71.7	2.2	3.0	36.4	358	527	47.2
50	Mountain	14.2	24.3	71.1	0.4	0.5	25.0	61	90	47.5
51	Mont. (c)	3.2	5.4	68.8	0.1	0.1	-	14	20	42.9
52	Idaho (c)	-	-	-	-	-	-	-	-	-
53	Wyo. (c)	-	-	-	-	-	-	-	-	-
54	Colo.	10.2	17.6	72.8	0.3	0.4	33.3	44	65	47.7
55	N.M. (c)	-	-	-	-	-	-	-	-	-
56	Ariz. (c)	-	-	-	-	-	-	-	-	-
57	Utah (c)	-	-	-	-	-	-	-	-	-
58	Nev. (c)	-	-	-	-	-	-	-	-	-
59	Pacific	69.3	119.0	71.7	1.9	2.5	31.6	300	442	47.3
60	Wash.	10.2	17.6	72.5	0.3	0.4	33.3	44	65	47.7
61	Ore.	10.2	17.6	72.5	0.3	0.4	33.3	44	65	47.7
62	Cal.	48.0	82.5	71.9	1.3	1.8	38.5	208	306	47.1
63	Alas.									
64	Haw.									

Notes: a, b, c, - Data for states marked with these letters withheld to avoid disclosing figures for individual companies. Data for each state noted with a,b,or c, is included in state first noted with that respective letter.

Source: A. T. Kearney, Inc. (Geographic distribution based fundamentally on manufacturing activity by state. Index of state manufacturing activity based on 1967 Census employment by state.)

FEDERAL ENERGY OFFICES

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, 1971.

SIC 3715 Industry Truck Trailers Year 1971

		Petroleum Products						Other Fuels					
	Geographic Unit	Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Gasoline (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total Billion BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
1	United States	25.5	35.1	32.6		6.5	546	16.9	1.68		2,184	683	3,413
2	NORTH EAST	5.8	8	7.4		1.5	124	8.6	0.29		498	155	778
3	New England	0.1	0.1	0.1		0.3	2	-	0.01		9	3	14
4	Maine (a)	0.1	0.1	0.1		0.3	2	-	0.01		9	3	14
5	N. H. (a)	-	-	-			-	-	-		-	-	-
6	Vermont (a)	-	-	-		-	-	-	-		-	-	-
7	Mass. (a)	-	-	-		-	-	-	-		-	-	-
8	R.I. (a)	-	-	-		-	-	-	-		-	-	-
9	Conn. (a)	-	-	-		-	-	-	-		-	-	-
10	Middle Atlantic	5.7	7.9	7.3		1.5	122	8.6	0.28		489	152	764
11	N.Y.		0.5										
12	N.J.	0.3		0.4		0.1	7		0.03		28	9	44
13	Penn.	5.4	7.4	6.9		1.4	155	8.6	0.25		461	143	720
14	NORTH CENTRAL	9.9	13.7	12.7		2.5	213	8.3	0.62		852	266	1,330
15	E. North Central	6.9	9.6	8.9		1.8	148	8.3	0.38		594	186	927
16	Ohio	3.4	4.6	4.3		0.8	72	5.4	0.16		289	90	450
17	Ind.	1.9	2.6	2.4		0.5	40	2.9	0.09		161	51	252
18	Ill.	0.8	1.1	1.0		0.2	17		0.06		67	21	106
19	Mich.	0.2	3.2	0.3		0.1	5		0.02		19	6	31
20	Wisc.	0.6	0.9	0.9		0.2	14		0.05		57	38	88

EXHIBIT VII-21
(Table 6d)
Page 1 of 3

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, 1971

		Petroleum Products						Other Fuels					
	Geographic Unit	Propane Butane, and Mixtures (Thousand Barrels)	Distillates (Thousand Barrels)	Residual (Thousand Barrels)	Feedstocks (Thousand Barrels)	Gasoline (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
21	W. North Central	3.0	4.1	3.8		0.8	65	0	0.24		258	81	403
22	Minn.	0.3	0.4	0.4		0.1	7		0.03		28	9	42
23	Iowa	0.8	1.1	1.0		0.2	17		0.06		67	21	106
24	Mis.	0.8	1.1	1.0		0.2	17		0.06		67	21	106
25	N.D.						17						
26	S.D.												
27	Neb.	0.8	1.1	1.0		0.2	17		0.06		67	21	106
28	Kans.	0.3	0.4	0.4		0.1	7		0.03		28	9	42
29	SOUTH	7.0	9.7	9		1.8	150	0	0.57		603	189	942
30	S. Atlantic	1.7	2.3	2.2		0.4	36	0	0.14		144	45	225
31	Del.(b)	0.5	0.8	0.8		0.1	12		0.05		48	15	75
32	Md.(b)	-	-	-			-		-		-	-	-
33	D.C.(b)	-	-	-		-	-		-		-	-	-
34	Va.(b)	-	-	-		-	-		-		-	-	-
35	W. Va.(b)	-	-	-		-	-		-		-	-	-
36	N.C.(b)	-	-	-		-	-		-		-	-	-
37	S.C.(b)	-	-	-		0.2	17		0.06		67	21	106
38	Ga.	0.8	1.1	1.0		0.1	7		0.03		28	9	44
39	Fla.	0.4	0.4	0.4									
40	S. Central	5.3	7.4	6.8		1.4	115	0	0.43		459	143	717
41	Ky.	0.4	0.5	0.4		0.1	7		0.03		28	9	44
42	Tenn.	0.4	0.5	0.4		0.1	7		0.03		28	9	44
43	Ala.	1.6	2.3	2.2		0.4	36		0.14		144	45	225
44	Miss.												
45	Ark.												
46	La.	0.3	0.4	0.4		0.1	7		0.03		28	9	43
47	Okla.	0.4	0.6	0.6		0.1	10		0.03		39	12	61
48	Texas	2.2	3.1	2.8		0.6	48		0.18		192	60	300

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, 1971

		Petroleum Products						Other Fuels					
	Geographic Unit	Propane Butane, and Mixtures (Thousand Barrels)	Distillates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Gasoline (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion (BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
49	WEST	2.7	3.7	3.4		0.7	58	0	0.21		230	72	358
50	Mountain	0.4	0.6	0.6		0.1	10		0.03		40	12	61
51	Mont. (c)	0.1	0.2	0.2		0.0	2		0.01		11	3	14
52	Idaho (c)	-	-	-		-	-		-		-	-	-
53	Wyo. (c)	-	-	-		-	-		-		-	-	-
54	Colo.	0.3	0.4	0.4		0.1	8		0.03		29	9	48
55	N.M. (c)	-	-	-		-	-		-		-	-	-
56	Ariz. (c)	-	-	-		-	-		-		-	-	-
57	Utah (c)	-	-	-		-	-		-		-	-	-
58	Nev. (c)	-	-	-		-	-		-		-	-	-
59	Pacific	2.3	3.1	2.8		0.6	48	0	0.18		192	60	297
60	Wash.	0.4	0.4	0.4		0.1	7		0.03		29	9	44
61	Ore.	0.4	0.5	0.4		0.1	7		0.03		28	9	44
62	Cal.	1.5	2.2	2.0		0.4	34		0.12		135	42	209
63	Alas.												
64	Haw.												

Note: a,b,c - Data for states marked with these letters withheld to avoid disclosing figures for individual companies. Data for each state noted with a,b, or c, is included in state first noted with that respective letter.

Source: A. T. Kearney, Inc., (Geographic distribution based fundamentally on manufacturing activity by state. Index of state manufacturing activity based on 1967 Census employment by state.)

FEDERAL ENERGY OFFICE

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, (1973).

SIC 3715 Industry Truck Trailers Year 1973

		Petroleum Products						Other Fuels					
	Geographic Unit	Propane Butane, and Mixtures (Thousand Barrels)	Distillates (Thousand Barrels)	Residual (Thousand Barrels)	Feedstocks (Thousand Barrels)	Gasoline (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short Tons)	Natural Gas Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total Billion BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
1	United States	51.1	46.9	54.3		6.5	853	22.1	2.48		3,140	1,024	5,017
2	NORTH EAST	11.7	10.7	12.4		1.5	194	11.3	0.43		716	233	1,144
3	New England	0.2	1.9	0.2		0.3	3	-	.011		13	4	20
4	Maine (a)	0.2	1.9	0.2		0.3	3	-	.011		13	4	20
5	N. H. (a)	-	-	-		-	-	-	-		-	-	-
6	Vermont (a)	-	-	-		-	-	-	-		-	-	-
7	Mass. (a)	-	-	-		-	-	-	-		-	-	-
8	R.I. (a)	-	-	-		-	-	-	-		-	-	-
9	Conn. (a)	-	-	-		-	-	-	-		-	-	-
10	Middle Atlantic	11.5	105	12.2		1.5	191	11.3	0.42		703	229	1,124
11	N.Y.												
12	N.J.	.7	6	0.7		0.1	11		0.04		41	13	65
13	Penn.	10.8	99	11.5		1.4	180	11.3	0.38		662	216	1,059
14	NORTH CENTRAL	19.9	183	21.2		2.5	333	10.8	0.91		1,225	399	1,957
15	E. North Central	13.9	128	14.8		1.8	232	10.8	0.56		854	279	1,365
16	Ohio	6.7	62	7.2		0.8	113	7.0	0.24		415	135	662
17	Ind.	3.8	35	4.0		0.5	63	3.8	0.13		232	76	371
18	Ill.	1.6	15	1.7		0.2	26		0.09		97	32	156
19	Mich.	0.5	42	0.5		0.1	8		0.03		28	9	45
20	Wisc.	1.3	12	1.4		0.2	22		0.07		82	27	130

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, 1973.

		Petroleum Products						Other Fuels					
	Geographic Unit	Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Gasoline (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short Tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion BTU's)	Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
21	W. North Central	6.0	55	6.4		0.8	101	0	0.35		371	121	592
22	Minn.	0.6	6	0.7		0.1	11		0.04		40	13	62
23	Iowa	1.6	15	1.7		0.2	26		0.09		97	32	156
24	Mis.	1.6	15	1.7		0.2	26		0.09		97	32	156
25	N.D.								-				
26	S.D.								-				
27	Neb.	1.6	15	1.7		0.2	26		0.09		97	32	156
28	Kans.	0.6	6	0.6		0.1	12		0.04		40	12	62
29	SOUTH	14.1	129	15		1.8	235		0.84		867	283	1,385
30	S. Atlantic	3.4	31	3.6		0.4	56	0	0.20		207	68	331
31	Del.(b)	1.1	10	1.2		0.1	19	-	0.07		69	23	110
32	Md. (b)	-	-	-		-	-	-	-		-	-	-
33	D.C.(b)	-	-	-		-	-		-		-	-	-
34	Va.(b)	-	-	-		-	-		-		-	-	-
35	W. Va.(b)	-	-	-		-	-		-		-	-	-
36	N.C. (b)	-	-	-		-	-		-		-	-	-
37	S.C.(b)	-	-	-		-	-		-		-	-	-
38	Ga.	1.6	15	1.7		0.2	26		0.09		97	32	156
39	Fla.	.7	6	0.7		0.1	11		0.04		41	13	65
40	S. Central	10.7	98	11.4		1.4	179	0	0.64		660	215	1,054
41	Ky.	0.7	6	0.7		0.1	11		0.04		41	13	64
42	Tenn.	0.7	6	0.7		0.1	11		0.04		41	13	64
43	Ala.	3.3	31	3.6		0.4	56		0.20		207	68	331
44	Miss.												
45	Ark.												
46	La.	0.7	6	0.7		0.1	11		0.04		41	13	64
47	Okla.	0.9	8	1.0		0.1	15		0.05		57	18	90
48	Texas	4.4	41	4.7		0.6	75		0.27		276	90	441

CONSUMPTION OF FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, BY GEOGRAPHIC UNIT, 1973.

	Geographic Unit	Petroleum Products						Other Fuels				Purchased Electrical Energy (Billion BTU's)	Grand Total (Billion BTU's)
		Propane Butane, and Mixtures (Thousand Barrels)	Distil-lates (Thousand Barrels)	Residual (Thousand Barrels)	Feed-stocks (Thousand Barrels)	Gasoline (Thousand Barrels)	Total (Billion BTU's)	Coal (Thousand Short tons)	Natural Gas (Billion Cubic Feet)	Fuels n.e.c. (Billion BTU's)	Total (Billion (BTU's)		
49	WEST	5.4	49	5.7		0.7	90	0	0.31		330	108	527
50	Mountain	0.9	8	1.0		0.1	15		0.05		57	18	90
51	Mont.(c)	0.2	2	0.3		0.0	3		0.01		16	4	20
52	Idaho (c)	-	-	-		-	-		-		-	-	-
53	Wyo. (c)	-	-	-		-	-		-		-	-	-
54	Colo.	0.7	6	0.7		0.1	12		0.04		41	14	70
55	N.M. (c)	-	-	-		-	-		-		-	-	-
56	Ariz. (c)	-	-	-		-	-		-		-	-	-
57	Utah (c)	-	-	-		-	-		-		-	-	-
58	Nev. (c)	-	-	-		-	-		-		-	-	-
59	Pacific	4.5	41	4.7		0.6	75	0	0.26		276	90	437
60	Wash.	0.7	6	0.7		0.1	11		0.04		41	14	65
61	Ore.	0.7	6	0.7		0.1	11		0.04		41	14	65
62	Cal.	3.1	29	3.3		0.4	53		0.18		194	62	307
63	Alas.												
64	Haw.												

Note: a,b,c - Data for states marked with these letters withheld to avoid disclosing figures for individual companies. Data for each state noted with a,b, or c, is included in state first noted with that respective letter.

Source: A. T. Kearney, Inc., (Geographic distribution based fundamentally on manufacturing activity by state. Index of state manufacturing activity based on 1967 Census employment by state.)

FEDERAL ENERGY OFFICE

STOCKS OF FUELS AND PETROLEUM PRODUCTS BY TYPE, 12/31/73 AND 3/31/74

SIC 3715 Industry Truck Trailers

	Types of Fuel or Material	Stocks (number of days supply related to average daily requirements in next quarter)					
		As of December 31			As of March 31		
		1971	1972	1973	1972	1973	1974
1	Propane						
2	Butane						
3	Propane Butane Mixture	3 - 5	3 - 5	3 - 5	3 - 5	3 - 5	3 - 5
4	Middle Distillates	3 - 10	3 - 10	3 - 10	3 - 10	3 - 10	3 - 10
5	Residual Fuel Oil	3 - 10	3 - 10	3 - 10	3 - 10	3 - 10	3 - 10
6	Chemical Feedstocks						
7	Gasoline	3 - 5	3 - 5	3 - 5	3 - 5	3 - 5	3 - 5
8	Coal	NA	NA	NA	NA	NA	NA
9	Natural Gas	(X)	(X)	(X)	(X)	(X)	(X)
10	Fuels, nec. total						

Source: A. T. Kearney, Inc. (Based on field survey of four of largest six manufacturers.)

EXHIBIT VII-23
(Table 9d)

FEDERAL ENERGY OFFICE

SEASONAL USE OF FUELS, PETROLEUM PRODUCTS AND ENERGY BY TYPE, 1973

SIC 3715 Industry Truck Trailers

Type of Material or Energy	Percent of Annual Use in 1973 in: January-March	April-June	July-September	October-December
Propane, Butane and mixtures	24.0	25.5	23.7	26.8
Distillates	29.0	24.0	19.0	28.0
Residual	30.0	24.0	18.0	28.0
Feedstocks				
Gasoline	24.0	25.5	23.7	26.8
Coal	34.0	23.0	15.0	28.0
Natural Gas	29.0	24.0	19.0	28.0
Other Fuels				
Electrical Energy (Purchased only)	24.0	25.5	23.7	26.8

Source: Current Industrial Reports (for production seasonality) A. T. Kearney, Inc. (For seasonal heating requirements.)

EXHIBIT VII-24 (Table 12d)

FEDERAL ENERGY OFFICE

SOURCES OF SUPPLY FOR FUELS, PETROLEUM PRODUCTS, AND ENERGY BY TYPE, 1973

SIC 3715 Industry Truck Trailers

		Percent of 1973 Consumption Supplied								
	Source of Supplies	Propane, Butane, and Mixtures	Distillates	Residual	Feed Stocks	Other Petroleum Products	Coal	Natural Gas	Other Fuels	Electrical Energy
1	Captive Production									
2	Purchased from:									
3	Refineries									
4	Other Manufacturers									
5	Wholesalers	75	75	75		75	100			
6	Importers									
7	Retailers	25	25	25		25				
8	Utilities							100		100
9	Other Sources									
	TOTAL	100	100	100	100	100	100	100	100	100
	Unit of Measure used to compute percent	KWH	KWH	KWH		KWH	KWH	KWH		KWH

Source: A. T. Kearney, Inc. (Based on field survey of four of six largest manufacturers. Assumes that plants employing over 250 buy wholesale; plants under 250 employment buy retail.)

EXHIBIT VII-25
(Table 11d)

FEDERAL ENERGY OFFICE

CAPTIVE PRODUCTION, CONSUMPTION, AND SALES OF FUELS, ENERGY, AND PETROLEUM PRODUCTS, 1973

SIC 3715 Industry Truck Trailers

Type of Energy or Material	Volume				Mil. BTU's			KWH Equivalents			Value of Sales ($000)
	Unit of Measure	Produced	Consumed	Sold	Produced	Consumed	Sold	Produced	Consumed	Sold	
NONE					- N O N E -						

Source: A. T. Kearney, Inc. (Based on field survey of four of largest six manufacturers.)

EXHIBIT VII-26
(Table 10d)

APPENDICES

APPENDIX A

GLOSSARY

CAPITAL EXPENDITURES	For establishments in operation and establishments under construction but not yet in operation, manufacturers were asked to report their expenditures for (a) permanent additions and major alterations to manufacturing establishments, and (b) new machinery and equipment used for replacement purposes and additions to plant capacity if they are of the type for which depreciation accounts are ordinarily maintained. These totals exclude that portion of expenditures for new facilities and equipment leased from nonmanufacturing concerns, new facilities owned by private companies, and plant and equipment furnished to the manufacturer by communities and nonprofit organizations. Expenditures for used plant and equipment (although reported in the census), expenditures for land and cost of maintenance and repairs charged as current operation expenses are also omitted from the figures for new capital expenditures.
COST OF MATERIALS	Direct charges actually paid or payable for items consumed or put into production during the year, including freight charges and other direct charges incurred by the establishment in acquiring these materials. It includes the cost of materials or fuel consumed regardless of whether these items were purchased by the individual establishment from other companies, transferred to it from other establishments of the same company, or withdrawn from inventory during the year. The important components of this cost item are (a) all raw material, semi-finished goods, parts, components, containers, scrap, and supplies put

into production or used as operating supplies and for repair and maintenance during the year; (b) electric energy purchased; (c) fuels consumed for heat, power, or the generation of electricity; (d) work done by others on materials or parts furnished by manufacturing establishments (contract work); and (e) products bought and resold in the same condition.

EMPLOYEES

The average number of production workers plus the number of other employees in mid-March. The number of production workers is the average of those for midmonth payroll periods of March, May, August, and November.

All full-time and part-time employees on the payrolls of operation manufacturing establishments for any part of the pay period ended nearest the 12th of the months specified on the report form. Included are all persons on paid sick leave, paid holidays, and paid vacations during these pay periods. Officers of corporations are included as employees; proprietors and partners of unincorporated firms are excluded.

END-OF-YEAR-INVENTORIES

Inventories at approximate current costs if possible; otherwise at book value. Since different methods of inventory valuation are used (LIFO, FIFO, etc.) the definition of the value of the inventories aggregated for all establishments in an industry is not precise. The figures on change in inventory between years are of considerably greater significance than the measurement of the level of inventories.

GROSS VALUE OF FIXED ASSETS

Fixed assets on the books of establishments at the end of the year for which depreciation accounts are maintained. The values shown (book value) represent the actual cost of assets at the time they were acquired, including all costs incurred in making the assets usable (such as transportation and installation). Included are all buildings, structures, and machinery and equipment. Excluded are nondepreciable assets; for example, inventories and intangible assets such as patent rights and royalties. Also excluded are land and depletable assets such as timber and mineral rights.

MAN-HOURS (PRODUCTION WORKERS)

Production worker man-hours worked or paid for at the plant including actual overtime hours (not straight-time equivalent hours). It excludes hours paid for vacations, holidays, or sick leave when the employee was not at the plant.

PAYROLL

Forms of compensation such as salaries, wages, commissions, dismissal pay, all bonuses, vacation and sick leave pay, and compensation in kind, prior to such deductions as employee's Social Security contributions, withholding taxes, group insurance, union dues, and savings bonds. The total includes salaries of officers of these establishments, if a corporation; it excludes payments to the proprietor or partners, if an unincorporated concern.

VALUE ADDED

A measure of manufacturing activity is derived by subtracting the cost of materials, supplies, containers, fuel, purchased electricity, and contract work from the value of shipments for products manufactured plus receipts for services rendered. The result of this calculation is then adjusted by the net change in finished goods and work-in-process inventories between the beginning and end of the year.

VALUE OF SHIPMENTS

The received or receivable net selling values, f.o.b. plant (exclusive of freight and taxes), of all products shipped, both primary and secondary, as well as all miscellaneous receipts such as receipts for contract work performed for others, installation and repair, sales of scrap, and sale of products bought and resold without further processing. Included are all items made by or for the establishments from materials owned by it whether sold, transferred to other plants of the same company, or shipped on consignment. The net selling value of products made in one plant on a contract basis from materials owned by another was reported by the plant providing the materials.

APPENDIX B

CONVERSION TABLE

Type of Material or Energy	Unit of Measure	Equivalent to Thousand BTU's	Equivalent to Kilowatt-hours
Propane, butane & mixtures	Barrel	4,011	1,175
Middle distillates	Barrel	5,825	1,707
Residual fuel oil	Barrel	6,287	1,842
Chemical feedstocks	Barrel	4,011	1,175
Other Petroleum Products			
Gasoline	Barrel	5,253	1,539
Kerosine	Barrel	5,670	1,661
Lubricants	Barrel	6,065	1,777
Wax	Barrel	5,537	1,622
Asphalt	Barrel	6,636	1,944
Residual fuels, pet, coke, acid sludge	Barrel	6,006	1,760
Miscellaneous	Barrel	5,796	1,698
Coal	Short Ton	26,200	7,677
Anthracite	Short Ton	25,400	7,442
Bituminous	Short Ton	26,200	8,468
Lignite	Short Ton	14,770	4,328
Natural Gas	Thous. cu. ft.	1,032	303.3
Fuels, n.e.c.			
Coke oven gas	Thous. cu. ft.	550	161.2
Blast furnace gas	Thous. cu. ft.	92	27.0
Still gas	Thous. cu. ft.	1,501	439.8
Coke	Short Ton	26,000	
Coke screening and breeze	Short Ton	20,488	
Electrical Energy	Kilowatt-hour	10.6 1/	3.1

1/ To replace fossil fuel as input to electricity generation

APPENDIX C

RELIABILITY TABLE

Table Number	Exhibit Number	Reliability Rating	Comments
1a	IV-3	2	The estimates of value of shipments were adjusted from the 1972 Census of Manufactures' figures to account for increased production and price level. The production volume was estimated from the increases in car and truck production in 1973 which were reported by the Automotive News Almanac Issue, 1974.
2a (Series)	IV-5 thru IV-15	4	Energy use by process and subprocess was based on estimates made by plant engineers and energy experts in the Industry.
3a (Series)	IV-16 thru IV-26	4	
4a (Series)	IV-27 thru IV-37	4	
5a	IV-38	4	Energy use by type of energy was determined from data provided by companies within the Industry with over 90 percent of the Industry reporting.
6a	IV-39	4	Total energy use by geographic unit was estimated based on the value of shipments for each geographic unit. The amount of each type of fuel used in each geographic unit was estimated from a limited amount of data on the Transportation Group (SIC 37) as reported in the 1972 Census of Manufactures.
7a	IV-40	4	

Table Number	Exhibit Number	Reliability Rating	Comments
8a	IV-41	4	Value of shipments were estimated for each geographic unit based on the total car and truck production in the area as reported by Wards Automotive Yearbooks. The employment in the Industry for 1971 was taken from the 1970-71 Annual Survey of Manufactures. The 1973 employment for the Industry was estimated based on the increase in employment from 1971 to 1973 as reported by the U.S. Department of Labor, Bureau of Labor Statistics. The total energy use for each geographic unit was assumed to be a direct function of value of shipments.
9a	IV-42	4	Stocks of fuel were estimated from a limited amount of information provided by the Industry. The number of companies and the percent of the Industry providing this information has been withheld to avoid disclosing the identity of the reporting companies.
10a	IV-43	1	Over 90 percent of the Industry was questioned regarding captive energy sources.
11a	IV-44	4	Over 90 percent of the Industry provided information on their sources of supply of energy.
12a	IV-45	4	The estimates of the seasonal use of energy were based on the opinions of plant engineers and energy specialists in the Industry. Detailed data is not kept by the companies on seasonal energy use.

Table Number	Exhibit Number	Reliability Rating	Comments
1b	V-3	4	
2b (Series)	V-4 thru V-14	4	
3b (Series)	V-15 thru V-25	4	
4b (Series)	V-26 thru V-36	4	Data based on field tested, theoretical process energy equations. Field test included data from eight SIC 3713 manufacturers.
5b	V-37	4	
6b	V-39	4	Because of the lack of homogeneity in the SIC 3713 subindustries, data developed for totals by inference are of low reliability. Further, numerous reporting inconsistencies were noted between Census and Industry Association data.
7b	V-40	4	
8b	V-38	4	
9b	V-41	4	
10b	V-44	4	
11b	V-43	4	
12b	V-42	4	
1c	VI-12	2	The total value of shipments was estimated based on the 1972 value of shipments from the 1972 Census of Manufactures, adjusted for changes in production quantities and price levels.

Table Number	Exhibit Number	Reliability Rating	Comments
2c (Series)	VI-13 thru VI-21	4	Energy use by process was estimated by A. T. Kearney based on energy requirements calculations.
3c (Series)	VI-33 thru VI-30	4	
4c (Series)	VI-31 thru VI-39	4	
5c	VI-40	4	Energy use by type of energy was determined from data provided by companies within the Industry with over 70 percent of the Industry reporting.
6c	VI-41	4	Total energy use by geographic unit was estimated based on the value of shipments for each geographic unit. The amount of each type of fuel used in each geographic unit was estimated from a limited amount of data on the Transportation Group (SIC 37) as reported in the 1972 Census of Manufactures. There was insufficient data available to estimate the energy use by individual state.
7c	VI-42	4	
8c	VI-43	4	The value of shipments for each geographic unit was estimated by adjusting the 1972 value of shipments by geographic unit (reported in the Preliminary Report of the 1972 Census of Manufactures). The value of shipments for each geographic unit in 1971 and 1973 was assumed to be in the same proportion to the total as it was in 1972. The 1972 Census of Manufactures did not report the value of shipments for each geographic unit and there was insufficient data available to determine the value of shipments for the areas not reported by the Census of Manufactures.

Table Number	Exhibit Number	Reliability Rating	Comments
9c	VI-44	4	Stocks of fuel were estimated from a limited amount of information provided by the Industry. The number of companies and the percent of the Industry providing this information has been withheld to avoid disclosing the identity of the reporting companies.
10c	VI-45	1	Over 70 percent of the Industry was questioned regarding captive energy sources.
11c	VI-46	4	Over 70 percent of the Industry provided information on their sources of supply of energy.
12c	VI-47	4	Stocks of fuel were estimated from a limited amount of information provided by the Industry. The number of companies and the percent of the Industry providing this information has been withheld to avoid disclosing the identity of the reporting companies

Table Number	Exhibit Number	Reliability Rating	Comments
1d	VII-3	2	Data projected from CIR reported figures which are assumed accurate.
2d (Series)	VII-4 thru VII-8	4	
3d (Series)	VII-9 thru VII-13	4	
4d (Series)	VII-14 thru VII-18	4	
5d	VII-19	4	Data based field tested, theoretical process energy equations. Field test included representative plants of 3 to 6 largest manufacturers.
6d	VII-21	4	
7d	VII-22	4	
8d	VII-20	4	
9d	VII-23	4	
10d	VII-26	4	
11d	VII-25	4	
12d	VII-24		

APPENDIX D

PROCESS ANALYSIS ENERGY BALANCE

IRON FOUNDRY

Cupola Melting

1. Coke Requirement for Melting

   Assumption: 8-1 Iron to Coke ratio
   95% yield iron charged to poured
   60% yield castings from iron poured

   $$\text{Coke} = \frac{2000}{8 \times .95 \times .60} = 440 \text{ lb./ton castings}$$

2. Fuel Requirement for Air Preheating

   Assumption: 1000°F. air preheat
   30,000 CF air per ton iron melted
   50% combustion efficiency
   10 BTU/CF air for heating

   $$\text{BTU} = \frac{30,000 \times 10}{.95 \times .60 \times .50} = 1,050,000 \text{ BTU/ton castings}$$

   If natural gas is used -

   $$\frac{1,050,000}{1,030} = 1,020 \text{ CF/ton castings}$$

   If fuel oil is used (#2 or #3) -

   $$\frac{1,050,000}{140,000} = 7.50 \text{ Gal./ton castings}$$

3. Fuel Requirement for Ladle and Runner Heating

   Assumption: 150,000 BTU/ton iron

   If natural gas is used -

   $$\frac{150,000}{1,030 \times .60} = 240 \text{ CF gas/ton castings}$$

4. Afterburners Fuel Requirement

Assumption: 450,000 BTU/ton melted

$$\frac{450,000}{1,030 \times .60 \times 9.5} = 765 \text{ CF gas/ton castings}$$

5. Total Gas Required CF Per Ton Castings

Air Preheating	-	1,020
Ladle & Runner Heating	-	240
Afterburners	-	765
Total		2,025 CF/ton castings

6. Electric Power Requirement for Melting

(a) Blower requirement - 50 oz. pressure
10 HP per ton/hr. iron melted

$$\text{Power used} = \frac{10}{.95 \times .60} = 18 \text{ HP/ton castings}$$

$$= 18 \text{ KWH/ton castings}$$

(b) Other power used - skip hoist, crane, air pre-heat blower, pumps, etc.

Power = 7 HP per ton/hr. iron melted

$$\text{Power Used} = \frac{12}{.95 \times .60} = 12 \text{ KWH/ton castings}$$

(c) Air pollution control

Power Installed = 50 HP/ton iron melted

$$\text{Power Used} = \frac{50}{.95 \times .60} = 90 \text{ KWH/ton castings}$$

(d) Holding furnace (channel induction)

Power Used = 60 KWH/ton iron

$$= \frac{60}{.60} = 100 \text{ KWH/ton castings}$$

(e) Total Electric Power for Melting

Blower	-	18 KWH/ton castings
Miscellaneous	-	12
Air Pollution	-	90
Holding Furnace	-	100
Total		220 KWH/ton castings

7. Total Energy for Cupola Melting Per Ton Castings Produced

Energy Form	Quantity	KWH Equivalent
Coke	440 lb.	1,670
Gas	2,025 CF	615
#2 Oil (Alternate)	7.50 Gal.	-
Electric Power	220 KWH	220
Total		2,505 KWH/ton castings

Electric Arc Melting

1. Electric Power Requirement

(a) Electric arc melting furnace

530 KWH per ton iron for melting @ 60% yield iron melted to castings

$$\frac{530}{.60} = 885 \text{ KWH per ton castings}$$

(b) Induction holding furnace

$$60 \text{ KWH/ton iron} = \frac{60}{.60} = 100 \text{ KWH per ton castings}$$

(c) Miscellaneous power; cranes, pollution control

$$\text{Power} = 50 \text{ KWH per ton iron}$$
$$= \frac{.50}{.60} = 85 \text{ KWH/ton castings}$$

(d) Total Power Use - Per ton castings

Melting -	885
Holding -	100
Misc. -	85
	1,070 KWH/ton castings

2. Gas for Miscellaneous Purposes

240 CF gas per ton castings

3. Total Energy for Electric Melting Per Ton Castings Produced

Energy Form	Quantity	KWH Equivalent
Electric Power	1,070 KWH	1,070
Gas	240 CF	75
Total		1,145 KWH/ton castings

Other Foundry Uses

1. Molding, Sand Preparation, Material Handling, Cleaning, Coremaking

(a) Electric power - 600 HP total load or
60 HP per ton castings

= 60 KWH/ton castings

(b) Gas - 100 CF per ton castings

2. Total Energy Use

Energy Form	Quantity	KWH Equivalent
Electric Power	60 KWH	60
Gas	100 CF	30
Total		90 KWH/ton castings

Summary Iron Foundry

1. Cupola Melting - Per Ton Castings

Energy Form	Quantity	KWH Equivalent
Coke	440 lb.	1,670
Gas	2,125 CF	645
Electric Power	280 KWH	280
Total		2,595 KWH per ton castings

2. Electric Melting - Per Ton Castings

Energy Form	Quantity	KWH Equivalent
Electric Power	1,130 KWH	1,130
Gas	340 CF	105
Total		1,235 KWH per ton castings

ALUMINUM FOUNDRY

Melting

1. Fuel Fired Furnace

   2,000,000 BTU/ton for melting with preheat to 500°F

   Yield from melt to castings - 60%

   (a) Using Gas -

   $$\frac{2,000,000}{1,030} = 1,950 \text{ CF/ton melted}$$
   $$= 3,250 \text{ CF/ton castings}$$

   (b) Using Oil -

   $$\frac{2,000,000}{140,000} = 14.3 \text{ gal/ton melted}$$
   $$= 24 \text{ gal/ton castings}$$

2. Electric Induction Melting - 500 KWH per ton melted or
   835 KWH per ton castings

3. Miscellaneous Runner & Ladle Heating

   Assume: 150,000 BTU per ton aluminum melted or
   250,000 BTU per ton castings

   Gas Use - $\frac{250,000}{1,030}$ = 245 CF per ton castings

Other Foundry Uses

Electric Power - Assume 60 KWH per ton castings

Fuel - Assume 100 CF gas per ton castings

Summary

1. Fuel Fired Melting Per Ton Castings

Energy Form	Quantity	KWH Equivalent
Gas	3,600 CF	1,090
Electric Power	60 KWH	60
Total		1,150 KWH/ton castings

2. Electric Melting Per Ton Castings

Energy Form	Quantity	KWH Equivalent
Gas	345 CF	105
Electric Power	895 KWH	895
Total		1,000 KWH/ton castings

ZINC DIE CASTINGS

Melting

Fuel-fired Furnace -

600 BTU per pound (average) melted

1,200,000 BTU per ton melted

1,200 CF gas per ton melted

Or at 75% yield

1,600 CF gas per ton castings

Other Uses

Gas for die heating, etc., - 50 CF gas per ton castings

Electric Power

60 KWH per ton castings

Total Energy Use Per Ton Castings

Energy Form	Quantity	KWH Equivalent
Gas	1,650 CF	500
Electric Power	60 KWH	60
Total		560 KWH/ton castings

STEEL FORGINGS

Heating of Stock

Average 2,500,000 BTU per ton steel heated at yield of 70% = 3,500,000 BTU per ton finished forgings

(a) Gas heating = 3,500 CF/ton forgings

(b) Oil heating = 25 gallon oil/ton forgings

Forging Operations

Average power consumption 1,000 KWH per ton of forgings.

Total Energy Requirement Per Ton of Forgings

Energy Form	Quantity	KWH Equivalent
Gas	3,500 CF	1,060
Power	1,000 KWH	1,000
Total		2,060 KWH/ton

ALUMINUM EXTRUSIONS

Heating of Stock

Average of 1,000,000 BTU per ton aluminum heated at yield of 70% = 1,400,000 BTU/ton extrusions

(a) Gas heating = 1,400 CF/ton extrusions

(b) Oil heating = 10 gallon oil/ton extrusions

Extrusion Operations

Average power consumption = 1,000 KWH/ton extrusions

Total Energy Requirement Per Ton of Extrusions

Energy Form	Quantity	KWH Equivalent
Gas	1,400 CF	425
Power	1,000 KWH	1,000
Total		1,425 KWH/ton

HEAT TREATED STEEL PRODUCTS

Quench & Temper Process

Heating to 1,600°F, quench in water or oil, temper at 800°F. Use gas fired furnaces, with alternate of No. 3 oil.

1. Heating - 300 BTU/lb. @ 40% efficiency

   BTU Required = $\frac{300 \times 2,000}{.4}$ = 1,500,000 BTU/ton

2. Tempering - 150 BTU/lb. @ 50% efficiency

   BTU Required = $\frac{150 \times 2,000}{.5}$ = 6,000,000 BTU/ton

3. Total Heat = 2,100,000 BTU/ton

   = 2,100 CF gas/ton

   or = 15 gallons oil/ton

Carburizing Process

Heating to 1,700°F - 10 hours - quench in water, use gas or oil fired furances.

BTU Required for Heating - 600 BTU/lb. @ 40% efficiency

Total heat = $\frac{600 \times 2,000}{.40}$ = 3,000,000 BTU/ton

= 3,000 CF gas/ton

or = 21.5 gal. oil/ton

Induction Hardening Process

Heating surface only to 1,600°F - quench -

280 BTU/lb. for portion heated.

Assume 20% of volume is heated.

280 x 2,000 x .2 = 120,000 BTU/ton product

Efficiency = 90%

Power $= \frac{120,000}{.9 \times 3,412} = 40$ KWH/ton

Miscellaneous Electric Power

Furnace blowers, conveyors, shotblasting, etc.

Average 50 KWH per ton

Annealing

Heat to 1,700°F for 3-4 hours.

Heat required = 2,000,000 BUT/ton

= 2,000 CF gas/ton

or = 15 gal. oil/ton

Summary

1. Quench & Temper Process Per Ton Heat Treated Product

Energy Form	Quantity	KWH Equivalent
Gas	2,100 CF	635
Electric Power	50 KWH	50
Total		685 KWH/ton

2. Carburizing Process

Energy Form	Quantity	KWH Equivalent
Gas	3,000 CF	910
Electric Power	50 KWH	50
Total		960 KWH/ton

3. Induction Hardening

Energy Form	Quantity	KWH Equivalent
Electric Power	40	40

4. Annealing

Energy Form	Quantity	KWH Equivalent
Gas	2,000 CF	600
Electric Power	50 KWH	50
Total		650 KWH/ton

PAINTING PROCESSES

Processes consists of washing, drying, painting (spray or dip), and paint baking.

1. Washing

Heating wash water - (washing & bonderizing)

1,000,000 BTU/ton steel washed

For two coats paint = 2,000,000 BTU/ton

= 2,000 CF gas/ton

or = 15 gallons oil

2. Drying

500,000 BTU/ton steel

For two coats paint = 1,000,000 BTU/ton

= 1,000 CF gas/ton

or = 7 gallons oil/ton

3. Paint Baking

1,000,000 BUT/ton steel

For two coats paint = 2,000,000 BTU/ton

= 2,000 CF gas/ton

or = 15 gallons oil/ton

4. Electric Power

Conveyors, fans, etc. - 75 KWH per ton

Summary Per Ton Product

Energy Form	Quantity	KWH Equivalent
Gas	5,000 CF	1,470
Electric Power	75 KWH	75
Total		1,545 KWH/ton

ELECTROPLATING PROCESS

Process consists of washing, rinsing, electroplating, rinsing for each plated coating

1. Washing

   Heating wash water - 500,000 BTU/ton steel washed

   = 500 CF gas/ton

   or = 4 gallons oil/ton

2. Electroplating

   Typical Use = 250 KWH/ton

3. Miscellaneous Power

   Conveyors, motors, etc. - 25 KWH/ton

4. Summary

Energy Form	Quantity	KWH Equivalent
Gas	500 CF	150
Electric Power	275 KWH	275
Total		425 KWH/ton

MACHINING

Assume average machined part weighs 20 pounds; machining time averages 10 minutes total - all operations. HP connected - 20 per average machine.

$$\text{BTU Used} = \frac{20 \times 75\% \times 2{,}545}{6 \times 20}$$

$$= 320 \text{ BTU/lb.}$$

$$= 640{,}000 \text{ BTU/ton}$$

$$= \frac{640{,}000}{3{,}412} \text{ KWH/ton}$$

$$= 190 \text{ KWH/ton}$$

WELDING (Resistance)

Assume average weight of 20 lb. - at 500 pcs./hr. - with 1,000 KWH connected -

$$\text{Power Use} = \frac{1{,}000}{500} \times \frac{2{,}000}{20} = 200 \text{ KWH/ton}$$

STAMPING

Assume average part weighs 10 lbs. - production - 1,000 pcs/hr.

Press HP = 300

$$\text{BTU Used} = \frac{300 \times 2{,}545}{\left(\frac{1{,}000 \times 10}{2{,}000}\right)}$$

$$= 153{,}000 \text{ BTU/ton}$$

$$= \frac{153{,}000}{3{,}412} = 45 \text{ KWH/ton}$$

with handling power = 50 KWH/ton

PRESS FORMING

Assume average part weighs 50 lb. - production - 60 pcs/hr.

4 press line

Press HP = 1,000 @ 50% Utilization

$$\text{BTU Used} = \frac{1{,}000 \times .50 \times 2{,}545}{\left(\frac{50 \times 60}{2{,}000}\right)}$$

$$= 850{,}000 \text{ BTU/ton}$$

$$= \frac{850{,}000}{3{,}412} = 250 \text{ KWH/ton}$$

ASSEMBLY

Assume total of 100 KWH/ton for all operations.