

Energy Consumption

Transportation Sector

America is a nation on the move. 28.75 percent of the energy we use every day goes to transporting people and goods from one place to another.

The Automobile

The people in the United States have always had a love affair with the automobile. Until the **oil embargoes** of the 1970s, Americans drove without thought of fuel economy or environmental impacts.

In 1973, there were 125 million vehicles on the road, driving an average of 10,000 miles a year. Today, there are more than 250 million vehicles, driving over 11,000 miles a year. Even with the scares of oil embargoes, political unrest in oil-producing areas, and damaging storms in the Gulf of Mexico, we are driving more cars, more miles. It's a good thing we're doing it more efficiently and cleanly.

Although the oil crises didn't alter Americans' driving habits much, they did bring about changes in vehicle design. Automakers downsized many large and mid-sized models and significantly reduced vehicle weight. Aerodynamic designs were incorporated and engine size reduced. More important, engines were improved to increase fuel efficiency with fuel injectors and electronic transmissions. All of these improvements have resulted in almost doubling the fuel efficiency for vehicles since the 1970s.

▪ Mileage Requirements

Most of the improvements in automobile efficiency have been the result of mandates by the Federal Government such as CAFE standards. First enacted by Congress in 1965, the purpose of Corporate Average Fuel Economy (CAFE) standards is to reduce energy consumption by increasing the fuel economy of cars and light trucks. The National Highway Traffic Safety Administration (NHTSA) sets fuel economy standards for cars and light trucks sold in the U.S., while the U.S. Environmental Protection Agency (EPA) calculates the average fuel economy for each manufacturer. Today, new passenger cars are required to achieve a combined city and highway mileage of over 40 **miles per gallon (mpg)**.



When gas prices were low, consumers made no great effort to buy fuel-efficient vehicles.

In 2004, for example, sales of the ten most efficient cars and ten most efficient trucks totaled less than one percent of total sales. On the other hand, sport utility vehicles (SUVs) and light trucks made up half of total passenger vehicle sales.

Many car manufacturers are producing hybrid vehicles powered by a combination of gasoline and electricity. These vehicles are much more fuel efficient than their gasoline-only counterparts because they are designed to run on only electricity during periods of low power demand. In many states, commuters driving hybrid vehicles are allowed in limited access lanes and are given tax deductions.

NHTSA has proposed CAFE standards for 2017-2025 for passenger cars and light trucks (including subcompact cars, large sedans, station wagons, crossover utility vehicles, SUVs, minivans, and pickup trucks). The proposed standards require over 41.0 miles per gallon in model year 2021, and 55.3 mpg in model year 2025. However, these standards are presently being reviewed.

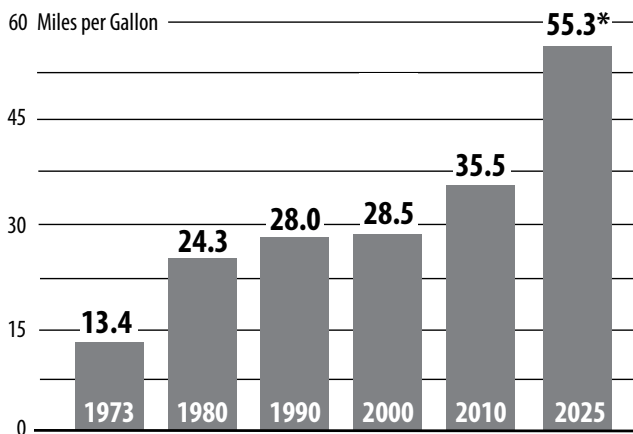
As the nation's automakers re-invent themselves, energy efficiency is a major consideration of future auto makes and models.

▪ Alternative Fuels

There is also a push to develop vehicles that run on fuels other than petroleum products or on blended fuels. Today, there are vehicles that run on electricity, natural gas, propane, biodiesel, ethanol, and hydrogen. In the 1970s, there were only a few vehicles that ran on alternative fuels. Today, there are more than one million alternative fuel vehicles in the United States. That number will continue to increase as barriers to acceptance across the nation are overcome. These include:

Refueling Infrastructure: Manufacturers are now capable of producing a large volume of alternative fuel vehicles, but there needs to be a convenient infrastructure for obtaining the fuels. Not many people are willing to drive 15 miles or more to refuel.

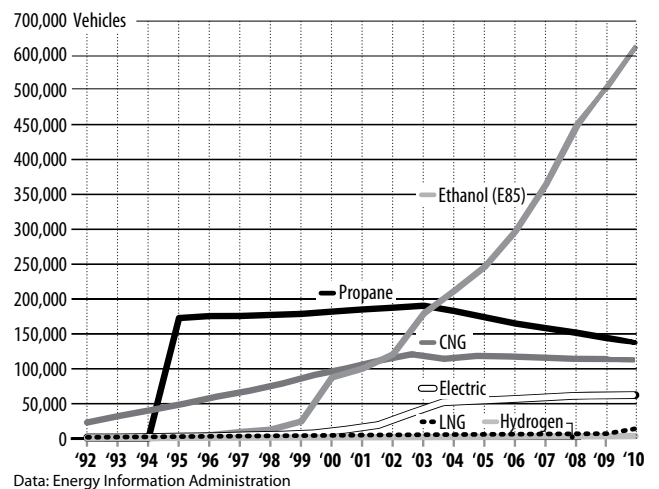
Average Fuel Economy of New Passenger Cars



*By 2025, new CAFE standards will require cars and light trucks to meet a 55.3 mpg fuel economy standard.

Data: U.S. Department of Energy

Alternative Fuel Fleet Vehicles in Use Since 1992



Data: Energy Information Administration

Consumer Education: Most Americans know very little about **alternative fuel vehicles**. Consumers must be educated about environmental and other benefits of these vehicles before they will consider them a choice.

If these barriers can be removed, alternative fuel vehicles can develop a strong niche market in the U.S. New technologies are being developed to make these vehicles more practical and convenient for consumers.

Commercial Transportation

The United States is a large country. We use a lot of energy moving goods and groups of people from one place to another. Passenger vehicles consume about 60% of the transportation fuel and commercial vehicles and transport modes consume the remaining 40%. The fuel efficiency of trains, trucks, buses, and planes has increased significantly in the last 40 years, as well as the number of miles traveled.

Trucks

Trucks use more transportation fuel than any other commercial vehicle. Almost all products are at some point transported by truck. In the early 1970s, the average tractor-trailer traveled 5.5 miles on a gallon of fuel. New trucks manufactured today can travel about seven miles on a gallon of fuel. This increase in fuel efficiency is due mainly to improvements in engine design and computerized electronic controls.

New diesel engines can convert about 45 percent of the energy in the fuel into vehicle movement, while gasoline engines can convert only about 30 percent. Federal research is aimed at improving diesel efficiency to 55 percent, by redesigning engines, redesigning braking systems to use air flow to help slow down vehicles, and engineering tires to roll more easily.

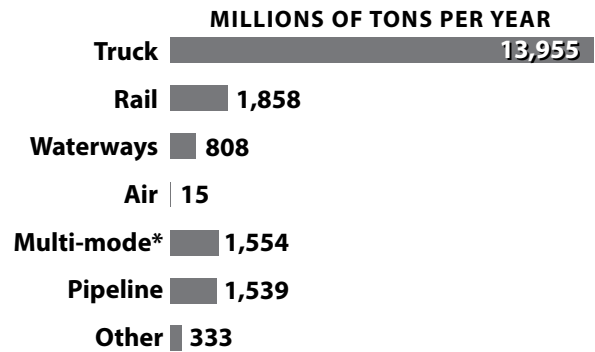
Planes

Since 1980, the number of passengers on planes has more than doubled. Planes all use petroleum products for fuel, which is the largest cost item for air transport after labor. The airline industry has been a leader in efficiency.

Since the 1970s, airlines have increased their fuel efficiency 70 percent. Many factors have led to better efficiency—newer engines, better flight routing, single engine taxiing, and design modifications. Boeing's newest plane, the 787 Dreamliner, is touted to be 20 percent more efficient than comparable sized planes by using new engines, lighter weight materials, improvements in aerodynamics, and other engineering advances. The International Air Transport Association has set a goal of improving fuel efficiency another 25 percent by 2020.

Airlines are also considering alternative fuels for airplanes. Airbus flew an A380 with one engine powered by a gas-to-liquid fuel in 2008. The same year Virgin Atlantic flew a Boeing 747-400 with one engine operating on a 20 percent biofuel blend. In 2009, Continental Airlines conducted a successful Boeing 737 test flight using jet fuel blended with algae oil and **jatropha**. Other airlines have been running similar tests, mixing biofuels with jet fuel. In 2010, the U.S. Navy flew an F/A-18 fighter jet on a 50/50 jet fuel/biofuel blend. These tests have demonstrated that biofuels can be blended with existing fuels and not impact an airplane's performance. United Airlines began flights using

U.S. Freight, by Mode of Transportation, 2015



* Multi-mode includes any combination of truck, rail, air, waterway, and mail.
Data: Bureau of Transportation Statistics

biojet fuel in 2016.

Railroads

Since the 1970s, the fuel efficiency of freight trains has increased by more than half. This reduction in energy use was accomplished by using longer trains with less handling and fewer changes and stops. The equipment is stronger and lighter to handle more cargo. There have also been major improvements in rail technology that have contributed to ease of movement.

The trucking and marine shipping industries work with the railroad industry to move cargo efficiently. More freight is being transported on trains directly in truck trailers and uniform containers so that there is less handling. Today, containers often travel by ship, rail, and truck in one shipment called multi-mode or intermodal transportation.

In the future, there will be an increase in the use of AC motors on diesel electric engines on locomotives. With AC motors, there are fewer moving parts, so less heat is generated, resulting in more efficient use of fuel. A train that today requires six locomotives might require only four with this new technology.

Mass Transit: Public Transportation

Mass transit is the system of public transportation for moving people on buses, trains, light rail, and subways. In 1970, nine percent of workers who traveled to work used public transit systems, two-thirds on buses. Today, less than ten percent of commuters use public transportation, half on buses. Why this decrease? Americans love cars. Most families own more than one. As more people have moved from cities into suburbs, public transportation has not been economically feasible for many dispersed locations.

The average American spends more than 40 hours each year delayed by traffic congestion. Building more roads isn't the only answer, especially with environmental concerns over vehicle emissions and the higher cost of transportation fuels.

Transportation

Americans own about 15% of the world's automobiles. The transportation sector of the U.S. economy accounts for 28.75 percent of total energy consumption and 71.22 percent of petroleum consumption each year. America is a country on the move. We love the freedom provided by our vehicles. The average price of gasoline in 2017 was \$2.35 per gallon and at the time of print was \$2.45. If the average vehicle is driven 11,300 miles each year, with an average fuel efficiency of 29.2 miles per gallon, the average driver spent more than \$900 per year per vehicle on gasoline. A person driving a small, fuel-efficient car will have spent as little as \$800 per year, while a person driving a larger vehicle that is less efficient could spend \$4,000 or more each year on fuel.

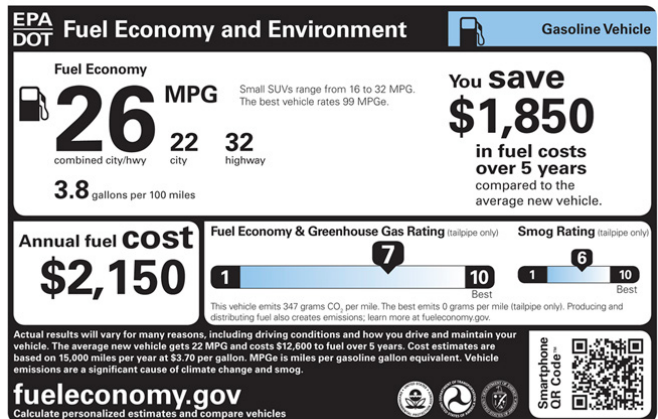
Most people must use a personal vehicle. The key is to use it wisely. When you are on the road, you can achieve 10 percent fuel savings by improving your driving habits and keeping your car properly maintained.

Improvements in the average fuel economy of new cars and light trucks from the mid-1970s through the mid-1980s were significant. The average fuel economy of cars almost doubled in that time period and for trucks it increased by more than 50 percent. These improvements were due mainly to the Corporate Average Fuel Economy (CAFE) standards enacted in 1975. The standards were met largely through cost-effective technologies such as engine efficiency improvements and weight reduction, not downsizing. The safety and environmental performance of new vehicles improved along with fuel efficiency during this period.

Today CAFE standards for brand new cars are set at over 40 miles per gallon, which is more than double the fuel economy of 1974 passenger vehicles. Standards for light trucks are slightly lower. Many manufacturers are meeting or exceeding these standards. Despite this, not all cars meet these standards. Manufacturers must pay a fine for each model that does not meet CAFE standards. The U.S. imports about 40 percent of the oil we use. Our dependence on foreign oil for gasoline will be greatly lessened by these standards.

When buying a vehicle, significant savings can be achieved by selecting a fuel-efficient model. All new cars must display a mileage performance label, or Fuel Economy Label, that lists estimated miles per gallon for both city and highway driving. Compare the fuel economy ratings of the vehicles you are considering and make efficiency a priority. Over the life of the vehicle, you can save thousands of dollars and improve air quality.

Fuel Economy Label



Label source: www.fueleconomy.gov

Fuel Economy

Follow these tips to increase fuel economy:

- Combine errands into one trip.
- Turn the engine off rather than letting it idle for more than a minute.
- Have your car serviced as described in the maintenance manual.
- Keep tires inflated to recommended pressures.
- Anticipate traffic stops.

These behaviors lower fuel economy:

- Quick acceleration.
- Traveling at high speeds. Traveling at more than 60 mph lowers fuel economy.
- Carrying unnecessary weight in the vehicle.
- Revving the engine.
- Operating the vehicle with the suspension out of alignment or with the wheels and tires out of balance.
- Using electrical accessories that require high amperage when they are not needed.