

## Metric Of the Month: November 2011 A Deeper Look into Interesting Trends in Energy Security Data

## MOTOR VEHICLE AVERAGE MILES PER GALLON

The Thanksgiving and Christmas holidays are two of the busiest times of the year on the nation's highways. Horse and sleigh have given way to the automobile, so as we take to the roads to celebrate with family and friends, we will be consuming a lot of petroleum-based fuels instead of hay.

This month we are going to take a closer look at Motor Vehicle Average Miles per Gallon, defined as the average on-road miles per gallon (MPG) of all motor vehicles. The "motor vehicles" covered in this metric include light-duty vehicles-such as passenger cars, sport utility vehicles (SUVs), and small trucks-as well as vans, heavyduty trucks, buses, and motorcycles. ${ }^{1}$ It excludes rail.

[^0]This metric indicates the degree to which the average motor vehicle uses energy efficiently. This matters because gasoline consumption alone accounts for roughly one-sixth of all the total primary energy consumed in the United States. Because there are presently no suitable substitutes for petroleum-based transport fuels at a large scale, our dependence is a major energy security risk. Energy efficiency in this sector-more miles to the gallon-lowers our fuel consumption and in so doing enhances our security. ${ }^{2}$

Among the myriad sources and uses of energy in our economy, the linkage
because of this the totals for all motor vehicles are considered to be a more durable indicator over the entire time frame than any individual subset. Therefore, in the 2011 edition of the Index this metric was recast as Motor Vehicle Average MPG to expand the portion of the entire motor vehicle fleet covered by the fuel economy metric and to provide a more comprehensive accounting of the shifts among passenger cars, SUVs, and light trucks.
${ }_{2}$ The argument has been made that because increased fuel economy lowers the cost of driving a vehicle, we drive our vehicles more than we would otherwise, thereby leading to greater overall fuel consumption. To what extent the "rebound" effect of energy efficiency comes into play with motor vehicle fuel, while the subject of much speculation, is beyond the scope of this short paper.
between petroleum energy and transportation are by far the strongest. About $70 \%$ of all of all the petroleum used in the United States is in the transportation sector, and, as seen in Table 1, $93 \%$ of all the energy used in the transportation sector, across all modes, is petroleum. But we would be consuming even more gasoline than we do today if it were not for tremendous improvements in the performance and efficiency of the cars we drive.

Table 1. Energy Consumption in the Transportation Sector by Fuel: 2010

| Fuel | Trillion Btu | Share |
| :--- | ---: | ---: |
| Coal | 0.0 | $0.0 \%$ |
| Natural Gas | 680.4 | $2.5 \%$ |
| Petroleum | $25,585.7$ | $93.3 \%$ |
| Electric Power | $1,153.7$ | $4.2 \%$ |
| \& Renewables | $27,419.8$ | $100.0 \%$ |
| Total |  |  |

Source: Energy Information Administration, Monthly Energy Review.

Petroleum's domination in transportation fuels has not always been so complete. In 1949, coal accounted for over $20 \%$ of all transportation energy, mainly for railroads. ${ }^{3}$ Still earlier in the twentieth century, petroleum use in transportation was but a minor factor, and river vessels and coalfired locomotives were much more significant relative to the young auto industry. These were, over time, surpassed

[^1]by gasoline and diesel-driven passenger cars and trucks.

In today's transportation sector, gasoline, diesel fuel, and jet fuel are the three main fuels in use, but for motor vehicles, it is mainly gasoline and diesel fuel. Because oil dominates the transportation sector, shifting trends in energy demand side can have a big impact on U.S. energy security.

Past improvements in motor vehicle fuel economy, and in the performance of all transportation modes overall, have made substantial contributions to our energy security, and continued improvements are projected.

The fuel economy of many types of vehicles has been regulated by the federal government for many decades. The high price of oil accompanying the Arab oil embargo of 1973 spurred government action to improve energy efficiency across the economy, particularly in the transportation sector. Corporate Average Fuel Economy (CAFE) standards were enacted as part of the Energy Policy and Conservation Act of 1975 to improve the average fuel economy of cars and light trucks, and the average fuel economy of the U.S. vehicle fleet after 1978 improved rapidly through the early 1990s, when improvements began to slow.

Figure 1 charts the average historical motor vehicle fleet fuel economy data since 1970 and projections through 2035. The historical data show sharp rise in average MPG following the oil price shocks of the 1970s and the imposition of auto mileage standards. From a fleet average of less than 13 MPG in the early 1970s, passenger car
average MPG reached 20 by 1990 before flattening out.

Over the last few years and looking forward, average MPG is projected to increase significantly as a consequence of higher fuel prices and more stringent mileage regulation. By 2035, the average motor vehicle is projected to get over 22 mpg, up sharply from about 17 MPG today.

The fuel price effect on average MPG is mainly a longer-term effect. In the shortterm, the response to higher fuel prices is modest, and affects the number of vehiclemiles traveled (VMT) more than the efficiency and/or mix of the vehicles driven. In the longer-term, higher fuel prices, or even expectations of higher fuel prices, can induce consumers to turn to higherefficiency vehicles, gradually raising average MPG as the capital stock is replaced.

Figure 1.

## Historical and Forecast Values (1970-2035):

Motor Vehicle Average MPG


Similarly, CAFE standards tend to have the greatest impact in the longer-term, since fleet turnovers take many years. Through administrative action, the Bush Administration in 2003 and again in 2006 raised the CAFE standards for light duty trucks. In 2007, enactment of the Energy Independence and Security Act raised CAFE standards for light duty vehicles to 35 MPG by 2020. This represented the first legislated increase in the standard for passenger vehicles since it was established in the 1970s. President Obama moved forward the date when the more stringent CAFE standards in EISA would have to be met by auto manufacturers (to 2016), and
in July 2011, it announced a proposal to increasing CAFE to 54.5 MPG by the 2025 model year.

Because the risks plotted by this metric move in the opposite direction of the metric-that is, because a higher average MPG indicates a lower risk-this metric had to be "flipped." This was accomplished by first inverting the values to express them in terms of gallons per mile rather than miles per gallon and second by normalizing the resulting time series to an indexed value, where the year 1980 is set at 100. This produces the values graphed in Figure 2.

Figure 2.



[^0]:    ${ }^{1}$ Passenger Car Average MPG was the fuel economy metric used for the 2010 edition of the Index of U.S. Energy Security Risk ${ }^{\circledR}$. The light-duty vehicles that are captured in this metric account for approximately $90 \%$ of the total miles traveled and $75 \%$ of the total fuel consumed by all motor vehicles. Because of this, is could be argued that a metric based solely upon passenger car or light-duty vehicle average MPG would be a sufficient metric. However, the mix of vehicle types has been changing, and will likely continue to change, particularly among traditional passenger cars and SUVs. Additionally, definitions and vehicle classifications can change over time as different models are introduced, and

[^1]:    ${ }^{3}$ Energy Information Administration, Annual Energy Review 2008, Tables 2.1e, "Transportation Sector Energy Consumption, Selected Years, 1949-2008." Available at:
    http://www.eia.doe.gov/emeu/aer/consump.html.

