

Bureau of Transportation Statistics

Transportation Trends in Focus

June 2009

A Time Series Analysis of Transportation Energy Use Per Dollar of Gross Domestic Product

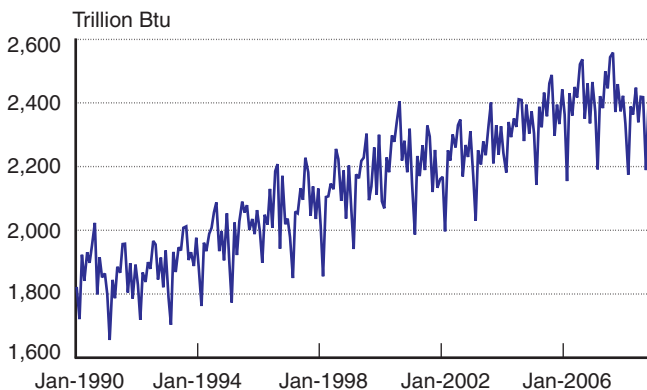
By Peg Young, Ph.D.

Transportation energy use relative to gross domestic product (GDP) has been declining within the past decade. However, the total transportation energy consumed (see figure 1) shows only a more recent decline. To see clearly the long-term decline, the seasonal component first must be separated from the underlying trendline to observe the long-term trend of that energy consumption. Then the ratio of the deseasonalized data and GDP can be taken.

The following graphs and analyses focus on recent trends from January 2000 to the present (October 2008). Figure 2 shows the actual monthly transportation energy use along with the underlying trend (noted in red) of that data over this shorter time period.

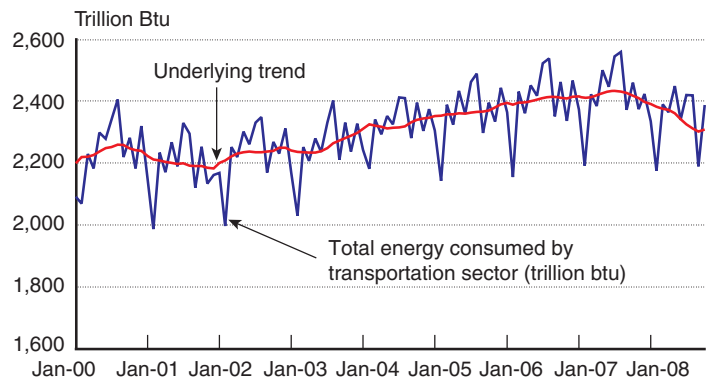
The underlying long-term trend was essentially upward, increasing approximately 5 billion Btu per month, until mid 2007 when the energy consumption trendline began to turn downward. Occasional slight dips in these consumption changes

Figure 1: Total Energy Consumed by Transportation Sector (Trillion Btu), January 1990–October 2008



SOURCE: U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, table 2.5, available at <http://www.eia.doe.gov/emeu/mer/contents.html>

Figure 2: Total Energy Consumed by Transportation Sector (Trillion Btu) Actual and Trend, January 2000–October 2008



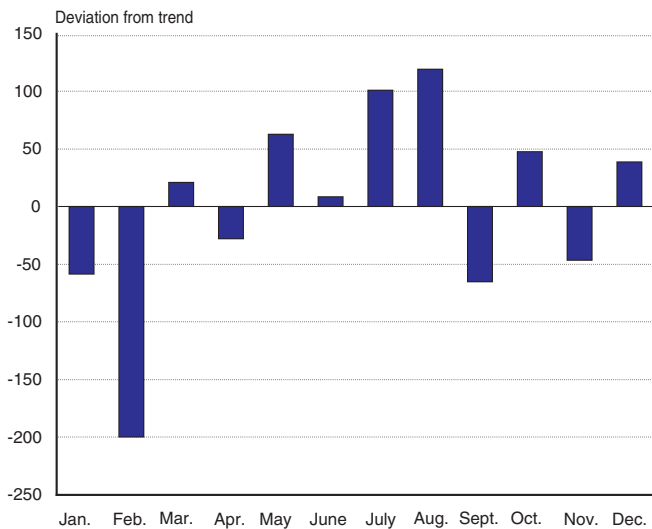
SOURCE: U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, table 2.5, available at <http://www.eia.doe.gov/emeu/mer/contents.html> and U. S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, special tabulations as of February 2009.

were temporary and proved minor when compared to the decline in more recent years.

For the past 8 years, seasonal patterns have exhibited little change over time; figure 3 depicts the average monthly seasonal variation from January 2000 to October 2008. The factors indicate that transportation energy consumption tends to be the lowest in February (approximately 200 trillion Btu below the long-term trend), whereas July and August tend to be the highest (approximately 100 and 120 trillion Btu above the trend).

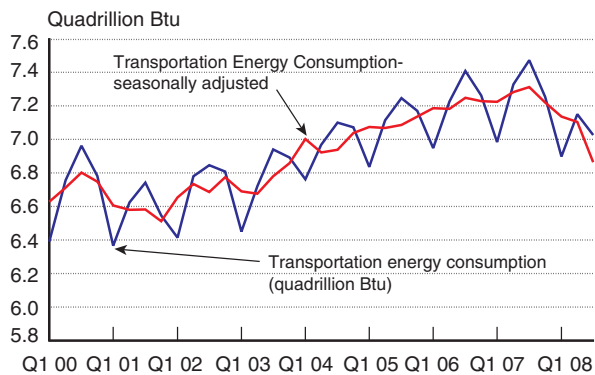
Seasonal variation in the data can mask long-term energy consumption trends. Removing the effects of seasonality from the monthly data reveals both the trend and any remain-

Figure 3: Average Monthly Seasonal Factors for Total Energy Consumed by Transportation Sector (Trillion Btu), January 2000—October 2008



SOURCE: U. S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, special tabulations as of February 2009.

Figure 5: Quarterly Energy Consumed by Transportation Sector (Quadrillion Btu) Actual and Seasonally Adjusted, 1st Quarter 2000—3rd Quarter 2008

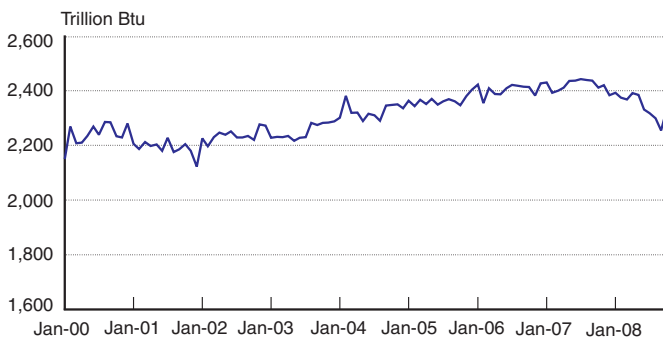


SOURCE: U. S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, special tabulations as of February 2009.

ing unexplained variation. Figure 4 provides the seasonally adjusted monthly data, i.e., the masking effect of seasonality has been removed.

The measure of transportation Btu per chained 2000 dollars of GDP is a measure of energy intensity for the economy and can be used to assess our dependence on oil. Comparing transportation Btu relative to GDP helps determine if the changes in GDP explain the changes in transportation energy consumption. Because GDP is a quarterly measure,¹ the transportation Btu (actual and seasonally adjusted values) are converted to quarterly values, as shown in figure 5.

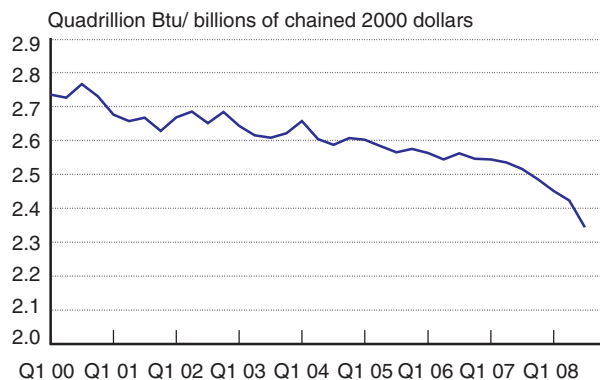
Figure 4: Total Energy Consumed by Transportation Sector (Trillion Btu) Seasonally Adjusted, January 2000—October 2008



SOURCE: U. S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, special tabulations as of February 2009.

Quarterly GDP, which is seasonally adjusted, is divided into the seasonally adjusted quarterly transportation energy consumption. The results are provided in figure 6, which shows that transportation energy consumption has been declining relative to GDP. The decline steepened beginning in the third quarter of 2007, when the cost of fuel rose dramatically.

Figure 6: Quarterly Energy Consumed by Transportation Sector /GDP Seasonally Adjusted, 1st Quarter 2000—3rd Quarter 2008



SOURCE: U. S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, special tabulations as of February 2009.

¹ Gross domestic product data available at the U. S. Department of Commerce, Bureau of Economic Analysis, <http://www.bea.gov/newsreleases/national/gdp/gdpnewsrelease.htm>

NOTE: Btu = British thermal unit. The average heat content of motor gasoline is 129,024 Btu per gallon. One quadrillion Btu is equivalent to the heat content of 7.75 billion gallons of motor gasoline.