



## Transportation Energy Efficiency Trends in the 1990s

### In the 1990s

- The transportation sector showed little increase in energy efficiency as transportation activity and energy use continued to grow.
- Passenger travel energy-efficiency levels improved slightly, mainly due to efficiency gains in the aviation sector.
- Freight transportation energy-efficiency levels declined slightly as modes of transportation that consumed the most energy for freight movement became less energy efficient.

### Energy Efficiency

For many, “miles per gallon” comes to mind when energy efficiency and transportation are mentioned in the same sentence. But energy efficiency isn’t just fuel economy. Many other factors greatly influence how effectively we use our transportation fuels, such as the choice of vehicle we drive, the average number of passengers boarding aircraft, and the method we choose to move our freight. In sum, factors such as these will determine the overall energy efficiency of our transportation system. This Issue Brief looks at transportation trends of the 1990s and how those trends affected the efficiency with which we used our transportation fuels and systems.

**Transportation Sector Shows Little Increase in Energy Efficiency:** Just as miles per gallon is used to measure fuel efficiency, the overall energy efficiency of our nation’s transportation system is measured by the ratio of *activity* (total miles traveled by all passengers and all tons of freight) to *consumption* (total Btu of energy consumed). Our transportation system carries two distinct cargoes—people and freight, with passenger travel consuming about 70% of transportation energy while freight transportation consumes the rest.<sup>1</sup>

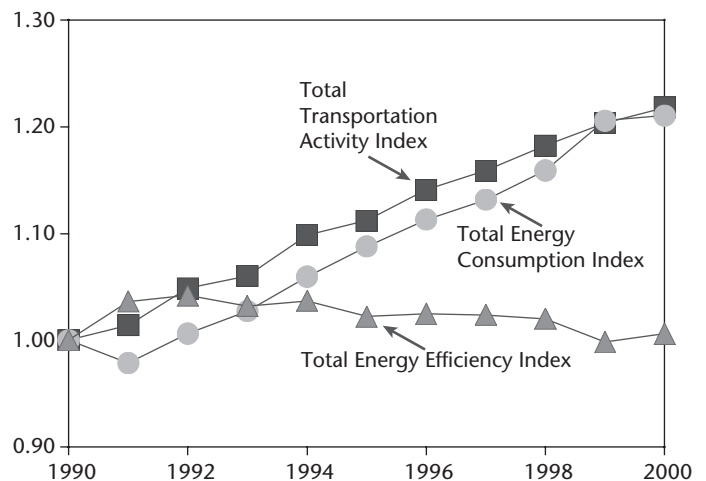
Although the overall energy efficiency of our transportation system improved at the beginning of the decade by as much as 4%, by 1999 it had reverted to its 1990 level

as less energy efficient options for transporting passengers and freight combined with neutral or declining fuel efficiency improvements (see Figure 1-1). Total energy efficiency gains in passenger travel, mainly due to efficiency gains in the aviation sector, were offset by energy efficiency losses in freight transportation.

Between 1990 and 2000, the growth rate in transportation activity was slightly greater than the annual 2.0% increase in energy consumption, which grew from 21.1 quadrillion to 25.7 quadrillion Btu. This increase in the amount of activity coupled with a slightly slower growth in energy use (with petroleum accounting for 97% of the transportation sector energy requirements<sup>2</sup>) is responsible for the slight gain in energy efficiency experienced in the 1990s.

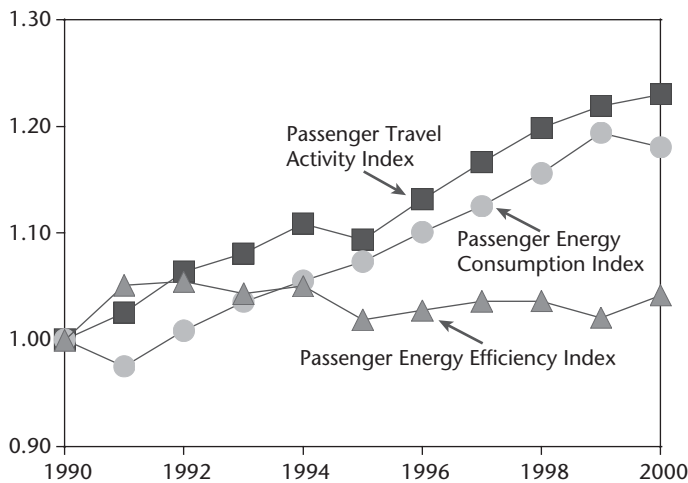
**Passenger Travel Efficiency Gains Mainly in Aviation:** By 1991, passenger energy efficiency had improved by 5% over the 1990 level, but was only 4% over that 1990 level in 2000 (see Figure 1-2). Passenger-miles of travel (activity) rose 23% while energy use (consumption) grew only 18%

**FIGURE 1-1. Total Transportation Activity, Energy Consumption, and Energy Efficiency Indexes, 1990=1**



Source: Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2002*, tables 1-34, 1-44, 4-6.

**FIGURE 1-2. Passenger Travel Activity, Energy Consumption, and Energy Efficiency Indexes, 1990=1**



Source: Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2002*, tables 1-34, 4-6.

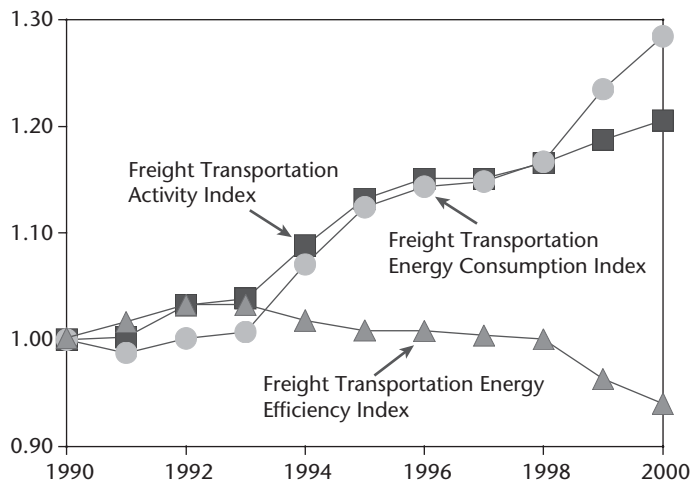
between 1990 and 2000. The most significant gains were achieved in commercial air travel, with passenger energy efficiency improvements of about 32% from 1990 to 2000. In 2000, air travel represented about 11% of all passenger-miles, but only 8% of the total energy used to move passengers. Both domestic and international flights had a combined increase of 9% in load factor during the 1990s, indicating more passengers per plane. These factors contributed to the 49% increase in air passenger-miles of travel, the highest growth of any mode of travel. The energy efficiency of commercial air received another boost as overall aircraft fuel economy improved by 20% between 1990 and 2000.<sup>3</sup>

Highway passenger travel (passenger car, motorcycle, and light truck) energy efficiency improved by only 1% from 1990 to 2000. Highway is the largest component of passenger travel, comprising 85% of all passenger-miles and consuming 88% of energy used for passenger travel in 2000. The 1990s marked a shift in consumer preferences that was largely responsible for bringing gains in energy efficiency to a virtual standstill. Rather than buying cars, many drivers purchased less energy efficient light trucks, while others bought even larger versions of these vehicles, such as full-size sport utility vehicles (SUVs), that burn even more fuel. As a result, efficiency improvements for passenger cars (6%) were virtually offset by the loss in efficiency from light trucks (5%).

**Freight Movement Becomes Less Energy Efficient:**

Freight energy efficiency improved slightly at the beginning of the decade, but declined 6% by 2000 (see Figure 1-3). The decline in freight energy efficiency occurred as a result of a slow 2% annual growth rate in ton-miles (the movement of 1 ton of cargo the distance of 1 mile) paired with a relatively rapid annual growth rate of 2.5% in freight energy consumption. Contributing to this trend

**FIGURE 1-3. Freight Transportation Activity, Energy Consumption, and Energy Efficiency Indexes, 1990=1**



Source: Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2002*, tables 1-44, 4-6.

was the decline in the energy efficiency of freight trucks and waterborne modes. The largest growth in freight energy consumption came from trucks, which represented 84% of the total freight energy consumption increase from 1990 to 2000. Fuel economy of trucks fell by 2.0% from 1990 to 2000, from 5.97 mpg to 5.85 mpg. Despite this loss in fuel economy, an expected rise in ton-miles per vehicle-mile (indicative of heavier loads), did not occur, leading to an overall decline in energy efficiency (ton-miles per Btu) of 2.1%. The growth in ton-miles for this period was mainly from trucks and rail with water declining by 21.3%. Total waterborne ton-miles decreased as a result of waterborne tonnage declining by 4.6% while the average length of haul fell by 17.1%. Furthermore, waterborne freight energy efficiency declined by about 25%.

Look for a full report on this subject in the fall of 2003.

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<sup>1</sup> Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2002*, table 4-6.  
<sup>2</sup> U.S. Department of Energy, Oak Ridge National Laboratory, *Transportation Energy Data Book: Edition 22*, table 2, 4, p. 2-6, Oak Ridge, TN, September 2002.  
<sup>3</sup> Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2002*, table 4-8.