Center for Sustainable Systems

University of Michigan
440 Church Street, Ann Arbor, MI 48109-1041
phone: 734-764-1412 fax: 734-647-5841
email: css.info@umich.edu
http://css.snre.umich.edu

factsheets

Personal Transportation

Patterns of Use

In the U.S., the predominant mode of travel is by automobile and light trucks, accounting for over 85% of passenger miles traveled in 2009.[1] The U.S. has less than 5% of the world's population,[2] but has 19% of the world's cars, compared to 4% in China, 9% in Japan, 6% in Germany, and 3% in Canada.[3] The following consumption patterns indicate that the current automobile-dominated transportation system is not sustainable.

Vehicle Miles Traveled

- U.S. passenger miles traveled in 2009 was 4.24 trillion[1]
- Vehicle miles travelled grew 1.7% annually, on average, from 1990 to 2009[1]
- Population grew 1.1% annually, on average, over the same period[2]

Vehicle Occupancy

- In 1977, U.S. averaged 1.87 persons per vehicle[4]
- In 2009, U.S. averaged 1.43 persons per vehicle[1]
- In 2009, the U.S. Department of Transportation reported 36 million more cars than licensed drivers[1]

Average Fuel Economy[5]

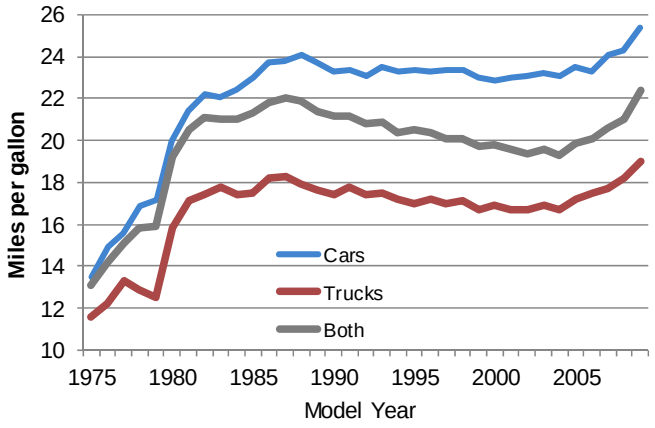
- Light-duty vehicle fuel economy peaked at 22.0 mpg in 1987, then declined and wasn't surpassed until 2009
- 2010 light-duty vehicle fuel economy was 22.5 mpg
  - Average new passenger car: 25.8 mpg
  - Average new light truck: 19.1 mpg
- The U.S. has the lowest required fuel economy standards, well below the EU, China, and Japan.[6]

Note: U.S. EPA fuel economy testing standards were revised in 2008 to better represent actual driving conditions. (http://www.fueleconomy.gov/feg/ratings2008.shtml)

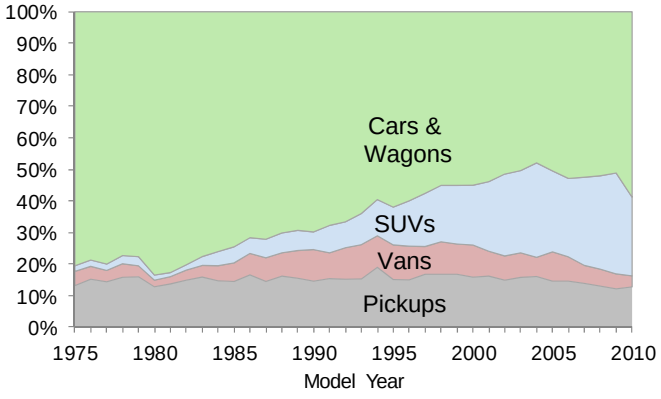
Vehicle Size[5]

- During 1987-2010:
  - Average vehicle weight increased 24% (due to the growth in SUV market share)
  - Horsepower increased over 86%
  - Acceleration increased (0 to 60 mph times dropped 27%)
- Had vehicle weights remained at 1988 levels, model year 2010 cars could have achieved a 12% higher fuel economy; trucks a 13% increase
- SUVs and pickups were 38% of new vehicles sold in the U. S. in 2010

MPG by Model Year[6]



Market Share by Vehicle Type, 1975-2010[6]



Overall

From 1973-2010, energy use by the U.S. transportation sector increased 1.1% annually on average. In 2009, American cars and light trucks used 16.4 quadrillion BTUs of energy, which represented **17.4% of the total U.S. energy consumption.**[3]

[1] U.S. Department of Transportation, Federal Highway Administration (2011) *Highway Statistics 2009*.
[2] U.S. Census Bureau (2010) *U.S. Population Clock* and *American Factfinder – Population Finder*.
[3] U.S. Department of Energy, Oak Ridge National Lab (2011) *Transportation Energy Data Book: Edition 30*.
[4] U.S. Department of Transportation (1981) *Vehicle Occupancy: Report 6*, 1977 National Personal Transportation Study. Office of Highway Planning.
[5] U.S. Environmental Protection Agency (2011) *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2010*.
[6] UN Department of Economic and Social Affairs (2011) Global Overview on Fuel Efficiency and Motor Vehicle Emission Standards – background document.

Life Cycle Impacts[7,8]

A typical passenger car is responsible for the following burdens during its product lifetime (raw material extraction through end-of-life). Most of these emissions are due to fuel use while driving.

Total Life Cycle Burdens for 1995 Mid-Sized Sedan

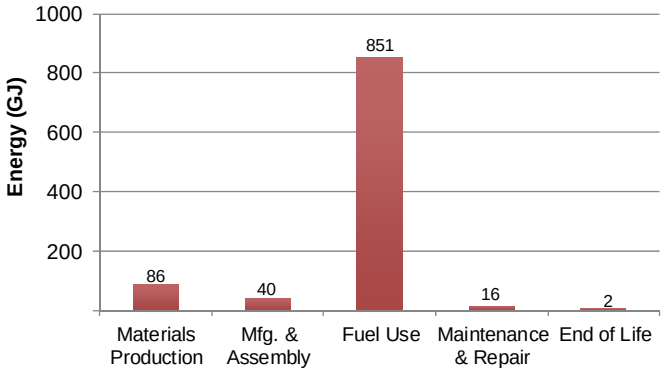
Environmental Flow	Lifetime (120,000 miles) Total (kg)	Per Mile (g)
CO_2	61,300	511*
CO	1,940	16
SO_X	137	1.1
NO_X	256	2.1
NMHC	259	2.1
Methane	70	0.58
Particulates	55	0.46
Solid Waste	4,380	36.5
Energy	995 GJ **	8.3 MJ

* Equivalent to 1.1 lb CO_2/mile

** Equivalent to 163 barrels of oil

(Life cycle energy by stage in figure on right)

Life Cycle Energy Consumption

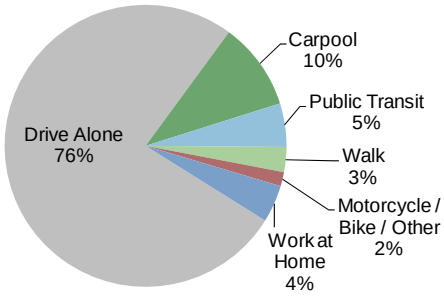


Solutions and Sustainable Alternatives

Reduce Vehicle Miles Traveled

- Live closer to work
  - Average commute length: 8.5 miles in 1983 - 12.2 miles in 2009[3]
- Consider telecommuting/home office
  - Telecommuters travel 53% to 77% less on days they telecommute compared to days they do not.[9,10]
- Combine errands to avoid unnecessary trips
- Join a carpool, consider car-sharing programs
- Use alternative modes (bike, bus, train)

U.S. Modes of Transportation to Work[3]



Purchase Fuel Efficient Vehicles

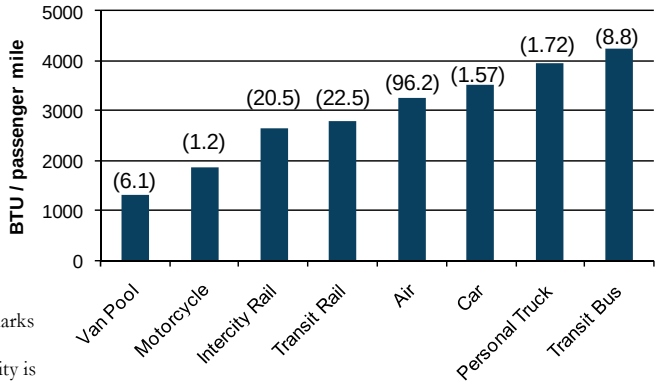
- Match intended use with vehicle type when possible.
- Consider buying a best-in-class vehicle*
  - Ford Fiesta SFE® (subcompact car) 29/40 mpg (city/highway)
  - Chevy Volt® (compact car) 35/40 mpg, 95/90 mpge**
  - Honda Civic Hybrid® (compact car) 40/43 mpg
  - Nissan Leaf® (midsize car) 106/92 mpge**
  - Toyota Prius® (midsize car) 51/48 mpg
  - Volkswagen Jetta SportWagen® (small wagon, diesel) 30/42 mpg
  - Hyundai Sonata® (large car) 24/35 mpg
  - Ford Escape Hybrid FWD® (SUV) 34/31 mpg
  - Honda Odyssey® (2WD minivan) 19/28 mpg
  - Ford Ranger Pickup® (2WD pickup) 22/27 mpg

* From Model Year 2011 Fuel Economy Guide (www.fueleconomy.gov). All registered trademarks are property of their respective makes.

** Mpg equivalence (mpge), for plug-in electric and hybrid vehicles, assumes 33.7 kWh electricity is equivalent to 1 gallon gas.

Energy Intensity of 2006 U.S. Passenger Travel[3]

(Average Vehicle Occupancy)



Encourage Progressive Transportation Policies

- Plan denser, mixed-use communities.
- Gallons per mile (gpm) is a better indicator of fuel efficiency than mpg. For example, upgrading from a 16 mpg to 20 mpg vehicle saves 125 gallons of fuel over 10,000 miles, whereas upgrading from 34 mpg to 50 mpg saves 94 gallons over 10,000 miles.[11]
- Reduce highway speed limits - slowing from 70 to 55 mph will improve fuel economy 21%.[3]
- Corporate Average Fuel Economy (CAFÉ) standards are set to increase to 39.5 mpg for passenger cars and 29.8 mpg for light trucks by 2016. For the first time, beginning in 2012, vehicles must also achieve progressively lower tailpipe CO_2 emissions.[12]

[7] Keoleian, G. A., K. Kar, M. Manion, and J. Bulkley (1997) *Industrial Ecology of the Automobile: A Life Cycle Perspective.* SAE R-194. Society of Automotive Engineers. CSS97-04.
[8] Keoleian, G. A., G. Lewis, R. B. Coulon, V.J. Camobreco, and H. P. Teulon. (1998) *LCI Modeling Challenges and Solutions for a Complex Product System: A Mid-Sized Automobile.* CSS98-07.
[9] Mokhtarian, P. and K. Varma (1998) "The Trade-Off Between Trips and Distance Traveled in Analyzing the Emissions Impacts of Center-Based Telecommuting." *Transportation Research* D 3(6): 419–28.
[10] Koenig, B., D. Henderson, and P. Mokhtarian (1996) "The Travel and Emissions Impacts of Telecommuting for the State of California Telecommuting Pilot Project." *Transportation Research* C 4(1): 13–32.
[11] Larrick, Richard & Soll, Jack. (2009). *The MPG Illusion.* Sciencemag.org.
[12] U.S. EPA (April 2010) "EPA and NHTSA Finalize Historic National Program to Reduce Greenhouse Gases and Improve Fuel Economy for Cars and Trucks" EPA-420-F-10-014.