



AutoSmart

Learn the facts: Weight affects fuel consumption

What is the issue?

Vehicle weight and engine power are important factors affecting an automobile's fuel consumption. Drivers can make choices that lessen those impacts through awareness of technology options and by not carrying unnecessary weight.

What do I need to know?

The heavier the vehicle is, the more energy it needs to get moving.

Heavier vehicles have greater inertia and greater rolling resistance, which both contribute to increased fuel consumption. Reducing weight is a very effective way to improve a vehicle's efficiency (RMI 2011).

Vehicle weight, engine power and fuel consumption trends tell an interesting story.

Vehicle weight and engine power are two of the most important parameters that influence a vehicle's fuel consumption and carbon dioxide (CO₂) emissions. The weight of the average vehicle decreased from the mid-1970s to the mid-1980s and then increased dramatically until around 2005. In recent years, the trend has become more stable. Average engine horsepower has followed a similar trend, doubling since the early 1980s (see the middle graph in Figure 1).

If all other factors are equal, higher vehicle weight and faster acceleration performance (e.g. shorter time to accelerate from 0 to 100 km/h) increase fuel consumption. Fortunately, the dramatic increases in weight and horsepower since the mid-1980s have not caused dramatic increases in fuel consumption (see the bottom graph in Figure 1). This effect is the result of automakers continually developing more efficient vehicle technologies. From the mid-1980s until the mid-2000s, this technology innovation was generally used to offset the impacts of increasing size, weight, power and other performance attributes of automobiles. Beginning in the mid-2000s, automakers increasingly shifted their attention and focused their efforts on reducing fuel consumption while keeping vehicle weight and power more constant.

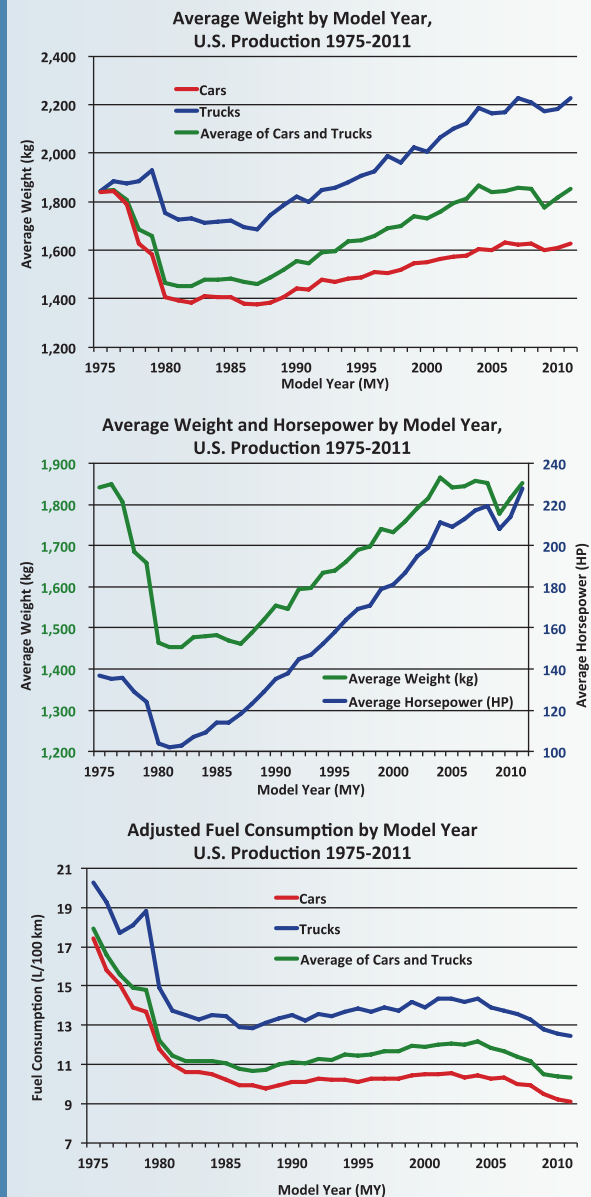


Figure 1: Top 2 graphs: Average weight based on U.S. production figures. Bottom: Average weight of cars and trucks, with horsepower shown on the right axis (EPA 2012).

Reducing weight reduces fuel consumption.

Increasingly stringent government fuel consumption legislation and evolving consumer preferences are making a difference. It is increasingly common to see automakers advertising their weight reduction initiatives. Automakers are achieving weight reduction by substituting lighter materials, such as aluminum and advanced composites, as well as making vehicle design changes. These improvements enable additional weight reductions because other vehicle components can then be made smaller, ultimately leading to building smaller engines with no sacrifice in performance – the less weight you have, the less power you need. A recent Massachusetts Institute of Technology study estimates that vehicle weight reductions of 35% could be implemented at reasonable cost. Their estimates consider the additional weight of future safety requirements and convenience features. Vehicle weight reductions of this magnitude could reduce fuel consumption by 12 to 20% with no sacrifice in current vehicle safety and performance attributes.

Reducing weight means reducing fuel cost.

A recent study found that for every 100-kg reduction, the combined city/highway fuel consumption could decrease by about 0.4 L/100 km for cars and about 0.5 L/100 km for light trucks (MIT 2008). Today's cars and light trucks weigh between 1 000 to 3 800 kg. The corresponding fuel cost savings are estimated in the following table.

Weight reduction	Estimated fuel cost savings over 200 000 km	
	Cars	Trucks
10 kg	\$104	\$130
25 kg	\$260	\$325
50 kg	\$520	\$650
100 kg	\$1,040	\$1,300
200 kg	\$2,080	\$2,600
400 kg	\$4,160	\$5,200
1 000 kg	\$10,400	\$13,000

Note: For illustrative purposes, savings are based on a fuel price of \$1.30/L and the average fuel consumption and weight relationship reported by MIT.

How can I help?

You can make a difference by:

→ Buying only what you need.

A good assessment of your vehicle needs is one of the most important steps in choosing a fuel-efficient vehicle. When possible, choose a smaller vehicle with the smaller, more fuel-efficient engine option. Natural Resources Canada's *Fuel Consumption Guide* is a great resource to help you compare fuel consumption among vehicles and vehicle types.

→ Lightening your load.

Don't carry unneeded items in your trunk. The extra weight increases fuel consumption.

What are the savings and benefits?

When buying a new vehicle, consider the lightest vehicle with the smallest engine option to meet your needs. For example, the difference between the combined city/highway fuel consumption ratings for the best and worst minivan is approximately 2.5 L/100 km, with a corresponding difference in curb weight of approximately 490 kg (note: the difference in consumption is not solely attributable to weight). At \$1.30/L, this translates to fuel cost savings of \$6,370 over 200 000 km.

References

- [1] EPA 2012. United States Environmental Protection Agency: *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2011*. (2012).
- [2] MIT 2008. *On the Road in 2035: Reducing Transportation's Petroleum Consumption and GHG Emissions*. Massachusetts Institute of Technology (2008).
- [3] RMI 2011. *Reinventing Fire: Bold Business Solutions for the New Energy Era*, Amory Lovins and Rocky Mountain Institute, Chelsea Green Publishing (2011).