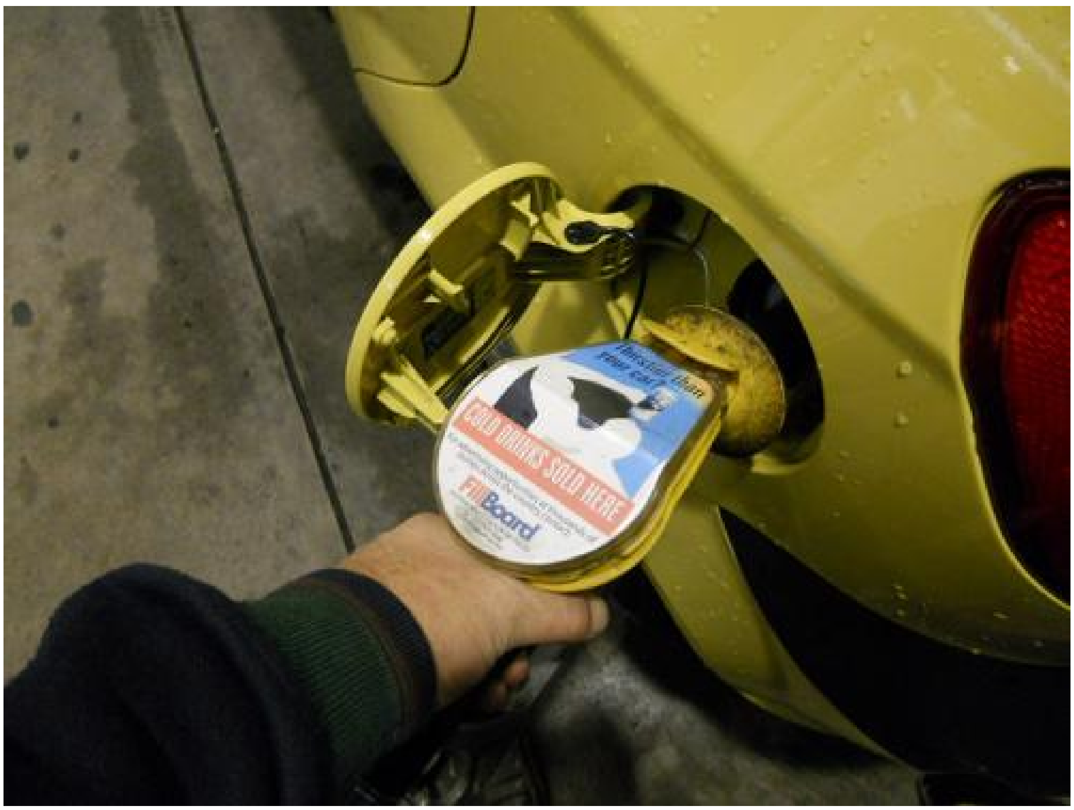
Can you save money at the bowser by only half-filling the fuel tank?

January 23 2015, by Tim Trudgian



Can you save time and money with a half-filled fuel tank? Credit: Flickr/Michael Coghlan, CC BY-NC

Fuel prices may be at historic lows at the moment but when they rise again, what is the best strategy to save money at the bowser?

There are many suggestions for saving money such as when and where to fill up, what time and day of the week and how to predict the highs and lows of the price cycle.

One theory on how to conserve fuel is to put less of it in your tank. The thinking is that you carry around less weight in the car, which means the engine does not have to work as much, which means a saving on fuel.

Does less save more?

But how much of a saving? And is this worth your while? This question has been asked (see here and here as typical examples), but not satisfactorily answered.

To answer this we need to look at the fuel economy of the car. This is often quoted as litres per 100km, say, 6L/100km (typical for a small car running basic unleaded petrol). This means that under some given conditions, on average the car will use 6L of petrol to drive 100km.

The conditions (sometimes stated in the quote, but often not) could be for: city driving, highway driving, two people in the car, etc. The more weight in the car, the harder the engine has to work to move the car at the same speed, and hence the worse (or higher) the fuel economy.

One study by consultants Ricardo Inc examined the effect of extra weight on fuel economy.

Roughly, it found the fuel economy increases by between 1% and 2% for every 100 pounds (43.5 kg) of weight added inside the car. This figure does not factor in any extra weight outside of the car, such as roof racks, trailers or sidecars.

Suppose we took the upper limit, 2%, and assumed a full tank of 60L in a car that is rated at 8L/100km (a typical family car).

Crunching the numbers

Since petrol has a density of roughly 720 grams/L the weight of the full tank of fuel is about 43.2kg. So, roughly, your fuel efficiency will drop to 8 x (1 + 0.02 x 43.2/43.5), which is roughly 8.16L/100km.

As you drive, you use up some fuel, and hence carry less weight in the car. When you have used half a tank your fuel efficiency is now roughly 8.08L/100km: the car is travelling more efficiently than it was with a full tank.

Suppose that we fill up the tank and see how far we can drive until we run out of fuel. Call this full-once: we have filled the tank with fuel once.

Consider our filling the tank half-way, driving until we run out of fuel, then filling the tank half-way again, and driving once more until we run out of fuel. Call this half-twice: we have filled the tank half-way, twice.

We will certainly travel further in the half-twice scenario. Why? We have used the same amount of fuel, but in the full-once scenario we had to suffer poor fuel efficiency (8.16 L/100km) at the start of our journey.

But how much do we save?

The actual price of fuel does not matter; the question is how much further will we travel in the half-twice scenario? This is not a simple high-school algebra calculation.

The rate at which we are consuming fuel decreases as the weight of the fuel decreases. We can use some first- or second-year university mathematics and solve a differential equation to find the total distance covered.

Assuming a fuel efficiency of 8L/100km, density of petrol at 720g/L, a loss of 2% of efficiency per 43.5kg, and a 60L tank, we find that we cover roughly 3.5km more in the half-twice scenario: not a lot by anyone's standards.

This is all well and good, but there is one obvious drawback to the half-twice scenario: we have to make an extra visit the fuel station and this costs us time.

So, rather than figure out the distance we save in the half-twice scenario, we should figure out the time we save.

Suppose we were driving at an average of 40kmh – this is lower than the urban speed limit owing to traffic congestion, slowing down, stopping at lights etc.

Under the same assumptions as above (that gave us the extra 3.5km), this means we save a little over five minutes in the half-twice scenario. Again, not very much.

The situation changes slightly for diesel cars. A tank of diesel weighs more than a tank of petrol (and so the savings should be increased), but according to the Ricardo study, the affect of weight on fuel economy is less pronounced.

Diesel engines are also more efficient, but even with small fuel efficient diesel cars, such as those suggested by the Royal Automobile Club of Western Australia, you cannot save more than five minutes.

Bigger is better

We can demonstrate a significant saving if we look at larger vehicles. Take a Toyota Landcruiser 70 Troop Carrier GXL: this is a diesel engine with an urban fuel economy of 14.3L/100km.

You make a saving here, not because the car is inherently efficient, but because its fuel tanks are enormous: it comes with two 90L tanks.

Filling both tanks means an awful lot more fuel is carried around, and hence a more pronounced saving. Assuming an average speed of 40kmh, you would save nearly 14 minutes by filling up half as much, twice as often.

If time is important to you then you can achieve savings of between five and 14 minutes – depending on the size of your vehicle – by only filling your tank to the half-full mark. If not, then you will need to find another strategy to save on your fuel costs. Happy hunting.

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