Fuel efficient commute with hybrid cars

Owning a car is not a cheap affair, especially here in Singapore. Besides the initial payment for the car itself, there are recurring expenses that a car owner has to contend with – fuel, insurance, road tax, toll and parking. Out of these recurring expenses, fuel cost usually forms the largest proportion; and this is expected to grow as the global price of oil increases.

It is due to high fuel cost that fuel efficient cars are a big draw to car buyers. Even a small increase in fuel efficiency can lead to large savings over the lifespan of the car. While saving car owners a considerable amount of money, a fuel efficient car also has the additional benefit of lower exhaust emissions, thus reducing the environmental impact of its use.

To meet this demand, car makers around the world have introduced models that are able to go further with less fuel. Some of the most efficient models are the so-called ‘hybrid cars’, which combine conventional internal combustion engines and electric motors to significantly reduce their fuel consumption. Examples of hybrid cars available in the market today include Toyota Prius and Honda Civic Hybrid.

What are hybrid cars?

Hybrid cars merge the best features of today’s internal combustion engine cars and electric cars, which allows the electric motor and batteries to help the conventional engine operate more efficiently, cutting down on fuel use. Meanwhile, the combustion engine overcomes the limited range of an electric car, giving a hybrid car the ability to travel distances comparable to a conventional car without having to plug-in for recharging, and with much less fuel.

Hybrids are classified according to the combination of the two power sources in their drivetrains:

![Figure 1: Toyota Prius, a popular hybrid car](image)

![Figure 2: Schematic of a parallel hybrid drivetrain](image)
• **Parallel hybrid drivetrain**: Has a fuel tank that supplies fuel to the internal combustion engine, and a set of batteries that supplies power to the electric motor. Both engine and motor turn the transmission at the same time, and the transmission then turns the wheels.

• **Series hybrid drivetrain**: The internal combustion engine turns a generator, and the generator can either charge the batteries, or power the electric motor that drives the transmission. Here, the vehicle is propelled by the electric motor alone; the engine does not directly power the vehicle.

• **Series/Parallel hybrid drivetrain**: This system merges the advantages of the above two. The engine can both drive the transmission directly and be effectively disconnected from it so that only the electric motor drives the transmission.

**Fuel efficient features of hybrid cars**

Hybrid cars can be significantly more fuel efficient compared to conventional cars with internal combustion engines due to the incorporation of several technological features. The contributions of these features to fuel efficiency are elaborated below.

These are the features of a *mild hybrid* car that can lead to increased fuel efficiency:

• **Idle-off**: When the car comes to a stop, for example at a red light, the engine is turned off. This is possible as a hybrid car does not rely on the internal combustion engine at all time, and is able to move off from a stationary position solely through propulsion by its electric motor. This feature saves fuel as the engine does not have to consume fuel continuously when not required.

• **Regenerative braking**: This enables hybrid cars to capture the kinetic energy of the car that would normally be lost as heat in the brakes when slowing down or stopping. Whenever the driver applies the brakes, the electric motor runs in reverse and acts as a generator to recharge the batteries. The stored energy can then be used to propel the car.

• **Power assist and engine downsizing**: For a hybrid car under gentle acceleration and moderate cruising speeds, a small engine usually provides adequate power. For situations where additional power is required, such as going uphill or overtaking, the electric motor will kick in. Power assist reduces the demands on the engine, enabling the use of smaller engine, while maintaining the same performance as a car with a bigger one. A small engine is more fuel efficient than a big one due to these reasons:
  - A car with a smaller, lighter engine uses less energy when accelerating and going uphill
The pistons and internal components of a small engine are lighter, and use less energy to move up and down the engine cylinders. Displacement of each cylinder is smaller, thus requiring less fuel in its combustion cycle. Lower number of cylinders in a small engine consume less fuel overall compared to an engine with more cylinders.

In addition to the fuel efficient features of a mild hybrid listed above, a full hybrid car also possesses the following fuel efficient feature:

- **Electric-only drive**: This feature allows the car to drive using only the electric motor. This enables the vehicle to spend more time operating its engine only when it is at its most efficient. At low speeds and at launch, the electric motor powers the car. For instance, in situations such as city driving where speed is generally low and a car has to constantly stop and start, it is possible to drive the car solely on electric power.

To illustrate, the Toyota Prius – one of the best-selling hybrid cars globally – has a fuel economy rating of 21.3 km/litre. Meanwhile, the 1.8L Toyota Corolla has a rating of 12.8 km/litre. This means the Prius is able to go 66% further than the Corolla with the same amount of fuel.

Another popular hybrid car, the Honda Civic Hybrid, has a fuel economy rating of 18.71 km/litre, while the 1.8L Honda Civic has a rating of 13.6 km/litre. The hybrid version here has a 38% advantage over its non-hybrid cousin.

A hybrid car clearly has many advantages over a conventional car, in terms of fuel efficiency. These advantages are even more marked in city driving conditions, making it a good choice for drivers here in Singapore. Although the price of a hybrid car is significantly higher than a conventional car, owners stand to gain over the long run due to the much lower fuel cost.

*To learn more about hybrid cars, please visit:*


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