

Vehicle Technologies: Hybrid Electric Vehicles



Overview

Hybrid electric vehicles (HEVs or, simply, hybrids) use an internal combustion engine (ICE) in conjunction with an electric motor to propel the vehicle. The electric motor is powered by a battery which is charged by capturing energy normally during braking and/or using excess ICE capacity.

This fact sheet describes *stand-alone* HEVs. For vehicles that permit charging with off-board electricity supplies, see *Vehicle Technologies: Plug-in Electric Vehicles*.[□]

Hybrid electric vehicles have been on South Australian roads for well over a decade. They are a proven and highly efficient technology. There are now a range of hybrid cars and mid-sized trucks on the market.

How do Hybrid Electric Vehicles Work?

From the driver's point of view, HEVs are hardly different to conventional vehicles: they run on familiar fuels alone, and drive like other vehicles. The differences lie in the use of an electric motor, powered by a battery, to supplement the internal combustion engine.

Most HEVs use the electric motor to accelerate from standstill and to provide extra power at higher loads. This permits the

use of a smaller ICE than would otherwise be used, which can be tuned for fuel efficiency rather than power or torque (electric motors provide exceptional torque).

HEVs use regenerative braking to capture energy normally lost when decelerating. The energy is converted to electrical power and used to charge the battery which, when needed, will drive the electric motor. Hybrids also turn the ICE off when idle or cruising steadily, saving more fuel.

Many hybrids can only be driven in purely electric mode when power demands are low – idling, cruising or steady acceleration at lower speeds. Some HEVs do not operate in electric only mode when the vehicle is moving above a certain speed.

Hybrid Configurations

Several hybrid configurations are available in South Australia:

- **Mild parallel hybrids** are relatively simple HEVs. An electric motor assists the ICE during acceleration, particularly from start-off, and acts like a generator to capture energy when the vehicle decelerates.

Further information:

Email: DPTI.LowEmissionVehicles@sa.gov.au

Web: www.lowemissionvehicles.sa.gov.au



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- **Series hybrids** are more like electric vehicles, where only the electric motor actually propels the vehicle. The ICE is used to drive a generator to charge the battery, and is tuned optimally for the task. This configuration would, more typically, also permit off-board recharging.
- **Power split hybrids** are a common hybrid configuration. Generally, these vehicles can be driven by the electric motor alone, the ICE alone, or any combination of the two. They combine the low-load efficiency of a series HEV with the higher load efficiency of a parallel hybrid.

Comparison to Conventional Vehicles

Hybrids offer substantial efficiency gains compared to conventional vehicles, particularly on stop-start urban driving (where anti-idling and regenerative braking are major advantages). HEVs are among the most fuel efficient cars on the road under standard tests.

Hybrids don't offer the same advantage in steady speed highway driving. The additional weight of the more complex drivetrain, coupled with the reduced need to accelerate and decelerate, significantly offsets the efficiency gains from regenerative braking.

Why Consider a Hybrid Electric Vehicle?

- Hybrids are available across light vehicle classes – sedans and SUVs – as well as mid-sized trucks.
- Hybrid vehicles are a highly efficient and proven technology. Hybrids are in common use in taxi industry, having demonstrated their longevity.

- High efficiency equates to lower fuel costs and greenhouse gas emissions.
- HEVs do not pose any real challenge for first-time drivers – they are fuelled as a conventional vehicle is fuelled and driven as a conventional vehicle is driven.
- Hybrids release no toxic emissions when in electric-only mode. Overall, their toxic emissions are lower, especially in the urban environment.

What issues are there?

- Upfront costs tend to be higher, reflecting the complexity of the drivetrain.
- Service costs, also, may be a little higher, and your choice of service providers could be more restricted.

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See Also:

- [Vehicle Technologies](#)
- [Vehicle Technologies: Conventional Vehicles](#)
- [Vehicle Technologies: Plug-in Electric Vehicles](#)
- [Emerging Fuels and Technologies](#)

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