



# HYBRID COMES OF AGE

The second generation Hino Hybrid is slowly gaining acceptance as an efficient metropolitan truck. Peter Shields put one to work and found it is more than just a 'greenie' gimmick.

**T**he current Hino Hybrid model replaced the first version that was introduced to Australia in 2007. At the time, Hino emphasised the hybrid's comparatively low emissions, and the model was mostly taken up by fleets that wanted to stress their environmental commitment.

This second generation released in late 2011 and based on Hino's new 300 series range, is a combination of innovative, yet mature engineering that provides an urban delivery truck that is essentially no different to drive than any other light truck and can therefore stand alone on its performance and efficiency with the environmental aspects being a bonus.

The Hino Hybrid driveline has undergone a number of fundamental changes, the most significant being the relocation of the automated clutch to a spot between the diesel engine and the electric motor, allowing each to be uncoupled to promote fuel and emission efficiency, and re-coupled to maximise power delivery and or maximum engine braking in what is termed a parallel hybrid system.

The electric motor/generator is a supplementary power source that generates electricity by gathering kinetic energy when the truck decelerates. The diesel engine is not involved in electricity generation and returns to idle whenever it is not required to drive the truck, thereby saving more fuel. The four-litre turbocharged diesel engine produces 110kW of power at 2,500 rpm and 420Nm of torque at a low 1,400 rpm. The 300V air-cooled electric motor produces 36kW and 333Nm across its operating range, and combined, the power units have 10 per cent more power and 19 per cent more torque, both at lower revolutions, than the previous model.

The engine also has cooled Exhaust Gas Recirculation, an oxidation catalyst and diesel particulates filter. A bar graph on the dash indicates the condition of the diesel particulate filter and triggers a "burn" once it reaches level three. At no time during several days of driving the Hybrid did we need to manually instigate a cleaning burn, though that facility is there if required.

The electrical components – including the motor, inverter and nickel-metal hydride battery – have been completely redesigned in order to reduce each item's weight and size and to increase their efficiency.

The 40-module (240 cells) 288 volt Nickel-Metal hybrid battery is the same as used in the Lexus RX450h luxury SUV and has a five-year warranty. Battery replacement cost is around \$3,000, which is less than half the figure often perceived by the Australian market. The battery weighs 42 kg and is mounted out of the way on the kerb side of the chassis.

The Hino Hybrid does not have a conventional starter motor or alternator as it uses the electric drive motor as the starter for the diesel engine and has a converter to create 24 Volt power for the lights, electronics and cabin functions. Eliminating the starter and alternator reduces weight as well as eliminating several components that over time wear out and would require replacement. Using the powerful electric motor to start the diesel makes for almost instant ignition, a factor crucial to the vehicle's Auto Stop Start feature.

**When cruising at a constant speed, the engine is operating in its most efficient range and provides all of the power to propel the vehicle while the electric motor remains inoperative.**

Activated by a switch on the dash, the Auto Stop Start function can automatically shut down the diesel engine when the vehicle comes to a stop, effectively eliminating the consumption of fuel that would otherwise be wasted when idling at intersections or in stop-start traffic. The engine automatically restarts when the driver removes their foot from the brake pedal.

The system works in conjunction with the Easy Start hill start assist feature, which automatically keeps the brakes applied

until the clutch reaches its friction point. The process quickly becomes second nature for the driver and an adjusting switch for the speed of the brake release ensures smooth take off regardless of the incline or the vehicle's load.

The Hybrid's transmission is Hino's own ProShift 5 sequential-shift five-speed automated manual (AMT), a classic two-pedal system. The developments in the electronic controls of the integrated driveline mean that the AMT is the only transmission offered (rather than a conventional automatic) and it provides smooth take offs and shifts as well as working with the control modules to ensure that the correct gear is always selected appropriate to the current conditions to obtain maximum efficiency. The nifty selector lever allows for manual over-ride if the driver wants it, but we found that leaving the selector in "D" produced the better result in both performance and economy.

The combined torque of the hybrid driveline permits the transmission to shift at very much lower rpm that a driver would probably expect from a diesel only truck.

The Hino Hybrid has a number of fundamental driving phases during which the various components interact in different ways. To the driver, all of these changes are seamless but many can be observed via the changing electronic icons on the dash.

On initial acceleration, the driving force is usually generated by a combination of the diesel engine and electric drive motor. However, depending on the state of charge of the hybrid battery and other conditions