



## **MANAWATU WANGANUI BRANCH December Visit Report.**

A group of members met at Toyota New Zealand's National Training Centre in Palmerston North recently.

Team Leader for Technical Training, Mike Bron greeted the IAME group and introduced the Toyota hybrid concept operating system where two independent power sources are used to drive a car.

The latest Prius uses a 1.8l petrol engine and an AC three phase Electric motor that independently or together can propel the vehicle. The electric motor develops maximum torque at low revs for efficient movement and can provide regenerative power when slowing down that is converted into DC for recharging the battery. The petrol engine operating under the Atkinson principle provides additional power when required or when maximum full acceleration is needed where both power sources work together via a continuously variable transmission. Traction control is employed to prevent over speeding of the transmission components in slippery driving conditions due to the high torque available from a stationary start. The electric motors and transmission unit is water cooled and lubricated by a Toyota proprietary oil. The engine exhaust system captures and recycles the exhaust heat via a water heat exchanger to preheat the engine and for the vehicle interior heating and demisting duties. The petrol engine has no accessory drive belts as the vehicle has electric power steering, an electric water pump, and an electric powered air conditioner compressor (Inverter Air Conditioning). The transmission has two electric motors, one acts as a starter motor for the petrol engine and generates electricity whilst the other is a 27kw electric drive motor and recovers the kinetic energy, converting this into electricity when the vehicle decelerates, charging the high voltage battery.

Mike explained about the 201.6V battery located in the boot and the electronic protection systems. When the ignition key is turned off three solenoids disconnect the high voltage battery system totally. There is a bright orange service grip on the end of the battery pack should removal of the battery pack be necessary (this renders the high voltage battery safe). The cells are nickel metal hydride and are filled with a paste like material so there is no danger of acid spillage or burns in the event of a vehicle roll-over accident.

The battery has 28 cells that are wired in series and the charge of each cell is electronically monitored. Temperature sensors control a cooling fan for the battery pack if required. Battery life is guaranteed for 8 years and lasts 10 to 14 years. The traditional 12 volt automotive battery for running the lights etc. is also located in the boot and is vented to outside the vehicle.

All wiring with bright orange insulation is at 201V (from the battery to the inverter) and up to 650V from the inverter to the motor generators). The high voltage system can detect a short to body ground and will turn off the high voltage supply from the battery should this be detected.

Mike displayed where traditional jump starting of the 12V battery system can occur under the bonnet and or in the boot if the battery goes flat due to doors being left ajar or interior light left on as in an ordinary vehicle.

Questions about the Atkinson cycle engine, towing, lubricants were happily answered by Mike. Branch Chairman Errol Manderson present Mike Bron with a IAME Branch Appreciation Certificate supported with a round of applause. Refreshment were then enjoyed in Toyota Café.



Visible is orange leads from 201V battery that plug into the electronic inverter/convertor that changes DC into AC for the 3 phase electric motor and raises the system voltage from 201V to up to 650V and vice versa. The two separate cooling systems for the 1.8 petrol engine and the electric motor. Electronic convertor located at the front



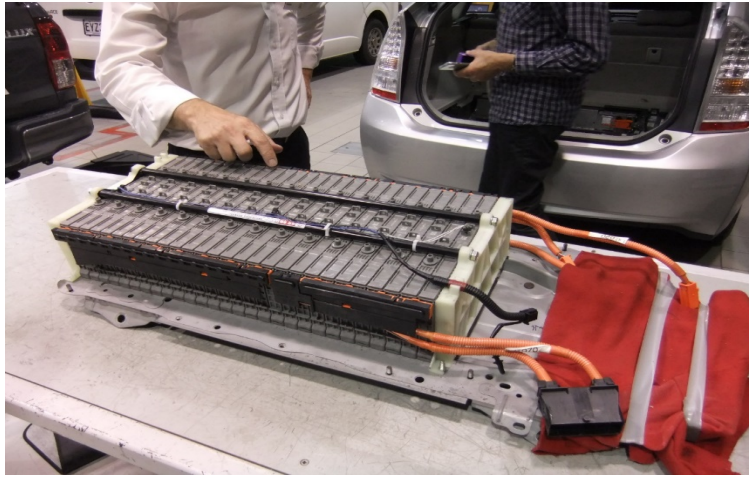
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The two electric motor generators (MG1 on the left and MG2 on the right) with a power split device and drive chain between them and disc clutch plate on end where connection to petrol engine occurs. Electric motor and transmission water cooling connections visible at bottom left.



201 volt battery located in boot well with orange service grip.



28 cell 201.6 volt battery unit



#### Engine – Combining efficiency with performance

The 2016 Prius v features a 1.8L, 4 cylinder, In-line, 16 valve DOHC petrol engine with Variable Valve Timing-intelligent (VVT-i) and Electronic Fuel Injection (EFI).

- ⌚ Maximum power – Petrol engine – 73kW at 5200rpm
- ⌚ Maximum torque – Petrol engine – 142Nm at 4000rpm
- ⌚ Combined system output (petrol engine and electric motor) – 100kW
- ⌚ Fuel economy – Combined/Urban/Extra-Urban (ADR 81/02). 4.4/4.2/4.3 L/100km.
- ⌚ CO2 emissions – 101g/km (combined ADR 79/04)
- ⌚ Exhaust emission standard – Euro 5
- ⌚ Drive type – Front-wheel drive
- ⌚ Fuel - 45L tank capacity. 91 octane is recommended.