

## Electric Cars

While, we have been hearing of them for at least the last 30 years or so, and there are still challenges to be addressed, there is now almost a definite certainty that the days of the petrol engine powered vehicles are over. It might even be sooner than you realise.

It has now been 15 years since the first production electric vehicle had been made available to consumers. Starting in 1997, in a trial, through co-operation between state government and General Motors, residents in California, were able to release the GM EV1 zero-emissions vehicle. It was the first fully electric car which had all the convenience and performance of a petrol vehicle that the drivers could charge at their homes, businesses or at special charging stations. At around \$500 a month to rent, it was quite expensive, it used the now, out-dated lead-acid batteries which took a long time to charge and the range was around 160kms. However, it gained quite a loyal following from the owners who were heart broken in 2003 when all the cars were taken away by GM and crashed when the EV1 loan scheme was discontinued by the company. According to GM the electric cars were uneconomical and too expensive to build. Only 2000 EV1 were ever made but the lessons learned from the car were perhaps more valuable. The shape of the rear of the car was specifically optimised to reduce drag and improve mileage; another novel technology in EV1 was the regenerative braking which charged the battery while the car was breaking. This technology is now standard part of all hybrid vehicles such as the Toyota Prius and is even used in the current line of Mazda petrol cars.

As an alternative to a fully electric vehicle, Toyota was the next future-minded company to consider alternatives to the status quo. At the time of its launch in 1997, the Toyota Prius, was a huge revolution in car design. It made heavy use of regenerative braking to virtually half the emissions and fuel consumption of a medium size petrol vehicle. This was done by addition of a Nickel Metal Hydrate high voltage battery and an electric engine to a standard Toyota four cylinder engine. In a regenerative braking setup; the electric engine would be connected to the vehicle's wheels while the vehicle is coasting or breaking and would cause breaking energy to be used to charge the high voltage battery. This energy could then be used to power the same electric engine to help the vehicle accelerate from a stopped position. The innovations did not stop there. The Prius also was the first vehicle to introduce Continuously Variable Transmission system to a production car. Instead of a complicated Automatic Gear Box, the Prius featured a simple and efficient CVT setup which allowed the vehicle to further reduce fuel consumption while offering a much more fluid and comfortable ride. This car was also the first to completely stop the petrol engine while the car was stationary and then start it up again when the vehicle moved off. This technology only is slowly making its way into the currently available petrol vehicles with the BMW Mini currently being the only car to feature this.

The Prius paved the way for more hybrid vehicles from other vendors all of which had varying levels of success. One of the biggest drawbacks to buying a Prius, after its sale price, was the expensive High Voltage battery which needed replacement every 8 (or so) years. At a cost of \$4-5k, it was an unattractive prospect for owners to contemplate. Priuses became popular with eco-minded movie stars and the well to do. It wasn't until around 2009, after the financial crisis that major car manufacturers started to seriously consider hybrids. These days, almost every major manufacturer either has a hybrid car available or one coming next

year. Of particular interest is Hyundai, who will be offering a lifetime warranty on the high voltage battery pack in the bid to alleviate consumer fears of having this large expense.

While making a huge difference to reducing emissions and petrol costs, hybrid cars are only the transition between petrol and fully electric cars. Another step in this gradual transition is the plugin hybrid. Plugin hybrids generally have a high voltage battery with larger capacity which uses a different battery technology; Lithium Ion Polymer. This technology has long been available and was used in laptop and mobile phone batteries. However, until recently, putting this battery in car has been considered unsafe. In a plug-in hybrid vehicle, the battery can be charge by the owner at their home by plugging in the car into a normal house power point in the garage. The vehicle will then use this energy to drive for the a few kms before falling back the petrol engine/hybrid system when the battery charge is low. This is ideal for short trips in the city of around 20km and can lead to a significant decrease in emissions and running costs. Many manufactures including Toyota will be offering plugin hybrids in the hybrid range in Australia starting from next year.

This year, the Nissan Leaf became the first full electric vehicle to be available in Australia. This car does not have any petrol tank, tail pipe or a noisy petrol engine. It operates entirely on power from Lithium Ion Polymer battery park located under the car. While the expensive battery pushes the vehicle price to over \$50,000 in Australia, it is nevertheless an encouraging development in the eventual path to reducing car emissions in use of non-renewable petrol energy in Australia.

Next year will see the introduction of the Holden/GM Volt and other electric cars to the Australian market. Projects such as a “E V Engineering” which aim to convert a commonplace Australian Sedan (Holden Commodore) to an all-electric vehicle and a “Better Place” which aim to establish automated electric battery swapping stations in Australia are all gaining traction and popular support. Whilst it is hard to estimate consumer demand, with the current rate of increase in fuel prices in Australia and around the world it is not unreasonable to anticipate that electric vehicles will become common place during the course of the next 5 years.

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