

# TECHNICAL REPORT



## ELECTRIC VEHICLE DEVELOPMENT AND DESIGN STRATEGIES -

WHERE IS IT GOING  
AND WHAT  
TECHNOLOGIES CAN  
WE EXPECT TO SEE?

A recent article that I came across, describing electric vehicle proliferation, their different classifications, and government incentives to expand their use on a global scale, caught my attention and provided some insight into where all of this is likely to progress to in the near future, as well as highlighting some of the issues around safety, identification and reparability.

In the first instance, it would be prudent to provide some clarity around the rather broad term "Electric Vehicle" – this general description actually encompasses four distinctly different power and drive train systems being produced and sold around the world today. Like almost everything else we describe about vehicle technologies and features in the modern age, they are categorized for the most part, by acronyms: -

1. HEV
2. BEV
3. PHEV
4. FCEV

### 1. Hybrid Electric Vehicles (HEV) -

The term "Hybrid" describes a vehicle that has two or more distinctly different means of propulsion, and in addition to the now more familiar passenger car, encompasses trains, trucks, commercial vehicles, buses, ships and 2 wheeled / cycle-type vehicles.

Globally, the general public think of hybrids being powered by petrol and electric motors (as this is certainly the most popular combination), but can, and does include numerous other combinations such as *Diesel- Electric* (e.g. trains), *Petrol-Air*, *Petrol -Hydraulic*, and *Electric-Human* (electric bicycles).

**Examples of conventional hybrid petrol - electric vehicles that feature predominantly in this part of the world, include:-**

- Toyota and Lexus models (Toyota Prius, Yaris, Camry, Corolla & Highlander - Lexus CT200, IS300, NX300 & RX450 variations).
- Honda Insight, Civic Hybrid, Fit and CR-Z.
- Nissan X-Trail, Cima and Serena.
- BMW 3 and 5 series.

*Note that with the exception of Toyota and Lexus (who supply NZ new), most other brands are Japanese domestic market vehicles imported into New Zealand.*

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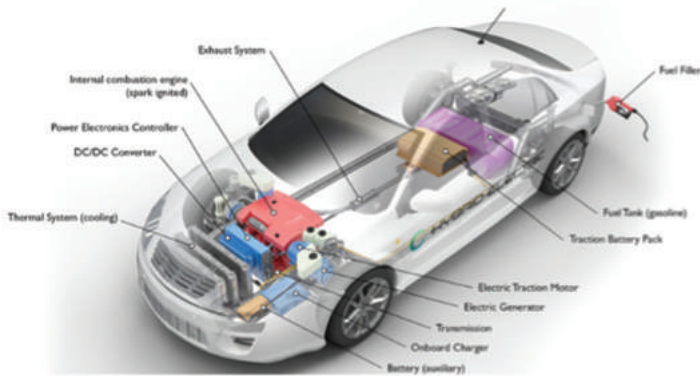
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## Hybrid Electric Vehicles



The ubiquitous Toyota Prius  
– ( 2017 model shown )



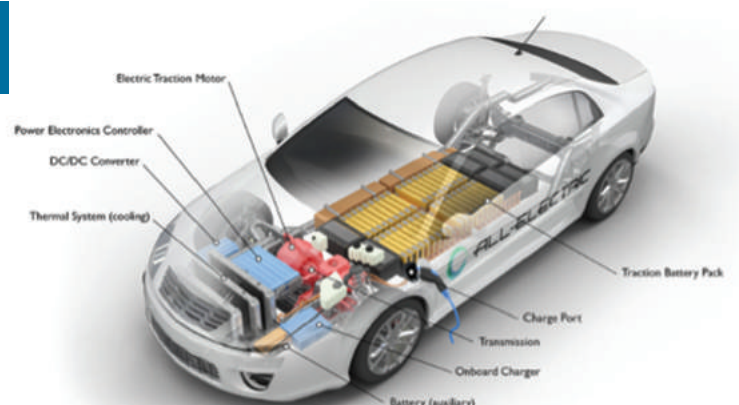
## 2. Battery Electric Vehicles (BEV)

As the name suggests, these are electric vehicles that rely solely on battery power to operate, and almost without exception, suffer from a limited driving range before requiring recharging. This issue is further exacerbated by the limited number of charging stations around the country (at this time).

The most popular BEV sold new in New Zealand (as well as the rest of the world) is the Nissan Leaf, which has now been discontinued here (Nissan NZ state that they are unable to source a suitable specification and price)- although it is expected that they will continue to sell well as used imports. The only other real contenders for new BEV sales in NZ are the Renault Zoe, and in even smaller numbers, the more exclusive Tesla Model S, which has a substantial advantage in both performance and range (over 400km, with a top speed of 225 Km/h), over any other BEV's.

The Tesla S range also features an all – aluminium construction with rear wheel and all-wheel drive options, (single and dual drive motors), solar absorbing laminated glass, and an 8 year, unlimited mileage warranty on both the battery and drive train. The new flagship model (P100D) is the fastest accelerating production car in the world today at 2.5 seconds 0-100 km/h and over 500 kilometre range.

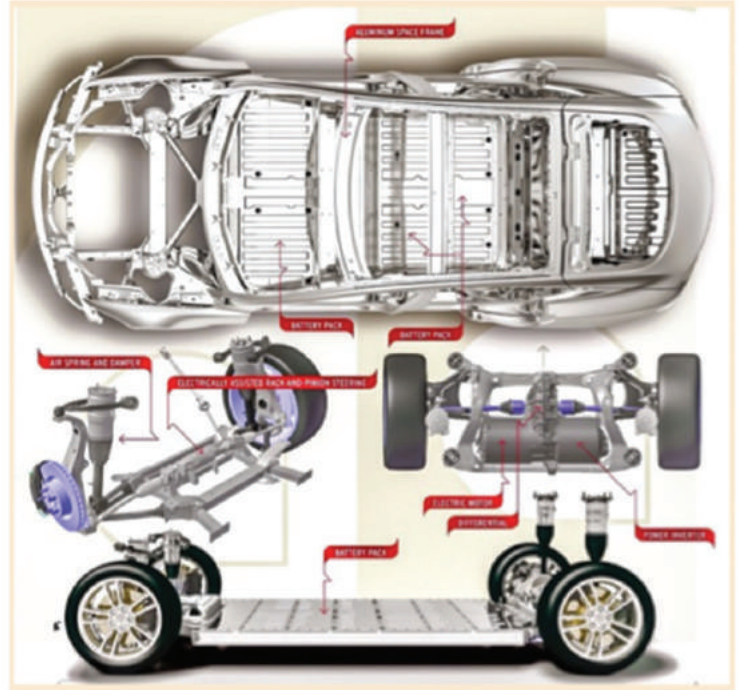
## All-Electric Vehicles





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## Latest model Tesla S



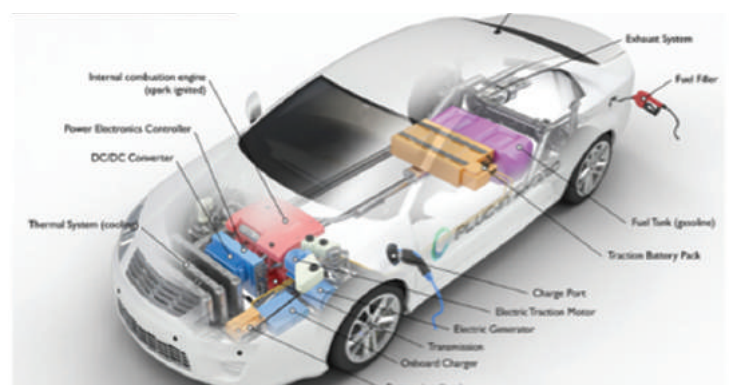
## 3. Plug-in Hybrid Electric Vehicles (PHEV) –

PHEV technology arguably has the best of all worlds when it comes to effective range, appropriate performance, and cost effectiveness. Using a petrol engine to generate power, as well as mains charging capability, allows travel on electric power only (as opposed to HEV, which requires the combustion engine engagement to drive). This means that short distance trips of between 30 - 50kms can be made without running the petrol engine at all – (the average daily kiwi commuter trip is 33 kilometres).

Perhaps the most well-known PHEV vehicle sold in New Zealand (and around the world), is the Mitsubishi Outlander PHEV – a competitively priced SUV with All Wheel Drive (AWD).

Other manufacturers that produce PHEV models include Audi with the A3 e-tron, Porsche Cayenne E-Hybrid, Volvo XC90 Twin Motor, and very recently, Mercedes Benz with PHEV variations of their C, E and S classes, as well as the GLE SUV.

## Plug-in Hybrid Electric Vehicle



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**Volvo XC90 Twin Motor PHEV**



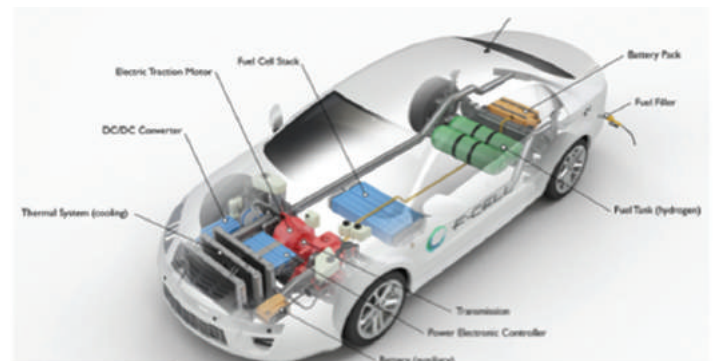
**Mitsubishi Outlander PHEV**

## 4. Fuel Cell Electric Vehicles (FCEV) –

Essentially, a fuel cell, generally comprising atmospheric oxygen and compressed hydrogen, is used to power an electric motor instead of, or in combination with, a battery. FCEV has been used previously to power forklift operations in indoor applications where clean emissions are important to air quality.

Commercially produced motor vehicles using FCEV technology have really only come onto the market since 2015, with the Toyota Mirai being sold in Japan, USA, Parts of Europe and the UAE. Honda have also entered the USA market with leasing of the Honda Clarity Fuel Cell. Hyundai also lease in small numbers, their Hyundai Tucson FCEV .

## Hydrogen Fuel Cell Vehicle



**Honda Clarity**

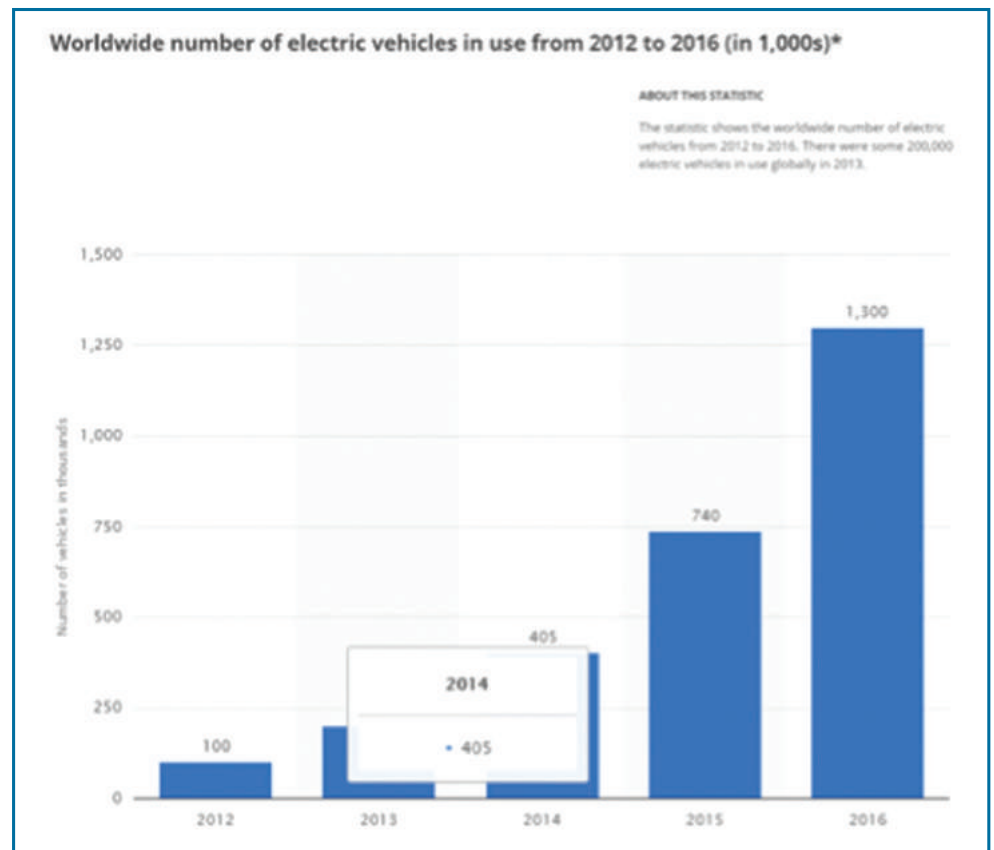


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Toyota Mirai FCV

By the numbers ....



BEV & PHEV – Charging station in downtown Wellington

*These articles have been written by Martyn Lane : I-CAR Instructor, Weld Test Administrator and Technical Specialist to the auto body industry*