

3. HYBRID PETROL/ELECTRIC CARS

Officer responsible Plant and Building Services Manager	Author Paul McNoe
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The purpose of this report is to outline the current availability and viability of hybrid petrol/electric cars for use in Christchurch.

INTRODUCTION

Before launching into the subject proper it is useful to overview the broader field of low emission vehicles. There are a broad spectrum of technologies both in use and under development to achieve lower vehicle exhaust emissions. The key technologies are summarised below.

1. Efficiency improvements to the conventional petrol and diesel engines through higher thermal efficiencies, improved combustion arrangements, direct fuel injection, electronic controls (e.g. intelligent valve timing), friction reductions within the drive train and post engine treatments (e.g. Catalytic converters). As fuel efficiencies rise exhaust emissions are reducing.
2. Battery powered cars with overnight or rapid recharge systems. In the past the driving range and performance of these cars has been low due the limited storage capacity and weight of the batteries. Advanced battery developments and rapid recharge systems are overcoming some of these shortfalls. The driving range on full charge is now in the order of 200 kilometers and their on-road performance is very comparable with the conventional engined car. There are no exhaust emissions.
3. Hybrid vehicles combine smaller battery packs with small high efficiency petrol, diesel or gas engines to recharge the batteries for a longer driving range and to provide more power during acceleration and hill climbing. The auxiliary engine starts and stops independently of the driver. The engine produces low exhaust emissions while running. The Shuttle buses are a good example of this technology applied locally.
4. Fuel Cell electric vehicles. Fuel cells combine Hydrogen and Oxygen in a chemical reaction that directly produces electricity and emits only water as a byproduct. The electricity produced charges a small lightweight battery pack and provides extra power for acceleration and hill climbing. They have no exhaust emissions with a driving range equivalent to a conventional car.

The last three technologies are similar in that they all use electric motor drive systems that have very low energy losses. The main differences being the electrical energy source, the energy storage capacity (battery) and hence weight of energy storage required. All these vehicles use regenerative braking, which uses the drive motor during braking to slow the car while recharging the battery. While batteries are the “normal” storage system for electrical energy, flywheels and capacitors have been and continue to be used in prototype vehicles.

Power technologies in the global market.

- Conventional cars have been in use for 120 years and development is ongoing with pressure from European, American and Japanese regulators for exhaust emission reductions and consumers expectations for improved fuel economy.
- Battery powered electric vehicles (BEV) are available in the USA, Japan and some sectors of Europe, notably France (since 1997). Manufacturers have tended to closely control the release of these units into Governmental or Public Utilities sectors in order to manage the introduction of this technology and their service support.
- Hybrid electric vehicles (HEV) are well advanced into the prototype phase and will soon be available on “home” markets. The Toyota Prius was released onto their domestic market in December 1997.
- Fuel Cell electric vehicles (FCEV) remain in the prototype phase. The major issues being reducing the size and weight of the fuel cell and efficient storage of the Hydrogen gas in a safe and convenient method.

It is the writer’s personal view that the fuel cell powered vehicles will prevail in developed countries once the issues surrounding hydrogen production, storage, transportation and miniturisation of the fuel cells are fully developed.

Manufacturers Overview

Toyota	BEV’s in USA and domestic markets. Cars and 4WD’s HEV’s on domestic market now due for release into USA and Europe in 2000
Ford	BEV’s in domestic market. Utilities
GM	BEV’s in domestic market. 2 seater sports car (EV1) and Ute
Chrysler	BEV in domestic market. Mini Van
Honda	BEV in USA and domestic markets.
Daewoo	BEV due for release on domestic market
Holden	Working with Toyota on FCEV technology.
Nissan	BEV in USA and domestic markets. Mini van
Mitsubishi	
Citroen	BEV in domestic market
Peugeot	BEV in domestic market
Mercedes	BEV in domestic market
BMW	BEV in domestic market

ELECTRIC VEHICLES IN NEW ZEALAND

At the current time there are no commercially available electric cars in New Zealand. As mentioned earlier manufacturers are releasing any electric cars in their domestic markets first to control the initial users experience and also to ensure that proper support is available for these new vehicles. The perceived risk is that without this after sales support this new technology could “fail” and so jeopardise its own future success.

Over the past five years a small number of standard cars have been converted within NZ into fully electric operations with battery packs. Generally these cars have tended to be used for display and public relations purposes and have not lead onto further developments. The Toyota Starlet owned by Canterbury Regional Council is an example of this conversion.

While there are no commercially available Hybrid electric vehicles available, Toyota have a four door sedan called Prius that is being evaluated for its suitability for use within New Zealand. Toyota can give no indication of when, or if, this vehicle would be available for purchase. The Prius has been available in Japan since December 1997 and has a fuel consumption of 5.8 litres/100 km (50 mpg) with CO₂ emissions 50% lower than its current 1.5 litre petrol equivalent.

In summary the availability of electric powered cars in New Zealand remains much the same as it was in 1997 i.e. nil. On the World scene however there have been significant developments with most manufacturers having released an electrically powered car or similar type vehicle into its local market and in some cases major overseas markets. Hybrid electric/petrol vehicles are expected to follow the first wave of battery electric vehicles with Fuel Cell electric vehicles close behind.

My prediction is that the hybrid electric/petrol vehicles will be the first electric cars released in New Zealand because they do not require new infrastructures nor significant investments from local suppliers. The motorist can use normal petrol stations, no kerbside recharging systems are needed within the cities or in homes and the support technology for the car franchisers would not require major expenditure or staff training. Both Fuel Cell and battery only cars require new infrastructures and significant upskilling of motor franchisers. Given that the Hybrid EV uses less fuel than conventional cars funding to support the introduction of these vehicle may be available from EECA.

Options for Council

1. Import Hybrid or other low emission vehicles direct from an overseas market, eg Japan. These vehicles are unlikely to be supported by the local distributor and will involve considerable time and expense in getting the cars on the road.

2. Lobby New Zealand motor distributors to advance the introduction of electric vehicles. Enlist support from EECA, Local Government NZ etc
3. Convert some existing cars over to full electric battery operation. The hybrid conversion would not seem to be a practical option because of the complexity of this conversion within an existing car or van. NB the Shuttle buses were designed with the Hybrid arrangement in mind.
4. Commission development of a NZ built electric vehicle
5. Invite, encourage the Motor industry to view CCC as friendly partner in trialing and evaluation of EV's for the local market
6. Wait quietly for EV's to be introduced into NZ.
7. Regular review of Electric Vehicle developments on the local market.

- Recommendation:**
1. That the Council lobby motor distributors to supply hybrid low emission vehicles in Christchurch at the earliest date possible.
 2. That the Council actively encourage the motor industry to view Christchurch City Council as a friendly partner in the trialing and evaluation of alternative low emission vehicles for the local market.
 3. That staff provide an annual update on hybrid low emission vehicle development.
 4. That the Council make a commitment to acquire as soon as practicable low emission vehicles for its fleet.
 5. That motor distributors in New Zealand who may have vehicles available in the near future be invited to meet with the Committee to discuss options for the introduction of suitable vehicles in Christchurch.