4. SUSTAINABILITY IMPROVEMENTS - THE COUNCIL'S OWN TRANSPORT

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The purpose of this report is to inform the Council of means and targets for improving sustainability of the Council's vehicle fleet.

CONTEXT

Since 2001 a number of changes have been made in the way the Council's white fleet is managed. A major initial focus was to achieve a reduction in the fleet numbers (which is not part of this report), as well as to develop a better plant replacement policy that would incorporate sustainable principles. The current replacement/purchasing policy dated 1993 does not include any consideration of a vehicle fuel efficiency or its environmental impact and, in essence, is based on the vehicle's initial capital cost as the prime consideration.

The major thrust is focused on reducing fleet operating costs while achieving sustainability improvements in two directions: providing more efficient operation of vehicles (initially at Civic Offices) and achieving better fuel efficiency and sustainability of the fleet. The latter issue lies under energy management responsibilities.

The National Energy Efficiency and Conservation Strategy (2001) has its Transport Programme as one of five sector programmes. The Transport Programme consists of a number of measures including ***fleet management*** with an objective to *"change fleet management perceptions, purchase decisions and management practices"* in order to achieve the strategy goals. To facilitate the implementation of the programme, the Energy Efficiency and Conservation Authority (EECA) has developed a comprehensive and informative EconoDrive guide.

RELEVANT CURRENT POLICY

The Council has a number of policies that are relevant to the issue of sustainability in transport and particularly to the Council's own vehicles. These include:

- *The Council, when developing new policies and projects, takes into account the effects of climate change where this is appropriate. Policies that initiate or support activities that counter the causes and effects of those changes, are to be preferred (26.04.1995).*

- *That the Council develop a transportation policy which serves to limit greenhouse gas emissions (26.04.1995).*

- *That the Council recognise the need to progressively implement appropriate changes to progress towards long-term economic, environmental and social sustainability (22.07.1999).*

The Council at its meeting on 23 March 2001 considered a report of the Annual Plan Working Party containing a proposal that *"for the next three years all draft budgets to be within the forecasts of financial model with new operating initiatives being funded from efficiency gains or substitutions", and resolved that:*

> *"in the coming three years all capital and operating budgets be contained within the projections in the Financial Plan, adjusted for inflation"*

The Council's Financial Plan and Programme, 2003 Edition states that:

> *"in adopting this plan the Council has now resolved to set in place processes to identify opportunities to achieve cost reductions and revenue increases in its operational budget to ensure that by 2005/06 the projected budget is reduced by $10 million".*

The Council at its meeting on 12 December 2001 considered a report on a Climate Change Consultation Paper entitled "Kyoto Protocol: Ensuring Our Future" and resolved that:

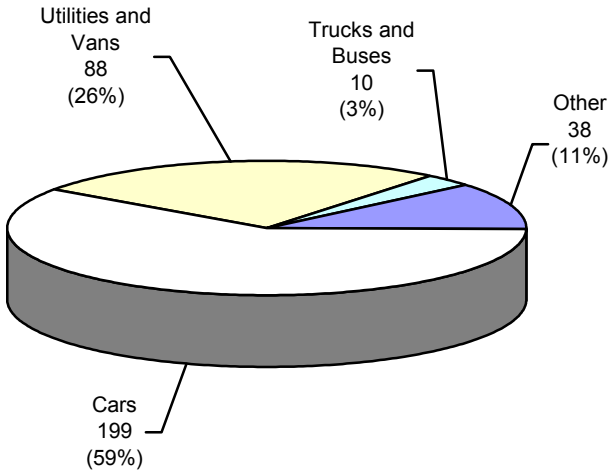
> "*the Strategy and Finance Committee be asked to consider early in 2002 a proposal that the Council set targets, and decide on strategies and mechanisms, for the progressive reduction of carbon dioxide emissions from its own operations, subject to the inclusion of any required budget provision in the 2003 Financial Plan".*

A report on this matter was considered by the Council in April 2002 and it has been further resolved that:

> "*the Council continues to develop and implement programmes and policies leading to energy efficiency improvements and greater use of renewable energy sources"*.

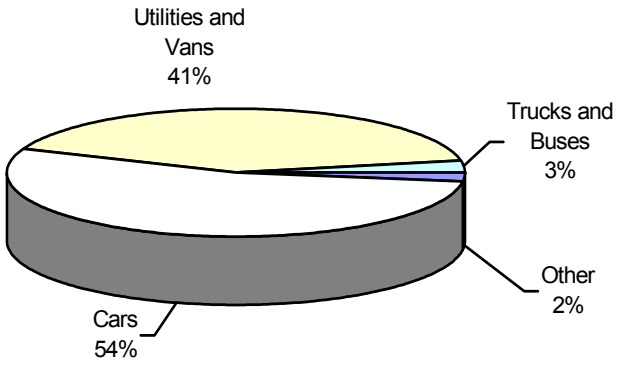
THE FLEET

The Council's fleet consists of 335 vehicles which fall into the following categories:



The "other" vehicles include motorcycles, forklifts, loaders and tractors.

Annual fuel consumption by the vehicles is 350,000 litres which is distributed over the vehicle categories as follows:



It is not immediately clear as to why utilities and vans use proportionately more fuel but a detailed analysis is being carried out to see if there are some opportunities for improvement.

GLOBAL AND LOCAL AIR POLLUTION

The fuel consumption by the fleet creates CO_2 emissions of 800 tonnes per year. The CO_2 emissions from the Council's vehicles represent 5% of total emissions by all Council's operations.

Local air polluting substances include sulphur dioxide, nitrogen oxides, carbon monoxide, volatile organic compounds and particulate matter (PM). These pollutants form from incomplete combustion of fuel and/or complex reactions which arise at the high temperature during the combustion period.

Both global (CO_2) and local emissions depend, as a general rule, proportionally on the vehicle fuel efficiency. In other words, a car consuming 5 litres of fuel per 100 kilometres emits approximately half the CO_2 per kilometre of a car consuming 10 l/100 km.

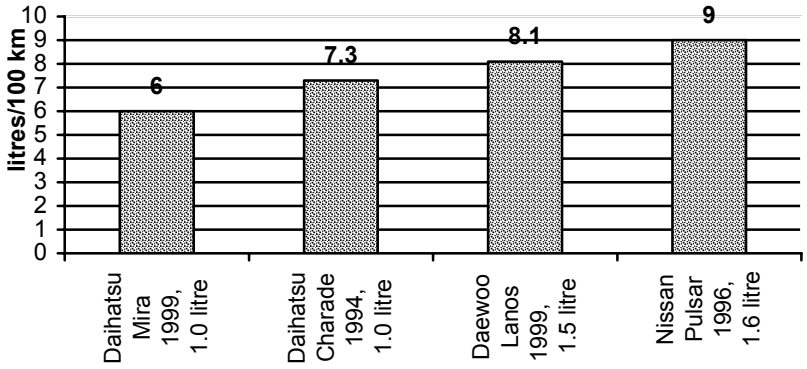
ACTION BEING TAKEN

A significant sustainability improvement potential lies within fleet management. Any reduction in fuel consumption leads to environmental benefits, as well as financial benefits. Fuel costs constitute approximately two thirds of the light vehicle fleet annual operating costs (excluding cost of ownership).

Fleet management includes improving the fleet utilisation, reviewing the Council's transport needs and choosing the right vehicles to suit real task requirements. The vehicle purchasing policy is currently under review with one of the goals being to make fuel economy an important criterion for vehicle specification.

Smaller and Newer Vehicles

As a general rule, smaller cars use less fuel compared to larger models and newer cars use less fuel compared to older ones. This can be illustrated by the graph below that shows actual fuel consumption by a number of monitored vehicles from the Council fleet. Choosing smaller cars (where it is possible) would result in a substantial reduction of fuel consumption.



The current light vehicle purchasing policy requires replacement after 6 years of usage (or 80,000 km). A reduced replacement period (3-4 years) would improve overall fleet fuel economy as we take advantage of newer technology earlier.

IMPROVING VEHICLE UTILISATION

The current average light vehicle utilisation factor is quite low at 12,000 km per annum and this needs to change. Although not part of this report, a number of new initiatives have lead to a reduction in the size of the fleet, better vehicle utilisation, improved transparency of costs associated with particular vehicles and a 17% reduction in the charges to Council units as reflected in the 2002/03 budget.

INTRODUCING ECO-EFFICIENT VEHICLES

The introduction of eco-efficient vehicles is one of the measures under the action plan of the National Energy Efficiency and Conservation Strategy, with an objective to *"transform the technology and energy systems powering the transport fleet".*

What is the ultimate "zero emission" car? It can be a pedal-propelled vehicle, a solar-powered electric car, a sail (wind driven) car, a hydrogen fuel cell car (if the hydrogen fuel for it is produced using only renewable energy sources), or an electric vehicle (rechargeable battery or trolleybus-like) if the electricity is produced using only renewable energy sources. Of this list, only bicycles are commercially available at present.

So, it is important to realise that the eco-efficient technologies considered below are not "zero-emission" ones, but they are capable of providing substantial environmental improvements, either in terms of local air pollution, or global greenhouse gas emissions, or both.

Some of the available technologies are not considered in this report, for example "compressed air" cars. The reason for this is that compressed air is not a fuel for producing motive energy but only a form of storing energy produced elsewhere, and the amount of fossil fuel burnt to compress the air (and associated harmful environmental effects) can be greater than that in a standard petrol driven vehicle.

Bicycles as Part of the Council's Fleet

The most cost-effective measure is reducing car travel requirements by providing more environmentally acceptable mobility options. Three bicycles have been introduced as part of the Council fleet in early 2002 and this so far has resulted in a 3% reduction in the number of trips by car at Civic Offices. Some Service Centres have also expressed interest in adding bicycles to their transport mix.

Biomass Fuels for Vehicles

Alcohol fuels, primarily methanol and ethanol, can be derived from biomass sources (such as sugarcane, wood residue, etc). The biomass fuels are CO_2–free (ignoring possible fossil fuel use for manufacturing and transporting of biomass fuels). However, the fuels do produce local air pollutants and there are technical and safety problems associated with the use of these fuels.

Ethanol is in extensive use in some overseas countries (notably in Brazil) as the primary fuel and as an extender (10-20%) in petrol/alcohol or diesel/alcohol blends (e.g. in the USA).

Vegetable (eg rapeseed) oils are in some use in Europe and USA as alternative to diesel fuel or, more often, as a 10% to 20% blend with mineral diesel fuel.

A critical point is that alternative fuels cannot be considered in isolation from engine systems. Furthermore, an alternative fuel can attack some engine and other vehicle components such as fuel filters, gaskets, carburettor components and certain paints, where these are not designed specifically with this fuel in mind. Vehicles need to be designed and optimised for particular fuels, which can be done in a big scale but not in the scale of the City Council's fleet.

It is notable that the National Energy Efficiency and Conservation Strategy, in its "Renewable Energy: The Proposed Target for New Zealand" (Consultation Document released in May 2002) considers *"changes to fuel specifications to allow ethanol blends in petrol"* but does not mention bio-diesel blends and concludes that *"no specific incentives for biofuels are proposed at this stage although the most appropriate tax regime for biofuels will be investigated".*

Alternative Gas Fuels

Two types of gas fuels are available in New Zealand: LPG (liquefied petroleum gas) and CNG (compressed natural gas). Both are fossil fuels and their sources are finite. Compared with petrol engines, LPG creates 14% less CO_2 emissions and CNG creates 20% less CO_2 emissions. The use of LPG or CNG results in a moderate reduction of urban air pollution as well.

The economics of these gas fuels can often only be justified for high utilisation vehicles such as taxis. During the 1980s, the Christchurch Drainage Board supplied compressed biogas derived from sewage for a variety of vehicles. This was stopped in 1994 because of a number of operational issues (including that of having a single refuelling station in the city and a necessity for the vehicles to travel extra distances for re-fuelling). The biogas at the Wastewater Treatment Plant is now used for other purposes, including electricity generation, which results in better economic and environmental outcomes.

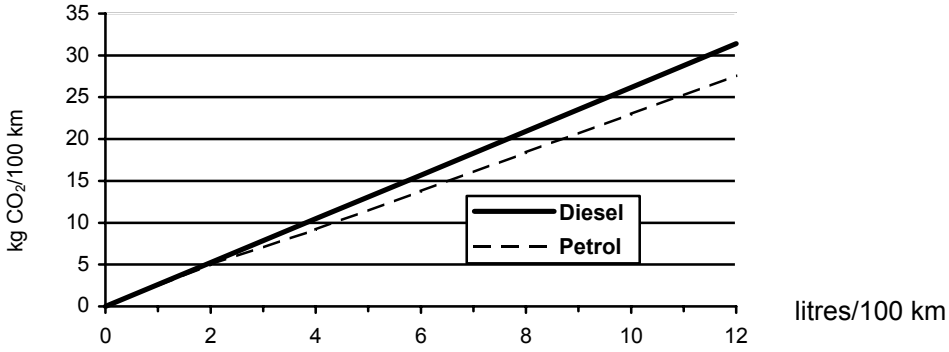
The Christchurch central city shuttles (Yellow Buses) operate on LPG.

Diesel Substitution for Petrol

The diesel engine is intrinsically more thermally efficient than the petrol engine. Therefore a diesel car may be 20% more fuel efficient and, respectively, would emit less CO_2 than its petrol equivalent.

Research by Mr Jim Watt, Target Zero Project Manager, shows that small diesel cars are now available in Europe that have a fuel economy index as low as 3.6 litres/100 km in extra-urban cycle and 5.6 l/100 km in urban cycle. The cars are not currently available in either New Zealand or Australia. The smallest diesel cars available are Audi A3 (engine size 1.8 litre) at a price around $54,000 and Volkswagen Golf and Passat (engine size 1.9 litre) in a price range of $37,000-$56,000.

It has to be noted that a direct comparison between diesel and petrol fuel consumption indices expressed in litres of fuel can be to some extent misleading, as the two fuels are different in their density, energy content and CO_2 emission factors. A more ecologically accurate comparison should be based on the vehicles' CO_2/100 km index rather than litres of fuel per 100 km. The graph below illustrates the difference, which is that a diesel car consuming 7 litres/100 km emits the same amount of CO_2 as a petrol car consuming 8 litres/100 km.



What is the environmental impact of diesel cars in terms of both global and local air pollution? The following quote from a recent (2001) publication by the UK Vehicle Certification Agency VCA (which is part of Department for Transport, Local Government and the Regions) summarises that *"compared to petrol, diesel vehicles have significantly lower CO_2 emissions per kilometre travelled because of the higher efficiency of diesel engines and hence have a lower impact on climate change. Diesel vehicles also emit lower levels of CO and hydrocarbons than equivalent petrol vehicles. However diesel engines emit greater levels of nitrogen oxides and particles than new petrol vehicles. Emissions of such pollutants are an air quality issue, particularly in urban areas."*

The "significantly lower CO_2 emissions" in the quote above means, in fact, only a 7% difference (calculated as an average difference between ten best diesel cars and ten best petrol cars, in accordance with the VCA ranking), while "*greater levels of nitrogen oxides"* (smog-forming substances) means up to a 10-fold increase. Emissions of smog-forming particles (PM) by the best diesel cars range from 17 to 29 mg/km compared to "practically zero" for the petrol cars. This is why none of the best diesel cars has been approved to the strictest Euro IV clean air standard.

In the USA, the Environmental Protection Agency (EPA) in its Green Vehicle Guide ranks small diesel cars among the dirtiest under the 1-star category (out of 5 stars allocated for the greenest vehicles).

The higher emission rates of smog-forming substances is of a particular concern as this represents a very specific air quality problem in Christchurch. This major concern alone doesn't allow to make a compelling conclusion in favour of purchasing these cars for the Council's fleet as this, while in a relatively small scale, would contradict ECan's draft Clean Air Plan and the City Council's own desires to clean up the city's air.

Electric Vehicles

A comprehensive report on all-electric cars was prepared by Mr Paul McNoe the then Plant and Building Services Manager for the July 1996 Strategy and Resources Committee meeting.

How clean electric vehicles are, in an environmental sense, depends upon their source of electricity. If electricity is produced from a fossil fuel source elsewhere, then CO_2 and other air pollutant emissions are even higher than those from a conventional car.

In places where local air pollution is the prime consideration, the use of electric vehicles is quite common. For example, two petrol or LPG driven forklifts at the Council's stores have been replaced recently with electric forklifts.

A growing recognition has been developed in the world over recent years that an all-electric car, while being a clean vehicle locally, is neither energy-efficient nor an "eco-efficient" car when a holistic view is taken on how the electricity was produced. It is notable that the National Energy Efficiency and Conservation Strategy does not mention all-electric vehicles as a means of achieving its goals. Over recent years, leading car manufacturers concentrated their efforts on the development of hybrid electric cars.

Hybrid Vehicles

Hybrid vehicles use motive power that is supplied by both an electric motor/battery system and a conventional internal combustion engine. Hybrid vehicles operate smaller internal combustion engines at maximum efficiency. The electrical system allows braking energy to be captured and returned as motive power, providing good overall fuel economy (claimed to be around 35% better than a standard engine vehicle). The hybrid vehicles do not need to be plugged in for recharging, the engine and vehicle braking provide charging for the battery. Therefore the vehicles show better fuel economy in a city drive mode (unlike conventional cars that have better fuel economy in a highway mode), which makes the hybrid vehicles more suitable for predominantly city operation. The Christchurch central city shuttles (Yellow Buses) are hybrid vehicles.

Hybrid cars such as "Toyota Prius" and "Honda Insight" are commercially available overseas but not in New Zealand yet. Honda announced that commercial production of a hybrid "Honda Civic" model would begin in the near future. Discussions between Mr McNoe of City Care and officers of the Corporate Services Unit with the car importers lead to the belief that the only visible reasons for these cars not being sold here are (a) lack of expression of interest and commitment by New Zealand organisations and individuals and (b) that the demand in other countries exceeds current production levels. The importers indicate that "Toyota Prius" would be commercially available in New Zealand in 2004 and that they would be very responsive to genuine inquiries.

In December 2000, both vehicles were made available for trials by the Council staff and elected members. "Toyota Prius" has a fuel economy index of 4.5 l/100 km (the average actual fuel consumption was somewhat higher at 6 l/100 km during the Council trials); "Honda Insight" has 3.5 l/100 km specified (average actual was 4.8). "Toyota Prius" has a retail price of around A$40,000 in Australia.

A possibility of manufacturing hybrid cars locally was discussed with Designline Limited, an Ashburton-based firm experienced in manufacturing hybrid buses. Mr Turton, the company director, stated that, in principle, the firm is capable of producing such cars. However, the manufacturing of cars is quite different from that of buses and practically all components would need to be imported, which, combined with costs of research and development for an one-off low-quantity production, would result in substantially higher costs for the produced vehicles compared to what can be purchased from world car makers.

Hydrogen Fuel Cell Vehicles

An important reason why the leading car manufacturers develop hybrid electric cars now as a mass production item is that the electric hybrid vehicle concept will be used as a platform for transformation into mass production of fuel cell cars in the future. A prevailing notion is that fuel cells will eventually replace internal combustion engines while all other elements of the hybrid electric car will be suitable for fuel cell vehicles.

Fuel cell cars use either hydrogen or petrol as a fuel. The latter have a "fuel reformer" (an on-board petrochemical plant) which transforms petrol from the fuel tank into hydrogen, which then is used in the car fuel cell to produce electricity by a chemical reaction between the hydrogen and oxygen from the air. The generated electricity goes to an electric motor which produces motive power.

Fuel cell cars (even if hydrogen is derived from fossil fuels) can substantially reduce CO_2 emissions due to the fact that fuel cell efficiency is higher than that of an internal combustion engine, which translates into a better fuel economy index. In addition, fuel cell engines do not emit local air polluting substances such as sulphur dioxide, nitrogen oxides, carbon monoxide, volatile organic compounds and particulate matter.

While there are numerous demonstration models of fuel cell cars produced by virtually all leading car manufacturers in Europe, USA and Japan, these cars are not commercially available yet. DaimlerChrysler announced that fuel cell cars "will begin rolling off the assembly line in 2004".

Best Sustainable Vehicles - International Ranking

Practically all commercially available vehicles are being periodically assessed by world leading environmental agencies and the lists/ranking published. The Vehicle Certification Agency (UK) has the hybrid Honda Insight on the top of its 2001 list of the environmentally best vehicles that meet the strict requirements of the European clean air standard known as Euro IV.

The Environmental Protection Agency (USA) has both hybrid Honda Insight and Toyota Prius leading its 2002 list of 5-star category.

Purchasing Options

An option of purchasing commercially available hybrid cars such as Toyota Prius for the Council's car pool is not likely to be considered favourably as the car specification substantially exceeds the requirements (four seats rather than two required, as well as other features beyond the Council's needs). There would be practically no fuel cost savings compared with a small pool car such as Holden Barina but the overall additional costs of a hybrid car would substantially exceed those of the small petrol car, mainly due to a significant difference in the vehicle depreciation. The difference would be in the order of 55 cents per km (77 cents for Toyota Prius compared with 22 cents for Holden Barina), or around $8,233 per year per vehicle.

Possible Co-operation with Ministry of Energy and EECA

As the purchase of hybrid cars for the Council's fleet would be associated with additional costs, a possibility of entering into some partnership with Government is being investigated, in terms of creating a consortium for the purchase of larger quantities of such cars. Another option for reducing the additional costs of the sustainable technology could be lobbying the Government for tax relief for hybrid and fuel cell vehicles.

The Energy Efficiency and Conservation Authority (EECA) is developing national renewable energy policies, mechanisms and incentive programmes aiming at the removal of barriers to greater uptake of new technologies, including transport technologies. Consultations with EECA so far indicated that while financial incentives for the introduction of hybrid vehicles may become part of such programmes, they are not likely to be available in the 2002/03 financial year.

SUMMARY

After considering a number of alternative fuel and vehicle options, the most promising future options that would provide both greater sustainable and environmental benefits, are hybrid and fuel cell vehicles.

Availability of new generation hybrid and fuel cell vehicles is limited both in the range of vehicles currently available and their commercial availability in New Zealand. While they could be imported, there is no support and service infrastructure operating here yet.

There are no cost-effective options for purchasing sustainable vehicles for the Council's fleet that would satisfy the requirements of current Council's fiscal policies.

In the meantime staff are actively pursuing other opportunities for improving vehicle fuel efficiency, reducing CO_2 emissions and local pollution, within existing technologies and will continue to monitor development and availability of new technology vehicles.

Recommendation:

1. That the information be received.

2. That fuel efficiency, CO_2 emissions and local pollution effects be incorporated in consideration as significant criteria for plant purchasing/replacing.

3. That the Council write to the Minister of Energy raising the need for Central Government to take action to facilitate the production and supply of biomass transport fuels and the benefits of subsidies or tax relief for hybrid and fuel cell vehicles.

4. That sustainability issues relating to the Council's fleet be reviewed regularly and staff report annually on new opportunities becoming available to the Council resulting from technological progress by the motor industry and environmental improvements achieved.