



### **3.0 INTRODUCTION**

- 3.1 As highlighted in previous reports, emissions from the Councils current vehicle fleet are monitored using a specialist exhaust gas analyser to ensure that Ministry standards are achieved.
- 3.2 As the current vehicle fleet is all diesel vehicles the analyser measures particulates (PM10's), which are a major factor in air quality.
- 3.3 Regular monitoring of vehicle utilisation ratios and "mpg" rates also helps to ensure that emissions are minimised.
- 3.4 Since the time of the previous reports there have been some significant changes to engine technology, legislation and types of alternative fuels.
- 3.5 These changes are: -
  - Diesel engines are required to meet the more stringent emissions levels as required by Euro 3 regulations.
  - Wider availability of modified (ultra low sulphur) diesel.
  - The introduction of Hydrogen fuel cell technology.

### **4.0 ALTERNATIVE FUELS**

- 4.1 As well as vehicles powered by the conventional fuels of petrol and diesel, there are currently production vehicles powered by: -
  - Dual fuel, petrol/liquid petroleum gas (LPG).
  - Gas, liquid natural gas (LNG), compressed natural gas (CNG).
  - Electric
  - Bio Diesel
  - Hydrogen Fuel Cell
  - Conventional Diesel Engine fitted with a Continuously Regenerating Trap (CRT).
- 4.2 Dual fuelled vehicles are becoming more widely available from the major vehicle manufactures. They are conventional petrol engine vehicles that have been modified to run on LPG. Generally the LPG tank is fitted in the spare wheel aperture and a smaller fuel tank replaces the conventional petrol tank. This type of application is available for car and light commercial application, with refuelling available at a limited number of major forecourt sites or depot based bunkered units.

- 4.3 LNG and CNG powered vehicles are designed for use with heavy commercial vehicles with an engine power output in excess of 300h.p. Below this size the engine range is very limited at present. Refuelling is only available at depot based bunkered sites of gas distribution terminals. Most refuse vehicles have engine rated between 230 and 280h.p.
- 4.4 Electric powered vehicles are being marketed by the major vehicle manufacturers in the car and light van areas. These have an electric motor in the place of an engine with a large battery pack to power it. They can be recharged using a 13 amp power supply and generally have a range of 50 to 110 miles on a full charge.
- 4.5 Vehicles that run on Bio diesel are powered by diesel that is refined from oil seed rape. It is a sustainable fuel source that produces a foul smell during combustion. It is available in certain areas at the forecourt and by arrangement at depot based bunkered sites.
- 4.6 The Hydrogen fuel cell is the newest alternative fuel to be marketed. At present it is limited in its use, being tested on light commercial applications. Hydrogen is mixed with oxygen in a fuel cell (essentially a stack of metal plates which act as a catalyst to trigger a reaction so the hydrogen combines with the oxygen) to produce the power source (electricity) for the driveline. It is considered to be the fuel of the future, projected to be in common use in about 10 years. The emission at the tailpipe is water.
- 4.7 The Continuously Regenerating Trap (CRT) is an advance in technology, which addresses the problem of diesel exhaust emissions, virtually eliminating Carbon Monoxide, Hydrocarbons and particulate Matter. Using a specifically formulated high active oxidation catalyst and a ceramic wall-flow filter operating at high temperature it converts Carbon Monoxide and Hydrocarbons to Carbon Dioxide and Water respectively and burns the Particulate Matter using chemical reactions.

## **5.0 AVAILABILITY**

- 5.1 There is a wide availability of vehicles powered by the conventional fuels of petrol and diesel along with a refuelling infrastructure to match. Vehicles powered by diesel are ideally suited to meet the requirement of the full range of the Council's services.

- 5.2 There are a number of vehicle manufacturers producing vehicles designed to run predominantly on LPG. These are aimed at the small van (Astra) and light commercial (LDV) sectors. There are limited refuelling facilities in the area at certain Shell Service Stations and vehicles powered by this fuel source would only suit part of the fleet. There is a possibility of an on-site fuel facility from fuel suppliers.
- 5.3 LNG and CNG powered engines are designed for use with heavy commercial vehicles (lorries and refuse vehicles). At present production of engines in the desired size range and refuelling is non-existent, unless expensive on-site fuel facilities are installed. Vehicles powered by this type of fuel source would only suit part of the fleet.
- 5.4 Electric powered cars and light vans are being produced mainly by Peugeot at present. They have a limited range, but can be recharged virtually anywhere. Vehicles powered by electric would be suited to part of the fleet provided they have access to recharging facilities during the working day.
- 5.5 Vehicles powered by Bio diesel are the same as those powered by conventional diesel. At present the supply of Bio diesel is limited to East Anglia and the M25 corridor. This type of fuel source would suit all of the fleet.
- 5.6 Vehicles powered by a Hydrogen fuel cell are still at the prototype stage with some light commercial vehicles under going extended trials with Westminster City Council. Future development may enable this type of fuel to suit all of the fleet.
- 5.7 CRTs are available for vehicles fitted with a turbocharged diesel engine over 130bhp in size. These can be fitted at time of vehicle purchase or as a retrofit to existing engines. The predominant use of ultra low sulphur diesel (ulsd) at fuel stations and by fuel suppliers means that the likelihood of a CRT being destroyed by the use of high sulphur diesel is now negligible.

## **6.0 ENVIRONMENTAL IMPLICATIONS**

- 6.1 The Authority has made a commitment to reducing the amount of Carbon Dioxide (CO<sub>2</sub>) and other greenhouse effect gasses it produces. The Government also wants to improve air quality affected by PM<sub>10</sub>'s and Nitrous Oxide (Nox). The areas worst affected are mainly inner city areas and metropolitan boroughs.

6.2 Recent legislation and improvements in engine technology mean that current production petrol and diesel engines are the most environmentally friendly ones ever produced.

6.3 Euro 3 emissions standards were implemented in October 2001. All production vehicle engines now being produced meet the new limits set.

Type	HC(g/km)	Nox (g/km)	HC+Nox (g/km)	CO(g/km)	PM10(g/km)
Petrol	0.2	0.15	N/A	2.3	N/A
Diesel	N/A	0.5	0.56	0.64	0.16

6.4 The more stringent standards of Euro 4 legislation are due to be introduced in October 2005.

Type	HC(g/km)	Nox (g/km)	HC+Nox (g/km)	CO(g/km)	PM10(g/km)
Petrol	0.1	0.08	N/A	1	N/A
Diesel	N/A	0.25	0.3	0.5	0.02

6.5 There are as yet no standard emission levels for alternative fuelled vehicles, as a comparison figures for gas engine vehicles have been inserted into the Euro 3 table.

Type	HC(g/km)	Nox (g/km)	HC+Nox (g/km)	CO(g/km)	PM10(g/km)
Petrol	0.2	0.15	N/A	2.3	N/A
Diesel	N/A	0.5	0.56	0.64	0.05
LPG	0.5	0.7	1.2	0.7	0.05
CNG	2.2	2.5	4.5	0.3	0.05
LNG	2.0	1.16	3.15	0.11	0.01

6.6 CO<sub>2</sub> is not measured on any of the test cycles but is recognised as being a major emissions source from gas powered engine, and is typically greater than in a diesel engine with no exhaust after treatment. A comparison of CO<sub>2</sub> emissions for an Astra van and an LDV Convoy van with no exhaust after treatment is shown below: -

Astra Van	Petrol Engine	Diesel Engine	LPG Engine
CO <sub>2</sub> (g/km)	171	132	151

LDV Convoy Van	Petrol Engine	Diesel Engine	LPG Engine
CO <sub>2</sub> (g/km)	283	226	256

- 6.7 A vehicle with Euro 2 specification engine fitted with a CRT will produce emissions to a level better than Euro 4 requirements thus qualifying the vehicle for a reduced pollution certificate and a reduction in the vehicle excise duty.

	CO (g/kWh)	HC (g/kWh)	Nox (g/kWh)	PM 10 (g/kWh)
Euro 11	4.0	1.10	7.0	0.15
Euro 1V	1.5	0.46	3.5	0.02
CRT	0.28	0.06	6.3	0.01

## 7.0 CRIME AND DISORDER IMPLICATIONS

- 7.1 There are no crime and disorder implications arising from this report.

## 8.0 CONSULTATION

- 8.1 This report has been considered by the LA21 Lead Officer Group, which supports the recommendations.
- 8.2 The views and consideration of the Environment Review Panel and Corporate and Finance Review Panel are sought prior to Recommendations to Cabinet.

## 9.0 FINANCIAL IMPLICATIONS

- 9.1 The cost of running a fleet of vehicles is dependant on a number of factors, the capital purchase cost and the fuel cost are major components in the annual running cost per mile of the varying type of vehicle.
- 9.2 The capital cost of purchasing an alternative fuelled vehicle is about 10% greater than a conventional fuelled vehicle. The following tables show average annual running costs for an Astra and an LDV van using NFCS and vehicle manufacturer data covering 15,000 miles annually (the average mileage for a vehicle in the fleet).

Vehicle and Fuel Type	Fixed Cost	Fuel Cost	Running Cost	Mileage	Pence per mile
Astra Diesel	3172	1077	4249	15000	28.33
Astra LPG	3328	1336	4664	15000	31.09
Vehicle and Fuel Type	Fixed Cost	Fuel Cost	Running Cost	Mileage	Pence per mile
LDV Diesel	5304	2245	7549	15000	50.33
LDV LPG	5616	2090	7706	15000	51.37

- 9.3 The fixed cost for the LPG engine vans allows for the full additional cost of the LPG conversion. Under the "Powershift " programme there used to be grants available to cover part of the cost of the conversion. A shift in the criteria for the grant award as a result of recent legislation means that it is unlikely that the New Forest will be considered an area that qualifies, not being an inner city or a Metropolitan Borough. No allowance has been made for a lower or higher residual value on the LPG vehicles.
- 9.4 The fuel cost for the LPG vehicles includes a sum for the petrol use on initial start up, as all LPG vehicle need to start on petrol and then switch automatically to LPG at a set engine temperature. No allowance has been made for drivers switching to petrol manually to increase the vehicle performance.
- 9.5 As can be seen from the tables at an average annual mileage of 15,000 the pence per mile cost is less when using a conventional vehicle. The average mileage would need to be in excess of 30,000 to reverse the trend.
- 9.6 The cost of fitting a CRT is £3,700 per vehicle, which equates to an additional £590 per annum on a seven year lease. This is off-set by a £500 reduction in the annual excise duty. For refuse collection vehicles this will allow the fitting of CRTs on a virtually cost neutral basis (£90/annum/vehicle) assuming the CRT does not need replacing during the vehicle's working life.
- 9.7 Recent discussions with the Energy Savings Trust have also identified a grant scheme (Clean-up), which potentially could finance 75% of the purchase and fitting costs of the CRT.
- 9.8 On the face of it, the combination of a 75% Clean-up grant and the 55% reduction in excise duty could produce a net annual saving of approximately £350 per large goods vehicle.
- 9.9 The potential to retro-fit CRTs to all suitable vehicles, with a remaining operating life of four years or more, may well justify an "invest to save" strategy in both financial and environmental terms.
- 9.10 This strategy will require further discussions with the Energy Savings Trust as the assistance is grant based and retrospective. This will be put in hand, but at this stage the fitment of CRTs to the two refuse collection vehicles programmed for 2002/3 financial year is considered worthwhile.

## **10.0 OVERVIEW**

- 10.1 Of the alternative fuels and vehicles available at the present time, LPG is the only one that is widely established and is fully tried and tested.
- 10.2 Some of the main users of LPG in the public sector are Police authorities, savings are being made because of the higher annual mileages and the previous predominant use of petrol engine vehicles.
- 10.3 Development in diesel engine technology means that modern engines are as environmentally friendly as gas engine vehicles and emit less CO<sub>2</sub>.
- 10.4 At present the use of battery powered electric vehicles is limited due to the restrictions of the range the vehicle can travel between charges.
- 10.5 The use of vehicles fitted with CRTs will improve vehicle emission levels and can be achieved on a virtually cost neutral basis..

## **11.0 CONCLUSION**

- 11.1 Diesel engines are currently the most fuel-efficient and have a lower capital cost, there would be financial implications of choosing an alternative fuel for part of the fleet.
- 11.2 Most alternative fuel sources are still in their infancy. Progress will be made with electric vehicles and fuel cells in the next five to ten years.
- 11.3 Jean-Martin Fools vice-president of Peugeot – Citroen has gone on record as saying that current standard of petrol and diesel emission control make LPGs inherently good emissions less significant than before, and that cost and size of fuel cell vehicles need to be reduced by a factor of five before they can become commercially viable by 2010.
- 11.4 A number of authorities and commercial organisations are operating alternative fuelled vehicles, only those with high annual mileages of special operating restrictions find them commercially viable.
- 11.5 In the final analysis, as diesel and alternative fuelled engine are developed, a pattern and direction will emerge as to which option is:
  - Most environmentally friendly.
  - Most fuel-efficient.
  - Most cost effective.
- 11.6 As the authority is committed to reducing CO<sub>2</sub> emissions, the use of diesel engines is best suited at present.



## 12.0 RECOMMENDATIONS TO REVIEW PANEL

- 12.1 That members consider the options set out in this report.
- 12.2 That members support the proposed course of action to fit Continuous Regenerating Traps (CRTs) to replacement refuse collection vehicles within the agreed capital programme.

## 13.0 RECOMMENDATIONS TO CABINET

- 13.1 That members note this report.
- 13.2 That the principle of fitting the Continuously Regenerating Traps (CRTs) to replacement refuse collection vehicles within the agreed capital programme, commencing with two vehicles in the 2002/3 programme, be agreed. It should be noted that this commits the Council to future lease costs that can be offset in the main by a reduction in annual excise duty and the balance of £90 per vehicle can be funded within existing budgets.
- 13.3 That opportunities to utilise Energy Savings Trust grant schemes should be pursued by officers.

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### Background Papers:

Previous Reports  
Central Services Committee 02.12.97  
" " " 16.06.98

Vauxhall Motors  
Peugeot – Citroen  
Power Shift  
Energy Saving Trust  
LPG Car  
LPG Auto  
Eastleigh Borough Council  
Fleet News  
LDV Vans