INFORMATION GUIDE NO. 4

ALTERNATIVE FUELS

1 INTRODUCTION

EcoStation is a joint initiative of the Victorian Environment Protection Authority (EPA) and the Victorian Transport Association (VTA) designed to reduce greenhouse emissions and air pollution from the road freight sector.

A key aim of EcoStation is to promote a sharing of information about the practical actions that can be taken by industry stakeholders to improve the fuel efficiency of road freight operation and to reduce the emissions associated with these vehicles.

With this aim in mind, EcoStation is producing information sheets that will provide commercial vehicle operators with guidance on a number of potential improvement actions with a view to encouraging increased adoption of these programs by industry. This information guide discusses the potential benefits of alternative fuels.

2 DESCRIPTION

Alternative fuels are those that present a potential substitute for diesel or petrol in the road freight sector. Rising oil prices and the potential for a carbon cost to impact on conventional fuels have made alternative fuels an increasingly attractive proposition.

The dominant fuels in the arena are considered to be those sourced from natural gas (LNG and CNG) and LPG, and these require some form of engine and fuel system modification.

Biodiesel and ethanol blends are also often considered as a partial substitute for diesel, and although they do not demand significant modifications (if any), their economic and environmental benefits have been questioned in recent times. Hydrogen and hydrogen fuel cells are not likely to be available before 2020 due to prohibitively high costs.

3 IMPROVEMENT RATIONALE

Alternative fuels offer the potential for decreased greenhouse and particulate emissions due to their lower carbon intensity and cleaner burning characteristics when compared to diesel and petrol.

4 POTENTIAL BENEFITS

The economic and environmental benefits of alternative fuels vary significantly between and among fuels. Although the fuels offer reduced tailpipe emissions on an energy equivalence basis, a greater quantum of energy may be required per kilometre travelled depending on the efficiency of the combustion process.

As a result, engine technology, vehicle application and duty cycle all play a significant role in the benefits associated with alternative fuels when compared to diesel.

4.1 COMPRESSED NATURAL GAS & LIQUEFIED NATURAL GAS

Case studies reflect a significant variance in potential benefits, with fuel consumption changes between a 25% reduction to a 25% improvement. Greenhouse gas benefits are often quoted as ranging from a slight negative to a 25% benefit.

Later compression ignition engine technologies combined with natural gas–derived fuels have delivered more consistent greenhouse gas and particulate emission reductions in the order of 25% when compared to conventional diesel.

4.2 LIQUEFIED PETROLEUM GAS

For 100% substitution, these systems can only deliver greenhouse benefits in the order of 5–10% for wholesale substitution of diesel, and uncertain fuel savings.

LPG induction technology has been demonstrated to deliver a significant diesel fuel saving of up to 28%, with improvements in the diesel combustion process and reductions in the level of unburnt diesel. There is subsequently a related reduction in particulate emissions.

4.3 BIOFUELS

Biodiesel and ethanol blended fuels offer a potential for reduced greenhouse and particulate emissions. Owing to the lower energy content of these fuels, a fuel saving is not generally realised; however, case studies have shown greenhouse gas and particulate emissions to be reduced by 15–20% with the use of B20 biodiesel (a blend of 20% biodiesel with diesel).

One of the principal challenges of this fuel has been the variation in fuel composition and the consequent impact on vehicle performance.

The actual benefits of alternative fuels are subject to a significant level of uncertainty, and fleet suitability is an important consideration.

5 ASSESSING FLEET SUITABILITY

Alternative fuels vary in their optimal application, and assessing fleet suitability is a key component of achieving effective results.

5.1 COMPRESSED NATURAL GAS & LIQUEFIED NATURAL GAS

Owing to fuel storage issues, CNG is most optimal for short-haul freight, while LNG is suited to long-haul applications. Both alternative fuels achieve the greatest benefit when used in vehicles with modern compression ignition (HPDI) engine technology, rather than spark-ignited.

5.2 LIQUEFIED PETROLEUM GAS

There is some doubt surrounding the potential for LPG to be a viable alternative fuel for heavy duty applications as a 100% substitute. However, in a dual fuel scenario, lower fuel consumption and emissions have been experienced in heavy vehicles.

5.3 BIOFUELS

Biodiesel has an inherent advantage in that it can be blended with conventional fuels (albeit at low volume blends) and used in conventional internal combustion vehicles without requiring modification to the vehicle.

However, most original engine manufacturers suggest that B5 biodiesel can be used in place of petroleum diesel, although it may depend on the vehicle model. Blends greater than this may require engine modifications.

6 IMPLEMENTATION CONSIDERATIONS

The primary consideration when implementing alternative fuels is typically of an investment nature, surrounding capital cost and payback period. To varying degrees, investment will be required in new engine technologies, fuel storage and establishing refuelling infrastructure.

Switching vehicles to natural gas fuels involves the greatest investment in engine and fuel storage technology, and generally requires high annual kilometres in order for an acceptable payback period to be realised. In addition, there is a considerable difference between the outcomes of spark-ignited and compression ignition engine technologies.

While LPG remains an immediate option for use in light commercial vehicles, there are currently limitations in the availability of proven dedicated LPG-powered engine technologies. Retrofit conversion kits have been

shown to produce unreliable outcomes, including increased fuel consumption and greenhouse emissions, and should be considered with caution.

Add-on LPG technologies that supplement the diesel combustion process may deliver an overall fuel saving in freight vehicles, but this is a relatively new technology.

Some trials have indicated that B20 performed as per diesel, maintaining distance and power performance, making a cost-effective alternative. However, a genuine fuel saving may not be experienced, with the lower energy content of the biodiesel meaning that although emissions and cost per litre are lower, fuel consumption may be greater.

All of the above should be considered alongside the likely increases in conventional fuel costs and the benefits of early adoption.

7 RESOURCE INFORMATION

Additional information on alternative fuels can be obtained from the following sources.

7.1 GOSFORD CITY COUNCIL (CNG)

Gosford Council's investment in CNG trucks resulted in an 18% greenhouse reduction, a 22% fuel saving (versus diesel), excellent operational performance and low commissioning effort.

The increase in oil price has resulted in an even greater fuel saving for the natural gas vehicles. As at June 2008 the Council experienced a 67% cost saving versus diesel, as discussed at:

http://www.truckworld.com.au/absolutenm/templates/isuzu.aspx?articleid=233&zoneid=12

7.2 UPS (CNG)

Trialling CNG using spark-ignited engine technology, UPS experienced a 28% lower fuel economy in diesel equivalence. However, with more efficient modern engine technology, the lower cost and emissions from natural gas have made it an attractive proposition, with UPS adding several hundred more CNG delivery trucks to its fleet in 2008. Newer technology has been estimated as having a fuel economy penalty of 10–15% in the UPS trucks. Further details are available at:

http://www.nrel.gov/vehiclesandfuels/fleettest/pdfs/31227.pdf

7.3 SITA ENVIRONMENTAL SOLUTIONS (LNG)

With the implementation of LNG, the refuse collection company experienced a 15% greenhouse saving (life cycle), a 40% fuel saving (versus diesel), good operational performance and low commissioning effort. There were marginally positive financial returns due to the high conversion costs involved. More information about this initiative can be found at:

http://www.vta.com.au/Portals/21/Alternative%20Fuels/Presentations/F%2007%20Alt%20Fuels%20McKenzie.ppt

7.4 MURRAY GOULBURN (LNG)

Implementing LNG in articulated trucks, the fleet experienced negative greenhouse outcomes for C12 400 horsepower engines and 8% saving for C15 520 horsepower engines. Good financial returns were realised, with up to 60% fuel savings versus diesel and high annual kilometres travelled at over 220,000 kilometres per year. More information can be obtained by visiting:

http://www.vta.com.au/Portals/21/Alternative%20Fuels/Presentations/F%2007%20Alt%20Fuels%20McKenzie.ppt

7.5 A & T CLARK AND DAUGHTERS PTY LTD (LPG)

This trucking company introduced LPG dual phase induction technology to a single truck in 2006, and to second and third trucks since achieving positive results.

Fuel economy has gone from 1.5 kilometres per litre, to approximately 1.7 to 1.75 kilometres per litre. Averaging 28,000 kilometres per month, the monthly cost savings per truck have been between $1500 and $2000,

depending on where LPG is purchased. Further information about this initiative can be found at:

http://gastoday.com.au/news/lpg_delivers_big_savings_for_diesel_trucks/004552/

7.6 UDT LOGISTICS (BIODIESEL)

Victorian milk transporter, UDT Logistics, reduced annual greenhouse gas emissions by 14%, or 874 tonnes, with B20 biodiesel from 80% used cooking oil and 20% animal tallow (fats) and canola oil. Further information on this case study can be found at:

http://www.tandlnews.com.au/2009/04/28/article/Cut-emissions-with-biodiesel/KZQWMCQVVY.html

7.7 HUDSON BAY TRUCKING (BIODIESEL)

In 2005, the Hudson's Bay Company began a project to test the use of B20 in twelve dedicated freight trucks. Carbon dioxide and particulate emission reductions were significant (in the order of 20%) but the study noted that although there were differences in the fuel efficiency, the differences were not statistically significant. For more information see:

http://www.tc.gc.ca/eng/programs/environment-ecofreight-road-tools-casestudies-hudsonsbay-108.htm

7.8 USPS (ETHANOL)

The United States Postal Service purchased over 30,000 E85 flexible fuel vehicles for its delivery fleet. The trial resulted in a 29% decrease in fuel efficiency, and significant problems associated with a lack of ethanol refuelling infrastructure. The company concluded that ethanol price must be at least 30% less than gasoline to be cost effective. For further information, see:

http://www.govenergy.com/2007/pdfs/strategy/Rios_Strategy_track_S8.pdf

8 FURTHER INFORMATION

Further information about EcoStation, including program participation, can be obtained by contacting the EcoStation Project Manager on:

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