VEHICLE INSPECTION/MAINTENANCE PROGRAMS AND OTHER ALTERNATIVES TO DECREASE GREENHOUSE GAS EMISSIONS FROM ROAD TRANSPORTATION IN ALBERTA:

A review by Climate Change Central

Summary

In 2002, Climate Change Central completed a study examining methods for potential greenhouse gas (GHG) reduction for Alberta's road transportation. The study focused on vehicle inspection and maintenance programs, but also examined four other alternatives; these alternatives were vehicle scrappage, compressed natural gas, a 10 per cent ethanol blended gasoline and a decreased speed limit for trucks (90kph).

The study found that an Inspection/Maintenance (I/M) program would not be a cost-effective strategy for reducing Alberta's greenhouse gas emissions. The other four possibilities were seen as viable options with pilot projects for vehicle scrappage and compressed natural gas already under way, and with a decreased speed limit for trucks and ethanol blended gasoline seen as "promising measures" by a national study. These four alternatives all require further study before being applied provincially.

Vehicle Inspection/Maintenance

Introduction

The combustion of fossil fuels in vehicles results in the emissions of hydrocarbons, nitrogen oxides (NOx), volatile organic compounds (VOCs), and carbon monoxide (CO). These emissions contribute to both decreased ambient air quality (phytochemical smog) and climate change. Despite emissions standards for new vehicles becoming more stringent over the last two decades, urban air quality has not improved. This discrepancy probably occurs because after one or two years of use, vehicles no longer meet the original standards. This decline can arise for several reasons:

- failure to adhere to the manufacturer's maintenance schedule
- improper adjustment of fuel mixture/spark timing/other emission critical engine parameters
- premature failure of emission control devices
- deliberate removal or disabling of emission control devices

An Inspection/Maintenance (I/M) program can help avoid these problems. At the time of this report, there were more than 35 I/M programs in the United States and two I/M programs in Canada (in Ontario and British Columbia).

Program Description

There are two types of tests used by existing I/M programs. The first is a stationary or idle test that either records emission levels at idle or at both idle and 2500 rpm (rotations per minute). The second type of test uses a dynamometer (similar to a treadmill) and tests vehicles under load conditions. The second test requires more time and equipment, but is more accurate.

The Federal standards for new vehicles are based on the emission levels per unit of the distance travelled. These standards not only account for the age of the vehicle, but also potential

variability in the testing procedures. Thus, a vehicle must have emission levels significantly higher than the allowable limit in order to fail the test.

The delivery of the program would have three levels of involvement: administration, vehicle testing and vehicle repair. Administration of the program is usually affiliated with a government. Responsibilities of the administrator would include notifying owners of required testing and of certified repair facilities, technician training, collection/analysis of the data, and inspection/auditing of facilities.

Alberta's test fees are estimated to be $30 per vehicle and would be paid by the vehicle owner. One-third of the fee would go to the test facility and two-thirds would go to the administrator. There are three possible models for vehicle testing. The first is an open-market model where independent parties become certified for emissions testing. This is the model used in Ontario. . The second option is a contractor-operated model where the administrative body contracts a firm to do the testing. This is the model used in BC. The last option is an in-house model where the administrative body operates the test centers. This is the model used in Oregon.

Administrators for I/M programs are not usually directly involved in the vehicle repair portion of the program delivery, but rather certify other facilities to complete the repairs.

Reporting of the results would be done online and then downloaded to a central database. No data management or analysis would be required at the test stations. This is beneficial because less training is required for the technicians and it is also more difficult to tamper with the reporting system.

Benefits

The two main benefits of having an Albertan I/M program would be job creation and improved air quality.

The number of jobs created was estimated using data from BC's program as a model and calculated based on the number of vehicles in Alberta more than two years of age. If the program was run province-wide, 111 to 222 jobs would be created if the test was done biannually and annually respectively. If the test was only done in urban centres[1], 71 to 142 jobs would be created if the test was done biannually and annually respectively.

I/M programs are focused on smog causing pollutants and would improve Alberta's ambient air quality.

Difficulties

The main problem with an Albertan I/M program is that it would not be cost-effective in terms of GHG mitigation. The cost for an I/M program is estimated to be $8399.14 per tonne of CO_2e (carbon dioxide equivalent) reduced. A program to reduce greenhouse gases should focus on fuel consumption, and although the tune-ups during an I/M program have some improved fuel efficiency (an average of 1.1 per cent) the focus is on smog causing pollutants. It becomes

[1] Airdrie, Calgary, Cochrane, Edmonton, Fort McMurray, Grande Prairie, Lethbridge, Medicine Hat, Red Deer, Sherwood Park and St. Albert

inefficient to test a large number of vehicles to catch a small number of polluters (only about 13 per cent of vehicles tested will require maintenance). Another difficulty is that the program is likely to be opposed by drivers due to the added cost and inconvenience. The study found that in general there is a lack of concern over air quality in Alberta, which would translate to a lack of support for an I/M program.

Vehicle Scrappage

Program Description
Vehicle scrappage programs encourage owners to turn in old and non-fuel efficient vehicles and in return receive incentives such as rebates for newer vehicles, transit passes or tax breaks.

A pilot vehicle scrappage program was conducted in Calgary with the goal of removing 60 pre-1988 vehicles from the road[2]. The maximum number of incentives provided for this project was 350 transit passes and 250 x $500 rebates. The estimated final cost of this project (including in-kind donations) was $500,000, or $800-900 per vehicle retired. It is difficult to measure the improvement in fuel consumption resulting from this program as not all rebates had been redeemed at the time of this study (the type of vehicle purchased would influence the overall fuel efficiency of the program). A likely scenario for Calgary would be that 350 transit passes were used and 250 rebates were used towards vehicles between six and nine years old (with an average fuel use of 11.3 l/100 km). This would result in a 2211 tonne CO_2e (carbon dioxide equivalent) reduction, at a cost of approximately $226 per tonne (this cost is for one year only and would be cheaper over the longer term life of the replacement vehicle).

Benefits
The vehicle scrappage program is cost-effective, assuming that vehicle life is reduced by two or more years. The pilot project was well received by the public in Calgary and received positive media attention. Removing older vehicles from the road would also improve ambient air quality.

Difficulties
There are a few issues that require examination before the program is implemented. For example, the largest cost of the program is the transit passes and without a donation from the transit authority the cost of the program would increase significantly. Also, there is no transit in rural areas so an alternative incentive would be helpful. Another difficulty is that the rebate may be used to purchase a non-fuel efficient vehicle, which would decrease the overall fuel efficiency of the program. To discourage these purchases, either a larger rebate could be provided for fuel efficient vehicles, or no rebate could be provided for non-fuel efficient vehicles.

[2] For more information on a current (2006) vehicle scrappage program in Alberta, please see www.carheaven.ca

Alternative Fuels: Compressed Natural Gas

Two of the most practical alternative fuels at the time of this study were compressed natural gas (CNG) and propane. Compressed Natural Gas is preferred due to its cleaner emissions, however it is considered to be inefficient in heavy duty trucks. In light duty vehicles the use of CNG results in a 26 per cent reduction in GHG emissions, and a 10 per cent decrease when used in buses.

A pilot project was conducted in the town of Banff to convert tour and transit buses to CNG buses. At the time of this study, 60 vehicles had been converted resulting in a potential 1000 tonne decrease in greenhouse gas equivalent per year; this translates to a cost of $50 per tonne. One of the most important factors that made this project possible was the instalment of a refuelling station in Banff. One of the major reasons why CNG vehicles cannot be used province-wide is the lack of refuelling stations across the province. At the time of the study, only 13 stations existed in Alberta. A first step would be to expand the pilot project to include the Banff-Jasper-Edmonton corridor and allow more tour operators in the National Parks to be incorporated into the program.

Alternative Fuels: Ethanol

Ethanol is usually derived from wheat or corn and can be blended with fuel to decrease GHG emissions; ethanol also helps in the complete combustion of the fuel. A 10 per cent blend of ethanol would result in a 3.5 - 4.6 per cent decrease in GHG emissions (or approximately 434,000 to 571,000 tonnes per year). This translates to a cost of $52 - $93 per tonne of CO_2e (carbon dioxide equivalent) reduced, depending on the source used to make the ethanol. A study completed by the Alberta Government found that a 10 per cent blend would cause a net economic increase of $104 to $132 million per year, due to the increase in employment and growth in the feed lot industry.

There is still some controversy over ethanol blended fuel. One of the reasons is that the input to output energy ratio for ethanol is higher than that of gasoline. This high energy requirement means that there is an increase in the GHG emissions during the production of ethanol. A possible way to make the process more efficient would be to use grass or straw as a source, which would more than double the GHG reductions from wheat or corn. Another reason why ethanol is not widely accepted is that oil refiners do not view the blending of ethanol as economical. Because ethanol is more costly than gasoline on a volume basis a mandate or financial concessions will likely be required to encourage refiners to use ethanol. The exception in Alberta is Husky Oil, who already blend ethanol in its fuels. At the time of this report, Alberta had a low production of ethanol since API Grain Processors (now Permolex) in Red Deer was the only producer and had an annual production capacity of 22 million litres. Assuming that no ethanol would be purchased from other jurisdictions, if a 10 per cent blend were used in Alberta it would require 400 million litres per year. At the time of this report, most of the ethanol produced in Alberta was exported to the United States.

Decreased Heavy-Duty On-Road Truck Speed Limit to 90 kph

In 2000, the trucking industry only accounted for 7.8 per cent of the vehicle kilometres in Canada while using 22.9 per cent of the vehicle fuel consumed. Fuel efficiency averaged at 43.14 l/100 km for tractor-trailers and at 34.79 l/100 km for straight trucks. A decrease in speed can help increase fuel efficiency. There is seven per cent less fuel used when trucks drive at 90 kilometres per hour (kph) than when they are driving between 90 and 110 kph; a further eight per cent is saved when compared to trucks driving between 110 and 130 kph. Reducing the speed limit for trucks to 90 kph would result in fuel savings of 3.8 l/100 km, which translates to decreased CO_2e (carbon dioxide equivalent) emissions of 279,000 tonnes per year, and approximately $58.6 million in saved fuel costs for operators. The increased cost of labour is expected to be greater than the fuel savings, thus the cost for this program becomes $47 per tonne CO_2e reduced.

There are three issues that could prevent this policy from being applied in Alberta.
1. There may be a safety concern with the dual speed limit (meaning that trucks are travelling at 90kph while other vehicles on the road are travelling at 100-110 kph). Although other jurisdictions in both Europe and the United States use this system, there is little documentation about risks of collisions.
2. There is an economic concern resulting from the slower movement of goods and the increased labour costs. There may also be a concern that companies in other jurisdictions would have a competitive advantage over those in Alberta.
3. Is the issue of enforcement of the dual speed limit. There is technology available in all trucks built after 1995 that allows the speed to be controlled automatically by the engine, which would reduce the need for roadside enforcement.

Conclusion

This study found that a Vehicle Inspection/Maintenance (I/M) program would not be a cost-effective way to decrease GHG emissions from Alberta's road transportation. These programs are designed to improve ambient air quality, by decreasing ground level ozone and smog. A program aimed at decreasing GHG emissions from the transportation sector should focus on vehicle fuel efficiency.

Several alternatives to decrease GHG emissions by addressing fuel efficiency were also examined in this study. These alternatives were all found to be more cost-effective than an I/M program, with estimated costs ranging from $50 to $226 per tonne of CO_2e (carbon dioxide equivalent) decreased compared to the $8,399.14 per tonne CO_2e decreased for the I/M program. Successful pilot projects for the vehicle scrappage and compressed natural gas programs have been completed in Calgary and Banff respectively. The decreased speed limits for trucks and ethanol blended fuel programs were both considered to have good potential as GHG emission reduction programs both provincially and nationally. All four alternatives require further study before they can be applied on a province wide basis.

For the full report from Climate Change Central please see:
http://www.climatechangecentral.com/resources/discussion_papers/GHG_Reduction_Road_Trans.pdf