

POLLUTION FROM MOTOR VEHICLES

Urgency of development of environment-friendly, cleaner system for road transport:

A. Introduction: Pollution from motor vehicle is the single largest source of air pollution emissions. Motor vehicle exhaust is a complex mixture, composition of which depends on fuel used, and type and operating condition of the engine – whether it uses any pollution control devices.

At present, motor fuels consists of Petrol, Diesel, LPG (mostly Butane) and CNG. In recent times, people have been very much successful in reducing motor vehicle pollutants; but due to enormous growth in population of vehicles on urban roads, the effectiveness of the new technology in reducing pollution is not very much relevant and practicable. Over the year, engine efficiency has also gradually improved with progress in Electronic ignition, Fuel injection systems and Electronic control unit; and so, the emission standards.

motorvehicles_exhaust_pollution

The major constituents of motor vehicle pollutants are 74% Carbon monoxide (CO), 16% hydrocarbon (HC), 8.5% nitrogen oxides (NO_x), 0.8% particulate matter and 0.6% sulfur oxide (SO_x).

* Carbon monoxide (CO): a product of incomplete combustion. Carbon monoxide reduces the human blood's ability to carry oxygen and is dangerous to people with heart diseases.

* Carbon dioxide (CO₂): It is well known that, carbon dioxide has very prominent role in global warming as a greenhouse gas.

* Hydrocarbons (HC): This is generated due to unburned or partially burned fuel and is a major contributor to urban toxic smog. They may cause lunge, liver damage and cancer to human being.

* Nitrogen oxides (NO_x): These are generated when nitrogen in the air reacts with oxygen under the high temperature and pressure conditions inside the engine. NO_x emissions contribute to both smog and acid rain.

* Sulfur oxides (SO_x): Produced by combustion of petrol or diesel.

* Evaporative emissions: These are produced from the evaporation of fuel, and are largely contributor to urban smog, as these heavier molecules stay closer to ground level.

Thus, Motor vehicles contribute significantly to greenhouse gases but nevertheless the rise and rise of petrol, diesel and kerosene vehicles continues at an alarming rate. Experts say, if all vehicles were tuned correctly there would be up to:

(a) 16 per cent less tailpipe hydrocarbon emissions;

(b) 26 per cent less tailpipe carbon monoxide emissions;

(c) 9 per cent less nitrogen oxides emissions.

The expert study also revealed that, on an average, maintenance to polluting vehicles does not require the replacement of major or expensive parts. Tuning is mainly limited to the following: (a) replacing points and air filter; (b) replacing fuel filter (if necessary); (c) replacing oil and oil filter; (d) checking spark plug condition and gap—adjusting or replacing as necessary; (e) checking distributor condition and operation and adjusting as necessary; (f) checking and adjusting idle mix and speed; (g) checking and replacing spark plug and distributor leads as necessary; (h) checking and replacing hoses and other minor items in fuel/electrical/emission control system as necessary; (i) examining vehicle diagnostics and replacing faulty components.

Additional technologically advanced incorporated emission control systems may be used, such as: (i) Emissions control systems for engines using diesel, ultra-low sulfur diesel, bio-diesel, natural gas, or propane fuels; (ii) Selective Catalytic Reduction (SCR) technology to reduce NO_x with the SCR Catalyst –

mostly for stationary IC engines; (iii) Catalyzed diesel particulate filters to reduce Particulate Matters, CO and HC from diesel engines; (iv) Oxidation catalysts to reduce CO and HC emissions; (v) Three-way catalysts to reduce NO_x, CO and HC emissions.

Engine Technology

Emissions reductions can be achieved by improving engine technology or using alternative fuels or reformulated gasoline.

Among engine improvements, the catalytic converter, which extracts pollution from exhaust, has made the largest contribution to reduce vehicles emissions in recent years.

A catalytic converter does not operate effectively, however, until it reaches its operating temperature after a car has been running for a few minutes. High sulfur content in fuel has been shown to reduce the effectiveness of the catalytic converter.

To reduce these emissions, a low sulfur fuel has been introduced by many Govt. Authorities. Researchers are exploring ways to reduce the time needed to heat the catalytic converter.

B. Factors to be considered for development of alternative & renewable fuel systems for motor vehicles:

It is known facts that, motor vehicle contribute adversely towards environment and causes significantly to increase greenhouse gasses. This picture is continuing alarmingly gloomier by the rise of petrol, diesel and kerosene vehicles. Not only do vehicles contribute net carbon gases, mainly CO and CO₂, into the atmosphere which contribute to global warming and climate change but the products of combustion also produce additional local pollution causing many physical problems. Besides, the emission of nitrogen oxides, sulfur and carbon particulates (soot) can be very detrimental to health.

We now intend to discuss some imminent developments in running motor vehicles using renewable fuels / systems: We know that, fossil oil and gas are hidden treasures found in the earth crust. Therefore, these fuels are intrinsically cheap, requiring only the costs of finding and extraction from ground. There are three other features that make petroleum based fossil fuels such as petrol, diesel and kerosene uniquely attractive – (a) their very high energy densities, (b) the speed of recharging and (c) the existing world-wide distribution network.

(a) Energy densities are of prime important factor in choosing a particular system of energy-source in motor vehicles. To understand the system, let's take few alternatives of new clean energy sources: (i) rechargeable electric batteries of lead-acid based; (ii) Lithium batteries; (iii) hydrogen gas and Fuel Cells (batteries energized by some form of hydrogen).

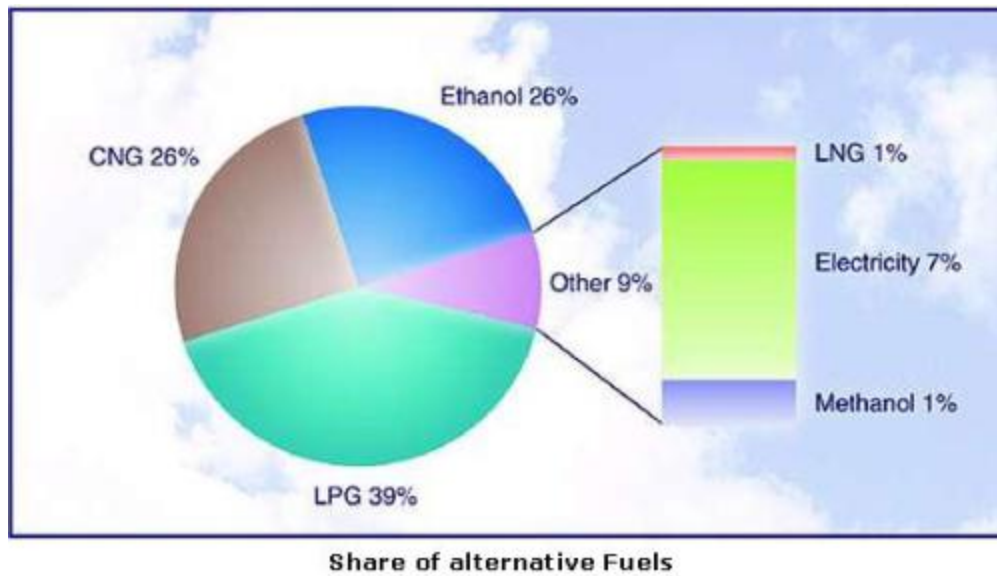
(i) Rechargeable batteries are relatively expensive and heavy (due to their low energy densities). Therefore, currently, they are not at all practicable in most of the cases. If we take a comparison between the energy stored per unit weight of petrol and lead-acid batteries the ratio would be about 500:1; even with nickel-metal hydride batteries (another possible contender), the ratio approaches 300:1.

(ii) Lithium batteries are emerging as a practical solution for commercial energy storage device for use in motor vehicles. It has an energy density some 30% to 60% higher than Nickel-Metal hydride, but the supply of Lithium batteries can make the system uneconomic.

(iii) Pure Hydrogen would be ideal, if it is derived in a sustainable way. Unfortunately, this is a gas we would be dealing with and so by definition it has a very low density. Extreme compression or cryogenic temperatures are needed to overcome this problem which poses lot of technological problems to be dealt with, and also the safety aspects. Fuel Cell technology is based on hydrogen, but experts say, liquid compounds containing hydrogen can be used instead of pure hydrogen. Such a system can, theoretically, match energy densities to those of the conventional combustion engine. Again, if using hydrogen means using petroleum compounds then its main advantage is lost.

(b) Speed of recharging is again a very important factor in selecting alternatives. The comparisons regarding speed of charging can be made very easily. How much time does a system take to recharge the vehicle in question in comparison to the time to fill the tank with petrol?

(c) Distribution network of conventional oil-based fuels is established world-wide as far the present system is concerned. For any alternative fuels it might take a longer time to build up such infrastructure for distribution.



Source : <http://saferenvironment.wordpress.com/2008/12/11/pollution-from-motor-vehicles-urgency-of-development-of-environment-friendly-cleaner-system-for-road-transport/>