

CSE dossier

factsheet CNG



Natural Gas Vehicles:

Separating Myth From Fact

A briefing note on why it is imperative to implement the Supreme Court order on conversion of diesel buses to CNG and answers to the disinformation campaign on CNG

CENTRE FOR SCIENCE AND ENVIRONMENT, FEBRUARY 14, 2001

MYTH 1: The government is serious about implementing the supreme court order on CNG buses.

(ARAI) has been asked to certify buses on the basis of these norms. But as yet little has happened.

FACT: No. IT is clear that government has been busy passing the buck and making excuses to delay implementation of the court order.

- Ministry of Surface Transport (MOST) is yet to issue safety guidelines for CNG vehicles. Gas Authority of India Ltd. (GAIL) claims that it is the responsibility of MOST to notify these guidelines.

We would like the Supreme Court to reprimand all these agencies for non-compliance of the court order.

- Delhi Transport Corporation (DTC) failed to place timely orders for new CNG buses in the two years given to it by the Supreme Court. Moreover, DTC informed the private bus owners about the Supreme Court directive as late as October 1999. On May 4, 2000, the Chief Minister issued a statement saying that an order of 1000 buses will be placed (Anon 2000, State orders 1,000 CNG buses, Asian Age, May 4, 2000). But the orders were placed only in September 2000. Delhi Government ordered for 500 buses each from TELCO and Ashok Leyland.

WHAT IS THE PRESENT SITUATION? WHAT ARE THE BOTTLE NECKS?

- Ministry of Surface Transport (MOST) held up the conversion process to CNG as it failed to modify the procedure for testing and certification for more than two years. Only in February 2000, MOST issued very ambiguous CNG norms. All that these norms say is that CNG vehicles must conform to the emission norms meant for petrol and diesel vehicles in force during the year of manufacture. Now Automotive Research Association of India

- Delhi Transport Corporation



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Name of the game is chaos

Number game

According to Rakesh Mehta, chairperson, DTC, has not purchased any bus since 1993 when it was still under the Union ministry of surface transport. Since its inception DTC has never operated more than 25 per cent of the public transport buses in Delhi. Till date the maximum number of buses that the DTC has operated is 2,000-2,500 buses. The rest are blue line buses, contract carriages and school buses. But, "presently we are running about 900 buses which are our own which are less than eight years," says Mehta. In view of this DTC now plans only to go for 2,000 buses. The rest will have to happen in the private sector.

Of these two thousand buses, 500 are to be specially designed urban buses also on CNG. For this they are talking to Volvo, Benz, Daimler. In fact 5 companies have responded to the tender. DTC would therefore only need 1500 buses from the Indian companies.

Private demands

Both the bus manufacturers TELCO and Ashok Leyland are now contacting the private bus owners for orders.

Ashok Leyland apparently has got orders of about 30 buses from institutions and schools. TELCO has already supplied 8 buses to institutions.

Meanwhile the private bus operators are demanding fiscal incentives for converting their buses, Delhi government has however turned this down on the ground that the revenue loss on this account would be enormous — as much as Rs 200 crore which the Delhi government cannot afford.

According to TELCO, although private owners usually like to purchase off the shelf, it is not possible to maintain a large inventory without firm orders in the case of CNG buses. Thus in absence of firm orders, TELCO will only be able to cater to DTC's need till March.

Private bus owners are also demanding that they be allowed to convert their diesel buses to Euro II diesel buses that will cost about Rs 2.5 lakh. The Supreme Court fortunately is in no mood to revert to diesel.

(DTC) has not given adequate attention to the conversion of old buses to CNG. Earlier, DTC said buses given to Rare Technologies for conversion have failed. But now they say that Rare Technologies does not have adequate certification from MOST to convert buses. Only 7 old converted DTC buses are on the road so far. NUGAS, a new agency has been given 25 more buses for conversion on a trial basis.

- The Delhi administration failed to implement the financial incentive schemes to encourage owners of old autos and taxis to convert to CNG on time. Although companies were ready with technology and owners agreeable to conversion, without financial incentives, the implementation plan took very long to take off. Despite these hitches, some auto drivers have availed of the incentive for 15-year old vehicles to switch over to CNG.
- Till date GAIL has set up 60 CNG stations as against 80 directed by the Supreme Court. They claim that they have not received the

appropriate licenses to do so for the remaining sites. Indraprastha Gas Ltd. (IGL) claims it has the equipment but not the land. In cases the land has not been allotted and in others site has been changed after being allotted.

- The manufacturers have informed the Delhi government that they already have the production capacity to meet the total demand in

Terminated by inaction

When the Centre for Science and Environment estimated the pollution load from vehicles and the effect of Supreme Court's orders on the pollution load, the results were shocking. If the government had been sincere about implementing the court order of moving all buses, auto rickshaws and taxis to CNG as scheduled then we would have been able to avoid as much as 15,617 tonnes of additional particulate pollution over the next 10 years — equal to 3 years of pollution from vehicles at the current level. This translates to prevention of 7,880 extra deaths, that is, more than 2 extra deaths a day over the next 10 years.

Progress Report: Delhi

At present there are 17,000 vehicles on CNG in Delhi. Of these around 130 are DTC buses, about 20 private buses, 5,000 three wheelers and the rest taxis and private cars. According to Indraprastha Gas Limited (IGL), there is no shortage of CNG in the city with 60 stations operating and selling around 1,700,000 Kg of CNG every month. Demand of CNG is growing at a rate of more than 15 per cent every month. IGL says that the passenger cars as well as taxis are going in for CNG in a big way. It has the capacity to supply CNG to 20,000 vehicles by March 2001.

IGL has already set up CNG stations at the Safdurjung and Okhla bus depots of DTC. It takes 3 to 4 minutes to fill up each bus. It takes about the same time to fill up a diesel bus.

the city if firm orders are placed. While TELCO has the capacity to produce 1,000 CNG bus chassis per month, Ashok Leyland can supply about 600 per month.

MYTH 2: Countries are moving out of CNG. It is not a proven technology.

FACT: The use of CNG is growing worldwide.

China already has 6,000 CNG buses. Recently it's ordered another 6,000 vehicles.

In the **US** CNG buses registered an increase of 38 per cent in 1998 over 1997.

Worldover there are over 10 lakh CNG vehicles and they are growing steadily every year, particularly because of environmental considerations which are focussing on the high particulate emissions from diesel vehicles.

MYTH 3: CNG technology has failed in the US

FACT: The US general accounting office says most buses using alternative fuels run on CNG

To support this myth an article on the GAO report appeared in *The Times of India* on the day of the

Supreme Court hearing on April 22, 2000. The article claimed that the experience with CNG in US has not been very happy (Yogendra Raj 2000, Is there a need for debate on CNG, *The Times of India*, April 22, 2000). This is also widely quoted in official circles in Delhi. The Delhi Government is now trying its best to hang on to this report as the excuse for its inaction (Dalip Singh 2000, CNG: Govt looks at US report for excuses, *Indian Express*, July 17).

Table 1: International Natural Gas Vehicles Statistics

| Country | Number of CNG vehicles | Refueling stations |
|----------------|------------------------|--------------------|
| Argentina | 401,000 | 531 |
| Italy | 290,000 | 284 |
| Russia | 205,000 | 187 |
| USA | 87,500 | 1,102 |
| New Zealand | 25,000 | 190 |
| Canada | 17,220 | 120 |
| Brazil | 14,000 | 39 |
| Egypt | 11,500 | 27 |
| Colombia | 4,600 | 22 |
| Pakistan | 13,000 | 12 |
| Indonesia | 3,000 | 12 |
| Trinidad | 3,000 | 13 |
| India | 2,500 | 6 |
| Germany | 3,600 | 80 |
| China | 2,000 | 10 |
| Chile | 1,600 | 2 |
| Venezuela | 1,500 | 20 |
| Japan | 1,211 | 42 |
| Australia | 1,000 | 35 |
| Malaysia | 975 | 8 |
| France | 869 | 9 |
| Iran | 800 | 1 |
| Holland | 535 | 15 |
| Bolivia | 400 | 6 |
| Great Britain | 370 | 15 |
| Sweden | 287 | 5 |
| Belgium | 217 | 6 |
| Burma | 200 | |
| Turkey | 189 | 3 |
| Thailand | 82 | 1 |
| Bangladesh | 65 | |
| Ireland | 34 | 1 |
| Czechoslovakia | 30 | 11 |
| Poland | 20 | 4 |
| Switzerland | 20 | 3 |
| Austria | 13 | 1 |
| Nigeria | 11 | 2 |
| Denmark | 5 | 1 |
| Norway | 5 | 1 |
| Finland | 4 | 1 |
| Korea | 4 | 1 |
| Mexico | 1 | 3 |
| Algeria | | 1 |
| Total | 10,49,182 | 2,794 |

Note: These figures have been updated till 1997. Where updated information not available previous information for 1994 remains.

Source: International Association for Natural Gas Vehicles online February 2, 2000

A Proven Technology

Light-duty vehicles

- Several auto manufacturers have CNG vehicles available, either as regular products or demonstration or experimental vehicles. Included on the list of manufacturers supplying natural gas light-duty vehicles are, among others MBW, Daimler-Chrysler, Fiat, Ford, Honda, Mitsubishi, Nissan, Toyota and Volvo. Many manufacturers offer both dedicated natural gas vehicles and bi-fuel vehicles capable of running on both natural gas and petrol.
- BMW offers a range of sedan and station wagon type vehicles on CNG.
- The CNG Dodge Ram manufactured by Chrysler was the first natural gas vehicle series-produced by an auto-maker.
- The Fiat Multipla is a recent model the Multipla is offered both as a bi-fuel version (Bipower) (petrol and CNG) and as a dedicated CNG version (Blupower).
- Of all auto manufacturers, Ford has the broadest range of alternative fuel vehicles. The bi-fuel Ford Contour (Mondeo) is an example of Ford's passenger cars for natural gas. The Ford F-150 pickup is another example of Ford's range of vehicles for natural gas. This light-duty truck is offered in six different models.
- The dedicated Honda Civic 1.6 is in mass production in the US.
- Volvo offers bi-fuel versions both of the popular S/V70 series and the new luxury car S80.

Heavy-duty vehicles

- There are several OEM engine manufacturers offering heavy-duty engines. In addition, a number of smaller companies have made engine conversions, mostly for

markets with less stringent emission regulations.

- Caterpillar is offering a wide range of industrial spark-ignition gas engines. For on-road applications, Caterpillar is offering dual-fuel engines, that is, engines in which the combustion is initiated by a pilot injection of diesel fuel. Both diesel and natural gas injection are electronically controlled. Typical diesel fuel substitution is 85 per cent. The power in dual-fuel operation is the same as in diesel operation, and the engine provides full diesel backup if necessary. In Australia, Caterpillar has calculated that for trucks running 200,000 kilometres per year, the payback time of the dual-fuel system is only 2 years.
- Cummins is one of the engine manufacturers that have been active in developing and commercialising natural gas engines for heavy-duty vehicles. By 1999, Cummins has put more than 3,800 heavy-duty natural gas engines on the road.
- Iveco has two engines available, a four-cylinder 2.8 litre engine and a 6-cylinder 9.5 litre engine.
- Already in the 1980s, Mercedes-Benz has natural gas engines available for category one markets, mainly South America. The most important natural gas engine from Mercedes-Benz is the naturally aspirated stoichiometric M447 heavy-goods engine. Mercedes-Benz also has a natural gas version of the Sprinter light-duty cargo vehicle.
- Volvo launched its natural gas bus engine in 1992. Since then, some 400 engines have been built, mainly for the Swedish market. Volvo has also delivered natural gas engines for truck applications.

(Nils-Olf *et al* 2000, *Exhaust Emissions from Natural Gas Vehicles*, International Association for Natural Gas Vehicles, March).

WHAT IS THE GAO REPORT?

In December 1999, the US General Accounting Office issued a status of alternative fuel use in transit bus fleets across the country. This report reviewed the types of alternative fuel bus technologies now in service and environmental and economic implications of their use. The report actually states that natural gas buses have a promising future. It reveals that natural gas buses make up the majority of alternative fuel buses now in operation (Anon

2000, GAO releases "Glass half empty" Transit Bus report, *Alternative Fuel News*, An official publication of the Clean Cities Network and Alternative Data Centre, US Department of Energy, Vol 4 No: 1).

THE GAO REPORT STATES:

1. The number of new alternative fuel transit buses being purchased by agencies across the country continues to grow. Nearly 20 per cent of all new bus orders are now alternative fuel vehi-

cles (primarily natural gas).

2. Half of all the agencies contacted by the GAO plan to continue buying alternative fuel buses; of those, all but one are buying 100 per cent alternative fuel buses (that is, *not ordering diesel buses any more*).

3. Half the CNG transit operators reported their fuel costs for CNG were less than their diesel costs would have been for the same period (note that this is before the steady price increases that diesel and gasoline are experiencing). No mention was made of anticipated price increases for low sulphur fuels necessary to achieve future emissions reduction in diesel engines.

This report however, has drawn a lot of criticism in the US especially from the US Department of Energy (DOE) for taking a "glass half-empty" attitude. Much of *the report dwells on the poor fleet experiences with early generation equipment*

from the late 1980s and early 1990s and the findings do not reflect current market conditions.

According to the DOE, the GAO cites no specific studies or indepth analysis as the basis of their report. It also does not address the critical issues that now drives the increased demand for alternative fuel buses in the US (Anon 2000, Department of Energy makes progress with state and fuel provider enforcement, *Alternative Fuel News*, US Department of Energy, Vol 4, No 1, An official publication of the Clean Cities Network and Alternative Fuel Data Centre p 7-8).

In the US an increasing number of transit agencies across North America have made the choice to convert their bus fleets to Compressed Natural Gas (CNG) in recent years, and even more are seriously considering it.

Since 1995, more than 80,000 Natural Gas Vehicles (NGV) are operating across USA served by over 1274 CNG stations. The NGV industry has

From California

According to Cindy Sullivan of the mobile source control division of the California Air Resources Board, fleets in states like Texas and California, are beginning to operate natural gas trucks.

The most popular engine has been a dual fuel engine, says Sullivan. This engine uses diesel and natural gas over the entire operating cycle, using diesel at idle and mostly natural gas during over-the-road operation. The engine is manufactured by Caterpillar and converted by a Southern California Caterpillar dealership, Power Systems Associates. Dedicated natural gas engines are also available from Detroit Diesel, Cummins, and John Deere at lower horsepower and torque ratings.

This dual fuel technology is available as a retrofit (certified to current standards) and as a new engine (certified to low NOx standards). "Because we want to make sure that vehicles using this engine operate on natural gas the majority of the time, it is not a simple on-off switch to go from natural gas to diesel," points out Sullivan.

Refuse trucks have also started using CNG. Waste Management, a large refuse company, took the lead in implementing natural gas trucks into their fleets in

Southern California. Other companies in Southern California began to purchase natural gas vehicles in order to be competitive with Waste Management. Since that time, the South Coast Air Quality Management District has implemented a rule requiring refuse companies to purchase alternative fuel trucks in the future. Several grocery companies in California have also initiated the use of natural gas trucks.

In a smaller weight class are local package delivery trucks. UPS has several hundred CNG trucks at locations throughout California. UPS has been using natural gas since the last 1980s.

On the point of converting existing heavy-duty diesel engines to run on CNG, Sullivan says emphatically that it is feasible to convert existing engines to operate on natural gas. This is not done in California because none of the retrofit kits have been certified to California's low emission standards. The current CARB regulations for retrofits (light- or heavy-duty) only require that emissions not increase beyond the existing standard. To obtain any kind of incentive funding, the retrofit would have to show emissions well below the standard. The regulations also require the manufacturer to establish emissions durability for at least 150,000 miles. For Delhi, it is a long way to go.

Out with diesel

For the first time in the world, a government has imposed restrictions on buying diesel vehicles for commercial use as an anti-pollution measure. Quite predictably, this move has come from the South Coast Air Quality Management District (SCAQMD), California, which leads the world in air quality management. It adopted three regulations on June 16, 2000, which puts a question mark on the future of diesel technology. The regulations bring into force a shift in the region's transit buses, garbage trucks and other vehicles like passenger cars used for commercial purposes from diesel to clean fuels.

From July 1, 2001, if any public fleet operator of 15 or more vehicles wants to purchase new vehicles or replace any in his fleet, he must do so with alternative-fuel vehicles or equivalent low-emitting gasoline

vehicles. The regulations define alternative fuel vehicles as any vehicle that is not run on diesel or gasoline but on compressed or liquefied natural gas, propane, methanol, electricity or fuel cells.

The action follows a study by AQMD in 1999 which showed that diesel exhaust cause around 70 per cent of the 1,400 in one million cancer risk from toxic air pollution in the area. "For more than half a century, Southern California's businesses and industries have reduced their emissions with cutting-edge technology to become the cleanest in the world. Now it is time for vehicle fleets — especially highly polluting diesel trucks and buses — to do their fare share in reducing smog-forming and toxic air pollution," said William Burke, SCAQMD's governing board chairperson.

planned a target of 1.6 million operating NGVs in United States by 2010. *More than 60 models including, light, medium, and heavy duty-trucks, vans and buses are available from original equipment manufacturers.*

Various factors at work are expected to expand the NGV market dramatically in the years to come in the US. Most important is the new thrust on clean fuels and extremely stringent emission regulations for diesel and petrol cars in the offing. Following the amendment of US Energy Policy Act in 1996, state air quality agencies are implementing Clean Fuel Fleet Programme to comply

with US Clean Air Act Amendments, a factor that is expected to drive regional NGV product demand higher from 1999 onwards.

In fact, the US is keen on alternative fuels, particularly natural gas.

US Department of energy is worried because even though more than 3,50,000 alternative fuel vehicles are operating in the US, the country still imports 53 to 55 per cent of its oil which accounts for more than 50 per cent of the total trade deficit in the US. Promotion of natural gas is seen, as a very important strategy to reduce US dependence

Republic of Korea chooses the CNG way

Not to be left behind, the ministry of Environment of the Republic of Korea has planned to replace a fleet of 20,000 diesel-powered buses with compressed natural gas (CNG) buses to bring down the levels of air pollution and greenhouse gas emissions.

Due to a rapid increase in automobile use, the motor vehicle has become the largest contributor to air pollution in large cities. For instance, in Seoul it accounts for about 85 per cent of total emissions. Although heavy-duty vehicles account for only 4 per cent of the total motorized vehicle fleet, they are responsible for 43% of total vehicular emissions.

The government is planning to fund replacement of current diesel-powered buses with

CNG buses from 2000. The plan is to ultimately replace 20,000 city buses by 2007. At first, 5000 buses will be replaced by early 2002 in cities hosting the 2002 World Cup.

The government is distributing 45.8 billion won in subsidies this year to introduce the initial 1500 city buses in the World Cup cities.

(Website of ministry of environment, government of the Republic of Korea)

on import of oil and trade deficit as natural gas is available in US in great abundance. The US Department of Energy estimates NGV market potential by the year 2010 to be over 1.6 million NGVs with natural gas consumption of approximately 4350 million gallons of gasoline equivalent. US now wants to target high fuel use fleet like trucks and buses for CNG use. Estimated 142,000 natural gas vehicles will be on road by the year 2000 (Anon 2000, Alternative Fuel Data Centre, Department of Energy Webster, May 2, 2000).

After the amendment of the US Energy Policy Act in 1996 (EPA Act) state fleets and alternative fuel provider fleets are mandated to acquire a specific percentage of alternative fuel vehicles as part of their regular annual light duty vehicle acquisitions. The amended US Energy Policy Act requires that "of the vehicles acquired by each agency for its fleets, 25 per cent should be alternative fuel vehicles in 1996, 33 percent in 1997, 50 per cent in 1998 and 75 per cent in 1999 and thereafter." All agencies will have to submit compliance report on these requirements. In case of violation of this requirement fines upto \$50,000 per violation per day can be charged. As of January 2000, almost 90 per cent of these fleets had complied (Anon 2000, Department of Energy makes progress with state and fuel provider enforcement, *Alternative Fuel News*, US Department of Energy, Vol 4, No 1, An official publication of the Clean Cities network and Alternative fuel data centre p 8).

MYTH 4: CNG buses emit the same amount of particulate matter (PM) as diesel buses.

FACT: Chassis dynamometer tests by

the West Virginia University show that CNG buses consistently emit dramatically less PM than diesel buses.

Emissions testing of real world buses (in-use vehicles) in Boulder, Colorado, demonstrated a 97 per cent PM reduction and a 58 per cent NOx reduction with CNG compared to diesel buses. It should be noted that the trace amount of PM associated with CNG is attributed to crankcase lubricating oil consumption which also occurs in diesel engines. (Anon 2000, Report of the U.S. Department of Energy at the South Coast Air Basin Alternative Fuel and Electric Transit Bus Workshop in Diamond Bar, California, March 15).

MYTH 5: CNG buses emit more ultrafine particulate than diesel buses.

FACT: US department of energy in a presentation in april 2000 said that tests have shown that CNG actually produces much fewer ultra-fine particles than diesel fuel.

However, the study of particle size distribution measurement and ultra fine particle counting are developing technologies, and initial data is mixed. New diesel engines have been observed to emit more ultra-fine particles while at the same time emitting less total PM mass than older diesel engines, presumably because of better fuel atomization (Anon 2000, Report of the U.S. Department of Energy at the South Coast Air Basin Alternative Fuel and Electric Transit Bus Workshop in Diamond Bar, California, March 15).

MYTH 6: Euro II and Euro III buses can be equally effective in reducing emissions.

Of ultrafine particles and not so fine games

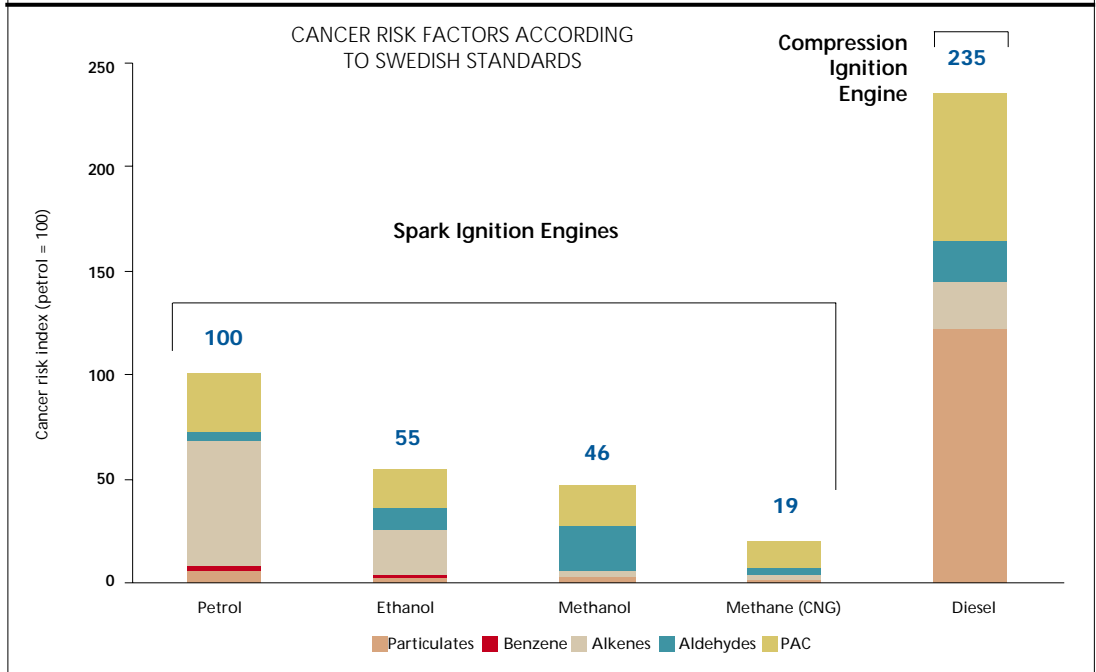
A recent report, done for the Navistar International, a leading bus and truck engine manufacturer, by the Harvard Centre for Risk Analysis is being quoted extensively by the auto industry. The report, basically a literature survey, says ultrafine particulate emissions might increase in CNG vehicles.

Being a 'study' commissioned by a leading engine manufacturer, the results are hardly surprising.

Secondly, all that this study has tried to do is a literature survey. It has only quoted another study to say that CNG may emit more ultrafine particles but fails to cite the study. Though this extremely biased study pretends to be a literature survey, a few studies that it quotes are against CNG, thus making its agenda very clear. It seems to be almost a study aimed at the decisions of the California Air Resources Board and USEPA to make emission norms extremely stringent, making it more difficult for diesel vehicles to survive.

GRAPH 1: DIESEL VS CLEANER FUELS

Diesel engine run on diesel fuel has the highest cancer risk index (235). The level is more than double than for petrol (100). The cleanest option is methane (CNG is 80 per cent methane), followed by methanol and ethanol



Source: Peter Ahlvik and Ake Brandberg 1999, Cancer Risk Index for Passenger Cars in India, Ecotraffic R&D AB, Stockholm, Sweden

FACT: No, if the thrust is on reducing toxic particulate emissions then the Euro norms are extremely lax. In Europe of these norms.

In Europe pressure is building up to set the same standards for both petrol and diesel vehicles under the Euro V norms. The US has equalised norms for petrol and diesel vehicles from 2004. Experts say this will wipe out the current diesel technology.

In fact, CNG vehicles achieve better emission levels than Euro IV norms. Comparison of emission levels of vehicles converted to CNG with Euro IV norms clearly show that even the emission levels of converted engines are cleaner than Euro IV norms. Emission levels of new dedicated CNG engines are expected to be even better.

MYTH 7: Advanced diesel engine (Euro III) will make CNG buses unnecessary.

FACT: Diesel buses can emit toxins (such as polyaromatic hydrocarbons, aldehydes, benzene, and 1, 3, butadiene) besides

deadly sulphate particles that CNG buses do not.

Based on the testing available today, it is evident that CNG buses will always have PM and toxic emission benefits over diesel.

A study conducted by Swedish Consultancy Eco-traffic shows that after taking into account all the toxic components in emissions the cancer potency level of diesel cars is double that of petrol cars in India. Even more frightening is the fact that if only particulate emissions are compared from different car models then the cancerous effect of diesel particulate matter from the new diesel car is equal to that of 24 new petrol cars and 81 compressed natural gas cars on roads.

- The most alarming finding of the Swedish study is that the cancer potency of diesel particulates alone is much higher compared to the total effect of all carcinogenic compounds present in the petrol cars.
- The results also confirm that among the alternative fuels though ethanol and methanol are cleaner options than petrol as

CNG at your doorstep

That the drive for increasing the share of CNG in a big way is on the rise is evident from the rapid strides being made in technological innovations .

BG International – the former British Gas – has produced a technology through 10 years of research and pilot projects which enables home refuelling of gas-powered cars. Under the scheme, motorists would use small compression units, costing about 200 pounds, to convert ordinary household gas (LPG) into CNG.

Both the government and the vehicle manufacturers have responded favourably and General Motors and Ford, the two largest carmakers are now monitoring the breakthrough (Tim Burt 2000, Gas Guzzlers Could Help Environment, in *Financial Times*, July 10).

these have lower cancer potency levels, CNG is still the best option (See graph 1).

The results of the Swedish study are further supported by evidence from another study conducted by the German Federal Environment Agency. They have found diesel to be several dozen times more cancer causing than petrol. Diesel particles alone constitute as much as 95 per cent of the cancer causing potential of all diesel emissions, it reported. In 1997, the German Federal Environmental Agency had set up a Research Advisory Group for diesel engine emissions that studied the comparative risk from different emissions. German researchers found that the cancer poten-

cy of petrol emissions in Euro II, III, IV standards cars is at least 10 times lower than the comparable diesel engines.

MYTH 8: Now that “ultra-low sulfur diesel fuels” is available we donot need CNG buses.

FACT: Firstly, “ultra-low sulfur diesel” stands for diesel with sulphur content less than 10 ppm (0.001 per cent). The so-called ultra-low sulphur diesel introduced in Delhi in April 2000 is 500 ppm (0.05 per cent). By no stretch of imagination can this be called “ultra-low”.

Only when special diesel fuel (0.001 per cent sulphur diesel, or 10 ppm and below) is used with a particulate trap (or after treatment devices) does diesel technology begin to compare with CNG. *But this is still in an experimental stage.*

Particulate traps have been developed which promise to reduce particulate emission by as much as 90 per cent. But introduction of such filter traps will remain a theoretical proposition unless diesel engine standards and diesel quality are improved drastically. Even Euro IV norms are not strong enough. Moreover, the diesel fuel needed for particulate trap to be effective should be very low sulfur fuel (near-zero) that is not commercially viable in India yet. Even in the US the U.S. EPA is considering possibly mandating the production of lower sulfur diesel

Table 2: CNG cost per mile compared to diesel

| Cost component Cost per mile (in \$) | Sacramento transit Authority CNG buses | SunLine Transit Agency CNG buses | Diesel buses operated by these agencies |
|---|---|---|--|
| Labour | 0.087 | 0.111 | 0.160 |
| Parts | 0.088 | 0.016 | 0.110 |
| Fuel | 0.122 | 0.149 | 0.223 |
| Oil | 0.006 | 0.012 | 0.007 |
| Indirect costs | 0.019 | 0.015 | 0.019 |
| Cost per mile | 0.322 | 0.348 | 0.519 |

Source: Richard Cromwell, 1998, Preliminary Draft Report: A Three year comparison: Natural Gas and diesel transit buses, Natural Gas Vehicle Coalition Conference, Rhode Island, September.

fuel, but the petroleum refining industry has argued that they could not produce such fuel until much later this decade, as huge refining cost is involved.

MYTH 9: CNG is not economically viable.

FACT: A study done by the Indian Institute of Public Finance for the Ministry of Environment and Forest (MOEF) on economic policy instruments for controlling vehicular air pollution concludes that CNG option for buses is more cost effective than the option of using particulate traps on diesel buses.

According to their estimates the costs per weighted tonne of emission reduction with particulate trap is 60 times higher than the cost of CNG retrofit. "CNG retrofitment appears most cost-effective among the available options for Delhi...under certain assumptions about vehicle utilisation rates, etc., the cost of CNG kits in a three-wheeler, taxi, car and bus can be recovered in 5.7, 6, 28 and 37.8 months" it points out (Rita Pandey 2000, Economic Policy Instruments for Controlling Vehicular Air Pollution, Study done for Ministry of Environment and Forests, New Delhi, *mimeo*).

In the US, while the initial capital cost of CNG buses is higher than diesel, the cheaper running and maintenance costs means that there is quick cost recovery. According to the US Department of Energy estimates, at 25 cents per gallon savings, the typical CNG bus could pay for itself in just over 3 years. Greater savings in fuel cost can result in even quicker paybacks (Anon 2000, U.S. Department of Energy at the South Coast Air Basin Alternative Fuel and Electric Transit Bus Workshop in Diamond Bar, California, March 15).

A draft report on a three-year comparison of natural gas and diesel transit buses in California shows clearly the cost effectiveness of moving to CNG. The report has reviewed two largest Bus transit agencies in California – Sacramento Regional Transit (SRT) and SunLine Transit Agency (STA). The former operates 240 buses of which 104 are diesel run and 136 are CNG run. The

report has looked into the O&M cost of both CNG and diesel buses and have concluded that:

- i) labour for diesel equipment is almost twice that for CNG vehicles
- ii) parts are 25 per cent more in case of diesel
- iii) fuel cost in diesel buses is approximately double

MYTH 10: CNG buses are unsafe.

FACT: CNG buses have different safety concerns than diesel fuel buses, but overall, there is no evidence that CNG buses pose any greater risk of fire or explosion than diesel buses.

The technology for making CNG tanks is well-known and mature. CNG fuel tanks are much stronger and safer than diesel or gasoline fuel tanks in the event of a vehicle collision. The few instances of tank failures that have occurred with CNG were carefully studied, and the problems have been remedied.

The US department of Energy says that both natural gas and diesel fuels are flammable (that is why they are used as fuels). Each requires the use of safety and fire protection equipment designed specifically for that particular type of fuel. However, in US, diesel bus facilities typically store much larger quantities of fuel on site than CNG facilities (usually 100,000 gallons or more of diesel fuel is stored on site, usually in large underground tanks, while only 500 gallons or so of CNG fuel is typically stored on site). Ground soil contamination from leaking diesel tanks is another concern that CNG facilities do not have to face.

While CNG tanks are more expensive than diesel fuel tanks, in hybrid application fewer of them are needed, and to meet future emission standards, the emission control devices for CNG engines are likely to cost less than those for diesel engines. Also, CNG is less expensive than the ultra-low sulfur diesel fuel required for advanced diesel engine emission control devices. On a life cycle basis, it is likely that CNG hybrid buses will be competitive in cost with diesel hybrid buses.

ON THE BASIS OF THE ABOVE FACTS AND GIVEN THE PROBLEM OF PARTICULATES IN DELHI, WHAT DOES CSE WANT?

Delhi today faces the serious challenge of lowering particulate load in the city's air by 90 per cent to secure public health. Any further increase in diesel vehicles will make this task impossible. We cannot allow slippage on CNG the strategy, as this is the only fuel that can help to reduce particulates drastically in Delhi today.

1. There should not be any dilution of the CNG order. Only CNG-driven buses, taxis and three-wheelers should be allowed in the National Capital Region.
2. In view of the production capacity already set up by the bus manufacturers, the entire city

bus fleet (both DTC and private) can be converted to CNG latest by December 2001.

3. Diesel (even if Euro II or Euro III compliant) should not be allowed for commercial and non-commercial transport at all. New research shows that when efforts are made to reduce the quantity of particulate matter emissions by improving diesel engines or diesel fuel, the number of fine and ultrafine particles shoot up. Health scientists have now concluded that smaller the particle size, more dangerous they are for public health. Thus, even improvements in technology can worsen the health threat from diesel.

We urge the court not to relax its order on CNG.

