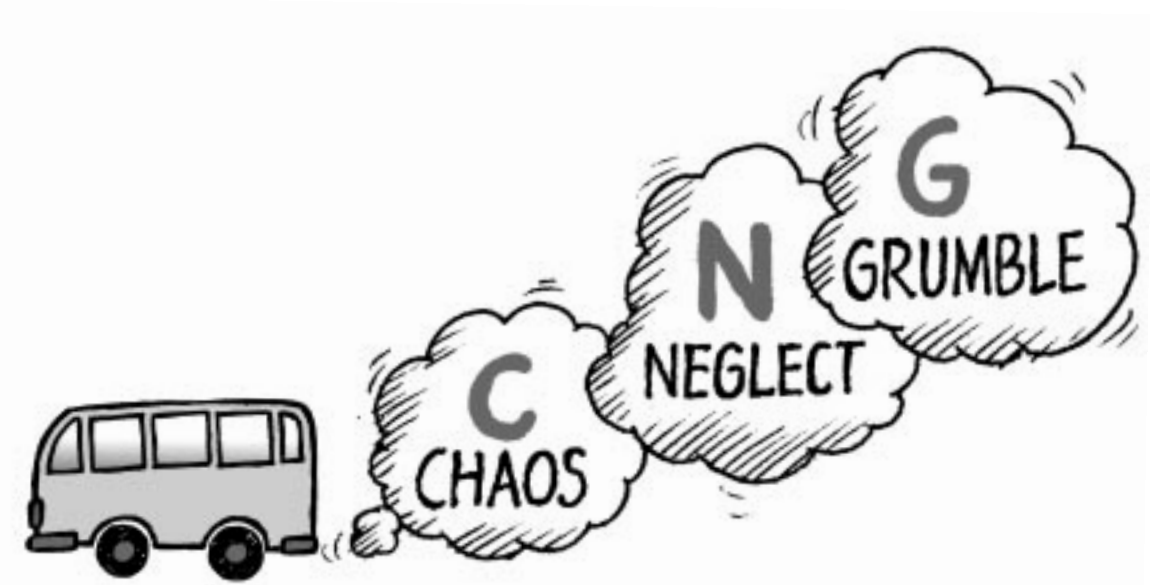

The smokescreen of lies

MYTHS AND FACTS ABOUT CNG

by

Right To Clean Air Campaign Team

CENTRE FOR SCIENCE AND ENVIRONMENT, NEW DELHI

August, 2001

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Right To Clean Air Campaign Team

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Right to clean air campaign

CSE blew the lid on smog and smogmakers in 1996 in its book *Slow murder: The deadly story of vehicular pollution in India*. The study found that the problem of vehicular pollution in India was the result of a combination of outdated engine technology, poor fuel quality, defective transportation planning and bad maintenance of vehicles on road.

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- **improve the decision-making processes related to air quality planning**
- **build up pressure on the government for more transparent policy mechanism**
- **raise public awareness about poor urban air quality and risks to public health**

If you agree with us, remember to give us your support.

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MYTHS AND FACTS ABOUT CNG

The Supreme Court of India ruled on July 28, 1998 that all eight-year-old buses and pre-1990 three-wheelers and taxis would have to be converted to compressed natural gas (CNG) by March 31, 2000. For the rest of the buses, three-wheelers and taxis, the deadline was fixed as March 31, 2001. This order, however, is getting to be the most difficult to implement. Resistance from the diesel lobby and lack of support from the government nearly sabotaged the initiative. It is only because of the strong stand taken by the Chief Justice bench that some progress is being made. Instead of building up consumer confidence in the CNG market, the government and industry alike have tried their best to propagate myths about CNG to mislead people. Even biased expert comments have been flaunted to discredit the move to bring in CNG. Without explaining the public health benefits expected out of the CNG strategy, administrative lapses and technical snags have all been mixed up to create confusion about CNG technology. Instead of taking pride in the fact that one of the largest CNG programmes of the world has been launched in Delhi, efforts are being made not to let it happen. Despite the opposition, Delhi today boasts of more than 2,200 CNG buses, 25,000 CNG three-wheelers, 6,000 CNG taxis and 10,000 CNG cars.

International experience shows that moving to any new technology is always beset with hurdles, primarily opposition from entrenched business interests. But other governments have taken strong proactive approaches to counter such opposition, and raise public awareness. A notable example is the public notification that was issued by the US Department of Energy to separate myths from facts about CNG when similar barbs were hurled at it in the US. To counter what it calls 'industry folklore', the US Department of Energy issued the notification, entitled *Natural Gas Buses: Separating Myth from Fact*, in April 2000. The release deals with every issue that is confusing Delhi's decisionmakers: cost, effect on global warming, safety, and health effects of nanoparticles or ultra-fine particles from CNG. "It becomes very difficult for people to understand the benefits of an alternative fuel programme if they are confronted with misinformation or poor comparisons based on false assumptions," points out the notification.

Similarly in Delhi, ever since the Supreme Court orders have come into effect, there has been a spate of statements from government officials, politicians, some experts and by the media on CNG. We were amazed at the level of misinformation that prevailed and incompetence of authorities and the scientific community to clear this confusion. We therefore felt the need to put together facts about CNG to expose the myths propagated by those in the service of polluters.

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MYTHS AND FACTS

MYTH 1: Low-sulphur diesel is clean fuel

- Supporting ultra low sulphur diesel (ULSD) over CNG, Tata Energy Research Institute (TERI) director R K Pachauri said there was enough evidence abroad that "ULSD is a better option" (*The Times of India*, March 28, 2001).

- Union petroleum minister Ram Naik and Delhi transport minister Parvez Hashmi have said that "the Centre and Delhi government have decided to request the Supreme Court to allow buses to run on low sulphur diesel along with CNG buses in Delhi" (*The Indian Express*, April 7, 2001).

- A report on a study conducted in Australia — filed in the Supreme Court conclusively states that low sulphur diesel (0.05 per cent sulphur content) along with oxidation catalyst is a "better" fuel than CNG and LPG (*The Times of India*, March 25, 2001).

FACT

- ***TERI is raking up a controversy based on a few outdated and unproven studies to bring diesel back and ignoring a range of other studies that prove that CNG engines are far cleaner than the currently available diesel ones***

- ***Though TERI defines ULSD as diesel with 0.005 per cent sulphur while quoting studies from abroad, it advocates diesel with sulphur content of 0.05 per cent (500 ppm) and Euro II diesel technology as an immediate strategy.***

- ***There are now numerous studies available that show that only reducing sulphur in diesel will make only a negligible impact on the particulate emissions from vehicles — between merely 5 per cent and 22 per cent. Therefore, it is false to claim that a marginal reduction of sulphur content is enough to make diesel an environmentally acceptable fuel.***

- ***Diesel begins to compare with other environmentally acceptable fuels only when it comes as part of a package with advanced diesel technology, state of the art exhaust treatment devices like continuously regenerating particulate traps along with diesel fuel with only 0.001 per cent (10 ppm) sulphur content and low aromatics content. But this combin ation is still experimental and not yet commercially viable.***

Diesel can be acceptable only when it comes as part of a package with advanced diesel technology, state of the art exhaust treatment devices, diesel fuel with only 0.001 per cent (10 ppm) sulphur content and low aromatics content

DISINFORMATION CAMPAIGN

Just two days after the Supreme Court ruled that it would not entertain any relaxation of the July 28, 1998 order to move the entire bus fleet of Delhi to CNG, TERI opened up the diesel vs CNG debate by issuing a pamphlet *Delhi's Transport and the Environment: shaken but not stirred* to create confusion and delay implementation.


Govt for recognition to low sulphur diesel as clean fuel

TERI rests its entire opposition to CNG on the basis of one set of measurements obtained from a London bus tested in Millbrook in 1996/1997 for the London Transport Buses. This study claims to have found that a Euro II diesel bus, running on ULSD (sulphur content of 0.005 per cent) and fitted with a continuously regenerating trap (CRT) — to control particulate emissions — achieves lower emissions than CNG buses.

What TERI omits to say is that after publication this study has come under serious scrutiny by other agencies that have found it flawed in terms of the methodology used. Various experts commenting on the London bus study say that it compares apples with oranges and does not give full details on the condition of the bus that was tested. The International Association for Natural Gas Vehicles (IANGV) has criticised this report on the ground that the difference in particulate matter emissions "most probably originates from excessive oil consumption of the CNG bus used by London Transport Buses. No detailed information on the condition of the test vehicles is available."[1]

TERI then flashes results from yet another study conducted in 1998, by an Expert Reference Group (ERG) set up in western Australia to recommend the best fuel for buses in Perth. This "study" concluded on the basis of a literature survey that ULSD (with 0.005 per cent sulphur) with a CRT is the best option from an environmental point of view. At the same time, the report on the basis of the same London bus study concludes that even diesel with a sulphur content of 500 ppm (0.05 per cent, that is, same quality as the diesel currently available in Delhi) and with an oxidation catalyst is better than CNG when it comes to particulate emissions.[2]

The selective use of information by TERI is astounding because while using these studies to discredit the Supreme Court's decision, TERI conveniently fails to mention that another study — a more recent one — done in March 2000, this time under the aegis of the Australian government, has trashed the ERG's 1998 study.

This new report entitled "*Lifecycle Emissions Analysis of Alternative Fuels for Heavy Vehicles*" by the Australian government's Council for Scientific and Industrial Research Organisation (CSIRO) clearly states "We used a risk-weighted scoring system, based on estimates of human health risk to rank the fuels. On a life-cycle basis, the gaseous fuels (LPG and CNG) give the lowest contribution to air pollution on this criterion."[3] Diesel is very low in the list of ten fuels they considered. The report has even questioned the method employed in the earlier 1998 study and says that the only data available for estimating emissions of vehicles using low sulphur diesel is based on only one London transport bus (see box: *Trashed by science: pro-diesel report takes a beating*). The report clearly brings out that CNG is much cleaner than both low sulphur diesel and ULSD in terms of all pollutants except non-methane volatile organic compounds (see table 1: *The cleanest one*).

Trashed by science: pro-diesel report takes a beating

1998: What the Experts Reference Group said

1. CNG emits more air toxins than any other automotive fuel
2. Diesel with 0.05 per cent sulphur ranks second to LPG in emission of air toxins
3. Low sulphur diesel (sulphur content of 0.05 per cent) is better for minimising population exposure to PM10 than CNG or LPG.
4. CNG emits more full life-cycle carbon dioxide than LPG and diesel

2000: Australian government's Council for Scientific and Industrial Research Organisation (CSIRO) refutes

1. Gaseous fuels like LPG and CNG emit much less greenhouse gases (in terms of carbon dioxide equivalents) over their lifecycle than diesel.
2. LPG and CNG pose the least public health risk when compared to other automotive fuels, particularly, low sulphur and ultra low sulphur diesel.

Table 1: The cleanest one

A recent study from the Council for Scientific and Industrial Research Organisation, Australia shows CNG is a much better option than diesel of 50 ppm sulphur content both in terms of public health risk and greenhouse gas emissions

Fuel	Emission in grammes per kilometre				Particulate emission relative to CNG emission
	Carbon monoxide	Non-methane volatile organic compounds	Oxides of nitrogen	Particulate matter	
Low sulphur diesel (500 ppm sulphur)	1.32	0.50	14.72	0.22	340 per cent higher than CNG emission
Ultra low sulphur diesel (50 ppm sulphur)	1.41	0.52	14.32	0.16	220 per cent higher than CNG emission
CNG	0.66	2.75	9.87	0.05	—

Source: Tom Beer *et al* 2000, Lifecycle Emissions Analysis of Alternative Fuels for Heavy Vehicles, CSIRO Atmospheric Research Report to the Australian Greenhouse Office, March, *mimeo*.

Still trying hard to discredit CNG, TERI flashes another study conducted by the New York State Department of Environmental Conservation along with Johnson Matthey, the manufacturer of CRTs, that compares emissions results of diesel buses based on their tests with the test results of CNG buses borrowed from tests done elsewhere in the US and Canada. It gives no clue about the conditions of the CNG buses used in the study.[4]

Though TERI uses this study to promote diesel buses, it understates the fact that the study has considered diesel buses that are fitted with CRTs and running on 30 ppm sulphur (0.003 per cent) diesel. After all this, TERI advocates Euro II diesel buses with oxidation catalysts for Delhi.[5]

Though TERI uses a study done in New York to promote diesel buses, it understates the fact that the study has considered diesel buses that are fitted with CRTs and running on 30 ppm sulphur diesel. After all this, TERI advocates Euro II diesel buses with oxidation catalysts for Delhi

Bus operators in Delhi, the Delhi transport department and the Union ministry of petroleum and natural gas (MOPNG), and their supporters are still hoping that if Euro II diesel with 500 ppm sulphur (0.05 per cent) somehow can be labelled as a clean fuel they won't have to do anything extra than run their old buses on the diesel already available in the capital. MOPNG is canvassing for the use of diesel with 500 ppm sulphur and Euro II diesel bus technology instead of CNG. It claims that this would reduce emissions by 70 per cent from Euro I level, but further reduction in sulphur content of diesel would not have any substantive effect on emissions. Therefore, the ministry believes that CNG is unnecessary if Euro II diesel buses are available.

Is low sulphur diesel a clean fuel?

Tests done across the world show that even with a major reduction in sulphur content in diesel particulate emissions reduce only marginally (see table 2: *Marginal decrease* and graph 1: *Small difference*).

Diesel begins to compare with CNG only when ULSD, that is, diesel with sulphur content below 30 ppm (0.003 per cent) comes as a package with advanced diesel technology, and state of the art engine emission control systems including CRTs. But this option is still not commercially viable.

What holds promise for diesel vehicles is the application of state of the art CRTs in combination with other catalytic converters and ultra low sulphur diesel with less than 30 ppm sulphur (see table 3: *Trapping the particles*). This combination of technology and fuel is coming into only those markets where very stringent emissions standards have been legislated such as California, the rest of the US and

Table 2: Marginal decrease

International experience shows that even a large decrease in sulphur content of diesel provides only a nominal reduction in particulate emission

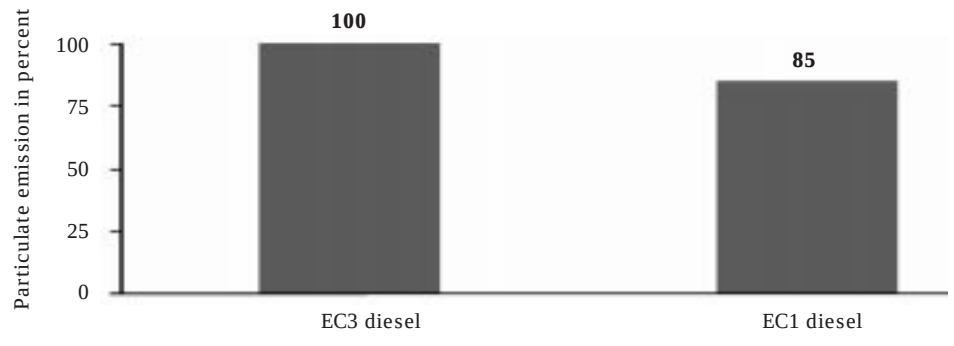
Study done by	Reduction in diesel sulphur content	Reduction in particulate emissions
European Auto Oil Programme [1]	From 300 ppm to 30 ppm	9 per cent
USA-based Southwest Research Institute[2]	From 300 ppm to 10 ppm	21.6 per cent Number of particles larger than 0.1 micron was found to go down with reduction in sulphur levels, but number of particles smaller than 0.1 micron increased.
Motor Test Centre, Sweden[3]	3,000 ppm to 50 ppm 3,000 ppm to 10 ppm	5-12 per cent 14-22 per cent
Hong Kong[4]	355 ppm to 35 ppm	4.4 per cent
New Zealand[5]	From 500 ppm to 50 ppm	5.1 per cent
Department of Environment and Transport for the Regions, Government of UK[6]	From 350 ppm to 10 ppm	Number of particles emitted by a Euro I heavy-duty diesel engine increased. Euro II diesel engine emitted more particles smaller than 56 nanometre when sulphur content of diesel was reduced to 10 ppm from 50 ppm sulphur diesel than on 50 ppm sulphur diesel.

Sources:

1. Anon 2000, *World-wide Fuel Charter*, European Automobile Manufacturers Association, Alliance of Automobile Manufacturers, Engine Manufacturers Association, Japan Automobile Manufacturers Association, April, p 37.
2. Melinda B Serman et al 1998, Emissions Comparison of alternative fuels in an advanced Automotive Diesel Engine, Interim Report for Department of Energy, Energy Efficiency and Renewable Energy, Office of Transportation Technologies, Office of Advanced Automotive Technologies, Southwest Research Institute, San Antonio, USA, *mimeo*.
3. Peter Ahlvik *et al* 1999, PoT-India: Possible Abatement of Air Pollution from Urban Traffic in India, Ecotraffic R&D AB, Stockholm, Sweden, mimeo.
4. Chiu L et al 2000, Performance and emission effect of ultra low sulphur diesel on double deck (Euro I) bus, paper presented at Better Air Quality, Motor Vehicle Control and Technology Workshop, Bangkok, *mimeo*.
5. Wilkinson 2000, ULSD fuels, paper presented at Better Air Quality, Motor Vehicle Control and Technology Workshop, Bangkok, *mimeo*.
6. Anon 2001, Summary Report, Department of Environment and Transport for the Regions/Society for Motor Manufacturers and Traders/CONCAWE, *mimeo*.

Graph 1: Small difference

Swedish studies show that moving from diesel with sulphur content as high as 3,000 ppm to diesel with 10 ppm sulphur reduces particulate emissions just by 15 per cent



Note: EC 3 diesel – sulphur content of 3,000 ppm and no limit on polycyclic aromatic hydrocarbons (PAH) content
EC 1 diesel – sulphur content of 10 ppm and PAH content of 0.02 per cent.
Source: Anon 1998, Ecotraffic, Sweden, *mimeo*.

Table 3: Trapping the particles

Tests conducted in New York show that a substantial reduction in particulate emission from diesel buses can be achieved only by using a combination of CRT and diesel with sulphur content of less than 30 ppm

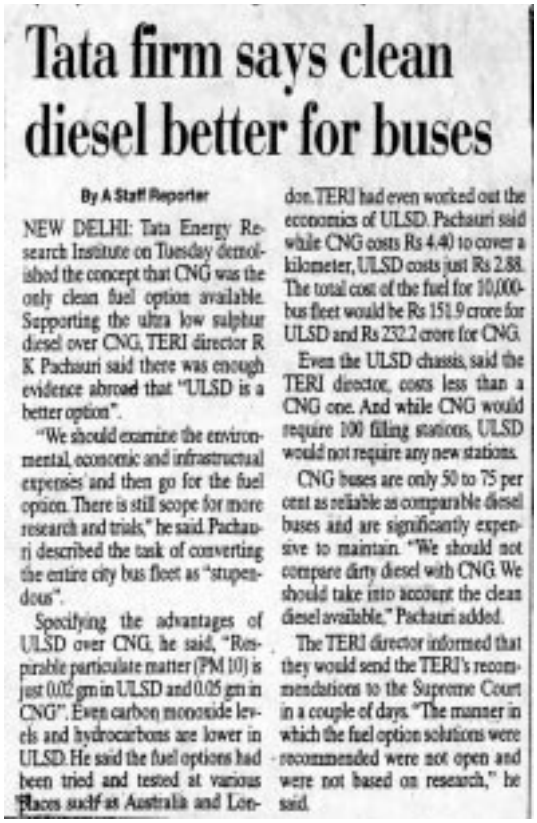
Bus	Test cycle	Aftertreatment device used	Diesel sulphur content	Particulate emissions (grammes per mile)
NYCT#6019	Central Business District cycle	Catalyst	350	0.21
		Catalyst	30	0.16
		CRT	30	0.04
	New York bus cycle	Catalyst	350	0.55
		CRT	30	0.04
NYCT#6065	Central Business District cycle	Catalyst	350	0.18
		Catalyst	30	0.12
		CRT	30	0.01

Source: Anon 2001, Emissions Results from Clean Diesel Demonstration Programme with CRT™ Particulate Filter at New York City Transit, New York State DEC, MTA NYCT, Johnson Matthey, Equilon, Corning, Environment Canada, and RAD Energy, *mimeo.*

in some countries of Europe like Sweden. Such a combination is also seen as necessary to meet the Euro IV emission standards for heavy-duty vehicles to be implemented in 2005.

The United States Environment Protection Agency (USEPA) informs that only a combination of diesel particulate filter and a catalytic converter or a catalysed particulate filter with ULSD is capable of meeting stringent particulate emission norms like that of the US Tier 2 emission standards that will be implemented in USA from 2004 onwards.[6]

USEPA has already mandated diesel with sulphur content of only 15 ppm (0.0015 per cent) to enable this combination of diesel technology to penetrate the market. This quality of fuel is absolutely essential for sophisticated particulate traps to be effective enough to control more than 90 per cent of diesel particulate matter emissions, it says.[7]



Tata firm says clean diesel better for buses

By A Staff Reporter

NEW DELHI: Tata Energy Research Institute on Tuesday demolished the concept that CNG was the only clean fuel option available. Supporting the ultra low sulphur diesel over CNG, TERI director R K Pachauri said there was enough evidence abroad that "ULSD is a better option".

"We should examine the environmental, economic and infrastructual expenses and then go for the fuel option. There is still scope for more research and trials," he said. Pachauri described the task of converting the entire city bus fleet as "stupendous".

Specifying the advantages of ULSD over CNG, he said, "Respirable particulate matter (PM 10) is just 0.02 gm in ULSD and 0.05 gm in CNG". Even carbon monoxide levels and hydrocarbons are lower in ULSD. He said the fuel options had been tried and tested at various places such as Australia and London. TERI had even worked out the economics of ULSD. Pachauri said while CNG costs Rs 4.40 to cover a kilometer, ULSD costs just Rs 2.88. The total cost of the fuel for 10,000-bus fleet would be Rs 151.9 crore for ULSD and Rs 232.2 crore for CNG.

Even the ULSD chassis, said the TERI director, costs less than a CNG one. And while CNG would require 100 filling stations, ULSD would not require any new stations.

CNG buses are only 50 to 75 per cent as reliable as comparable diesel buses and are significantly expensive to maintain. "We should not compare dirty diesel with CNG. We should take into account the clean diesel available," Pachauri added.

The TERI director informed that they would send the TERI's recommendations to the Supreme Court in a couple of days. "The manner in which the fuel option solutions were recommended were not open and were not based on research," he said.

PARTICULATE TRAPS

The advanced particulate traps that the world is talking about are exhaust emission control devices which filter or trap diesel particulate matter from the exhaust. But these are different from the low cost particulate traps to the extent that these advanced traps have a self cleansing system. While filtering particles they get loaded to the point when a reaction process is activated that burns off the trapped particles.[8] These are called continuously regenerating particulate traps (CRTs). But even this is not enough to control the soluble organic fraction of the particulate matter. Therefore, these CRTs have to be fitted along with oxidation catalysts which can oxidise the toxic organic components of the exhaust. Since this kind of application require active regeneration technology the systems become very expensive.[9] But these traps also oxidise sulphur to more harmful sulphate particles if the sulphur level is high in the fuel.[10] This problem still needs to be grappled with.

MYTH 2: Particulate traps can work with low sulphur diesel

The Tata Engineering Locomotive Company (TELCO) in its submission to Environment Pollution (Prevention and Control) Authority (EPCA) says, "The equipment manufacturers have stated that their filters can be used up to 350 ppm sulphur diesel. But they admit, "filter efficiency will be low at higher sulphur content and will improve substantially as the sulphur level goes down (SIAM 2001, Note on information given by TELCO during the SIAM meeting with EPCA on April 16, 2001, TELCO's submission to EPCA, *mimeo*).

FACT: TRAP EFFICIENCY DEPENDS ON THE SULPHUR LEVELS IN FUEL

- ***Ensuring particulate trap efficiency is critical to make diesel vehicles dramatically cleaner than what they are today. But for advanced aftertreatment systems like CRT to be effective, diesel with minimal sulphur content, if not totally sulphur free, is essential. Moreover, this application is still limited and very expensive.***

- ***It is misleading to claim that low cost filters on high sulphur fuel will be as effective as CNG in reducing emissions.***

Neither the industry nor their experts explain adequately that simple soot or particulate filters are grossly inefficient when used along with high sulphur fuel and that advanced filters like the CRTS do not even work on high sulphur fuel.

The future of diesel vehicles depends to a large extent on the effective application of exhaust emission control devices along with engine development and fuel quality improvements

The future of diesel vehicles depends to a large extent on the effective application of exhaust emission control devices along with engine development and fuel quality improvements. But these devices will work only if sulphur level in the fuel is minimal — below 30 ppm (0.003 per cent). This is very different from saying that even low cost particulate filters or soot filters along with low sulphur diesel with 500 ppm sulphur can be as effective as CNG.

Information from Hong Kong shows that fitting diesel vehicles with low cost particulate traps has had very little impact. Fitting low cost particulate traps to 66,400 diesel vehicles weighing lower than four tonnes and run on 500 ppm (0.05 per cent) sulphur diesel, has cut particulate emissions by only 7.5 per cent. Fitting catalysts into 83,000 diesel vehicles weighing more than four tonnes has lowered particulate emissions by only 13.2 per cent.[11]

Air quality regulators worldwide are therefore looking into the possible development and application of more advanced exhaust emission control devices such as CRTs. But these are extremely sulphur-sensitive. USEPA has gained experience with its voluntary diesel retrofit programme. For this programme it has considered a number of aftertreatment systems including two types of diesel particulate filters — base metal oxidising filter and highly oxidising precious metal particulate matter filter. USEPA informs that the base metal oxidising particulate matter filter, which has a potential of reducing particulate matter by 80 per cent, can operate only when diesel with sulphur content much lower than 500 ppm is used[12] and a CRT will work only on 15 ppm sulphur diesel.[13] The highly oxidising precious metal particulate filter, which can reduce particulate emissions by more than 90 per cent needs diesel with lower than 15 ppm sulphur.[14]

Some particulate filter manufacturers, Engelhard for instance, claim that their filters

can work even on 500 ppm (0.05 per cent) sulphur diesel fuel. But no data on any test having been conducted is available from these manufacturers to substantiate their claims.[15] Moreover, most of these traps have been used in off-road and stationary engines, which are very different from heavy-duty vehicles like buses and trucks, and are still in the demonstration stage for vehicles.[10] The overwhelming evidence provided by regulatory agencies across the world contradicts any claim of sulphur-neutral traps.

For advanced aftertreatment systems like CRT to be effective, diesel with minimal sulphur content, if not totally sulphur free, is essential

According to the California Air Resources Board (CARB), "Although catalyst-based diesel particulate filters can be used with diesel fuel of varying sulphur content, the greatest reductions come from using very low sulphur fuels. Used with very low sulphur (less than 15 ppm) diesel fuel, catalyst-based diesel particulate filters have been reported to reduce diesel PM emissions by over 85 per cent."[16]

Emission test results from USEPA show that when a heavy-duty diesel engine fitted with CRT and diesel sulphur level is reduced from 150 ppm to 3 ppm, particulate matter dips by 96 per cent[17] (see table 4: *Sulphur poisons*).

Test results from UK also show that lower the level of sulphur in diesel, greater is the efficiency of CRT to reduce particulate matter emissions (see table 5: *Similar results*).

Table 4: Sulphur poisons

Tests conducted in the US show that a combination of 15 ppm sulphur diesel with a continuously regenerating particulate trap just meets the US Tier 2 emission norm for particulate matter

Fuel sulphur in ppm	PM emission in gram per g/bhp-hr	Percentage increase in PM emission relative to 3 ppm sulphur diesel
3	0.003	0
7	0.006	100
15	0.009	200
30	0.017	470
150	0.071	2,300
Tier 2 emission standard (2004-2009)	0.01	—

Note: PM – particulate matter; g/bhp-hr – grammes per brakehorsepower-hour; ppm – parts per million.
All tests done under the supplemental test procedure of the US EPA.
Source: Anon 2000, *Regulatory Impact Analysis: Heavy-duty Engine and Vehicle Standards and Highway Diesel Fuel Sulphur Control Requirements*, United States Environmental Protection Agency, Washington DC, December.

Table 5: Similar results

Emissions test results from the Department of Environment and Transport for the Regions, Government of UK also show similar results

Engine	Sulphur content of diesel	Impact of particulate trap on particulate emission
Euro I diesel	50 ppm	75 per cent reduction
Euro I diesel	10 ppm	90 per cent reduction
Euro I diesel	50 ppm	Produced more sulphate particles when operated with a CRT compared to what it emitted when it operated without a CRT.

Source: Anon 2001, Summary Report, Department of Environment and Transport of the Regions/Society of Motor Manufacturers and Traders/CONCAWE, *mimeo*.

Though the use of CRTs can help heavy-duty diesel vehicles meet Tier 2 emission standards, according to the USEPA, they will need another aftertreatment device called NOx-adsorber to meet the emission standards set for nitrogen oxides.[18] While USEPA says that none of these technologies will operate efficiently enough to help heavy-duty vehicles meet the emission standards if the sulphur content of diesel is more than 15 ppm, the US-based Engine Manufacturers' Association has demanded diesel containing no more than 5 ppm (0.005 per cent) sulphur for these technologies to be able to function.[19]

While USEPA wants diesel with 15 ppm sulphur for CRTs to function properly, the US-based Engine Manufacturers Association want diesel with 5 ppm sulphur

Quality of air improves in Delhi as old vehicles go off

S P Sagar
NEW DELHI

The ambient air quality of Delhi has shown a perceptible improvement following withdrawal of old commercial vehicles from the roads since April, in compliance with a Supreme Court order.

These vehicles were more than eight years old and possessed high pollution potential. The monitoring was done by the state-run Central Pollution Control Board (CPCB).

The comparative data are those taken at the Bahadurshah Zafar Marg. The exact number of vehicles which have gone off the roads are:DTC buses —

AMBIENT AIR QUALITY DATA

SO2	36	20	27
NO2	86	46	57
SPM	473	426	349
RSPM	243	165	223
CO (8 hourly average)			
0600-1400 Hrs	4729	2107	2897
1400-2200 Hrs	5668	4156	4912
2200-0600 Hrs	7053	7053	7454

es and other pollutants emitted by the old petrol and diesel vehi-

old," chairman of Taxi and Auto Union of Delhi Ramesh

MYTH 3: CNG vehicles emit more ultrafine particles than diesel

- Dinesh Mohan of Delhi IIT cites a European study that has revealed that CNG emits even finer particles than diesel which have greater propensity to enter the lungs thereby making the CNG option that much more dangerous (*Business Standard*, May 21,2001).

FACT

- ***The detractors of CNG pull out extremely limited and yet unproven data to claim that CNG vehicles emit more ultrafine particles.***

- ***While particles come from all kinds of combustion sources it is the toxicity of the particulate emissions that help to prioritise the control of emissions. Particulate emissions from diesel vehicles are tiny and are coated with extremely toxic chemicals called polycyclic aromatic hydrocarbon (PAH) some of which are known to be the most potent carcinogens.***

- ***Numerous studies are now available that establish that CNG is a cleaner fuel compared to diesel***

Issues get murkier when the problems associated with diesel are hurled back at CNG. So if diesel emits high amount of fine particles so does CNG — is now a common refrain. The limited evidence the CNG detractors pull out of their bag is a "study" done by the US-based Harvard Centre for Risk Analysis, which contends that CNG vehicles emit more ultra fine particles (also called nanoparticles) than diesel vehicles.[20] In 2000 this "Harvard" study had mysteriously made its way to the tables of all top decision-makers in the Delhi government. The Lieutenant Governor of Delhi went on record to the media arguing that CNG was a problem because of "nanoparticles". TERI researchers use this study to support their claim as well.

The "Harvard" study when examined was found to be a six-page pamphlet, which was a literature survey with no references to the information cited. Moreover, the study was funded by the world's largest truck manufacturer — Navistar International. Michael Walsh, a highly respected air pollution expert and former official of the USEPA says of the study, "Any undergraduate who turned such a report in to his professor would surely get a very poor grade."

The lobbies at work completely ignore the fact that while particles come from all kind of combustion sources, it is the toxicity of the particulate emissions that should guide prioritising the control of emissions. Across the world, scientific studies have established that particulate matter from diesel exhaust is extremely toxic. It comprises tiny particles coated with extremely toxic chemicals called polycyclic aromatic hydrocarbons (PAH), some of which are known to be the most potent carcinogens. Compared with diesel vehicles, CNG vehicles emit negligible amount of particles. Moreover, even the little particles that are emitted by CNG vehicles are not as toxic as particles emitted by diesel vehicles as CNG is composed of mainly methane gas.

More studies are now available to confirm that diesel vehicles emit more ultra-fine particles than CNG vehicles. The Harvard study was first countered by the US Department of Energy (DOE), when it came out with a paper called *Separating Myth from Fact*, in April 2000. The paper said CNG buses consistently emit dramatically less particulate matter than diesel buses. Emissions testing of on-road buses in

While particles come from all kinds of combustion sources it is the toxicity of the particulate emissions that help to prioritise the strategies for control of emissions

Boulder, Colorado, on the central business district (CBD) driving cycle of the US demonstrated a 97 per cent reduction in particulate matter emission and a 58 per cent reduction in nitrogen oxide when compared to diesel buses.[21]

The trace amount of particulate matter associated with CNG is attributed to crankcase lubricating oil consumption (which also occurs in diesel engines). The DOE report said, "Some tests have shown that CNG actually produces much fewer ultrafine 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 ultrafine particles while at the same time emitting less total particulate matter mass than older diesel engines."

In one of his papers published in 2000, by the US-based Society of Automotive Engineers, Christopher Weaver, president of the California-based Engine, Fuel, and Emissions Engineering, Inc. says that even deterioration of the natural gas engine does not have significant effect on particulate emissions. "Particulate matter emissions from natural gas engines are unlikely to increase substantially due to wear or inadequate maintenance — at least until the piston rings, valve seals, or turbocharger oil seals are so worn that oil control is lost," says Weaver. According to him, this is not surprising, since particulate matter emissions from natural gas engines are derived from lubricating oil rather than fuel combustion.[22]

The trace amount of particulate matter associated with CNG is attributed to crankcase lubricating oil consumption which also occurs in diesel engines

When the Department of Environment and Transport for the Regions (DETR) of the Government of UK tested emissions from buses run on CNG and diesel, the results showed that the *mass* of ultrafine particles smaller than 0.056 micron (a micron is a millionth of a metre) emitted by CNG bus was just marginally higher than a Euro III diesel bus run on Swedish Class 1 diesel fuel (which has a sulphur content of 10 ppm). But diesel buses were found to emit more particles, bigger than 0.056 micron, than the CNG buses[23] (see graph 2: *Ultrafine emissions*).

But when the *number* of the ultrafine particles was considered, the Euro III bus on the Swedish Class 1 diesel was found to emit many more particles both smaller and larger than 0.05 micron compared to the CNG bus[24] (see graph 3: *More from diesel*). This clearly shows that ultrafine particle emissions remain a problem even with advanced diesel engines.

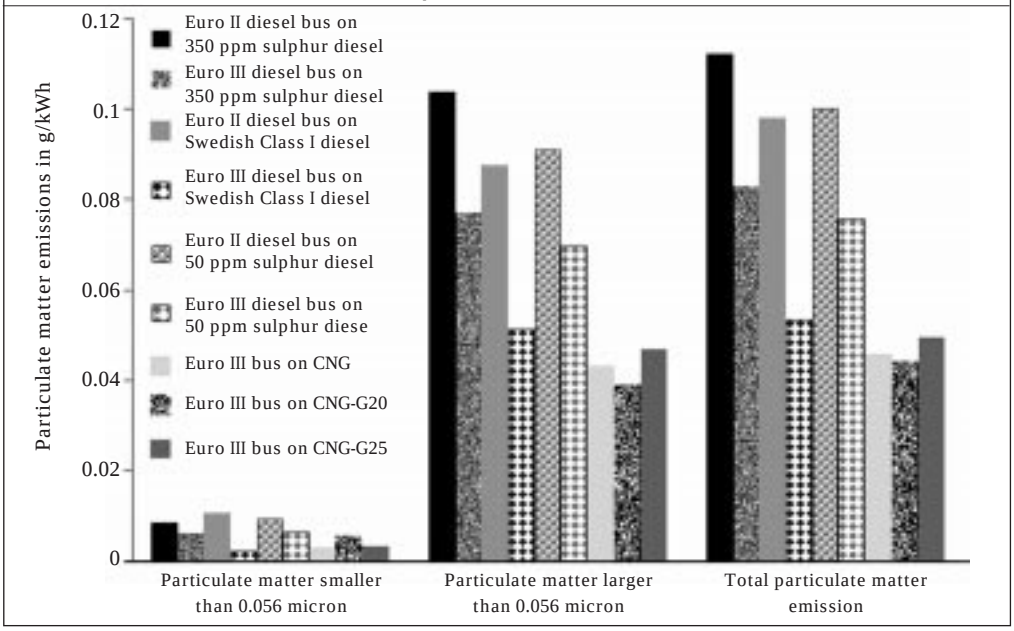
Again, when the Sweden-based Motor Test Centre (MTC) tested emissions from diesel and CNG buses, it observed similar results. The buses were tested on two driving cycles — the European and Santiago driving cycles. On both driving cycles the number of ultrafine particles (smaller than 0.1 micron in this study) emitted by the diesel engine was much higher than emissions from CNG buses[25] (see graph 4: *Ultrafine emissions: European driving cycle*, and graph 5: *Ultrafine emissions: Santiago driving cycle*).

MORE STUDIES PROVE THAT CNG IS A MUCH CLEANER OPTION

It is surprising how CNG detractors ignore a large number of studies that show CNG is a much cleaner fuel. Even the basic science of clean fuels eludes them. In its report on clean fuel, submitted to the Supreme Court, EPCA clearly states that no hydrocarbon fuel can be treated as a clean fuel. But based on the nature and structure of hydrocarbons it is possible to classify some of them as environmentally acceptable fuels. So the report states, "The pollution potential of the hydrocarbon fuels depends on the ratio of carbon to hydrogen atoms. Petrol and diesel belong to long-chain hydrocarbons with a larger number of carbon atoms forming the chain with hydrogen atoms. On the other hand, fuels like CNG, LPG and propane belong to the group of short-chain hydrocarbons having lesser number of carbon atoms.

Graph 2: Ultrafine emissions

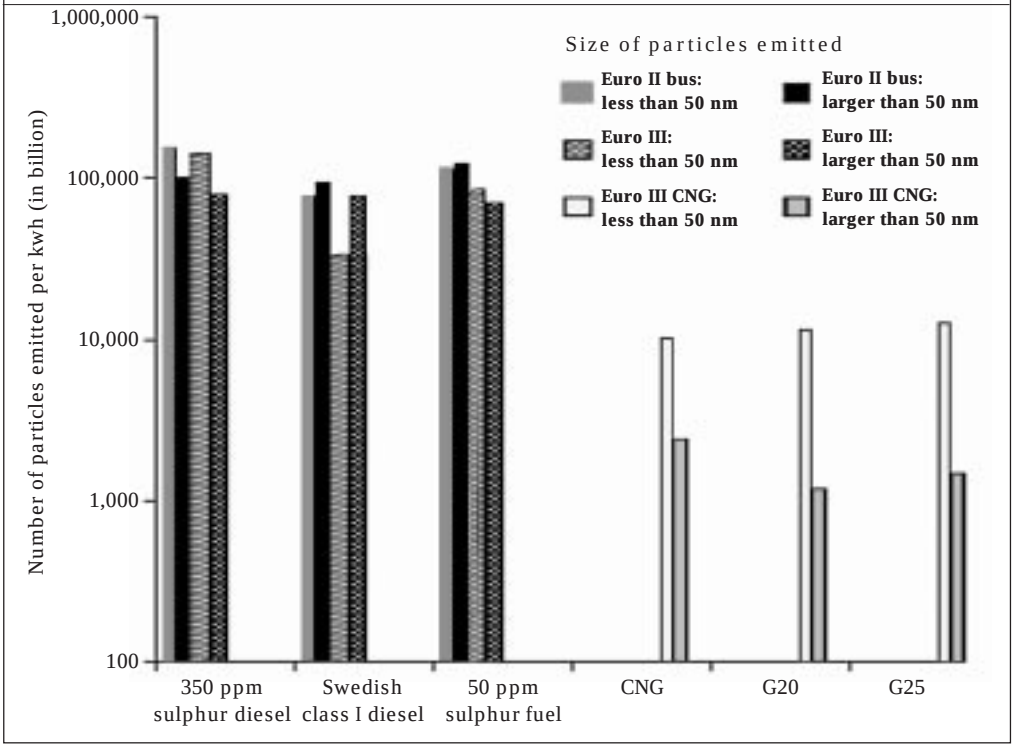
Recent tests conducted in the UK found that CNG buses emitted marginally higher ultrafine particles than diesel buses



Note: CNG-G20 — CNG with 100 per cent methane content CNG-G25 — CNG with 85 per cent methane content
Source: Anon 2001, Summary Report, Department of Environment and Transport for the Regions/Society for Motor Manufacturers and Traders/CONCAWE, *mimeo*.

Graph 3: More from diesel

Tests conducted in the UK show that the total number of ultrafine particles emitted by diesel buses are far more than CNG buses

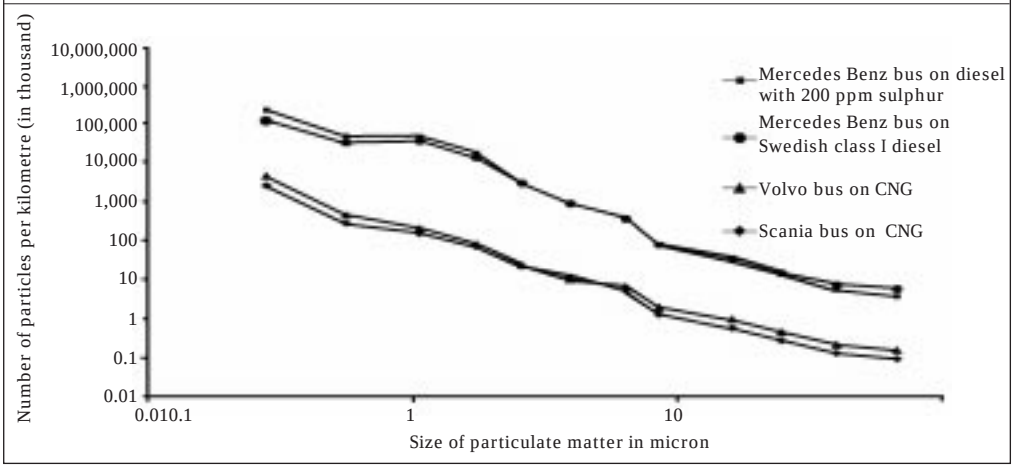


Source: Anon 2001, Summary Report, Department of Environment and Transport for the Regions/Society for Motor Manufacturers and Traders/CONCAWE, *mimeo*.

Studies from across the world show that number of ultrafine particles emitted by diesel vehicles are much higher than emissions from CNG vehicles

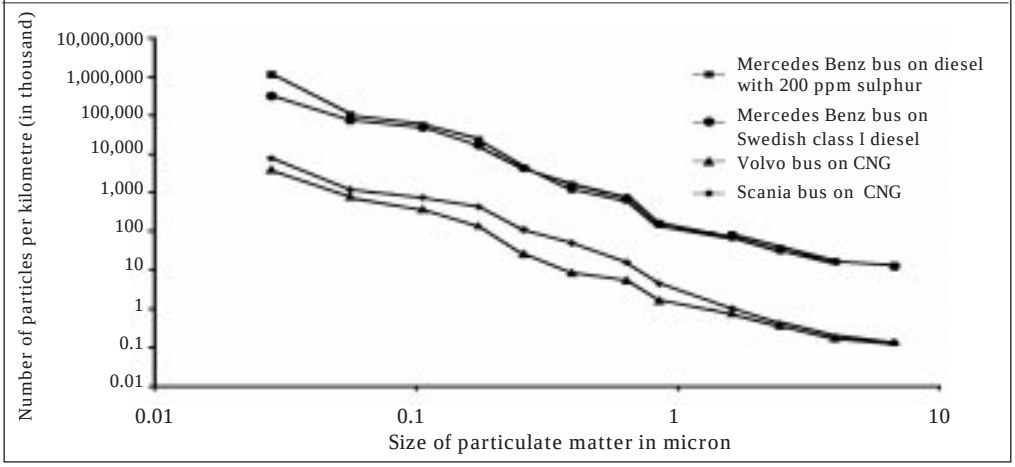
Graph 4: Ultrafine emissions: European driving cycle

Tests show that buses running on even the best quality diesel emit more ultrafine particles than CNG buses



Graph 5: Ultrafine emissions: Santiago driving cycle

CNG buses were found to emit much fewer ultrafine particles during tests conducted under the Santiago driving cycle



Source: Both graphs 4 and 5 are based on Kerstin Grägg 2000, *Emission tests of city buses fuelled by CNG for Santiago (Chile)*, a report for Vastra Gotaland – Santiago Cooperation, MTC AB, October 2000, Sweden, p 27.

While petrol and diesel have long-chain hydrocarbons, fuels like CNG, LPG and propane belong to the group of short-chain hydrocarbons having lesser number of carbon atoms. Therefore, these fuels are less polluting

Hence, the latter are less polluting. This factor, together with the combined effect of fuel characteristics, fuel additives and exhaust treatment systems in automobiles as well as secondary pollutants generated through atmospheric reactions, is the reason for air pollution and its health effect caused by automobile emissions."[26]

Emissions results of CNG vehicles available from different countries confirm that CNG vehicles are inherently cleaner than diesel vehicles. A report from Canada, published in 2000, compiles emissions test results from across the US and Canada which show that CNG buses emit up to 43 times less particles than comparable diesel engines fitted with particulate traps[27] (see table 6: *Clean chit*).

CNG also wins the race for cleaner fuels because of lower emissions of other gaseous pollutants. Swedish test results show that a CNG bus emits lower non-methane hydrocarbon and oxides of nitrogen compared to Euro II diesel bus with particulate trap.[28] For a Euro II diesel bus running on diesel with 10 ppm sulphur (0.001 per cent)

Table 6: Clean chit

Tests conducted in the US show that CNG buses emit less particulates than even diesel buses fitted with particulate traps

Engine	Location	Model year	Number of buses tested	Particulate matter emission in grammes per mile
Compressed natural gas				
Cummins L10-240G	Miami	1991	5	0.01
Cummins L10-240G	Tacoma	1992	5 with 2 replicates	0.01
Cummins L10-260G	New York	1993	5 with 2 replicates	0.03
Cummins L10-260G	Tacoma	1994	5	0.02
Cummins L10	Garden City, New York	1996	10	0.03
Detroit Diesel 50G	Atlanta	1996	10	0.03
Diesel fuel				
Detroit diesel 6V92TA with particulate trap	Peoria	1992	3	0.44
Detroit diesel 6V92TA with particulate trap	St Paul	1993	1 + 4 with 2 duplicates	0.34

Note: 1 mile = 1.61 kilometre

Source: D.V. Bates et al 2000, *Diesel particulate matter and associated environmental concerns, health risks and tradeoffs*, Vancouver, Canada, March.

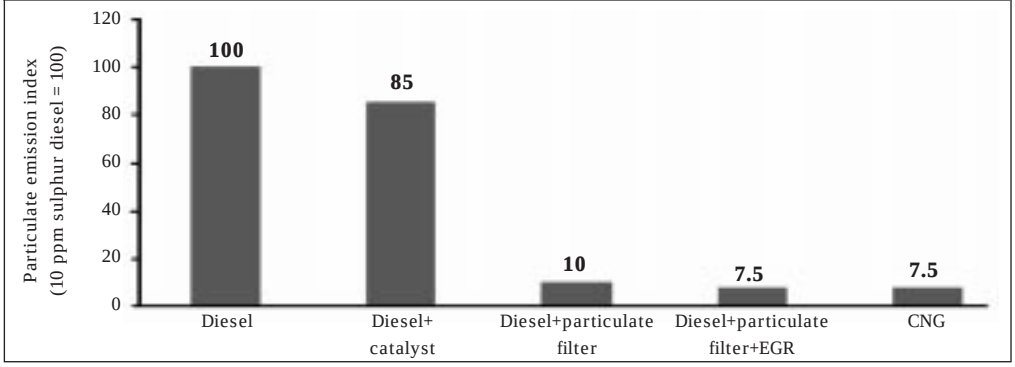
to achieve emission levels comparable to that of a CNG bus, would need exhaust gas recirculation system in addition to a particulate filter[29] (see graph 6: *Package deal*).

When the DETR, government of UK, conducted emissions test on diesel buses running on 0.005 per cent (50 ppm) and 0.001 per cent (10 ppm) sulphur diesel fitted with particulate traps, and CNG buses, it found that particulate emissions from Euro I bus fitted with CRT using 10 ppm sulphur diesel was close to that from a CNG bus. But running the CRT-fitted Euro I diesel bus on 50 ppm (0.005 per cent) sulphur produced greater particulate emissions than the CNG bus.[30]

The CNG bus gave better results despite the fact that it was tested on a transient cycle while the Euro I bus with CRT was tested on a steady state cycle. A transient test cycle is more representative of real driving conditions, emits more pollutants than a steady state cycle. Moreover, the CNG bus tested had a stoichiometric engine and only an oxidation catalyst which is not the state of the art technology. A three-way catalyst, would have given even better results.[31]

Graph 6: Package deal

Data from Sweden shows that a package of advanced emission control systems is needed along with the best quality diesel to reduce particulate emissions from diesel to the level of CNG engines



Source: Peter Ahlvik *et al* 2000, *Relative Impact on Environmental and Health from the Introduction of Low Emission City Buses in Sweden*, paper presented at SAE International Spring Fuels and Lubricants Meeting and Exposition, Paris, June.

A package of advanced emission control systems is needed along with the best quality diesel to reduce particulate emissions from diesel to the level of CNG engines

MYTH 4: CNG causes cancer

Narendra Nath, industry minister of Delhi, said the people he met at the explosion site told him that, CNG is carcinogenic (*The Indian Express*, April 7 2001).

FACT

- ***Conventional diesel is 100 times more, Euro II diesel 30 times more, Euro III diesel 20 times more and Euro IV diesel 10 times more carcinogenic than CNG. Emissions from the cleanest diesel vehicles, equipped with particulate filters and running on best quality diesel fuel are still four times more carcinogenic than CNG***

- ***3-nitrobenzanthrone, a highly carcinogenic compound found in diesel exhaust has produced the highest score ever reported in an Ames test, a standard measure of the cancer-causing potential of toxic chemicals***

- ***Several organisations like the National Institute of Occupational Safety and Health, USA, International Agency for Research on Cancer, World Health Organisation, California Environmental Protection Agency, California Air Resources Board, United States Environmental Protection Agency have indicted diesel exhaust for its toxicity and carcinogenicity***

A strange rumour campaign raged in the Capital for sometime — CNG causes cancer. Sensing that this would undermine consumer confidence in the new technology, CSE organised a rapid survey to confirm if this campaign was really on. It surveyed about 207 autorickshaw drivers across the city in Hamdard Nagar, Batra Hospital, Civil Lines, Mall Road, New Delhi Railway Station, ITO, ISBT, Delhi University, GTB Nagar, and Connaught Place.

CSE was shocked to find out that the rumour was spreading like wildfire. More than half of those surveyed had heard that CNG causes cancer. Many thought that the CNG drive would end soon as it caused cancer.

The word spread quite effectively through the network of autorickshaw drivers. Not surprisingly, all of them had heard about it from "some friend" or "another auto-driver". None of them could authenticate this hearsay with a newspaper report or any organisation. But, quite a few of the drivers referred to a case filed by Apollo hospital to stop usage of CNG because it causes cancer. CSE immediately got in touch with Apollo to find out if this was true. Apollo Hospital confirmed that there was no such case. Some of the drivers even talked about CNG-related cancer deaths in some government hospitals recently.

3-nitrobenzanthrone, a compound found in diesel exhaust has produced the highest score ever reported in an Ames test, a standard measure of the cancer-causing potential of toxic chemicals

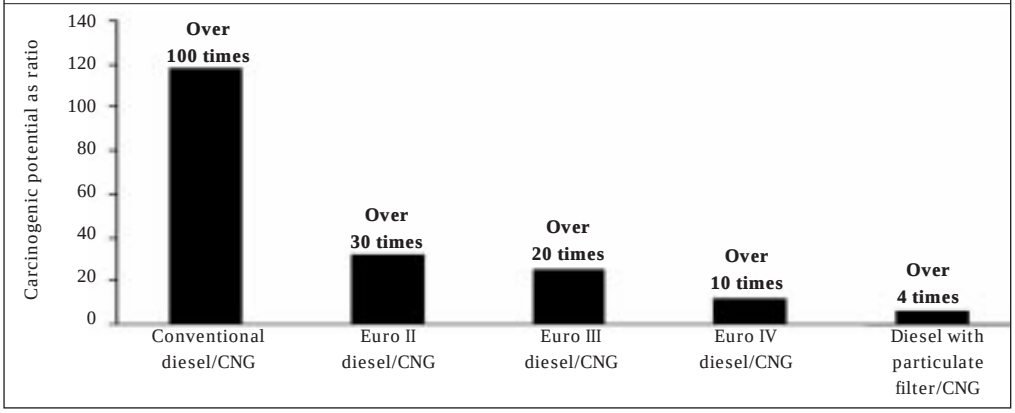
CSE even surveyed a smaller group of taxi drivers, about 30 of them, to confirm whether they had heard the rumour. Each and every one of those surveyed had heard the rumour on cancer and CNG.

DIESEL AND CANCER

In 1998, CARB declared diesel particulates to be toxic air contaminants. A number of other research organisations and regulatory agencies too have branded diesel fumes as a likely carcinogen (see table 7: *Lethal fuel*). If the cancer-index for fuels — potential of emissions from different fuels to cause cancer — is taken into

Graph 7: Cancer potency

Tests conducted by the German Environment Agency have found that even the cleanest diesel technology is over four times more carcinogenic than CNG



Source: Nils-Olof Nylund, Alex Lawson 2000, *Exhaust emissions from natural gas vehicles*, Issues related to engine performance, exhaust emissions and enviromental impacts, a report prepared for the IANGV technical committee, p 29.

consideration then CNG is still the safer option than diesel. A study conducted by the German Federal Environmental Agency (UBA) shows that Euro IV diesel vehicles using ULSD and fitted with CRT would be over four times more carcinogenic than CNG vehicles.[32] It is to be noted that Euro IV technology is still under development and will be introduced in Europe in 2005 (see graph 7: *Cancer potency*).

A study conducted by the German Federal Environmental Agency shows that Euro IV diesel vehicles running on ULSD and fitted with CRT are over four times more carcinogenic than CNG vehicles

A compound discovered in the exhaust fumes of diesel engines may be the most carcinogenic ever analysed, say Japanese researchers. They warn that it could be partly responsible for the large number of lung cancer cases in cities. The compound, 3-nitrobenzanthrone, produced the highest score ever reported in an Ames test, a standard measure of the cancer-causing potential of toxic chemicals. "I personally believe that the recent increase in the number of lung cancer patients in vehicle congested areas closely linked with respirable carcinogens such as 3-nitrobenzanthrone, " says Hitomi Suzuki, a chemist at Kyoto University who led the study. Emissions from truck engines and the air above central Tokyo both contained the compound. It has been found to be more dangerous than 1,8-dinitropyrene, which is also found in diesel exhaust and had until now been constituted the most powerful known mutagen[33] (see table 7: *Lethal fuel*).

Table 7: Lethal fuel

A number of research organisations in different countries across the world have indicted diesel exhaust as carcinogenic

Country/Organisation	Year	Conclusion
National Institute of Occupational Safety and Health, USA	1988	Potential occupational carcinogen
International Agency for Research on Cancer	1989	Probable human carcinogen
World Health Organisation	1996	Probably carcinogenic
California Environmental Protection Agency	1998	Carcinogenicity reasonable and likely
California Air Resources Board	1998	Diesel particulate matter is a toxic air contaminant
United States Environmental Protection Agency	2000	Diesel exhaust likely to be carcinogenic

Source: Anon 1999, *Diesel Emissions and Lung Cancer: Epidemiology and Quantitative Risk Assessment*, Health Effects Institute, Massachusetts, USA, p 10.

MYTH 5: CNG vehicles are not safe

- In an interview with *Down To Earth*, Sheila Dixit, chief minister of Delhi, said, "even new (CNG) buses are not able to withstand the heat…I hope they will survive the heat this summer" (*Down To Earth*, April 30, 2001).
- In another interview with *Hindustan Times*, Sheila Dikshit said, "No (safety) norms (for CNG kits) have been notified. The CNG vehicles are on the road without this clearance — we are playing with the lives of people, especially children. And I fear to think of how the CNG buses will perform in the middle of the summers. They are known to overheat…"
- One self-styled expert has even remarked on TV, "Ten kg of CNG is like 10 kg of RDX".
- A cylinder blast is just what the anti-CNG lobby needs to prove that Delhi is heading towards a major disaster once the entire public transport converts to CNG (*The Indian Express*, April 7, 2001).

FACT

- ***CNG, unlike LPG, is a gas that is lighter than air, it quickly dissipates into the environment and is unlikely to acquire enough concentration in the air to explode. Moreover, CNG has a higher flash point (the temperature at which the fuel is likely to explode on its own) of 540ºC than petrol which has a flash point of 232-282ºC***
- ***In the event of a vehicle collision, CNG fuel tanks are much stronger and safer than either diesel or gasoline fuel tanks, says the US Department of Energy***
- ***The biggest safety problem in India is likely to be the use of spurious cylinders, especially when unauthorised agents for cars, taxis or autos carry out conversions from petrol to CNG. But the problem can be dealt with if adequate efforts are made. The Mumbai transport department has done this successfully.***

The biggest safety problem in India is likely to be the use of spurious cylinders, especially when unauthorised agents for cars, taxis or autos carry out conversions

It is not surprising that several people wonder whether CNG cylinders will explode when Delhi summer temperatures touch 45º Celsius. People have a right to be worried about safety (see box: *There is no chance of the cylinder blowing up even if a bus catches fire*).

But let us see how this works. When temperatures rise, gases expand. If kept in an enclosed space, pressure builds up. Companies manufacturing the cylinders should be able to say what pressure a CNG cylinder can take. If there are doubts, the cylinders can be tested by heating them in a laboratory. If found deficient — not just in normal summer temperatures but also in extreme situations like a bus catching fire — appropriate safety specifications can be set.

A petrol or a diesel tank can also explode — try throwing a burning match into one of them — but

they rarely do. This is only because there are safety specifications. The government can easily take appropriate steps and keep people informed. But neither the state government of Delhi nor the Central government have cared to do anything.

In principle, CNG is quite safe. CNG, unlike LPG, is a gas that is lighter than air, quickly dissipates into the environment and is unlikely to acquire enough concentration in the air to explode. Moreover, CNG has a higher flash point (the temperature at which the fuel is likely to explode on its own) of 540ºC than petrol which has a flash point of 232-282ºC.[34]

CNG cylinders are put through severe abuse tests before the statutory authorities give approvals. They are tested to withstand pressure of up to 340 bars as against the working pressure of 220 bars. The Nagpur-based Chief Controller of Explosives (CCOE) using standards set by the Bureau of Indian Standards (BIS) certifies these cylinders[35]. Thus, the chances of them exploding are next to impossible.

Nobody has cared to find out that even Cairo, a hot desert city, is going in for CNG vehicles. If there is no fear of CNG tanks bursting there, why is this an issue in Delhi? Let us not forget that the big future for transport will be fuel cells powered by hydrogen, the ultimate non-polluting fuel, but which is an even more inflammable gas with a flash point of 259ºC.

Myths about the safety of CNG have been spread across the world. A statement from the US DOE says, "The technology for making CNG tanks is well known and mature. In the event of a vehicle collision, CNG fuel tanks are much stronger and safer than either diesel or gasoline fuel tanks. The few instances of CNG tank failures were studied carefully, and the problems, mostly involving support strap failure or tank abrasion during normal operation, have been remedied."[36]

"CNG buses have some 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. Natural gas buses have on-board gas detectors and other safety equipment specially designed to ensure safe operation," points out the DOE statement.

The biggest problem in India is likely to be the use of spurious cylinders, especially when unauthorised agents for cars, taxis or autos do conversion. For buses, conversion is being undertaken only by agencies which have been certified by the government, and therefore, the use of spurious cylinders is less likely. But even the problem of conversion in the case of cars, taxis and autos can be dealt with if adequate efforts are made as the Mumbai transport department has done (see box: *Dealing with safety in Mumbai*).

Ironically, despite the concern over safety, the regulatory agencies never cared to evaluate the safety regulations in force for CNG vehicles. CSE was concerned that if there were doubts about safety then it needed to be investigated and proper enforcement regulations and systems needed to be put in place to deal with the matter. In the absence of the official action in this regard, CSE decided to take it upon itself to get this evaluation done. So it invited three international experts, Christopher Weaver, President, Engine, Fuel, and Emissions Enginering, Inc., USA, Lennart Erlandsson of Motor Testing Centre, Sweden, and Frank Dursbeck formerly with TUV Rheinland Sicherheit Und Umweltschutz GMBH, Germany with wide experience in CNG technology to come and evaluate all currently available CNG technology in India. Their report (henceforth referred to as the CSE experts panel report on CNG) has provided valuable policy guidelines (Box: *Safety matters: Issues raised by the CSE panel of experts*).

Is CNG really safe?

By A Staff Reporter

NEW DELHI: The crucial question is here again: How safe is CNG, which requires 232 to 282 degrees celsius. "The ignition temperature of the CNG

"There is no chance of the cylinder

A R GULATI, Director, Transport Engineering, Bureau of Indian

Who manufactures CNG cylinders in India and how are they certified?

There are three companies which manufacture CNG cylinders in India – Everest, Faber and Bharat Pumps and Compressors. These cylinders are manufactured in a special way to ensure that they can withstand high pressures. They are similar to oxygen cylinders which have been in use for a long time in India. Rules and regulations for this were laid down a long time ago and are called Static and Mobile Pressure Vessels Rules (SMPV Rules), which are followed by the Chief Controller of Explosives based in Nagpur.

The cylinders are manufactured according to India's Pressure Vessels Code. This has been formulated taking into account the British Pressure Vessels Code as well as the US Pressure Vessels Code. This code has various parameters. Engineering parameters include size and dimensions, strength and so on. It also prescribes special parameters such as 'relieving'. When a cylinder is being manufactured it experiences what is called stress and the metal becomes brittle. To get rid of this stress, 'relieving' is done. Several technical parameters are prescribed.

These cylinders are made in a special way. For the manufacture of normal cylinders, a metal sheet is moulded and welded but in case of CNG and other gases which are kept under pressure, a solid metal block, called a slug, is pierced from within to avoid any cracks. The chance of such a cylinder bursting is very rare.

Can the CNG cylinders withstand the heat of Delhi summer?

A CNG engine, similar to a petrol engine, generates a lot more heat to produce the same amount of power as compared to a diesel engine. That is why there is a chance that the area around the engine and near the driver may get heated up. But there is no safety risk from this.

What happens to a CNG cylinder or a kit when a bus catches fire?

I can assure you that there is no chance of the cylinder blowing up even if a bus catches fire. Yes, there will be dire consequences for the bus and the passengers but a certified cylinder will not burst.

Is it true that cylinders can withstand 340 bars pressure and the ignition temperature of CNG is 540 degree Celsius, as reported in the newspapers?

I am not sure of the exact pressure that a cylinder can withstand but it is at least 1.5 times the pressure under which CNG is stored, which is 200 bars. The flashpoint of CNG is 540ºC. This is the temperature when CNG explodes on its own. The flashpoint of petrol and diesel is much lower than CNG.

Is there a danger in CNG vehicles in keeping the valve remains?

It is like keeping the regulator of your LPG cooking cylinder open. The valve is supposed to close on its own when not in use. If it is not functioning properly and gas continues to leak then it could be a problem. A CNG kit involves the actual conversion kit, pipes,

Dealing with

A staff member of the Centre for Science and Environment who visited Mumbai in mid-April 2001 found that the government moved fast in Mumbai to deal with the problem of uncertified cylinders. When two blasts occurred (one in Ghatkopar and another in Chembur within one week of each other in March 2001) no one talked of CNG being an unviable option. The day the blast took place, the transport department immediately drew up a plan to check the use of spurious cylinders. In Mumbai, the responsibility is being put on Mahanagar Gas Ltd (MGL) for both supply and safety. The transport commissioner first made MGL responsible for issuing stickers after checking that the right cylinders (seamless and manufactured by either Faber India Ltd, Everest Canto, and Bharat Pump and Compressors — the three certified companies) were used and so was the kit and its fitting.

Initially, this drive was started at one or two dispensation stations and was extended to all 22 stations in the city. The inspectors included MGL engineers, NGOs (mainly volunteers and senior citizens), and members of the taxi drivers union. MGL conducted workshops for the inspectors so that they would know exactly what to look for.

So, within two days of the blast in Chembur, the entire checking system was functional. The transport commissioner set a deadline of March 31, 2001 by when he wanted all CNG vehicles to get stickers showing that they were using genuine parts after which they would be denied CNG at the dispensing stations. But another problem came up — the rain was washing the stickers away. The CNG committee, which has been constituted by the High Court to oversee the implementation of the orders, asked that the stickers be converted to metal tags which should be screwed on to the kit inside the bonnet. The stickers are now being gradually replaced with metal tags and a deadline of September 30, 2001 has been set. These will be done at CNG

blowing up even if a bus catches fire"

Standards, New Delhi, speaks with the Right to Clean Air Campaign team

valve and the whole system. Proper regulations for the valve are there in the draft document but they have yet to be notified.

What is the role of the Chief Controller of Explosives (CCOE) in the entire procedure? Does every cylinder have to go to the CCOE for certification?
A cylinder manufacturer first has to send the drawings and designs of the cylinder to the CCOE. After these are approved, the CCOE checks whether the proponent's manufacturing facility is adequate or not. The qualification of the factory staff is also taken into account. Another important criteria is to make sure whether the manufacturer can consistently maintain the quality. Tests are carried out within the facility of the manufacturer where a prototype is examined. But even after this an inspecting authority is appointed to check whether the prescribed regulations are being followed by the manufacturer or not. Some of these inspecting authorities are the Director General of Quality Assurance (Defence), Lloyds Registering and Inspection Services, Engineers India Limited and Bureau of Indian Standards.

What is the role of the Automotive Research Association of India (ARAI) and other emissions testing agencies in the certification process and how is it different from that of the CCOE?
ARAI and other testing agencies come into the picture only when a new vehicle is fitted with a CNG kit, not when an old vehicle is fitted with a kit (in case of petrol vehicles). Balraj Bhanot is part of the committee that is formulating rules for kits.

Is there any way of keeping a check if the actual retrofitting of CNG kits is being done properly?
It is essential that qualified people and not roadside mechanics fit the kits. But what is happening today is that kit importers send their people to get trained in whichever place they are importing the kit from. These trained people then come back to India and impart their knowledge to others who then do the job. There is no system of testing and certifying kits in India. The rules and regulations for this are in the draft stage and are now being circulated. Today, the only criteria that the kit has to meet is to get a certificate from the country where it is manufactured. When a CNG kit importer gets a kit from abroad, the only thing that is examined is the certificate that importer gets from the country of manufacture. The kit, which comprises the valve, pipes and so on, is not tested. This is tested when a new vehicle is fitted with a kit or when a diesel bus is converted to a CNG bus by ARAI and other testing agencies. But there is no agency which checks whether a kit fitted to an old private car has been done properly. For this the Central Motor Vehicles Rules need to be amended.

What kind of measures should be implemented to check the use of spurious cylinders in CNG vehicles?
The Central Motor Vehicles Rules need to be amended to make an agency responsible for monitoring the installation of kits. This has to be amended by the standing technical committee formed under Ministry of Surface Transport (MOST). The members of the committee are Bureau of Indian Standards, Automotive Research Association of India (ARAI), Society of Indian Automobile Manufacturers and Vehicle Research and Development Establishment (Ahmednagar). The Indian Institute of Petroleum is not part of this committee.

safety in Mumbai

stations from where the vehicle had got the sticker.

The government found that duplicate cylinders were being manufactured from scrap metal in one particular area in Mumbai. Scrap is available at Rs 4 per kg. These cylinders can be bought for anything between Rs 1,000 to Rs 3,000 while the original costs around Rs 10,000 upwards depending on its capacity. Some taxi drivers even say that pipes (used for water supply) were taken, the ends welded and used as cylinders. With this kind of gross mismanagement, it is surprising that only two blasts have taken place. Once the checks started, one or two offenders did come to light but managed to escape. The registration numbers of their cars have been circulated to all stations and the police are on the lookout.

The Transport Commissioner's office has caught a couple of people manufacturing spurious CNG cylinders and a first information report (FIR) was lodged against them. They were put behind bars but they are now enlarged on bail. However, the blasts have really scared some of the petrol pump owners as they think that if something is not done soon, then their lives are at risk. In the meanwhile, some taxi operators have threatened the dealers that they have to be given CNG even if they do not have authorised kits.

Unfortunately, as a result of this the waiting time at CNG stations has become even longer. So now there are two lines — one for CNG dispensation and another for checking. Although the taxi drivers' union has been raising a hue and cry about this, the authorities have not relented. They say that a taxi gets filled with gas only once a day so even if that means that the taxi has to queue up for a couple of hours, it is worth it as this will eventually save lives.

Safety matters: Issues raised

In May, 2001, Centre for Science and Environment invited three international experts with wide experience in CNG technology, — Christopher Weaver, President, Engine, Fuel, and Emissions Engineering, Inc., USA, Lennart Erlandsson of Motor Testing Centre, Sweden, and Frank Dursbeck formerly with TUV Rheinland Sicherheit Und Umweltschutz GMBH, Germany, to evaluate the current emissions and safety regulations and CNG technology in India. These experts have pointed out the further scope of improvement in these areas to address the safety concerns.

Inspection of CNG vehicles

No provisions have been made for the inspection of in-use buses after conversion to CNG. In order to guarantee the compliance of the converted bus with the specifications of the type approved vehicle, it is important to inspect each and every bus before it is allowed on road. This inspection can be seen as equivalent to the foreseen conformity of production (COP) inspections for OEM CNG buses. This kind of system is already in place in many countries.

Each and every converted bus must undergo an inspection of the engine and high-pressure fuel storage system before being allowed on road. This inspection programme should subsequently be made annual for all operating CNG vehicles to check the emissions and safety compliance.

There should be a periodic inspection of CNG vehicles particularly those converted from diesel to CNG. The periodic inspection system in India consists of a road-worthiness inspection and a control of concentration of carbon monoxide in exhaust gas (maximum 3 per cent by volume at idle conditions). Going by experience in other countries, this is not sufficient to guarantee a correct functioning of the emission control system of CNG buses equipped with catalytic converters and closed loop mixture control. in a German Demonstration Project (BMU Demonstrationsvorhaben Emissionsarme gasbetriebene Nutzfahrzeuge) the following periodic inspection procedures for CNG vehicles have been very effective:

- **Visual check of components relevant to emission, including the exhaust emission system,**
- **Measurements of carbon monoxide, hydrocarbons, carbon dioxide and oxygen levels with the engine idling,**
- **Closed loop control check, and**
- **Determination of nitrogen oxides and carbon monoxide levels under full engine load (as specified in rule 115, sub-rule 2 of the Central Motor Vehicle Rules) on a simple chassis dynamometer (which costs less than US $20.000).**

This kind of inspection system should be introduced immediately as already a large number of CNG buses are operating for more than one year in Delhi. The inspection frequency for CNG buses should be set to one year, and combined with the annual road-worthiness check. Furthermore, all new and converted buses should undergo the same procedure before coming into operation in order to establish the reference values for the NOx standard and to verify that the closed-loop air-fuel ratio control is functioning properly.

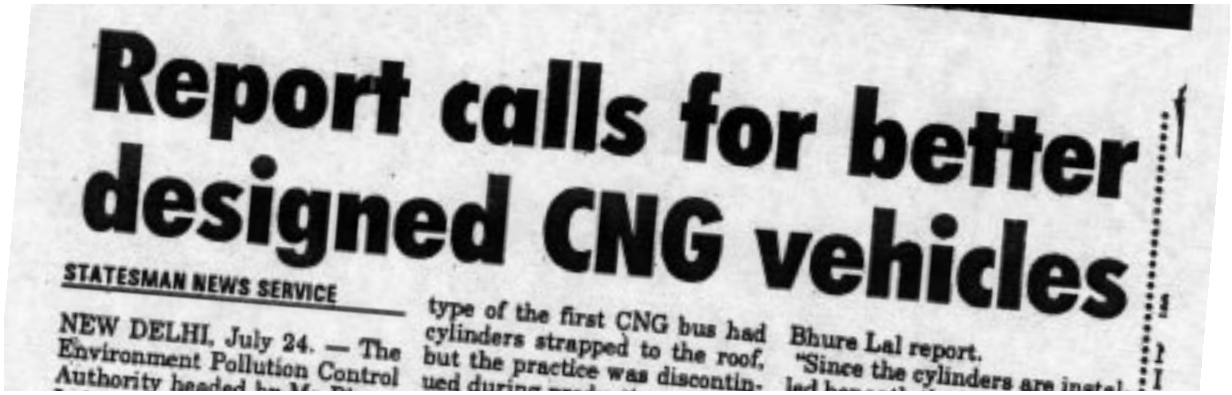
As standards to be fulfilled at idle the panel of experts recommended the following:

For carbon monoxide: 0.5 per cent by volume at idle and 0.3 per cent by volume at high idle (1,700 ± 150 rpm for buses and HDT, 2,650 ± 150 rpm for light-duty vehicles and light-duty trucks).

For oxides of nitrogen: type-specific standards should be defined based on reference values derived from the initial exhaust concentration inspection.

Conversion workshops should be authorised

According to the Union ministry of road transport and highways (MRTH) notification, conversion kit installation on in-use vehicles can only be carried out by workshops authorised by the kit manufacturer/kit supplier. But requirement for these workshops, either



Report calls for better designed CNG vehicles

STATESMAN NEWS SERVICE

NEW DELHI, July 24. — The Environment Pollution Control Authority headed by M. [illegible]

type of the first CNG bus had cylinders strapped to the roof, but the practice was discontin- ued during [illegible]

Bhure Lal report. "Since the cylinders are instal- led [illegible]

by the CSE panel of experts

legal or technical, have not been defined. This again is a reason for the recommendation made earlier to inspect each and every vehicle after conversion. MRTH must notify norms for the conversion workshops.

Other engine modifications desired

The experts panel noticed some flaws in the engines and engine designs of CNG buses as well. More detailed rules and guidelines for certification are required to deal with these.

In the production of the chassis, room for improvement lies in areas such as, material of the high-pressure piping, fixing of pipes to the chassis, tightening of the couplings, venting of the pressure relief valve and inspection of gas pipes. The experts felt that it should be avoided to mix brass fittings with pipes made of steel. Under moist conditions this combination could cause electro-galvanic corrosion. To avoid potential future problems with corrosion, they recommend the use of stainless steel fittings and tubing for high-pressure gas components.

Gas pipes should be mounted in such a way that movement and vibrations in the chassis are not transferred to the gas pipes, thereby causing a risk that the pipe could be broken or damaged by scraping after some time of use. It is common to use rubber wall tube insulators when bridging parts of the chassis and to attach the pipes to the chassis by the use of rubber pads. In addition, when vibrations cannot be avoided there should be enough room and length of the pipe to allow minor movements.

Experts have observed that leakage test is carried out after installation of the gas piping. This is necessary to identify whether there is leakage in the system. The leakage test is carried out by the use of soap-water brushed on each connection. Experts detected leakage in some places. To reduce the chance of leakage, it would be useful to use Teflon sealing tape in threaded fittings. Furthermore, it would be wiser to use compression fittings, where possible, or fittings with a tapered thread instead of cylindrical thread.

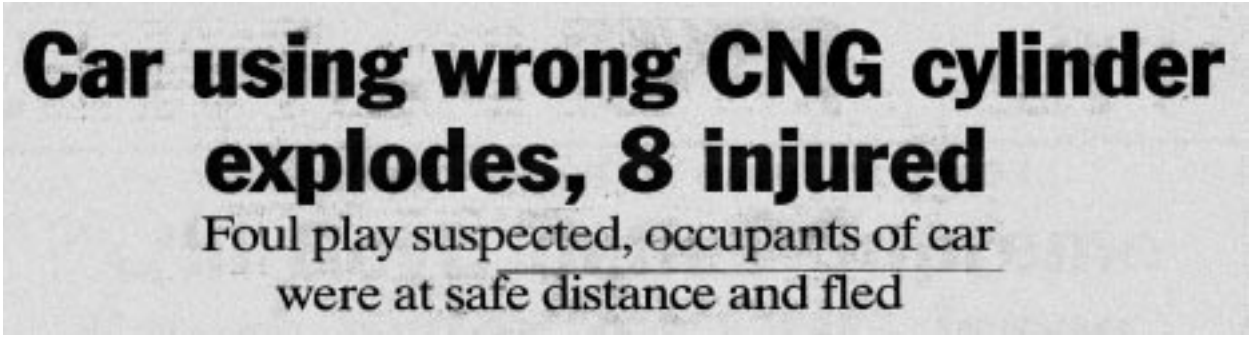
Each gas cylinder has a pressure relief valve to vent the gas if the cylinder is exposed to high temperatures or high internal pressure. As of now, the venting of the valve is not directed, thereby releasing the gas close to the cylinder. Since the cylinders are installed beneath the body of the bus, there is a risk that the vented gas will reach an area close to people or, in unlucky cases, may enter the passenger compartment. One solution would be to direct the venting of the pressure relief valve via a hose or piping to the roof of the bus. This would allow the gas to dissipate harmlessly upward, with little chance of contacting persons or ignition sources.

When a CNG vehicle has been in use for some time gas pipes should be visually inspected. However, gas pipes used in some case are covered with a protecting layer of plastic or rubber. This will make it very difficult to visually inspect the pipes. If stainless-steel tubing is used instead of ordinary steel, then it will not be necessary to cover the tubes to protect them from corrosion, and this will facilitate visual inspections.

Nozzles and safety

There are problems with the refuelling of vehicles with New Zealand Standard (NZS) nozzles mandated by the February 9, 2000 notification. Filling is slowed down by the frequent O-ring failures that these nozzles experience. Such failures occurred quite frequently at the refuelling stations, and they occur on average about every 20 fillings. This failure not only interrupts fuelling and requires replacement of the O-ring, it also creates a fire hazard due to the release of a significant amount of high-pressure gas.

Standardising all vehicle-refuelling receptacles on the NGV-1 standard would reduce fuelling time requirements and queues, and make possible more efficient use of existing compression capacity. It would also help to open other international markets to Indian CNG vehicles, as this fitting is by far the most common internationally.



Car using wrong CNG cylinder explodes, 8 injured

Foul play suspected, occupants of car were at safe distance and fled

MYTH 6: CNG technology is experimental and no other country has done such large scale conversion to CNG

- "There is no city in the world that has even one-tenth of the number of 10,000 buses targeted in Delhi, using CNG." — R K Pachauri, director, TERI in *Hindustan Times*, April 8, 2001

FACT

- ***CNG buses are coming in either to meet stringent emissions standards in more advanced markets or to catch up fast with better emission standards in developing countries.***

The claims that other cities of the world still do not have such a large fleet of vehicles are often made out of context. Public transport in Delhi was asked to move to CNG in the perspective of the extremely high levels of toxic pollutants in the city in the ambient air. No city in the world has been found with particulate matter pollution as high as that of Delhi.

But another reason why a large fleet of buses have not yet been made the target of mandatory alternative fuel regulations in European and US cities is because of lesser number of buses in those cities, lesser intensity of bus use and comparatively lesser relative contribution of buses to air pollution. It is also important to note that availability of CNG also varies from country to country but wherever it is available a move is being made to use it for transportation. Also tighter emissions regulations in future will help to phase in more alternative fuelled vehicles.

The report of the CSE panel of experts on CNG concludes, "In cities facing severe air pollution problems, the use of heavy-duty natural gas engines in place of diesels offers numerous environmental benefits. This has led cities from Tehran to Los Angeles to substitute natural gas for diesel engines in buses, garbage trucks, and other urban vehicles. Los Angeles, California, has more than 900 natural gas buses in service, and is in the process of adopting regulations requiring natural gas or other clean fuels in garbage trucks, and school buses as well. Mexico City has purchased more than 500 natural gas garbage trucks. Sacramento, California, has replaced more than two-thirds of its bus fleet with natural gas buses, and has a declared policy never to buy another diesel bus. Bangkok, Santiago, Cairo, Beijing, and many other major cities have also established natural gas bus programmes".[37]

MYTH 7: CNG will inhibit introduction of better engine technology in the future

- The trouble with a complete switch is that Delhi would be saddled with today's technology for years instead of phased modernisation which can be ensured by phasing out a proportion of a vehicles every year (*Business Standard*, May 21, 2001).

FACT

- ***Moving to CNG will not only help us to get emission results comparable to Euro IV norms, it will also straightaway reduce cancer risk from diesel vehicles significantly.***

- ***Since CNG is a cleaner fuel, it is possible to meet much tighter standards within a short time frame and make a quantum leap.***

In a situation where the government is content with moving at an extremely slow pace to tighten emissions standards, this contention seems almost pointless. Moving to CNG is actually helping the bus technology to make a quantum leap and catch up with better emissions standards fast.

If left to the designs of industry and government, very little advancement in engine and fuel is possible in the next 10 years. Society of Indian Automobile Manufacturers (SIAM) in its road map of future emissions standards has given the following plan for meeting tighter emissions standards:

- Passenger cars: Euro III in 2004
  Euro IV in 2007

- Multi-utility vehicles Euro II in 2002
  To skip Euro III
  Euro IV in 2008

- Heavy duty vehicles: Euro II in 2003
  To skip Euro III
  Euro IV in 2008


CNG is unproven, govt to say in court

EXPRESS NEWS SERVICE
NEW DELHI, DECEMBER 8

DELHI Transport Minister Hashmi today said the

HASHMI: Once I fit CNG kits in buses, I will take them to the court and ask for gas

This shows that according to SIAM's plan heavy-duty vehicles would meet Euro II norms only in 2003 and Euro IV norms as late as 2008.

The government plan to improve fuel quality is even more dismal. The new fuel norms under consideration for 2005 are at best by the government's own admission, close to only Euro II fuel standards. Clearly, there is no urgency to catch up with world standards in the interest of public health. The tribe of detractors that includes MOPNG would have to admit that even the little improvement in the fuel quality that has been possible so far is solely due to the Supreme Court order.

Moving to CNG will not only help us to get emission results comparable to Euro IV norms, for diesel vehicles it will also reduce cancer risk significantly straightaway. There is no reason why we should wait for eight more years for Euro IV technology if by moving to CNG today we can get results better than Euro IV norms. In the meantime the Supreme Court orders have made it possible to get rid of the old

pre-Euro I diesel buses replacing these and others with a much cleaner CNG technology. If the government now sets appropriate CNG emission standards in line with the European environmentally enhanced vehicles emissions standards then it will be possible to phase in much cleaner technology.

It is unfortunate that though CNG technology can help to meet much tighter emissions standards, existing emissions regulations for CNG vehicles are extremely flawed. The CSE experts panel report on CNG has pointed out that despite the fact

CSE experts

Stringent emission standards and better certification procedures could be used to bring in better CNG technology faster

The CSE experts panel evaluated the current emission regulations in force for CNG vehicles as notified in the February 9, 2000 notification of the Union ministry of road transport and highways (MRTH), and found them to be extremely inadequate.

- **The current CNG regulations only require that converted buses should meet the emissions standards meant for diesel and petrol vehicles of their year of manufacture. This does not recognise that CNG is a cleaner fuel and can meet much tighter emissions standards. This also fails to ensure same conversion procedures.**

- **Setting tighter emissions standards for gaseous pollutants for converted and retrofitted buses will eliminate the possibility of bad conversion that can lead to safety hazards. It is very important to ensure proper conversion as bad conversion can increase emissions of gaseous pollutants.**

- **Therefore, the present proposal of mandating Bharat stage I norms for retrofitment of old diesel buses with new CNG engines is not acceptable. To ensure that the conversion agencies take care of wear and tear of the old bus through proper repairs and according to the manufacturer's specification Bharat Stage II emissions standards should be made mandatory for vehicles to be retrofitted with new CNG engines and also for old engines to be to be converted CNG.**

- **Euro IV standards should be enforced for CNG vehicles from 2005 (same as for Europe), and Environmentally Enhanced Vehicles (EEV) should be simultaneously introduced with the help of economic incentives for new CNG vehicles meeting stricter standards.**

In addition to this requirements for durability testing, emission warranty and other commitments to be made by the manufacturer of the engine should also be laid down.

Each engine model should be separately certified

- **The February 9, 2000, notification also allows the extension of the type approval certificate to other engine/CNG-kit combinations than the one originally submitted for type approval. This is allowed as long as the engine displacement of the other engine is**

DELHI/TROUBLE ALL THE WAY

5 buses set ablaze, 40 damaged

By Prashant Pandey

NEW DELHI, APRIL 3. The Capital's first working day today after the Supreme Court's latest directive on eco-friendly CNG vehicles saw large-scale violence with five buses being set afire and another 40 damaged by angry commuters in different parts of the city.

The worst affected area was Badarpur in South Delhi where five buses were set on fire a score damaged. A large crowd gathered at the Badarpur border around 8 a.m. and surrounded police personnel stationed

The trans-Yamuna area saw 18 buses being damaged. While four were smashed at Mandoli border post in Nand Nagri and one in Bhajanpura, two each were stoned at Seelampur and near Gagan Cinema in North-East Delhi. Another bus was targeted at Trilokpuri in East Delhi.

So chaotic was the situation on the city roads that stranded commuters did not even spare buses carrying school children. A large number of people forcibly boarded a DTC bus ferrying children of St. Stephen's School, Tis Hazari, at Shastri Park. They even roughed up the conductor when he objected to their unruly behaviour.

Utter chaos on the road. The scene in Delhi on Tuesday in the wake of the CNG crisis. — Photos: Sandeep Saxena

that CNG is inherently a cleaner fuel our present emission regulations for CNG vehicles does not recognise this. Therefore, it has not been possible to get the best out of the CNG strategy. The CSE panel of experts have recommended that all vehicles either converted from old diesel engines or retrofitted with a new CNG engine must meet Euro II emissions standards. At the same time for new CNG vehicles Euro IV standards should be made mandatory in 2005 (same as for Europe), and simultaneously introduce Environmentally Enhanced Vehicles (EEV) standards with the help of economic incentives (see box: *CSE experts panel report*).

panel report

lower than that of the type-approved system, and within a certain range. This is possible for conversion of petrol engines fitted with carburettors, but not for converted diesel engines. As the current regulation has been interpreted, a conversion system developed and type approved for a specified diesel engine could be used on any other engine of equal or less engine displacement from any other manufacturer without any further type approval nor inspection. This can result in unacceptable exhaust emission levels, poor driveability and performance etc. The new draft notification from MRTH does address this issue but it is important to reiterate that certification is done model wise. The conversion kit and the engine have to be considered as a unique and optimised system. Engine converters must obtain a new type approval for each separate diesel engine model they seek to retrofit. Since the number of diesel engine models used in Delhi buses is small, — just three models, this would not pose much of a hurdle.

Table 4.1: Existing and future European emission standards for gas-fuelled engines for heavy-duty vehicles

CO	NMHC	CH4	NOx	PM	Level	"Euro"	Date of Implementation in EU
5.45	0.78	1.6	5.0	0.16	A	III	2000
4.0	0.55	1.1	3.5	0.03	B1	IV	2005
4.0	0.55	1.1	2.0	0.03	B2	V	2008
3.0	0.40	0.65	2.0	0.02	C	EEV	2000

NOTE:1. Please observe that the above specified limit values should be fulfilled by the use of the new European driving cycle (ETC, European transient cycle).

2. All units are in g/kwh.

Source: Frank Dursbeck *et al* 2001, *Status of implementation of CNG as a fuel for urban buses in Delhi*, study done for Centre for Science and Environment, New Delhi, May, p 12.

Delhi passes the buck to Centre on CNG chaos

By Our Staff Reporter

NEW DELHI, April 3. Stating that it would not be possible to meet the September 30 deadline on plying only CNG buses on Delhi roads, the State Assembly today unanimously passed a resolution blaming the Centre for the present crisis and failure to put adequate infrastructure and urging the Supreme Court to accommodate the concern of the members of the Assembly.

Moving the resolution, the Delhi Transport Minister, Mr. Parvez Hashmi, said that the CNG technology was not a success as was evident from inputs

alternative arrangements could be made. It is the responsibility of the elected representatives of Delhi to provide them uninterrupted transportation and also to provide them clear air in Delhi. The Central Government had failed to provide an adequate number of authorised agents for conversion of diesel engines. This inaction has created a monopoly that is detrimental to any successful outcome of this issue. No initiatives appear to be forthcoming from the Central Government in this regard".

It further said:"This House urges the Central Government to ensure that more authorised agents are

MYTH 8: There is not enough gas to meet the demand of Delhi's vehicles

- Union minister of petroleum and natural gas Ram Naik told parliament on Wednesday that there were limitations to supplying CNG as production from the Oil and Natural Gas Corporation (ONGC) gas fields was declining. "Any diversion of the committed supplies to the vital sectors like power and fertiliser will affect them adversely," he pointed out (*Financial Express*, July 26, 2001).

- "The real glitch is that there is simply not enough CNG to go around. Did it occur to anyone to stock up on the fuel the minute the court issued its orders? Of course not" (*The Times of India*, March 28, 2001).

FACT

- ***MOPNG is trying to project that an acute fuel crisis is about to hit public transport. They have inflated demand projections of CNG much beyond the estimates by Indraprastha Gas Limited (IGL) and argue that available gas cannot meet this kind of demand.***

- ***This claim comes at a time when IGL fails to meet its commitment to set up all the 80 CNG stations as mandated by the Supreme Court and falls short of converting all the 'daughter stations' to 'daughter-boosters' to help keep uniform pressure for gas and reduce filling time.***

- ***MOPNG is silent on the fact that it is possible to increase allocation for the transport sector. In the meantime more gas has been allocated for affluent households in Delhi to substitute LPG that will not make any impact on the air quality.***

While more gas has been allocated for affluent households in Delhi, MOPNG is silent on the fact that it is possible to increase allocation for the transport sector

MOPNG has suddenly woken up to a new reality — that it has to ensure long-term supply of CNG to the city. But it is also looking for an escape route to avoid making such commitments. The ministry did not take the Supreme Court orders of July 1998 to move the entire public transport system to CNG, seriously. They had only considered buses but not the autos and taxis which were also mandated to move to CNG. Surely 80 CNG stations would not have been ordered by the Supreme Court if only buses had to be catered to. (The real reason for the ministry's slumber is, as one senior official put it, "We did not expect the orders to be implemented.")

The ministry has argued that it cannot supply the growing use of CNG by vehicles. But there are several discrepancies in the CNG demand figures given by the Ministry of Petroleum and Natural Gas (MOPNG) and the Indraprastha Gas Ltd. (IGL). According to the Planning Commission, the ministry has allocated 3.07 million standard cubic metre per day (MMSCMD) that is, 24.76 lakh kg per day (one kg of CNG is equivalent to 1.24 standard cubic metre) of natural gas for Delhi as follows:

Power: 2.60 MMSCMD (20.97 lakh kg per day)
Delhi Vidyut Board (DVB): 0.84 MMSCMD (6.77 lakh kg per day)
Pragati Power: 1.75 MMSCMD (14.11 lakh kg per day)

Others (which includes vehicles and households): 0.48 MMSCMD (3.87 lakh kg per day)

According to the ministry, only an allocation of 0.15 MMSCMD (1.21 lakh kg per day)

has been made for vehicles. The rest has apparently been made for households. It is now quite clear from the various estimates available from the IGL and MOPNG that their demand projection has always remained flawed and they are playing around with it to mislead everybody.

Demand and supply projections of IGL, made in April 2001, show that the dispensing capacity will always remain ahead of the projected demand

According to the submission of IGL on April 4, 2001 to EPCA,

- While the total demand of CNG from buses, autos and taxis in April 2001 was 1.00 lakh kg per day the supply capacity was 2.23 lakh kg per day[38] (about 0.28 MMSCMD). In other words, according to this estimate, the current demand then was only 51 per cent of the available dispensing capacity.
- One bus consumes about 56.5 kg of CNG per day[39]. Therefore, if 10,000 buses were to run on CNG, the demand from buses only would be 5.65 lakh kg per day (0.7 MMSCMD).
- Supply by October 2001 would be 6.65 lakh kg per day (0.82 MMSCMD).[40] Thus, there would be excess CNG available even after catering to all the buses. Clearly availability of CNG as such was not a problem according to IGL as on April 2001 (see table 8: *Demand and supply*).

Thus, demand and supply projections of IGL, made in April 2001, show that the dispensing capacity will always remain ahead of the projected demand till March 2002.

Around the same time, Ram Naik also pointed out that adequate quantity of natural gas was available for the city. According to his estimates presented to the media in the first week of April, there was supply of 1.96 lakh kg per day of CNG as against a demand of 0.95 lakh kg per day. Thus, according to his estimates, the present capacity utilisation was only of about 48.5 per cent.[41]

Table 8: Demand and supply

IGL has gone back on its earlier claims that there was excess supply of CNG in the city. Its revised estimates show that it will only be able to meet the demand by February 2002

Month	IGL's estimates in April 2001 Demand (lakh kg/day)[1]	IGL's estimates in July 2001Demand (lakh kg/day)[2]	IGL's estimates in April 2001 Dispensing Capacity (lakh kg/day)[1]	IGL's estimates in July 2001 Dispensing Capacity (lakh kg/day)[2]
Installed capacity in March 2001	1.00	NA	1.96	NA
April 2001	1.4	1.79	2.2	1.83
July 2001	2.5	3.3	3.6	2.22
September 2001	3.4	4.2	5.6	4.4
October 2001	3.8	4.75	6.7	4.5
November 2001	4.4	5.44	8.1	4.6
December 2001	5.1	6.21	9.5	5.3
January 2002	5.9	7.20	11.0	6.8
February 2002	6.8	8.12	12.7	9.0
March 2002	7.6	9.10	14.3	11.7

Note: Both the studies have considered the same number of vehicles in all categories but their per unit consumption varies considerably.
Col 2 and Col 4: Average consumption of CNG per day Bus: 56.5 kg Cars/taxis 4 kg Auto 3 kg
Col 3 and Col 5: Average consumption of CNG per day Bus: 70 kg Cars/taxi: 8 kg RTV/LCV 18 kg Autos 5 kg

Source: Col 2 and Col 4: Indraprastha Gas Ltd, 2001, Status of CNG Infrastructure:existing and augmentation plan, submission to EPCA, April 4, *mimeo*.
Col 3 and Col 5: Indraprastha Gas Ltd, 2001, CNG activities of IGL, submission to EPCA, July 14, *mimeo*.

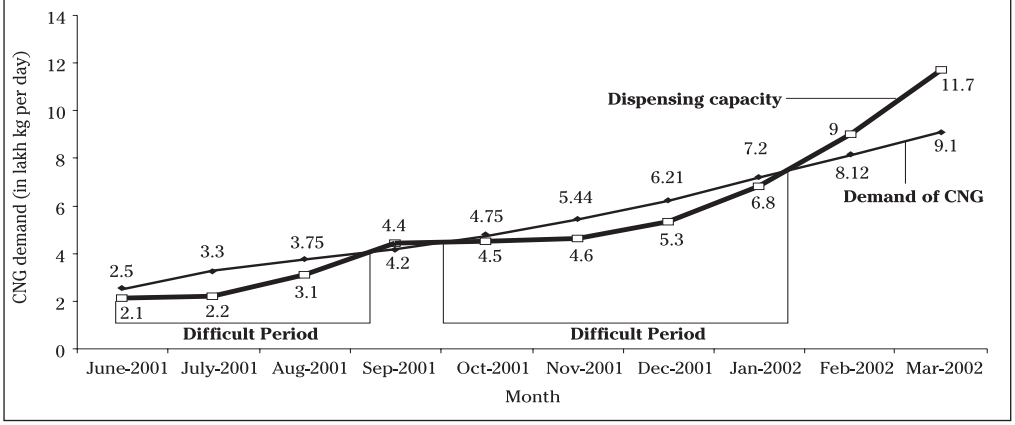
But a new game unfolded in the month of July, 2001, when the former managing director Rajiv Sharma was dismissed and with the change of guard the estimates for demand and supply also changed overnight.

In its presentation to EPCA in July 2001, IGL revised its older estimates. In the new estimates, they modified the consumption figures for all vehicles. While according to the old estimates given in April a bus consumed 56.5 kg of CNG per day, the new estimate is that of 70 kg per day. The new daily consumption estimate for cars and taxis was doubled from 4kg to 8 kg and that of three-wheelers from 3 kg to 5 kg.[42]

The consequence is that the July estimate shows that the dispensing capacity will catch up with demand only in September 2001 once, slide back again and then catch up once more in February, 2002 (see graph 8: *CNG demand and dispensing capacity of IGL*).

Graph 8: CNG demand and dispensing capacity of IGL

According to the latest estimates of the Indraprastha Gas Limited, it can meet the full demand of CNG only by Februrary 2002



Source: Indraprastha Gas Ltd, 2001, CNG activities of IGL, submission to EPCA, July 14, *mimeo*.

A new game unfolded in the month of July, 2001, when the managing director of IGL was dismissed and with the change of guard the estimates for demand and supply also changed overnight

What is the petroleum and natural gas ministry doing about this?

MOPNG is trying to cash in on the existing shortfall to create a sense of an acute fuel crisis to hit public transport in Delhi.

MOPNG has tried to inflate the demand projection of CNG much beyond the IGL estimate. The ministry projects that CNG demand in Delhi will increase to almost 16 lakh kg per day by June 2002 against the present allocation of 1.2 lakh kg per day (see table 9: *Inflated*). This is an increase of over 13 times. However, if the latest consumption figures as given by IGL are used for the number of vehicles used by MOPNG, the demand goes up to 21.5 lakh kg per day (see table 10: *Difference of opinion*). IGL now estimates that CNG demand will go up by almost 12 times by March 2002, but the difference between IGL and the ministry's projection for the per day consumption in 2002 is still in the region of more than 5 lakh kg of gas. The ministry has played around with the number of vehicles very liberally to project very high demand for gas.

The ministry's estimates are based on a number of erroneous assumptions (see table 10: *Difference of opinion*). Even when three-wheelers (these are the only light public transport vehicles run on petrol because taxis run on diesel) were allowed to run on petrol their total registered number in January 1999 was about 87,000.[44] If the

Table 9: Inflated

Demand of CNG in Delhi estimated by Union the ministry of petroleum and natural gas is exaggerated

Vehicle type	Projections for June 2002		
	Number of vehicles	Demand in kg per day	Demand in standard cubic metre/day (SCMD)
Buses	12,000	677,994	843,425
Petrol driven vehicles: Light public transport vehicles	150,000	700,800	871,795
Petrol driven private cars	70,000	200,000	248,800
Total	232,000	1,578,794	1,963,020

Source: Anon 2001, Supply of CNG and its sustainability and clean liquid fuels, Submission of the ministry of petroleum and natural gas to Shri Bhure Lal committee, April 20, *mimeo*.

MOPNG's projection of demand for CNG in Delhi is based on wrong assumptions and is almost double the estimate of IGL

fact that no commercial vehicle more than 15 years old are allowed to operate in Delhi is taken into account, it would bring their number down to about 57,000. Even IGL's estimate puts the number of three-wheelers at around 50,000 in March 2002.[45] Therefore, the estimate of the ministry is a gross overestimate for autos, almost three times higher than the actual numbers.

The number of cars on CNG, according to the ministry, would be 70,000 in June 2002.[46] This again is a clear case of exaggeration. IGL estimates that the number of

Table 10: Difference of opinion

The MOPNG and the IGL differ on the number of vehicles they expect will run on CNG in Delhi

Description of Vehicle		IGL estimates for March 2002[1]			MOPNG estimates for June 2002[2*]	
IGL	MOPNG	Projected number of vehicles in March 2002	CNG demand as estimated in April 2001 (kg per day)	CNG demand as estimated in July 2001 (kg per day)	Projected number of vehicles in June 2002	CNG demand as estimated in June 2002 (kg per day)
Buses	Buses	8,170	461,605	571,900	12,000	840,000
Autos	Petrol-driven vehicles: Light public transport vehicles	49,500	148,500	247,500	150,000	750,000
Cars/Taxis	Petrol-driven private cars	35,900	143,600	287,200	70,000	560,000
RTV/LCV	—	1,500	6,000	27,000	—	—
Total	—	95,070	759,705 7.59 lakh kg per day	1,133,600 11.33 lakh kg per day**	232,000	21,50,000 21.50 lakh kg per day

Notes: 1) 1.24 standard cubic metre/day = 1 kg/day
According to IGL estimates of July 2001, 2) One bus consumes 70 kg per day. 3) One car/taxi consumes 8 kg per day.
4) One auto needs 5 kg per day. 5) RTV/LCV 18 kg per day.
*Demand for CNG has been calculated on the basis of consumption figures as given by IGL in its July 2001 presentation to EPCA, keeping the estimated number of vehicles same as in the original MOPNG estimate.
**Demand estimates submitted by IGL to EPCA in July 2001, are erroneous. Even without changing the number of vehicles and their CNG consumption per day, the demand comes to 11.33 lakh kg per day against 9.1 lakh kg per day in March 2002, as estimated by IGL.
Source: 1) Anon 2001, Submissions of IGL to EPCA on April 4 and July 14, *mimeo*.
2) Anon 2001, Supply of CNG and its sustainability and clean liquid fuels, Submission of MOPNG to Shri Bhure Lal committee, April 20, *mimeo*.

cars and taxis put together would be around 37,400 in March 2002.[47] Thus, the ministry's estimate is almost double of the actual numbers. The number of registered taxis in 1998 was 1.66 million. After getting rid of more than 15 years old it cannot still exceed maximum 10,000. There is no reason for such dramatic increase in the number of private CNG cars.

Delhi Govt wrong, there's enough CNG, says Centre

MOPNG has projected the demand so high to argue that investment to meet such high level of demand will be quite prohibitive as this would need major improvements in the system, including upgradation of the existing pipeline system from Hazira to Dadri and Delhi (with a length of about 1,145 km), which will involve a huge cost.[48]

IGL FAILS TO KEEP ITS COMMITMENTS: SUPPLY OF CNG FAILS TO KEEP PACE WITH DEMAND

The long queues for CNG and harrowing experience of the CNG users are legend. IGL has failed to speed up its dispensing capacity and supply to meet the sudden surge in demand for CNG despite its commitments to the EPCA. Once the Supreme Court made it clear that it would not entertain any dilution of its original order, the CNG market that was sluggish initially, picked up and within a very short time a large number of vehicles in different segments rolled in (see table 11: *High on gas*). IGL was caught unawares.

People are only busy counting the numbers of stations. Even though as many as 74 stations as against the original mandate of 80 stations are in place it is the inadequate dispensing capacity and low pressure levels in each of these stations that have compounded the problem.

Latest projections of demand and supply from IGL show that supply will fall short of demand till the end of 2001 and long queues can be expected till then.

Just in three months IGL has backtracked on many of its earlier commitments to EPCA (see table 12: *Yawning gap*). In May 2000, IGL had assured that compressors needed to convert all daughter stations to daughter-booster stations (in order to provide speedy dispensing of CNG) were already on their way from Argentina. But these are still not in place.[39] Because of these delays there are long queues of cars, autos and buses waiting to get CNG.

INVESTMENTS DELAYED

It is obvious that IGL has not made timely investments. IGL had plans to spend Rs 328 crore in the first phase but has spent only Rs 123 crore of that till now.[50] Only now when the court order is on its head is IGL thinking of taking a loan of Rs 200 crore from the Oil Industry Development Board. Converting daughter stations to daughter booster stations is the need of the day to increase dispensing capacity. But it is clear that orders for compressors were obviously not placed in time and thus from April 2001 to July 2001 only five daughter stations could be converted to daughter booster stations.

In the meantime the queues for CNG are getting longer and rarely do consumers get a tankful of CNG. Why is this so? There are several issues related to the supply of CNG:

a) Speedy supply at dispensing stations,
b) Long-term assurance supply of CNG, and
c) Reliability of CNG supply

Table 11: High on gas

Number of CNG vehicles has increased sharply by as much 46.6 per cent from April 2001 to July 2001

Number of vehicles	April 2001	July 2001
Buses (DTC)	175	700
Buses (Private)	100	620
Three-Wheelers	13,500	22,575
Cars/Taxis/RTVs	11,100	13,500
Total Vehicles	26,876	39,396

Source: Anon 2001, Submissions of IGL to EPCA , April 4, 2001 and July 14, 2001, *mimeo.*

Latest projections of demand and supply from IGL show that supply will fall short of demand till the end of 2001 and long queues can be expected till then

Table 12: Yawning gap

IGL has failed to meet its commitments to expand the CNG distribution network in Delhi

Type of stations	Status reported as on April 2001	Commitments made by IGL on their future plans on April 14, 2001	Status reported as on July 11, 2001
Mother stations for dispensing CNG	8	15 by July 2001	9
Online stations for dispensing CNG	13	—	16
Daughter stations	44	All daughter stations to be converted to 'daughter-boosters' by August 2001	39
Daughter-booster stations	3	50	8
Dedicated CNG stations for DTC buses	3		4
CNG dispensing capacity	2.23 lakh kg per day	3.5 lakh kg per day – 42 per cent more than estimated demand and will stay ahead of demand till at least March 2002	2.2 lakh kg per day – 33 per cent less than demand and will catch up only in September 2001, slip upagain after that and catch up only by January 2002

Source: Anon 2001, Submissions of IGL to EPCA , April 4, 2001 and July 14, 2001, *mimeo.*

Number of dispensing stations

A researcher of CSE who visited Mumbai in April 2001, found that while Mumbai was dispensing one lakh kg of CNG per day through 22 stations,[51] Delhi supplied 0.95 lakh kg of CNG per day through 68 stations,[52] that is, over three times the number of dispensing stations than Mumbai. However, by June 2001, the daily sales in Delhi went up to 1.92 lakh kg per day.

Mumbai also has long queues but this is mainly because of a large number of

vehicles, not the long time taken in dispensing CNG. In Mumbai, Mahanagar Gas Ltd has to set up more dispensing stations but there is a serious problem of land availability and there is not enough space in existing petrol pumps because of safety requirements for CNG dispensing stations. So why does Delhi with so many dispensing stations have long queues? Several factors are responsible for this.

One factor is the lack of an adequate number of compressors. In Delhi, out of 74 stations, 47 are daughter stations of which only eight have compressors or boosters.[34] In comparison, Mumbai has 22 stations, of which there are only four daughter stations, all of which are equipped with boosters (see table 13: *Action stations*).[55]


Delhi blames petro ministry, IGL says it's on target

CNG DEADLINE

Table 13: Action stations

Despite having fewer stations than Delhi, Mumbai has a higher rate of dispensing CNG daily

Type of station	Mumbai	Delhi
Mother stations	1	9
Online stations	17	18
Daughter-booster stations	4	8
Daughter stations	-	39
Total CNG dispensing stations	22	74

Note: **Mother station**: a station which is attached to the gas pipeline and which delivers CNG at a pressure of 250 bar to cascades.
Online station: a station which is online and has a smaller compressor to deliver CNG to vehicles at 250 bar.
Daughter-booster station: a daughter station with its own compressor (booster).
Daughter station: a station which receives a cascades (CNG tank) from a mother station.

The biggest compressors, which are installed in mother stations, have a flow rate of 1,100 kg/hour. For online stations, a smaller compressor is used which can fill 250 kg/hour. Both these compress the gas up to 250 bar pressure and can serve two dispensers at one time, that is, they can help to fill up four vehicles at one time (one dispenser is used to fill two vehicles).[56] Therefore, lack of adequate number of compressors in a dispensing station can result in the dispensers becoming non-functional. For instance, at the dispensing station near CGO complex, in spite of there being five dispensers, all of them cannot be operated simultaneously as there is only one compressor. IGL is in the process of installing a second compressor in that station.[57]

There is another type of compressor called booster, which is used only in daughter stations. The booster is used to increase the pressure of the gas when the pressure in a cascade drops to about 180 bar from the required filling pressure of 200-220 bar while dispensing gas. In absence of a booster, it is not possible to dispense gas once the pressure level falls to 180 bar, and then the cascade has to be changed.[58] Cascades full of CNG under adequate pressure are brought to a daughter station after being filled at a mother station. A mother station is connected to the pipeline.

A study on filling time of three-wheelers done by IGL in daughter stations without

boosters in Delhi showed that when the filling pressure is 200 bar, it can fill the cylinder of a three-wheeler to its full capacity, that is, 3.5 kg in 90 seconds. But when the pressure drops to 180 bar in the cascade, it can fill up to only 3.15 kg. It takes 67 seconds to do so. At a pressure of 165 bar, the cylinder can be filled up to 2.89 kg only in 48 seconds, and at 150 bar only 2.63 kg can be filled up and it takes 29 seconds to do so. At this pressure, it is not possible to fill the cylinder any more and the cascade needs to be changed and replaced with a new one.[59] In other words, once the pressure drops in the cascade of a daughter station, very little gas gets filled up in the vehicle's cylinder. This means that a commercial vehicle which runs all the day has to keep coming back to a refilling station.

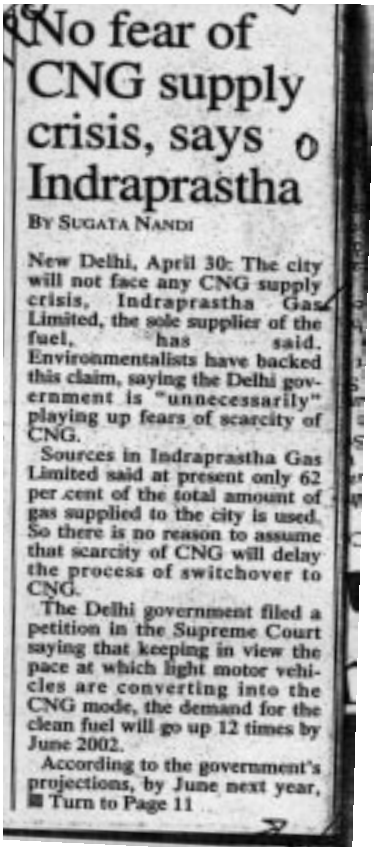
Number of cascades in a dispensing unit

This points out to another problem in the dispensing of CNG in Delhi, that is, inadequate number of cascades in a daughter station. If there are an inadequate number of cascades, then the dispensing station will have to be closed till more cascades are obtained. While the daughter stations in Mumbai have 3-6 cascades on average, in Delhi, there are less than three cascades for each daughter station. There are 47 daughter stations in Delhi and about 120-125 cascades. At a given point of time one cascade is used, one is getting filled up at the mother station and one is in transit. Not surprisingly daughter stations often have no gas to dispense in Delhi.[60]

Distribution of dispensing stations

Besides the problems with the dispensing stations, the distribution of dispensing stations is also a problem. There are 31 stations in south Delhi in comparison to 12 in north Delhi and 11 in central Delhi. East and west Delhi have only nine stations each. While all the mother and online stations are restricted to north and south Delhi, east Delhi has only daughter stations and that too without boosters. All the nine stations in west Delhi are daughter stations but only two with a booster.[61] This means that IGL must move fast to extend the pipeline to east and west Delhi (see table 14: *Weak links*).

According to MOPNG, though there are 74 CNG stations in Delhi but only 16 online stations are catering to 75 per cent of the demand and that is resulting in long queues.[44] If this is true, it is obvious that this is happening because better pressure is maintained at the online stations.[62]



No fear of CNG supply crisis, says Indraprastha

By Sugata Nandi

New Delhi, April 30: The city will not face any CNG supply crisis, Indraprastha Gas Limited, the sole supplier of the fuel, has said. Environmentalists have backed this claim, saying the Delhi government is "unnecessarily" playing up fears of scarcity of CNG.

Sources in Indraprastha Gas Limited said at present only 62 per cent of the total amount of gas supplied to the city is used. So there is no reason to assume that scarcity of CNG will delay the process of switchover to CNG.

The Delhi government filed a petition in the Supreme Court saying that keeping in view the pace at which light motor vehicles are converting into the CNG mode, the demand for the clean fuel will go up 12 times by June 2002.

According to the government's projections, by June next year,

Turn to Page 11

There are 31 stations in south Delhi in comparison to 12 in north Delhi and 11 in central Delhi. East and west Delhi have only nine stations each

Table 14: Weak links

Most of the dispensing stations are located in south Delhi. This shows that there has been practically no planning on how to supply CNG to the entire city

Type of station	Zone					Total
	East	West	North	South	Central	
Mother - IGL	0	0	2	3	0	5
Mother - DTC	0	0	1	3	0	4
Online	0	0	2	10	4	16
Daughter	9	7	4	14	6	39
Daughter booster	0	2	3	1	1	8
Total	9	9	12	31	11	72

Source: Anon 2001, CNG activities of IGL, Indraprastha Gas Limited, New Delhi, submission to EPCA, July 14, *mimeo*.

Nozzles blamed for long filling time

As queues for CNG got longer, IGL and the industry began to squabble over whom to blame. Since CNG three-wheeler drivers were most affected by these long lines industry blamed it on low pressure in the dispensing stations. But IGL was not willing to accept that and held outdated nozzles fitted to the three-wheelers responsible for slow filling time. IGL points out that the gas pressure is adjusted according to the size and capacity of the filling intake of different vehicle types. Thus, when filling a three-wheeler the pressure is lowered and again increased when filling a bigger vehicle. IGL attributes this problem to the design of the nozzle currently used by Bajaj Auto three-wheelers which does not allow free flow of gas and, therefore, creates back-pressure if filling is done at a high pressure.[63] Constant adjustments in pressure at the dispensers lead to delays. No information is available on the situation in Mumbai as the number of three-wheelers in Mumbai is still very small – just about 190.

ARAI report on nozzles

Since a major controversy ensued over this matter, EPCA set up a committee to resolve this issue. The report submitted to EPCA by B B Bhanot, director, ARAI, who coordinated the committee, contradicts IGL's claim that changing from the New Zealand Standard (NZS) nozzles used by Bajaj Auto to the Natural Gas Vehicle-1 (NGV-1) nozzles in three-wheelers will help in reducing filling time. The report does not give any data on the difference in filling time between three-wheelers fitted with NGV-1 nozzles and NZS nozzles. In case of taxis it only mentions that taxis with NZS nozzles need 16-20 second per kg of filling time but does not give the corresponding data for NGV-1 nozzles. Yet it concludes that, "since the requirement of gas in taxis is limited to 5-7 kg, the time limitation hardly has any bearing on the overall cycle time for a turnaround of one vehicle." It goes on to conclude, somewhat arbitrarily for both taxis and autos, that "nozzle size for autos and four-wheelers is a non-issue." It also says, "The reason for long queues for three-wheelers and four-wheelers in Delhi were due to the filling pressure at the dispensing stations not being adequate for faster filling. Filling time more or less remains same both with NGV-1 and NZS type filling nozzles."[64]

Yet the limited data presented by the report contradicts its conclusions. It says that buses fitted with NGV-1 nozzles take comparatively less time (4-5 seconds per kg) than those fitted with NZS nozzles (7-8 seconds per kg). "Mother stations have been installed for filling of commercial buses in Delhi which have bigger compressor capacity and hence use of NGV–1 nozzle helped in reducing the filling time," the report points out. It goes on to recommend that "Buses should be fitted with NGV-1 nozzles as they require larger volume/quantum of gas. Besides the dispensing stations should have a commensurate compressor capacity depending upon the quantum of gas requirement/hour. Even in Mumbai it would be preferable to changeover to NGV-1 nozzles for buses, as eventually when compressor capacities are enhanced, there would be a reduction in filling time."[65]

The report also expresses apprehensions that in Delhi some filling stations have started insisting on NGV-1 nozzles and vehicles are being converted from NZS to NGV-1 violating the safety code of practice. For instance, they are not installing an interlock electrical system for ignition cut-off during refilling or any ventilation provision for gas leakage, the report points out.[66]

Thus the report fails to make it clear whether changing over to NGV-1 nozzles in three-wheelers will help to reduce filling time. But it implies that nozzles could reduce filling time further after ensuring adequate pressure of the gas at the point of dispensation has substantially reduced it.

The CSE experts panel on CNG however found NZS nozzles inappropriate mainly because of frequent O-ring failures on an average after every 20 fillings. While this disrupts filling it also compounds safety hazard as gas escapes when the O-ring snaps. They recommended changing over to NGV-1 nozzles.[67]

The CSE experts panel on CNG found NZS nozzles inappropriate mainly because of frequent O-ring failures on an average after every 20 fillings. They recommended changing over to NGV-1 nozzle

GAS ALLOCATION

MOPNG argues that production and supply of natural gas from the ONGC wells are declining on account of the fact that these wells are more than 15 years old. In this scenario, increasing the allocation of more CNG to Delhi would mean decreasing the allocation of natural gas to industries, power stations and fertiliser units which are being fed from the existing gas pipeline. "This would have a serious impact on the economy of the country" says the ministry.[68] But the ministry is not concerned about improving public health.

The ministry, therefore, does not want autos, taxis and cars to get converted to CNG. Instead it wants them to continue to run on the petrol (unleaded petrol with 1 per cent benzene) and diesel (with 500 ppm sulphur content) which are now available in Delhi. The ministry is only prepared to assure gas supply for 12,000 buses. But this is only the current busload in the city. The city is scheduled to grow from its current population of 14 million to more than 22 million in 2021.[69] How will the gas needs of the future bus requirements be met? It is obvious that the current allocation strategy has to change to take into account public health.


No CNG stations in outer, east Delhi: Centre

EXPRESS NEWS SERVICE

Shahdara Depot II, Yamuna Vi-
har, Nangloi and Kashmiri
Apartment Depot are installing
of operations will take 12 to 14
months, the letter said.
The Union minister's letter
was in response to a letter written

THE Ministry of Petroleum
and Natural Gas has said that it
will not be able to provide CNG
stations in outer and east Delhi

The key issue here is prioritising allocation of natural gas. There is much scope of allocating more natural gas to Delhi but MOPNG is not willing to do that. Instead it is trying to raise the bogey of gas shortage.

Even as the transport sector is being starved of gas, piped gas is being supplied to hotels and affluent households. It was first supplied to Kaka Nagar, Bapa Nagar and Pandara Park in 1997 as a pilot project. Since then it has been extended to Golf Links, Sunder Nagar and Sujan Singh Park. More recently, gas supply has started in Nizamuddin (east and west), New Friends Colony, Friends Colony, Maharani Bagh, Kalindi Colony, Sukhdev Vihar, Sukhdev Vihar Pocket A & B, Ishwar Nagar and Zakir Bagh. In addition, five-star hotels The Hyatt Regency, Hotel Taj Mahal, Hotel Oberoi, Hotel Ambassador and Hotel Surya have switched over to natural gas for commercial application like cooking, water heating, air conditioning, space heating, and power generation.[70]

All these areas are high income areas which were earlier using LPG. Switching from LPG to CNG will have almost no impact on pollution reduction. In any case, there is no shortage of gas, it is a question of allocating enough gas to meet the vehicular demand of Delhi.

Gas allocations are made by MOPNG on the recommendations of the Gas Linkage Committee (GLC), which is an inter-ministerial committee with representatives from the planning commission, and the Union ministries of finance, power, chemicals and fertilisers and steel. The allocations are made based on the requests received, taking into consideration the existing allocations and the gas availability projections in different regions from time to time.

In view of the importance of the fertiliser and power sectors in the national economy, preference in allocations has been given to these sectors. As and when shortage of gas is perceived in any region, an action plan for the region is drawn up and approved by the GLC wherein fertiliser and the power sectors are given priority. The departments of fertiliser and power are consulted in this regard and the GLC, while approving the action plan considers the bulk allocation for each of these sectors while leaving the individual requirements of each unit to these departments within the overall allocation for the sector. All gas-based units are required to have dual fuel capability so as to use other fuels whenever availability of gas is restricted.

The Planning Commission has set up a working group on petroleum and natural gas for the Tenth Plan under the chairmanship of the secretary, MOPNG. The working group has set up various subgroups including a subgroup on demand of petroleum products and a subgroup on natural gas production, availability and utilisation. The working group coordinates the functioning of the various subgroups. This practice was also followed for the Ninth Plan.

At present the gas allocation for consumers in Delhi is 3.07 MMSCMD (24.76 lakh kg per day) — 2.59 for power and 0.48 for other consumers. Out of 0.48 MMSCMD (3.87 lakh kg per day) only 0.15 has been allocated for transport and the remaining 0.33 MMSCMD (2.66 lakh kg per day) for households. Though there is a proposal from IGL requesting GLC to allocate an additional 1 MMSCMD (8.06 lakh kg per day) of gas to Delhi, MOPNG has shown no intent to approve the proposal.

According to IGL's estimate, Delhi's transport will need about 11.33 lakh kg per day by March 2002. This is just 4.1 per cent of the capacity of the HBJ pipeline

IGL claims that the all their CNG stations are over-utilised and are working at more than 100 per cent of their capacity. Gas dispensation capacity is estimated on the basis of the 18 hours of operation per day. But as of now they are operating their stations for almost 24 hours. But even with this kind of utilisation, IGL is not able to meet the demand for transport in July 2001. IGL's dispensing capacity in July, 2001, is 0.27 MMSCMD (2.22 lakh kg per day).

According to IGL, out of an allocation of 0.48 MMSCMD (3.87 lakh kg per day) only 0.15 (1.21 lakh kg per day) MMSCMD has been allocated to the transport sector. This means that IGL is already diverting 0.12 MMSCMD (0.96 lakh kg per day) from the allocated gas to the domestic sector. IGL can play around with supply as long as it is within 0.48 MMSCMD (3.87 lakh kg per day), according to its new managing director, A K Dey . Going by IGL's estimates, in September 2001, the total demand by the transport sector will be 0.52 MMSCMD (4.2 lakh per day) and dispensing capacity will remain around 0.54 MMSCMD (4.4 lakh kg per day). Both overshoot the total allocation of 0.48 MMSCMD. Therefore, at least 0.06 MMSCMD (0.48 lakh kg per day) will have to be allocated from other sectors for Delhi by September 2001.

According to MOPNG, Delhi will need a maximum of 2 MMSCMD of CNG (16.13 lakh kg per day) in June 2002. This means a further allocation of 1.52 MMSCMD of natural gas to the city is required. According to IGL's corrected estimates Delhi's transport will need only about 1.4 MMSCMD (11.33 lakh kg per day) by March 2002. This is just 4.1 per cent of the capacity of the Hazira-Bijaipur-Jagdishpur (HBJ) pipeline with a capacity of 33.4 MMSCMD (269.4 lakh kg per day). Even MOPNG's inflated estimate amounts to just 4.6 per cent of the capacity of HBJ pipeline. Thus there is no reason why this demand cannot be met.

Intervention by the Supreme Court to increase gas allocation

The Supreme Court has in the past intervened in the allocation of gas. The allocation of gas for Mathura Refinery was made as per the directives of the Supreme Court to supply clean fuel, that is, natural gas, to all polluting industries in the Taj Trapezium Zone in order to save the ecology and environment around the Taj Mahal. The polluting industries included the Mathura Refinery and accordingly gas allocation of 1.4 MMSCMD (11.29 lakh kg per day) was made by the GLC to the Mathura Refinery. The pipeline was laid and supply commenced in 1996.

There are precedents to show that gas allocation have been augmented to meet higher demand from other sectors as well. Here are some instances:

- In September 2000, allocation to Essar Oil Ltd was increased by 0.7 MMSCMD

(5.65 lakh kg per day) from 1.71 to 2.41 MMSCMD. that is, an increase of 5.64 lakh kg per day. Similarly, Reliance Refineries Limited got an increased allocation of 0.4 MMSCMD (3.22 lakh kg per day) raising it from 0.49 to 0.89 MMSCMD.

- In 1999, a new allocation of 0.85 MMSCMD (6.8 lakh kg per day)was made to Indian Petrochemicals Corporation Limited (IPCL), Dahej.

- In July 1999, National Thermal Power Corporation (NTPC), Kawas was allocated 2.1 MMSCMD (16.94 lakh kg per day). NTPC was further allowed NTPC to divert 1.5 MMSCMD(12.09 lakh kg per day) of the allocated gas to their plant at Jhannore in 2001.

- Allocation of 1.75 MMSCMD (14.11 lakh kg per day) of gas was shifted from the proposed power plant at Bawana that did not come up, to the proposed Pragati power plant of DVB in 2001. But Pragati power plant is yet to see the light of the day.

- Around 0.4 MMSCMD (3.22 lakh kg per day) of gas was allocated to Gujarat Industries Power Corporation Limited (GIPCO), Vadodara, by GAIL without any firm allocation.

- Gujarat State Fertiliser Corporation (GSFC), Vadodara, was supplied 0.8 MMSCMD (6.45 lakh kg per day) of gas to by GAIL against an allocation of only 0.4 MMSCMD (3.22 lakh kg per day) by GLC.

- DVB was given was given 1.2 MMSCMD (9.68 lakh kg per day) of additional gas by GAIL against an allocation of 0.84 MMSCMD (6.77 lakh kg per day) by GLC.

- GAIL supplied around 1.46 MMSCMD (11.77 lakh kg per day) to different consumers against an allocation of 0.48 MMSCMD (3.87 lakh kg per day) by sanctioned by GLC.

- The central minister of state for petroleum has written a note to GAIL asking it to work for city gas distribution in the city of Lucknow (the prime minister's constituency) and Bareilly (constituency of minister of state for petroleum). On the basis of this MOPNG has approved a total allocation of 0.15 MMSCMD (1.20 lakh kg per day), of which allocation for Lucknow is 0.1 MMSCMD (0.80 lakh kg per day) and 0.05 MMSCMD (0.40 lakh kg per day) for Bareilly.


DELHI MAY BREATHE EASY, CNG SUPPLY TO BE AUGMENTED

All this extra allocation has been done after the Supreme Court orders of July 28, 1998.

How can gas dry up if there are major expansion plans for gas supply in the future?

The expanded infrastructure being planned for delivery of regasified LNG to northern India is the expansion of the HBJ pipeline network from a capacity of 33.4 MMSCMD (269.35 lakh kg per day) to over 60 MMSCMD (483.87 lakh kg per day). The first phase envisages 800 km pipeline network linking Dahej LNG terminal with the HBJ system at Vemar in Gujarat and a parallel 42 inch pipeline to the existing HBJ pipeline from Vemar upto Vijaipur to transport 30 MMSCMD (241.94 lakh kg per day) of additional gas to the states of northern India. The investment in the first phase would be approximately Rs. 2,968 crore. The second phase envisages additional compression facility and expansion of the existing HBJ pipeline to Delhi and beyond to Haryana and Punjab to meet the requirements of natural gas in these states. The details of investment plans in the second phase are being worked out. How can gas become scarce with such massive projects in advanced stages of planning?

MYTH 9: The pipeline often breaks down and restoring it needs time which will disrupt supply as CNG cannot be stored. So the complete dependence of public transport on it is bad. The city will come to a halt if there is a breakdown in the only gas pipeline in the country

- The Union Government has claimed that there will, however, be uncertainty over uninterrupted supply if either the gas processing plant or the pipeline fails (*The Pioneer*, July 26, 2001).

FACT

CNG pipeline disruption rare: Centre

- ***The possibility of the pipeline breaking down is remote. Various methods of natural gas storage have been developed to meet the demand for natural gas during shortages These methods are now technologically well established.***

- ***Natural gas can also be stored in the form of liquefied natural gas (LNG).***

- ***According to the US DOE, natural gas can be stored in the pipeline itself by increasing the capacity of the pipeline or by compressing more gas into the same space for short periods of time.***

CSE experts panel report on CNG as a fuel for urban buses in Delhi states, "In our view, the chances of a disruption of gas supply that could shut down the public transport fleet are remote. Gas pipelines are highly reliable, and are designed to be able to continue in operation at reduced capacity even if there were failure in, for instance, a pumping station. Further, the pipeline and distribution systems themselves store a considerable quantity of gas, as would the CNG tanks of the buses themselves. Appropriate contingency plans should be put in place to assure that buses would have first priority in access to this gas in the event of a supply disruption."[71]

"Although the chance of a prolonged disruption in gas supply is remote, such an event would have serious consequences for public transport. To guard against this possibility, we suggest that the cognisant authorities consider establishing gas storage facilities."[72]

The demand for natural gas can sometimes exceed the amount that can be supplied through a pipeline on a daily basis and during certain periods of a year. In countries like the US this is seen during the winter when demand for gas for room heating increases sharply. To meet this demand various methods of natural gas storage have been developed and the storage methods are now technologically well established.

A large amount of natural gas is stored in the US today. The three principal types of underground storage sites used in the US are:

1. Depleted reservoirs in oil or gas fields: This is by far the most prevailing type of storage. These are usually located close to the centres of consumption.
2. Aquifers: An aquifer is suitable for gas storage if the water-bearing sedimentary rock formation is overlaid with an impermeable cap rock.
3. Salt cavern formations: This is a more costly option than the other two.[73]

In 2000, there were 348 depleted gas/oil reservoirs, 40 aquifer and 27 salt cavern

storage sites for storing natural gas in the US. The total amount of natural gas stored that could be delivered was 77,734 million cubic feet (equivalent to 2,201 million cubic metre) per day.[74]

Alternative methods of natural gas storage

1. An alternative method for on-site storage of natural gas is to store it in the form of LNG. A possible alternative source of CNG for transport fleets is to build (or obtain access to) a fuelling station where CNG is dispensed from LNG that is stored on-site. This is done by using high-pressure cryogenic pumps to compress the LNG to 4,000-4,500 pound square inch (psi, equivalent to 276-310 bar) and then vaporising the highly compressed liquid.[75]

This method offers several advantages over conventional CNG:

a) Cryogenic pumps require significantly less energy than the compressors used at the conventional CNG stations and are less maintenance-intensive.
b) Since LNG is essentially pure methane, LNG or CNG is delivered to the vehicle with virtually no contaminants or undesirable fuel elements such as oil carryover, moisture and higher hydrocarbons. This eliminates the need for elaborate gas drying and filtering systems.

According to the US-based Gas Research Institute, the capital costs of a large (2,000 standard cubic feet per minute = 3,398 cubic metre per hour) LNG or CNG station can be nearly 50 per cent lower than a conventional CNG station. Operation and maintenance cost can also be significantly lower.[76]

The CSE experts panel on CNG points out in their report that "Many gas utilities in the northern US have set up gas liquefaction and vaporisation facilities to help them meet peak wintertime gas demands. During off-peak periods, these facilities convert part of the incoming pipeline gas to LNG, which is stored in large insulated tanks. The LNG is then re-vaporised in and injected into the gas distribution system to meet peak demand. A similar facility could be used to assure continuity of essential gas supplies to Delhi in the event of a prolonged disruption in pipeline activity."[77]

"The presence of a LNG backup system could also help in other ways. LNG can be used as an alternative to CNG for storing gas on-board vehicles, and has many advantages over CNG for heavy-duty trucks and long-haul buses (in particular, more fuel can be stored with less penalty in increased weight). Systems for converting LNG to CNG have also been developed. These have the advantage that the LNG can be pumped up to the dispensing pressure of 200 bar as a liquid, and then vaporised under pressure to produce CNG. This eliminates the need for a compressor at the dispensing station. Transporting gas to off-pipeline stations as LNG and then dispensing it as CNG would have many advantages over the present arrangement of mother and daughter stations — specifically, more gas could be transported over much longer distances, making it practical to provide CNG over a wider geographic range, and even in surrounding cities not served by the gas pipeline," points out the experts' report.

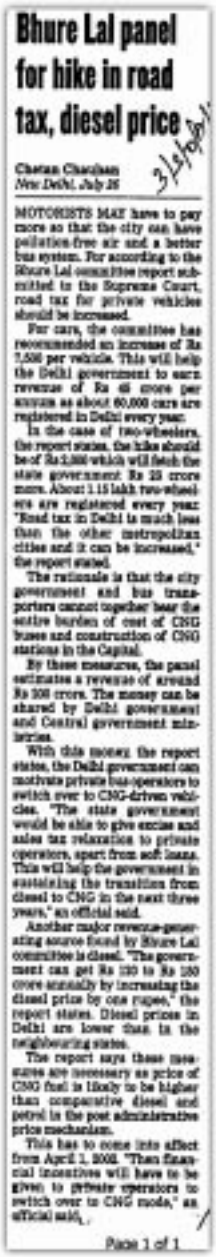
2. Storage in pipeline: According to the US DOE, pipelines can be another place for storage of natural gas. This can happen either by increasing the capacity of the pipeline or by compressing more gas into the same space for short periods of time. The second alternative is called line packing.[78]

3. Theoretically, natural gas can also be stored in the form of hydrates. This requires freezing the gas in presence of water. When frozen in presence of water, natural gas produces a stable compact structure that can be quickly thawed as needed to retrieve the gas. Some 181 standard cubic feet of gas can be stored per cubic feet of hydrate.[79]

MYTH 10: CNG prices should be hiked to recover the costs of investment

Both Ram Naik and the managing director of IGL, A K Dey, have issued statements to the press that CNG prices would have to be hiked to recover the cost of investment. On July 26, 2001 *The Times of India* reported Ram Naik saying that the cost of CNG would be substantially higher than diesel when the requirement would be met through liquefied natural gas (LNG) imports. IGL has made large investments for setting up CNG stations and is incurring loss in Delhi.

Shortly after taking over office Mr Dey had made a presentation before the Union Minister of Petroleum, Ram Naik, wherein he had advocated an increase in the price of compressed natural gas (*The Statesman*, July 23, 2001).



Bhure Lal panel for hike in road tax, diesel price

Chetan Chauhan
New Delhi, July 25

MOTORISTS MAY have to pay more so that the city can have pollution-free air and a better bus system. For according to the Bhure Lal committee report submitted to the Supreme Court, road tax for private vehicles should be increased.

For cars, the committee has recommended an increase of Rs 7,500 per vehicle. This will help the Delhi government to earn revenue of Rs 45 crore per annum as about 60,000 cars are registered in Delhi every year.

In the case of two-wheelers, the report states, the hike should be of Rs 1,000 which will fetch the state government Rs 15 crore more. About 1.15 lakh two-wheelers are registered every year. "Road tax in Delhi is much less than the other metropolitan cities and it can be increased," the report stated.

The rationale is that the city government and bus transporters cannot together bear the entire burden of cost of CNG buses and construction of CNG stations in the Capital.

By these measures, the panel estimates a revenue of around Rs 308 crore. The money can be shared by Delhi government and Central government ministries.

With this money, the report states, the Delhi government can motivate private bus-operators to switch over to CNG-driven vehicles. "The state government would be able to give excise and sales tax relaxation to private operators, apart from soft loans. This will help the government in sustaining the transition from diesel to CNG in the next three years," an official said.

Another major revenue-generating source found by Bhure Lal committee is diesel. "The government can get Rs 120 to Rs 150 crore annually by increasing the diesel price by one rupee," the report states. Diesel prices in Delhi are lower than in the neighbouring states.

The report says these measures are necessary as price of CNG fuel is likely to be higher than comparative diesel and petrol in the post administrative price mechanism.

This has to come into effect from April 1, 2002. "Then financial incentives will have to be given to private operators to switch over to CNG mode," an official said.

Page 1 of 1

FACT

- ***Ram Naik has gone on record to say that the price of CNG would have to be hiked as IGL has made large investments for setting up CNG stations in Delhi. This claim defies logic as IGL is making profit from the very first year of its operation and only recently an excise duty has also been slapped on it to raise revenue. Clearly, Naik hasn't yet learnt his lessons of how to promote cleaner fuels with the help of fiscal instruments to make them more competitive in the market.***

Just as the CNG market is picking up MOPNG plans deviously to decimate the market by increasing the prices. The recent murmurs in the media and the various submissions to the EPCA are evidences to the short-sightedness of the ministry.

The annual report of IGL shows that the company has been making profit right from the first year. It is showing profits even after taking depreciation and payment of taxes into account. IGL showed a profit of more 35 lakh in the year 2000 and in 2001 has shown a profit of more than one crore.[80]

One of the most hackneyed arguments given by both IGL and MOPNG about the issue of price rise is that if MGL in Mumbai can increase prices so much why should Delhi lag behind**.** In fact, A K Dey admitted that IGL had the opportunity to hike CNG prices in the past but the previous MD and chairperson preffered not to do so. After joining office in June 2001, Dey made a presentation to MOPNG that CNG prices should be raised for the financial health of IGL although he refused to disclose when and by how much. But he assures that IGL would not increase CNG prices as long as the commuters are facing difficulties and have to stand in long queues.

It seems to elude both IGL and MOPNG that the comparison with MGL is not fair as MGL in Mumbai is running into losses and so they have had to increase the price of CNG to recover losses. This is essentially because they are running their equipment at 30-40 per cent of their capacity where as IGL is not. Moreover, most of the price increase is because of the higher tax burden on CNG in Mumbai compared to Delhi. In Delhi there is no sales tax on CNG as compared to sales tax of Rs 2.43 in Mumbai. (see table 15: *Raking in money*).

In any case according to guidelines of MOPNG, CNG should be priced in such a way that the owner of the vehicle can recover the cost of the CNG conversion kit in two years. IGL has priced CNG in such a way that the price of conversion kit for a diesel

Table 15: Raking in money

Cost of CNG is higher in Mumbai as MGL pays higher excise duty and sales tax

Price	MGL (Mumbai)	IGL (Delhi)
Market Price of CNG	18.35	12.21
Excise duty paid to the government	1.18	0.91
Sales tax	2.43	Nil
Net realisation	14.74	11.30
Price of purchase from GAIL	4.04	5.41
Gross earning	10.70	5.89

Note: All figures in Rs per kilogramme
Source: A K Dey 2001, Managing Director, Indraprastha Gas Limited, *personal communication*, July 21, 2001.

vehicle that is more expensive is recovered in two years.

Market watchers contend that as the main input of CNG is natural gas so if the price of natural gas does not increase there is no way that the price of CNG should increase. Besides volume of demand in Delhi is so high that it is unlikely that IGL will ever run into losses.

Ram Naik in a recent statement to Parliament has said "the cost of CNG would be substantially higher than diesel when the requirement would need to be through liquefied natural gas imports."

This can only come from a government that has no experience or feels no urgency to learn the basics of fiscal management to influence fuel choices in the market. World over cleaner fuels like CNG have lower prices compared to conventional fuels like diesel that have always attracted higher taxes. Moreover, in the US, practically all the states have their own financial incentive schemes to bring in more natural gas vehicles besides the federal schemes.

IGL sources say that even with import of LNG per kg increase in prices will be minimal as the volume of sales is going to be much larger. Prices may increase when the administrative price mechanism is dismantled completely and 100 per cent import price parity is maintained. But even then gas prices will remain lower than petrol and diesel prices.

A suggestion to increase price of CNG can only come from a government that has no experience or feels no urgency to learn the basics of fiscal management to influence fuel choices in the market

IGL suggests hike in CNG price

STATESMAN NEWS SERVICE

NEW DELHI, July 22. — The CNG might not be a cheap fuel if the Indraprastha Gas Limited has its way. The IGL has suggested an increase in the price of CNG, to the Centre. The managing director of IGL, Mr A K Dey, contends that IGL is "losing money" on the sale of CNG in the Capital.

...in the context of Mumbai, sales tax, the IGL MD said that gross contribution that IGL receives per kg is Rs 5.89, while it is Rs 10.70 for MGL. "The deducted capital is utilised for financing the infrastructure," said Mr Dey. He noted that there was "huge discrepancy in the price mechanism of MGL and IGL. Interestingly, IGL had shown profits of 20 per cent after its first year of operations, earning a net profit of Rs 35.5 lakh for a turnover of Rs 7.10 crore for

...he said. He, however, stated that a rise in price "may not be appropriate," now.

In its representation to the Bhure Lal Committee, the Ministry of Petroleum and Natural Gas had made a representation that CNG would be more expensive than petrol and diesel in the "post Administrative Price Mechanism" which is scheduled to come into 1 April 2002.

This is, however contended by the chairman of the Central Pollution Control Board, Dr D K Biswas, who said the dis-...of APM should not

MYTH 11: CNG buses are much more expensive than diesel buses

Union minister of petroleum and natural gas states that dependence on a single fuel for the public transport system is not desirable, he said the higher initial and subsequent maintenance cost of CNG vehicles, and substantially higher prices of CNG compared to diesel has also to be considered (*Hindustan Times*, July 26, 2001).

FACT

- ***While capital costs compared to diesel will go up in case of CNG, operational costs will go down because of the lower fuel cost of CNG as compared to petrol or diesel.***
- ***The maintenance costs of CNG vehicles are lower. The use of CNG extends engine life, primarily because it is a gaseous fuel.***
- ***The cost of CNG conversion can be recovered in just about three years.***
- ***It is important to include health costs while estimating cost effectiveness of the CNG strategy. A Swedish study comparing CNG trucks with diesel trucks running on 10 ppm (0.001 per cent) sulphur diesel (the best diesel in the world) with a CRT found that when public health and environmental costs were included, the costs of running a CNG truck was much lower.***

It is important to include health costs while estimating cost-effectiveness of the CNG strategy

This is just another manifestation of the several vested interests which are resistant to meeting the deadline and the inaction of the government.

The high cost of CNG buses is a major reason for the current opposition against it. The biggest opposition today is coming from transporters, that is, bus, taxi and auto owners. Since these people constitute a major vote bank, it is feared politicians will continue to pander to their opposition because they see their political interest in doing so. Given the fact that auto drivers have been asked to switch over to electronic meters and a large number of transporters were allowed to bring in diesel buses over the last two years despite the July 28 court order, they are all arguing that conversion to CNG is yet another expense for them. These people should be helped to move over to CNG through subsidies.

Even in public finance, a one-time subsidy is considered to be acceptable. Subsidies, when given on a recurring cost like the price of fuel, are always bad because they lead to a regular charge in government budgets. A one-time subsidy is acceptable especially if it helps to offset the recurring cost that the public bears for its health.

Health costs of air pollution

According to studies carried out by the World Bank and the Centre for Science and Environment, the health costs of particulate pollution in Delhi were around Rs. 1,000 crore in the early 1990s (see table 16: *Health costs of particulate pollution in Delhi*).

A Swedish study comparing CNG trucks with diesel trucks run on 10 ppm or 0.001 per cent sulphur diesel (the best diesel in the world) with a CRT found that when public health and environmental costs were included, the costs of running a CNG truck was much lower. The societal costs of running a diesel truck even with a CRT were very high (see table 17: *Cost of alternatives*).

Table 16: Health costs of particulate pollution in Delhi

Costs	1991-92 [1]	1995[2]
Annual premature deaths due to ambient SPM	7,491	9,859
Episodes of illness due to ambient SPM	39,48,923	51,97,018
Monetary losses resulting from premature deaths due to ambient SPM (in Rs crore)	651.0	856.7
Monetary losses from sicknesses requiring medical treatment due to ambient SPM (in Rs crore)	24.6	32.4
Monetary losses from minor illnesses	275.0	NA

Source:

1 Cartor Brandon and Kirsten Hommann 1995, The cost of inaction: Valuing the economy-wide cost of environmental degradation in India, Asia Environment Division, World Bank, Washington DC, October 17, *mimeo*.

2 Centre for Science and Environment 1997, Death is in the air, in *Down To Earth*, Society for Environmental Communications, New Delhi, November 15.

Table 17: Cost of alternatives

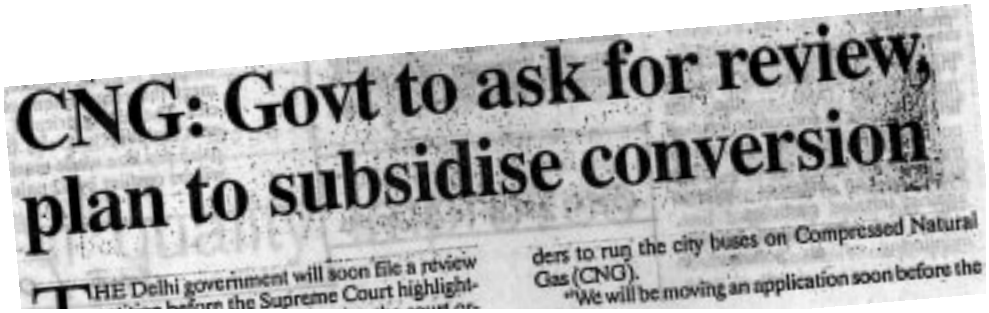
A study done in Sweden shows that although the operational cost of natural gas vehicles is marginally higher, the social cost is much higher for even diesel vehicles fitted with CRT

Cost(in Swedish Croner/km)	Natural Gas	Diesel/CRT
Operational Costs	0.36	0.24
Societal costs	0.16	0.58
Total cost	0.52	0.82

Source: Anon 1999, The Price of Air Quality, *Financial Times Automotive Environment Analyst*, Financial Times Business Ltd., Issue 49, February, p 22.

A subsidy on capital can bring down the increase in the cost of running a CNG bus — as compared to a diesel bus — from 6-12 per cent to 3-7 per cent per km

Unfortunately, in India, even the full economic benefits of converting to CNG have not been fully quantified. While capital costs compared to diesel will go up, operational costs will go down because of the lower fuel cost of CNG as compared to petrol or diesel. In addition, the maintenance costs may also go down. The use of CNG extends engine life, primarily because it is a gaseous fuel. As a dry gas, it does not wash the cylinder walls, thereby lowering the amount of lubrication. CNG engines are also less likely to contaminate engine oil, extending the time between oil changes and extending engine life by not weakening the lubricating abilities of the motor oil. CNG is less prone to causing carbon deposits in the engine. The benefits from reduced maintenance costs and extending of vehicle lifetime have not been quantified in India.



CNG: Govt to ask for review, plan to subsidise conversion

THE Delhi government will soon file a review ... ders to rug the city buses on Compressed Natural Gas (CNG). "We will be moving an application soon before the

Economics of CNG conversion

In a newspaper report, Delhi Transport Corporation chairperson, Rakesh Mehta, claimed that the "fares may have to be doubled"[81] But is this true?

According to R Ramakrishnan of Ashok Leyland, the cost saving by running a CNG bus is about Rs. 0.79 per kilometre (see table 18: *Matter of thrift*). But because of the additional capital cost of CNG vehicle, the capital depreciation cost is high. The calculations attempted by Ramakrishna show that the actual cost increase per km for a new CNG bus over a diesel bus would be 6-12 per cent (see table 19: *Cost-effective*), which is quite a small amount to protect public health. But if a capital subsidy of, say, Rs. 1,50,000 is provided for every new CNG bus the cost increase would go down to 3-7 per cent.

According to another study, the cost of CNG conversion can be recovered in 37.8 months or just about three years.[82] But owing to low utilisation rate of school buses (that is, buses owned by schools), CNG retrofitment or buying a new CNG bus is a costlier option for them. Schools could be encouraged to buy CNG buses by providing them with a higher subsidy than normal transporters.

This higher subsidy to schools would be justified by the higher cancer risks that schoolchildren face when travelling in diesel buses. A study published by the US-based Natural Resources Defence Council in January 2001 points out that schoolchildren suffer from sustained exposures to diesel exhaust while travelling in school buses for 1-2 hours every day during a school year of 180-200 days over a schooling period of 10 years (a normal school-going child's routine). The study concludes that a child riding a diesel school bus is being exposed to as much as 46 times the cancer risk considered significant by the USEPA.[83]

Total cost of conversion

The Delhi government has already lost a major opportunity to get prices reduced for DTC and the private transporters. The Delhi government keeps harping on the fact that such a big effort to convert to CNG has not been made elsewhere. But it did not try to turn this to its advantage. The government could have easily pooled all the orders of the DTC and the private transporters and then made the companies compete, thus, ensuring both quality and lower cost. But by letting the one-two bus

Table 18: Matter of thrift

As CNG is much cheaper than diesel, more so in Delhi, it leads to substantial savings in fuel cost

	BEST		DTC	
	CNG	DIESEL	CNG	DIESEL
Cost of fuel	Rs. 18.35/kg	Rs. 20.67/ltr	Rs. 12.21/kg	Rs. 17.04/ltr
Fuel consumption	2.83 km/kg	3.2km/ltr	3.0 km/kg	3.5 km/ltr
Fuel cost/km	Rs. 6.41	Rs. 6.46	Rs. 4.07	Rs. 4.86

Notes: BEST — Brihan Mumbai Electricity Supply and Transportation, DTC — Delhi Transport Corporation
Source: R Ramakrishnan 2001, CNG — The Clean and Cost Effective Fuel for Delhi Vehicle, Presented in the International Conference on Sustainable Development of Alternative Energy Driven Vehicle Programme, Society of Indian Automobile Manufacturers, April 17-18, 2001, p 14, *mimeo*.

Table 19: Cost-effective

The actual increase in cost of operation for a new CNG bus is just six to 12 per cent over a diesel bus. A capital subsidy can easily reduce this increase in cost by half

Item	Cost
Extra cost of CNG bus compared to diesel Euro I bus	Rs. 5,03,000
Interest and depreciation at 38 per cent per year	Rs. 1,92,600
Increased cost per day (300 working days per year)	Rs. 642
Less savings in fuel cost per day (Rs. 0.79 per km for 250 km)	Rs. 197
Increased cost per day (300 working days per year)	Rs. 445
Cost per km (250 km per day)	Rs. 1.78
Additional cost per passenger-km (assuming 100 passenger per km)	1.78 paise
Additional cost per passenger-km (assuming 50 passengers per km)	3.56 paise
Present fare per passenger km	30 paise
Percentage increase	5.9 per cent (100 passengers per km) or 11.87 per cent (50 passengers/km)

Note: Maintenance cost of a CNG bus is unlikely to be higher than a diesel bus.
Source: Adapted from R Ramakrishnan 2001, CNG-The Clean and Cost Effective Fuel for Delhi Vehicle, Presented in the International Conference on Sustainable Development of Alternative Energy Driven Vehicle Programme, Society of Indian Automobile Manufacturers, April 17-18, 2001, p.15, *mimeo*.

The government could have pooled all orders for CNG buses from DTC and private transporters and then made suppliers compete, ensuring both quality and lower cost

and auto owners negotiate separately with the companies, the Delhi government has left them at the mercy of the wolves in the market.

A few years ago, several European city authorities, across different countries, pooled their orders to buy zero-emission buses for use in historic city centres to avoid pollution and got a big discount. If cities across nations can pool their orders, why couldn't we do it in one city? On April 8, 2001, *Hindustan Times* reported that Nugas which got 4,100 orders for converting buses to CNG was charging a bulk customer like the DTC only Rs. 2.60 lakh as compared to Rs. 4.50 lakh for private transporters — a difference of Rs. 1.90 lakh. Its competitor Rare Technologies which failed to get certification was asking for only Rs. 3.5 lakh.[84] It is obvious that companies have been charging what different markets can bear.

The current total cost of all the new buses and autos is estimated to be slightly above Rs. 1,000 crore (see table 20: *Prices at a glance* and table 21 *Booking orders*). Subsidies which can be given in different ways, for instance, 25 per cent of conversion cost for autos, or 20 per cent of the cost of a new bus can amount to Rs 165 crores, that is, about 16 per cent of the total cost (see table 22: *Scope for incentives)*. Subsidies should be targeted to new vehicles rather than conversion of old vehicles. This would encourage transporters to go in for new buses or for retrofitted buses instead of conversions. If this scheme were to work and all of the orders received by Nugas were to go instead for retrofitting with Ashok Leyland or TELCO, the total subsidy would increase to Rs. 209.51 crore. But in this way better CNG buses would come on to the road. Retrofitted buses would be better than converted buses.

Table 20: Prices at a glance

Although new CNG buses cost more than converted or retrofitted buses, a waiver of sales tax can help to introduce them on a larger scale

Company	Vehicle Type	CNG Mode	Cost	Upfront money (in Rs)
Nugas[1]	Bus	Conversion	Rs 4,86,000 (inclusive of sales tax)	25,000
Ashok Leyland[2]	Bus	Retrofit (1)	Pre Euro bus: Rs 5,98,320 (Inclusive of sales tax) Euro I bus: Rs 6,88,338 (Inclusive of sales tax)	25,000
			Retrofitment labour charge: Rs 45 – 50,000	
	Bus	CNG chassis	Rs 10,37,415 + Sales Tax of 1,24,439.80 (@ 12%) = Rs 11,61,904.80 (inclusive of sales tax)	50,000
Telco[3]	Bus	Retrofit (company has not yet started retrofitment work, this proposal is in pipeline)	Rs. 7,25,000 + Applicable tax in Delhi	Not mentioned
	Bus	CNG chassis	Rs. 10,29,000 + 1,23,480 (@ 12%) = 11,53,000 (according to Tata Sales and Services, New Delhi)	50,000
Rare Technologies[4]	Bus	Conversion	Rs 3,49,000 (inclusive of all tax)	
Hindustan Motors[5]	RTV (mini bus)	New CNG vehicle	4,70,000 (on road HM RTV)	
Trans-Energy[6]	Taxi/petrol cars	Conversion	Rs 35,440 (inclusive of sales tax)	
			Additional 10,000 for MPFI engine cars	
Shrimankar gas service[7]	Auto	Conversion	Rs 22,700 (inclusive of sales tax)	1,000
Bajaj Auto Ltd[8]	Auto	New	Rs. 89,000 According to a Bajaj Auto dealer the CNG autos are only available through replacement of old petrol autos at STA office at Burari, Petrol autos are not sold in Delhi right now)	

Note:

1) Ashok Leyland has two prices of retrofitment. As the norms for pre-Euro I diesel buses were very poor, the company is not fitting a cat convertor on pre-Euro I buses whereas it is fitting a cat convertor on Euro I buses.
2) MPFI: Multiple Point Fuel Injection

Sources:

1) Biju Kurian 2001, Nugas Limited, *Personal Communication*, and Anon 2001, Government Removes Nugas hurdle for bus operators, *The Indian Express*, April 23
2) A.K. Amrolia 2001, Ashok Leyland, April 5, *personal communication*.
3) V. Krishnan 2001, Vice President (Corporate Communications), TELCO, *personal communication.*
4) Sheetal P Singh 2001, Rare Fuels and Technologies Limited, *personal communication.*
5) Rajiv Motors 2001, Dealer Hindustan Motors, New Delhi, *personal communication.*
6) Trans Energy 2001, *personal communication*.
7) Shrimankar Gas Service 2001, New Delhi, *personal communication*.
8) Bagga Link 2001, Bajaj Auto Dealer, New Delhi, *personal communication*.

Table 21: Booking orders as on May 2001

Company	Bookings
TELCO[1]	Orders booked for chassis 4,600 (890 DTC + 3,700 private operators)
Ashok Leyland[2]	Orders received for chassis 2,051 Orders for Retrofitting buses 180
Hindustan Motors (RTV)[3]	On road RTV-370; Orders placed-1,100
Rare Technologies[4]	Delhi on-road buses 7 Gurgaon on-road buses 22
Shrimankar[5]	Taxis booking 50 CNG converted autos on road 4000–5000 Conversion bookings for autos 19,000
Nugas[6]	On road buses around 25 Bookings for conversion 4,100

Source:

1) V. Krishnan 2001, Vice President (Corporate Communications), TELCO, *personal communication,* April 5.
2) A.K. Amrolia 2001, Executive Director, Ashok Leyland, *personal communication,* April 5.
3) Rajiv Motors 2001, Dealer Hindustan Motors, New Delhi, *personal communication.*
4) Sheetal P Singh 2001, Rare Fuels and Technologies Limited, *personal communication.*
5) Jignesh Dhruve 2001, Shrimankar Gas Service, New Delhi, *personal communication.*
6) Biju Kurian 2001, Nugas Limited, *personal communication.*

Table 22: Scope for incentives

Waiver of sales tax can provide a sizeable incentive for transporters to buy CNG buses

Company	Total Estimated Income	Subsidy
TELCO (bus chassis)[1]	Rs. 530.35 crore (incl. sales tax Rs. 56.80 crore)	@Rs. 2.25 lakh per bus (19.5 per cent of total cost) Rs. 103.5 crore
Ashok Leyland (bus chassis)[2]	Rs. 238.31 crore (incl. sales tax Rs. 25.52 crore)	@Rs. 2.25 lakh per bus Rs. 46.15 crore
Ashok Leyland (bus retrofitting)[2]	Rs. 13.29 crore (assuming all orders are for Euro-I buses) (incl. Rs. 0.99 crore)	@Rs. 1.1 lakh per bus (20 per cent of total cost) Rs. 1.98 crore
Nugas (conversion)[3]	Rs. 199.26 crore (incl. sales tax)	No subsidy
Shrimankar Gas Service (auto conversion)[4]	Rs. 43.13 crore (incl. sales tax)	@25 per cent of conversion cost Rs. 10.78 crore
TOTAL	Rs. 1,024.34 crore	Rs. 164.41 crore

Source: Calculated from the figures provided by the following companies.

1) V. Krishnan 2001, Vice President (Corporate Communications), TELCO, *personal communication,* April 5.
2) A.K. Amrolia 2001, Executive Director, Ashok Leyland, *personal communication,* April 5.
3) Biju Kurian 2001, Nugas Limited, *personal communication,* April 25.
4) Jignesh Dhruve, Shrimankar Gas Service, *personal communication,* April 25.

MYTH 12: The CNG strategy will hurt the poor the most

- Has anyone spared a thought for the many taxi and autorickshaw owners who simply have no means either to buy a new vehicle or convert their existing ones? Of course not (*The Times of India*, March 28, 2001).

- Who considers the price paid and still to be paid by the office-goers, workers, the auto drivers, the schoolchildren, the handicapped, and the self-employed? (*The Indian Express*, May 3, 2001).

FACT

- ***Financial incentives are a must for the CNG strategy to work. The federal government in the US provides 80 per cent of the cost of a basic transit bus and 90 per cent of the incremental cost of a bus running on alternative fuel.***


DELHI

Queues get longer as babus, netas drag their feet

- ***The Society for Indian Automobile Manufacturers (SIAM) requested the Delhi government for financial incentives for buses in September, 2000, but no response has been received.***

- ***The state government can subsidise the capital cost of CNG-mode public transport vehicles without incurring any charge on its existing budget.***

- ***Increasing the price of diesel to that of Mumbai would have netted the government over Rs. 450 crore in one year. A one-time increase of Rs. 7,500 in the road tax for cars and Rs. 2,000 for two-wheelers will fetch the Delhi government of Rs. 68 crore every year. In this way, private vehicle owners can cross-subsidise the users of public transport who make a much better use of road space.***

As the key barrier to the CNG technology is its high capital cost, governments across the world have provided fiscal incentives for the introduction of natural gas vehicles recognising their environmental and public health value. For instance, the federal government in the US provides 80 per cent of the cost of a basic transit bus and 90 per cent of the incremental cost of a bus running on alternative fuel. Thus, if a bus costs $35,000, the local share is just about 10 per cent which can be amortised over the life of a vehicle which is 12 years or 500,000 miles (805,000 kilometres). In Italy, too, CNG/LPG vehicles get a subsidy. A major incentive for users of CNG/LPG vehicles is that only they are allowed to ply on a bad pollution day when there is a pollution emergency alert. In several countries this is a tool used by governments to push vehicle owners to go in for CNG vehicles. But a pollution emergency system does not exist in India.

While so much noise has been created over the high cost of CNG buses — about Rs 16 lakh, all was quiet when Delhi government rolled out specially designed air conditioned urban buses in June this year costing a staggering Rs 54 lakh. It defies reason why focus is shifting to get even more expensive buses when Delhi is still struggling to get comparatively cheaper CNG buses.

SUBSIDIES GIVEN BY DELHI GOVERNMENT TO AUTOS AND TAXIS

Following the Supreme Court order of July 28, 1998, the Delhi government offered certain forms of financial assistance to auto and taxi owners to switch over to CNG (Cabinet Decision No. 503 dated 11.4.00). Both were given a complete sales tax exemption. In addition, autos were given a six per cent subsidy on interest on loans from the Delhi Finance Corporation (DFC) and taxis a four per cent subsidy on interest on loans. But according to the Delhi Auto Sangh, no new notification has been issued after March 31, 2001. The Society for Indian Automobile Manufacturers (SIAM) requested the Delhi government for financial incentives for buses in September, 2000 but no response has been received.

According to Ganesh Budhhiraja, President of Delhi Auto Sangh, an auto drivers union in the capital, because there is no incentive scheme available for autos from the government, as new notification for financial incentives and subsidies has not been issued after March 31, 2001 several auto owners are taking advantage of a scheme of replacement offered by Bajaj Auto Ltd to replace old petrol autos. While a CNG auto costs Rs. 1,43,000 on road, an auto owner who turns in the old auto just has to pay Rs. 89,000.[85]

POSSIBLE SOURCES OF REVENUE FOR PROVIDING SUBSIDIES

The state government can subsidise the capital cost of CNG-mode public transport vehicles without incurring any charge on its existing budget.

According to the National Capital Region Planning Board (NCRPB), a key reason for the rapid growth of Delhi is the fact that even though it has the highest per capita income in the country, it has an extremely low tax regime and thus offers high job opportunities. As a NCRPB document puts it, "The phenomenal physical and economic growth of Delhi and the underdevelopment of the area outside Delhi, or, to be more specific, outside the Delhi Metropolitan area, is primarily a problem of relationship rather than a problem of scarcity. To give an example, the total journey time from Delhi to the farthest towns in the region is so short that no big centre of transportation and trading activities have developed in the outer ring of NCR. The entire region outside the Delhi Metropolitan Area is thus registering a relatively slow growth rate leading to a lop-sided development of the region characterised by the 'Metropolis-Satellite' syndrome, where part of the economic surplus of the periphery is extracted by the core and whatever development takes place in the periphery, mostly reflects the expanding needs of the core. Under this phenomenon, the region rather than adding or accelerating, went on supporting the growth and prosperity of Delhi whereby setting an uneven system tied up in a chain of 'Centre-Periphery' relationship. This relationship, helped to raise the income levels in Delhi. Delhi with per capita income of Rs. 19,779 at current prices (1995-96), as compared to all India per capita income of Rs 9,321, has the distinction of having highest per capita income in the country. Thus, ample job opportunities couples with higher wages and earnings provide enough opportunities for the people to migrate and settle in Delhi."[86]

"It has been strongly argued at various forums that whereas there is a reasonable amount of uniformity in tax and tariff rates among the neighbouring States, the effective rates of tax and tariff are substantially lower in Delhi. These differentials in tax rates with added advantage of better social and physical infrastructure in Delhi have greatly influenced in past the decision making regarding location of industry and trade. The articles where the margin of profit is low and transportation costs are not so high, such variations result in attracting buyers from far-off places," points out the report.[87]

Price of diesel in Delhi is not only lower than other metros but also lower than neighbouring states where the diesel sold is much poorer in quality

DIESEL PRICES

The low rate of taxation in Delhi is also reflected in the transport sector. It has a diesel price not only lower than other metros but also lower than neighbouring Uttar Pradesh which is much poorer and has lower quality diesel to sell (see table 23: *Uneven pricing*).

An additional sales tax of Re 1 on diesel in 1999 and 2000 would have fetched about Rs 300 crore — enough for the government to be able to give away more than 3,000 retrofitted buses free

ROAD TAXES

Not only are fuel prices lower in Delhi, even road taxes are very low compared to other metros even though Delhi has more vehicles than Mumbai, Chennai and Kolkata combined (see table 24: *Chennai: Tax structure*, table 25: *Different strokes*, and table 26: *Different strokes*). The road tax for cars owned by individuals in Chennai is not only twice that of Delhi but the tax for cars owned by companies is further increased. In Mumbai, the road tax is not the same for all vehicles but is a percentage of their price. Even in the case of scooters, the road tax is relatively on the lower side in Delhi.

Given the fact that these private modes of transport occupy a disproportionate amount of space compared to the passenger-trips they provide when compared to buses, their road tax should be increased. By taking a one-time tax, the transport departments not only cannot check the vehicles every year, but also cannot keep on increasing the road tax according to age which will encourage owners to phase out older and polluting vehicles. In Japan, road taxes rise so rapidly that after 5-6 years everyone buys a new car leading to a huge market worldwide in second-hand Japanese cars which is threatening the Indian auto industry with import regulations becoming weaker and weaker.

POTENTIAL FOR RAISING REVENUE

There are numerous options for raising funds for subsidising the conversion of the city public transport fleet to CNG to a point that there will be no need to increase public transport rates.

Table 23: Uneven pricing

City	Price/Litre	Sulphur content of diesel	Comments
Delhi	Rs. 17.06	500 ppm (0.05 per cent)[2]	Earlier Rs. 16.56 when 2,500 ppm (0.25 per cent) sulphur diesel was also available
Mumbai	Rs. 20.27	Mainly 500 ppm (0.05 per cent) now but only 500 ppm from June 1, 2001[2]	
Chennai	Rs. 18.01	At present 2,500 ppm but 500 ppm is also being sold[2]	
UP (Noida)	Rs. 18.11 (2500 ppm diesel) Rs. 18.65 (500 ppm diesel)	Both types of diesel are being sold[1]	Very little high quality diesel is getting sold in Noida because people prefer to buy it at cheaper rates in Delhi
Haryana (Gurgaon)	Rs. 16.51	2,500 ppm diesel mainly (500 ppm will be available from June 1, 2001)[2]	

Source: 1) Survey by Centre for Science and Environment.
2) K K Gandhi 2001, Society for Indian Automobile Manufacturers, *personal communication*, April 21.

Table 24: Chennai: Tax structure

Motor cars	Purchased on or after 25.9.2000					
	Value less than Rs. 5 lakh		Value Rs. 5-10 lakh		Value over Rs. 10 lakh	
	Individuals	Others	Individu-als	Others	Individuals	Others
Less than 700 kg	Rs. 8,210	Rs. 16,420	Rs. 12,320	Rs. 24,640	Rs. 16,420	Rs. 32,840
700-1,500 kg	Rs. 10,950	Rs. 21,900	Rs. 16,430	Rs.32,860	Rs. 21,900	Rs. 43,800
1500-2,000 kg	Rs. 13,690	Rs. 27,380	Rs. 20,540	Rs. 41,080	Rs. 27,380	Rs. 54,760
2,000-3,000 kg	Rs. 15,060	Rs. 30,120	Rs. 22,590	Rs. 45,180	Rs. 30,120	Rs. 60,240
Over 3,000 kg	Rs. 17,110	Rs. 34,220	Rs. 25,670	Rs. 51,340	Rs. 34,220	Rs. 68,440

Source:
1) Survey by Centre for Science and Environment.
2) K.K. Gandhi 2001, SIAM, personal communication, April 21.

Table 25: Different rates

Road tax paid by different types of vehicles in Mumbai, Delhi and Chennai

CAR	Price in Delhi	Road tax in Delhi	Price in Mumbai	Road tax in Mumbai (4 per cent of the vehicle price)	Road Tax in Chennai	
					Individual[1]	Others[2]
Maruti 800 Euro II[1]	2,59,569	3,815	2,80,662	11,226.48	10,950	21,900
Hyundai Santro[1]	4,01,116	3,815	4,09,138	16,365.56	10,950	21,900
Matiz[1]	2,92,000	3,815	3,16,000	12,640.00	10,950	21,900
Fiat Uno[1]	3,74,059	3,815	3,66,199	14,647.96	10,950	21,900
Ambassador Petrol[1]	4,18,365	4,880	3,88,000	15,520.00	10,950	21,900
Ambassador Diesel[1]	3,69,362	4,880	NA	16,734.60 Price n.a. for Mumbai	10,950	21,900
Ambassador CNG[2]	3,70,000	4,880	4,42,000	17,680.00	10,950	21,900
Indica Petrol[1]	4,14,296	3,815	4,21,931	16,877.24	10,950	21,900
Indica Diesel[1]	4,25,600	3,815	4,34,654	17,386.16	10,950	21,900

Note: Road tax and all prices are in Rs.
'Individual' category comprises of individual persons with a proper name and 'others' comprise of fleet operators or cars owned by a firm
Source:
1) Anon 2001, The Morning Monthly in *Business Standard*, February.
2) Anon 2001, Ambassador CNG price in *Overdrive*, October 2000.

In 1998-99, the total sale of diesel was 1,451 million litres. An additional sales tax of Re 1 in 1999 and 2000 would have fetched about Rs 300 crore. This sum is so large that the government could have even given away more than 3,000 retrofitted buses free. Such a tax can still be levied to subsidise the conversion to CNG. Increasing the price of diesel to that of Mumbai would have netted the government over Rs. 450 crore in one year. With buses and taxis which run on diesel moving over to CNG, sales of diesel in Delhi will definitely come down but there will still be a substantial demand for diesel by goods vehicles and generator sets. Moreover, the increased price difference between diesel and CNG will make the latter even more attractive. Every year, some 60,000 cars and 115,000 two-wheelers get added to Delhi's fleet of

Table 26: Different strokes

A comparison of prices and road tax on two-wheelers in Delhi and Mumbai

Two wheelers	Price in Delhi	Price in Mumbai	Road tax in Mumbai (4% of the vehicle price)	Road tax in Delhi
Kinetic DX	39,640	37,760	1,585.60	1,220
Bajaj Chetak	28,747	26,593	1,149.88	1,220
Hero Puch	26,422	26,422	1,056.88	615
Bajaj Kawasaki	41,590	41,590	1,663.60	1,220
Bajaj Boxer	35,427	35,427	1,417.08	1,220
Hero Honda CD100	39,629	39,629	1,585.16	1,220
Hero Honda CD100SS	41,124	41,124	1,644.96	1,220
Hero Honda Splendour	43,383	43,383	1,735.32	1,220
Hero Honda Passion	45,150	45,150	1,806.00	1,220
Hero Honda Street	33,134	33,134	1,325.36	1,220
Hero Honda Street Smart	35,338	35,338	1,413.52	1,220
Kinetic Challeger	42,620	42,620	1,704.80	1,220
LML energy	43,392	43,392	1,735.68	1,220
LML Adreno	44,821	44,821	1,792.84	1,220
Suzuki Max 100	34,140	34,140	1,365.60	1,220
Yamaha Crux	41,300	41,300	1,652.00	1,220

Source: Monalisa Sengupta 2001, Zip, Zap, Zoom On a 100 CC Dream Machine in The Hindustan Times, May 1.

Subsidies are needed to make it easier for transporters to bring in more CNG vehicles and also to ensure that the increased capital cost of a CNG vehicle does not lead to increased commuter costs

vehicles. Even a one-time increase of Rs. 7,500 in the road tax for cars and Rs. 2,000 for two-wheelers will fetch the Delhi government Rs. 45 crore and Rs. 23 crore, respectively — a total of Rs. 68 crore every year. In this way, private vehicle owners can cross-subsidise the users of public transport who make a much better use of road space. According to the DTC, buses carry 50 per cent of the passenger load while occupying only one per cent of the road space.

There is, thus, really no problem in financing the switchover to CNG. The government can easily provide people with a subsidy of upto Rs. 200-300 crore without losing its existing revenue. For the short-term it can even take loans to finance the transformation which it can recover from increased taxes over time. Using the polluter pays principle, taxes could be levied more on private vehicle owners, users of gensets and those who use polluting fuels.

The government should provide effective fiscal incentives to the operators which are anywhere between 20-30 per cent of the total cost of conversion or of buying a new bus. The government is definitely in a position to do this.

PURPOSE OF SUBSIDIES

In vehicular air pollution management, it is important to ensure that good vehicles come on to the road as fast as possible. Because once a dirty vehicle is allowed on the roads, it will continue to operate and pollute for many years before it gets

phased out. Therefore subsidies should be given to:

a) Make it easier for transporters to buy new CNG vehicles or get their old ones converted to CNG or retrofitted with CNG engines;
b) Ensure that the increased capital cost of a CNG vehicle does not lead to increased commuter costs, which means that subsidies would have to be pegged at an appropriate level; and
c) To ensure that people go in for better CNG technology, which means that subsidies should be so structured that they provide a greater incentive to choose a better technology.

There is really no problem in financing the switchover to CNG. The government can easily provide people with a subsidy of upto Rs. 200-300 crore without losing its existing revenue

MYTH 13: CNG buses emit more greenhouse gases than diesel buses

- On February 3, 2000, a report in the Delhi edition of *Hindustan Times* quoted TERI's Ranjan Bose as saying that moving to CNG will add to global warming because methane is 20 times stronger a greenhouse gas than carbon dioxide.

Perhaps the most resounding answer to the global warming vs urban smog debate has come from the California environmental regulators who emphasised their "clear, unmistakable authority to enact regulations is to reduce urban smog. Global warming is an international issue and the USEPA ought to be the agency taking the lead"

The media went suddenly abuzz with reports in February 2000 merely one month away from the Supreme court deadline to move all buses more than eight year old to CNG, carrying 'expert' views that moving buses to CNG will aggravate global warming and diesel vehicles must be allowed to continue. Earlier, automobile companies had been trying to justify their move towards dieselisation by arguing that it is one of the solutions to the global warming problem. Consultancy groups joined them to create confusion in the minds of the policy makers over the merit of the Supreme Court ruling on moving the entire bus fleet in Delhi to CNG. Their contention was that CNG will lead to higher methane emissions and cause global warming, thus diverting attention from the already very high lethal effects of severe particulate pollution in Delhi.

FACT

A recent report from CSIRO, Australia, very clearly brings out that CNG emissions contribute less to global warming than diesel (see graph 9: *The impact on global warming*). What has escaped the global warming pundits is the common knowledge that air quality regulators worldwide have to address the dual objectives of controlling air pollution and global warming. In the West, where global warming has emerged as a more serious and an immediate issue, the local pollution control authorities still give precedence to the problem of urban smog in pollution hot spots, primarily to protect health of local citizens. Policy action must be in accordance to the immediacy of the problem, and in the case of New Delhi, it is particulate pollution in the ambient air that poses immediate danger.

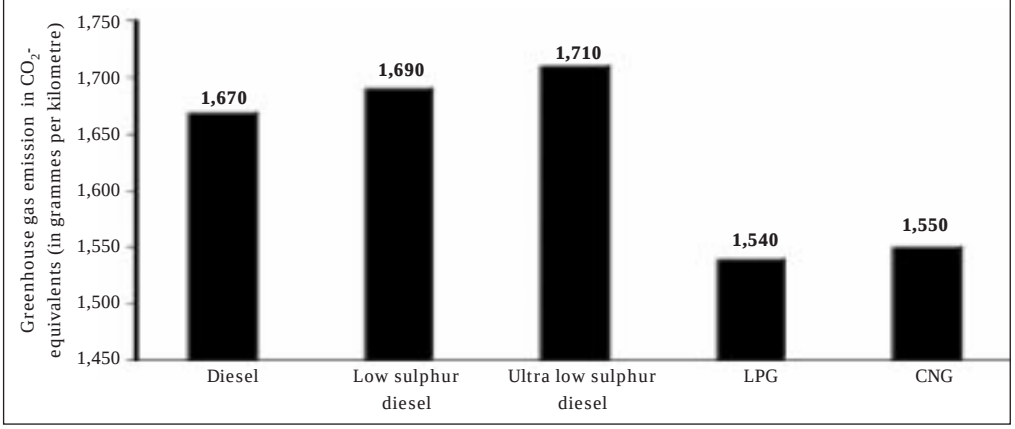
Methane is indeed a greenhouse gas, though carbon dioxide is responsible for about half of the enhancement of the global greenhouse effect. But in view of Delhi's air quality profile, the benefits of moving to CNG outweigh the potential ills such as higher methane emissions. Delhi is reeling under particulate pollution load and according to WHO, particulate are responsible for maximum health damage and have no safe levels. Studies confirm that respirable particles kill even at low concentration and with minimal increase and their levels in Delhi reach as high as eight times the standards. Therefore, the priority in Delhi is to move out of fuels that emit more particles such as diesel as fast as possible. Let us get the facts right.

Immediate benefits of moving to CNG:

- Problem of toxic particulate emissions will be virtually eliminated.
- Total hydrocarbon emissions will be high but most of it is methane. The non-methane hydrocarbon components that are cancer-causing and come mostly from diesel and petrol vehicles, constitute a small fraction of the total hydrocarbon emissions from CNG vehicles.
- The nitrogen oxide emissions though high compared to other emissions from CNG vehicles will still be much lower compared to diesel vehicles.
- Sulphur dioxide emissions that also lead to formation of deadly sulphate particles will be virtually eliminated.
- Carbon monoxide levels will be considerably lower.

Graph 9: The impact on global warming

The global warming potential of emissions from CNG buses is much lower than that of diesel buses when the entire lifecycle of the fuels are taken into account

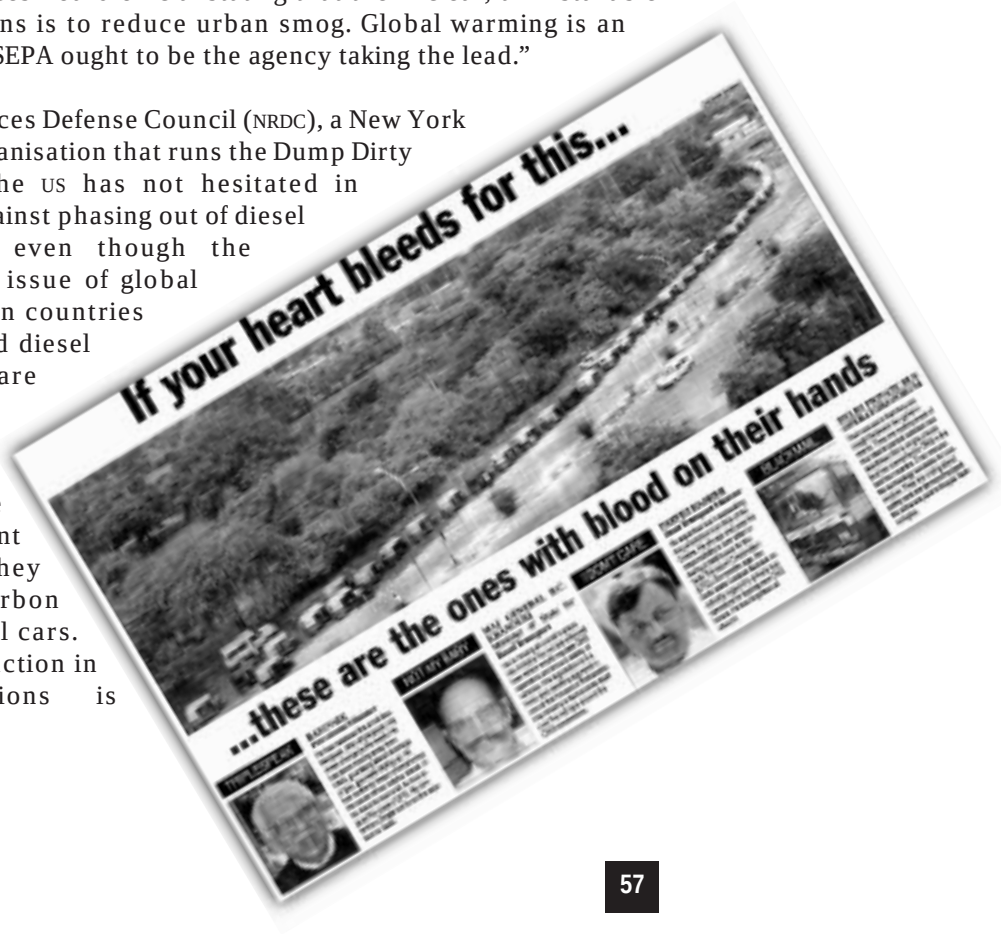


Note: LPG—liquefied petroleum gas; CNG—compressed natural gas

Source: Tom Beer *et al* 2000, Lifecycle emissions analysis of alternative fuels for heavy vehicles, CSIRO atmospheric research report to the Australian Greenhouse Office, March, *mimeo*.

Delhi faces the challenge of lowering the particulate matter load in its ambient air by 90 per cent in order to make it safe to live. Any further increase in diesel vehicles will make this task impossible. Perhaps the most resounding answer to the global warming vs urban smog debate has come from the US. Faced with a similar dilemma the California environmental regulators made it clear that reducing emissions of greenhouse gases is not their priority; it is the responsibility of the USEPA in Washington, DC. While reporting the debate in November 27, 1998 the *New York Times* quoted California Air Resources Board official stating that their "clear, unmistakable authority to enact regulations is to reduce urban smog. Global warming is an international issue and the USEPA ought to be the agency taking the lead."

Similarly, the Natural Resources Defense Council (NRDC), a New York based non-governmental organisation that runs the Dump Dirty Diesel Campaign across the US has not hesitated in campaigning successfully against phasing out of diesel and phasing in of CNG, even though the organisation works on the issue of global warming. Even the European countries that have earlier encouraged diesel to combat global warming are rethinking diesel. A study by the Swedish Environmental Protection Agency shows that while diesel cars use 20-25 per cent less fuel per kilometre, they emit 15 per cent more carbon dioxide per litre than petrol cars. As a result, the overall reduction in carbon dioxide emissions is 'negligible'.



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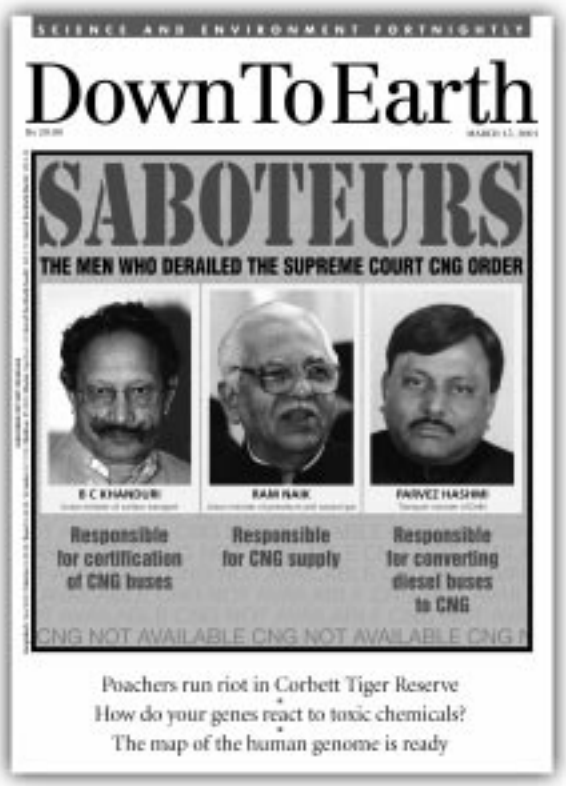
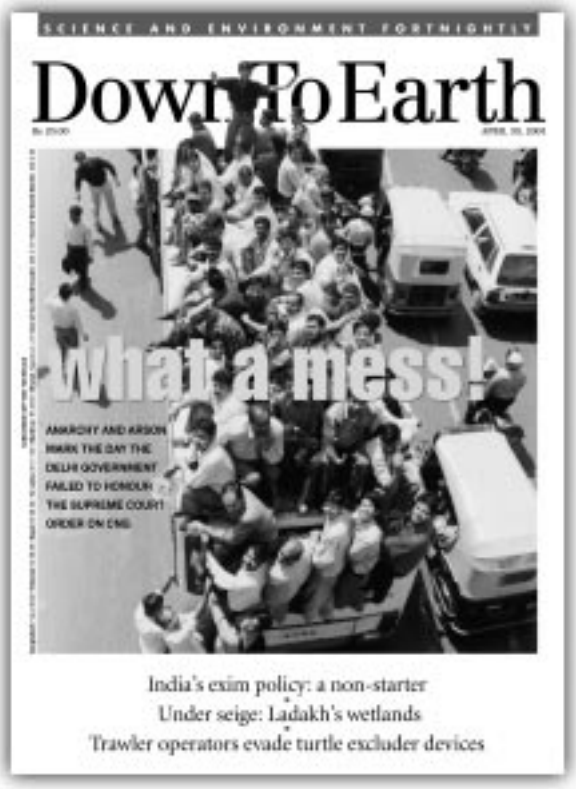


PUT THE SABOTEURS ON DOCK.....

FOR THE MESS THEY HAVE CREATED



XYLENE

POLYCYCLIC AROMATIC HYDROCARBONS

BENZO[A]PYRENE

AMMONIUM SULPHATE

AROMATICS

BENZENE

TOLUENE

PHOTO-IONISATION DETECTOR

BTX ANALYSER

NUCLEATION

and you still insist it's the tailpipe

NANOPARTICLES

AIR QUALITY GUIDELINES

MORTALITY

EMISSION WARRANTY

CONTINUOUS REGENERATING PARTICULATE TRAP

MPFI

COMMON-RAIL INJECTION

EXHAUST GAS RECIRCULATION

BIO-FUEL

ETHYL TERTIARY BUTYL ETHER

ETHANOL

EMISSION TAX

FUEL-DUTY ESCALATOR

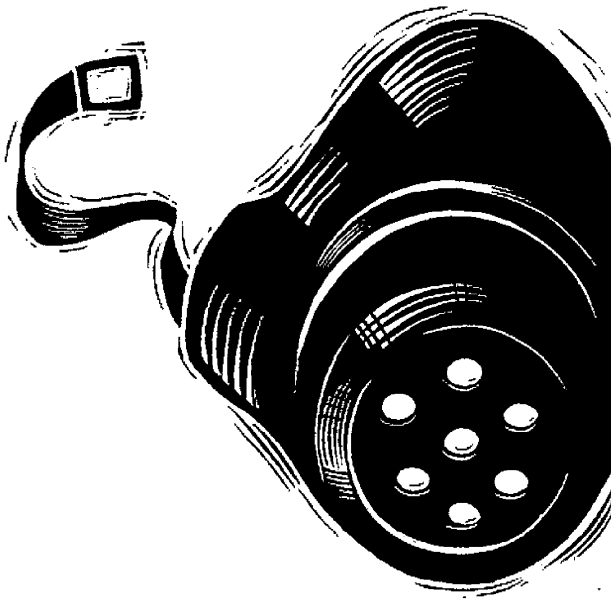
ENVIRONMENTAL EXCISE DUTY

FUEL CELL

CARBURETTOR

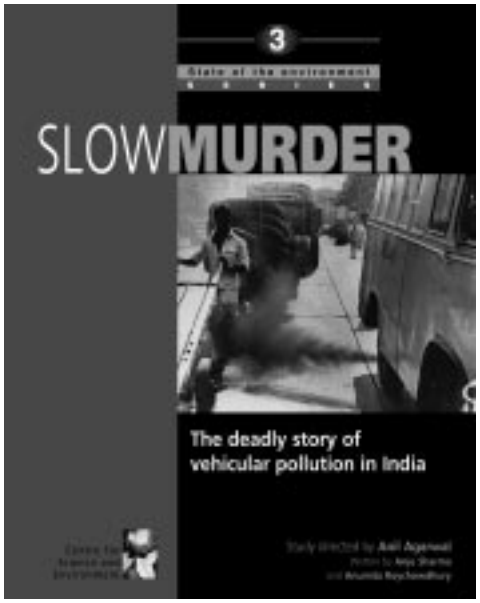
LEV I LEV II ZEV SULEV

EURO

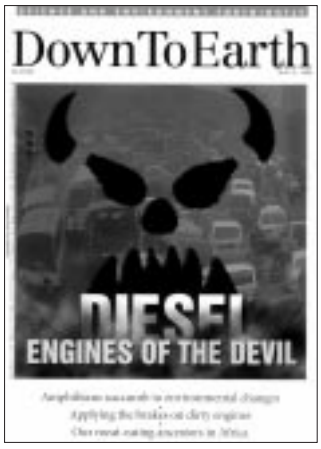


Join the Right To Clean Air Campaign

Centre for Science and Environment
41 Tughlakabad Institutional Area
New Delhi 110 062 INDIA
Tel 91-11-608 1110/3394/6399 **Fax** 91-11-608 5879
Email cse@cseindia.org **Website** www.cseindia.org



Published in 1996,
Slow Murder gives you the complete story of vehicular pollution in India



***Down To Earth* keeps you informed every fortnight.**
Prepare yourself to change the future

Roll down the window of your bullet-proof car, Mr Minister
The security threat is not the gun. It's the air of Delhi

Hon'ble Prime Minister,

Here is something that just may convince you: while India's Gross Domestic Product has increased two-and-half times in two decades (1975-1995), the pollution load from industries has gone up four times and from vehicles a shocking eight times.

A study by the Centre for Science and Environment shows that the number of people dying due to air pollution went up by almost 30 per cent in four years between 1991 and 1995. An estimated 52,000 people are dying due to air pollution every year — about 10,000 of them in Delhi itself.

One person dies every hour due to air pollution in the city ruled by your party.

In Delhi vehicles are responsible for 70 per cent of the pollution load. Because of the high toxicity of fumes from transport fuel, one out of every 10-15 people living in Delhi is likely to get cancer.

Your government has failed to arrest this deterioration of air quality in Indian cities. Worse still, it contributes to the pollution in a big way by producing low quality fuel in state-owned refineries. Improving fuel quality is a short-term measure which will go a long way. Vehicles using clean fuel will pollute less.

Seeing your government's inability to tackle air pollution, we present you with a peoples' charter for clean air. This will help to immediately improve the quality of the air we breathe.

Mr Prime Minister, 50 years into Independence, please give us our right to clean air. We hope you will take our concern seriously.

Yours sincerely

Centre for Science and Environment
November 2, 1998

PEOPLES' CHARTER ON CLEAN AIR

FOR IMMEDIATE IMPACT

✔ **PRODUCE CLEAN DIESEL, OR IMPORT IT**
Diesel emissions contain deadly particulate matter with traces of the strongest carcinogen known till date. Indian diesel is 250 times dirtier than the world's best.

✔ **REMOVE BENZENE FROM PETROL**
India is moving towards unleaded petrol. But this fuel contains too much benzene. Though we use one hundred times less petrol than USA, the total amount of benzene emissions from Indian vehicles is the same as in the US.

Benzene causes blood cancer and air should have no benzene at all, says WHO. Yet the level of benzene in and around Connaught Place in Delhi is 10 times higher than the European safety limit. If you live in Delhi, your chances of getting blood cancer are twice as high as people living in Bangalore, Chennai and Mumbai.

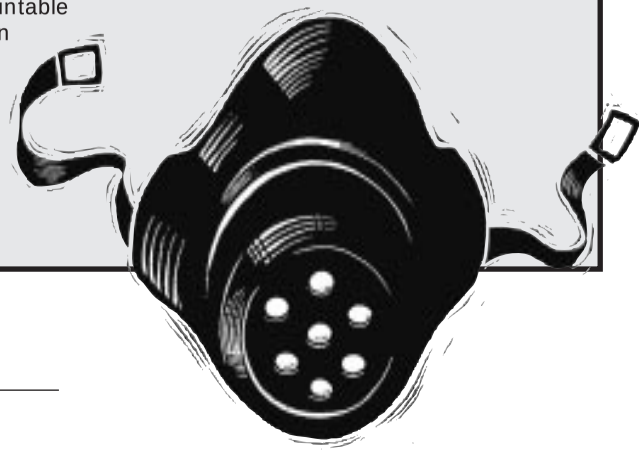
✔ **STOP PRIVATE DIESEL CARS**
Registration of all private diesel models should be banned in cities like Delhi. Cheap government diesel means more diesel cars, including luxury models.

✔ **TAX TO IMPROVE VEHICLE TECHNOLOGY**
Penalise vehicle manufacturers for producing polluting technology. Tax vehicles according to their emission level. Manufacturers will then invest in cleaner technology.

✔ **INTRODUCE EMISSION WARRANTY**
Make the industry accountable for the life-long emission efficiency of all vehicles they produce.

✔ **MAKE EMISSION LEVELS PUBLIC**
Manufacturers must inform buyers of the exact emission levels of their vehicles.

✔ **MONITOR ALL HARMFUL GASES**
Improve air quality assessment. A wide range of poisons are not monitored till date. Alert people about pollution levels in the city. It is done all over the world.



Register your protest to the Prime Minister today

PMO, South Block, New Delhi 110 001
Tel: 301 8939 Fax: 301 6857, 301 9817

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