CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

Centre for Science and Environment

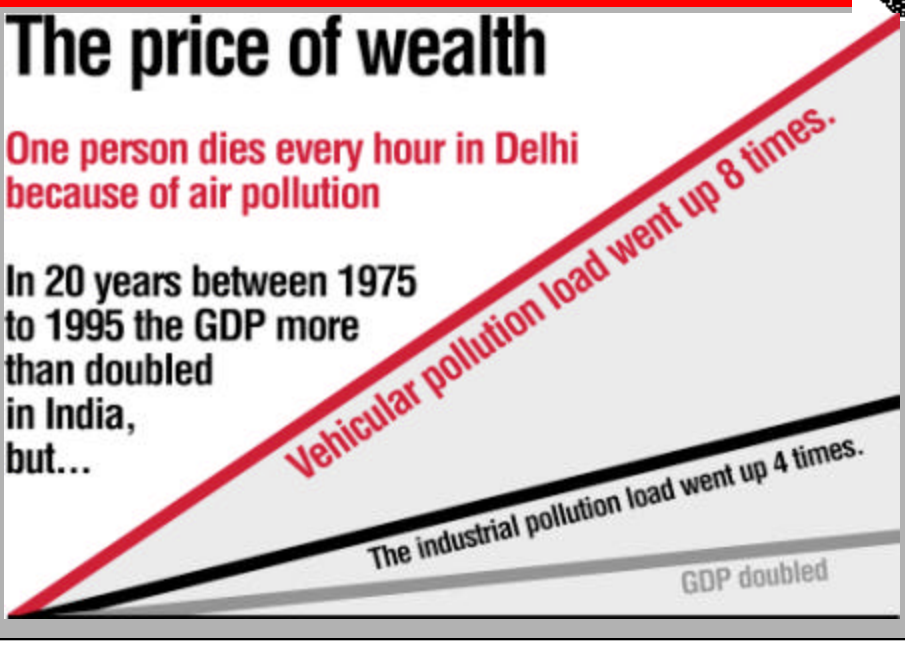
Action Plan for Reducing Vehicle Emissions
ADB Regional Workshop: Fuel Quality and Alternative Fuels
May 2-4, 2001
New Delhi

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

The price of wealth

One person dies every hour in Delhi because of air pollution

In 20 years between 1975 to 1995 the GDP more than doubled in India, but...



CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

Emerging evidence on health effects of air pollution in India

World Bank: 40,000 premature deaths in 1991

CSE: 52,000 premature deaths in 1995

But officials ignore health data while setting norms for fuels and vehicles.

It is important to factor in public health criteria in the norm setting process.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

Numerous studies have been undertaken in the West to understand the causes of cancer such as genetic susceptibility, environment factors and lifestyle. These show an overwhelming influence of environmental factors in triggering cancer.

- A recent study that has shocked the western world is based on a survey of cancer incidence amongst 44,7888 pairs of twins in Denmark, Sweden, and Finland.

The study concludes:
"Inherited genetic factors make a minor contribution to susceptibility to most types of neoplasms. This finding indicates that the environment (pollution, radiation, diet etc) has the principal role to play in causing sporadic cancer."

According to the national cancer registry programme of Indian cancer incidence in cities like Delhi is already very high.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

CANCER RISK

Environment poses a greater risk in triggering cancer than genetic factors

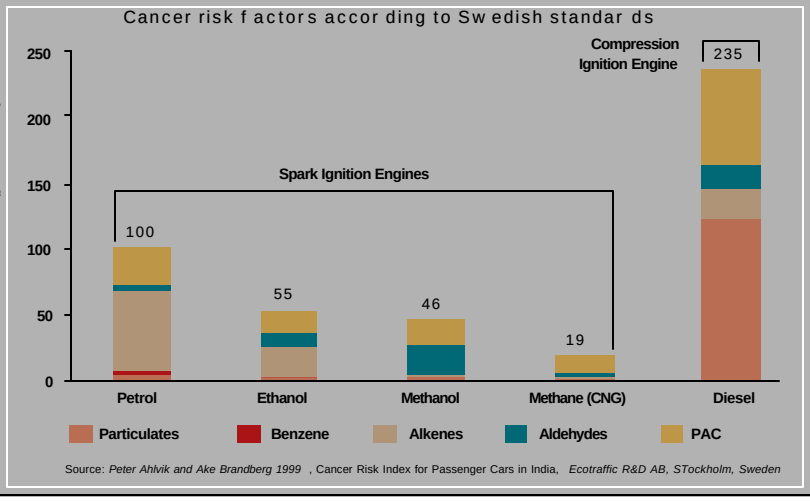
Cancer	Statistically significant genetic risk	Environmental risk
Prostrate	0.42	0.58
Pancreas	0.36	0.64
Colorectum	0.35	0.65
Bladder	0.31	0.69
Stomach	0.28	0.72
Breast	0.27	0.73
Lung	0.26	0.74
Ovary	0.22	0.78
Leukaemia	0.21	0.79
Lip/oral/cavity/pharynx/larynx/brain and Other nervous system/thyroid/bone/Esophagus/liver/gall bladder and Biliary tract/cervix/uteri/testis/kidney/Skin/soft tissue/non-hodgkin's Lymphoma/hodgkin's diseases/Multiple myeloma	0.00	1.00

Source: Paul Lichtenstein *et al* 2000, Environmental and heritable factors in the causation of cancer, *The New England Journal of Medicine,* Vol 343, No 2, July 13.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

The cancer index...

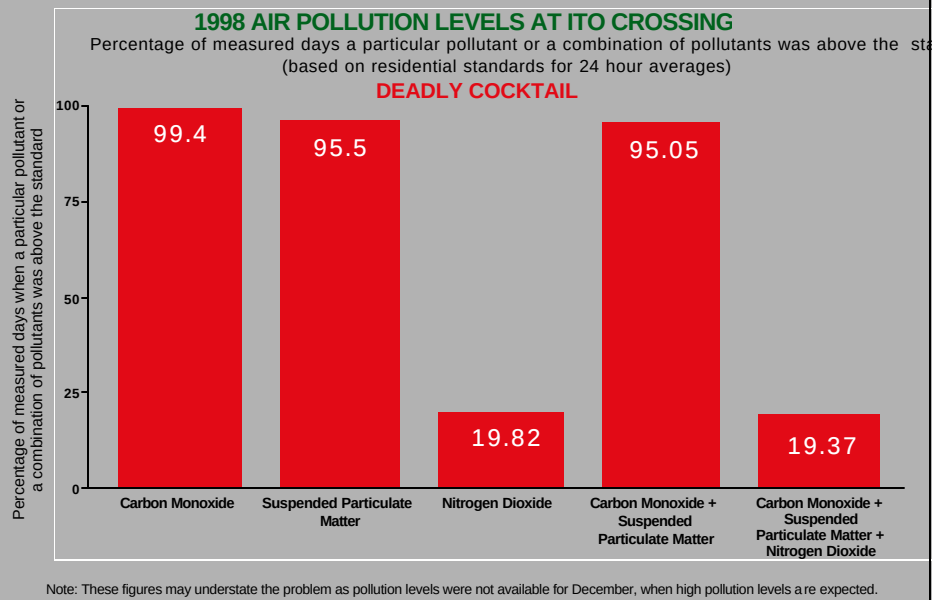
It is possible to quantify toxic risks from different emission sources and capture it in a cancer index to rate emissions and fuels



CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

Targets for fuel quality improvement and phasing in of clean fuels should be discussed in the context of local pollution.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

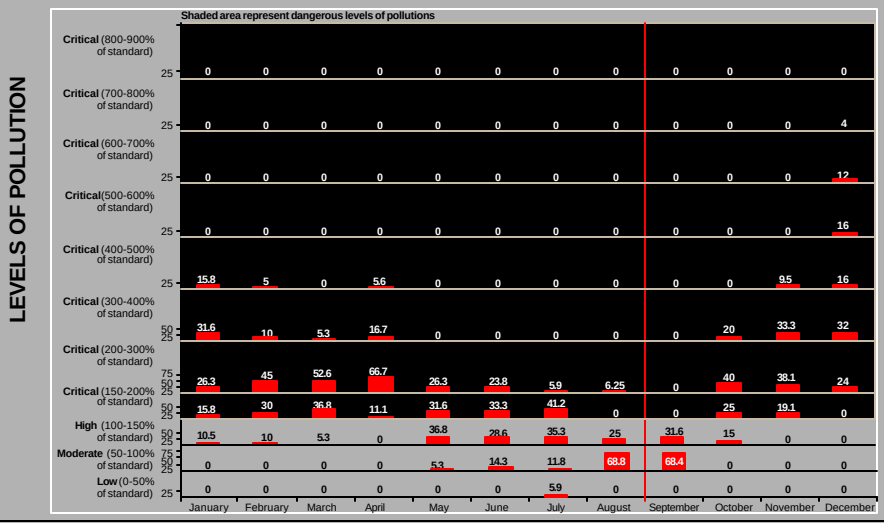


Note: These figures may understate the problem as pollution levels were not available for December, when high pollution levels are expected.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

1999 RESPIRABLE PARTICULATE POLLUTION LEVELS AT ITO CROSSING

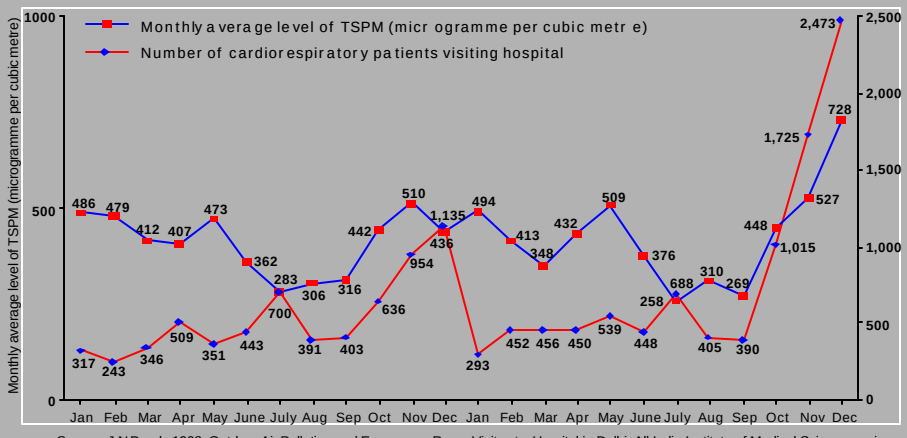
Percentage of measured days when PM10 levels were above the standard
National Standard (Residential) — 100 microgrammes per cubic metre (24 hours average)



CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

Foul air and sickness

A study carried out at the All India Institute of Medical Sciences over 1997 and 1998 clearly shows that with an increase in levels of particulate pollution, more people suffer from cardiorespiratory diseases, particularly from October to December



Source: J N Pande 1998, Outdoor Air Pollution and Emergency Room Visits at a Hospital in Delhi, All India Institute of Medical Sciences, *mimeo*

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

To clear the air of poisons it is vital to develop a pollutant-wise action plan

YOUR DAILY POISON AND COMBAT PRIORITY	
Particulate (PM10) and smaller from diesel vehicles. Extremely toxic, very high in Delhi. Can trigger lung cancer, respiratory and heart problems.	1
Benzene from petrol vehicles (especially vehicles without catalytic converters and scooters). Carcinogenic, levels frightening in Delhi. Triggers blood cancer.	1
Carbon monoxide from petrol vehicles. High levels in Delhi. Not as toxic as particulates and benzene. But toxic enough. Reduces oxygen carrying capacity of blood and impairs the heart and nervous systems.	2
Polycyclic aromatic hydrocarbons from diesel and petrol vehicles. Lethal. Levels probably high but not monitored. Can cause cancer.	2
Oxides of nitrogen mainly from diesel vehicles. Toxic. Levels not very high but steadily rising. Also produces toxic ozone. Triggers respiratory and heart problems.	3
Sulphur dioxide from diesel vehicles .Levels in Delhi's air still low. But contributes to making of sulphate particles. Deadly. Triggers breathing problems.	3

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

Fuel quality improvement is one of the important strategies to reduce air pollution and its toxic effect. But how should it be approached?

Delhi is getting better quality of fuel than the rest of the country. This has been possible not because of the proactive policy of the government but active judicial intervention and and a strong public campaign.

- Diesel with 2500 ppm suphur diesel from September 1998
- Diesel with 500 ppm sulphur in November 2000
- Petrol with 1 per cent benzene from June 2000.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

Court action in Delhi has set an important precedence: While national standards are a minimum requirement, special standards will have to be designed for more polluted hotspots like Delhi.

Despite an initial push from the judiciary, the new fuel norms under consideration for 2005 are at best by the government's own admission , close to only Euro II fuel standards. These were enforced in Europe in 1996. Clearly there is no urgency to catch up with world standards in the interest of public health.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

TREND IN FUEL QUALITY IMPROVEMENTS IN INDIA SINCE 1996

The fuel standards that the Indian government is proposing to me et 2005 aims to bring Indian fuel quality close to only Euro II fuel standards. This will keep India 10 years behind time

Environment related fuel quality parameters	India 1996-2000	Fuel Quality in Delhi (Present)	Recommen-ded 2005	World best standards
PETROL				
Benzene (v%)	3-5	**1.0**	**1.0**	**1.0** (California present)
Aromatics (v%)	Not specified	Not specified	**45**	**25** (California present)
Sulphur (ppm)	**2000**	**1000**	**300**	**50** ppm by 2004 (California)
Oxygen wt % max	2.7	**2.7**	**2.0**	Getting rid of the requirement
Olefins vol %	Not specified	Not specified	**18**	**6** (California present)
Lead	0.013		**0.005**	

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

TREND IN FUEL QUALITY IMPROVEMENTS IN INDIA SINCE 1996

The fuel standards that the Indian government is proposing to me et 2005 aims to bring Indian fuel quality close to only Euro II fuel standards. This will keep India 10 years behind time

Environment related fuel quality parameters	India 1996-2000	Fuel Quality in Delhi (Present)	Recommen-ded 2005	World best standards
DIESEL Sulphur (ppm)	**10000** (2500)	**500**	**500**	**10** (Swedish Class I diesel)
Cetane number	**42**	**42**	**50**	**50** (EU)
Polycyclic aromatics (wt %)	Not specified	Not specified	**10**	**0.12** % by volume (Swedish Class I diesel)

Source: Anon, 2001, Transport fuel quality for year 2005, Central Pollution Control Board, December

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

The most serious limitation of the norm setting process is that it does not indicate what kind of air quality target it is trying to achieve.

Delhi faces the challenge of reducing particulate pollution by as much as 90 per cent from the current peak levels to reach anywhere near the clean air target which is to attain at least 50 per cent of the standard throughout the year. How the proposed norms will help us go even near that target is not known.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

The challenge

Slow incremental process of improving engine and fuel standards will not help. Incremental change is possible only in those countries that are already in the forefront of technology not in India or other developing countries that are lagging behind by more than 10 years.

Policies should be designed for quantum leap and bring in latest technologies to meet clean air targets. Only this will help to avoid the polluting pathways that industrialised countries have gone through. This essentially means that India would need to make rapid advances in technology to make a quantum jump and only slow improvements in technological efficiency will not help.

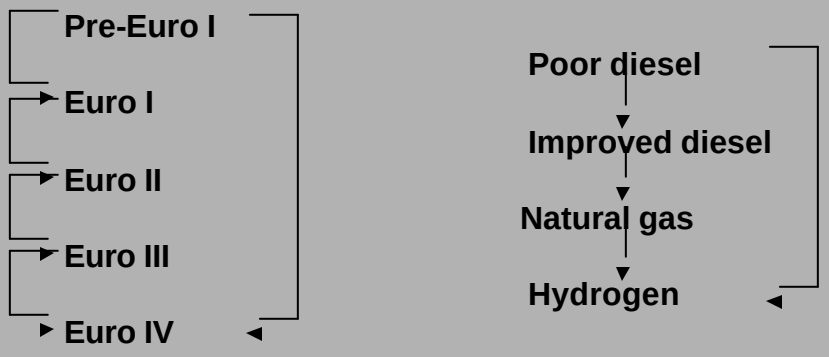
But making this quantum leap with the help of conventional fuels is going to be far more expensive than that based on an alternative fuel strategy.

The Supreme court order of moving the entire public transport including all taxis, autos and buses to CNG or other clean fuel is the first ever step towards a quantum leap

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

A KEY QUESTION

Do we have to go through the same stages of environmental management that the West went through or can we leapfrog?



CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

INDIAN TEST RESULTS

Test results from Ashok Leyland shows that a stoichiometric CNG bus fitted with a three-way catalyst is far ahead of a comparable diesel bus. It meets the Euro IV norms for both particulate matter and oxides of nitrogen

Pollutant	Test results standards (in grammes per kilo watthour)		Emission (in grammes per kilo watthour)			
	CNG	Diesel	Euro I	Euro II	Euro III	Euro IV
Oxides of nitrogen	3.24	7.721	8.0	7	5	3.5
Total Hydrocarbon	1.30	0.262	1.1	1.1	0.66	0.46
Non-methane hydrocarbon	0.04					
Particulate matter	0.014	0.31	0.36	0.15	0.1	0.02

Source: R Ramakrishnan 2001, CNG – The Clean and Cost-effective Fuel for Delhi Vehicles, *mimeo*.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

It will be immensely difficult getting anywhere close to the clean air target by 2010 with the help of conventional fuels.

The diesel route will need drastic improvements in engine technology, application of state of the art aftertreatment devices like catalyst-based diesel particulate filter, expensive fuels like ultra-low sulphur diesel with at least 10-15 ppm sulphur.

Both capital costs and running costs will be prohibitively high.

The government of India has already invested Rs 10,000 crore to upgrade its refineries to produce diesel with sulphur content of 500 ppm sulphur diesel for supply to metro cities. To produce diesel with 350 ppm sulphur an additional investment of Rs 9,358 crore would be needed. By their own admissions producing 10 ppm sulphur immeduately is not feasible. If imported it is likely to increase the prices of diesel by at least 4-5 rupees per litre.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

Even the best diesel by itself does not reduce particulate, PAH, and sulphur dioxide emissions substantially if used in existing or even improved engine technologies.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

IMPACT OF REDUCING SULPHUR ON EMISSIONS

Tests done all across the world show small decrease in particulate emissions even with large reduction in sulphur content of diesel

Country	Reduction in diesel sulphur content	Reduction in particulate emissions
European Auto Oil Programme	From 300 ppm to 30 ppm	9 per cent
Study by US-based Southwest Research Institute	From 300 ppm to 10 ppm	**21.6** per cent Number of particles larger than 0.1 micron went down with reduction in sulphur levels, but number of particles smaller than 0.1 micron went up.
Motor Test Centre, Sweden	**3000** ppm to **50** ppm **3000** ppm to **10** ppm	**5-12** per cent **14-22** per cent

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

IMPACT OF REDUCING SULPHUR ON EMISSIONS

Tests done all across the world show small decrease in particulate emissions even with large reduction in sulphur content of diesel

Country	Reduction in diesel sulphur content	Reduction in particulate emissions
Hong Kong	355 ppm to 35 ppm	4.4 per cent
New Zealand	From 500 ppm to 50 ppm From 350 ppm to 10 ppm.	5.1 per cent Number of particles emitted by an Euro I heavy-duty diesel engine increased Euro II diesel engine emitted more particles smaller than 56 nanometre when running on 10 ppm sulphur diesel than on 50 ppm sulphur diesel

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

Wherever huge investments have been made to get diesel with sulphur content of 10 ppm to 15 ppm, it has come as a package with technology – very low sulphur and PAH diesel together with good engines, constantly regenerating traps and de -NOx catalyst.

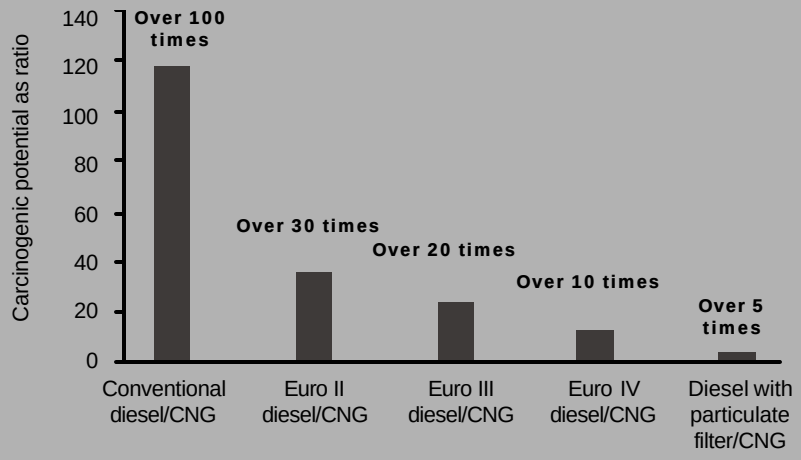
Fuel sulphur in ppm	PM emission in gram per g/bhp-hr	Percentage increase in PM emission relative to 3 ppm sulphur diesel
3	0.003	0
7	0.006	100
15	0.009	200
30	0.017	470
150	0.071	2300
Tier 2 emission Standard (2004-2009)	0.01	

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.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

Cancer risk: the clean diesel myth

The carcinogenic potential of even the best quality diesel in vehicles fitted with particulate traps is about five times that of CNG



Source: Nils-Olof Nylund and Alex Lawson 2000, International Association of Natural gas Vehicles

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

Gaseous fuels can also eliminate the problem of fuel adulteration which is a very serious problem in India.

Even if we get the best quality diesel, we would need strong regulatory measures to ensure that the fuel does not get adulterated and the particulate traps are cleaned and regenerated when required.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

It is imperative to have the right fiscal policies to make clean technologies competitive. This applies to both CNG and other alternative fuels like LPG, ethanol, battery-operated vehicles and so on.

Market for these technologies is still very hostile in the absence of any clear official policy to promote them.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

With the help of fiscal instruments, it is possible to generate revenue that can be used to phase in clean technologies and clean fuels.

World over governments relate fuel taxes to GDP. Ratio of per capita GDP and fuel prices show how much more or less the citizens are paying for fuels in relation to per capita GDP. Lower the ratio higher the tax level.

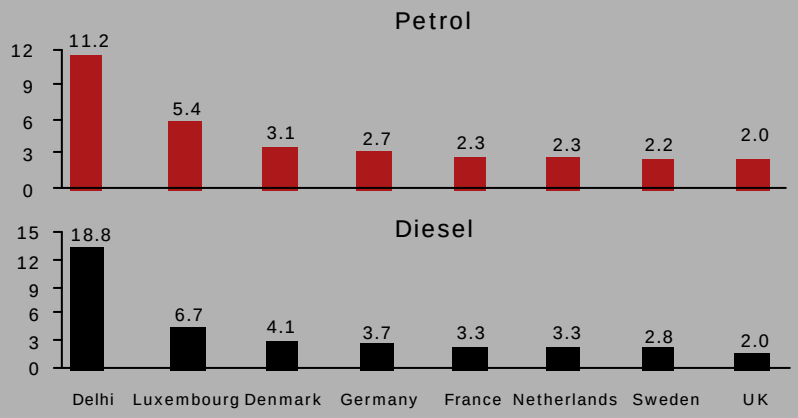
Delhi has the highest per capita income in the country and also the lowest diesel prices compared to other metros in India.

This means fuel is underpriced, promoting consumption of dirty fuels which lead to pollution and wastage.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

Fuel comes cheap in India

The ratio between per capita GDP and fuel prices show that fuel comes cheap in India than in EU countries. The difference is stark in case of diesel



CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

The CNG crisis in Delhi could easily be averted had the government focussed on designing fiscal instruments and fiscal incentives to phase in CNG technology over the last three years.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

It is possible to design finance schemes without losing any revenue.

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. Increasing the price of diesel to that of Mumbai would have netted the government over Rs. 450 crore in one year. Such policies can still be implemented to subsidise the CNG conversion process.

Even road taxes for cars and scooters in Delhi is very low. The road tax for cars in Chennai is twice that of Delhi. Our estimates show that if we revise these rates nearly Rs 70 crores can be raised.

CHALLENGES TO IMPROVING FUEL QUALITY IN INDIA: addressing public health concerns

Recommendations

- We need to leapfrog. Incrementalism will not work. This needs proper fiscal and technological policy-framework.
- Need special fuel and emission standards for pollution hot spots in the country.
- Need to frame an alternative fuel policy for the whole country.
- Strengthen regulatory institutions through training and capaci ty building.
- We need not repeat mistakes. It is possible to make decisions based on international experience.