

MINDA IMPCO TECHNOLOGIES . LTD.

We Thank The **Clean Cities Program (US,DOE)** For Giving Us This Opportunity.

We Welcome All the Participants to this **10th National Clean Cities Conference** and to this Presentation on **India's AFV Success, Learnings and Road Ahead**

3rd May, 2004

We Care for Air

Taj Mahal

World's Wonder. India's Pride.

Presentation Plan

<p>A. Overview of Alternate fuel vehicles program in India</p> <ul style="list-style-type: none"> (a) Indian Economy and Energy Sector (b) Registered Vehicles and AFVs (c) NG Program in India (d) LPG Program in India (e) Comparison Chart (Auto Fuels) (f) Other Alternate Fuel Program 	<p>Slide 3-11</p> <p>Slide 3</p> <p>Slide 4-5</p> <p>Slide 6-8</p> <p>Slide 9</p> <p>Slide 10</p> <p>Slide 11</p>
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Indian Economy & Energy Sector

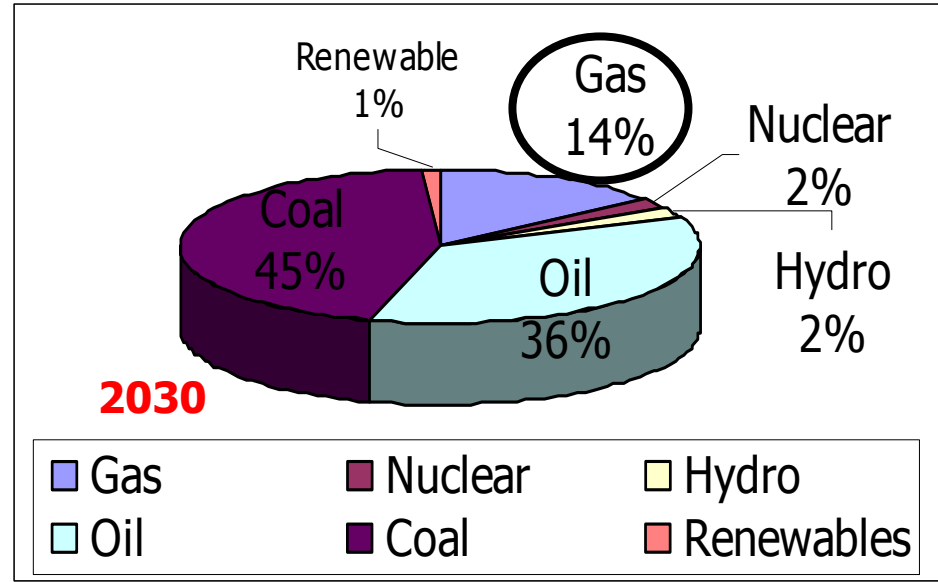
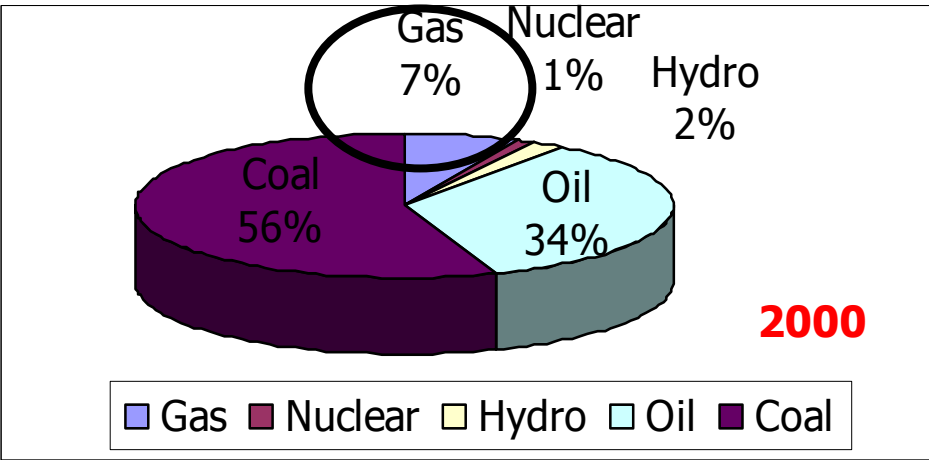
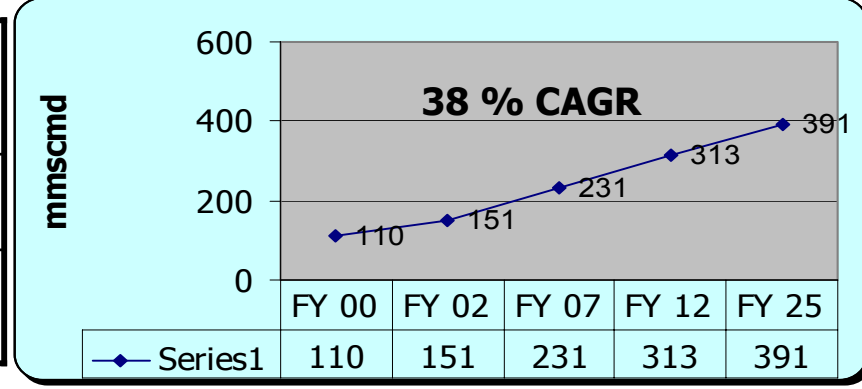
Population	1.1 Billion, 3.79 times of U.S
Geographical Area	3.29 million Sq. Mtr., 1/3 of U.S

Country	GDP	Inflation
India (2003-04)	8.1%	4.4%
US (2003)	3.1%	1.9%

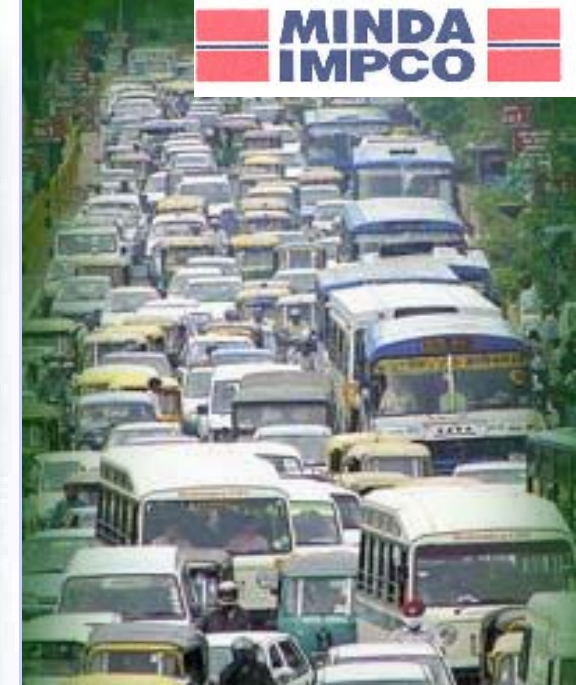
Energy Sector In India

	Production (2002-2003)	Proven Reserves (2002-2003)	Life (Years)
Crude Oil	33 Million Tones	740 Million Tones	23
Natural Gas	31 Billion Cubic meters	751 Billion Cubic meters	25

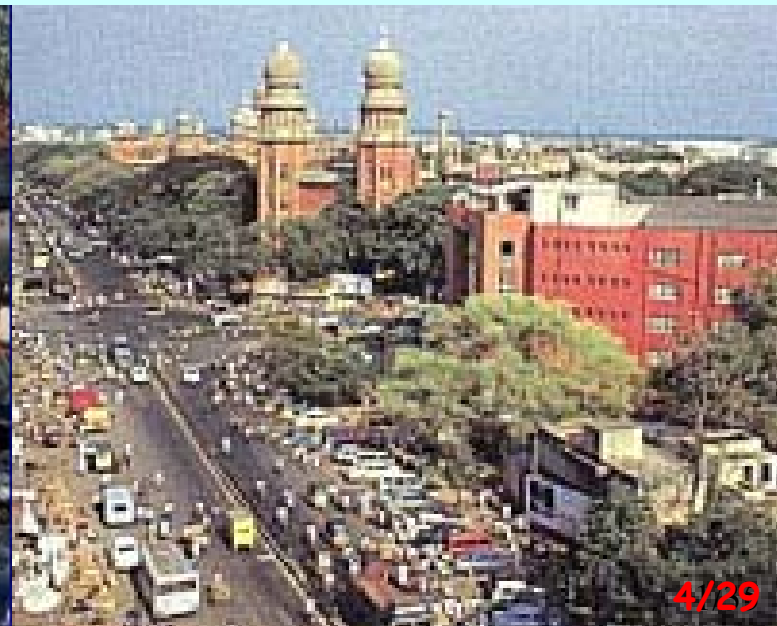
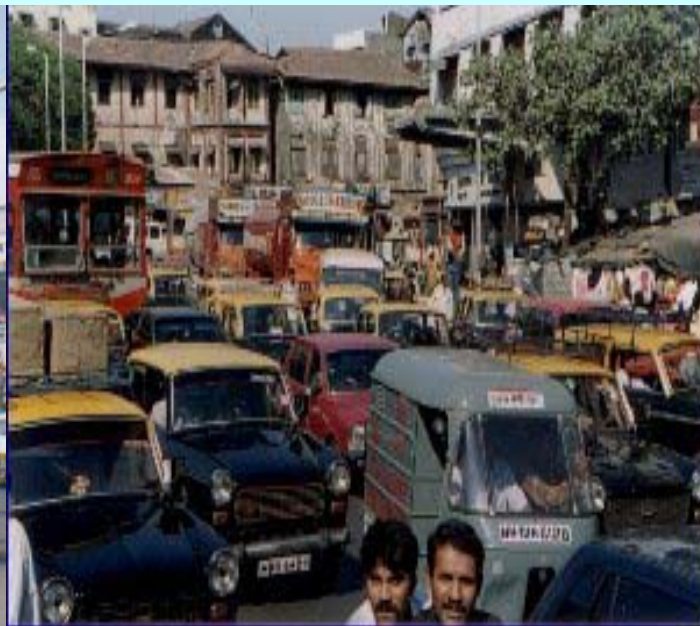
Projected demand for natural gas



In Mtoe	Year 2000	Year 2030
Energy Demand	300	750
Gas Demand	22	97



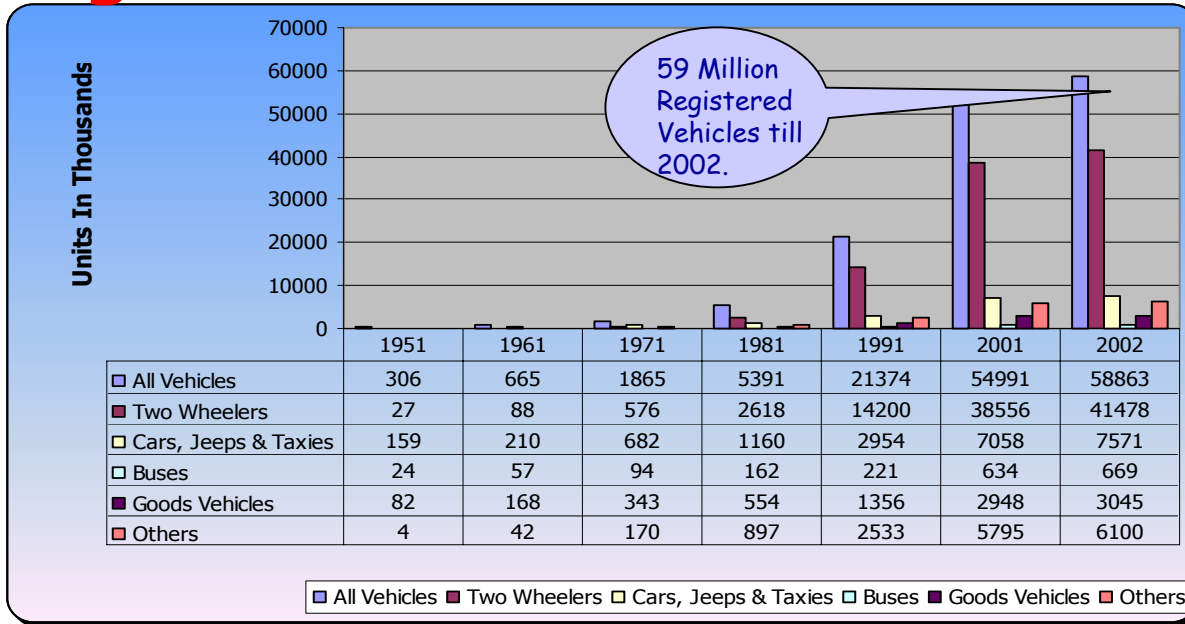
**INDIA: VEHICLES & POLLUTION INCREASING EVERYWHERE, AFVs
RIGHT CHOICE IN MAJOR CITIES**



Registered Vehicles In India



Source: morth.nic.in



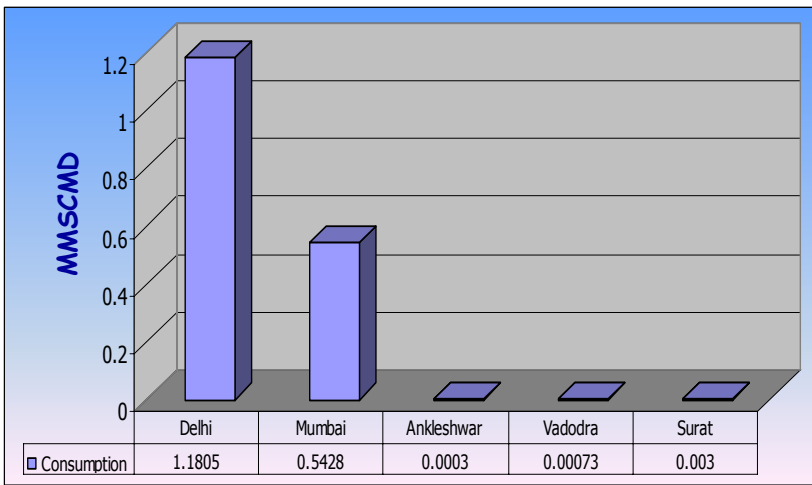
Vehicles on CNG

Items	Delhi	Maha.	Gujarat			Total
	IGL	MGL	Vadodra	Surat/ GGCL	Ankeleshwar	
No. of Vehicles						
Cars	15876	47870	450	663	123	64982
Autos(3-wheelers)	56846	61497	16	429	0	118788
Mini Bus	5164	7	0	0	0	5171
Buses	10075	47	0	0	0	10122
TOTAL	87961	109421	466	1092	123	199063

NG Program In India

- In Delhi & Mumbai entire public transport is on CNG and CNG vehicles are increasing in the states where NG is available e.g. Gujarat state (Vadodra, Surat /GGCL,Ankeleshwar).
- PNG (Piped Natural Gas) is supplied to 0.18 Million houses In Mumbai, 0.14 Million in Gujarat & 0.031 Million Houses in Delhi.
- India has received its first consignment of 138,000 cubic metres of liquefied natural gas (LNG) from Qatar on 30th Jan, 04.
- Reliance's Krishna-Godavari reserves are likely to hold more than 15 trillion cubic feet (tcf) of gas.

CNG CONSUMPTION IN MAJOR CITIES as of January 1, 2004



Station Types	Delhi	Maha.	Gujarat			Total
	IGL	MGL	Vadodra GAIL	Surat GGCL/ GSPC	Ankeleshwar GGCL	
Mother	56	03	1	1	0	61
Online	25	46	0	2	0	73
Daughter Booster	30	15	0	0	0	45
Daughter	6	0	1	0	1	8
TOTAL	117	64	2	3	1	187

GSPC & GSPL Infrastructure



- Gujarat State Petroleum Corporation (GSPC) is oil & gas producing company, GSPC has created Gujarat State Petronet Limited (GSPL) for gas transportation.
- 208 km pipeline has been constructed and is under operations since its inception.



GGCL Network

- Gujarat Gas Company Limited (GGCL) is promoted by British Gas group to procure, distribute & utilize NG.
- GGCL feeds more than 2.2 million standard cubic metres per day (mmscmd) of Natural Gas.

Source:www.gujpetronet.com



- Adani Group has formed Gujarat Adani Energy Limited. A company which has rights to set up Natural Gas distribution in Ahmedabad & Vadodra cities. The demand for these 2 cities is estimated as 1.5mmscmd.
- Adani Group is planning Rs 5000 Crore (1.1Bn.\$) turn over in next 5 years and present turn over is 638 Mn.\$ in year 2002-03.

Natural Gas Pipelines In India

- Gail has the major pipeline share in India, its Hajira - Bijapur and Jagdishpur 2700 Km gas pipeline brings gas to Northern part of India.
- Other players in pipeline are ONGC, Assam Gas,GSPL, GGCL etc.Gail wish to create a national grid in India, several MNCs have shown interest in pipeline projects in India

Proposed National Gas Grid



GAIL (INDIA) LTD, PROPOSED NATIONAL GAS GRID (PHASED DEVELOPMENT)



Auto LPG Status In India

CITY	Commissioned	To Be Commissioned	Work In Progress	Total
Delhi	5	12	1	18
Mumbai	20	4	1	25
Bangalore	6	0	2	8
Hyderabad	8	0	2	10
Jaipur	2	0	0	2
Chennai	5	19	5	29
Kolkata	2	2	16	20
Ahemdabad	2	0	3	5
Agra	0	1	0	1
Chandigarh	2	0	0	2
Bhopal	1	0	0	1
Indore	1	0	0	1
Pune	3	1	1	5
Lucknow	1	0	0	1
Tirupati	1	0	0	1
Nashik	1	0	0	1
Total	60	39	31	130



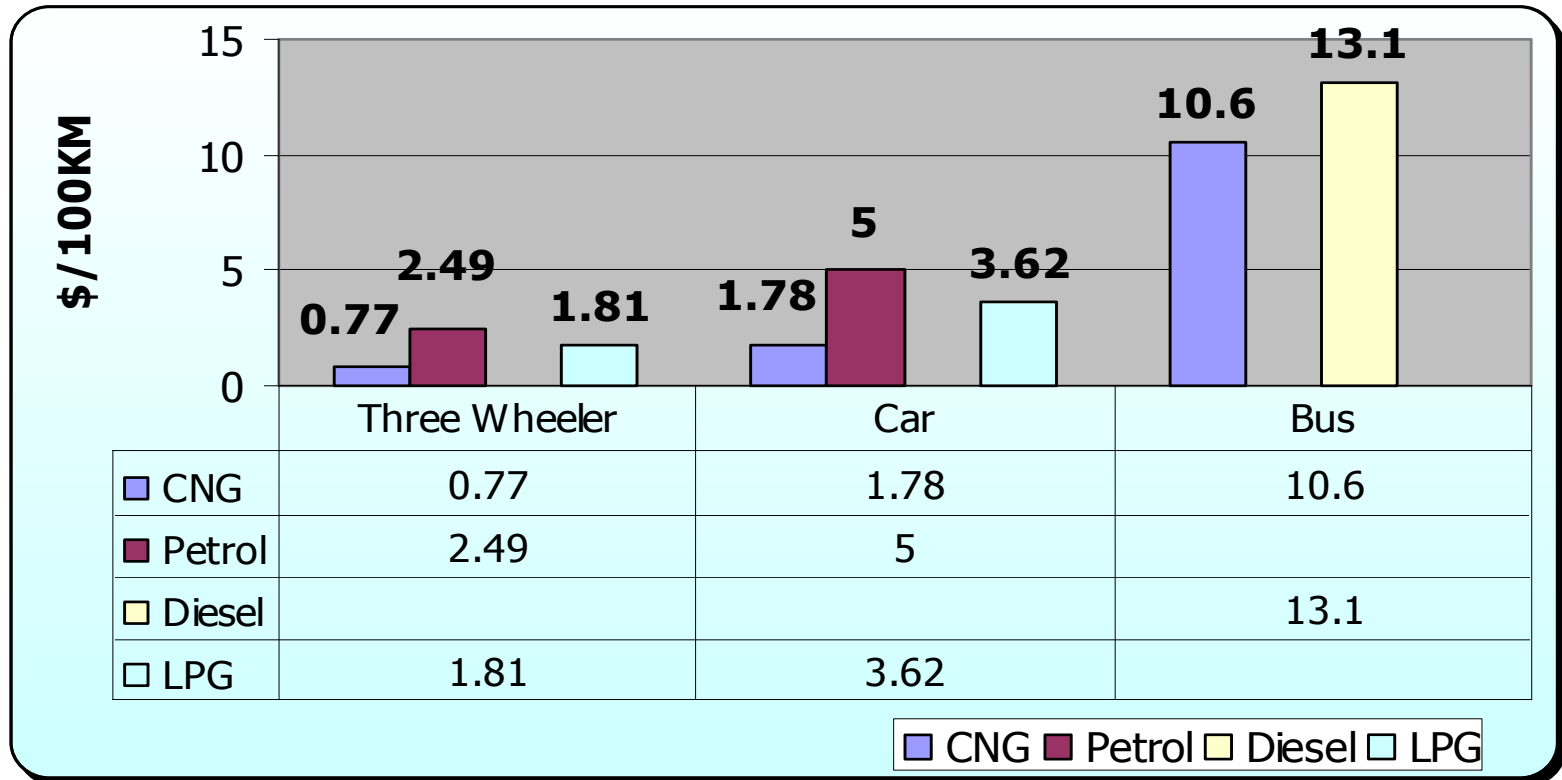
ALDS of oil companies

COMPARISON CHART (AUTO FUELS)

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Type of Vehicle	Avg. on CNG/KG	Avg. on LPG/LT	Avg. on Petrol/LT	Avg. on Diesel/LT
Car	21	13.5	15	
3 W	48.5	27	30	
Bus	3.5			3.5

Price	In INR	In \$
Petrol/LT	33.70	0.74
CNG/KG	16.83	0.37
LPG/LT	22.02	0.48
Diesel/LT	20.73	0.46



Ethanol

- Government of India issued a notification on 12th Sep, 2002 mandating supply of 5% ethanol-blended petrol in nine states and four Union Territories with effect from 1 January 2003.

Bio diesel

- The first successful trial run of a passenger train was conducted on Dec 31, 2002 when the Delhi-Amritsar Express used 5% bio diesel as fuel. Haryana Roadways buses trials planned

Fuel Cell

- MNES has been promoting this project.
- BHEL-R&D, SPIC and TERI are developing indigenous fuel cell technology. BHEL R&D has developed fuel cell of 50 kW. SPIC Science Foundation is working on fuel cells.

Hydrogen/Hydrogen Derivative Vehicles

- IOC (R&D) has been given the mandate by Govt of India through a R&D fund to develop the Hydrogen or Hydrogen Derivative vehicle Technology.

Electric Vehicles Experience

- Reva, first electric car in India has been launched
- BHEL has supplied electric buses, Mahindra & Mahindra has developed electric vehicle called Bijlee



Battery Powered Road Vehicle



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Delhi

- 1985-1996, SC Orders Unleaded Petrol, Catalytic Converter on New Cars, Low Sulphur Diesel, Govt. fleet on CNG in Delhi.
- SC directed all the Public transport vehicles to run on alternate fuel.
- Setting up of authorities like the Environment Pollution (Prevention & Control) Authority for protecting and improving the quality of environment.

Kolkata

- **Kolkata High Court** has instructed within one year (October, 2004) all vehicles in Kolkata Municipal Area should conform to Bharat Stage II.

Mumbai

- All commercial vehicles to run on CNG by End Dec, 2004 .

Hyderabad

- Phasing out of commercial vehicles above 15 years in age.
- No. fuel without PUC.
- Issue of necessary amendment of Motor Vehicles Act to apprehend and penalize the use of adulterated fuel in vehicles.

•Bangalore Government -

Proposes to provide interest subsidy of Rs 2,000/- per auto rickshaw from the Green Tax collected by the state

•Delhi Government -

It has designed some fiscal incentives that includes sales tax exemption on autos and taxis and 6 per cent subsidy on interest on loans for autos and 4 per cent subsidy on loans for taxis from Delhi Finance Corporation.

• Gujarat Government -

It has also planned some subsidy on AFV in their state.They have enacted a CNG Act for proper implementation of CNG infrastructure in the state.

EMISSION REGULATIONS

EMISSION NORMS

(PETROL ENGINE)

gm/km

Types of Vehicles	Norms	CO	HC+NO _x
Three Wheelers	BS II	2.2	0.5
	Euro III	2.3	0.35
Cars	BS II	2.2 – 5.0	0.5- 0.7
	Euro III	2.3	0.35

(Diesel Vehicles)

Types of Vehicles	Norms	CO	HC	NOx	HC + NOx	PM
GVW upto 3.5 Tons (gm/km)	BS II	1.0-1.5	-	-	0.7-1.2	0.08-0.17
	Euro III	0.64	-	0.50	0.56	0.05
GVW > 3.5 Tons (gm/kwh)	BS II	4.00	1.10	7.00	-	0.15
	Euro III	2.10	0.66	5.00	-	0.10

Coverage	Cars, LCVs & Heavy Duty Diesel vehicles	2/3 Wheelers
Entire Country	Bharat Stage II: 1.4.2005 Euro III Equivalent: 1.4.2010	Bharat Stage II: 1.4.2005
11 Major cities (Delhi/NCR, Mumbai, Kolkata, Chennai, Bangalore, Hyderabad, Ahmedabad, Pune, Surat, Kanpur & Agra)	Bharat Stage II: 1.4.2003 Euro III Equivalent: 1.4.2005 Euro IV Equivalent: 1.4.2010	Euro III Equivalent: Preferably from 1.4.2008 but not later than 1.4.2010

Some Regulatory Standards

CNG Components	ISO 15500-1:2001
LPG Components	ECE-R-67-01

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US Clean Alternative Fuel Vehicles Delegation India Trip

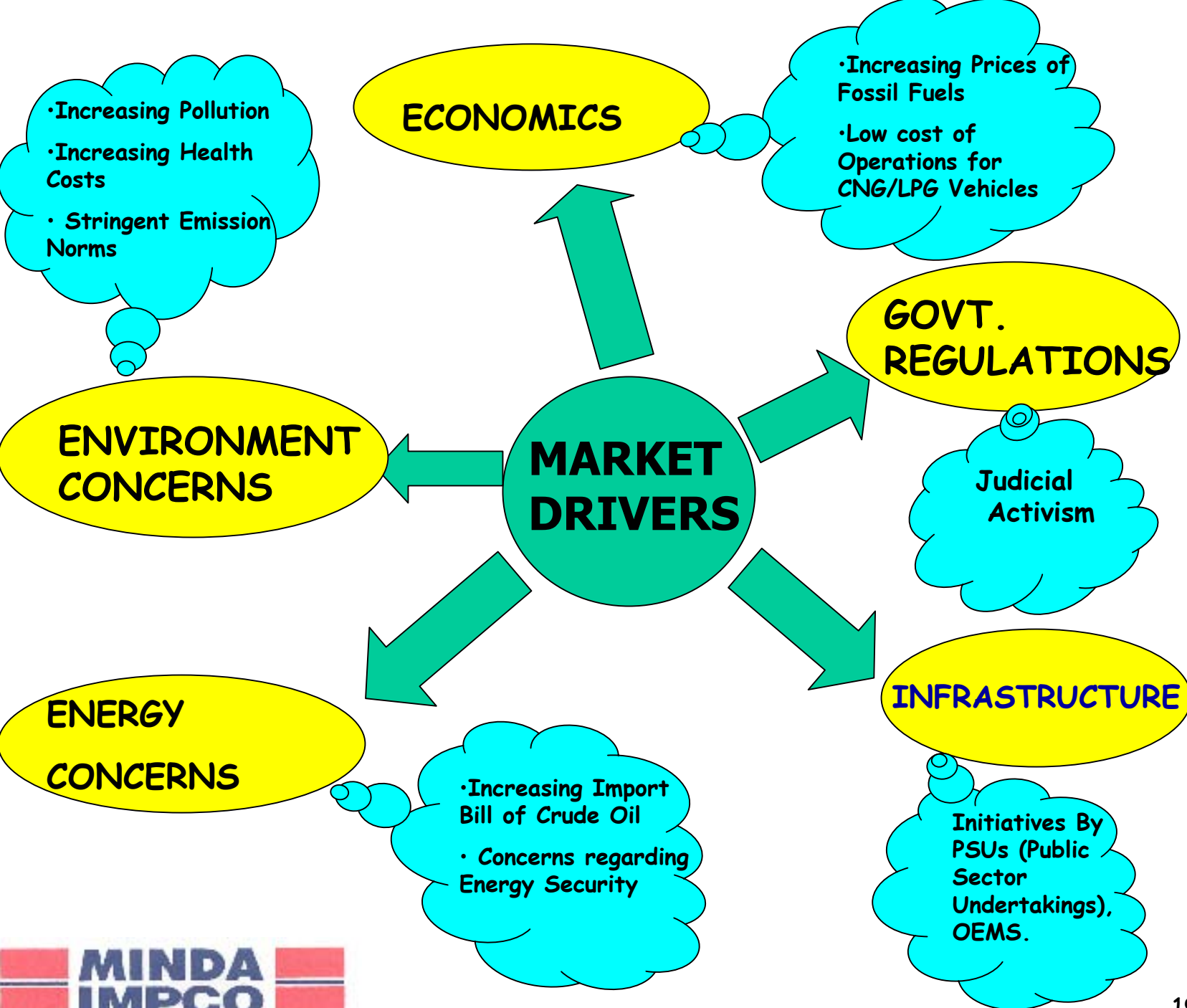


The US Delegation Team convenes in Chennai. Those pictured in first row (L to R) are K. Balakrishnan, US-AEP - New Delhi; Shishir Agrawal, Minda Impco; and Orestes Anastasia, SAIC. Second row (L to R) are Edward Farrell, Wentworth Institute; Ira Dorfman, eMobility International; and Stacia Harper, NETL.

- * Visit of a high level US delegation to support Indian AFV program: Delegation of US consultants, supported by the US - India Climate Change Partnership of the
- United States Agency for International Development (USAID).
- US Department of Energy's (DOE) International Clean Cities Program.
- * ILPGAC (Indian LPG Auto Gas Coalition): During the visit of US delegates, Inaugural meeting of ILPGAC was organised at Mumbai, Minda Impco provided the support.
- * Trainings in India on AFVs: Mr. Edward Farrell, Wentworth Institute, Boston, MA is an automotive expert in alternative fuels. Mr. Farrell conducted training sessions in Mumbai and Chennai.

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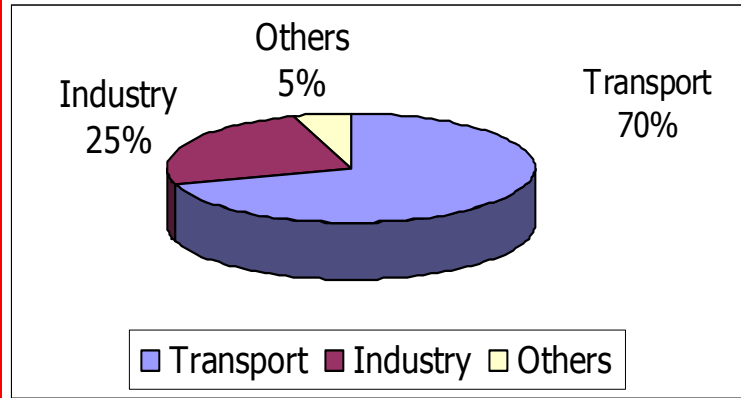
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Pollutant	Effect on Human Health
Carbon Monoxide	Affects the cardio vascular system etc.
Nitrogen Oxides	Increased susceptibility to infections, pulmonary diseases etc.
Sulphur Dioxide	Affect lung function adversely etc.
Particulate Matter	Fine particulates irritating lung tissue and causing long-term disorders etc.
Lead	Impairs liver and kidney, causes brain damage in children etc.
Benzene	Both toxic and carcinogenic. Excessive incidence of leukemia etc.



Such Polluting Vehicles Were Common in Indian Metro Cities



Major Contributor To Pollution In Indian Metropolitan Cities

COST OF POLLUTION

WORLD BANK STUDY, USING 1992 DATA, CALCULATED :

- ANNUAL HEALTH COST TO INDIA WAS 1.15 Bn. USD DUE TO AMBIENT AIR POLLUTION
- COST OF AIR POLLUTION IN DELHI ALONE WAS 0.21 Bn. USD

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Pioneering Efforts for the Success of AFV program in India:

— Judiciary, EPCA, Central and State Governments, Transport departments, ARAI, Chief Controller of Explosives, NGOs like - CSE, OEMs and other Equipment Suppliers; all played a pioneering role for the success of AFV program.

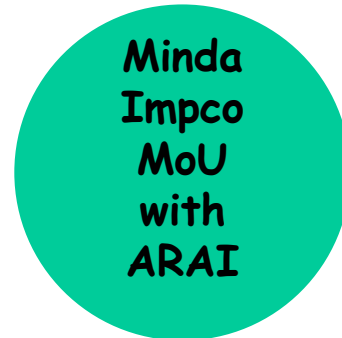
Being an Equipment supplier, we can share our experience and role:

- We along with other equipment suppliers contributed by providing the basic R&D, technology and products necessary for AFV.
- Minda Impco worked closely with OEMs and in the After Market to provide CNG and LPG kits.
- We helped in creating awareness by conducting camps.
- We are disseminating the information on AFV in India through our newsletter.
- Minda Impco has also joined hands with ARAI to develop AFV technologies for meeting Euro III applications in India

Minda Impco Awareness Camp, showing Mr Khattar, MD, Maruti Udyog



Minda Impco Newsletter



MINDA IMPCO TECHNOLOGIES LIMITED

A Joint Venture of



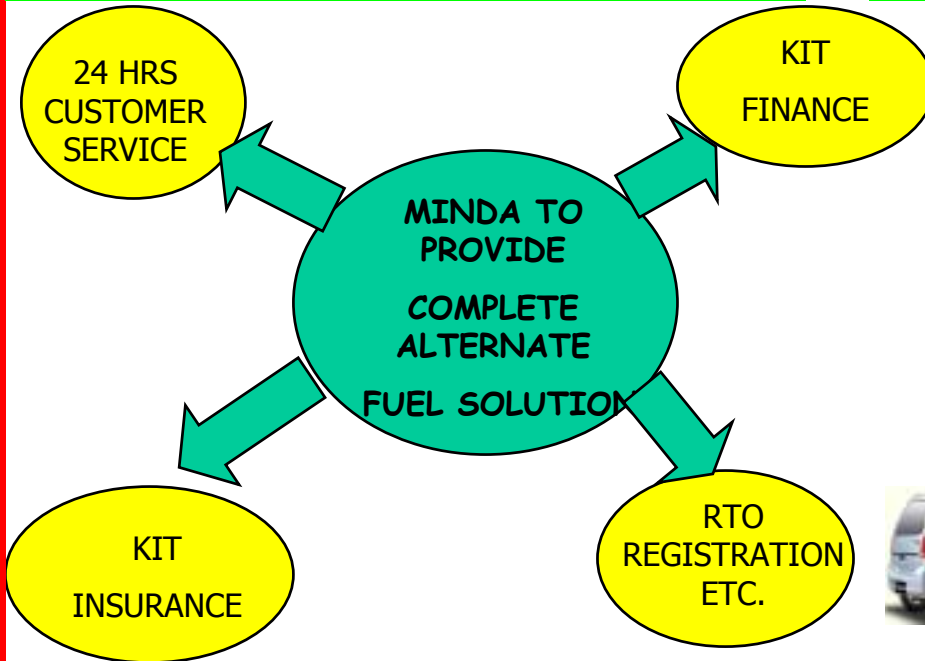
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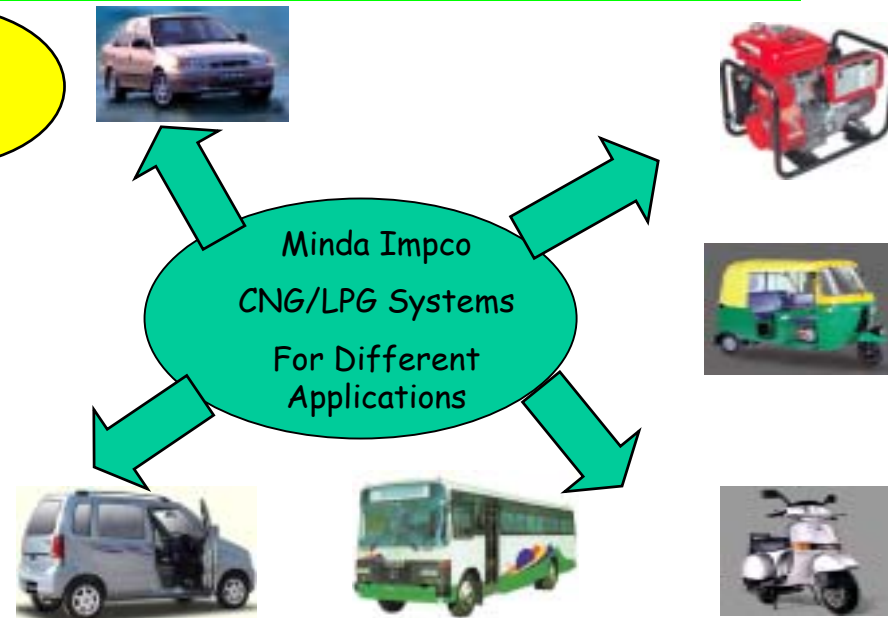
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MINDA IMPCO'S UMBRELA OF SERVICES



MINDA IMPCO'S RANGE OF ALTERNATE FUEL KITS



We Care for Air



IMPCO TECHNOLOGIES INC., USA



**Over 44 years
500 employees
worldwide**



**The Market Leader in the Expanding
Alternative Fuels Industry**



**ISO
9001:2000
Certified**

**Our Business: Design
& Marketing Of
Alternative Fuel
Components For
Internal Combustion
Engines**



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Suggestions and conclusion

Chicken & Egg Story

Oil Companies complain that there are not enough consumers of Auto LPG , on the other side OEMs are waiting for the Auto LPG infrastructure to be in place.

AMC for Out of warranty buses

Out of the warranty buses need periodic maintenance and inspection. This may be carried out through proper maintenance schedule or by introducing AMC (Annual Maintenance Contract).

Fuel availability

For a successful CNG program there should be adequate availability of fuel across cities, to meet the demand of growing alternate fuel users in India.

Price & Cross subsidization strategy

1. Reduction of Kit prices by cross subsidy from gas prices
2. Gas & gasoline prices to have adequate difference.

Pump design regulations

CCOE visiting the Clean Cities Conference in May and being arranged some side trips to LPG fueling sites to demonstrate safe LPG use utilizing above-ground design and smaller station footprints is a step in positive direction.

Public Awareness Programs

We should organize free emissions testing camps with assistance from the NGO's and manufacturers. Seminars, debates at schools and colleges, and lectures to taxi and truck drivers are some of the other components of the awareness programs.

Appropriate Standards and monitoring of conversion, training on Safe Practices

Govt, should ensure proper standards for AFVs and facilitate their conversion.

Unauthorized conversion is a safety hazard.

In India about 9 buses were involved in fire due to lack of safety standards, lack of training among Bus drivers, lack of awareness among people.



Bus Fires

Spurious products in India from other countries

Small traders are importing spurious and substandard kits from all over the world, this results in unfair trade practices.

Initiatives

India has a great energy & environment concern, US clean cities program can initiate steps in India and other South Asian Countries in overcoming these concerns. We already have taken steps for e.g.

- We are trying to work on a pilot project, develop an engine of a six seater public transport diesel vehicle (called *MiniDor*) to run on LPG in the city of Pune.

- We are also trying for the possible investment of Minda Impco in CNG and LPG Vehicles in the Philippines. Philippines has energy and pollution concerns similar to India. For this 2 units of Philippine jeepneys will be sent to India for conversion to CNG.

- We also initiated our participation in ICC (India CNG consortium) where in Gail India Limited has initiated talks with leading corporates to jointly tap CNG business opportunities abroad under the umbrella of an 'Indian CNG consortium. This consortium will offer total solution package to gas rich countries keen to create CNG infrastructure.

Conclusion

AFV Boom in India & South Asian Countries not only helps in addressing Environment concerns but also Makes Good Business Sense for US Companies to Focus on the Region

Glossary of Terms

ARAI	Automotive Research Association of India
AFV	Alternate Fuel Vehicles
ASEAN	Association of South East Asian Nations
AMC	Annual Maintenance Contract
ALDS	Auto LPG Dispensing Station
BHEL	Bharat Heavy Electricals Limited
BS	Bharat Stage I, II, III etc.
BCM	Billion Cubic Meter
CO	Carbon Monoxide
CSE	Center of Science & Environment
E & Y	Ernst and Young
CNG	Compressed Natural Gas
CCOE	Chief Controller of Explosives
EPCA	Environment Pollution Prevention & Control Authority
DOE	Department of Explosives
GSPL	Gujarat State Petronet Limited
GSPC	Gujarat State Petroleum Corporation
GGCL	Gujarat Gas Company Limited
GDP	Gross Domestic Product
GAIL	Gail (India) Limited
GVW	Gross Vehicle Weight
HBJ	Hazira-Bijapur-Jagdishpur
INR	Indian Rupee
IGL	Indraprastha Gas Limited
ILPGAC	Indian LPG Auto Gas Coalition
IOC	Indian Oil Corporation
ICC	India CNG Consortium
LNG	Liquefied Natural Gas

LCV	Light Commercial Vehicle
LPG	Liquefied Petroleum Gas
MoU	Memorandum of Understanding
MGL	Mahanagar Gas Limited
MUL	Maruti Udyog Limited
Mn Tons	Million Tones
MTOE	Millions Tons of Oil Equivalent
MNES	Ministry of Non Conventional Energy Sources
MMSCMD	Million Standard Cubic Meter s Per Day
NETL	National Energy Technology Laboratory
NGO	Non-Governmental Organizations
NOx	Nitrogen Oxide
ONGC	Oil & Natural Gas Corporation
OEM	Original Equipment Manufacturer
PNG	Piped Natural Gas
PUC	Pollution Under Control
R&D	Research and Development
RTO	Regional Transport Office
SC	Supreme Court of India
SAIC	Science Applications International Corporation
TCF	Trillion cubic feet
US-AEP	United States-Asia Environmental Partnership
USAID	United States Agency for International Development
USDOE	US Department of Energy
VRDE	Vehicle Research Development Establishment