

# CNG EXPERIENCE IN DELHI

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# Disclaimer

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# Introduction

## Representing **Indraprastha Gas limited**

*A Joint venture of GAIL (India) Ltd, BPCL &  
Govt. of NCT of Delhi*

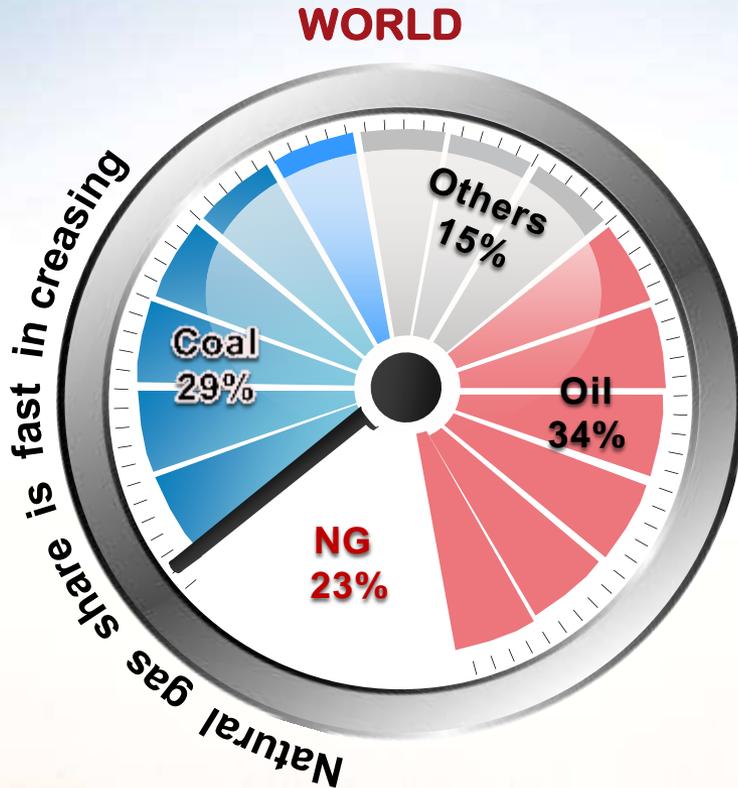


India's Largest CNG Distribution  
company

IGL Operates City Gas Distribution  
Network in Delhi and  
adjoining areas (NCR)

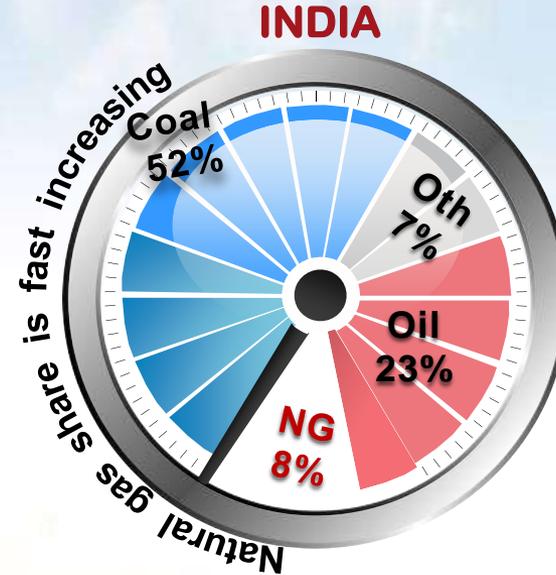
Providing Natural Gas to Automobiles,  
Households,  
Commercial & Industrial Customers

# Energy Basket - Global and India



Natural Gas contributes 23% of worlds energy consumption

While overall primary energy consumption rose by 2.1% last year , natural gas consumption rose by 2.5%



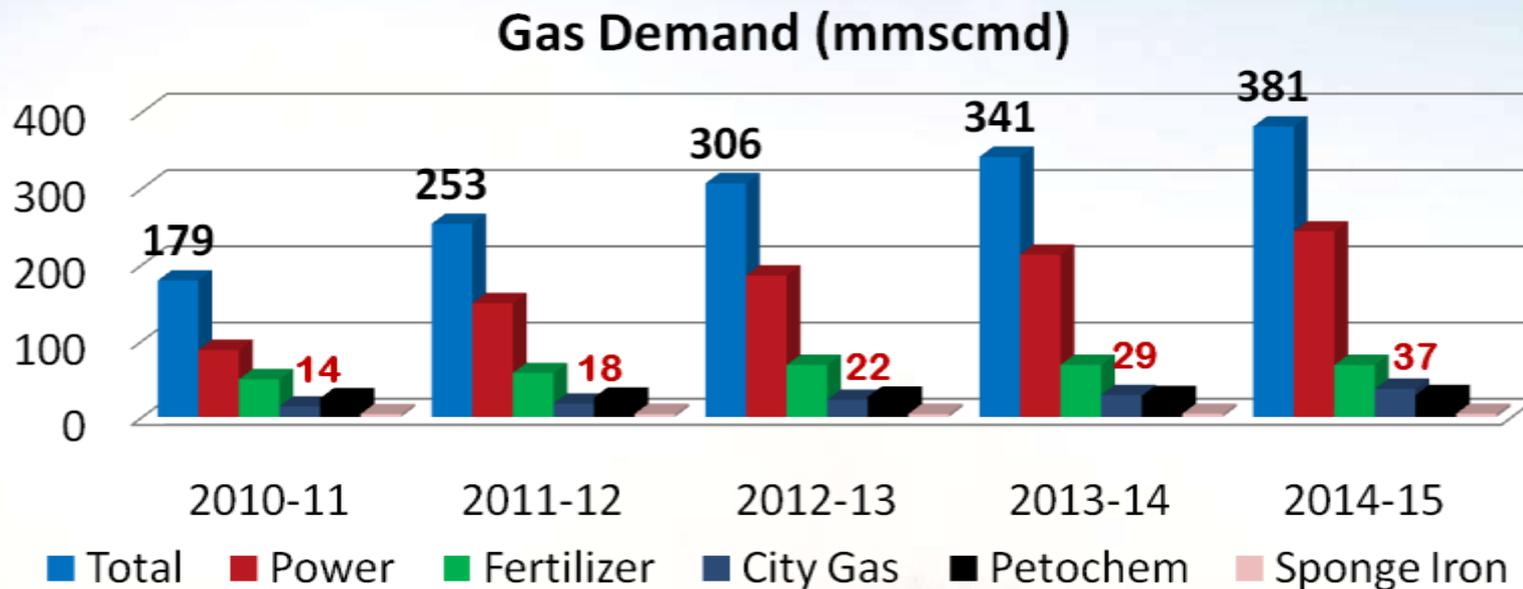
NG contributes 8% of India's energy consumption

While overall primary energy consumption rose by 4.8% last year , natural gas consumption rose by 6.6%

# Demand for Natural Gas in India



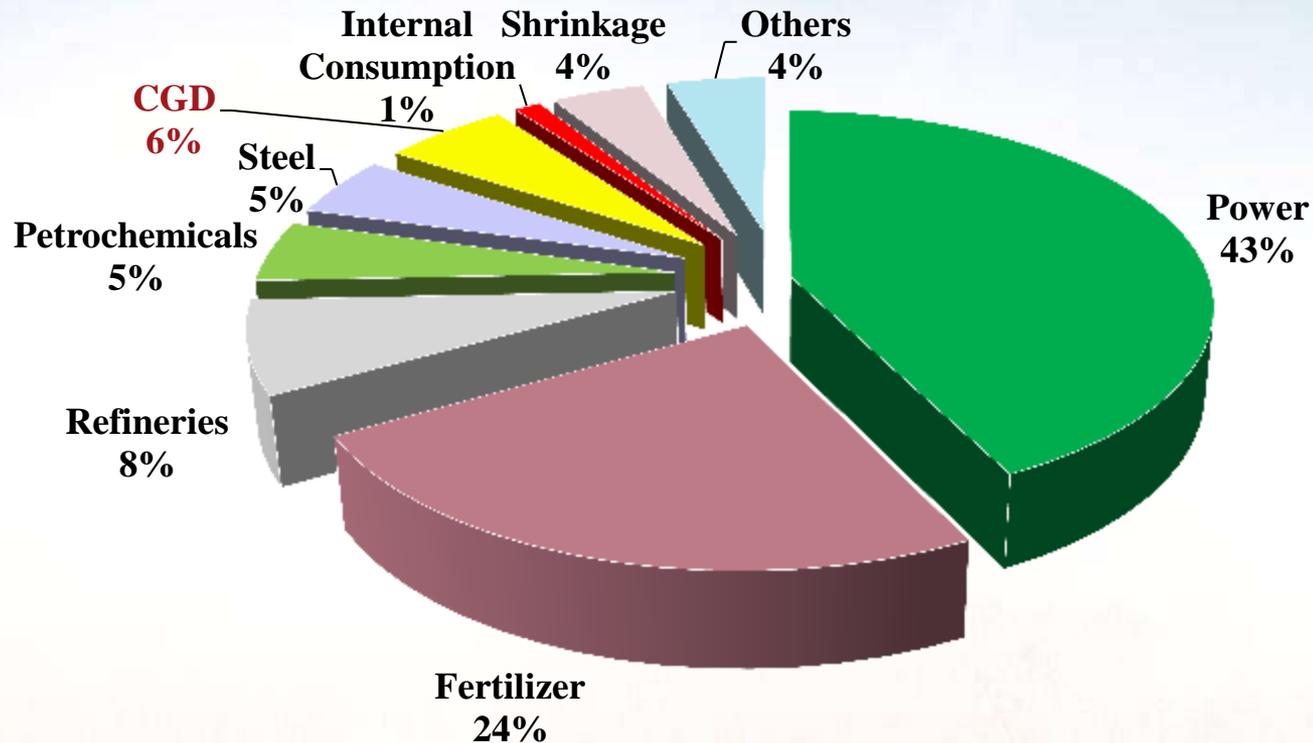
India leads in CNG, in the sense that 4% of gas is consumed in this segment compared to 1% world average



- CGD has a share of 6% in the Natural Gas basket in India and is expected to 14% in the times to come
- CNG contributes ~ 50 % of CGD natural gas demand
- CNG presently constitutes 4% of total gas consumed. This shall grow progressively to around 8% with time.

# Natural Gas Consumption in India

## Sector wise





# COMPARATIVE PROPERTIES OF AVAILABLE FUELS

PROPERTIES	UNIT	PETROL	DIESEL	CNG
CALORIFIC VALUE	KCAL/KG	11200	10850	10600
RELATIVE DENSITY	AIR=1	3.4	3.9	0.65
AUTOIGNITION TEMPERATURE	°C	232-282	225	540
FLAMMABILITY LIMIT	% IN AIR	1-8	0.6-5.5	5-15
FLAME TEMPERATURE	°C	1977	2054	1790
OCTANE NO.	-	87	-	127
CETANE NO.	-	10	45	10

**CNG : AN INHERENTLY CLEAN & SAFE FUEL**

# Natural Gas is cleanest fuel

Natural gas is the cheapest fuel source. It is also the least polluting

	Natural gas	Diesel	Furnace oil	Coal	Petrol
<b>Emissions*</b>					
Carbon dioxide	<b>117,000</b>	<b>135,250</b>	<b>164,000</b>	<b>208,000</b>	<b>285,700</b>
Nitrogen Oxide	<b>92</b>	<b>1,632</b>	<b>448</b>	<b>457</b>	<b>4,081</b>
Sulphur Oxide	<b>0.6</b>	<b>1,121</b>	<b>1,122</b>	<b>2,591</b>	<b>204</b>
Particulates	<b>7</b>	<b>1,021</b>	<b>8</b>	<b>2,744</b>	<b>41</b>

\*Emissions are pounds of air pollutants produced per billion British thermal unit (BTU) of energy

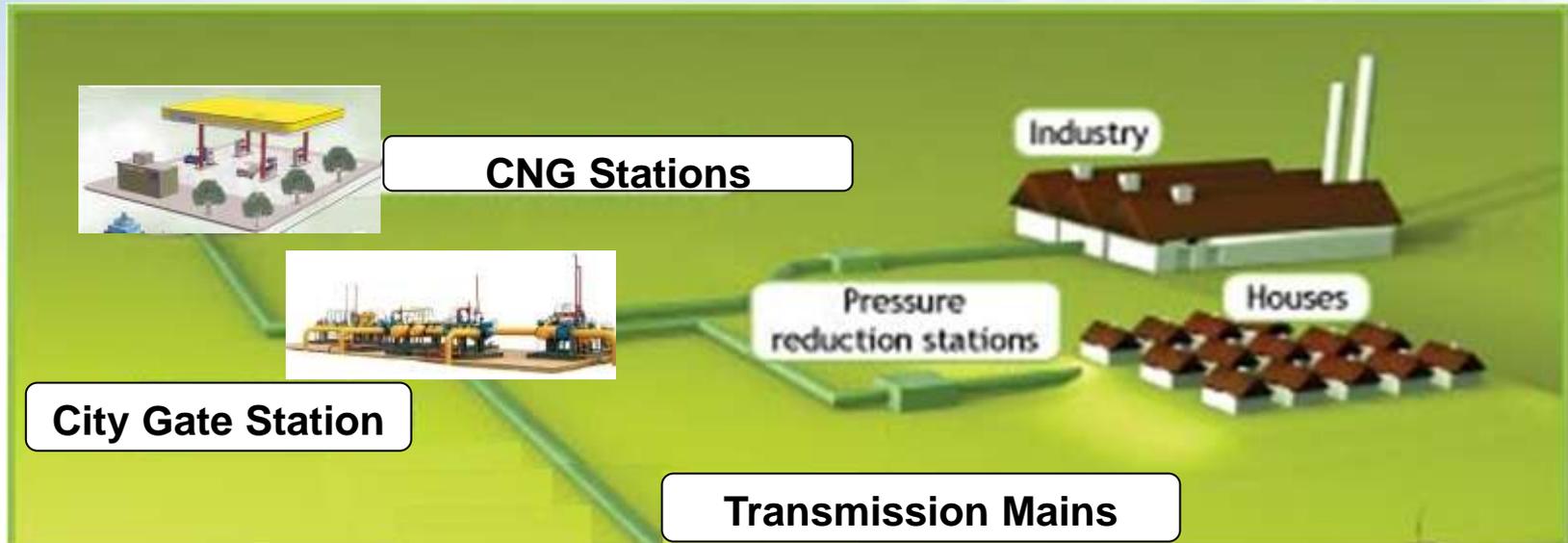
Source: Energy Information Administration, US; Crisil Infrastructure Advisory

# TYPICAL COMPOSITION: NATURAL GAS vs BIOGAS



Key numbers		Natural gas	Biogas
CH <sub>4</sub> (methane)	[vol%]	91	55-70
C <sub>2</sub> H <sub>6</sub> (ethane)	[vol%]	5.1	0
C <sub>3</sub> H <sub>8</sub> (propane)	[vol%]	1.8	0
C <sub>4</sub> H <sub>10</sub> (butane)	[vol%]	0.9	0
C <sub>5</sub> + (pentane)	[vol%]	0.3	0
CO <sub>2</sub> (carbon dioxide)	[vol%]	0.61	30-45
N <sub>2</sub> (nitrogen)	[vol%]	0.32	0-2
H <sub>2</sub> S (hydrogen sulphide)	ppm	~1	~500
NH <sub>3</sub> (ammoniac)	ppm	0	~100
Water dew point	[°C]	<-5	saturated
Net calorific value	[MJ/nm <sup>3</sup> ]	39.2	23.3
	[kWh/nm <sup>3</sup> ]	10.89	6.5
	[MJ/kg]	48.4	20.2
Density	[kg/nm <sup>3</sup> ]	0.809	1.16
Relative density	[-]	0.625	0.863
Wobbe index (W)	[MJ/nm <sup>3</sup> ]	54.8	27.3
Methane number	[-]	73	~135
<b>Stoichiometric mixtures</b>			
Air requirement	[nm <sup>3</sup> /nm <sup>3</sup> gas]	10.4	6.22
Flame temperature*)	[°C]	2040	1911

# About City Gas Distribution



- ✚ **Retail marketing of Natural Gas to all categories of consumers within the City or defined Geographical area.**
- ✚ **Gas received within the city at 19 Bar pressure**
  - ◆ **CNG** (Automobile Sector) – *Gas dispensed at 200 Bar pressure*
  - ◆ **PNG** (Domestic, Commercial & Industrial Sectors) – *Gas supplied at 21 mBar to 2 Bar pressure by reducing Pressure through DRS, PRS & MRS*

# *Back Ground of CNG Program in Delhi*

- Increasing vehicular pollution from conventional fuels
- Exponential rise in pollution related diseases such as asthma, lung cancer, pre-mature deaths...
- Delhi - Most polluted metro in the country
- 65% of air pollution from vehicles
- Pollutants (RSPM) up to 200 to 300 micro gram per cubic meter against permissible level of 100 micro gram per cubic meter

## ***Supreme court directives to reduce vehicular pollution (order dated 28.07.1989)***

- Replacement of all pre 1990 autos & taxis with new vehicles on clean fuels by 31.03.2000.
- No 8 year old bus to ply except on CNG or other clean fuels after 01.04.2000.
- Entire city bus fleet (DTC & private) to be steadily converted to single fuel mode on CNG by 31.03.2001.
- Gas Authority of India Ltd. to expedite and expand from 9 to 80 CNG supply outlets by 31<sup>st</sup> march, 2000

In compliance of Supreme court directive ***“Indraprastha Gas Limited” incorporated in 1998 as a joint venture of GAIL (India) Ltd & BPCL along with Govt. of NCT of Delhi.***

### **Status after 14 yrs:-**

- Annual Sales Turnover ~ Rs. 3380 Cr.
- Network of ~631 kms of steel & ~ 6479 kms of MDPE Pipeline
- Largest CNG distribution company in India
- 324 CNG outlets
- Average sale 3.67 mmscmd
- Catering to more than 6,65,758 vehicles (including 17,103 nos. buses – world’s largest fleet of CNG buses in any single city)

# CGD Implementation by IGL

## Growth in Infrastructure - last 5 years

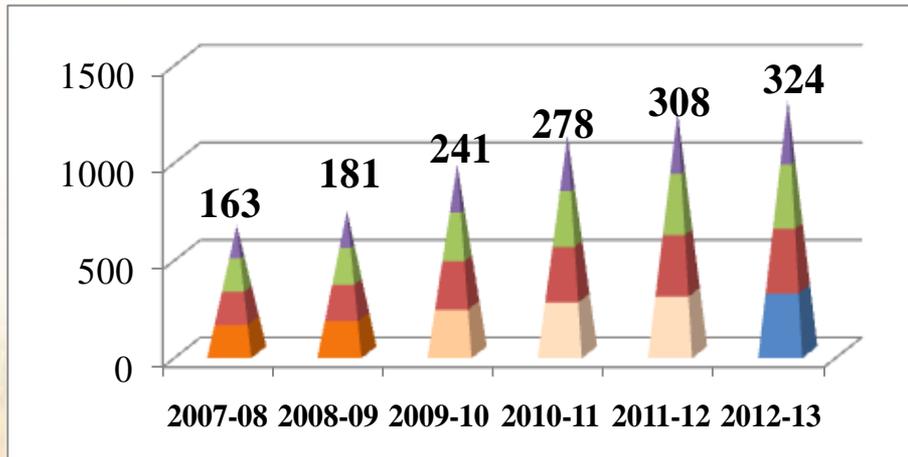


### PNG Domestic

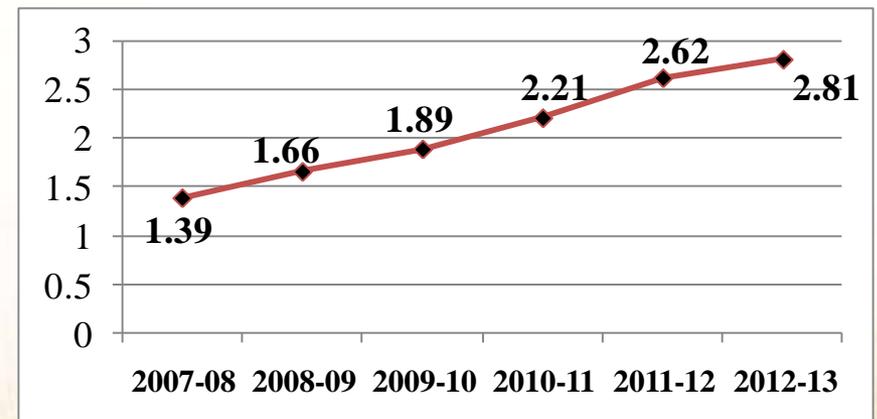
	2007-08	2012-13	CAGR
No. of Customers	1.22 lacs	3.86 lacs	25%
Sales (mmscmd)	0.04	0.17	33%

### Industrial & Commercial

	2007-08	2012-13	CAGR
No. of Customers	320	1833	42%
Sales (mmscmd)	0.08	0.49	44%



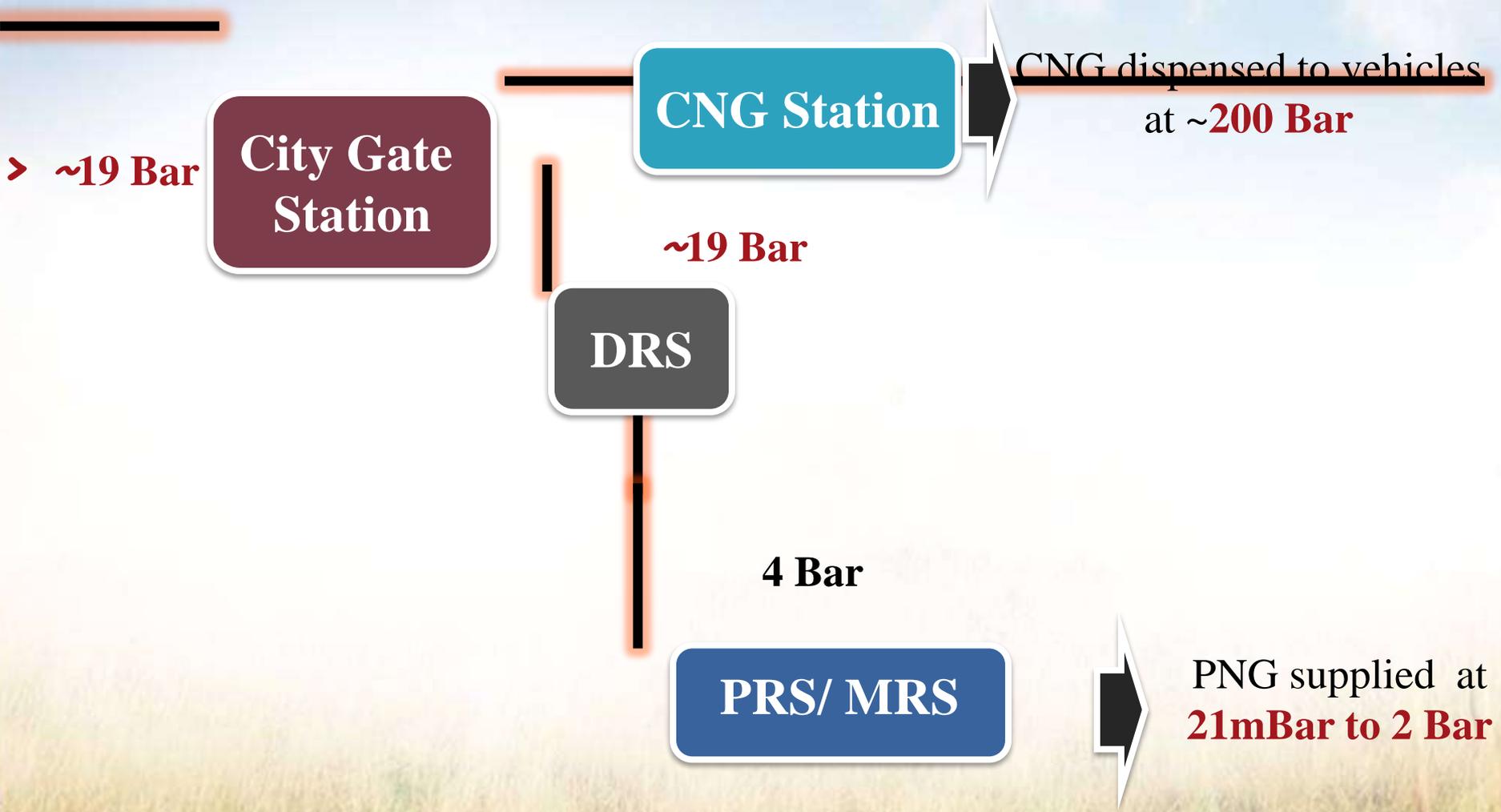
CNG Stations (Nos.)



CNG Sales (mmscmd)

# CNG & PNG Distribution

## Schematic Representation

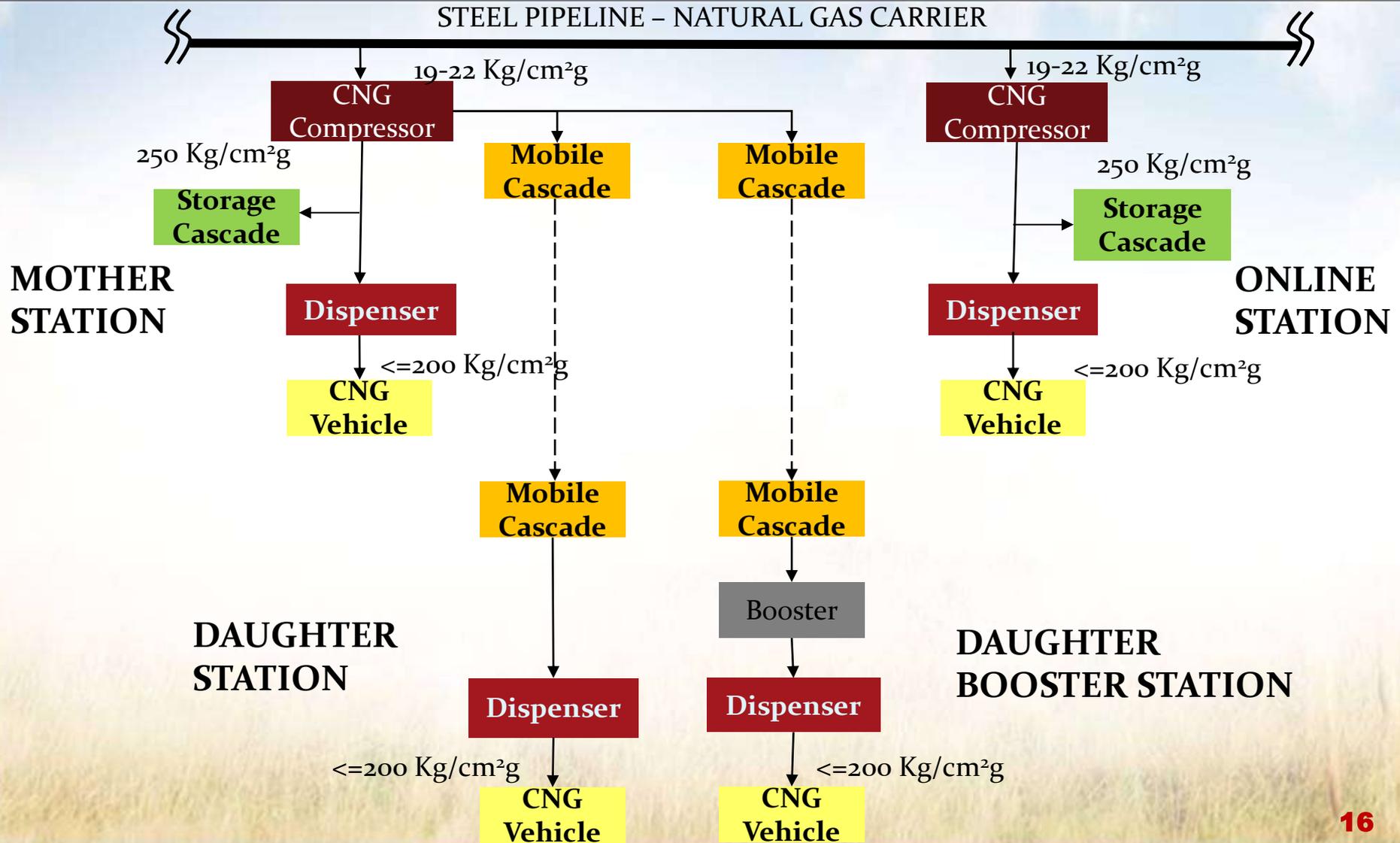


# CNG Segment

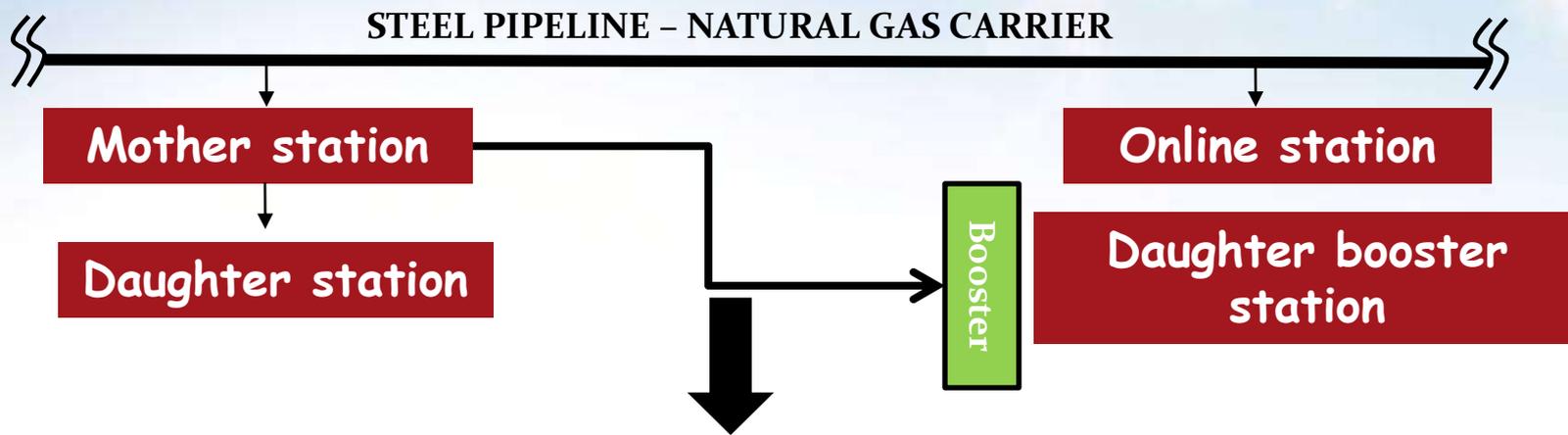
- Natural gas is compressed to 250 Kg/cm<sup>2</sup>g through reciprocating compressors installed at Mother and On-Line CNG Stations for use as automotive fuel.
- CNG is dispensed to vehicles at maximum 200 Kg/cm<sup>2</sup>g pressure.
- CNG is artificially odorized(Ethyl Mercaptan)
- Physical Properties of CNG:
  - Colourless
  - Non-toxic
  - Lighter than air
  - Non-corrosive



# IGL's CNG Supply Chain



# IGL CNG stations



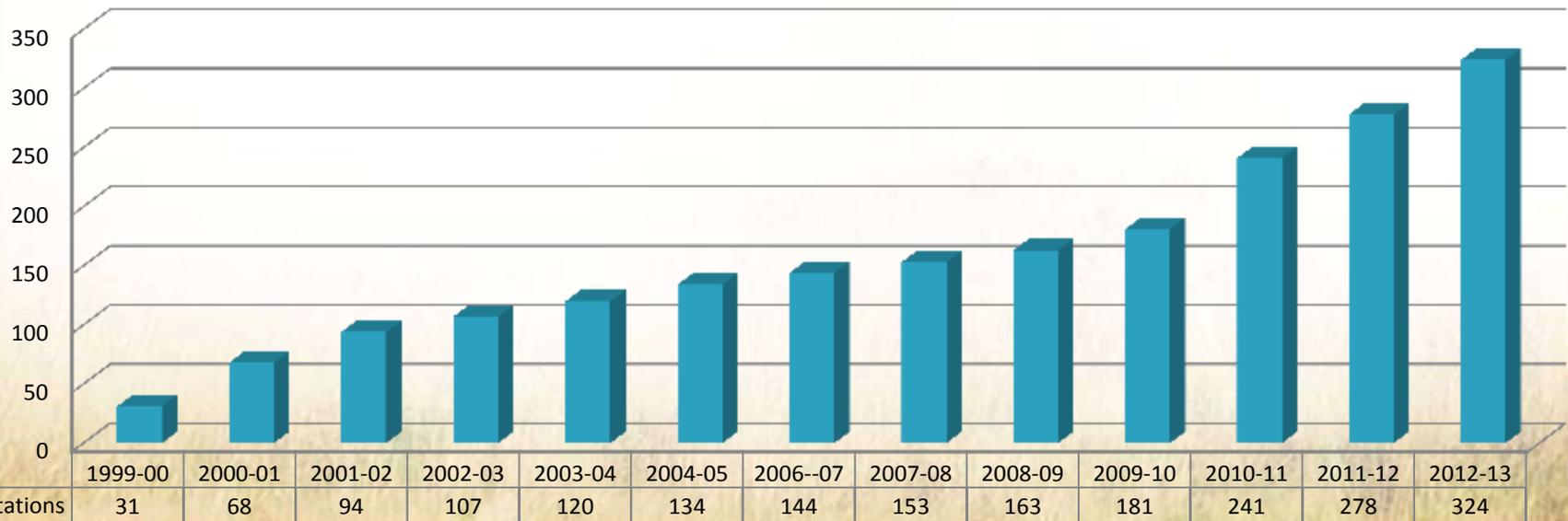
# CNG Implementation by IGL

*Growth in Infrastructure since inception*



Parameter	End 1998	As on 1 <sup>st</sup> April - 2013
Compression Capacity	.02 million Kg/day	6.38 million Kg/day
No. of Compressors	4	389
Natural Gas sales/day	.003 million kg/day	3.66 million Kg/day
No. of CNG Vehicles	1200	0.65 million

**No. of Stations**



# NGV Population in Delhi



Buses	17,103
RTVs	6,764
Passenger Autos	164,506
Goods Carrier Autos	66,910
Taxi	28,137
Private Cars*	425054
Phatpat Sewa	359
Trucks	251
Grameen Sewa	6,180

**The Private vehicles on Natural gas are growing @ 25% YoY**

# CNG Kit Fitment

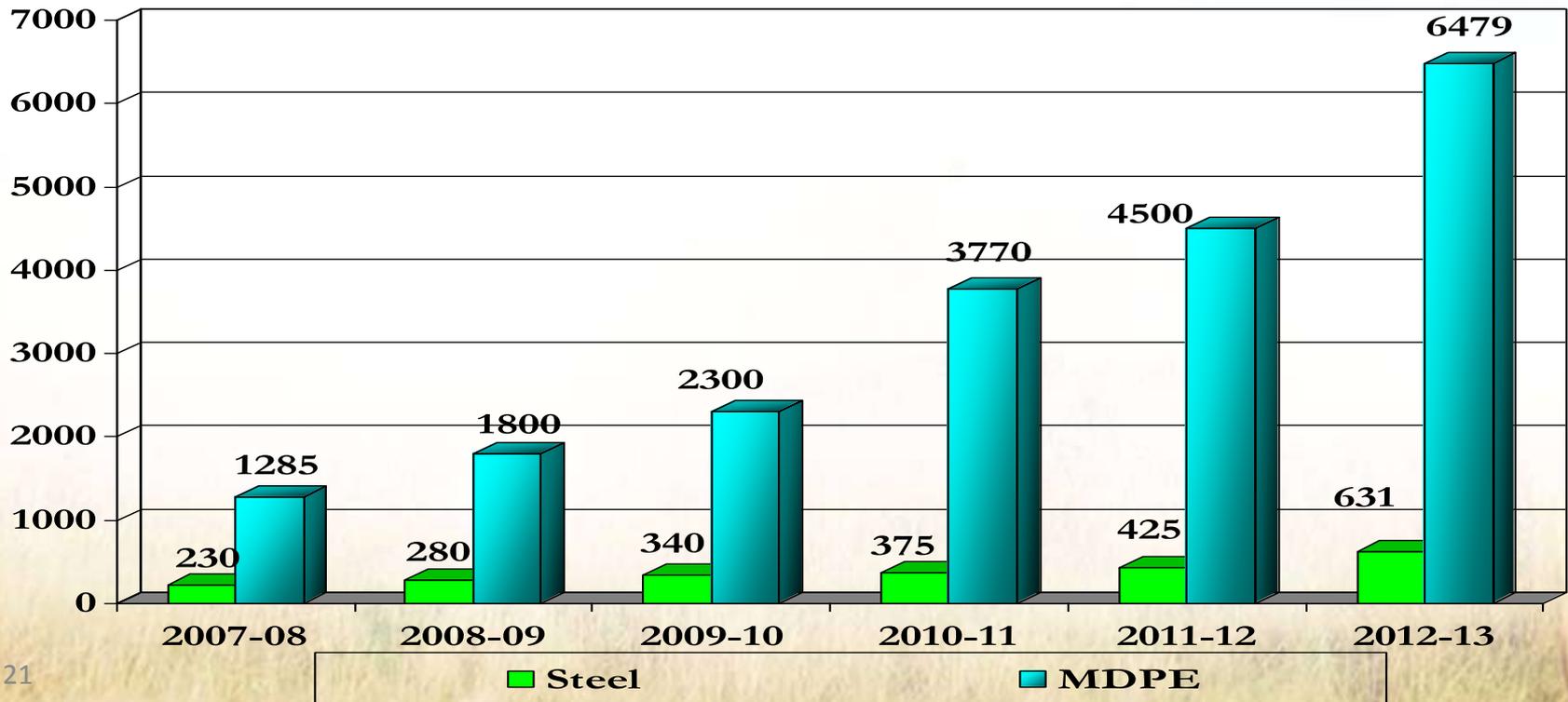


- Conversion to CNG is carried out by Authorized retailers ,authorized by Local Transport Authority .Type approval of kit fitment is taken by kit manufacturer from ARAI for a particular vehicle.
- It is mandatory for vehicle Owner to get the fuel conversion entered into the Registration Certificate of the Vehicle .
- For Public Utility Vehicles, in addition to Compulsory Incorporation of CNG Kit in Registration Certificate , Transport Authority also Issues “Compliance Plate” which is riveted to the body of the vehicle for regular check.
- Each Public Utility Vehicle gets the CNG kit checked every six months for leakage and proper fitment from Authorized Certifying agency as appointed by Local Transport Authority.

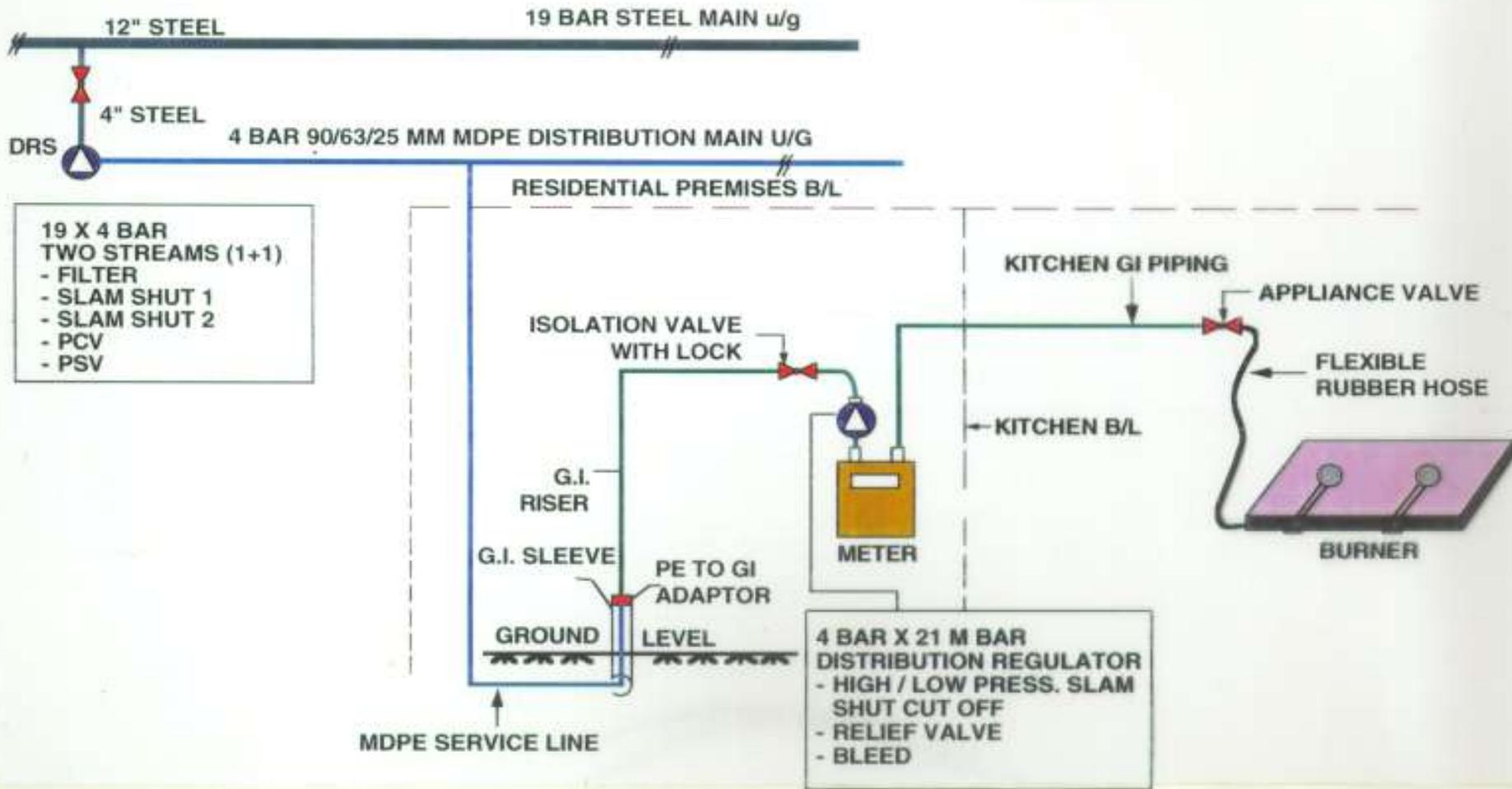
<b>Cost of conversion</b>	
Car	~Rs 50,000 (US\$ 892)
Bus	~Rs 3,50,000 (US\$ 6250)
CNG cylinder (12 kg)	~Rs 18000 (US\$ 322 )
Major Kit Manufacturer	Landi Renzo, Tomesseto , Lovato
Major CNG cylinder Manufacturer	Everest Kanto , Rama, Maruti, Nitin, Faber

# PNG Segment

- Domestic Connections – 4,03,924
- Commercial Connections – 1323
- Industrial Connections – 546
- *Total PNG Sales – 0.33 MMSCMD*



# PNG - A Typical Gas Supply Scheme



# FEW OF THE SATISFIED CUSTOMERS



AKSHARDHAM TEMPLE



# PNG Supply at President Estate & Amar Jawan Joyati



- **Safety - Accorded Top Priority by Management and is the Top Agenda during all review meetings.**
- **The CNG Stations are designed as per Best National & International Codes and Standards.**
- **Safety is followed in Design, Construction and Operation of all Activities.**





## EMERGENCY RESPONSE VEHICLES (ERV)







# SAFETY INTERLOCKS IN COMPRESSORS

Safety interlocks are provided in the PLC system to give Audio-Visual alarm & trip the unit whenever any of these parameter crosses the High/Low limits :

- High Discharge Pressure : Each stage
- Low Pressure : Suction, Engine Lube Oil, Compressor Oil
- High Temperature : Each stage, Lube Oil, Coolant
- Gas Leakage in the Package
- Flame
- Low Level : Lube Oil, Coolant
- High Vibration

The CNG compressor packages are provided with an Emergency Shut Down System.

- The ESD system is activated by pushing a Mushroom Head type Emergency switch mounted in a safe & accessible location.
- The ESD system, when activated,
  - Brings the unit to an immediate halt.
  - Isolates the unit from Gas Suction Line.
  - Closes all the output priority valves, thus isolating the Compressor, Cascades & Dispensers from each other



# **SALIENT/SAFETY FEATURES OF DISPENSERS**

## **CAR DISPENSERS / BUS DISPENSERS**

- **TYPE** FAST FILL / ULTRA FAST FILL
- **NO OF ARMS** 2 / 1
- **FLOW RANGE** 0-15 KG/MIN / 0-75 KG/MIN
- **DESIGN CODE** NFPA 52, NGV 4.2/A.G.A. 1-93,  
ANSI/NGV1,NGV 4/A.G.A., AG901,  
IS 5572, IS 5571, OISD 179 AND OISD 113
  
- **SAFETY FEATURES** OVER FILL PROTECTION, ESD MANUAL  
VALVES, BREAK-AWAY COUPLING  
WITH AUTO CUT-OFF DEVICE  
EXCEEDING 200 KG/CM<sup>2</sup>.

# SAFETY PRACTICES IN O&M

- Preventive Maintenance of Equipment
- Regular Testing and Calibration
- CNG is odorized for easy detection in case of leakage
- Portable & fixed Gas Detectors for Checking Leaks
- Compressor Area Fenced
- Installation of Safety Guards for Dispensers
- Safety & Operational Training to all staff
- Safety Manual with all safety & emergency information.
- Safety Work Permit System followed.
- Display of Safety Film on CNG.
- Use of required Personal Protective Equipment
- Safety Committee for worker participation.
- Safety Audit / Safety Inspection conducted.
- Accident Reporting, Recording, Investigation & Analysis
- Safety Awareness and Campaign conducted.
- CNG refueling is done with no passengers in the vehicle
- Ignition keys of vehicles are removed before refueling



# FIRE PROTECTION SYSTEM AT CNG STATIONS

## A) FIRE FIGHTING ARRANGEMENTS AS PER OISD-179

EQUIPMENT	DCP-75KG.	DCP-10 KG.	CO2- 4.5 KG.
COMPRESSOR	1 (online & mother)	1	-
DISPENSER	-	1	-
CASCADE	-	1	-
LCV POINT	-	1	-
ELECTRICAL PANEL	-	-	1

**B) AS PER CCoE GUIDELINES: 6 NOS. FIRE BUCKETS AT EACH CNG STATION.**

**C) ADDITIONAL SAFETY MEASURES BY IGL: CO2 FLOODING SYSTEMS FOR COMPRESSORS ARE INSTALLED AS STANDARD SAFETY MEASURE.**

# DCP Flooding System installed for Bus Dispensers





# FIRE EXTINGUISHERS IN ELECTRICAL PANEL ROOM

4.5 KG. CO2 FIRE EXTINGUISHER



# Emergency Mock drills

- Major Mock drills involving external agencies are conducted once in a year as per PNGRB guidelines and their recommendations are complied.
- A Mock drill as per PNGRB guidelines involving District Authorities was conducted recently.



GAS LEAKAGE FROM PIPET LINE FLANGE OF BIHERO COMPRESSOR



FIRE FIGHTING BY THE STATION STAFF



MOVING THE BUSES AWAY FROM THE BURNING



PUSHING THE VEHICLES OUT FROM THE BURNING



# LIVE FIRE FIGHTING TRAINING



Demo site has been developed by IGL at Rohini Fire Station to impart live fire fighting training to IGL employees, station staff & other stakeholders regularly.



# Safety Training



Training is given Prime Importance and Regular Trainings are imparted to IGL Employees, Contract workers, CNG & PNG Consumers, Security Guards and Delhi Fire Service personnel.

Multi-discipline Core Safety Groups trained from NEBOSH, UK ensures implementation of Safety Management System.



# Safety Awareness for customers



- Safety programs regularly carried out by IGL for Educating consumers through Safety Pamphlets, Stickers, Safety Clinics, Free CNG Vehicle Kit Service Camps.
  - Random Gas Leak and Statutory Conditions Compliance Checking in vehicles at CNG stations and report forwarded to DTC and Department of Surface Transport.
  - Live Fire Fighting Training to DTC and Non-DTC Bus drivers nominated by DTC and Deptt. of Surface Transport and EPCA at Gas Fire Training Center at Rohini Fire Station.

<b>INDRAPRASTHA GAS LIMITED</b> (A Joint Venture of GAIL (India) Ltd., BPCL & Govt. Of NCT of Delhi)			
MATERIAL SAFETY DATA SHEET			
1. NATURAL GAS: CHEMICAL FORMULA: C <sub>1</sub> H <sub>4</sub> - nC <sub>2</sub>			
PROPERTIES			
Type of chemical	: Flammable gas	Explosive limits % Vol in air	: 5 to 15
Physical form	: Gas	Solubility in water	: Insoluble
Ignition temp. °C	: 535 °C	Vapor Density (Air=1)	: 0.6
Flash point	: Not available	Sp. Gravity	: 0.42
OTHER CHARACTERISTICS			
Colorless, odorless gas. Lighter than air can be compressed to liquid at very low temperature.			
HAZARDS	PRECAUTIONS	EXTINGUISHING AGENT	
FIRE: Highly flammable	No open fire, sparks, no smoking.	Shutting off supply is essential before extinguishing fire using dry chemical powder.	
EXPLOSION: Gas forms an explosive mixture with air in unusual conditions.	Gas Leak tests with explosive meter suitable for methane.		
SYMPTOMS	PRECAUTIONS	FIRST AID	
Inhalation: breathlessness	Ventilation, local air extraction, use of respirator.	Remove the person to fresh air and resort to artificial respiration if necessary. Report for medical attention immediately.	
DISPOSAL	STORAGE	ANTIDOTES	
INTERMITTENT COLD FLAREING	Storage in cool, well ventilated place and isolate from oxidizing agents.	NIL.	
<b>Additional information:</b> High concentration in air causes oxygen deficiency leading to unconsciousness. <b>Important Safety Instructions To CNG &amp; PNG Consumers:-</b> <ol style="list-style-type: none"> <li>1. Fire Fighting equipments should be properly placed, free from obstructions and maintained in healthy condition.</li> <li>2. Area around the gas meter and isolation valve to be kept clear, properly ventilated with sufficient illumination and free from combustible materials and electrical wiring.</li> <li>3. Inspection of CNG Kits every year and CNG Cylinders after every five years should be ensured.</li> </ol>			
IMPORTANT TELEPHONE NUMBERS:-			
<b>CNG O&amp;M CONTROL ROOM</b>			
Sarai Kale Khan Lado Sarai	65423902103, 65623229, 65699489 30959805, 65658809, 65652336	Punjabi Bagh Dhaerpur	65652327, 30905817, 30959804 65515316, 65462577, 65152250
<b>PNG CONTROL ROOM</b>			
Saraji Nagar Purjar Gazi Sector 18, Rohini	65653872, 65479914 65286448, 65286568 65286337, 65286536	C.G.O. Complex Chhla Meer Kala Nagar	24380735, 65857970 26322494, 65899467 24323276, 24323093, 65899468
		R.K. Puram Mayapuri Vihar Nalson Mandela Vasant Kari	65868218, 65480275 65644992 65622328
Toll Free No. : 1800 11 2535			Emergency No. : 9810117201

i CNG

## आपकी सुरक्षा के लिए

1. सी. एन. जी. किट को केवल मान्यता प्राप्त कार्यशाला पर ही लगवाएँ एवं मरम्मत करवाएँ।
2. सी. एन. जी. सिलेण्डर को प्रत्येक पांच वर्ष में हाइड्रो टेस्ट करवाएँ।
3. सी. एन. जी. किट की प्रत्येक वर्ष जांच पड़ताल करवाएँ।
4. सी. एन. जी. सिलेण्डर तथा सी. एन. जी. किट के प्रमाण पत्र साथ रखें।
5. सी. एन. जी. वाहन (बस, RTV) में अग्नि शामक यंत्र एवं प्राथमिक उपचार (पैटी) अवश्य रखें।
6. सी. एन. जी. वाहन में गैस भरते तथा चलाने समय सुरक्षा नियमों का पालन करें।
7. किसी भी आपातकालीन स्थिति के लिए सचेत रहें।

“सतर्कता में ही सुरक्षा है।”

# FREE CHECKUPS OF CNG CARS



## EDUCATING CONSUMERS

Free Service Camps are conducted to check the fitness of CNG vehicles and creating awareness for conservation of gas, among consumers by educating them and pasting cautionary instructions on their vehicles.



# CHALLENGES



- Availability of Natural Gas at affordable price
- Business under regulatory regime
- Support of local government
- Retention of trained manpower
- Shrinking land availability
- Long gestation period for commercializing stations from concept due to delays in statutory clearances
- Permission to lay pipelines not easily forthcoming
- Lack of infrastructure

# FEW POINTS TO REMEMBER

- Support of local government is essential
- Safety should be a high agenda item
- Long term advance planning for building CNG infrastructure is necessary
- Genuine cylinder, kits & spare parts to be used for CNG vehicles to avoid accidents
- Education / Training of operators , consumers is very important

# Bright future of CGD in India

**Indian Gas market is at the threshold of expansion at exponential rate**

**200 odd cities would come up for CGD projects through bidding route**

**Huge Opportunities for distribution companies, suppliers, vendors, contractors.**

**US \$ 10 billion investment in pipeline in CGD sector**  
*(at least 50 % would be in CNG segment)*

**Opportunities for strategic partnerships**

**8 Sections of National Gas Grid totaling to 8000 kms is under implementation**



**Thanks**

