4th NGV India Summit

The Lalit, New Delhi

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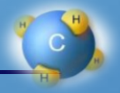
Sustainable Mobility- The role of natural gas



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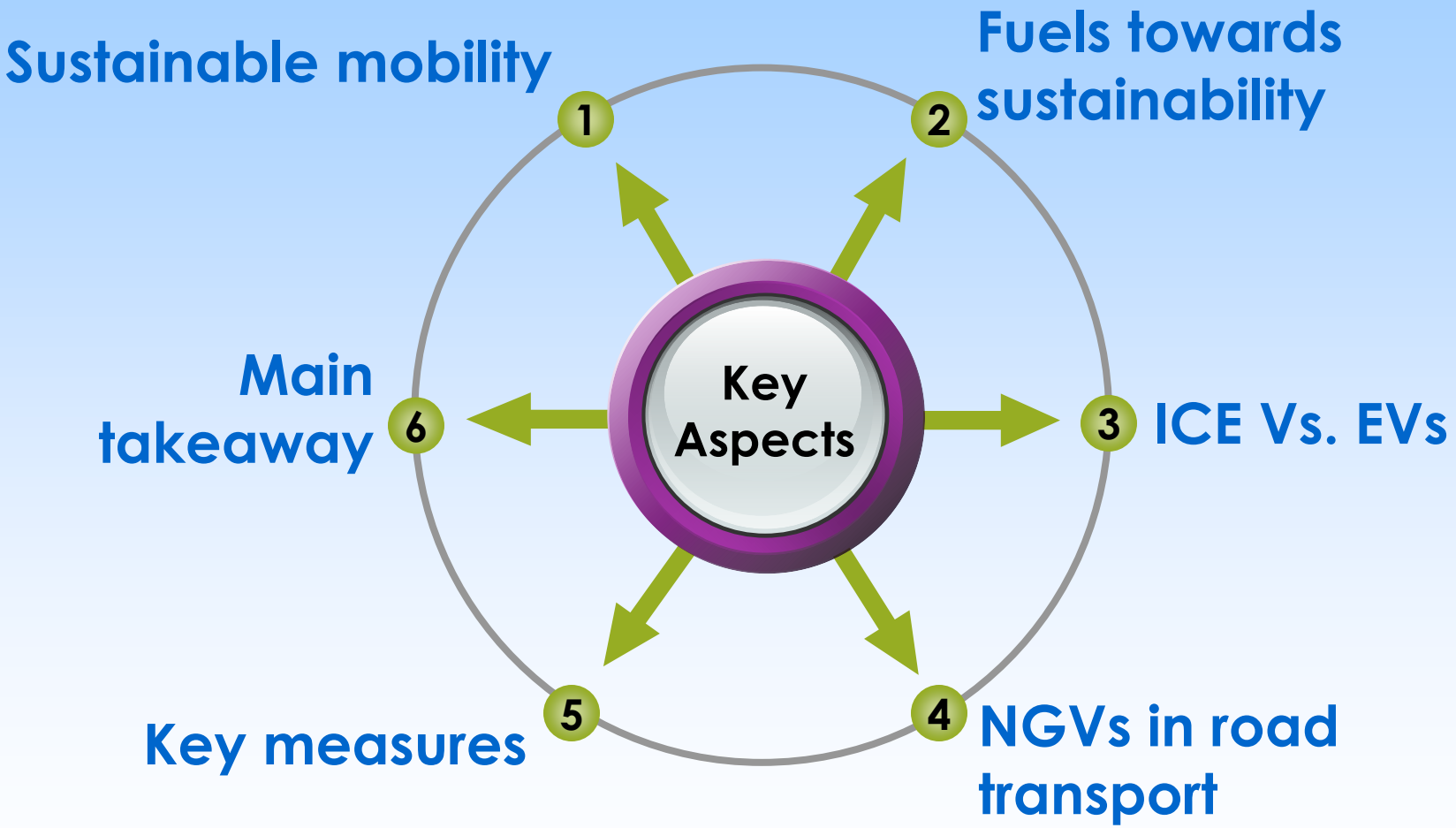
Sustainable Mobility- Role of Natural Gas



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Is it sustainable?

.....California 66% gas in power capacity

.....Turkey 28% gas in energy mix

.....large city on a good day

Challenges in developing cities- Is it sustainable?

Road transport is a major contributor to air pollution and climate change. Transport contributes to approx. 25% of energy-related CO_2 emissions and is still growing! (India -13%, road transport -90% of total transport emissions)

Challenges in cities - Is it sustainable?

Worldwide, 1.3 Million road deaths and up to 50 Million people injured per year

Is it sustainable?

...where is the space for people?
the silent pedestrian, the invisible cyclist must be seen.

Possible approaches…

Sustainable development

- *The development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Report)*
- *Three pillars: economic, social & environmental;*

Alternative 1:

Traditional Approach

Automobile centered approach;

Alternative 2:

Sustainable Approach

Contemporary approach, planning to improve access , planning for people, moving people not cars;

AVOID/Reduce

Reducing the need to travel

SHIFT

Changing mode choice or at least keep up the mode share of NMT, (ownership to TAAS)

IMPROVE

Increasing the energy efficiency of vehicles, fuels, transport operations and adopt new technologies;

There is a need to develop a "sustainable mobility policy 2030"

Comparing five countries

	Argentina (2.3 million)	China (5.3 million)	India (3 million)	Iran (4 million)	Italy (1 million)
NGV Policy Purpose	Energy Security	Air Pollution	Air Pollution	Air Pollution Energy Security	Air Pollution
Factors Affecting NGV Population	1984: Liquid Fuel Substitution Program 2000s: Economic Crisis 2004: F… Crisi…	1999: Clean Vehicle Action Program 2004: WEPP…	1985: M.C. Mehta v Union of India	2000: Development Plan for Natural Gas Utilization in the Transportation … to	1970s: Retrofitting 2008 to 2010: Government subsidies for NGVs
Key Challenges	Fue… price…		…stations		…of …estic fuel …pply
Future Trends	LNG for heavy duty vehicles Possibilities for importing NGVs	LNG for heavy duty vehicles 13th Five-Year Plan for Natural Gas Development New Energy Vehicle Policy	15% Electric Vehicles target considering banning non-CNG fossil fuel powered vehicle	…th country development Plan	**NGV preferred**

1. **Energy Security & air pollution;**
2. **Court mandates & subsidies;**
3. **Price competiveness;**

Lack of delivery infrastructure
Affordability

ICE vs. EV

Opex - EV < ICE, due to efficiency (100x less moving parts)

Efficiency	%
EV	90-95
Efficient ICE	35-45
ICE	20-30

Fuel	₹/km	Basis; compact car
Petrol	6.5	₹3.2/km tax
Diesel	4.5	₹1.8/km tax
CNG	2.4	$10/mmbtu LNG
EV	1.8	₹10.5/kwh

Source: Brookings; Long term forecast = $65/bbl Brent

Capex - ICE < < EV, due to battery cost

Battery cost	= $210/kwh in 2018, global average
Range 1 kwh charge	= ~ 6 km (for 1.2 lit compact car)
Battery size	= ~ 50 kwh global average

Capex@ 2018 avg.	ICE	EV	Remarks
Car, ₹ lakhs	4.6	12.3	= ₹7.7 lakhs
Payback, km	Base	1,64,000	Uneconomic

Source: Brookings; $1 = ₹ 68

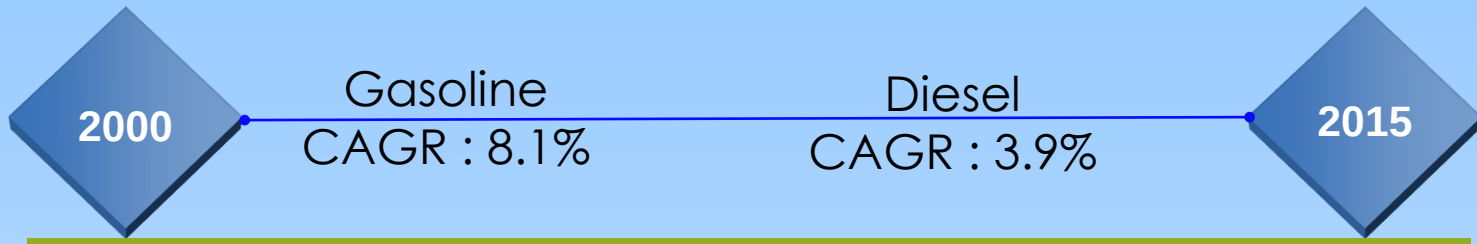
Cost of ownership

ICE < EV, Trending towards ICE ≈ EV ($ 120 $/KWh), Inflection point between 2025-2030

Emissions

According to BNEF's data, electric vehicles in China produce 188.5 grams of carbon dioxide (CO2) emissions per mile, the most of any country globally. In comparison, electric vehicles in the United Kingdom produce just over 76 grams of CO2, while in France just 2.7 grams are produced per mile. (Petrol-248.5 Gram CO2/mile)

Indian Road Transport Sector- At a glance

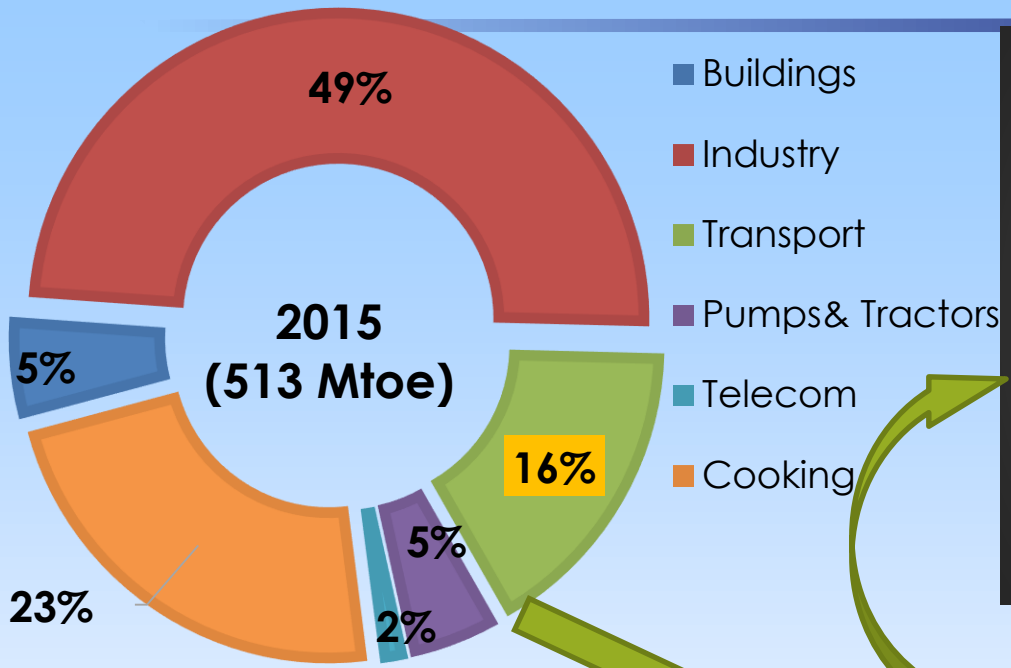


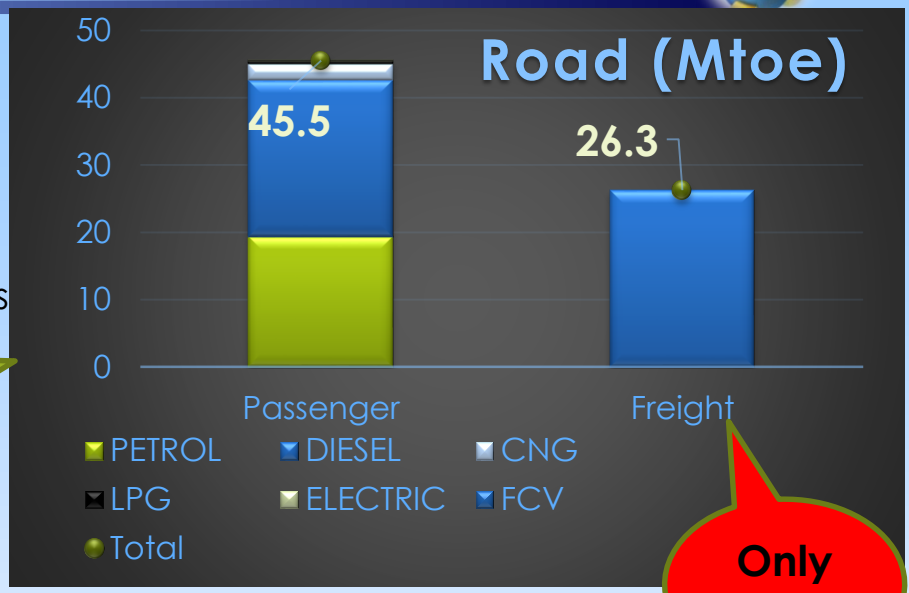
Registered cars, taxis and jeeps	6.1 Million	10.7% CAGR	28.1 million
Registered two-wheelers	34.1 Million	10.4% CAGR	149.6 million
Freight LCV /HCVs	7.8 Million	7.2% CAGR	22.2 million
Share of biofuels	0.25%	Road Transport energy	0.27%
CO2 intensity in transport	0.40	KCO2/$05P	0.37

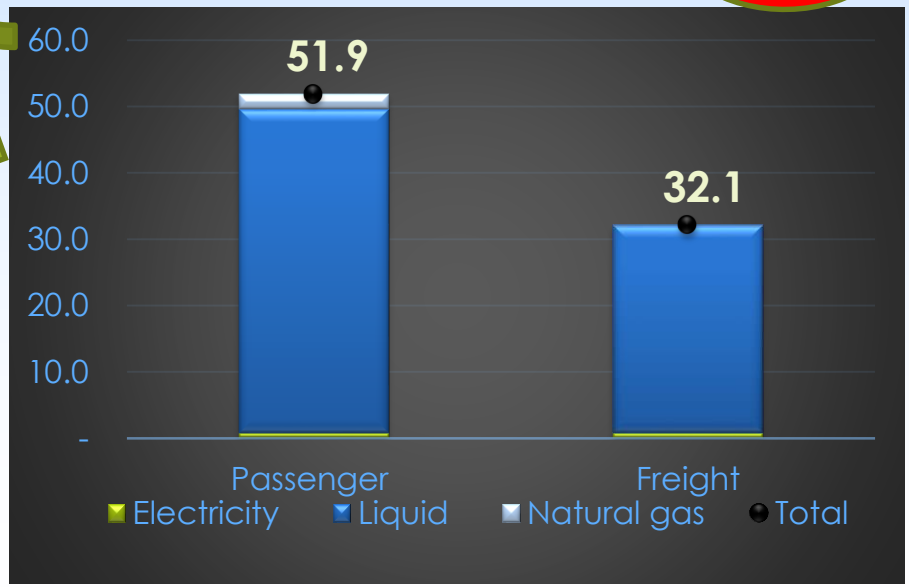
Transport fuel in 2014-15

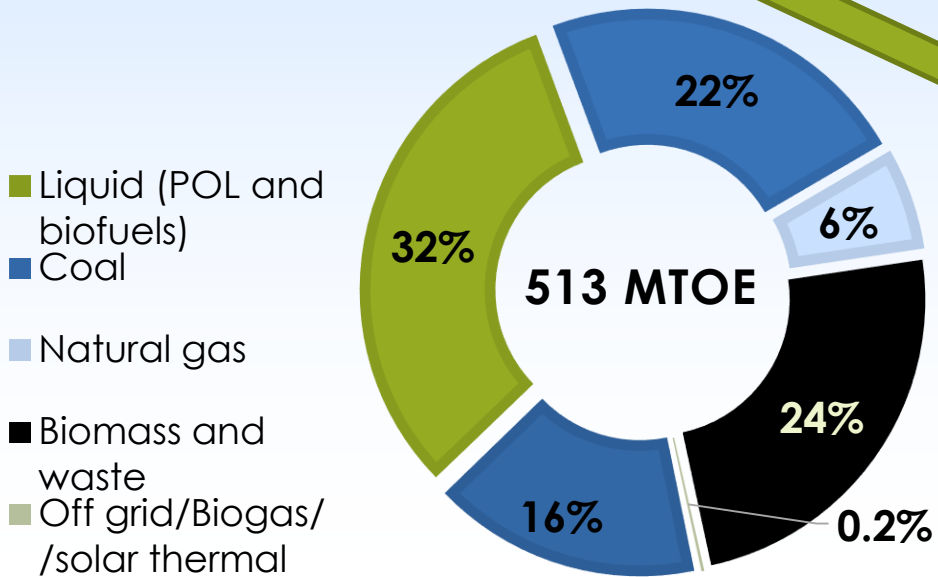
PETROL	DIESEL	CNG	LPG	ATF	ELECTRIC
23.1%	63.5%	2.7%	0.6%	6.9%	0.02%

Final energy consumption in 2015

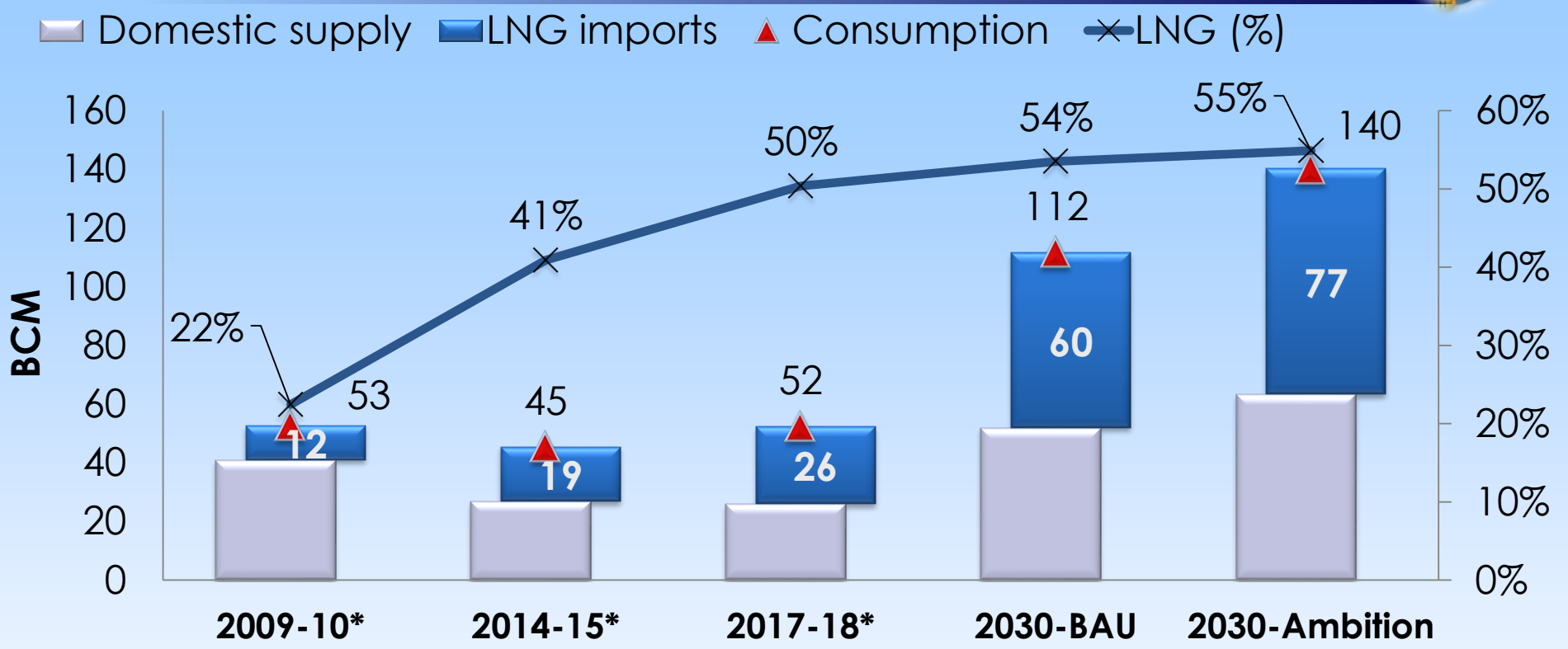








Trend in domestic natural gas sector

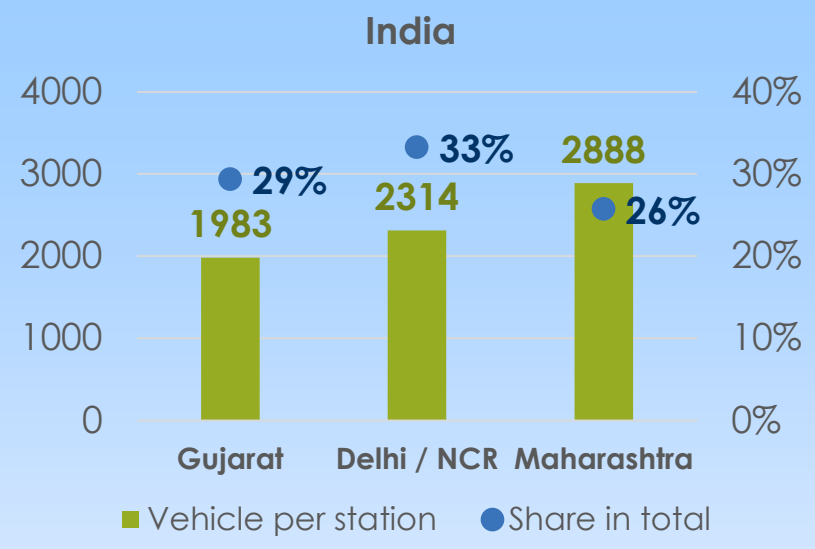


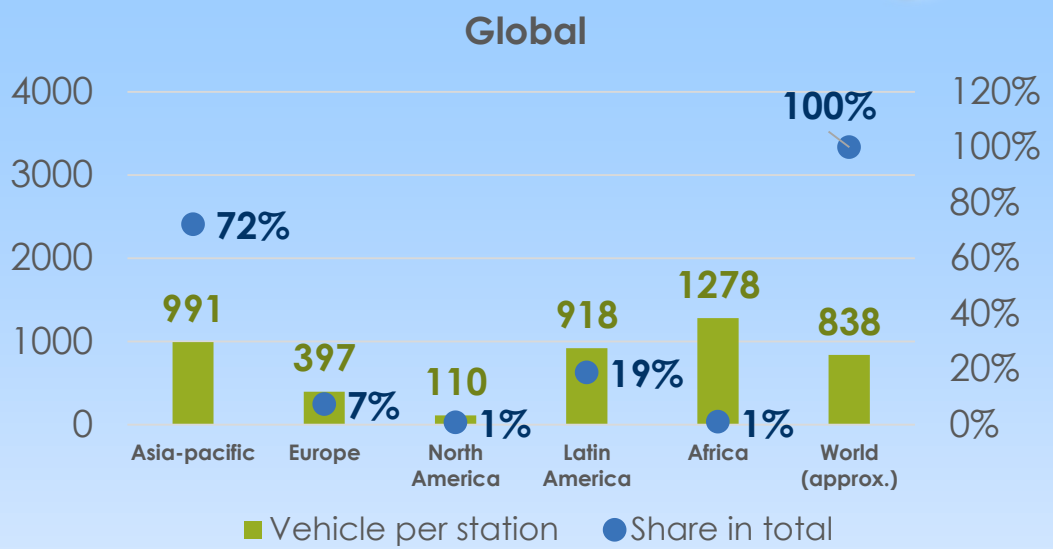
* Excluding internal consumption

Sectors (%LNG)	2016-17	2017-18
Fertilizer	49%	53%
Power	21%	22%
CGD	41%	45%
Ref., petchem & others	76%	72%

- ***Largely LNG dependent***
- Stagnant production
- ***Price sensitive consumption***
- Infrastructure bottleneck
- CGD sector picking up

Ramp up CNG stations





- 88% of total CNG stations
- Highest in Maharashtra- 2888V per station

- 91% in Asia-pacific & LA
- Highest – 1278
- World average – 838V per station

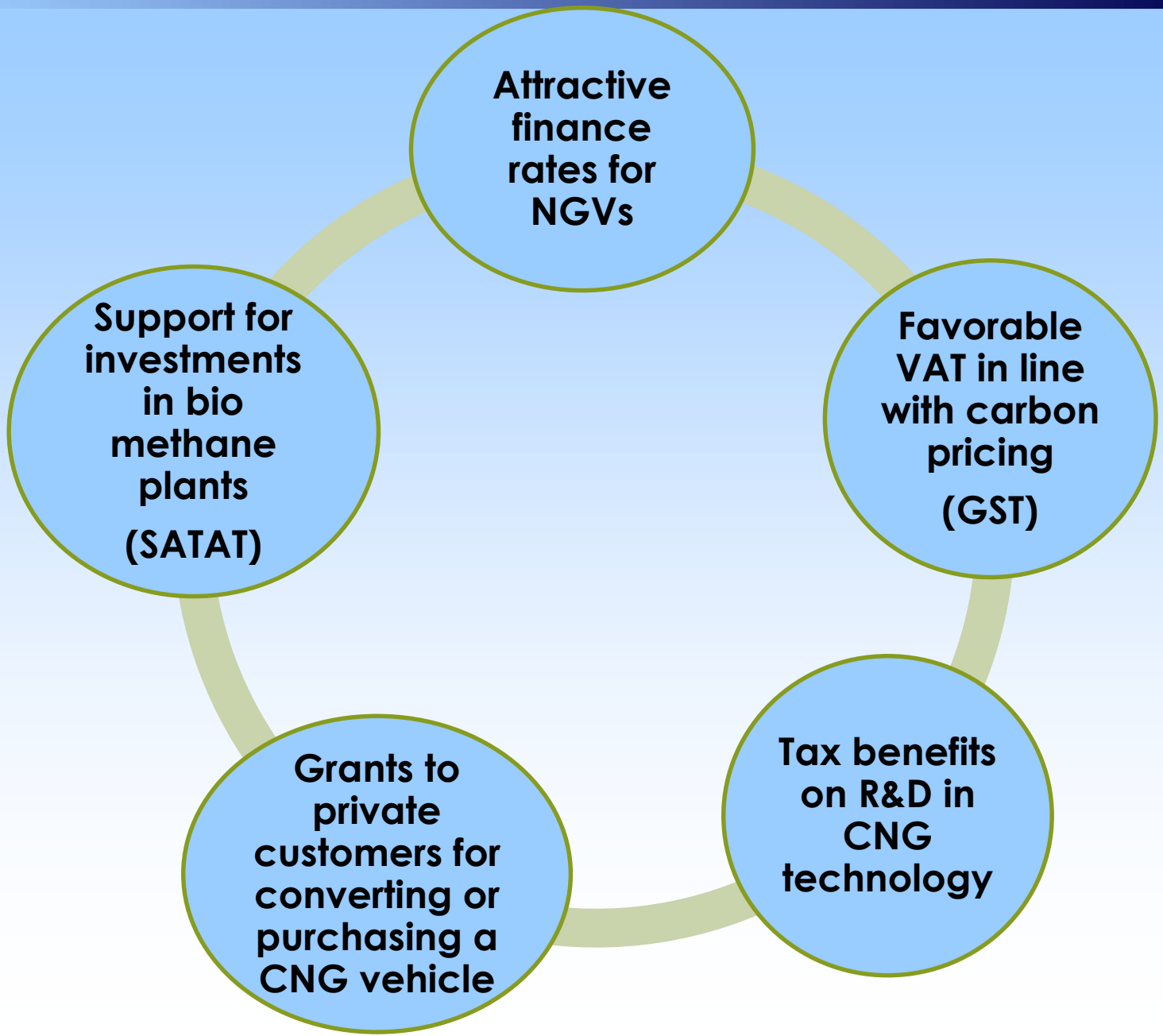
- **Addition of 4600 CNG station in the next 8 years (as per recent CGD bidding);**
- **In order to target 1 cr of vehicles, 2500 more CNG stations may be required; (2.6 MMT to 7.6 MMT by 2024-25)**
- **Implementation of awarded projects under bidding rounds;**
- **Retail outlets of OMCs may play a greater role to be a great enabler;**

CNG stations along highways and pipeline corridors (Green corridors)

Phase-1- National Highway (NH)	Green Corridor along NH/portion of National Highways in the vicinity of existing cross country pipelines/Geographical Areas (GAs).	Green Corridor along NH/portion of National Highways in the vicinity of proposed Natural Gas Grid (NGG).
Phase-2- State Highways (SH)	Green Corridor along SH/portion of State Highways in the vicinity of existing cross country pipelines/GAs.	Green Corridor along SH/portion of State Highways in the vicinity of proposed NGG.
Phase-3- Rural Roads	Green Corridor along rural roads in the vicinity of existing cross country pipelines/GAs/proposed NGG.	

Delhi to Chandigarh, Jaipur, Agra and Haridwar in phase-1(out of 8 in phase-1)
-Long range buses cost roughly ₹ 39 lakh (700 kilometers in each refill)
-CNG stations at every 50 kilometers on both sides

Various incentives



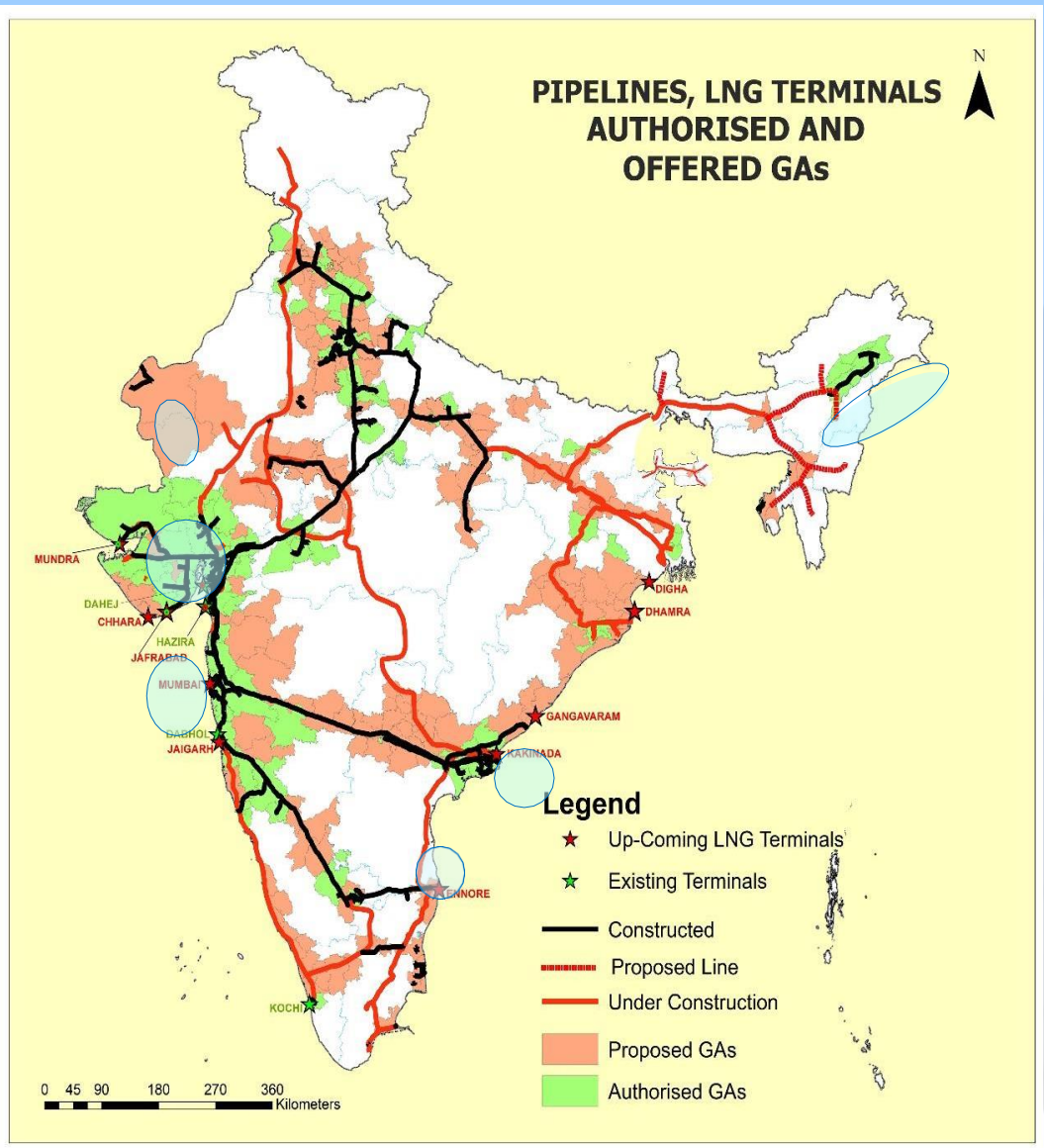
Natural gas infrastructure in India

Pipelines (km)

- In operation – 16,788
- In execution – 14,239

LNG (MMTPA)

- Operating–36.7
- Upcoming –28.8



PMUG Project

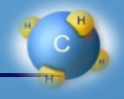
- Jagdishpur-Haldia/Bokaro-Dhamra Pipeline **(3400-km including Baruani-Guwahati)**
- Indradhanush Gas Grid Limited (IGGL)-North East Gas Grid **(1500 Km)**

Gas Producing Areas

Main takeaway

- Develop a “Sustainable Mobility Policy 2030”
- EVs and NGV may coexist till 2030;
- NGV seems more promising in the next decade;
- Ramp up CNG stations & green corridors;
- Develop natural gas grid;
- Fiscal and financial incentives;

Thank for your kind attention !



"The path is the goal." -Mahatma Gandhi