



NGV – A Promising Future

NATURAL GAS SCENARIO

NATURAL GAS VEHICLE SCENARIO

NGV AS A FRONTRUNNER FOR SUSTAINABLE MOBILITY

NGV ECOSYSTEM – NAVIGATING THE CHALLENGES

POLICY RECOMMENDATIONS

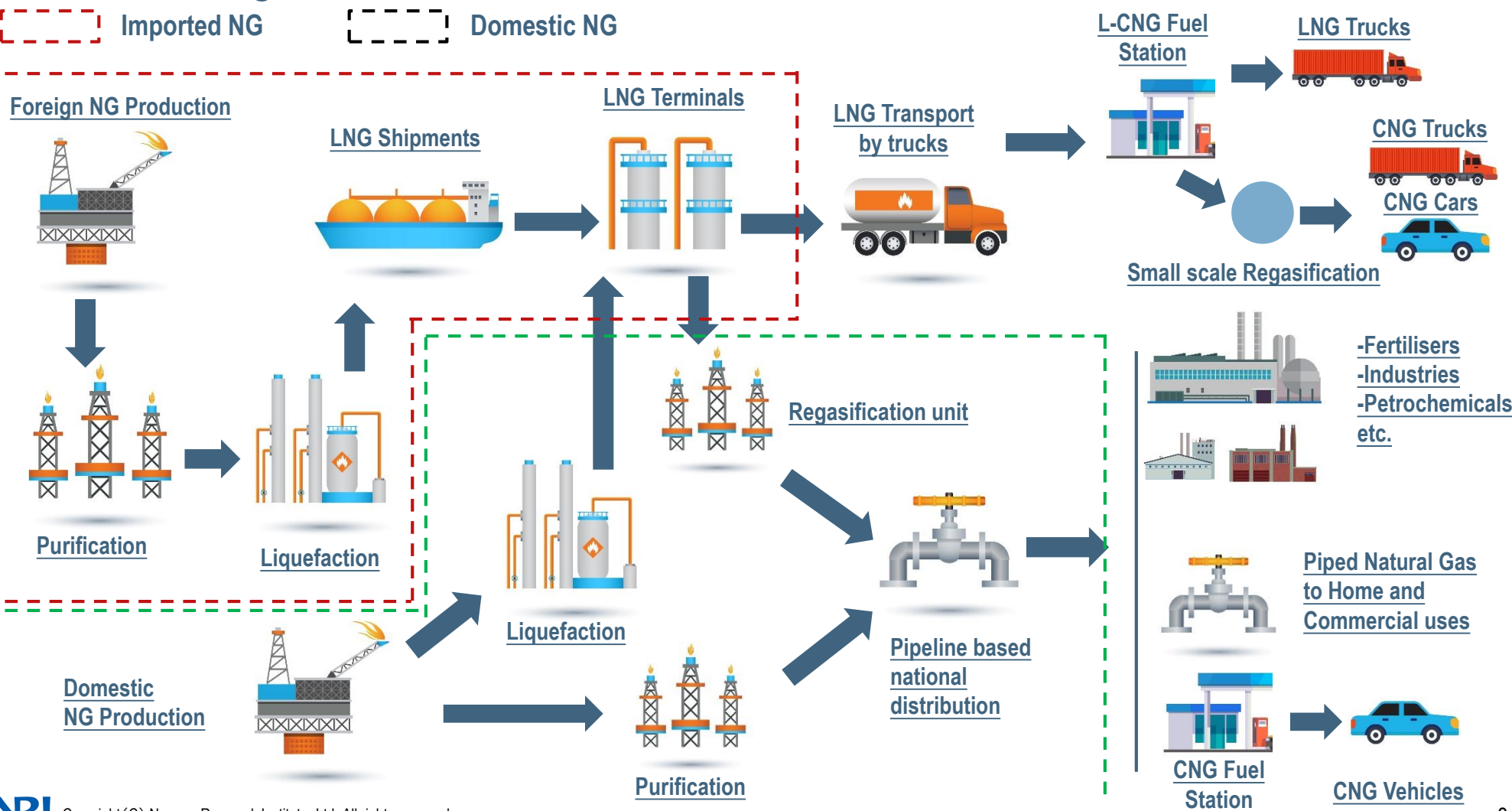
NATURAL GAS SCENARIO



Natural Gas Value Chain

Natural Gas is converted into liquefied (LNG) or compressed gaseous (CNG) forms throughout the value chain based on the use cases and economics

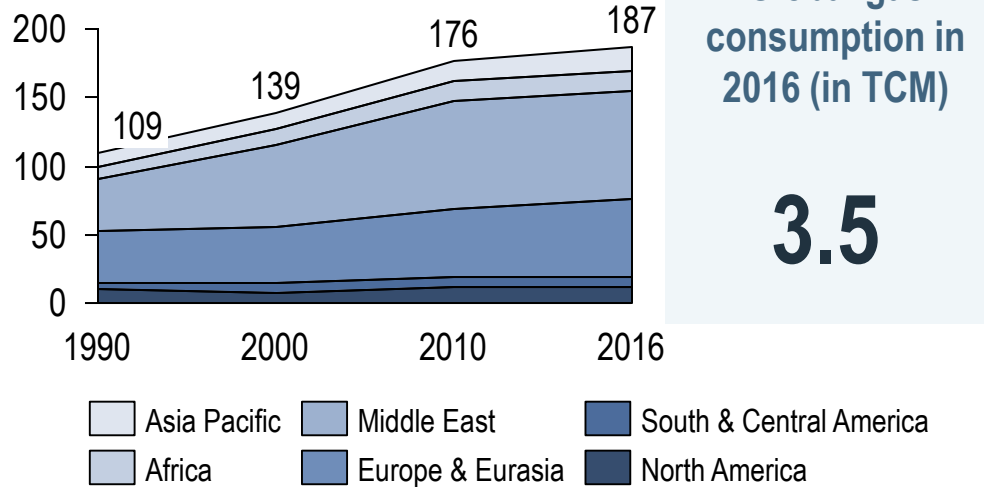
Flow of Natural gas in various forms



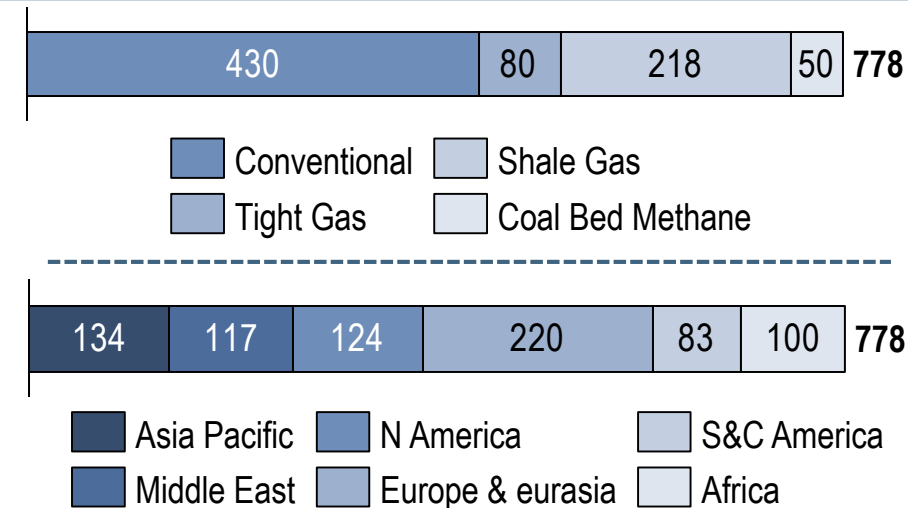
Iran, Qatar, and Russia have the largest amount of proven natural gas reserves. India has also explored around 5 TCM of recoverable reserves

Natural gas resources and reserves

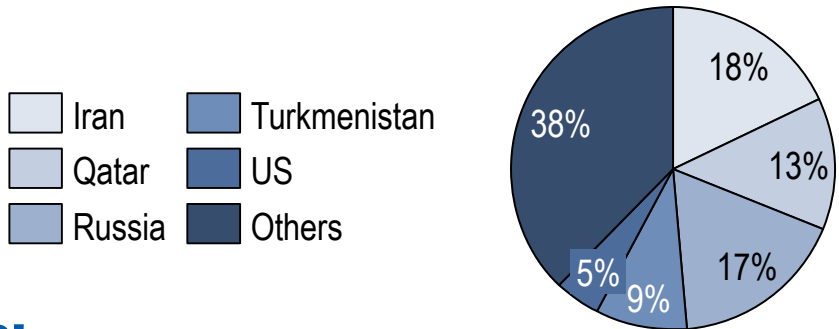
Global Reserves (in TCM)



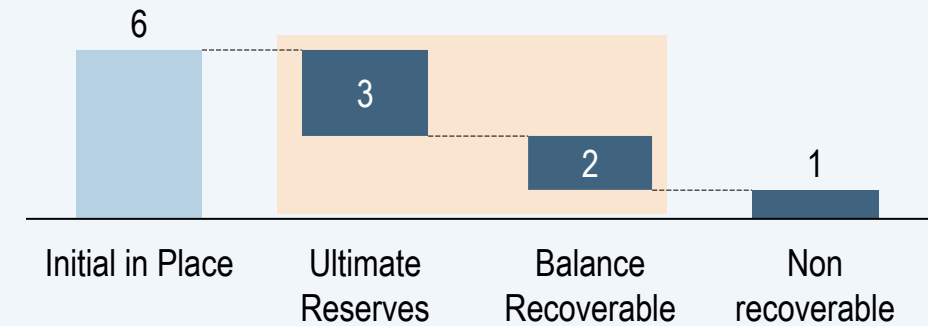
Global Resources (in TCM, est. in 2015-16)



Share of Global Reserves (in TCM)



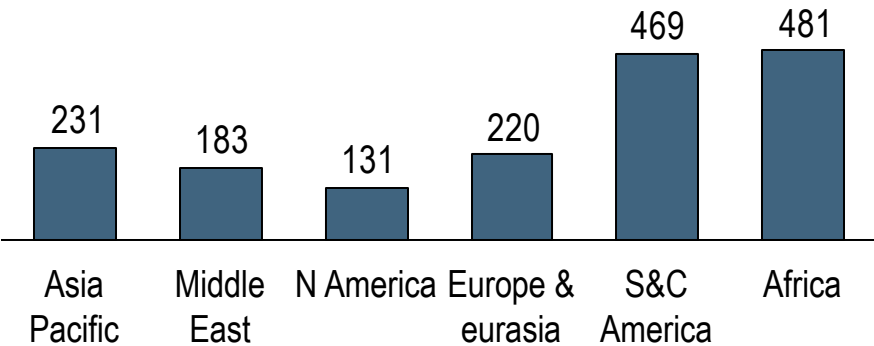
Indian Reserves (in TCM)¹



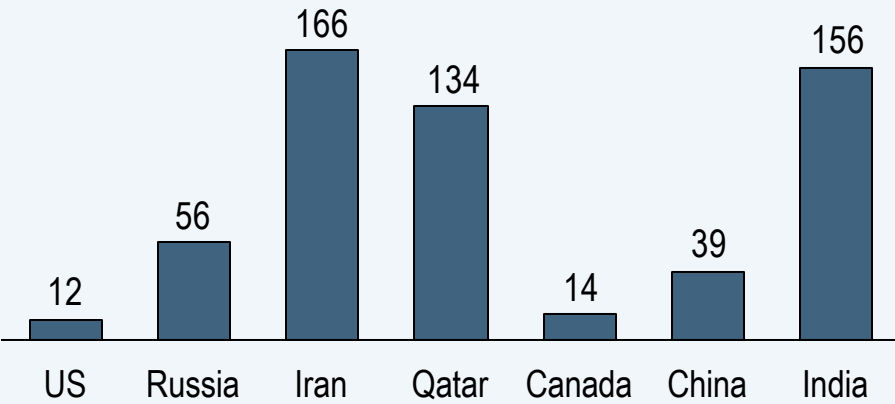
Globally Natural gas is in abundance; Middle eastern countries have proven almost all of their resources whereas N. American countries are still waiting

Global Natural gas production and trade (2016)

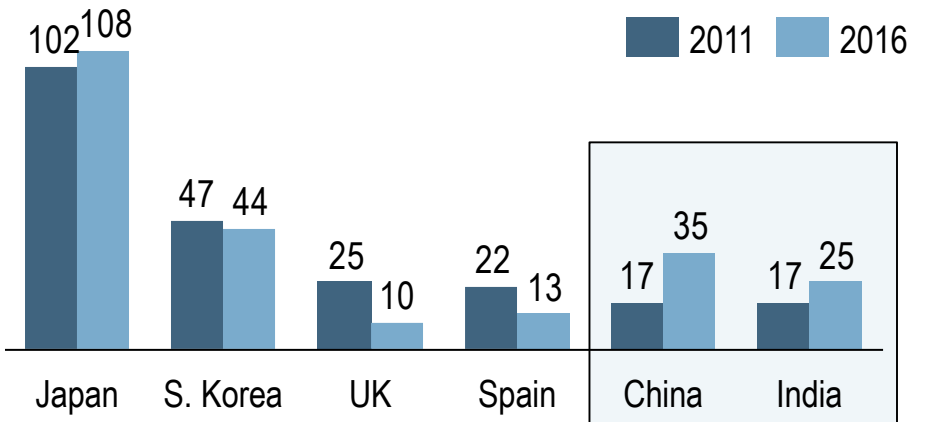
NG Resources to production ratio



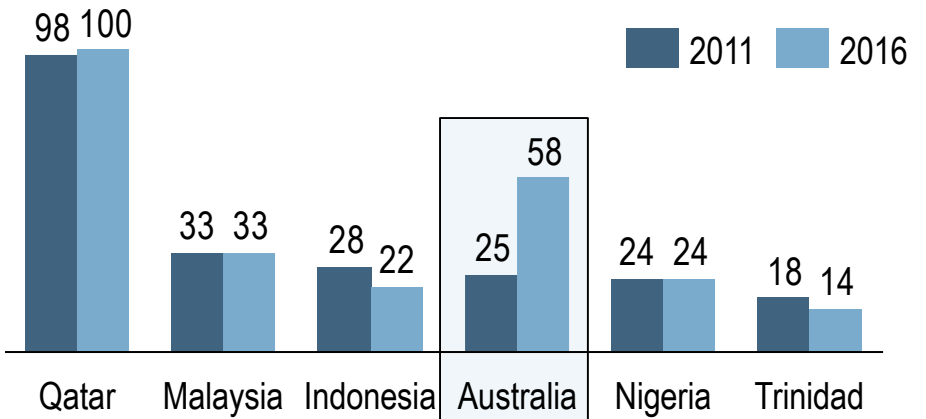
Reserves to Production ratio for top 6 producers
(proven reserves / annual production)



Top Importers (in BCM)



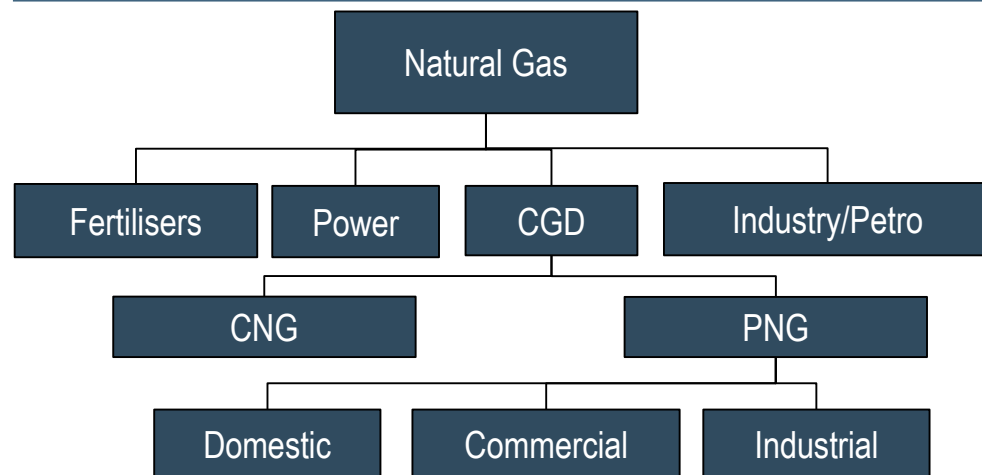
Top Exporters(in BCM)



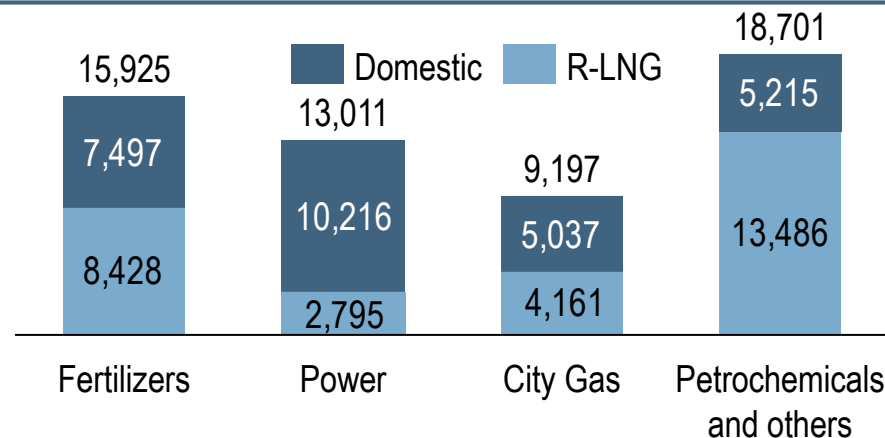
CGD (CNG Transport and PNG domestic) has been given highest priority to allocate domestic gas in India, this will boost the use of gas in CGD sector

Allocation and consumption of NG in India

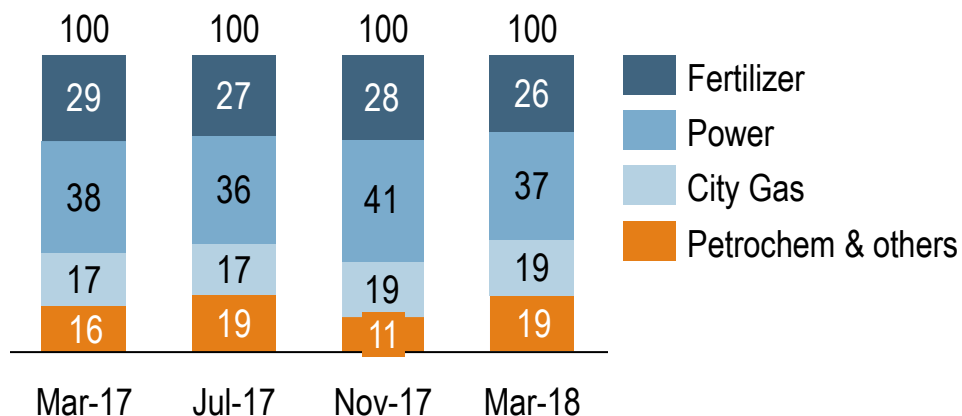
Major uses of Natural Gas in India



Sectoral consumption of natural gas (FY18, in MMSCM)



Distribution of domestic gas (in FY18, in %)



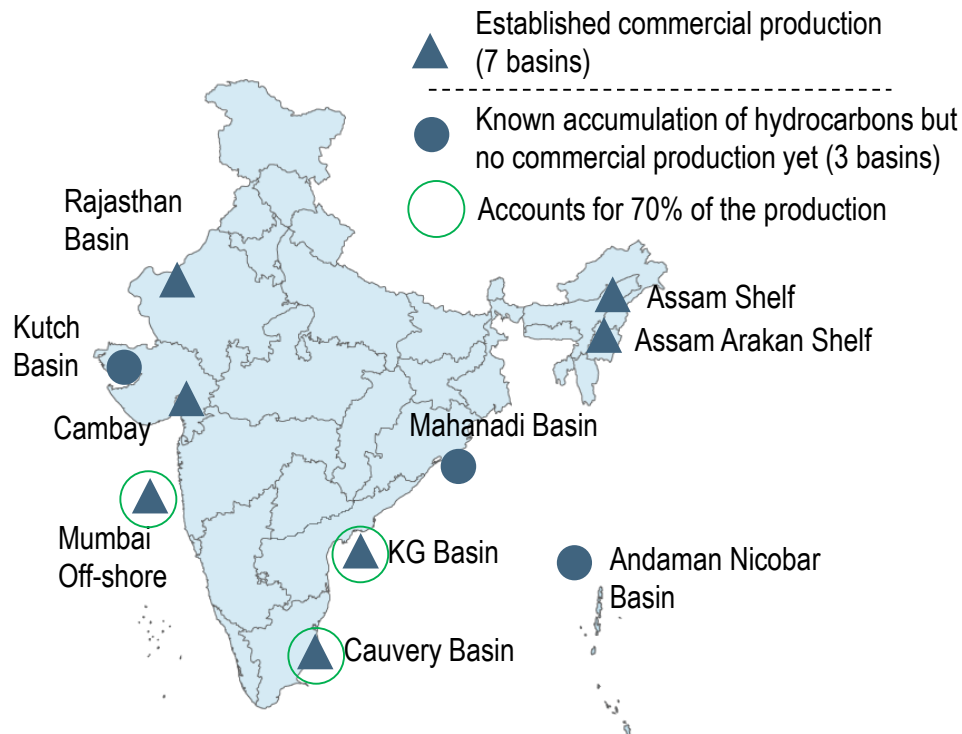
Allocation priority for domestic natural gas

- In 2014, CGD (CNG transport and PNG domestic) segments were **moved from 4th priority to 1st priority** in terms of domestic gas allocation
- GAIL is authorised to **supply 10% over and above the 100% requirement** of CNG (trans.) and PNG (domestic) requirements of CGD in half yearly reviews

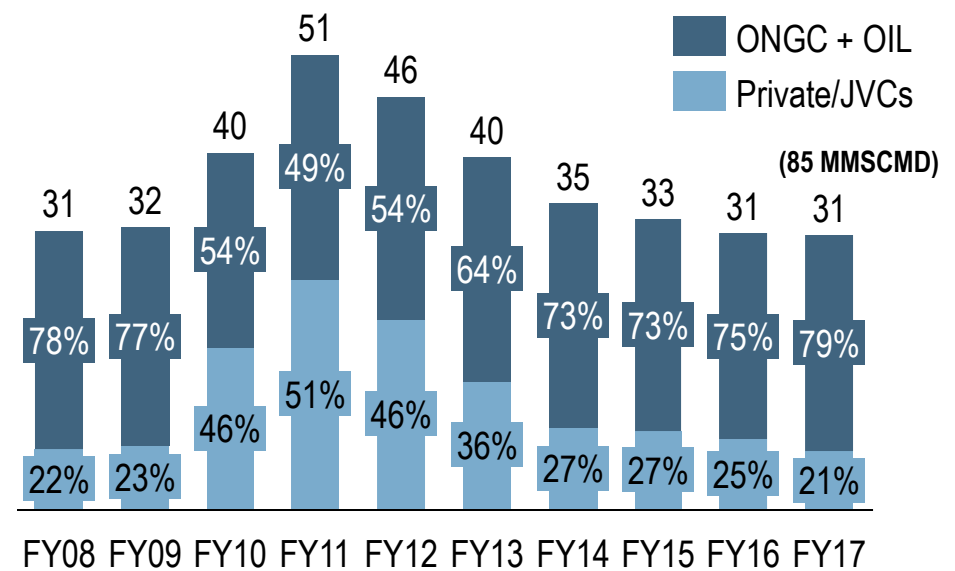
Natural gas production in India is done primarily from off-shore basins and it saw a decline post FY11 mainly due to low production by private/JVCs

Natural Gas Production in India

Natural gas production basins



Natural gas production in India (in BCM)

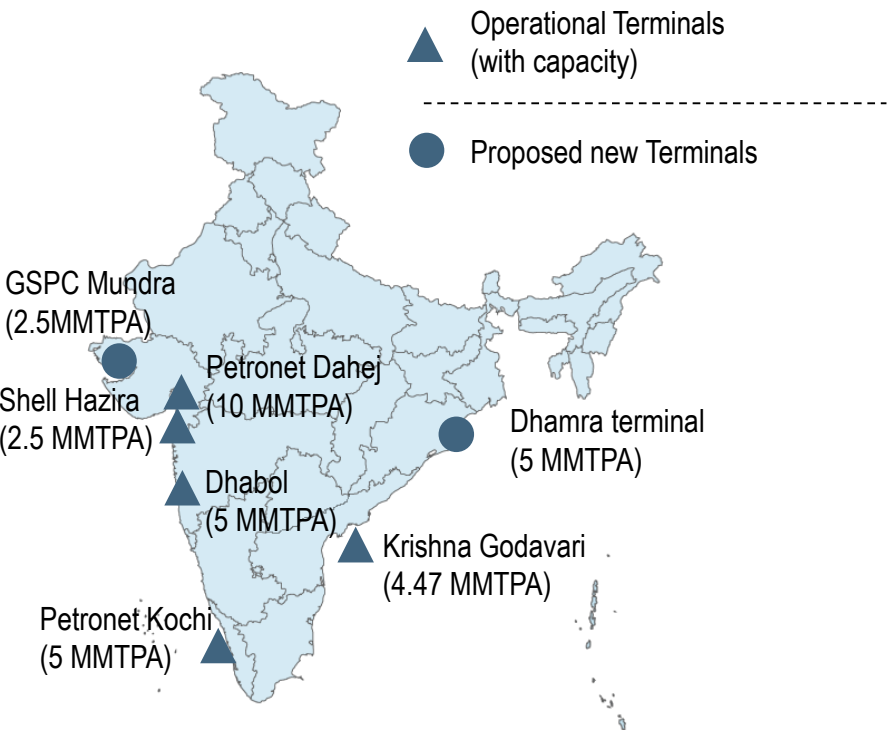


Reserve to Production ratio for India is around 156 which in case of US and Russia is 12 and 56 respectively

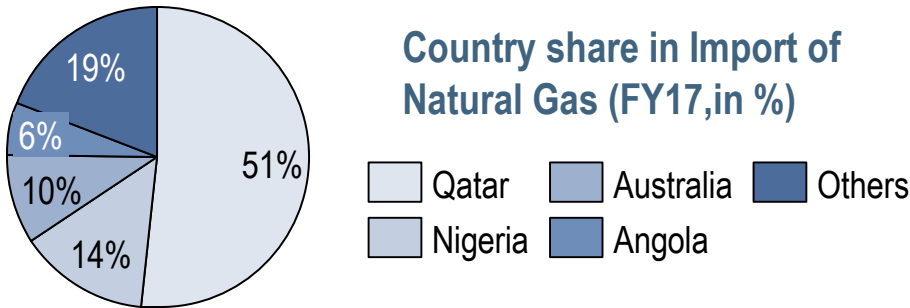
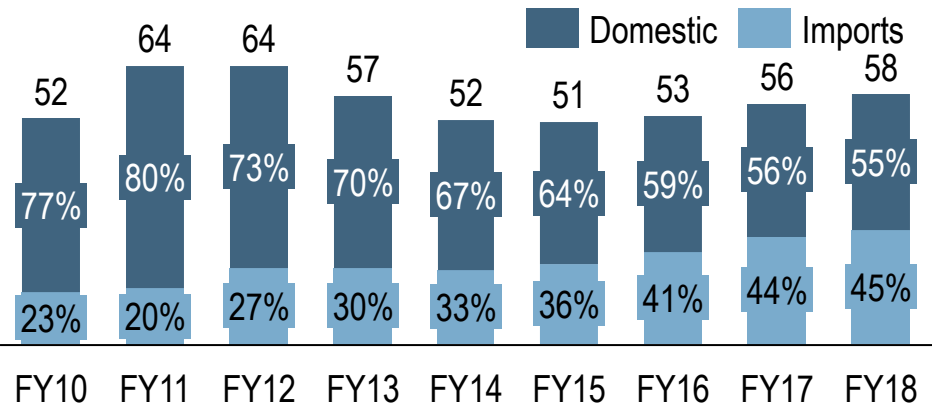
- Currently **7 major basins** are providing the supply of domestic natural gas with **major volumes (~70%)** coming from **off-shore basins**
- India is still in nascent stage in terms of harnessing the proven reserves of natural gas

Abundant gas supply is being made available; Many LNG terminals are coming up to support the additional requirement

Imported Natural Gas
Natural gas Imports terminals



Natural Gas consumption in India (in BCM)

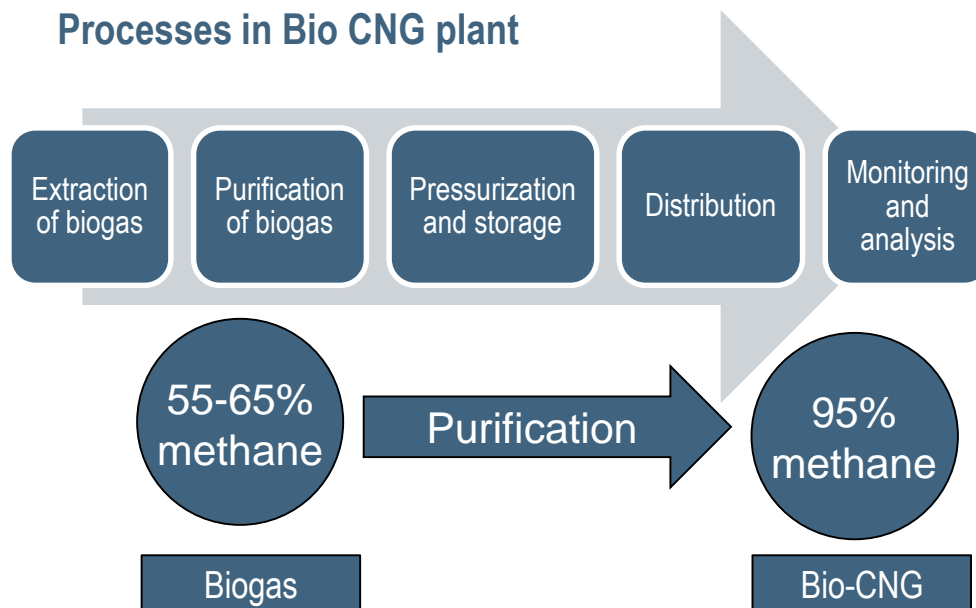
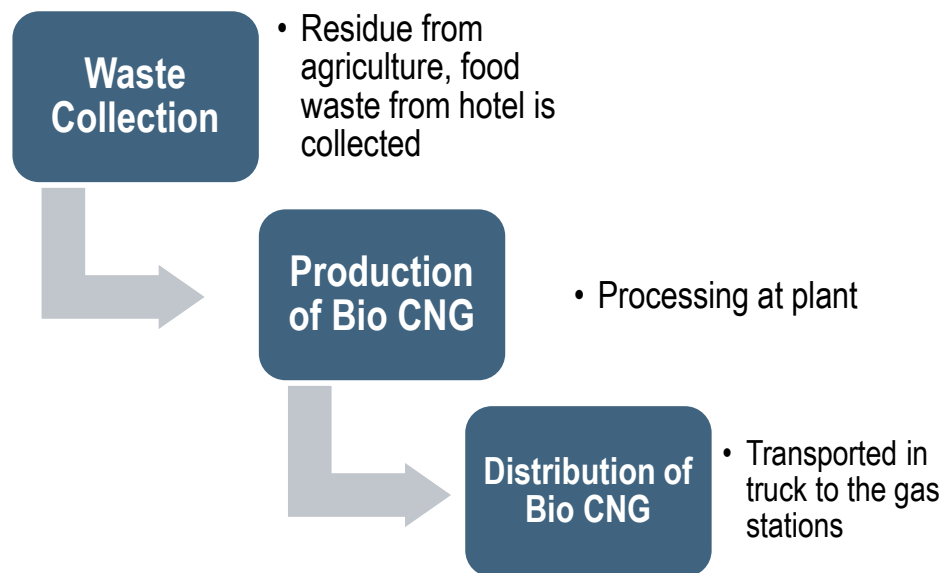


Average landing price of NG is estimated to be **USD 10.73 / MMBtu** but it reduced to **USD 7.73/MMBtu** after the delivery of US Gas started in India which is pegged to Henry Hub prices

Organic waste can be purified to get automotive fuel grade methane which when compressed can work as Bio-CNG

Concept of Bio-CNG

While natural gas is a fossil fuel, **Bio-CNG** is a **renewable form** of energy produced from agricultural and food waste



Bio CNG can create a unique sustainable model of Local Waste getting converted to Local Fuel while also generating Local Employment & Income

Potential of Bio - CNG

Additional Income 1

- For farmers through selling of crop residue
- For vegetable market vendors as well as large establishments like hotels, restaurants., etc. by selling their waste



Crop burning 3

Solution to crop burning & related hazardous (PM 2.5) pollution



Local Employment 2

Generation of local employment opportunities in Bio CNG plants



Swatch Bharat 4

Waste Recycling to realise the cleanliness objectives envisioned by 'Swatch Bharat'



Bio -
CNG

Bio CNG provides an effective solution to local issues, however, the uncertainty of bio-mass availability poses a challenge

Challenges of Bio-CNG



Biomass availability is not certain for whole year



There is a need to store agricultural residue as harvesting period lasts for only 2-3 months



Delay in collections due to

- Lack of mechanization in Indian Agriculture Sector
- Fragmented land holdings



Transportation of any kind for more than 50 Km becomes unviable for a power plant of size 10-15MW

Takeaways

- 1 Natural gas reserves and resources are in abundance globally
- 2 Iran, Qatar, and Russia are global leaders in NG export but recently US and Australia have also picked up
- 3 India has significant reserves of natural gas and same need to be tapped
- 4 Gas availability is being ensured in India via major LNG terminals, and domestic exploration of domestic gas
- 5 Availability of domestic gas to CNG (Auto) and PNG (Domestic) is being prioritised by the Govt.
- 6 Bio - CNG has multiple benefits for the country. Projects should be initiated to tap into this opportunity and ensure additional CNG supply

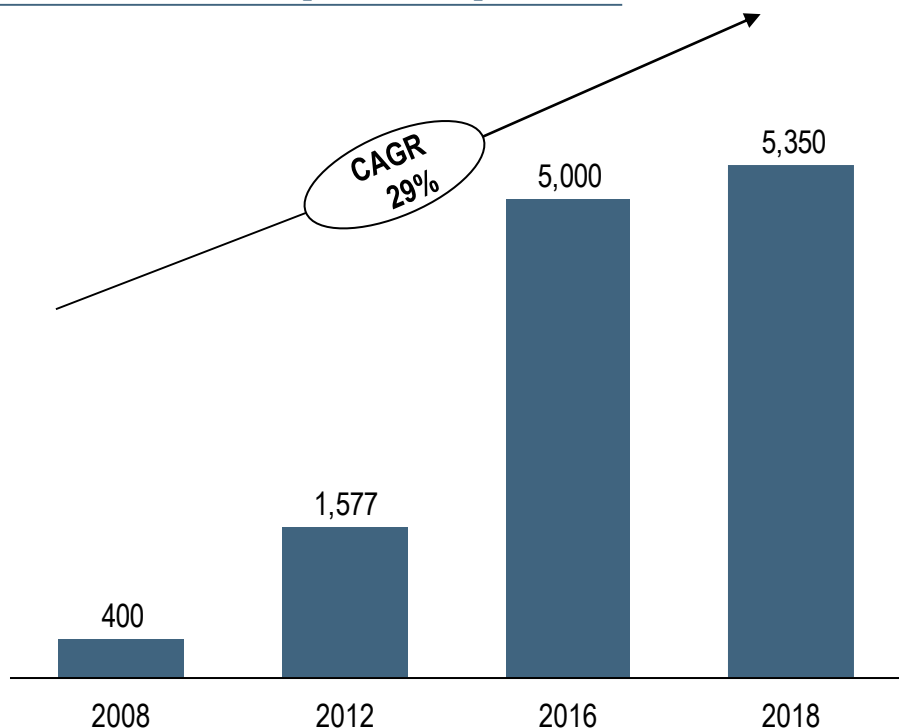
NATURAL GAS VEHICLE SCENARIO



The penetration of NGVs remains low; considerable efforts are being made to encourage cleaner fuel vehicles with focus on LNG for heavy duty trucks

China

NGV Fleet in China ['000 units]



Current NGV Fleet penetration is
~3.3% in China

Focus on LNG in heavy duty vehicles

LNG trucks account for **more than 4% of ~6 mn** heavy vehicles (40 to 45 tonnes hauling capacity) on China's roads

Promoting Factors for LNG

- LNG trucks being more economical saw faster adoption in long haul high tonnage trucks. (The market for high tonnage trucks also saw a rise because of ban on overloading which further boosted LNG truck sales)
- Ban on use of diesel trucks to transport coal at northern ports

India has developed a vast network of NG pipelines to cater to a variety of consumers including the City Gas Distribution networks

Distribution and Consumption

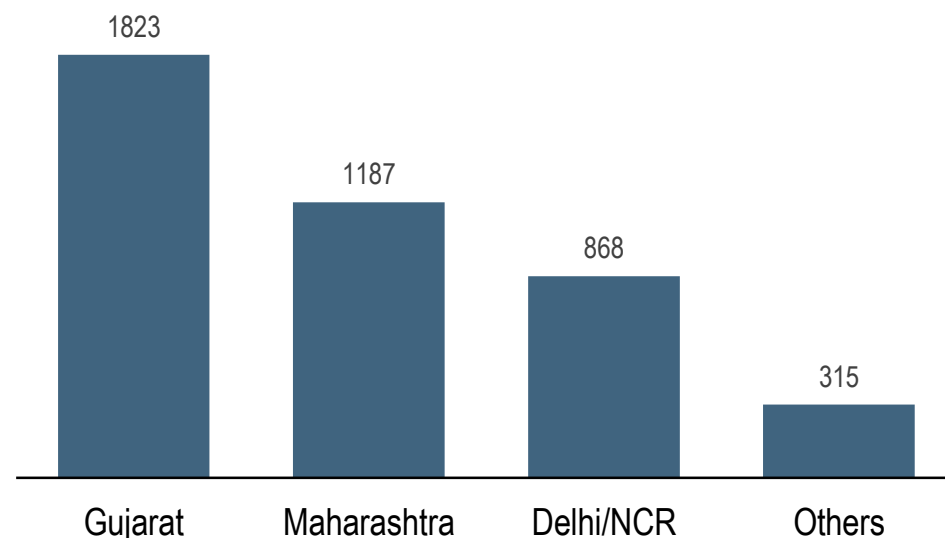
Gas Pipelines in India (as of Oct 2017)

	Existing	Under Construction
Total Length (in km)	16,470	13,489
Total Design capacity (in mmscmd)	387	548
Average utilisation (in %)	41	-

Major pipelines in India

Network	Length (Kms)	Design Capacity (mmscmd)	Util. (%)
Hazira-Jagdishpur	4,660	53	59%
Dahej-Vijaipur	1,119	54	61%
East-West (Reliance)	1,480	80	19%
GSPL network	2,613	43	68%

Domestic PNG connections in each state (in '000s)

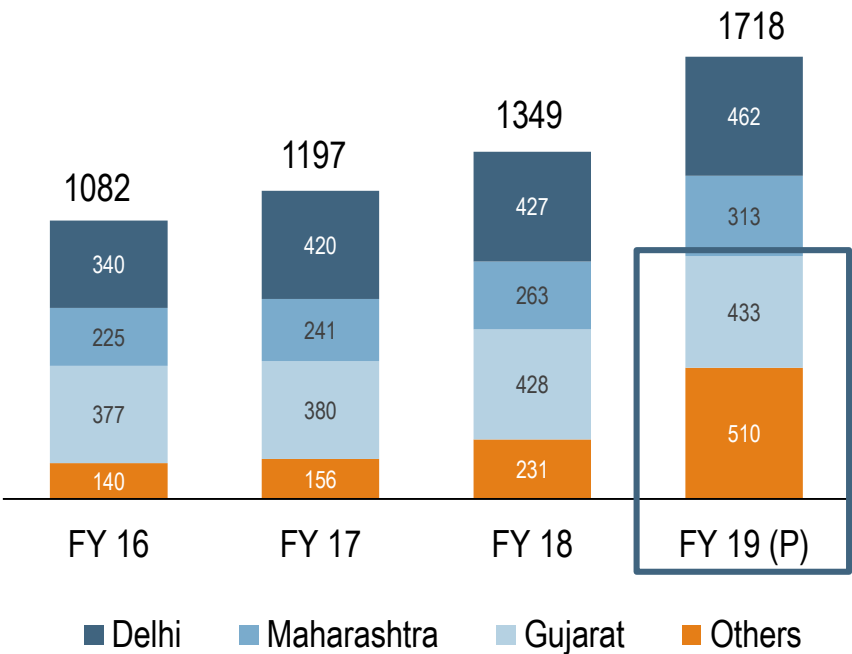


- City gas distribution has been **concentrated in Delhi, Maharashtra, and Gujarat** for past few years mainly because of Government regulations
- The Government had revised the new PNG connections target from 12 lakh to 7.5 lakh for the financial year 2018 and has been able to achieve it

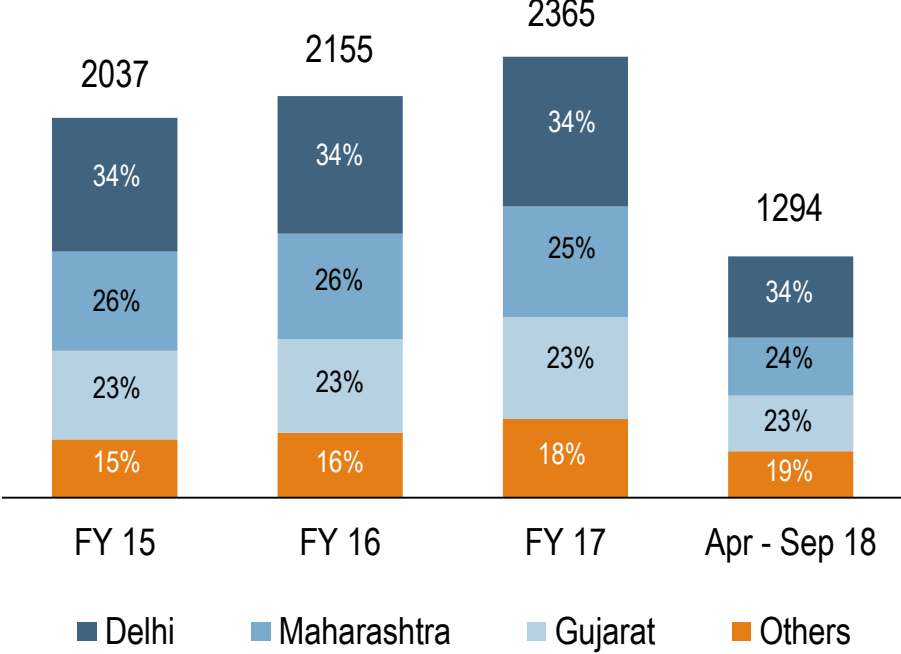
CNG infrastructure has remained concentrated in few cities for the past couple of years with new stations planned in other cities

CNG Infrastructure and Sales

CNG stations in each state



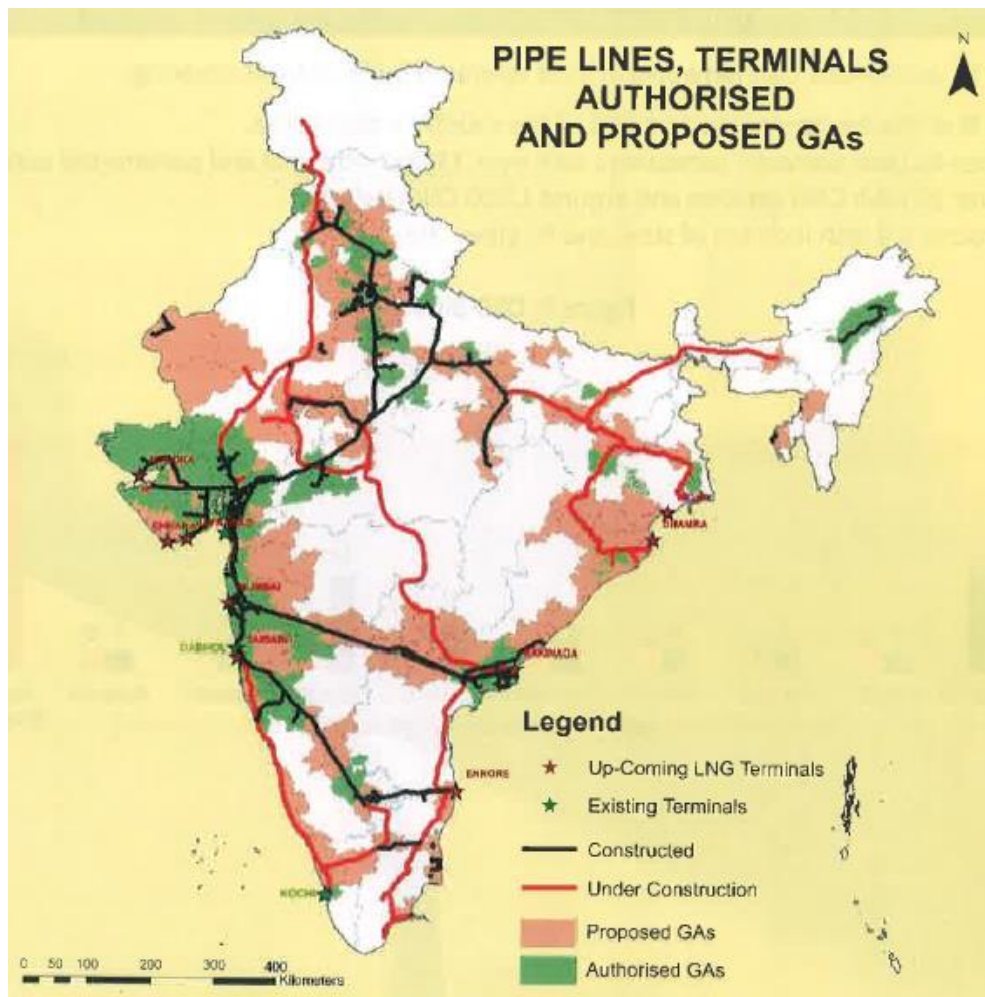
CNG sales in each state (in TMT)



Over the last 6 months, a lot of focus has come in for the development of CGD networks throughout the country

Gas pipeline network has been concentrated in West & North, however, the Govt.'s new GA's are set to ensure uniform distribution through new pipelines

Gas pipeline network in India



- Pipeline network is mostly concentrated on the northern and western parts of India
- Latest rounds of bidding for CGD development are focussing on increasing the spread to Eastern and Southern regions
- All the GAs proposed are around the trunk lines
- This will make sure that supply of gas to newly developed CGDs is provided as early as possible

Government is focussing on creating a robust Natural Gas infrastructure to make India a gas economy and achieve the vision of 1 crore PNG connections

Government Initiatives in NG and their impact

1

Gas Allocation Priority

- Government has moved CNG (auto) and PNG (domestic) to the highest priority in domestic natural gas allocation

2

Price Mechanism

- MoP&NG issued domestic gas pricing guidelines to fix prices using a globally indexed formula
- The prices are revised every 6 months

3

Developing CGD Infrastructure

- In multiple stages, PNGRB has started bidding for the development of CGD networks throughout the country. Recently the 9th bidding round has been a big move with 86 GAs up for bidding. Government has also simplified the bidding process

4

PNGRB Regulations

- PNGRB Act passed in 2006 to form a regulatory authority
- Plans to develop a gas trading hub in India on the lines of Henry Hub in the US
- PNGRB preparing regulations to reserve 1/5th of new LNG terminal capacities for 3rd party access

Government Initiatives

Central and state Governments are promoting usage of compressed natural gas through a number of initiatives and policy changes

Government Initiatives for natural gas

Policy changes

State Governments slashing VAT on CNG – Gujarat from 15% to 6%, UP from 21% to 5%

Pushing Ola and Uber to use CNG – Maharashtra Government wants to make usage of CNG mandatory for the taxi aggregators

In its quest to promote use of CNG, Delhi Government announces 50% concession on CNG cars registration

Ninth round of bidding for City gas distribution launched by PNGRB for 86 Geographical Areas spread across 174 districts in 22 states and Union territories

Press releases (FY 18)

Indian Oil, HPCL, BPCL to invest Rs10,000 crore for Bio-CNG plants

IOCL will execute the plan in north India, BPCL and HPCL will replicate - Livemint

Nitin Gadkari to auto firms: No alternative to green fuel shift

Government has strict policy to reduce crude imports & curb pollution - Livemint

Delhi govt says will roll out 2,000 new CNG buses within a year

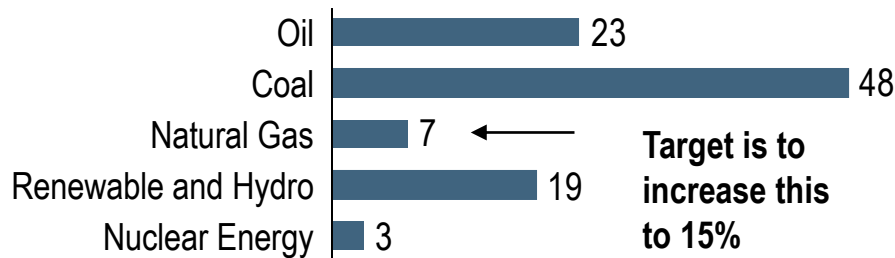
By the end of 2018 the target is to have 2000 new CNG buses – India Today

Government Initiatives

Government is focussing on increasing the share of gas in Indian energy mix and for that PNGRB is facilitating rapid development of CGD networks

Steps to further develop CGD infrastructure in India

Forecast of energy mix in India by 2040



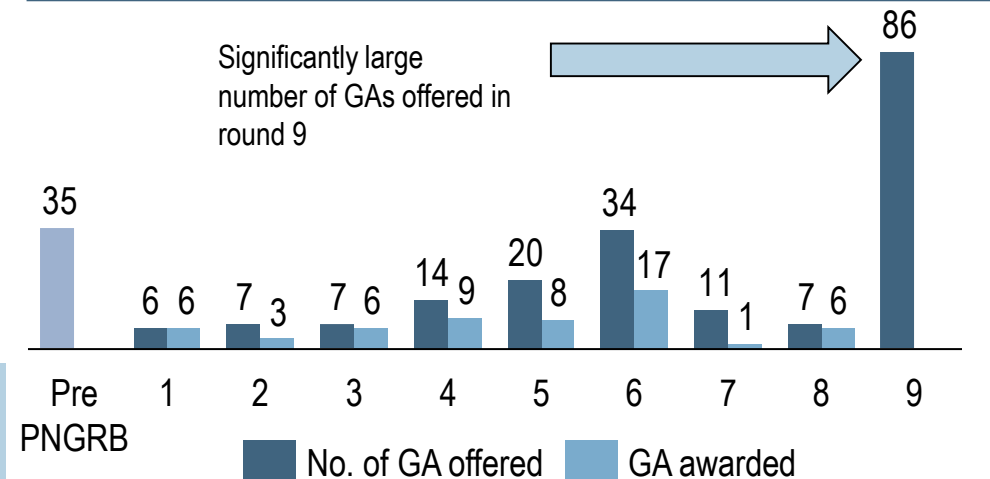
To increase gas share, PNGRB is focussed to

- Create infrastructure to support higher consumption of NG in India
- Establish a vibrant and transparent NG market in India
- Balance interests of consumers, transporters, and producers of natural gas

Policy Enablers

- Regulatory interventions for CNG public transport
- CGD designated as public utility
- State Governments commitment for CGD networks

CGD Bid rounds and allocation by PNGRB



Investor friendly environment for bidding

- Smart combination of districts with all GAs on existing or proposed pipelines
- E-bidding for quick and transparent bidding
- Quick start of CGD allowed through cascades or others
- 8 year exclusivity, trunk line operator to provide gas within 270 days, bid bond discontinued

Takeaways

- 1 Natural gas pipeline network is growing across India
- 2 Utilisation of pipelines is still low, especially the pipelines owned by private players
- 3 CNG station infrastructure was concentrated in a few states but in the past few months, there has been a significant development
- 4 CNG will help realise the PNG mission of the Government

NGV AS A FRONTRUNNER FOR SUSTAINABLE MOBILITY



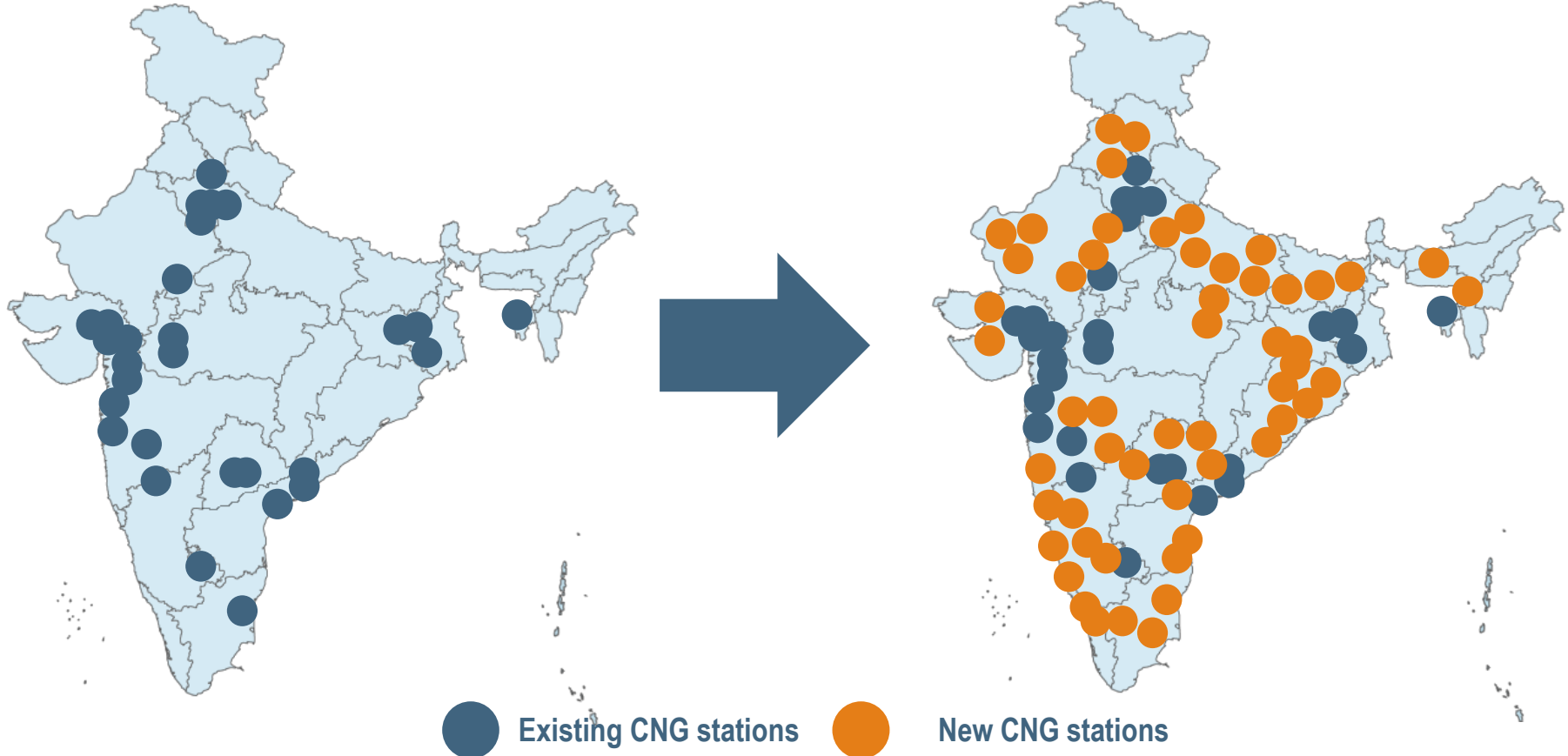
Expansion of CNG station network

With the help of a strong network of **5,000 CNG stations**, India will be able to achieve a robust natural gas eco-system

1,349 CNG stations

TO

5,000 Additional CNG stations



NGVs are at the forefront of sustainable mobility with better air quality & crude oil import savings while safeguarding employment in the industry



Crude Oil Import Savings by FY 25¹

~95,000 crore INR



Additional CNG Stations by FY 25

5,000



Target PNG Connections by FY 25

1.3-1.5 Cr



Additional Employment in CNG stations

100,000 - 125,000



CNG vehicles¹ on road by FY25

1 Crore

All major PV OEMs have natural gas vehicles in their portfolio

OEM actions in NG PVs

Maruti Suzuki bets big on CNG, hybrid cars

April 30, 2018 Article courtesy: Money Control

- Maruti has share of 50% in the domestic passenger vehicle segment
- All such vehicles, run on alternative fuels and technologies, help in reducing oil imports and air pollution.

CNG PVs suppliers in current market

TATA MOTORS



HYUNDAI



HONDA

MARUTI SUZUKI

Way of Life!

Tata Motors expands its CNG portfolio

November 22, 2013 Article courtesy: Tata Motors

- The Tata Indigo and Tata Indica emax have a low carbon footprint of 0.251 g/km and 0.338 g/ km, respectively.
- They are very fuel efficient cars with a mileage of 23.7 km/kg for Indica emax and 24.6 km/kg for Indigo emax.

CNG vehicle technology exists in PVs and all major OEMs have CNG models in their portfolio

Tata Motors



Maruti Suzuki



Maruti Suzuki



Honda



Hyundai



Mahindra

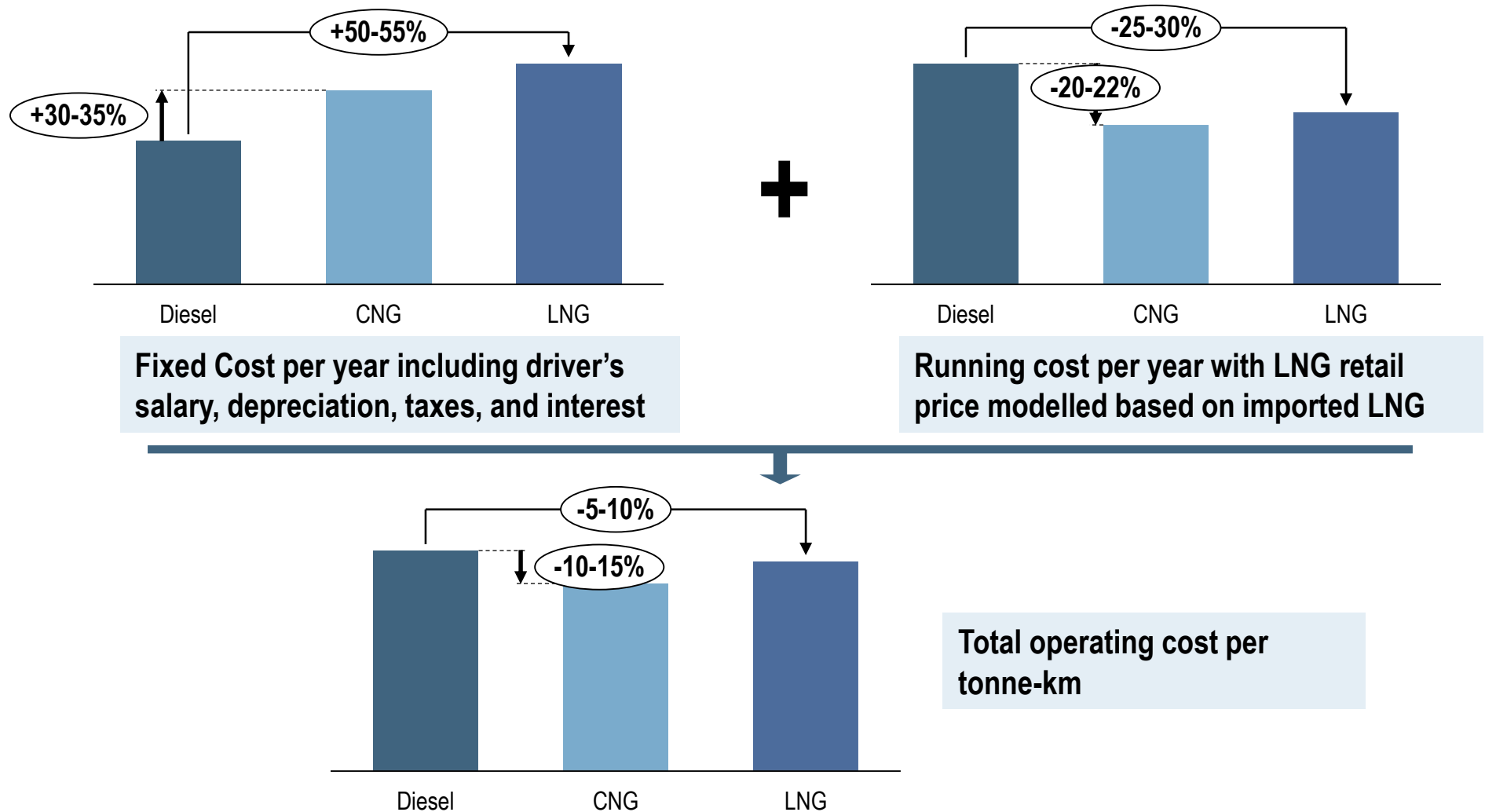


Technology availability with all major OEMs, some launched others waiting

NGV – Cost competitiveness

In CVs, both LNG & CNG provide a better TCO compared to Diesel, however, CNG provides 7-8% more benefit compared to LNG due to higher LNG prices

Economic viability for LNG and CNG trucks



Gas acceptance for trucks

All major commercial vehicle OEMs have CNG vehicles with some coming up with LNG trucks for long hauls

OEM actions in NG CVs

SML Isuzu introduces its CNG-run truck Sartaj HG72 in Jaipur

January 06, 2017 Article courtesy: ET Auto

- Diesel trucks entering Delhi have to cough up a green tax of Rs 1400, it makes a compelling reason for people to buy CNG vehicles
- CNG-run vehicle incur about 5% less maintenance cost

CNG Truck suppliers in current market



LNG: Tata Motors ready to step on it for its buses and trucks

November 26, 2016 Article courtesy: The Hindu Business Line

- In the West, it is estimated that about 10 per cent of transportation fuel will be LNG by 2020," says Tata motors

Gas acceptance for CVs

CNG vehicle technology exists in CVs and all major OEMs have CNG models in their portfolio

Mahindra



Tata Motors



Eicher



Eicher



Eicher



Tata Motors



Ashok Leyland



Ashok Leyland



Mahindra



Gas acceptance for 3Ws

CNG vehicle technology exists in 3Ws and all major OEMs have CNG models in their portfolio



Bajaj Auto



Bajaj Auto



PIAGGIO



Bajaj Auto



TVS Motors



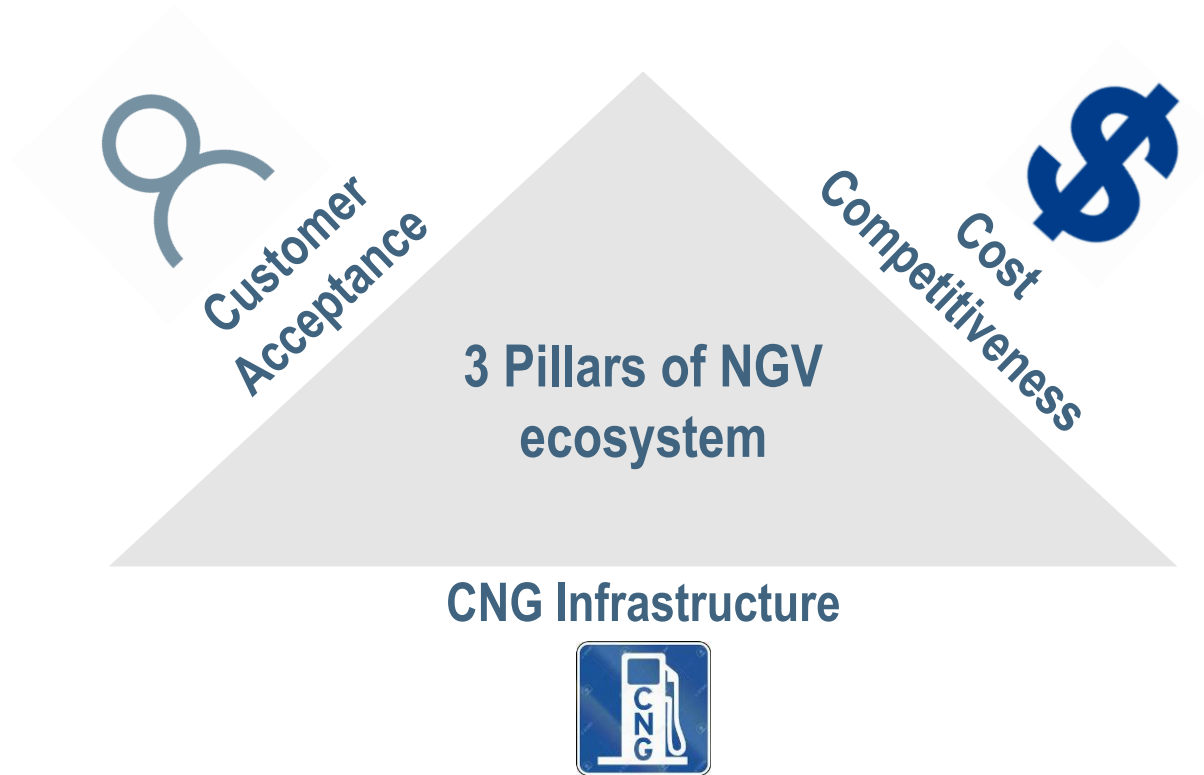
PIAGGIO

Technology availability with all major OEMs, some launched others waiting

NGV ECOSYSTEM - IMPERATIVES

NGV Ecosystem – 3 Pillars

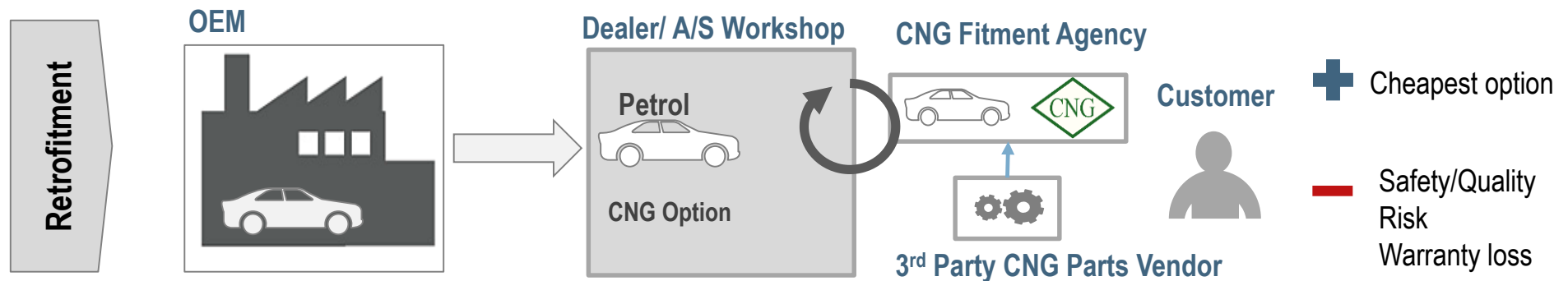
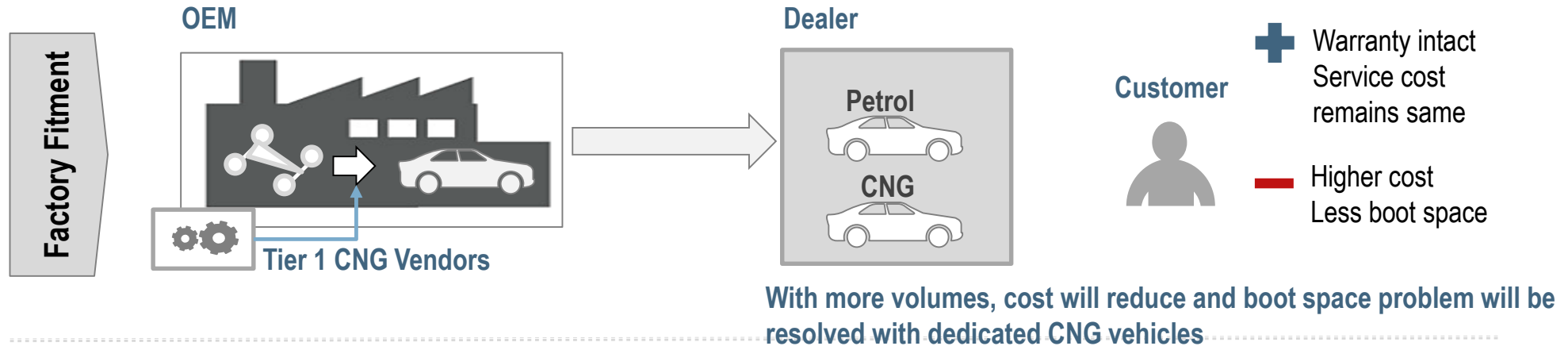
Customer Acceptance, Cost Competitiveness & CNG Infrastructure, along with a favourable policy environment are essential for promotion of NGVs



Conducive policy environment for market creation, technology development and setting up of a widespread infrastructure for natural gas vehicles

Current fitment models pose a challenge for customer acceptance, Govt. & OEMs need to work towards their resolution

Fitment Models



A central authorization agency should be set up for the certification of the fitment process & Regular (scheduled and surprise) Audit mechanism of CNG retrofitting.

Cost Competitiveness

A stable pricing policy & selling environment needs to be set up to ensure the TCO advantages of the vehicles are considered during purchase decisions

City-wise price of fuel & VAT rates

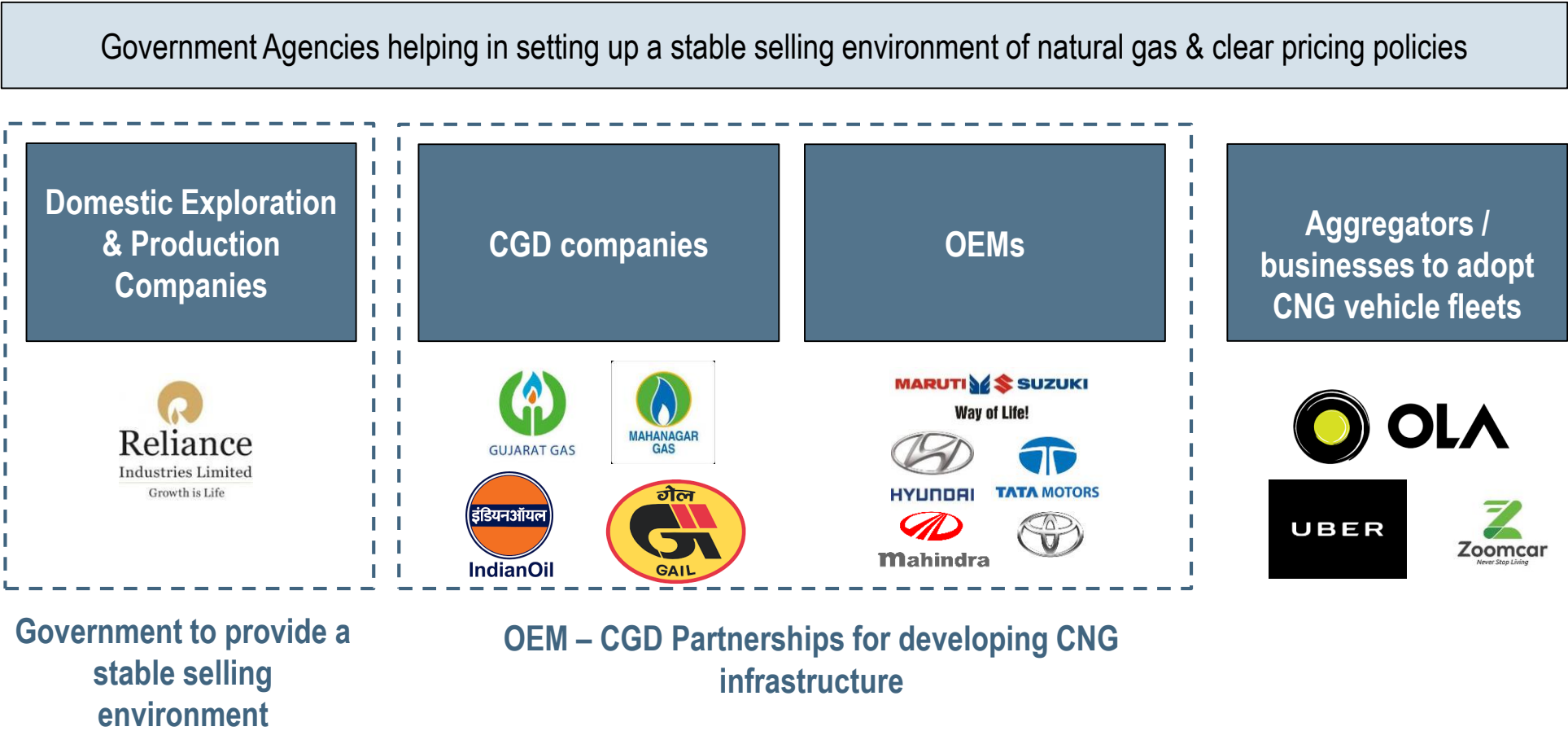
City	Petrol (INR/L)	Diesel (INR/L)	CNG (INR/Kg)	VAT rates
Delhi	76.57	67.82	40.61	0%
Noida, Ghaziabad	77.41	68.01	47.05	5%
Bengaluru	77.81	68.98	49.37	18%
Mumbai	84.40	72.21	44.22	13.4%
Hyderabad	81.11	73.72	52.00	14.5%

While CNG is cheaper than conventional fuels, a large variation exists in prices across cities due to difference in VAT rates and selling & distribution costs

Regulation of the proposed natural gas trading hub and uniform pricing policies will lead to a stable NGV environment going forward

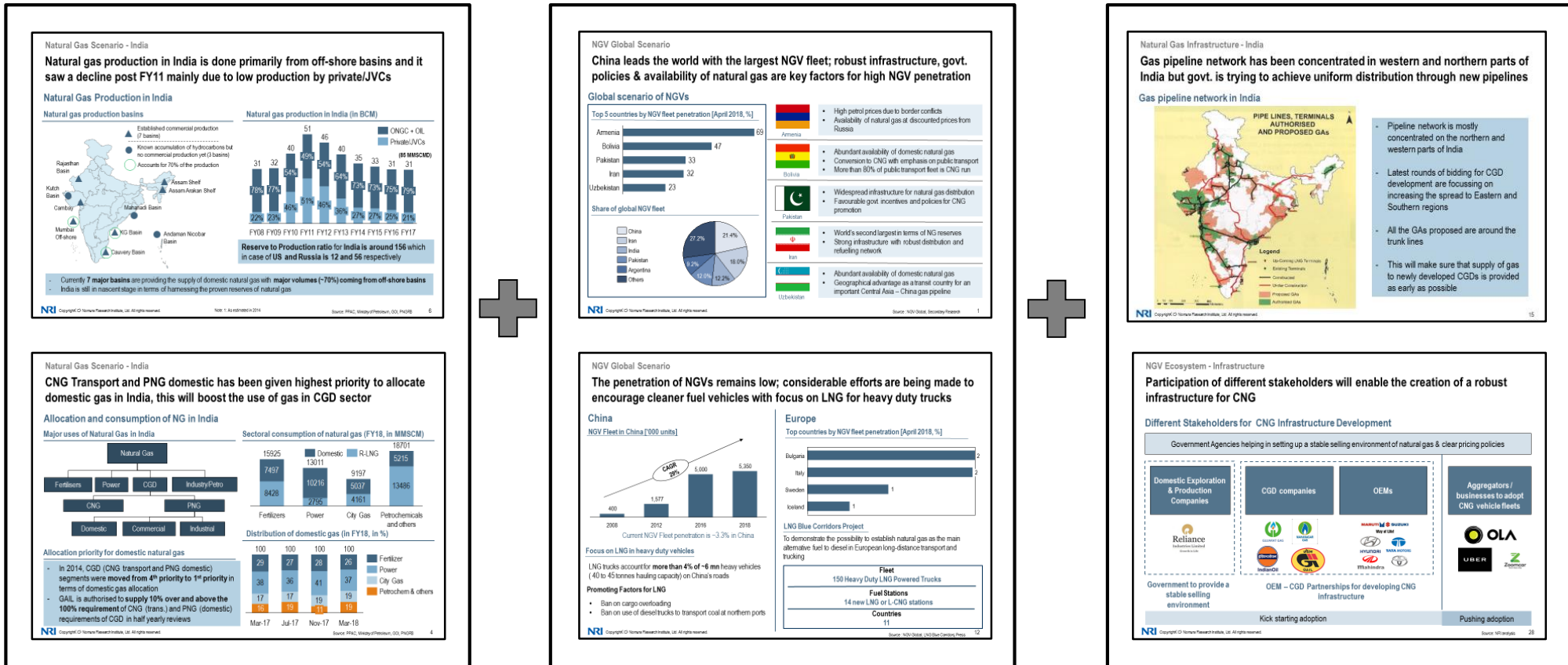
Participation of different stakeholders will enable the creation of a robust infrastructure for CNG

Different Stakeholders for CNG Infrastructure Development



POLICY RECOMMENDATIONS

Policy recommendations have been derived based on the Indian Natural Gas scenario, global developments & Indian NGV ecosystem



Natural Gas Scenario

Global Developments

Indian NGV ecosystem

NGVs are at the forefront of sustainable mobility with better air quality & crude oil import savings while safeguarding employment in the industry



Crude Oil Import Savings by FY 25¹

~95,000 crore INR



Additional CNG Stations by FY 25

5,000



Target PNG Connections by FY 25

1.3-1.5 Cr



Additional Employment in CNG stations

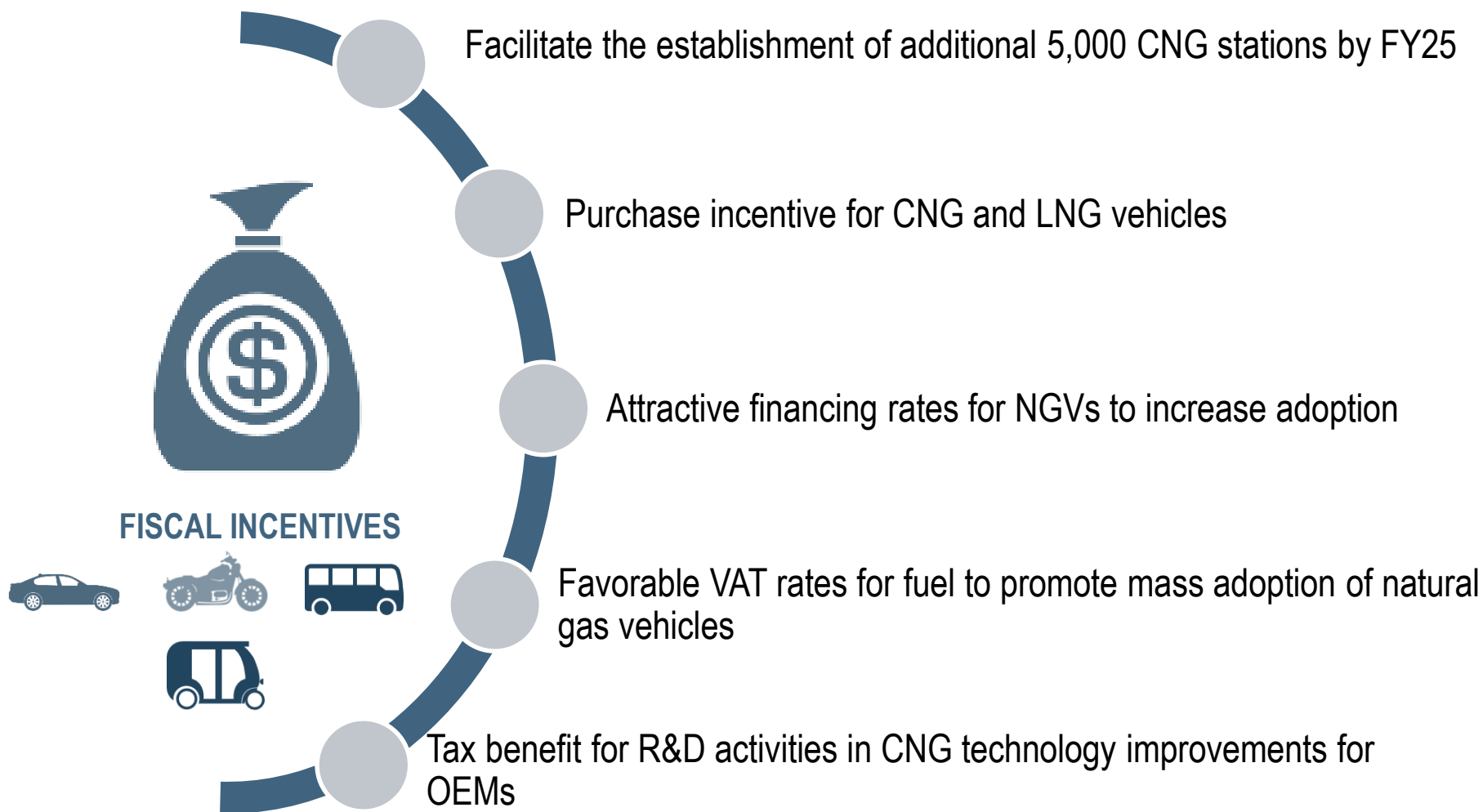
100,000 - 125,000
















CNG vehicles¹ on road by FY25

1 Crore

Fiscal incentives should be given with the aim of promoting natural gas vehicles



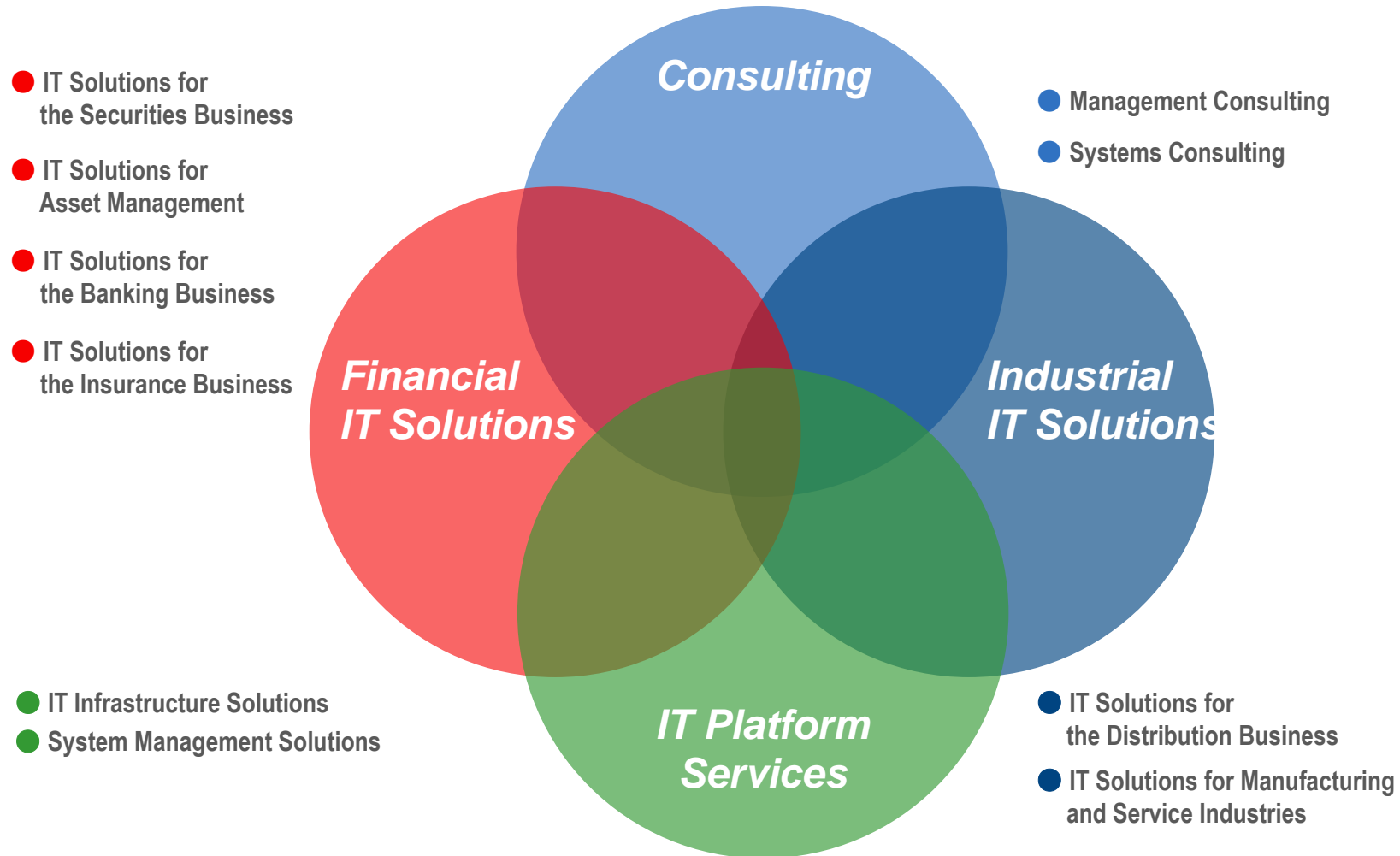
Non-fiscal policies directed towards different stakeholders should aim at promoting an overall NGV environment

		Stakeholders	Government Policies
<div>     </div> <p>NON - FISCAL POLICIES</p> <div>     </div>		 <p>Domestic E&P Companies</p>	<ul style="list-style-type: none"> Regulation of proposed gas trading hubs Establish uniform pricing policies & tax structures across states for a stable selling environment
		 <p>OMC Companies</p>	<ul style="list-style-type: none"> OMC companies to be mandated to add CNG dispensing units at their fuel stations
		 <p>CGD Companies</p>	<ul style="list-style-type: none"> Simplification of land acquisition laws for CNG pipeline and fuel station development Further simplification of the bidding process to promote infrastructure development
		 <p>OEMs</p>	<ul style="list-style-type: none"> Foster joint collaboration between CGDs and OEMs for CNG infrastructure development
		 <p>Customers</p>	<ul style="list-style-type: none"> Set up a central authority for certification of fitment process Set up safety & quality standards for the fitment process

The background of the slide is a photograph showing the silhouette of industrial valves and pipes against a vibrant sunset sky. The sky transitions from a deep blue at the top to a bright orange and yellow near the horizon where the sun is setting. The industrial equipment, including several large hand-operated valves, is dark and stands out against the colorful background.

ABOUT NOMURA RESEARCH INSTITUTE (NRI) CONSULTING & SOLUTIONS

NRI Consulting & Solutions (part of the USD 4 bn NRI group) is a premier global management consulting and IT solutions firm headquartered in Japan



NRI Consulting team works closely with clients to help achieve more success by superior strategy development & business performance improvement

Business Strategy and Optimization

- Business strategy development
- Business modelling
- M&A advisory
- Organizational development
- Internal & external positioning
- Implementation planning
- Cost optimization
- Benchmarking programs

Sales

- Sales strategy and growth development
- Dealer development
- Customer penetration and shares of wallet
- Sales organization
- SOP & process optimization

Service, Spares

- Service portfolio alignment
- Service process optimization
- Spare parts logistics and service levels
- Product line and service unit interface optimization

Products & Technology

- Product portfolio planning
- Technology roadmaps
- Product cost optimization
- Variant, configuration and change management
- Engineering excellence
- ESO

Supply Chain

- Supply chain performance measurement
- Supply chain strategy and network improvements
- Working capital improvement
- Logistics optimization
- Warehousing improvements

Procurement & Ops

- Supplier management and development
- Material cost reduction
- Capex optimization
- Advanced cost modeling
- Supplier innovation management
- Operations improvement

Top-line impact

Bottom-line impact

We look forward to supporting the industry in these VUCA times

From Negative (-)



To Positive (+)



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