



Petronet LNG Limited

LNG as an Automotive Fuel



16 March , 2018



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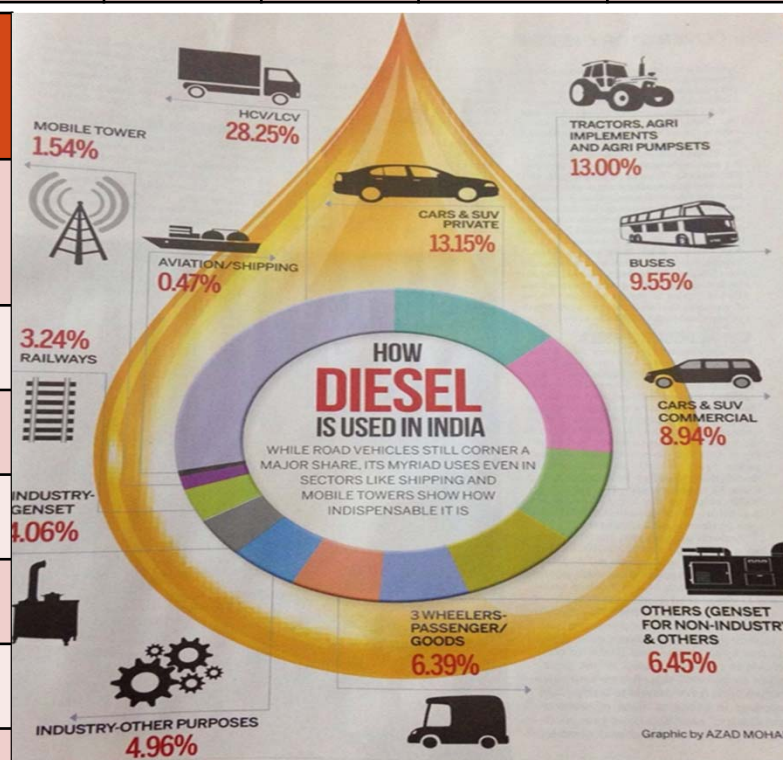


Diesel market in India

Diesel Market In India

Year	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18 (till January 2018)
Total DO consumption (Million MT)	64.7	69.1	68.4	69.4	74.6	76.02	67.16

Growth in consumption of DO from 2010 to 2016		
	Growth (Million MT)	Growth (%)
2012-13	4.4	6.8
2013-14	-0.7	-1.0
2014-15	1.0	1.5
2015-16	5.2	7.5
2016-17	1.41	1.9
Average	2.27	3.34



Data source: *PPAC & INDIA TODAY



Diesel consumption by M&HCV (Trucks and Buses)

S.No	PARTICULARS	NUMBERS
1.	Total diesel consumption in India ('000) tonnes in FY 2017	76,027
2.	Percentage share of Trucks in total diesel consumption in India	28.25%
3.	Share of diesel consumption for Trucks in India ('000) tonnes	21,478
4.	Percentage share of Buses in total diesel consumption in India	9.55%
5.	Share of diesel consumption for Buses in India ('000) tonnes	7,260
6.	Total Diesel Consumption (Trucks + Buses) ('000) tonnes	28,738



Growth in Medium & Heavy Commercial Vehicles (Trucks)

Data Source- ICRA Report

S N	F.Y	Volumes
1.	2014-15	1,95,918
2.	2015-16	2,58,488
3.	2016-17	2,55,267
4	10m FY2018	2,29,570
Yearly Average		2,46,289



Growth in Buses

Data Source- ICRA Report

S N	F.Y	Volumes
1.	2014-15	81,653
2.	2015-16	92,845
3.	2016-17	98,126
4	10m FY2018	63,484
Yearly Average		87,201



Automotive Sector Challenges



Automotive Sector Challenges

- Growing concern for the environment
 - ❖ BS IV already in force
 - ❖ BS VI to be implemented from 2020.
- Squeezed Margins due to increase in overhead & Fuel cost
- Fuel prices to increase further due to BS VI implementation
- Thrust on environmental concerns needing clean fuel
- Price of Vehicles are likely to increase



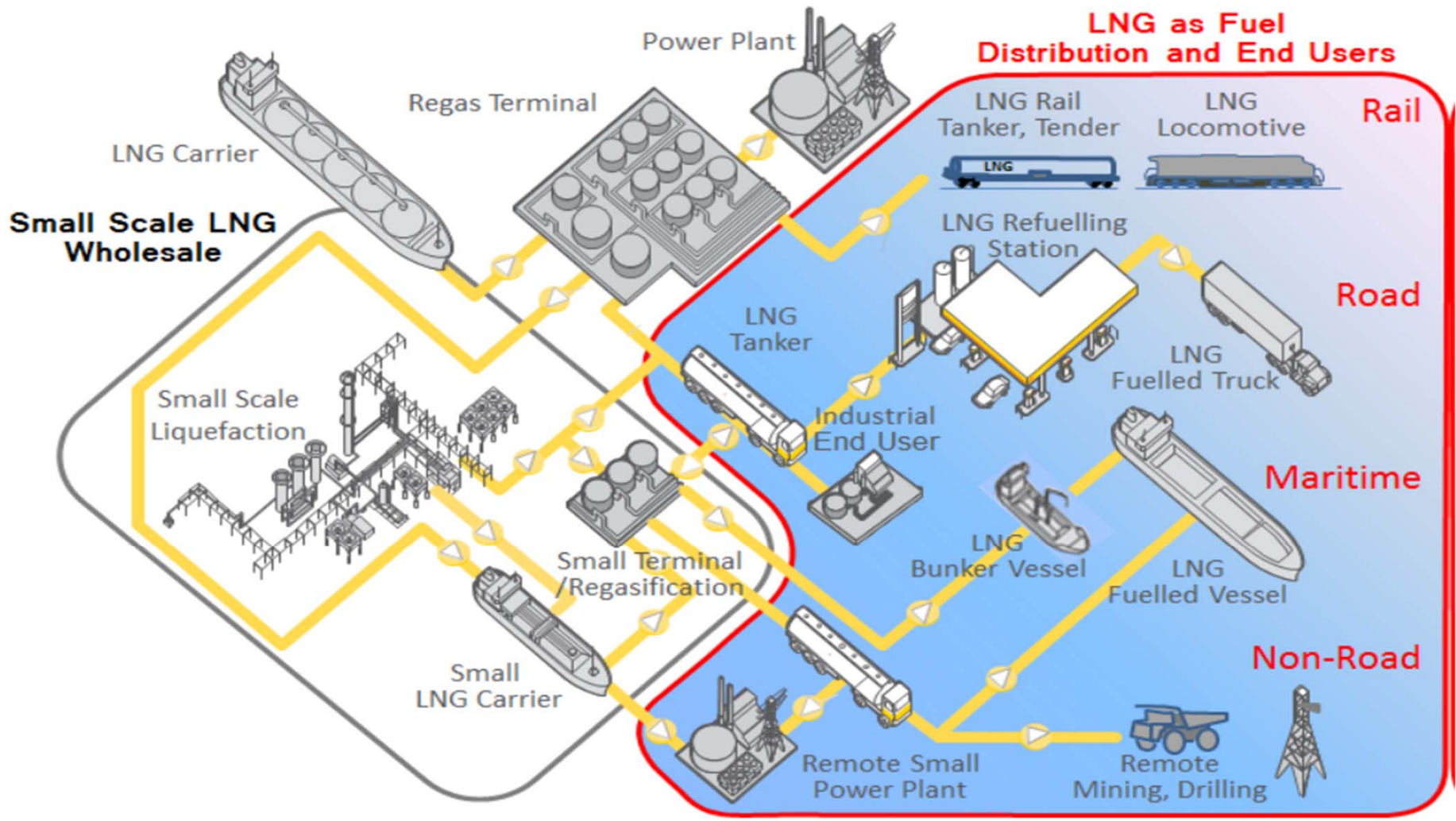
Options to counter these challenges

- Introduction of new fuels like Electric : This is not a solution for India in trucking segment due to very high cost of vehicle
- Compressed Natural Gas (CNG) is one solution but not suitable for Cargo / logistics / trucking segment due to less fuel storage and lower payload issues
- Solution is Liquefied Natural Gas (LNG)



Application of LNG as Fuel

LNG As Fuel Applications – Target Markets And Means Of Transport



Source: IGU



Worldwide use of LNG as an Automotive Fuel

Road Transport in China

- China is paving the way for LNG in road transport

Year	2012	2013	2014	2015
Number of LNG trucks	70,000	100,000	250,000	300,000
Number of LNG fueling stations	n.a.	n.a.	2,122	2,600

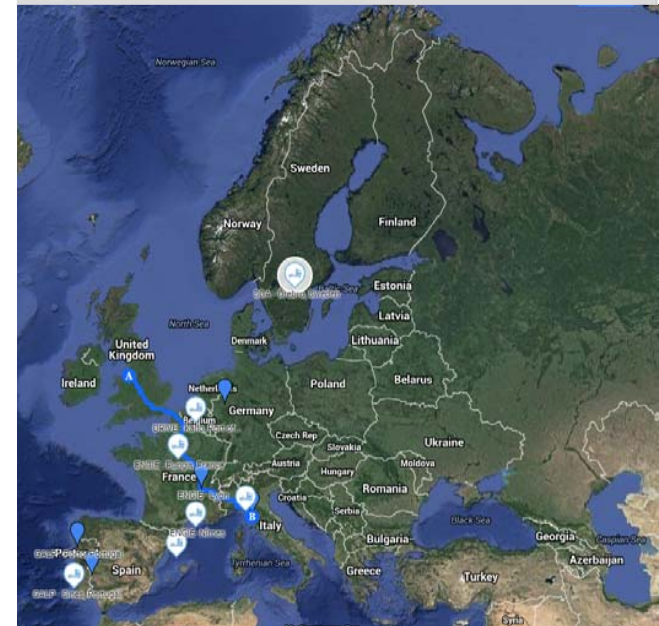
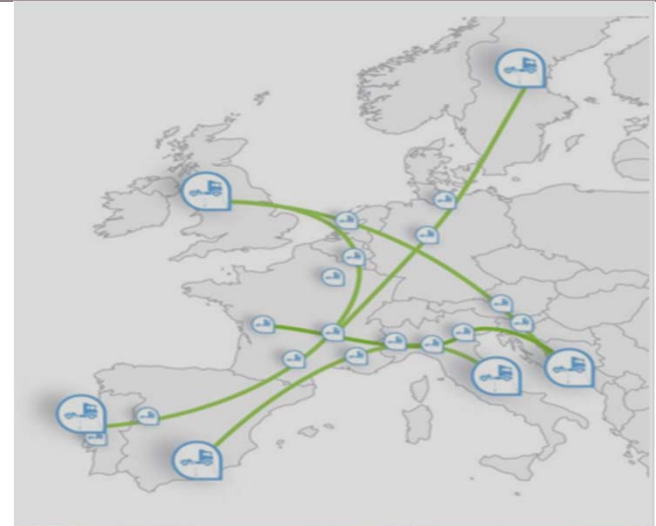
- OEM active involvement: 60+ OEMs



Use of LNG as fuel in Europe

• LNG BLUE CORRIDOR

- There are 5 LNG facilities built in Europe. They are located in Italy, Sweden, Belgium, Portugal and Spain.
- There is high refuelling frequency: + 5000 fillings in the LNG BC stations, delivering more than 500T of LNG.
- Nearly 3.5 million km were driven by the current fleet of 30 LNG BC trucks. These trucks consumed more than 950 tons of LNG.
- Initially expectations of 100 LNG trucks will be exceeded by far, with more than 140 trucks on the roads and monitored.
- All the planned remaining filling stations will be in place by the end of this year.



Use of LNG as fuel in USA

- There are approximately 173 LNG stations in US
- Clean energy is a major player in US for LNG dispensing stations across major highways
- There are large number of LNG fuelled trucks operating in USA

America's Natural Gas Highway™



LNG COMPETITIVENESS



LNG Benefits

- Attractive Savings
- Economic benefits.
- Better combustion.
- Environmentally friendly clean fuel.
- LNG supply by trucks already existing practice.
- Site Gas storage possible.
- Better product quality.
- Better safety features due to dispersion properties of Methane



Emissions - Diesel v/s LNG

S. No	Parameters	BIS – IV norms (g/km)	BIS -VI norms (g/km)	Percentage difference BIS IV & BIS VI	NG Emissions (g/km)
1	CO	0.50	0.50	0%	0.22
2	NO _x	0.25	0.06	76%	0.25
3	PM	0.025	0.005	80%	0.0029
Diesel			LNG		
Major Expenses by refineries for making Diesel fuel as Euro-6 Compliant.			Fuel is as such Euro-VI compliant.		
Major Expenditure by truck manufacturers for 'after treatment' of Flue gases.			Very Minimal expenditure on 'after treatment' due to absence of particulate matter.		

LNG is a Euro VI compliant fuel



Why LNG as Transportation Fuel

Energy Density - LNG v/s CNG v/s Diesel

Energy Density

- Since space occupied by fuel is a very important factor in moving vehicles, we need to understand the term energy density. Energy density is the energy contained in a fuel per unit volume occupied by that fuel.
- LNG achieves a higher reduction in volume than CNG, because the volumetric energy density of LNG is 2.4 times greater than that of CNG.
- Diesel on the other hand, achieves slightly higher reduction when compared to LNG.

Diesel



LNG



CNG





Pay back – Truck owners

S. No	Particulars	LNG/KG	Diesel/Litre
	Price/KG with Exice and with VAT - Crude \$64	50	63
1	Kilometer run per Month	6000	6000
2	Mileage/KG of fuel	3	3
3	Repair & Maintance - per/ km	2.42	2.42
4	Number of days running in a year	12	12
5	Total Km Running in a year	72,000	72,000
6	Fuel Consumption per year	24,000	24,000
7	Cost of Fuel/year	12,00,000	15,12,000
8	Repair & Maintance - 10% additional	1,74,240	1,74,240
9	Total operating Cost	13,74,240	16,86,240
10	Savings Per year over Diesel Truck	3,12,000	-
11	Total life of Truck	10	10
12	Additional Investment over Diesel Truck	9,00,000	-
13	Per Km Savings	4.33	
14	Payback of Additional Investment (Years)	2.88	-

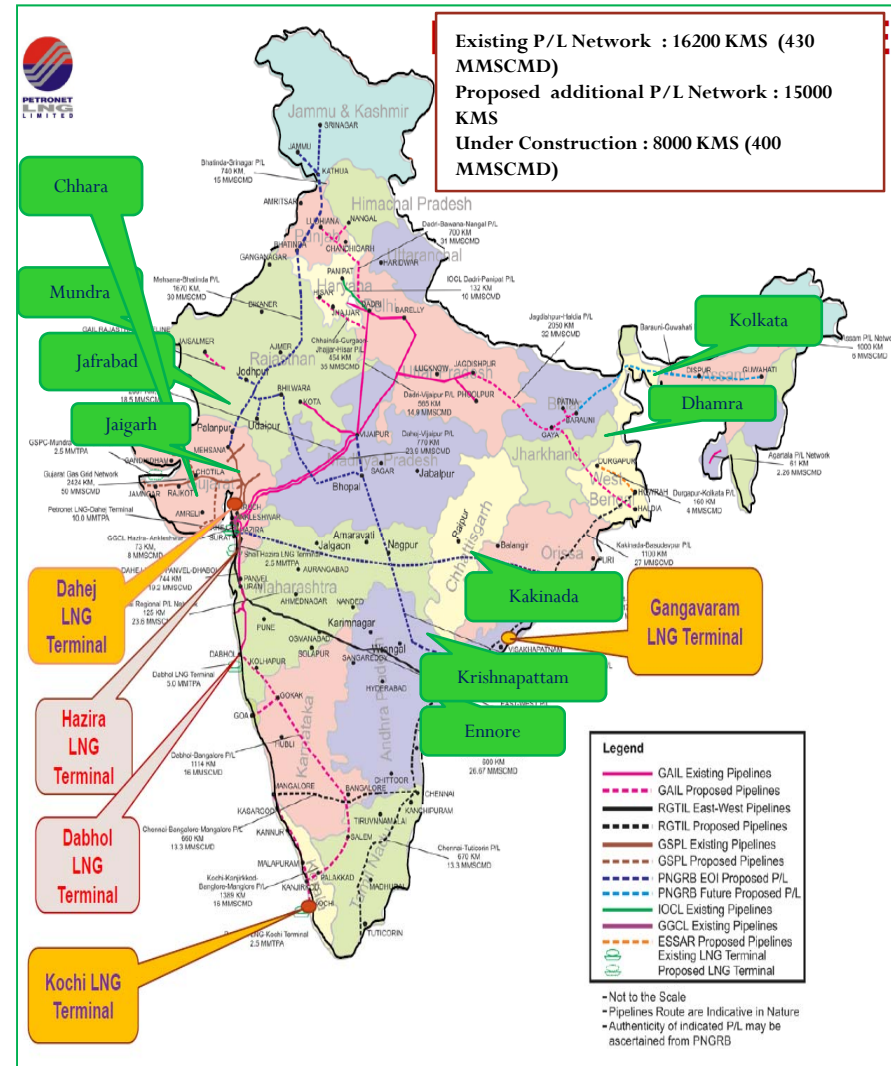


PLL's Planned Pilot Route



LNG TERMINALS & GAS PIPELINES

No.	TERMINAL	DEVELOPERS	CAPACITY (MMTPA)
Existing Terminal			
1	Dahej	Petronet LNG Limited	15.0
2	Hazira	Royal Dutch Shell, Total Gaz Electricite	5.0
3	Dabhol	GAIL, NTPC	5.0
4	Kochi	Petronet LNG Limited	5.0
TOTAL EXISTING			30.0
UNDER CONSTRUCTION			
1A	Dahej Expansion Phase III B	Petronet LNG Limited	2.5
5	Mundra	GSPC, Adani	5.0
6	Ennore	Indian Oil Corp, TIDCO	5.0
TOTAL UNDER-CONSTRUCTION			12.5
PLANNED			
7	Kakinada	APGDC, Shell, ENGIE or VGS	2.5
8	Dhamra	Adani	5.0
9	Jafrabad (FSRU)	Swan, Exmar	5.0
TOTAL PLANNED			12.5
PROPOSED			
10	Gangavaram	Petronet LNG Limited	5.0
11	Jaigarh	H Energy	2.5
12	Kolkata Port	H Energy	2.5
13	Chhara	HPCL & Shapoorji Pallonji	5.0
14	Krishnapattam	LNG Bharat	2.5
TOTAL PROPOSED			17.5
GRAND TOTAL			72.5



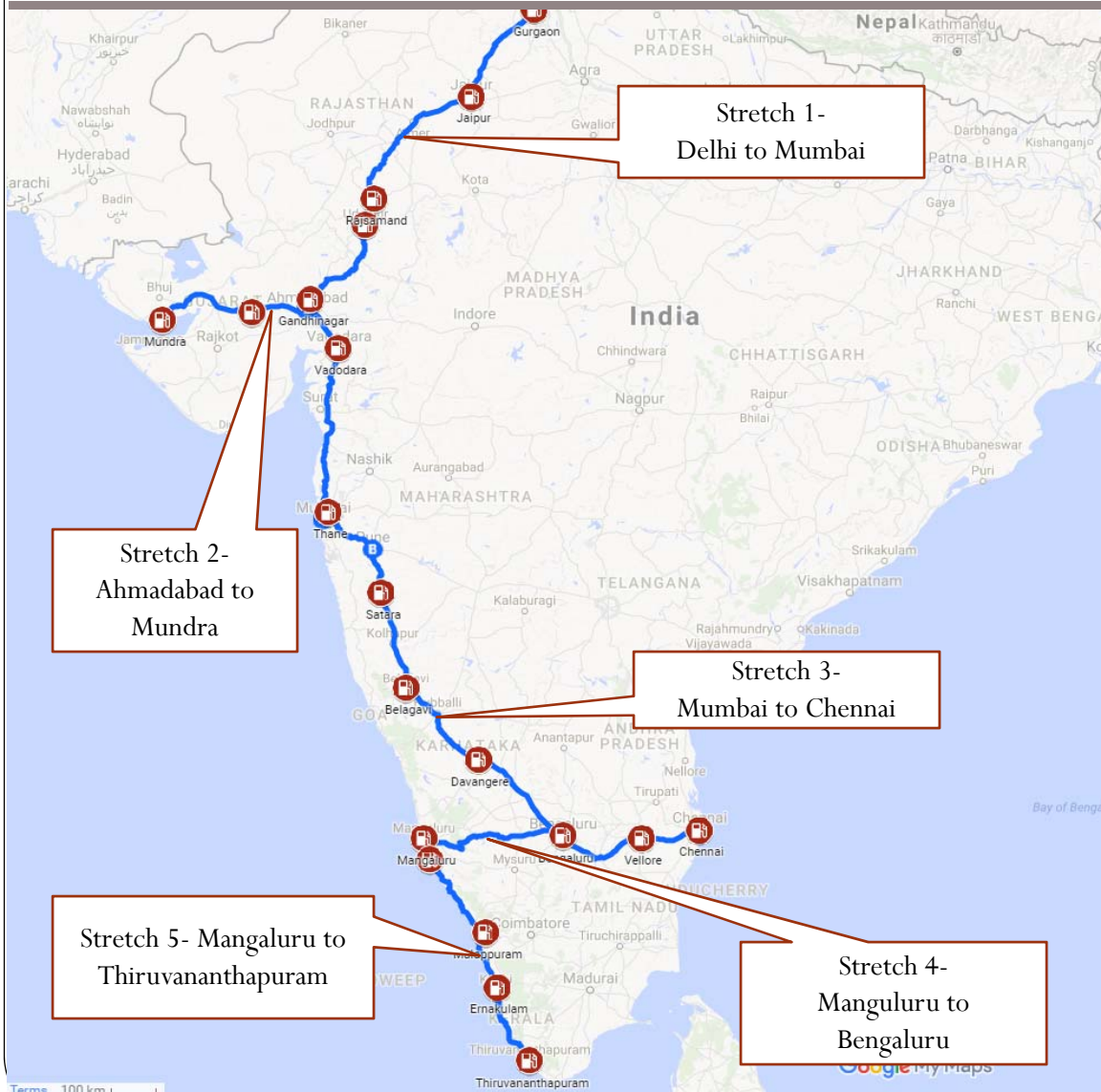


Project Plan for Pilot Development

- Development of Pilot route with establishment of 20 LNG fuelling stations. The distance between two stations being 250 km. The proposed route is as follows:
 - Delhi to Mumbai Highway
 - Ahmadabad to Mundra Highway
 - Mumbai to Chennai
 - Manguluru to Bengaluru
 - Mangaluru to Thiruvananthapuram
- PLL plans to ply 100 trucks powered by LNG on Delhi- Mumbai corridor and Kochi – Mangalore corridor.
- Finalization of business plan with OEMs including Tata Motors & Ashok Leyland (key players in heavy commercial transportation) for trucks and buses.
- PESO is formulating standards & inclusion of LNG fuel tank and dispenser stations in Gas cylinder rules.



PLL Pilot plan for LNG station installation



No.	Location
1.	Gurgaon, Haryana
2.	Jaipur, Rajasthan
3.	Rajsamand, Rajasthan
4.	Udaipur, Rajasthan
5.	Gandhinagar, Gujarat
6.	Dhrangadhra, Gujarat
7.	Mundra, Gujarat
8.	Vadodara, Gujarat
9.	Thane, Maharashtra
10.	Satara, Maharashtra
11.	Belagavi, Karnataka
12.	Davangere, Karnataka
13.	Bengaluru, Karnataka
14.	Vellore, Tamil Nadu
15.	Chennai, Tamil Nadu
16.	Mangaluru, Karnataka
17.	Kasargod, Kerala
18.	Mallapuram, Kerala
19.	Ernakulam, Kerala
20.	Thiruvananthapuram, Kerala



India's First LNG Bus Launch



Launch of 1st LNG bus trial in Kerala on 8th November 2016



[LNG Bus launch video](#)



Launch of 1st LNG bus trial in Kerala on 8th November 2016





Regulatory Framework



Regulatory Developments in Last 2 Years

- Amendments in CMVR to recognize LNG as Auto Fuel like CNG to facilitate Vehicle Registration : This exercise is done and finally LNG is recognized as Automobile Fuel on 27 June 2017. A Milestone Achieved.
- Developments of LNG Fuelled Vehicles : Tata Motors has successfully developed Tata LNG Prima 4032 Tractor and LNG bus as demonstrated in Trivandrum.
- Many other Vehicle manufacturer are also working on their LNG Vehicle Models. Expected launches soon.



Regulatory Developments in Last 2 Years-Cont.

- In August 2016 an Expert committee was formed by PESO to study and give recommendation for formulation of new rules for setting up LNG Dispensing Stations.
- After the detailed deliberations the committee proposed various amendments in the Schedule IV of the SMPV Rules which deals with LNG Storage, Handling, Transportation, Operation, Maintenance and Dispensing.
- On 17th July 2017, Gazette Notification of Draft Rules has been published for 45 days of Public Consultation process.
- Public Comments as received were resolved by the committee and PESO has recommended its parent ministry to notify it in the Gazette.



Statutory Approvals

S.No	Component	Type of Approval	Approving Authority	Remarks
1.	Fuel	Approval of LNG as automotive fuel	Ministry of Road Transport and Highways, under Central Motor Vehicle Rules	LNG has been notified as an automotive fuel on, 27 th June 2017
2.	LNG Fuel Tank	Approval for LNG fuelling system for trucks/buses	PESO (Petroleum and Explosive Safety Organization)	LNG dispenser station and fuelling components inclusion in SMPV Public comments Received has been resolved. It is yet to be notified in Gazette
3.	LNG Fuelling Station	Approval for installation of fuelling station and dispenser	PESO (Petroleum and Explosive Safety Organization)	LNG dispenser station and fuelling components inclusion in SMPV Public comments Received has been resolved. It is yet to be notified in Gazette



THANK YOU