

11th World PetroCoal Congress (11th WPCC 2021) and the Virtual World Future Fuel Summit (WFFS21)

Keynote Session -VIII: LNG for a Green Energy Transition

17- Feb -2021

LNG Infrastructure - Gas Based Economy in India



GSPC LNG

Anil Joshi
President, GSPC LNG Ltd.

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India's commitment on climate change

- **India's commitment on climate change as per the Paris agreement – COP 21**
 - India is committed to reduce its carbon footprint by **33% - 35%** from 2005 levels as per COP 21-United Nations Framework Convention on Climate Change (2015)-Paris Agreement.
 - To achieve approx. 40 % cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030
 - To create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030
- **India's measures to achieve the commitments**
 - Massive push towards gas based economy with thrust on renewable energy to achieve sustainable development.
 - Govt. of India aims to increase the share of natural gas in India's primary energy basket from existing **6% to 15% by 2030**.
 - Huge focus - improving energy efficiency (Industrial equipment, LED lighting etc.)
 - Reducing emissions by reducing diesel intake, moving to higher vehicle emission norms/ standards (BS-VI)
 - Increasing share of renewable energy in power generation

Challenges for transition to Gas based economy

2. Infrastructure
Accessibility

1. Availability of
Supply

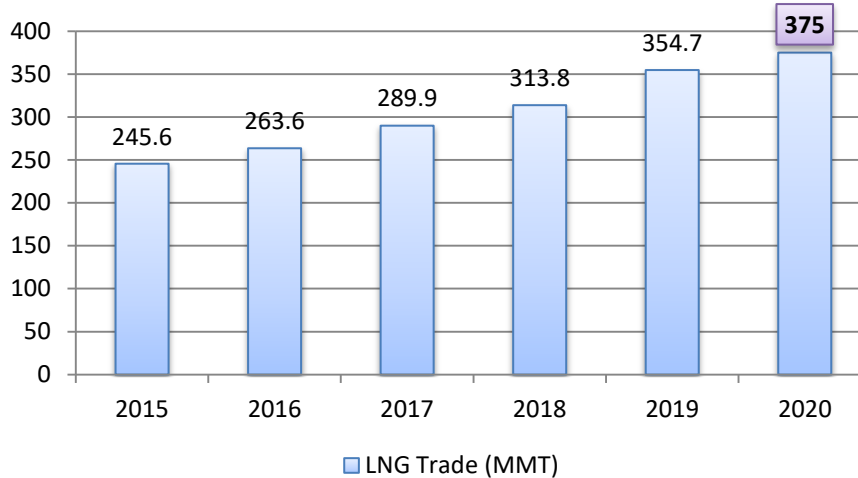
Challenges

3. Affordability
against alternate
fuels

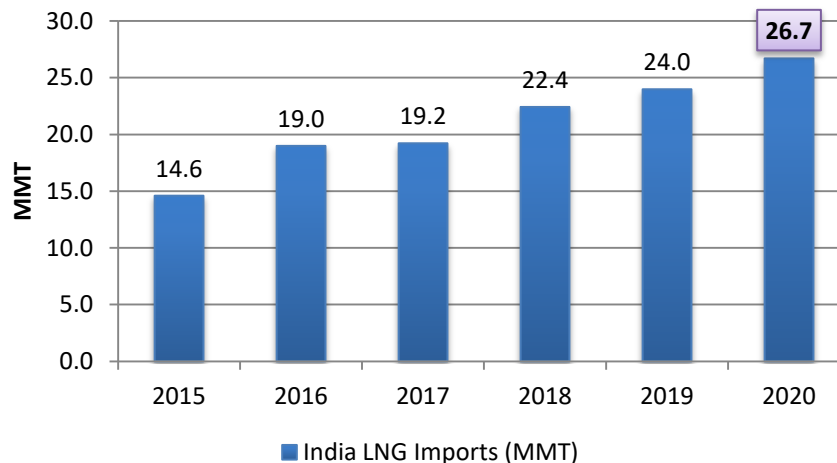
4. Regulatory
and Tax Reform
interventions

International LNG Trade and LNG imports in India

International LNG Trade (MMT)

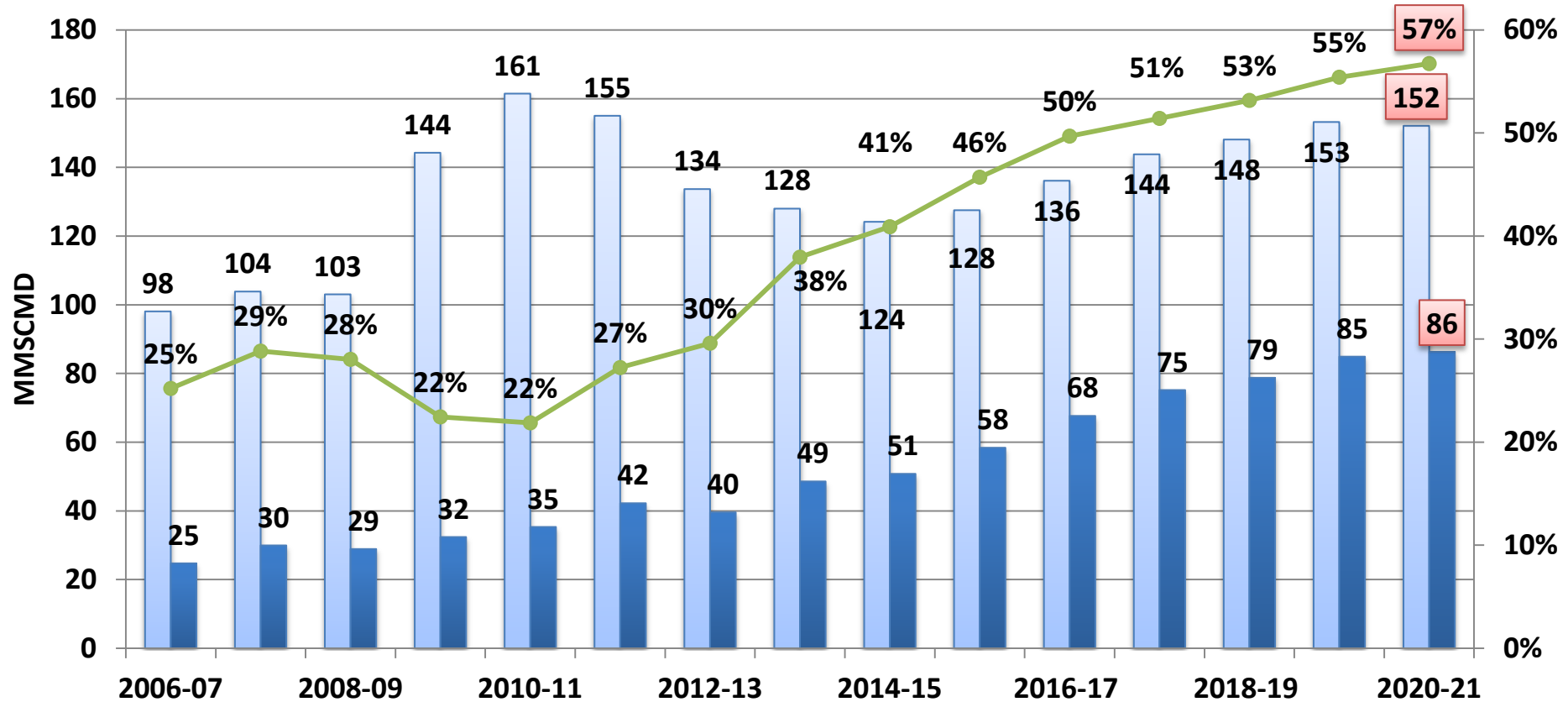


India LNG Imports (MMT)



- International LNG Trade has grown at 9 % p.a.(approx.) for past few years.
- Multiple factors such as abundant LNG supply, promotion of clean and green fuel (NG) in many countries, Climate change etc.
- India's LNG imports have also steadily risen with growth in LNG infrastructure, Development of Transmission Pipelines and last mile connectivity through CGD network development
- Key policy reforms and regulations such as Unified tariff, Setting up of Gas exchange etc. shall further push the usage of Natural Gas in India.

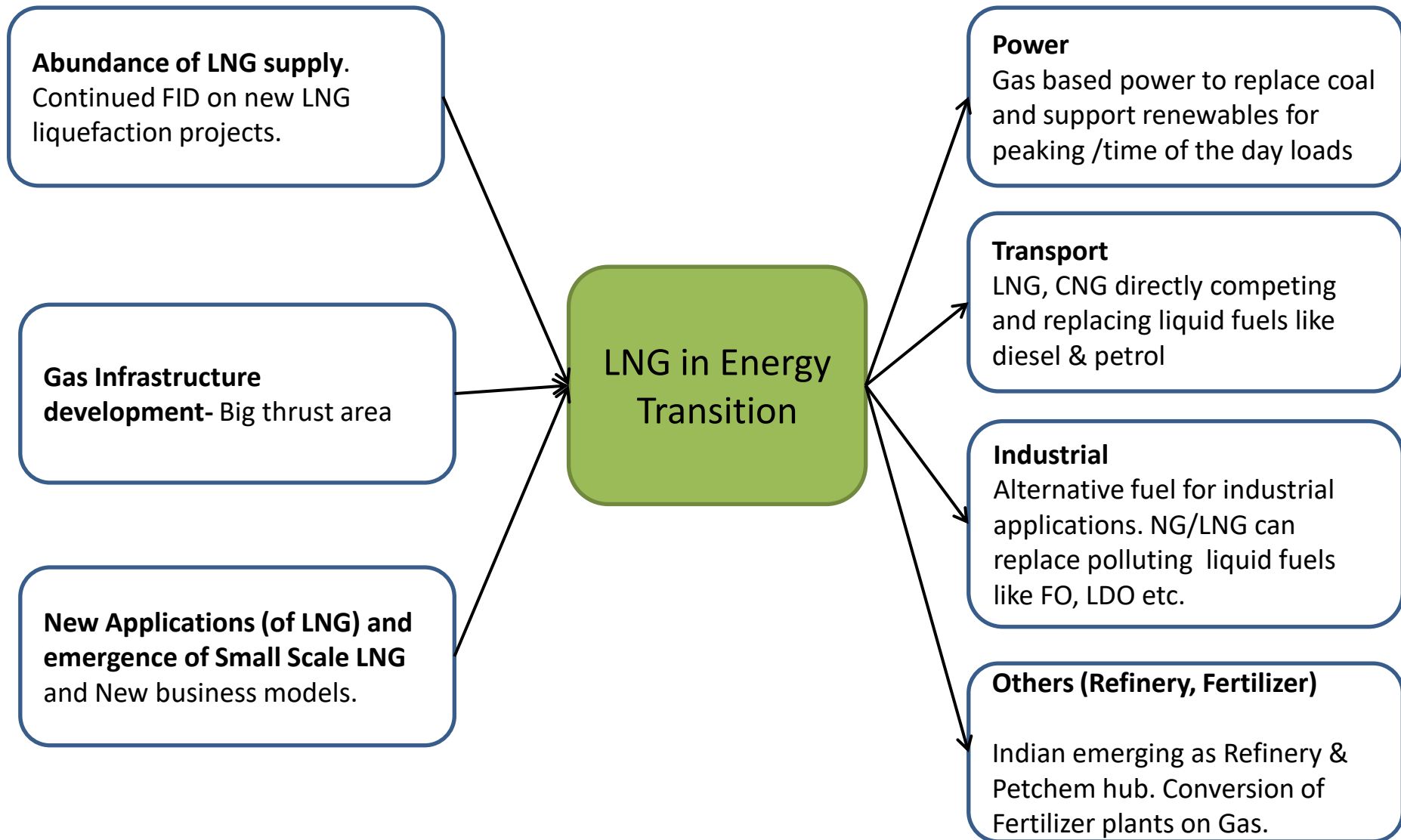
Natural Gas Consumption in India



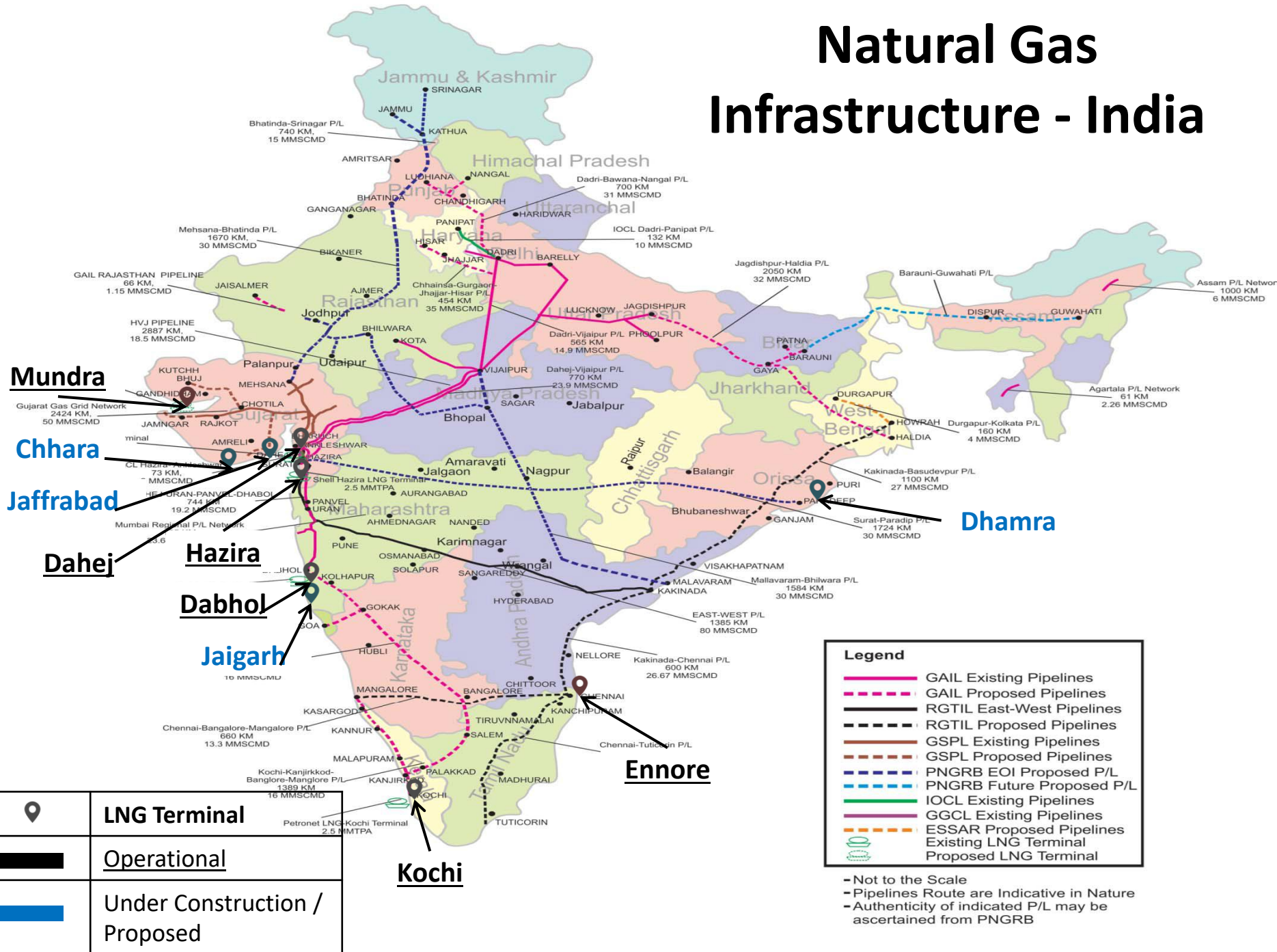
■ Total Gas Consumption India (Domestic + RLNG)
 ■ LNG import
 —●— LNG as % of Total Consumption

- LNG meets more than 50 % of India's total NG consumption.

Natural Gas/ LNG -constituents of Energy transition



Natural Gas Infrastructure - India

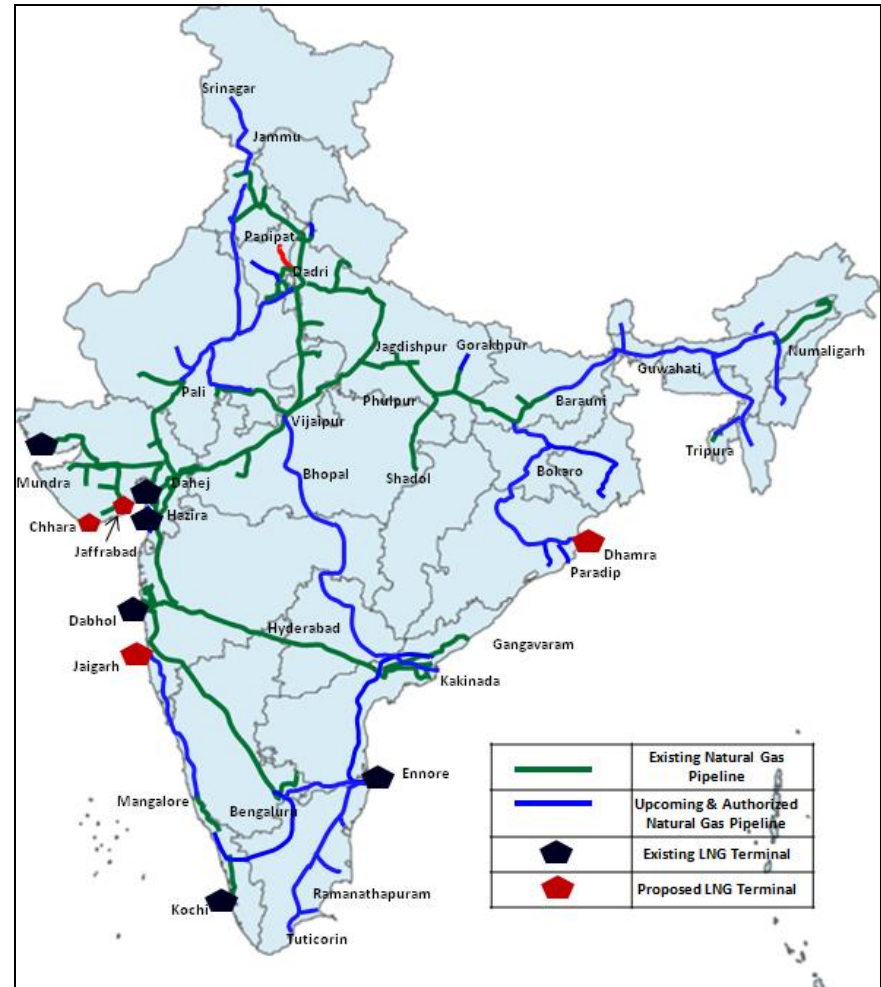
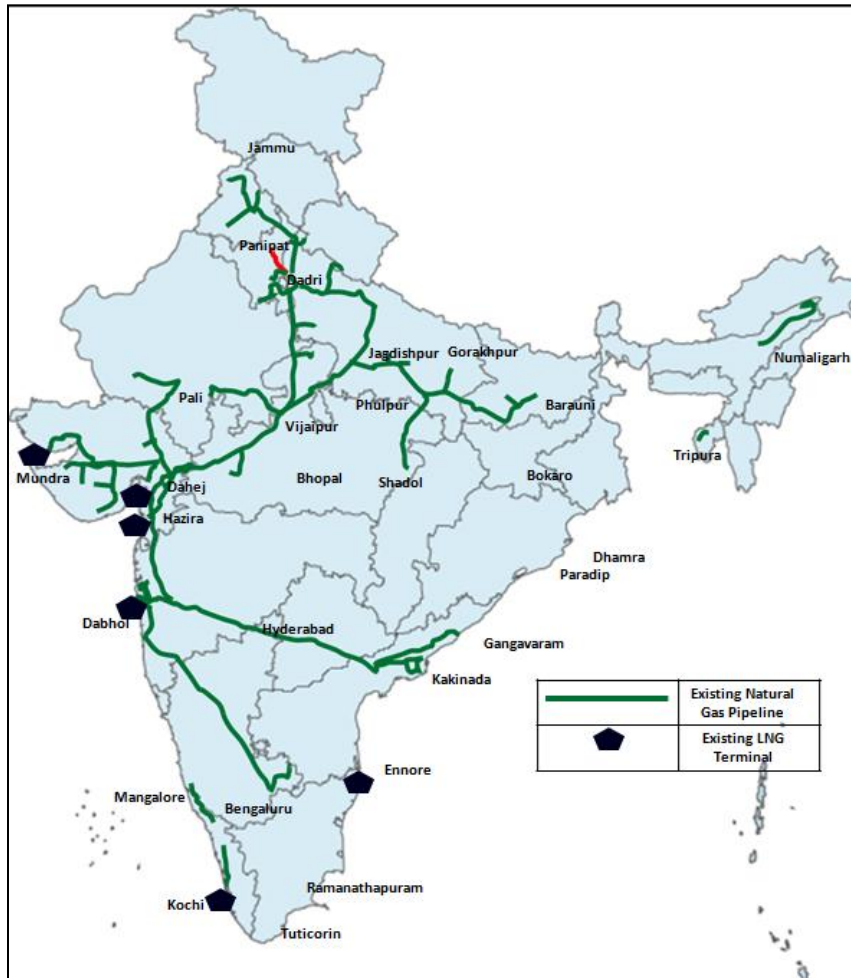


LNG Terminals - India

Sr. No	Terminal Location	State	Promoter	Capacity (MMTPA)
Operating Terminals				
1	Dahej	Gujarat	Petronet LNG Ltd.	17.5
2	Hazira	Gujarat	Shell	5
3	Dabhol	Maharashtra	Konkan LNG Ltd. (GAIL)	5*
4	Kochi	Kerala	Petronet LNG Ltd.	5
5	Ennore	Tamil Nadu	IOCL	5
6	Mundra	Gujarat	GSPC LNG Ltd.	5
Total				42.5
Under construction and planned				
1	Jaffrabad	Gujarat	Swan LNG Private Ltd.	5
2	Jaigarh	Maharashtra	H - Energy	4
3	Dhamra	Odisha	Adani Group	5
4	Chhara	Gujarat	HPCL Shapoorji Energy Pvt. Ltd.	5
5	Dahej	Gujarat	Petronet LNG Ltd.	2.5
Under construction and planned				21.5
Total (Operating + Under Construction/Planned)				64

* **Note:** Dabhol - 1.7 MMTPA usable out of 5 MMTPA on account of absence of breakwater.
 PLL Dahej slated for expansion to 20 MMTPA and in future possibly to 22.5 MMTPA.

Changing LNG/Gas infrastructure landscape



➤ Focus on developing pan India Gas infrastructure and last mile connectivity.

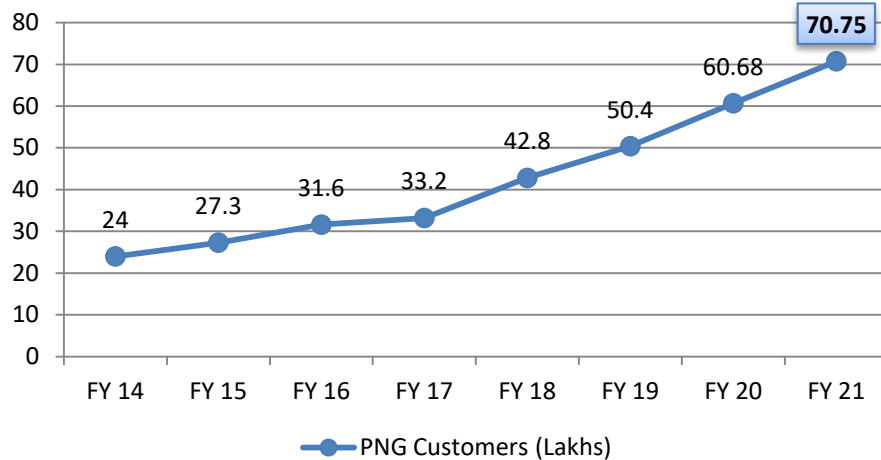
- LNG terminals: **42.5 MMTPA** (Existing) to **64 MMTPA** (By 2025)
- Operational pipeline: **17000 Kms.** Under Construction: **15550 Kms** (approx)
- CGD coverage: **20%** India's population (2019) to **70%** population by 2025 (estimated)



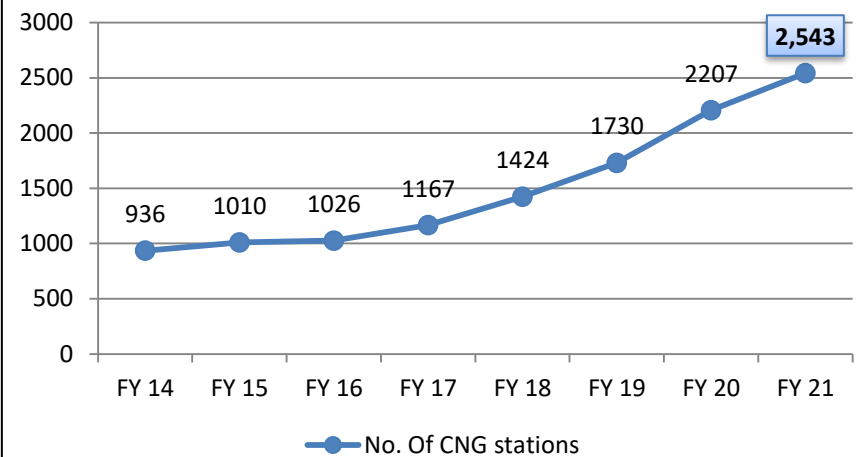
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CGD Sector-Creating robust demand growth

No. Of PNG Customers

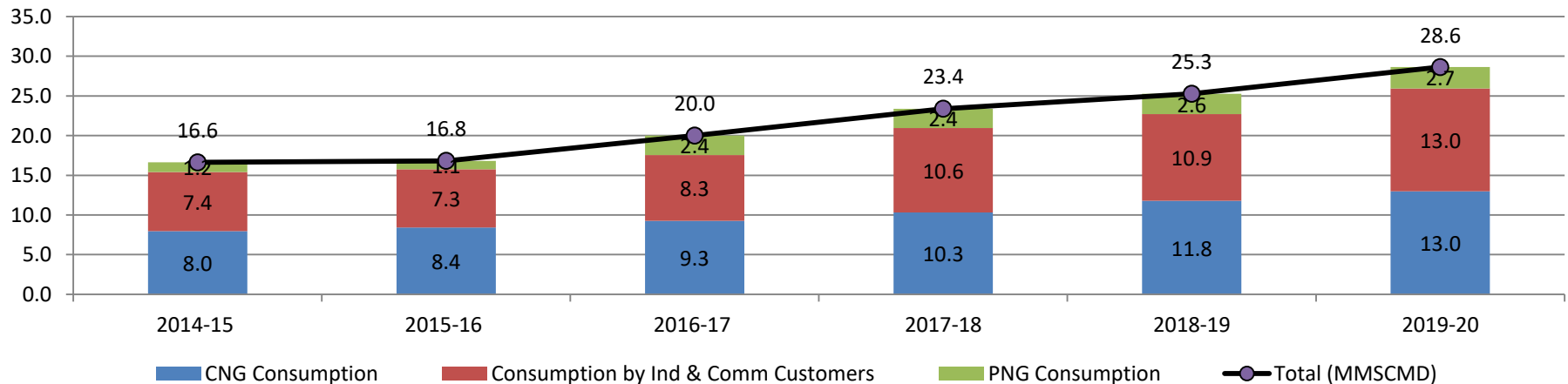


No. Of CNG stations



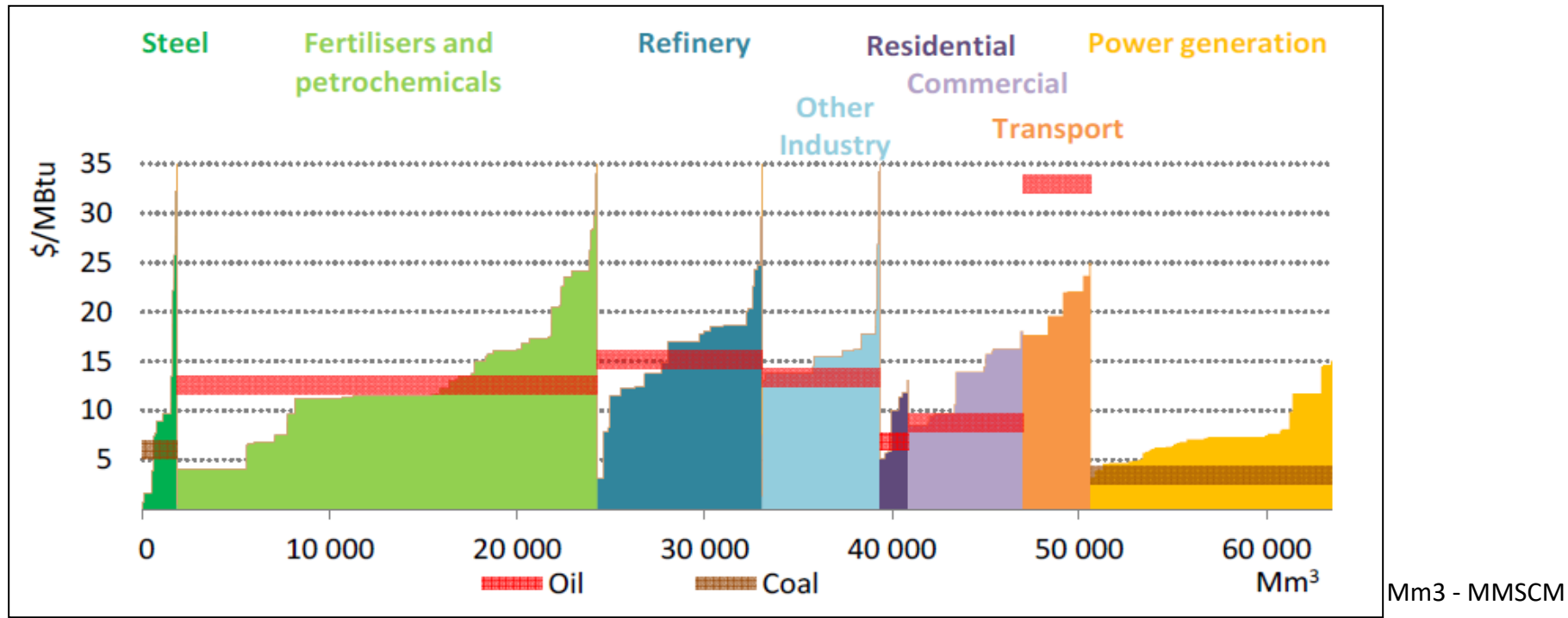
CGD sector ensures connecting to the last mile and catering to the smallest consumers necessary for widespread adoption/transition to NG.

CGD Consumption (PNG & CNG, MMSCMD)



Source : PPAC. PNG customers & CNG stations data till 30.11.2020 (for 2020-21).

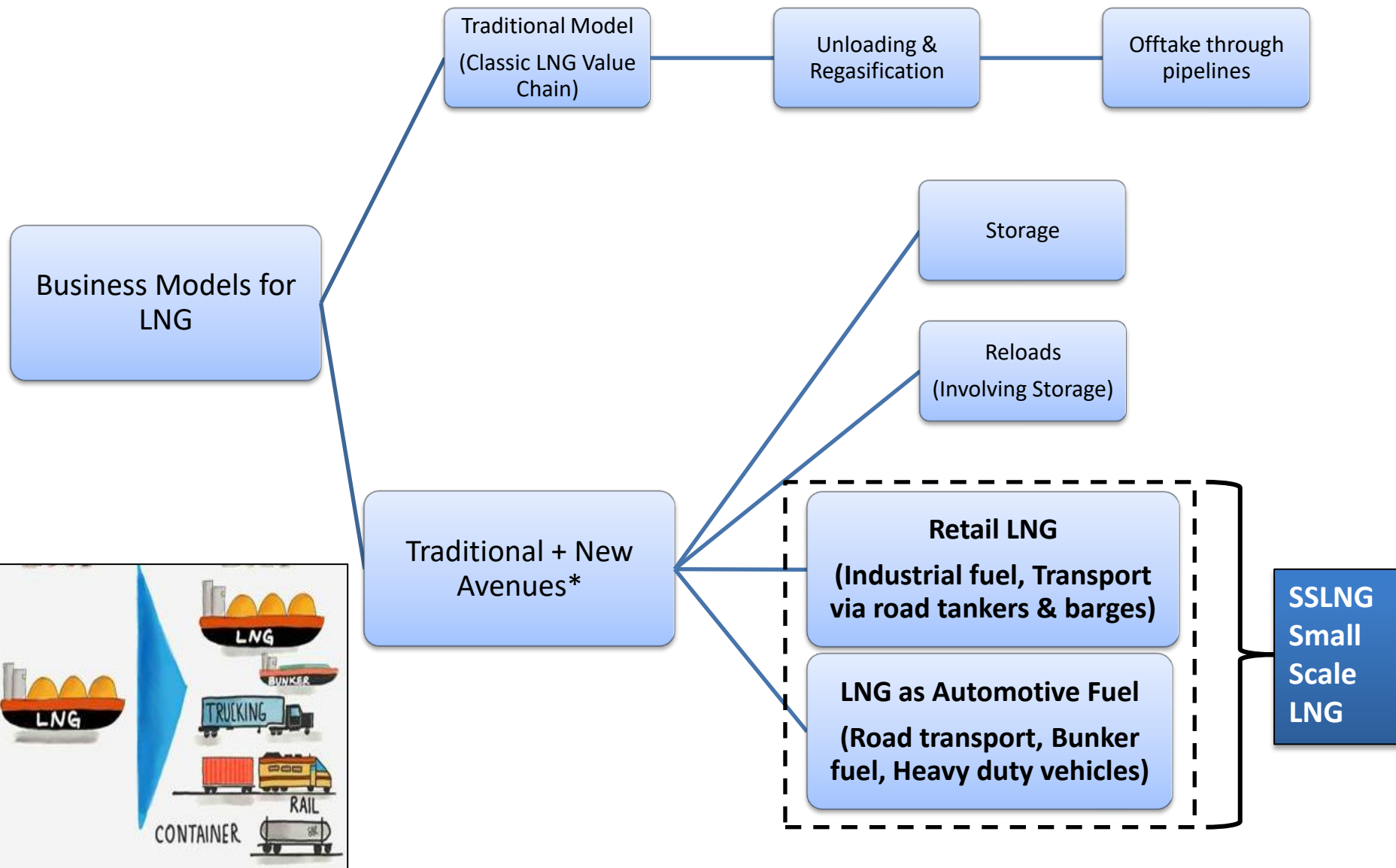
Reducing the price affordability Gap & Sectoral reforms



Source : IEA India Energy Outlook 2021

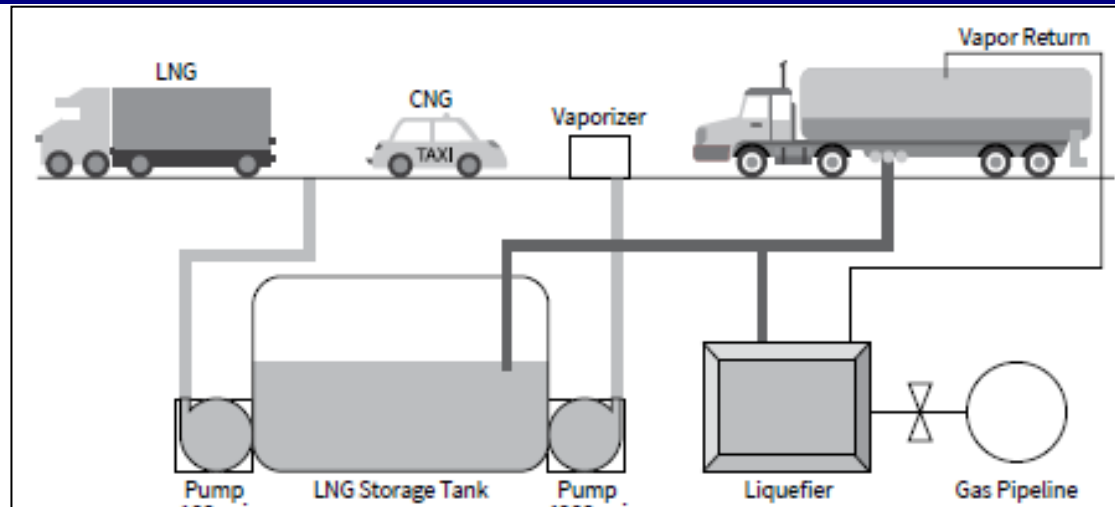
- There is an affordability gap between natural gas/LNG and other competing fuels in several sectors.
- Energy transition is function of competition among the alternative fuels.
- IEA study indicates that efforts are required to make NG prices more affordable to the industry.
- Continued regulatory reforms on pipeline tariffs, CGD regulations, Setting up of gas exchange for proper price benchmarking, setting up of TSO for pipelines etc. are very positive steps.
- The next progressive step for the sector could be reforms on taxation (Natural Gas under GST, No customs duty on imports of LNG etc).

Evolving LNG Business Models – Emergence of SSLNG



*- New avenues in conjunction with traditional models

LNG, CNG and L-CNG concept



Source: Wegrzyn and Litzke, 1999

- Indian cities started implementing CNG in late 90's and early 2000.
- Greater emphasis for clean-air cities is emerging in India and CNG (an environment friendly fuel) could be its biggest beneficiary.
- LCNG can be a temporary (or even permanent) solution to provide CNG connectivity to cities¹ not on NG pipeline grids.
- This can also act as a temporary solution where(when) public protests are seen in the process of laying NG pipelines.
- Thus LCNG/LNG road tankers can become a potential mode of providing access to gas in absence of pipelines.
- LNG by road tankers have potential to support a mini or micro pipeline grid targeting a specific sector or area like industrial estates.

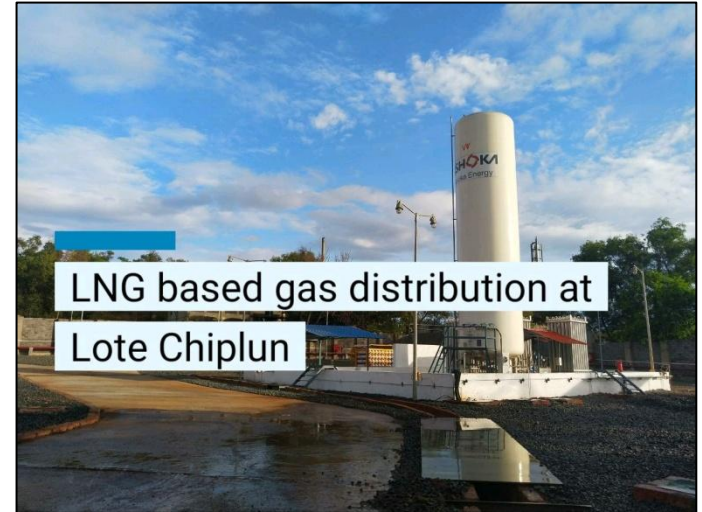
Note: 1 This has been successfully implemented in the city of Bhubaneswar in Odisha, Chiplun & Nagpur in Maharashtra. Recently in Jodhpur & Bhopal.

LNG Satellite Terminals and LCNG

Some examples of Satellite LNG Terminals in India supporting LCNG and LNG as fuel.



Vadodara, Gujarat



Ratnagiri District, Maharashtra



Bhubaneswar, Odisha



Nagpur, Maharashtra

LNG as a fuel



- LNG has potential to **replace Diesel** as an **automotive fuel** used in long haul heavy duty trucks as well as public transport buses.
- LNG as automotive fuel has many economic advantages and environmental benefits (LNG also does not emit soot, dust and fumes, prominent reason for air crisis in some parts of India. LNG also reduces SOx and NOx emissions when compared to diesel).
- In Nov.2020 foundation stone laying and announcement for India's first 50 LNG stations located across various highways was announced. It is the first step to achieve target of 1000 LNG stations.
- Identification of specific transport corridors for implementation. For e.g. :
 - Mundra - Ahmedabad
 - Mumbai - New Delhi
 - Trivandrum - Mangalore
 - Bangalore – Mangalore
 - Mumbai - Chennai
- Investments in infrastructure (primarily by OMCs, LNG terminals, OEMs etc.).

Growing demand for Green LNG

- The post pandemic World has started moving towards Energy transition at an even faster pace with steps and strategies to achieve targets of either zero or net-zero carbon emissions.
- **LNG as a source of energy / fuel also needs to be evolve and be a part of this Energy transition.**
- There are attempts being made to buy and sell carbon neutral LNG cargoes.
 - An LNG cargo is considered carbon neutral if carbon dioxide emissions at various stages along the LNG value chain are removed from the atmosphere by using carbon capture and storage processes, reducing flaring and using renewable power.
 - Carbon emissions that cannot be reduced are offset through the purchase of carbon credits or investments in afforestation, reforestation and renewable projects that benefit the environment by producing oxygen and reducing greenhouse gas (GHG) emissions. All carbon-neutral LNG deals with Asian buyers so far have involved the purchase of carbon credits.
- Shell, Total and Jera Global Markets have sold a total of around 9 carbon-neutral LNG cargoes on a spot basis to Asian buyers since June 2019.
- Singapore's Pavilion Energy and Qatar Petroleum signed in Nov. 2020 the only carbon neutral LNG term supply deal for 1.8mn t/yr for 10 yrs from 2023.
- QP has set target of reducing GHG emissions by capturing & storing 7 MN T/Yr of CO₂ from its operations by 2030.
- Shell's target to become net zero emissions energy business by 2050.
- LNG demand continues to grow and so does carbon consciousness which would further push demand for greener LNG in future.

Key Conclusions

India's commitment to Paris climate accord shall ensure transition towards clean energy.

Government of India's (GOI) vision to increase the share of natural gas in India's energy mix from 6 to 15% by 2030 is a step in the right direction.

LNG's abundant availability in international market shall provide security of supply for undertaking the Energy transition. Pace of Infrastructure development needs to match up.

LNG business model has evolved from traditional LNG value chain towards Small Scale LNG. Flexibilities in LNG contracting, flexibility of pricing, delinking of LNG from Oil linked contracts and commoditization of LNG.

Accelerated emergence of Green LNG / Carbon neutral LNG as part of Energy transition in post pandemic World.

Thank You