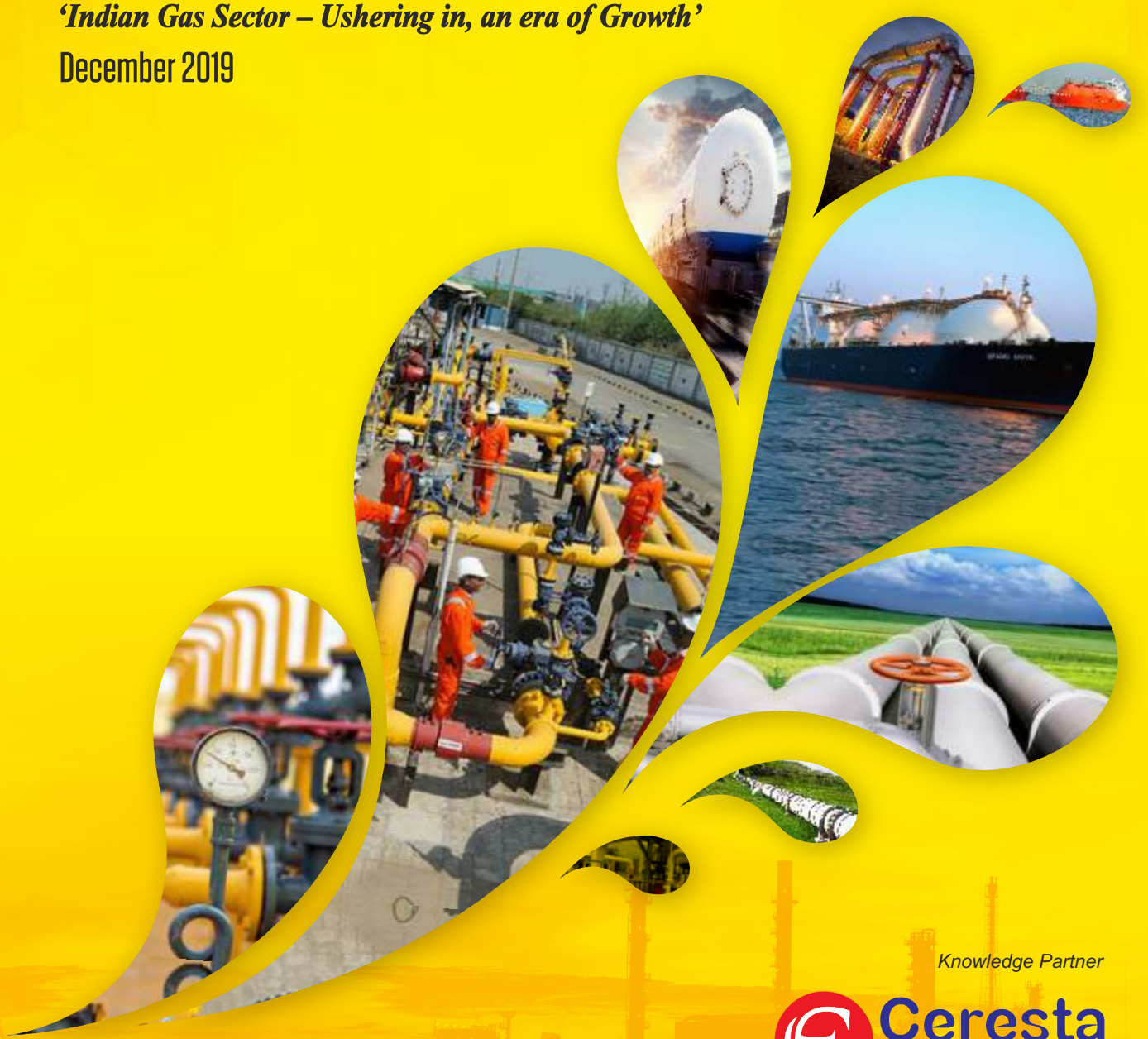
FICCI

REPORT ON

INDIA GAS INFRASTRUCTURE

'Indian Gas Sector – Ushering in, an era of Growth'

December 2019



Knowledge Partner

Ceresta
Business Consulting

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Dilip Chenoy
Secretary General, FICCI



FOREWORD

The future of India's energy sector and a large part of its economic development will be dominated by energy transition in the coming years, where conventional fossil fuels such as diesel and oil will take a backseat. Global environmental commitments and domestic regulations are pushing India to switch to cleaner and more efficient energy sources, forcing us to place energy infrastructure at the top of the agenda. Natural Gas is one such clean energy source which needs to be incentivized, and its share progressively increased. This scenario also gels with our commitments at COP 21 where we have made commitments to reduce carbon emission intensity and have 40% of India's energy basket by way of non-fossil fuels.

The government has fixed an ambitious target of increasing the share of gas in the energy basket - from the current 6.2% to 15% by 2030. However, this is accompanied with its own set of issues. Currently, the natural gas sector in India is facing major challenges due to lack of a robust gas infrastructure to support our desire to transition into a gas-based economy.



Moving towards a gas-based economy and putting in place a robust infrastructure base go hand in hand and cannot be treated separately. We have to evaluate the demand/supply scenario viz-a-viz supply options, transportation costs, geo-political realities and evolve a holistic approach that looks at the entire value chain from well to the burner.

The report on "India Gas Infrastructure: Ushering in, an era of growth" jointly prepared by FICCI & Ceresta Business Consulting looks at these issues and suggests a way forward.

We hope that this report will set the context for the deliberations and facilitate us in implementing the action points identified during the Conference.

Dilip Chenoy
Secretary General
FICCI



S.Ravishankar
Chief Executive Officer
Ceresta Business Consulting



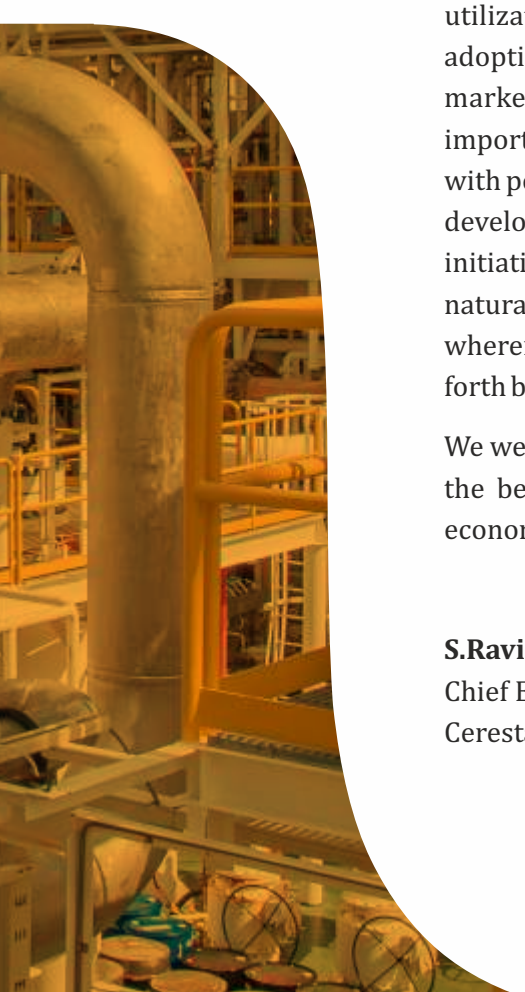
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FOREWORD

Indian Government has embarked on two important missions: Energy Transition and Global Integration. Expanding renewables, usage of electric mobility and stepping up gas consumption are part of the strategy to move towards clean energy. When it comes to natural gas, the sector has been facing one of the major challenges in recent years in terms of lower quantum and sluggish growth in domestic gas production, challenges of under-utilisation of regasification and transmission pipeline infrastructure and global oil and gas market dynamics. This is an important phase of energy sector growth in India and therefore some clear policy initiatives and business strategies need to be adopted in order to give a fillip to natural gas sector growth.

In this Knowledge Paper prepared by Ceresta Business Consulting, the main theme is focused on "India Gas Infrastructure: Ushering in, an era of growth'. The paper sets the context by delving into the gas market scenario in India and the global market trends and puts forth the need for enhancing the capacity utilization of natural gas infrastructure, expanding the usage of LNG by adopting new strategies and stepping up domestic production. Since Indian gas markets are greatly influenced by end use sectoral dynamics, it is also important to evolve strategies keeping this aspect in mind. A clear road map with policy and strategic prescriptions covering government policy, gas market development, infrastructure options, new technologies and sector focussed initiatives are covered in the report. Indeed, it is a daunting challenge as far as natural gas sector is concerned but it is an opportune and critical time phase, wherein certain initiatives have to be taken in order to achieve the target set forth by the government.

We welcome suggestions and dialogue on the paper because we believe that is the best way evolve an effective strategy for moving towards a gas based economy.



S.Ravishankar
Chief Executive Officer
Ceresta Business Consulting



CONTENTS



REPORT ON

INDIA GAS INFRASTRUCTURE

'Indian Gas Sector – Ushering in, an era of Growth'

Section 1: Indian Gas Sector in the context of Energy Sector: A Brief Overview 02

1.1 Introduction 02

1.2 Key developments in Energy Transition and India's Energy Sector Strategy 05

Section 2 : Indian Gas Markets – Critical Success Factors for Growth. 08

2.1 Indian Gas Market: Historical Overview 08

2.2 Natural Gas market: Review of Production and LNG import Trends 10

2.3 Natural Gas – Understanding the End-use sector dynamics. 11

Section 3 : Gas Infrastructure – Need for an Integrated Strategy for Growth. 15

3.1 Gas Transmission and Distribution Pipeline Infrastructure – An overview 15

3.2 India Gas Transmission Infrastructure: A brief overview. 16

3.3 India Gas Distribution Infrastructure 18

3.4 Emergence of Electric Vehicles: A new era of growth 20

3.5 LNG Re-gasification Infrastructure: Need to step up R-LNG consumption and enhance capacity utilisation 21

3.6 Transnational Pipeline Infrastructure 22

Section 4 : Global LNG Markets - A New World Order: Changing Trade, Pricing and Contractual Dimensions 24

4.1 Global LNG Markets: A Market Perspective 24

4.2 LNG Pricing: A brief review. 28

4.3 LNG Cargo Diversions / Destination Flexibility 29

4.4 LNG Contract- Price Review Provisions. 30

4.5 Changing Contractual Durations. 30

4.6 Global LNG Market Outlook: What is in store for the future. 31

Section 5 : The Road Ahead and Recommendations. 32



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Section 1

Indian Gas Sector in the context of Energy Sector: A Brief Overview

1.1 Introduction

Indian economy is growing despite recessionary challenges faced by various parts of the world. Government is taking a number of measures across sectors to bring about overall growth. The energy sector is one of the major sectors which is going to see enormous growth in the coming years, in the context of Indian population reaching approximately 1.44 billion people by 2024 (as per UN World Population Survey), creating greater demand for energy. India has committed to low carbon energy and hence its energy portfolio mix is going to undergo major changes, with Renewables



and Natural Gas set to play a major role. India has the potential to be a much larger producer and consumer of natural gas. Indian economy has long been plagued by lack of a strategic energy roadmap in effectively changing the energy mix of the country, which is still heavily tilted towards coal and oil. But definite strategic shift in India's policies towards optimizing the energy mix is already taking place in the last few years. An objective review of the period from 2000 to 2016, would show the country's constant struggle in stepping up natural gas production and enhancing its usage. The prospects of increasing natural gas production was short-lived during 2008-09 to 2010-11 when the expected production with KG-D6 fields of Reliance had declined dramatically and the announced gas finds of GSPC and ONGC did not materialize. Adding to these challenges, uncertainty in gas pricing policy and high prices of oil and LNG in global markets during 2011-2014 had effectively crippled the natural gas sector and the industries that were dependent on natural gas. Power sector is a case in point. 14000 MW power capacity was rendered stranded due to decline in domestic natural gas production and withdrawal of allocation. Government did see the potential for natural gas in power sector and introduced schemes to revive the stranded or under-utilized power plants through usage of Regasified LNG through a reverse bidding process. But this strategy turned out to be more of a short-term measure rather than a long-term solution to the power sector.

At the same time, Indian government has been clear in its thinking that India has to expand the gas pipeline transmission infrastructure and city gas distribution network, which, though expanding, is still going through a slow course of implementation due to a number of inter-related challenges. If one looks at the last 6 -7 years, it can be seen that the already created gas pipeline infrastructure was getting underutilized due to fall in gas production during 2012 - 2015 and its slow revival thereafter and the anchor sectors like fertilizer and power losing its share over the years. While GAIL is investing in gas transmission infrastructure both with and without government's funding support, fresh investments are becoming a challenge. Yet, any measures taken by government will bear its fruit only after a few years and gas sector is no exception. Domestic gas production is seeing an upward trend, albeit slowly and LNG infrastructure is getting expanded to import more LNG. Some of the major initiatives and strategies undertaken by government and companies in the gas sector in the last 4 years and the ultimate target are enumerated below:

- Domestic Gas Pricing Policy based on global hub gas prices / Gas pricing Policy for Deep Water / Ultra DW fields
- Subsidy scheme for revival of stranded power plants based on R-LNG (withdrawn in Budget 2017 and announced again in 2019)
- Hydrocarbon Exploration Licensing Policy 2016 (HELP)
- Discovered Small Fields (DSF) Bidding rounds
- Open Acreage Licensing Policy (OALP) - National Data Repository (NDR)

- LNG Price Re-negotiation with Qatar, Australia, Russia and Revised Formula to reflect changing market conditions
- Pursuit of strategic investment and sourcing opportunities in the LNG sector
- Viability Gap Funding (VGP) - for creating Pipeline infrastructure in the East to North Corridor
- Bidding rounds for CGD sector - with good responses from 9th and 10th round and increase in the number of players in the sector
- LNG Companies / suppliers looking beyond power sector, pursuing opportunities in other areas like LNG for transportation, LNG by road for industries and CGD.
- Target to reach 1 crore households with Piped Natural Gas (PNG) supply in the nest few years
- Stepping up share of Natural Gas in Primary Energy Mix from 6.2 % to 15% by 2030.

Talking about policy actions, one of the most important steps Indian government must consider is bringing the natural gas under GST and gas should be treated at par with coal at 5% GST. This can be one significant step which can gave a fillip to the gas sector growth. Since the government is keen to promote clean power in the country, this would be an important step in that direction.

Coupled with these policies and actions, India has set a Renewable Energy target of 1,75,000 MW by 2022 and more recently, announcing a target of 4,50,000 MW by 2030, a tall order indeed. India's plans for creation of LNG terminals in East Coast, expanding in west coast and expanding the gas transmission and distribution infrastructure, do indicate definite prospects for growth of energy sector in India. At the same time, it is also important to note that the various targets for renewable power, gas and coal may be competing with each other and a lack of an integrated approach may pose major challenges and it is amply clear that India's energy mix is going to undergo a major change with oil and coal usage reducing in percentage terms but still raising in absolute terms (though continuing to be significant in their usage) giving way to renewables, gas and electric mobility. Will natural gas play a significant role in the emerging scenario is the question everyone is left pondering with. It can, if a focussed strategy is followed to enhance the gas production, attract investments, enable better utilization of infrastructure, expand LNG usage in other areas of consumption and pursue a more innovative strategy for the power sector, distinctively different from the past. Looking at all these factors, it is important to establish a realistic demand for gas and enable companies to achieve economic viability of investments.

India still has a very low usage of natural gas in terms of its volume. It must also be noted that the proportion of gas in the energy mix has fallen from about 10% in 2011-12 to the current

level of 6.2%. This has been due to the fall in natural gas production in the country since 2012 and non-affordability of the high price of LNG during that period and volatility of LNG in the anchor sectors especially power sector. India should look at the following strategic options to enhance the usage of natural gas in the energy mix:

- Sustained investments in India's upstream and step up domestic exploration. The efforts already underway should be sustained.
- Enact policies and action plans to enhance usage of gas in those industries and commercial segments where polluting fuels like diesel and coal are being used as a primary or back up generation fuel.
- While sustaining the policy of expanding renewable energy usage, promote gas based power to meet peak and intermittent demand to serve the overall objective of clean power.
- Promote gas usage beyond the traditional base load power and fertilizer and expand markets to include the newer areas of gas application and usage.

The thrust by the government towards Energy Infrastructure development and Investment into India, has truly given the necessary impetus to the Energy Sector. Developing gas infrastructure like regasification terminals, transmission pipelines and distribution network, though important, is only one aspect of the strategy. Real challenge lies in the strategy to utilize the created infrastructure gainfully through adequacy of gas supply, integration of the value chain in terms of supply options, realistic demand estimation, taking a decisive call on enhancing gas usage in key sectors of the economy like power and encouraging new areas of LNG / gas usage in transportation, distributed generation at home and commercial complexes and a more efficient gas dispensing stations across cities and highways.

Indian government has charted out its vision for its Energy Sector. A closer look at the need for energy transition will create the necessary context for a gas sector strategy which cannot operate in isolation.

1.2 Key developments in Energy Transition and India's Energy Sector Strategy

- Globally, major countries have put in place an Energy Transition Strategy wherein reduction in fossil fuel usage and move towards cleaner energy options like Renewables, Electric Mobility, Gas usage in on-land and sea route transportation and expanding the clean energy usage in agricultural and urban sectors of the economy, form important components of the strategy. India Energy Forums are undertaking a number of initiatives in collaboration with a number of developed economies. Some key

developments in Energy Sector and India's actions are detailed below, which will set the context for gas sector strategy.

- There are alarming rates of carbon emission threatening the environment across the world. India is also experiencing the same. Unless a long-term strategic framework roadmap is put in place with a clear ten-year plan, it would be impossible to achieve energy and environmental sustainability in the years to come.
- Hydrocarbon use is going to reduce and there is going to be a transition to green energy such as renewables and electric vehicles. India also will slowly move away from coal and to some extent oil too in the fossil fuel segment and natural gas is expected to play a major role.
- India's focus is going to be on green energy - Renewables, moving towards Electric Vehicles, Gas based technologies to usher in a drive towards a new era of Clean Energy.
- India's only other focus as distinct from other developed economies is - effort to provide access to energy to all in an affordable and sustainable manner. This is where a well thought-out and integrated energy strategy is needed.
- India's aims for a low carbon future with a judicious mix of coal, oil, gas, nuclear and renewables. Government has fixed a target of 450 GW Renewable Energy by 2030 - Renewable share has been continuously increasing in India with the RE share in terms of Installed Capacity jumping from 8% in 2012-13 to 22.7% as on 30th Sept 2019 (as per Power Ministry Data).
- On the oil side, there is definite move towards reducing the share of liquid fuel consumption in the transportation segment with a clear move towards natural gas and electric mobility if government's thrust and targets on CGD and Electric Vehicles, is anything to go by. Also, the ethanol blending percentage in petrol has risen from 1.5% in 2013-14 to 6.2% in 2019. While more than 95% households now have access to LPG, the focus will be to sustain the LPG supply and ensure timely supply to a large cross section of people.
- When India prepares for 450 GW of Renewable Energy (RE) capacity by 2030, it is important to address the issue of intermittency / variability in the electricity supply associated with RE. Therefore, it is also important to plan back-up, dispatchable alternate generation sources as part of India's National Electricity Plan. Natural gas can be playing an important role as a balancing fuel / support fuel in power generation in the years to come. It is important to put in place a strategy for gas-based power generation which needs a special attention. A strategy for natural gas to complement RE would give a great fillip to natural gas usage.

- The use of conventional liquid fuel in transport sector will be optimized by expanding the mix of the following: CNG, LNG as transport fuel for Buses / Trucks / long haul transport through Railways and use of electric mobility.
- Use of clean coal technologies to enable a more sustainable use of coal and setting up fertilizer plants based on clean coal technologies which is being pursued in the country.
- In summary, the direction is clear - a move towards a clean energy portfolio. Integrating natural gas into the portfolio effectively will be the key for the companies in the gas sector.



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Section 2

Indian Gas Markets – Critical Success Factors for Growth

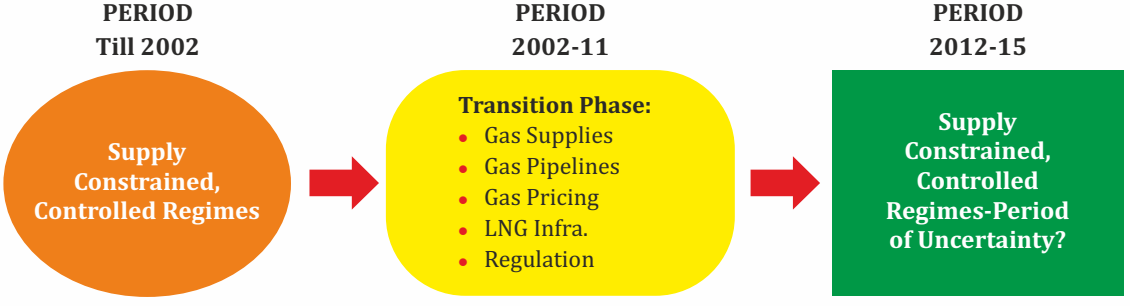
2.1 Indian Gas Market: Historical Overview

The period of 2000 to 2004 was a period of optimism for Indian gas market with world class gas finds in KG Basin, setting up of LNG Re-gasification terminal and commencement of LNG supply, successful operation of city gas distribution projects and its positive impact on environment, plans to set up a Regulator given the emergence of gas economy and related infrastructure development. The period after that (2004 -2011) truly marked the beginning of the gas era in the country with successful commencement and



operation of the LNG terminal, expansion of transmission pipeline network in the north-western corridor and new network in the east-west corridor, setting up of the regulator (Petroleum and Natural Gas Regulatory Board) and authorisation of new pipelines and geographical areas for CGD Network, substantial jump in gas production from KG Basin and increased supply of gas to many end use sectors. During this period, government announced a Gas Allocation Policy prescribing a customer-wise allocation for the gas that was being produced from KG Basin. The following period 2011 - 2015 saw the unprecedented decline of gas production from KG basin from a high of about 60 MMSCMD to a very low level of around 10 MMSCMD. The gas production forecasts from other finds in the KG basin also failed to materialize. With declining gas production from the traditional fields of ONGC, the country saw a period of continuous fall in gas production for 5 years and the government's decision not to pursue any new gas based power projects, in the light of stranded power projects to the tune of around 14000 MW. Effectively, a period of uncertainty ensued for which the current government has been taking effective steps by announcing a number of policies to attract investment and step up the production.

Figure 1: Indian Gas Sector – Journey from 2000 to 2015



As one can see from Fig.1, Indian gas sector has moved on from a supply constrained, controlled regime through a vibrant phase of emerging gas economy (2002-11) before getting back to a period of constrained supply and controlled regime, rather quickly. Post 2015, the global markets have undergone major changes in terms of oil and LNG prices which have had great impact on Indian markets too. It is also important to note that the current policies and strategies of government are being made in the context of the recent developments. This would involve a multi-pronged strategy - stepping up gas production from existing fields under production or exploration as well as introducing policies to attract investments. Besides, other strategies like policy and regulatory certainty to bring about a conducive climate for growth, thrust to CGD sector and encouraging LNG infrastructure and expanding the use of LNG in various sectors, are also being considered.

2.2 Natural Gas market: Review of Production and LNG import Trends

Table 1 provides an overview of natural gas production / consumption and import trends in India.

Table 1: Trend of Natural Gas Consumption in India (including internal consumption)

In BCM

Financial Year	2008 -09	2009 -10	2010 -11	2011 -12	2012 -13	2013 -14	2014 -15	2015 -16	2016 -17	2017 -18	2018 -19*
Net Production**	31.75	46.49	51.23	46.45	39.75	34.57	32.69	31.13	30.85	31.73	32.05
LNG import	10.54	11.82	12.89	17.99	17.61	17.8	18.6	21.38	24.84	27.43	28.69
Total Consumption (Net Production + LNG import)	42.29	58.31	64.12	64.45	57.36	52.37	51.3	52.51	55.69	59.16	60.74
Total Gas Consumption (MMSCMD)	115.9	159.7	175.7	176.6	157.15	143.48	140.55	143.86	152.58	162.11	166.41***

**Provisional **Gas available for consumption after deduction of gas flared / loss Source: PPAC*
****includes internal consumption of 18.2 MMSCMD*

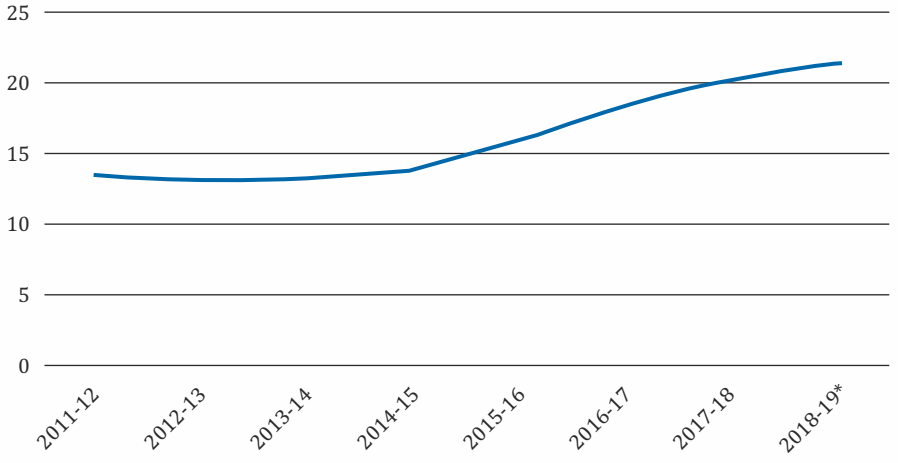
As can be seen from Table 1, the production of natural gas in India showed a substantial jump from 31.75 BCM in 2008-09 to 51.23 BCM in 2010-11, an increase of substantial 61% in two years, due to ramp up of KG D6 gas production from KG Basin. There has been continuous decline since then over the next 6 years to a level of 30.85 BCM in 2016-17. Overall Gas Consumption during the period showed a substantial increase between 2008-09 and 2011-12 (115.9 MMSCMD to 176.6 MMSCMD) due to both domestic gas production in the first two years and significant jump in LNG imports during 2011-12 but declined thereafter considerably to a level of 143.86 MMSCMD in 2015-16. From 2016-17 onwards, gas consumption showed a good recovery going up to 152 MMSCMD in 2016-17 and up to 166.41 MMSCMD (includes internal consumption) during 2018-19, primarily contributed by increase in LNG Consumption and a small reversal of trend in domestic production.

Table 2: Import of Liquefied Natural Gas – FY 2011-12 to 2018 -19

Year	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19*
Total LNG Imports (Long Term, Spot) in MMT	13.6	13.3	13.4	14	16.1	18.8	20.7	21.7*
Total LNG Imports (Long Term, Spot) in MMSCM	17997	17614	17801	18607	21388	24849	27439	28692
Total LNG Imports (Long Term, Spot) in MMSCMD	49.31	48.26	48.77	50.98	58.60	68.08	75.18	78.61

*Source: PPAC *Equivalent to 28.69 BCM*

Total LNG Imports (Long Term, Spot) in MMT



Mirroring the trend of fall in domestic production and reduced domestic gas supply to consumers, the share of LNG has increased from 25% about in 2008-09 to 45% in 2016-17. Overall gas consumption was impacted substantially due to fall in domestic production and the consistently higher prices of LNG prevalent in global markets till 2014. It is also interesting to note that LNG share in gas consumption which was 25% in 2008-09 had actually fallen to around 20-21% during the period 2009 - 2011 before moving up again to 25% in 2011-12, mirroring the rise and fall of domestic gas production and overall gas consumption in the country. From 2012-13 onwards, the share of LNG in total gas consumption has shot up considerably driven by gas demand, falling global LNG prices and government scheme for reviving stranded gas based power projects through R-LNG supply. In 2018-19, the share of LNG in overall gas consumption stood at 47.2 %.

Since late 2014, announcement of new gas pricing policy in India, changing global market dynamics and continuous fall in global oil and LNG prices, government scheme to revive stranded gas based power projects based on LNG and government's thrust to increase domestic gas production and expand city gas distribution are some of the key factors, which have provided some traction to the hitherto struggling Indian gas sector. It is also reported that domestic gas production will show a jump during 2019-20.

2.3 Natural Gas - Understanding the End-use sector dynamics

In recent years, the gas supply has always been a deterrent factor for the sectoral growth. India's gas demand is much higher than the total gas supply in the country including both domestic supply and imported gas. However, the different demand sectors have varying demand dynamics and price sensitivities. The demand for natural gas in India is expected to get more than triple in the period 2012-13 (243 MMSCMD) to 2029-30 (746 MMSCMD)

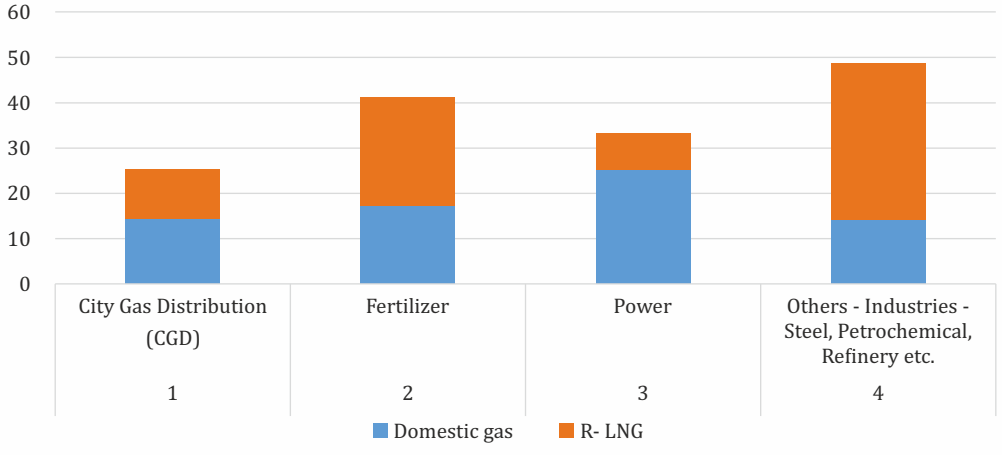
according to Vision 2030 document of PNGRB. A more recent assessment of demand puts it in the range of 450 to 500 MMSCMD. On the supply side it is certain that over the next several years, exploration and production efforts will result in an increase in the availability of natural gas in the country but even in the most optimistic scenario, it is unlikely to meet the demand for natural gas projected by various agencies. In FY 2018-19, the total gas consumption in various sectors (excluding internal consumption) in India was around 148.02 MMSCMD including LNG. The share of domestic gas and imported RLNG was about 48% and 52% respectively.

TABLE 3: SECTOR-WISE GAS CONSUMPTION (2018-19) (Fig in MMSCMD)

Sl. No.	Sector	Domestic gas	R- LNG	Total^
1	City Gas Distribution (CGD)	14.36	10.91	25.27
2	Fertilizer	17.18	23.85	41.03
3	Power	25.11	8.07	33.18
4	Others- Industries -Steel, Petrochemical, Refinery etc.	14.05	34.49	48.54
	Total	**70.70**	**77.32**	**148.02**

Source: MOPNG Report (Provisional) *^ Fig net of Internal Consumption of 18.2 MMSCMD*

SECTOR-WISE GAS CONSUMPTION



From Table 3, it can be observed that the Power sector dominates the Domestic Gas consumption while the Fertilizer sector has a larger share in the LNG consumption. It is important to note here that about a decade ago, the two sectors had a share of almost 70% which has fallen to around 50% in 2018-19. During the intervening period, the share of power sector has fallen significantly, because of fall in domestic gas production and therefore stoppage of allocation of KG D6 gas to the sector. Fertilizer has indeed maintained its share of allocation of gas since that sector retained its priority tag though its percentage share in consumption has fallen . High priced LNG has never been an option for power sector and hence its share fell along with domestic supply fall. In fact, more than 14000 MW of new gas based power plants were rendered stranded by lack of domestic gas supply. The introduction of a government reverse bidding subsidy scheme for supply of LNG to these

stranded power plants to make them operational at 35% PLF did revive some of these plants for two years. Effectively, power sector will be a non-consumer of gas (barring the old supplies), if further domestic gas is not made available or there is no special government scheme for supply of R-LNG to the sector with incentives. As far as fertilizer plants are concerned, most of the existing plants have converted to gas and they continue to get get supply. But in terms of future growth for gas demand, the sector has limited potential and hence any new LNG terminal operators do not look at it as a major anchor barring some scope for revival of a couple of plants.

Doing a reality check and making a realistic assessment of gas supply and demand is an important step to understand the ground realities and plan for accelerating gas usage in future. Another important strategy companies have realized and started adopting is to look for new areas of gas consumption and expanding the market base. Petronet LNG and GAIL are indeed pursuing such opportunities, being market leaders. That is definitely a good sign. While India is pursuing multiple strategies of enhancing domestic gas production and creating LNG import infrastructure, it would also be important to make an informed assessment of the demand for gas in various sectors and its sensitivity to gas price and pursue a well thought out strategy especially in the context of India's pursuit of green energy and electric mobility.

To summarize, the falling domestic supply and increasing imports of LNG into the country had brought down the overall share of the two traditionally anchor sectors – Power and Fertilzers. One of the major gainers during the last 5 years has been the City Gas Distribution (CGD) sector that has grown from 7 – 8% share before 2010 to around 17% in 2018-19, supported by both expanding network, favourable economics, environment friendliness and government thrust through policy interventions. With renewed thrust of government to reach out PNG to one crore households in 5 years, the sector is gaining traction and considered to be an important growth sector in the coming years. But in terms of gas consumption, it will be slow because Piped Natural Gas Supply (PNG) to households has a low share in terms of quantum of supply though it may be large in terms of absolute numbers. CNG and Industrial / Commercial segments will hold the key here. Making gas available to various cities through various possible means is the key to success of the CGD industry.

The major gainers in the last few years when LNG supply shot up, were the other sectors led by Refinery, Petrochmicals, Steel & Sponge Iron and other industries. In terms of overall gas consumption, these sectors have gone up to around 33% share. When it comes to LNG consumption, its share has gone up to 44%.

Talking about realistic demand assessment, it is a fact that sectoral gas demand is in the context of gas price in India and it continues to be so. While unconstrained demand can be very high in India, the actual demand at different price points are more relevant from the perspective of an infrastructure developer. Table 5 provides a matrix of price and sectoral affordability with an indicative demand composition.

Table 4: Indian Natural Gas Demand - Affordability Matrix

Delivered Cost Range (US$ / MMBTU)	Consumption Sectors	Estimated Demand Composition %
US$ 10 -15	LPG, Refinery - Feedstock, Petrochemicals, Diesel Back-up Power, Peak Power and other new areas of gas usage	45 - 48 %
US$ 7.5 - US$10	Fertilizer, CGD, Industrial / Commercial	
US$ 5.5 - 7.5	CGD - Transport / Domestic, Refinery Fuel, Industry Fuel	55 - 60 %
<US$ 5.5	Base Power	

Source: Ceresta / EnerGlobe Price – Demand Framework updated 2019

Effectively one can see that power sector is completely going out of LNG usage given that the base power is highly sensitive to gas price and any delivered price of gas above US$ 5.5 / MMBTU makes it challenging for gas based power to compete with coal based power. With renewable power prices also coming down in recent years with a recently concluded tender quote of Rs. 2.71 / kwh, competitiveness of gas based power faces a test and therefore, a specifically focussed strategy on power sector to make gas usage viable or acceptable is what is required. Here both Environment and Economics will come into play.

Keeping the above aspects of power sector in view and governments thrust on Renewable Energy, two important steps need to be taken if government wants the power sector to be an important driver of gas sector growth. Given the current capacity of power sector remaining stranded or operating at low PLF, some sector focussed reforms can be real demand booster for natural gas.

- Integration of gas based power with Renewable Energy is an important step. Given the intermittency of RE and the peaking power load on the grid during peak hours, gas based power can perfectly integrate with RE in providing clean and round-the-clock power. The environment friendliness of gas makes it the right fuel to integrate with RE in the lines of Hydro Power.
- Power Sector Reforms: Introducing peaking tariff for gas based power and in Merit Order Despatch, adequate weightage to be given to clean power including gas based power in relation to the delivered price of gas based power. Renewable Energy has Renewable Purchase Obligations on the part of state governments. Gas based power should also have a supportive policy if the government really aims to step up the volumes.

One of the major factors in the gas sector production as well as consumption is the issue of gas price. Currently gas in India is priced through a linkage with international trading hubs and markets. Since the government intends to step up the usage of gas significantly in the coming years, two important issues are to be addressed – Stepping up domestic production and implementing a realistic price discovery mechanism. The international markets and hubs are far more matured gas markets with adequate gas supplies and price discovery mechanisms. India's gas pricing mechanism must reflect India's gas scenario, targets and government plans. In the current context, it is important to have a market focussed price discovery mechanism reflective of the Indian market dynamics and that can go a long way in aiding the growth of gas markets in India.

Section 3

Gas Infrastructure – Need for an Integrated Strategy for Growth

3.1 Gas Transmission and Distribution Pipeline Infrastructure – An overview

Indian natural gas sector is facing one of the major challenges in recent years in terms of lower quantum and sluggish growth in domestic gas production, challenges of under-utilisation of regasification and transmission pipeline infrastructure and global oil and gas market dynamics. Though gas industry in India has witnessed growth in terms of demand and infrastructure in the last decade, the growth has still remained limited to few regions and the



pipeline and distribution infrastructure has remained confined to a few states in the West - North belt and East to West. When it comes to utilization of these pipelines, the situation has not improved significantly. While new pipelines are being constructed in various parts of India including South and East, the progress has been very slow. It is also worth mentioning that the country is at an important stage of growth with a number of cross country and regional pipelines under implementation and on the gas distribution side, a large number of geographical areas have got added after the 9th and 10th round of CGD bidding. How far and how fast these projects progress will determine how fast the sector is going to grow in the coming 5 years.

3.2 India Gas Transmission Infrastructure: A brief overview

The challenge of under-utilisation and lack of supply have seriously questioned the viability of these projects. If one looks at Table 5, it is clear that GAIL still dominates the pipeline infrastructure space with a share of almost 70% of the pipeline network, followed by GSPL and a much under-utilized RGTIL.

Table 5: India Gas Pipeline Infrastructure: An Overview – March 2019

S. No.	Transporter	Length (KM)	% Share
1	GAIL	11411	69.9
2	RGTIL	1784	10.9
3	GSPL	2692	16.5
4	AGCL/DNPL	297	1.8
5	IOCL	140	0.9
	TOTAL	**16324**	**100.0**

Source: PPAC and Ceresta Analysis

GAIL and RGTIL operate at lower capacity utilisation with GAIL operating at 48.5%, RGTIL at 24.2%. GSPL stepped up the capacity utilisation of the network over the last two years from 59% to almost 80% in 2018-19. GSPL has been one of the success stories of the decade with a growing capacity utilisation since it is a state network and was created much earlier under the Gujarat Gas Act. Given the locational advantage, the state had the easiest access to both domestic and LNG sources and adopted a strategy of reaching out large cross section of industries and extensive network of city gas distribution. Most importantly, the state government played an important role to giving a thrust in expanding the network across the state. On an overall basis, the country's transmission pipeline network's capacity utilisation stood at 47%. It is clear that there is a major challenge here which is not getting adequately addressed and this problem is being reported time and again in various conferences and fora.

Table 6: India Gas Pipeline Infrastructure: Capacity Utilisation – 2018-19

S. No.	Transporter	Length (KM)	Design Capacity (MMSCMD)	Average Flow (MMSCMD)	% Capacity Utilization 2018-19
1	GAIL	11411	230	111.6	48.5
2	RGTIL	1784	84	20.3	24.2
3	GSPL	2692	43	34.6	80.5
4	AGCL/DNPL	297	3	1.9	63.3
5	IOCL	140	10	5.0	50.0
	TOTAL	**16324**	**370**	**173.4**	**46.9**

Source: PPAC / Ceresta Analysis

In transmission pipeline segment, one of major enablers of growth and capacity utilization is the government policy and regulation besides regular access to multiple sources of gas and demand centres across the network. Regulations are expected to provide a fair and level playing field for operators while ensuring that the customers get regular supply at reasonable prices. At the same time, the regulation must facilitate investment and expansion of network by serious players keeping the economic viability in view. When such growth enablers are stifled, it has a direct impact on the pipeline capacity creation as well as utilisation. This issue is well brought out by the low capacity utilization of the existing pipeline network. Furthermore, such a status of current network would definitely have a negative impact on upcoming pipelines. Though government laid out ambitious plan to double the pipeline network and Indian pipeline companies have obtained authorisation for a number of pipelines through PNGRB, the progress of construction of these pipelines has been very tardy, as reflected by the data provided in Table 7.

Shadol-Phulpur Pipeline has been completed and the authorisation of GAIL for Surat – Paradip Pipeline has been cancelled during the last one year or so. All other pipelines have shown very slow progress or no progress. The pipeline which is currently showing speedier progress in recent months is the Jagdishpur – Haldia – Bokaro – Dhamra Pipeline (JHBDPL). In recent months, the JHBDPL is showing faster progress given the thrust by the government for setting up of City Gas Networks in a number of cities in the corridor in few of the states besides provision of Viability Gap Funding (VGF). The other Pipeline which has started progressing is the Kochi – Bangalore – Mangalore Pipeline network. With just 1058 KM of construction out of the planned 11377 KM of pipeline network, it is a great cause for concern. Unless there is renewed government support and integrated planning to enable higher gas supply and pipeline capacity utilisation, there would be mounting challenges which would render this planned expansion, a Pipe Dream.

Table 7: India Gas Pipeline Infrastructure under execution (2018)

NETWORK/REGION	Entity	Length in Kms	Design Capacity (mmscmd)	Status of Pipeline laid (Km)
Kochi - Kottanad - Bengaluru - Mangalore	GAIL(India) Ltd.	1056	16.0	240
Dabhol -Bengaluru (DBPL) Spur Lines, Phase-2	GAIL(India) Ltd.	302	16.0	Only LMC pipelines are being constructed
Jagdishpur- Haldia-Bokaro-Dhamra (JHBDPL) (Phase-I, 755 Km, 7.44 MMSCMD Capacity)	GAIL(India) Ltd.	2539	16.0	577
Mallavaram - Bhilwada*	GSPC India Transco Ltd.	2042	78.3	0
Mehsana - Bathinda *	GSPC India Gasnet Ltd.	2052	77.1	170
Bathinda -Jammu-Srinagar*	GSPC India Gasnet Ltd.	725	42.4	71
Kakinada - Vizag-Srikakulam *	AP Gas Distribution Corporation.	391	90.0	0
Ennore- Nellore*	Gas Transmission India Pvt. Ltd.	250	36.0	0
Ennore-Thiruvallur-Bengaluru-Puducherry-Nagapattinam-Madurai -Tuticorin*	Indian Oil Corporation Ltd.	1385	84.7	0
Jaigarh-Mangalore*	H-Energy Pvt. Ltd.	635	17.0	0
Total		**11377**	**473**	**1058**

Source: PPAC

3.3 India Gas Distribution Infrastructure

The City Gas Distribution (CGD) sector has been a growing sector in the last decade and in terms of % share in gas portfolio, CGD has shot up from less than 5% before 2005 to about 17% in 2018-19. In terms of potential, this sector offers a major growth potential if it is planned well. An overview of the Piped Natural Gas (PNG) is given in Table 8.

Table 8: Piped Natural Gas (PNG) Overview (June 2019)

No. of States Covered	No. of Cities / GAs covered	No. of Companies	No. of Connections		
			Domestic	Commercial	Industrial
27	228	30	5.60 Million	28417	9024

Source: PNGRB

After the 10th Round of CGD Bidding, the PNG connections are expected to increase phenomenally if executed as per plans. In the CNG segment, the number of stations established is 1758, as in June 2019 and it is expected to increase phenomenally if the nos. committed by companies in 9th and 10th Rounds of CGD Bidding, are any indication.

Government has taken important steps in terms of policy support and other facilitating steps to promote gas usage in the sector. Some of them are:

- Regulatory interventions CNG in public transport in certain cities
- Ban on Pet coke and Furnace Oil - Delhi, Haryana, Uttar Pradesh and Rajasthan
- Domestic gas allocation for PNG (Domestic) and CNG (Transport)
- CGD granted "Public Utility" status
- State Governments' commitment for facilitation of CGD networks
- Government's drive to connect 10 million households to PNG by 2020

Three major issues pose a major challenge for the growth and expansion of PNG and CNG especially in the new geographical areas bid out. One is the availability of gas and the second is development of infrastructure as per the plan due to constraints at state level as well as overhang of investment and profitability concerns for companies. The third major factor is the demand for PNG and CNG in these states and phenomenal efforts needed on the part of companies to introduce and expand markets for both PNG and CNG. In the case of existing developed cities, CNG and Industrial / Commercial PNG Consumers form the major share of gas consumption. Domestic PNG, though large in terms of nos., consumption is much lesser.

For addressing pollution issue, major thrust has been given by the government in major cities. In case of Delhi and Mumbai, the SC order mandating CNG usage gave the necessary impetus. For promoting CNG in other states, similar government mandate needs to be done, especially in metro, capital and other developed cities. Also, a thrust to usage of CNG and PNG by government can step up volumes and make it viable for CGD developers.

With 136 geographical areas bid out in the last two rounds, the target is a tall order and concerted efforts by companies with support of government and all stakeholders is mandatory for making it successful.

Steps taken by Government to promote PNG and CNG in the country

In order to promote the expansion of City gas networks and enhance the usage of natural gas in cities, the Government has taken following steps:

1. Domestic gas, which is cheaper than imported gas, has been allocated to meet the entire

requirement of PNG (Domestic) and CNG (Transport) segments of CGD sector and it has been kept under no cut category.

2. Public Utility Status granted to CGD Projects by Ministry of Labour and Employment.
3. Ministry of Defence has issued guidelines for use of PNG in its residential areas/unit lines.
4. Department of Public Enterprises has issued guidelines to Public Sector Enterprises (PSEs) to have the provisions of PNG in their respective residential complexes.
5. Ministry of Housing and Urban Affairs has issued advisory to State Governments on following aspects:
    - o To standardize the Road Restoration/permission charges along with time bond permission in accordance with the local conditions.
    - o Earmarking of land plot for development of CNG Stations at the planning stage of town/city and same should be specified in the revised Master Plan.
    - o Relevant modification in building by-laws for providing gas pipeline infrastructure in residential & commercial buildings at architectural design stage.
6. Further, Ministry of Housing and Urban Affairs has directed Central Public Works Department & National Building Construction Corporation to have the provisions of PNG in all Government Residential complexes.
7. Department for Promotion of Industry and Internal Trade (DPIIT) (earlier DIPP) has notified Gas Cylinder (Second amendment) Rules, 2018 to ease out process to set up CNG dispensing facilities at existing Retail Outlets for Petrol & Diesel.

3.4 Emergence of Electric Vehicles: A new era of growth

Electric vehicles promises to be the zero emission option and given the pollution challenges in major cities of India, the Indian government has provided the necessary thrust through Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles schemes that encourage, and in some segments mandates the adoption of electric vehicles (EV). Indian government has kept a target of 30% EV penetration by 2030. Globally, Electric Vehicles are expanding faster and one can be reasonably sure that India will adapt to electric vehicles faster than many would like to think. A 30% penetration by 2030 will generate an estimated saving of up to 474 Millions of tonnes of oil equivalent (Mtoe) and 846 million tonnes of net CO2 emissions over their lifetime. Creating the necessary infrastructure for charging, support for scaling up Lithium - Ion batteries and enabling faster usage through incentives and duty concessions will go a long way in introducing EVs and their faster adoption. Though two-wheelers and three wheelers are getting larger attention amongst manufacturers, big

players of passenger cars have also put in place strategies to step up volumes. Given the initial stage of EV introduction in India, creating a charging infrastructure at existing fuel stations is a major challenge because of the time taken for an AC / DC charging. The viability of the station itself is currently considered as a major issue. Also source of power whether at stations or at home or offices also needs to be looked into. So, from the perspective of CNG sales, though there may not be an immediate impact, it is important for CNG Companies to track this development in order to develop their own CNG strategy while looking for opportunities in EV sector through appropriate collaborations.

3.5 LNG Re-gasification Infrastructure: Need to step up R-LNG consumption and enhance capacity utilisation

India has created a capacity of 39.5 MMPTA of LNG Regasification infrastructure (including Ennore and Mundra Terminals). Only Dahej terminal of Petronet LNG and Hazira Terminal of Shell are operating at high capacity utilization. As per the recent MOPNG / PNGRB report, another 14 MMTPA is under construction and another 14 MMTPA is proposed, making the likely upcoming capacity to 28 MMTPA. With the market dynamics that is prevalent in global LNG markets in recent years, even contracted long term contracts by companies are facing challenges in bringing cargoes to India or selling in global markets. Adding to this, the marketing challenges of R-LNG within India is another major issue. The task in hand is to utilize the current commissioned or operational terminals like Kochi, Ennore and Mundra. The terminals under construction need to really get good deals of LNG supply since market leader Petronet LNG has signed a MOU with a US company which is reported to have offered an attractive deal, re-defining the benchmarks in the market.

From the above, it is clear that 3 - 4 new terminals might see the light of the day but with the demand and customer tie-ups still uncertain in the commissioned and to be commissioned LNG terminals, it seems a daunting task. The uncertainty of LNG demand can be summarized as below:

- What is actual demand and who are the anchor customers - none of the terminals are able to ascertain and lock up demand. All new terminals are looking to sectors like Refinery, Petrochemicals and CGD as their main demand base because of challenges associated with Power and Fertilizer sectors.
- Indian customers are unwilling to sign in long term contracts for LNG given the dynamic market conditions and prevalence of low oil and LNG spot prices. Given the uncertain global oil and gas markets, Indian customers are well informed and unwilling to commit to long term contracts
- In some cases, the pipeline infrastructure is unavailable and therefore no connectivity to markets.

- One important development is that Petronet LNG is already taking steps to promote new areas of LNG usage in transport sector and other areas in order to expand the market base.

In the context of the above scenario and domestic gas production constraint, LNG will have to play a major role in the coming years. Efforts to develop and expand markets for LNG usage is already being pursued by companies. With active global LNG trade and expected growth of LNG usage in India, Open Access for LNG Terminals would be an important enabler to give a thrust to Indian gas market and make it more market focussed and would enable wider access to LNG terminals for many players.

3.6 Transnational Pipeline Infrastructure

- India has been, both in the past and currently, evaluating a number of options of gas supply through Transnational pipelines
  - Turkmenistan - Afghanistan - Pakistan - India Pipeline (TAPI)
  - Iran - Pakistan - India Pipeline (IPI)
  - Iran - India Pipeline (with Oman Link)
  - Russia - India Pipeline via Iran / Middle East
  - Middle East India Deep Water Pipeline (MEIDP) - (Oman-India Pipeline)
- In case of TAPI, though GSPA was signed 4 years ago, the commercial terms were yet to be frozen. Of late, TAPI has been going through a major issue of security concerns of passing through Pakistan. IPI has been formally shelved by the government due to security considerations
- Iran - India Pipeline was found to be the most technically and economically viable alternative. India has taken a clear stand on bilateral relations with Iran that certain of its strategic investments in upstream - Farzad B Block and Port and logistics have to be honoured by Iran along with adherence to principles of peace in the region. In the current circumstances of re-imposition of US Sanctions on Iran, possibility of a pipeline from Iran to India looks rather remote.
- Russia - India pipeline pre-feasibility presented highlighted both technical and commercial challenges in terms of higher price of gas though an option of routing via Middle East was being considered. With Russia stepping up its LNG production, India may prefer LNG deal with competitive terms rather than a challenging transnational pipeline

- That leaves us with the option of Middle East India Deep Water Pipeline (MEIDP) - (Oman-India Pipeline) which was presented as a viable option by the promoters and the landed gas price including the transportation tariff presented in the range of USD 6 / MMBTU may be one of the most competitive tariffs comparing with the tariffs of other pipeline sources as well as with LNG prices. From the perspective of feasibility, Oman to India deep water pipeline seems a good option because it has no major security threat and has been presented to the Ministry as a economically viable and sustainable alternative compared to competing alternatives like LNG

Given the challenges faced by LNG terminal investors in tying up demand for LNG in India, the transnational pipelines would really face major challenges because of the huge investment involved and the price and market competition faced by them in Indian gas markets. It is important that Oman - India Pipeline, the Middle East India Deepwater Pipeline (MEIDP) be evaluated about its feasibility and economics and supported fully if India's dream to bring in gas through a transnational pipeline, has to become a reality.



Section 4

Global LNG Markets - A New World Order: Changing Trade, Pricing and Contractual Dimensions

4.1 Global LNG Markets: A Market Perspective

The volume of LNG traded globally has quadrupled in the last two decades and is set to double over the next two. Future supply will come heavily from the United States and Australia, with demand coming from many of the traditional players in Europe and Asia. As volumes continue to increase, the market has potential to reach critical mass, leading to shifts in the countries and companies involved and market structure. These developments hinge on maximizing the strengths and opportunities of the

LNG value chain, while reducing the impact of the strategic weaknesses and threats from external developments. Seven key factors are expected to drive how the LNG industry will grow:

- **Global economic growth:** LNG consumption is driven by global growth in Europe and Southeast Asia. A slip in regional growth, particularly in China, would flatten natural gas demand in key importing countries.
- **Energy efficiency:** Energy intensity growth has declined over the last few decades as high energy prices and environmental concerns have driven the adoption of higher efficiency technologies.
- **Excess capacity:** New capacity coming online in US and Australia is weighing down on an already saturated market. Not all the planned projects may be needed to meet demand through 2035 and only those with the competitive advantages like lower costs, access to domestic gas at competitive prices, direct access to markets, and contracted buyers with a competitive offer, will move forward. Though there may be some demand-supply balance that might take place in the next 3-4 years, oversupply seems to be on the cards if the proposals for new LNG capacities are anything to go by.
- **Shipping costs:** Shortening the trading distance with more flexible contracts and widening of the Panama Canal can reduce the cost of shipping, driving an increase in volumes as incremental margins improve. This will also impact the natural gas price differential required to drive investment.
- **New markets:** Japan and South Korea used to import half of all LNG volumes, historically paying a premium vis-a vis shipments in the Atlantic basin. Growth in trade will require new LNG regasification facilities to be built in new countries to meet growing global fuel needs, which is already happening. Japan and Korea may no longer drive future growth. China led the jump in incremental volumes of LNG import in 2018 vis-à-vis 2017. India has already shown significant jump in LNG trade and a few other new countries like Pakistan have hit the market.
- **New end users:** LNG is traditionally consumed for utility-scale power generation, but LNG as an alternative transport fuel for shipping, trains, or trucks as well as a power source for remote small-scale grids and LNG for City Gas sector will provide a long tail of potential demand growth. Market players are clearly looking at these areas as the new demand drivers
- **Market liquidity:** Floating liquefaction and regasification facilities combined with new countries building both import and export capacity, can transform the current contract-dependent market into one that provides trading opportunity through transparent gas benchmarks and a flexible spot market.

While LNG export volumes remained flat over the five years 2010 - 2014, there has been renewed growth in the last 3 years. Looking at it over a longer period, total LNG production

has grown tremendously - quadrupling over the last two decades and roughly doubling its market share from 5% to 10% of the total natural gas consumed. The market is preparing for the next phase of growth, if the growth of LNG trade in recent years since 2015 is any indication. The latest IGU global LNG report shows 2019 presents a positive picture with another record-breaking year for LNG trade in 2018 and reinforces the global LNG industry's role in expanding access to natural gas for a more sustainable and prosperous future.

Reviewing the recent trends, the global LNG trade in 2017 reached 288.3 million metric tonnes (MMT) - an increase of 12% from 2016 (262 MMTPA), which has further jumped to 316.5 MMT in 2019. This is the third consecutive record-year for the industry and the highest annual growth since 2010. 99 MMT of this trade was non- long-term, a 11 MT increase over 2017, and comprising a significant 31% of total LNG trade.

Global LNG Market 2018 – A Snapshot



Source: IGU

This significant growth in recent years can largely be attributed to increases in new LNG supply, driven primarily by projects in Australia and the United States bringing new capacity on line. Let us look at both 2017 and 2018 to get a perspective. A look at the year 2017 indicates that, with additional trains at Australia Pacific LNG, Gorgon LNG, and higher production from existing trains, Australia added 12.2 MMT of production in 2017. United States production gains of 10.2 MMT were driven entirely by Sabine Pass LNG, which added two new trains in 2017. Qatar remained the world's leading exporter of LNG, with 2017 liquefaction reaching 81 MT. In 2017, unlike 2016, increases in world trade occurred without new major entrants to the global LNG market. Coming to the year 2018, In terms of incremental growth in 2018 over 2017, Australia led all exporters with 12.2 MMT additional LNG supply, supported by the new Wheatstone LNG and Ichthys LNG projects. The United

States added 8.2 MT as trains at Sabine Pass LNG operated for the full year and Cove Point LNG came online thereby making US the second largest driver of LNG supply in the year. Interestingly, Russia emerged among the top incremental supplier during 2018 with an additional supply of 7.8 MMT. On the demand side for LNG, Asia led the incremental imports. China broke its own record for incremental LNG by importing an additional 15.8 MMT in 2018. This was again driven by the strong enforcement of environmental policies designed to promote coal-to-gas switching as well as continued economic growth. Other key markets that drove global LNG growth included South Korea (+6.4 MMT), India (+4.0 MMT), and Pakistan (+2.4 MMT), which took in a combined 12.8 MT of incremental imports. Bangladesh and Panama joined the LNG market as new buyers. The Pacific Basin continues to be the key driver of trade growth, with intra-Pacific trade flows reaching a record 134.2 MT, supported by Australian production and Chinese demand. Global LNG Trade in 2018 between Basins and the market share of top countries are presented in Table 9.

Table 9: Global LNG Trade between Basins, 2018

Exporting Region / Importing Region	Africa	Asia-Pacific	Europe	Former Soviet Union	Latin America	Middle East	North America	Reeexports Recieved	Reeexports Loaded	Total
Africa	0.3		0.4	0.2	0.1	1.0	0.1	0.1		**2.3**
Asia	10.5	39.4	0.4	1.6	0.9	28.1	3.6	1.4	0.1	**85.9**
Asia-Pacific	4.6	81.8	0.2	11.4	2.6	44.7	7.5	1.4	0.9	**153.3**
Europe	20.5		3.1	4.9	4.5	16.9	2.7	0.4	2.9	**50.0**
Latin America	1.2		0.2	0.3	3.8	1.1	2.5	0.2	0.1	**10.6**
Middle East	2.3	0.1	0.2	0.3	0.8	22	1.1	0.3		**7.4**
North America	1.1	0.2	0.1	0.1	3.2		3.6	0.1		**7.1**
Total	**40.6**	**121.6**	**4.6**	**18.9**	**15.8**	**94.0**	**21.1**	**3.9**	**-3.9**	**316.5**

Source: IGU

Table 10: LNG Exports and Market Share of Top Countries - 2018

Country	Exports (MMT)	Market Share %
Qatar	78.7	24.9
Australia	68.6	21.7
Malaysia	24.5	7.7
USA	21.1	6.7
Nigeria	20.5	6.5
Russia	18.9	6.0
Indonesia	15.2	4.8
Trinidad and Tobago	12.2	3.9
Algeria	10.3	3.3
Oman	9.8	3.1

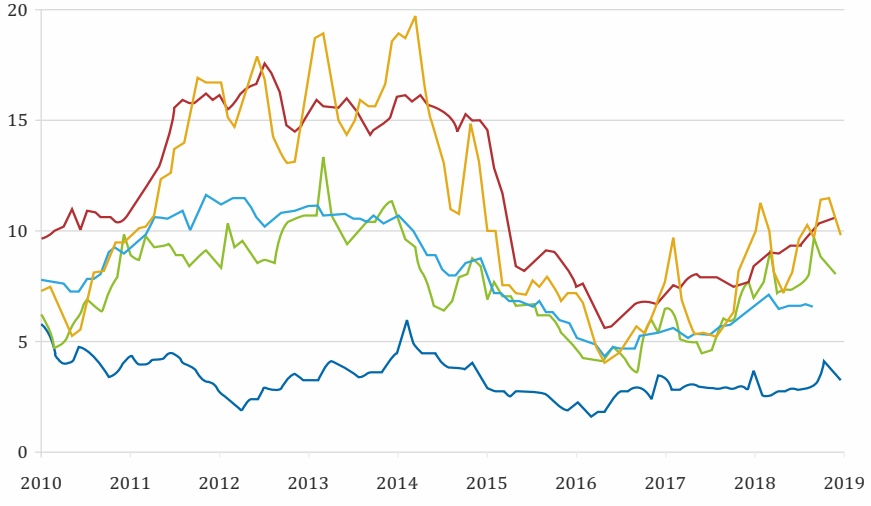
Source: IGU

Despite these headwinds and market dynamics of recent years, the LNG supply growth is expected to continue over the next five years as new facilities, currently under construction, comes online in the US, Australia and Russia including the world's largest offshore facility, Shell's Prelude FLNG, as well as five American facilities along the Atlantic and Gulf Coasts. From an Indian perspective, all these supply options are being realistically evaluated and some of them may lead to signing of contracts depending on the commercial attractiveness. BP's World Energy Outlook forecasts LNG supply growth of 7.8% per annum between 2013 and 2020. Beyond that, there is potential for additional sources of supply—the opening of Iran's extensive known gas reserves to international investment (though US sanctions has threatened this status), Canadian Pacific Coast liquefaction facilities supplied from prolific gas / shale resources, East African LNG producing from recent discoveries in Mozambique and Tanzania, growing Russian supplies, new projects in the United States and Australia, along with brownfield expansions of existing plants.

4.2 LNG Pricing: A brief review

LNG prices across markets have undergone a sea change and divergence over the period 2010 – 2019 and one can see from the graph that the gas / LNG prices have settled at a lower band during 2014-2019 compared to the earlier period. Gas prices in North America are largely set at liquid trading hubs, the largest and most important of which is Henry Hub in Louisiana. In Europe, wholesale gas is sold mainly via long-term contracts. These contracts make use of gas hub-based or oil-linked pricing, and often use both. In Asia and many emerging markets without established and liquid gas trading markets, the price of LNG is for the most part set via oil-linkages, supplemented by a smaller share of spot imports. US LNG supply to Asian markets has brought in the much needed alternative pricing mechanism based on Henry Hub Gas Price linkage. The delivered costs of US LNG provide an increasingly important reference point for global markets, given the flexibility of its destination-free supply as well as the liquidity and pricing transparency of the US market.

Fig 2: Global LNG Price Trends (2010 – 2019) – in US$ / MMBTU



Source: IGU

Global LNG markets have undergone significant changes since 2014, when oil prices started drifting downwards and reached all time lows and has remained at lower band since then. LNG prices have also followed suit. There was also clear divergence in the price levels (See Graph on Price Trends) of North American, European and Asian markets post recession 2008-09, leading to various challenges for buyers and sellers in terms of pricing and destinations for LNG. Two major developments that have taken place during the period is detailed below – Destination Flexibility / Cargo Diversion and Price Reopener Provisions.

4.3 LNG Cargo Diversions / Destination Flexibility

In the Atlantic basin in particular, demand for LNG decreased following the global recessionary downturn and as a result of the growth of shale gas in the US. On the other hand, while Asian markets also got impacted by recession, the recovery of these markets were faster. The demand in Asia further spurted because of earthquake in Japan in March 2011 and subsequent nuclear shut down. Therefore, the traditional consumers in Atlantic basin started looking at various options to manage the crisis. What added further to the dynamics was the increasing production of Shale Gas from US and the proposals for setting up of capacities for LNG liquefaction. Therefore, the LNG prices under traditional gas and LNG long term contracts have been placed under considerable stress. On a broad basis, the reasons for this trend can be attributed to weakening demand, increased gas production from new sources, US shale gas boom, development of stronger and expanding spot LNG markets and increased gas to gas competition. The buyers of long-term LNG were affected by the market conditions wherein their downstream demand has gone down while the LNG spot market has expanded and spot prices hovered at a lower level compared to long term formula driven prices.

LNG buyers went on to increasingly seek the flexibility to divert cargoes, to protect against swings in demand and volatile market conditions and to benefit from fluctuations in spot prices. In contrast, sellers preferred to limit any diversion rights to protect their own financial interests, as well as to protect against the potential costs and shipping issues associated with diversions while on the other hand, they may still consider diversion from the perspective of taking advantage of better pricing in new lucrative markets. As the global gas market and the LNG market evolved over the decades, leading to increased competition and introduction of new terms to LNG contracts, negotiators have continued to seek ways to 'add value' to their LNG SPAs, and therefore, the contracts have evolved to incorporate contractual rights for the buyer to divert cargoes to alternative destinations as well as certain other rights regarding pricing.

4.4 LNG Contract- Price Review Provisions

Delving deep into the anomalies of long term formula driven price and the spot prices and the emerging over supply situation along with gas based indexation of US LNG supply providing stiff competition to traditional LNG suppliers, many buying countries / companies sought review of the price formula to reflect the market conditions and their survival. A number of contacts across the globe were revisited and the pricing provisions were re-negotiated in order to stay relevant in the market – both from buyers and sellers' perspective. From the Indian context, Indian companies re-negotiated contracts successfully with Ras Gas, Qatar and Gorgon, Australia and Gazprom, Russia. Given the continued down trend in market and uncertain market conditions with over supply hangover, Price Review provisions have become part of LNG SPA negotiations.

4.5 Changing Contractual Durations

Another major trend that has taken place in the LNG Market is – from a dominant strictly long term rigid contracts of 25 years, contracts have undergone important changes. One of them is the increased spot LNG / short-term supplies in the market and reduction in the average duration of long term contracts from 20 – 25 years to a duration of 12 – 16 years over the last decade. Even traditional buyers and Korea have resorted to building a portfolio of long term, medium and short term contracts thereby aiming to achieve price optimization given the challenges in their country's economy.

Indeed, recent years have seen spot and short-term markets getting more vibrant with increasing share of the total LNG trade. In total, all non-long-term LNG trade reached a record 99 MMT in 2018 and accounted for 31 % of total gross LNG trade. The growth in spot / short term trade is the result of several key factors:

- The growth in LNG contracts with destination flexibility, which has facilitated diversions to higher priced markets.
- The increase in the number of exporters and importers, which has amplified the complexity of the industry and introduced new permutations and linkages between buyers and sellers.
- The lack of domestic production or pipeline imports in Japan, South Korea and Taiwan, which has pushed these countries and others to rely on the spot market to cope with any sudden changes in demand like the Fukushima crisis.

Other key developments which have impacted the global market and driven short-term market growth are:

- The decline in competitiveness of LNG relative to coal (chiefly in Europe) and shale gas (North America) that has freed up volumes to be re-directed elsewhere.
- Large disparity between prices in different basins from 2010 to 2014 and continuation of divergence trend, which made arbitrage an important and lucrative monetisation strategy.
- The faster development timeline and lower initial capital costs of FSRUs compared to onshore regasification, which allow new countries to enter the LNG market.
- The large growth in the LNG fleet, especially vessels ordered without a long-term charter, which has allowed low-cost inter-basin deliveries.

4.6 Global LNG Market Outlook: What is in store for the future

The last four years in global gas markets, have seen some significant developments, which has led to new paradigms of Supply-Demand dynamics and changing contractual and pricing provisions. While suppliers were vying for an increased market share and buyers aiming for more optimized portfolios, the LNG prices have mirrored the fall in oil prices and had gone down to more reasonable levels, if one may say so. Though LNG price touched a rock bottom in 2016 and part of 2017 (as low as $ 5-6/mmbtu), it has recovered since then to the levels of $7 - 8/mmbtu in 2018 while hitting a downward spiral during the second quarter of 2019 and thereafter. Oil and gas market factors such as supply and demand, project profitability, reducing contract duration, diversification of supplies etc are having significant impact on the markets. There is therefore, a widespread agreement that significant fundamental changes have taken place in the markets, which may determine the direction and growth of the market in the years to come.

A recent IEA study talks about re-shaping of the global gas markets by three major structural shifts:

- Emergence of China as the world's largest gas importer within the next two-three years,
- Steep rise in US production and exports of natural gas, and
- Industries are going to be the major demand growth drivers, taking over from the power sector.

Indian companies led by Petronet LNG see good potential in the years ahead and are putting in place growth strategies to become a integral part of the global LNG growth story. Given the constraint in supply of LNG to anchor sectors, Indian companies are definitely looking up to expanding LNG usage in new areas of application. LNG can potentially emerge as a widely traded fuel and Indian companies are looking to integrate with the world in leveraging the opportunities offered by LNG markets growth.

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Section 5

The Road Ahead and Recommendations

Reviewing the recent developments in the natural gas sector in India, as discussed in the various sections of this report, it is quite clear that there are a number of inter-related issues and challenges in the sector, which need to be addressed in order to trigger the growth of this sector. Government has taken a number of steps to give a boost to the sector especially in the areas of enhancing production, creating infrastructure and expanding key application areas like City Gas Distribution. This is the most important period in the Indian Energy Sector, wherein multiple areas of growth are being addressed simultaneously and a more integrated planning at this stage will help in charting the course of natural gas in the country. This section



brings out the key challenges in evolving an integrated plan and in developing such a robust and extensive infrastructure, thereby bringing out the key recommendations for the road ahead. The issues and recommendations cover a wide array of areas including markets, infrastructure, policy and regulation, end use sector intervention, new technologies and market reach.

- **Demand re-assessment and need for a strategy** on the part of companies to address customer issues and market challenges, given the price sensitive nature of certain sectors. Given the fact that the power sector has remained out of focus for gas supply for many years and fertilizer sector provides minimum scope for growth, the demand for gas is primarily confined to other sectors like CGD, Refinery, Petrochemicals and Industries wherein CGD is considered as a major driver of demand given government's serious concern to expand the CGD sector. Gas availability, infrastructure creation and market reach are the key issues to be addressed.
- **Gas Infrastructure development** would need an integrated planning to enable better utilisation and economic viability. Due to lack of integrated approach, the development of the sector has remained lopsided. As we create more transmission infrastructure, there is always a concern of capacity utilisation and the economic viability of projects. Even the LNG re-gasification infrastructure created in recent years have not achieved the desired capacity utilisation. While the gas grid is expanding, still connectivity of East and South corridors will take time and there is uncertainty on the capacity utilisation of such networks.
- **Gas marketing Challenges:** While we talk of India as a potential market, global market dynamics in the last 3 years have posed a plethora market related challenges - US Henry Hub gas-based contracts are no longer as attractive compared to the time when it was signed, especially in the current market conditions of oil and gas prices. Vanishing of premium in gas indexed contracts vis-à-vis oil indexed contracts due to steep fall in oil prices and reluctance of end use customers to enter into long term agreements have made companies vulnerable. Even attempts to trade US LNG in international markets is a major issue due to down trend in spot LNG prices.
- **City Gas Sector Development:** Many bid-out and awarded pipelines and CGD geographical areas in the past, have not progressed at all in spite of PNGRB stipulated timelines, due to various market related challenges; though the developers have gone ahead with bidding and won the authorization. A further 136 geographical areas have been offered to winning bidders in the last two rounds of CGD Bidding. CGD development barring Delhi-NCR, Mumbai and Gujarat has also been slow due to lack of major anchor load customers in non-metros, lack of policy and judicial support and local / state level clearance and administrative challenges. It is all the more important to put together an implementation plan with sourcing of gas / LNG and establishing the economic viability of these investments. Government may have to mandate usage of CNG in transport in many of the cities as well as promote use of gas in the commercial

and industrial sectors. Clean environment must become the key objective and steps should be taken accordingly. China and US have introduced clear coal-to-gas switching policy to address environment concerns. Diesel and other polluting fuels should no longer be used in back up power generation. This would require reaching out gas to a much larger geographical reach.

- **LNG price trends and Volatility:** India has been a price sensitive market and therefore, demand is elastic to prices of LNG, especially some of the anchor sectors. But given the current trends in LNG prices in global markets and the need for more LNG to meet the growing requirements of gas in India, it would be prudent to put together a strategy for LNG usage and expand the market. Given the international interest in Indian markets, there are good opportunities to be pursued here.
- **State level issues:** ROU acquisition has posed stiff challenges and pipeline laying has faced land acquisition challenges due to local farmers' protest and unviable routes proposed by state governments, causing major project delays. Further local statutory clearances delays have also delayed projects.
- **Stranded Power sector assets:** The stranded assets of 14800 MW and low PLF of operational assets has totally shut the sector from gas consumption. LNG at the current price points and volatility is unviable. A more innovative strategy for power sector to enable procurement of gas based power for industrial and commercial sectors or large users keeping the environmental objective in mind is needed if we really want power sector to be a gas consumer. Potentially, the revival of power sector may generate a demand of 75 - 80 MMSCMD for gas.
- **Power Sector Reforms and Integration of gas based power with Renewable Energy:** Power sector has about more than 14800 MW capacity stranded and even many of the current operational power plants are operating at a low PLF of around 30 - 35%. A well thought-out strategy and the much needed reforms specially for power sector can potentially step up the volume of gas consumption. In addition, with government's thrust on Renewable Energy provides another opportunity to integrate gas with RE. The steps proposed below can truly be the demand boosters:
    - Given the intermittency of RE and the peaking power load on the grid during peak hours, a strategy to use gas based power along with RE in providing clean and round-the-clock power, will be a natural way forward for a country, which is increasingly facing challenges of pollution. The environment friendliness of gas makes it the right fuel to integrate with RE in the lines of Hydro Power.
    - It is the right time for the government to introduce power sector reforms. Merit Order Despatch always put clean power on top. Therefore, it is important to go beyond just intent and implement reforms for gas based power. Clean power purchase must include gas based power at the delivered price of such power. In line with the Renewable Purchase Obligations on the part of state governments, gas

based power should also have a supportive policy if the government really aims to step up the volumes.

- **Government Policy:** Some of the policy support which government can introduce to expand usage of natural gas is listed below:
  - This is the stage when natural gas must be brought under GST and more importantly, gas should be treated at par with coal with 5% GST. This policy can be one significant step which will bring to the fore, government's decisive step to move towards cleaner fuels and away from coal in the longer run, thereby giving a fillip to gas sector growth.
  - Customs Duty waiver on LNG
  - Mandated use of gas in industries instead of fuel oil / furnace oil / petcoke to address environment issues and consequential health effects on population and loss of productivity.
  - Closure of all old coal based power plants
- **Gas Pricing in India:** Currently gas in India is priced through a linkage with international trading hubs and markets. Two major steps are needed in this context: Stepping up domestic gas production and implementing a realistic price discovery mechanism. The international markets and hubs are far more matured gas markets with active trading and price discovery mechanisms. Rather than subjecting domestic gas prices to the price movements and volatility of international markets, it would be more prudent to have a price discovery mechanism which is reflective of the Indian market dynamics so that India's gas pricing mechanism reflects India's gas scenario, targets and government plans.
- **Government thrust on Electric Vehicles (EVs):** EVs can turn out to be longer term threat to gas sector in transportation segment. The recent Phase II of FAME scheme launched, has targeted 1 million two wheelers, 0.5 million three wheelers, 55,000 four wheelers and 7,000 buses to operate on lithium-ion batteries/other power trains. A market penetration of 30% is targeted by 2030. It was also presented in the Union Budget this year that there is a strong EV focus in the years to come and government proposed to launch an International Competitive Bidding (ICB) to set up mega manufacturing plants in new sectors such as solar PV, lithium batteries and solar electric charging infrastructure. The Government also has a stated vision that India would aim to become a global hub for EV manufacturing including solar storage batteries and charging infrastructure and have moved the GST council to reduce rate on EVs from 12% to 5% along with tax rebates. These developments and aggressive promotion of EVs by government may pose a big challenge to the gas sector and importantly the CGD sector, if faster moves are not made now.
- **Power for all:** Gas based Fuel Cell technologies (eg: - Solid Oxide Fuel Cells - SOFC) have met with success in US, Israel, Japan and some of the European countries and are set to

be the next growth areas. These technologies, if properly adopted and promoted can virtually reach any home or commercial buildings or hospitals, where gas gets supplied. These technologies have agricultural application too and can be a potential source of power for agriculture sector. This kind of distributed generation can potentially transform the gas sector in the country.

- **Renewable Energy Thrust:** With a tall target creation of a capacity of 450 GW by 2030 in RE assets, it is important to address the intermittency and peak period issues. A clear policy roadmap to introduce gas based power as a peak load supplier should grow simultaneously with the RE strategy. There is a big opportunity here.
- **Promoting new areas of LNG usage:** Given the over-supply hangover in global LNG markets , it is important to promote LNG with a long term view in mind and pursue alternate strategies to reach out to larger section of gas industries and users through technologies like LNG by road, LCNG, LNG as transportation fuel etc, which have been gaining traction worldwide. China has waged a war against pollution with strict environment driven coal to gas switching policies and promoting LNG as transportation fuels. Demand for LNG trucks has gone up significantly in the current year and with government curbs on diesel-based trucks, it is predicted that LNG trucks would emerge as a major growth area in China. There are 39000 heavy duty trucks sold during the first seven months of 2019 in China and it is set to grow further, as per a global study. India has made a very good beginning and there should be adequate support to these technologies without yielding into the sector lobbying of competing fuels. A strict environment oriented directive is important for such new areas of usage to take off.
- **FSRU investments** need to expand, given its advantage of faster implementation time, lower investment cost and flexibility. Globally, FSRUs are growing more rapidly in recent years. This can bring in gas faster and at a lesser investment.
- **Open Access for LNG Terminals:** It is quite evident that LNG will have to play a major role to play in India in the coming years. Expanding LNG usage in India will require sustained efforts by LNG companies in India to develop markets and as well as wider participation of consumers in the market. In this context, Open Access for LNG Terminals would be an important enabler to ensure wider access to LNG terminals for many players, who can then implement strategies for wider market reach.
- **Transnational Pipeline:** Many of the transnational pipelines proposed in the past have challenges of security threat or logistics or economics and have never progressed much. Therefore in terms of feasibility, Oman to India deep water pipeline seems a good option because it has no major security threat and has been presented to the Ministry as a economically viable and sustainable alternative. It is recommended that Oman - India Pipeline - the Middle East India Deepwater Pipeline (MEIDP) be more actively supported and pursued so that we have another option to bring in gas at a competitive price. In view of the country's experience in the past with transnational pipelines, the only good option that needs to be evaluated seems to be the Oman - India deep water pipeline.

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About Ceresta Business Consulting

Ceresta Business Consulting is a premier Consulting and Training Organisation in the areas of Business Planning and Strategy, Business Efficiency Studies, Investment and Market Evaluation and HR and Organisational Development across industries. It offers Strategic Consulting in the Energy Sector across Upstream, Oil and Gas / LNG Markets, Midstream & Downstream and helps its clients in making well informed strategic decisions and bring about operational and business excellence. We also offer a no. of management development trainings in the areas of business excellence, customer service management, leadership development, CGD Business and Induction programmes and a range of such programmes. Our key areas of consulting focus are:

- Long Term Business Planning and Strategy
- Work Flow and Efficiency studies in Customer Service Management and Customer Complaint Management
- Market Studies, Demand Assessment and Growth Plans
- Gas / LNG contracts and Evaluation
- Investment Advisory / Mergers and Acquisition
- Business Efficiency and Work Flow Studies
- Energy Business Consulting
- Human Resources Development (HRD)
- Organisational and Leadership Development

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ABOUT FICCI

Established in 1927, FICCI is the largest and oldest apex business organisation in India. Its history is closely interwoven with India's struggle for independence, its industrialization, and its emergence as one of the most rapidly growing global economies.

A non-government, not-for-profit organisation, FICCI is the voice of India's business and industry. From influencing policy to encouraging debate, engaging with policy makers and civil society, FICCI articulates the views and concerns of industry. It serves its members from the Indian private and public corporate sectors and multinational companies, drawing its strength from diverse regional chambers of commerce and industry across states, reaching out to over 2,50,000 companies.

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