

STRENGTHENING

  
**ENERGY**

  
**SECURITY**

**Developing Pipeline  
Infrastructure in India**



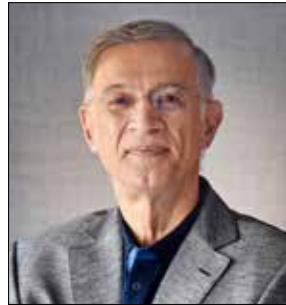
Knowledge Partner





# Foreword

India is being looked at by the world how it prepares for Atmanirbhar Bharat. The Indian Government too is steadfast in its commitment of “Sabka Saath Sabka Vikas”. Access to basics infrastructures like electricity, financial inclusion, clean drinking water, health, education, clean fuel are some of the priorities laid down by successive governments to bring in change.



**Dr. Niranjan Hiranandani**   **Mr. Deepak Sood**

The challenges that face the establishment zero down to one answer, which is the development of a strong and robust network of infrastructure. Infrastructure development in India is a two-pronged strategy; while it will provide for man-days of employment, it will also ensure greater access to essential services for the citizenry.

Development of infrastructure also has a proactive role to play in not just economic development but also poverty alleviation and improving the quality of life. Development of not only hard infrastructure but strategic infrastructures like power networks, communication network, and pipeline network for distribution for oil and gas, is also important among many others.

As per an estimate, a global investment of 94 trillion USD is needed to meet the infrastructure requirement of the world between 2016 and 2040. Out of this 94 Trillion USD, 50% of the requirement is in Asia. Major areas of investments are expected to be water and energy. It is to further this agenda that the Government of India under its National Infrastructure Pipeline has made a commitment to invest INR 100 Lakh Crore to develop the infrastructure in the country.

What lies ahead in this challenge is a strong partnership between the Public and Private Sector in bringing about infrastructural development aligned with global standards. Investment in India’s infrastructure since 2013 has followed a 70:30 ratio between the public and the private sector aligned with the trend globally. While the public sector has been at the forefront of social change since independence and has hugely influenced the economic scenario in how it looks today, it is the expertise of the private sector that needs to be tapped.

Through this report brought out by Primus Partners, a debate is being started to contemplate on the need for an independent entity to plan the future of the pipeline network in India to ensure efficient and quick transportation of oil and gas throughout the country.

**Dr. Niranjan Hiranandani**

President – ASSOCHAM & Co-founder –  
Hiranandani Group

**Mr. Deepak Sood**

Secretary General, ASSOCHAM



# Foreword

After a pause on account of the pandemic, India is likely to embark upon its growth trajectory again. Indications are that, both the impact of pandemic as well the slowdown that was witnessed across the globe would be well behind us in FY 22. The stage set by reforms, the most difficult ones taken in the economic history of the country would also propel quick turnaround of economic activity. This would call for much enhanced use of energy resources.



**Mr. Atanu Chakraborty**

Across the globe, now, there is an acute concern on account of global warming. This means a realignment in the use of energy resources. This would entail, globally, reduction of carbon print. Therefore, India has to meet both the imperatives of growth as well the goals for standards of emission that are essential to protect the planet from severe aftereffects. Fortunately, Prime Minister has over last six years steered the energy usage of the country away from polluting ones to renewals. This has been a game changer. This report has this scenario as the backdrop and attempts to paint a scenario of energy basket of India in the coming decade(s).

I do see a lot of merit in attempting to position gas as the balancing fuel. Technological imperatives such as availability, storage, technology etc, put certain limitation on renewals. This limitation has, wisely been suggested in the report, to be complemented by removing impediments in the use of gas. This, I feel is a brilliant strategy. The report goes on further to lay down the requirements to move towards a 'gas based' economy. This would limit the emission on account of other fossil fuels. The report then goes on to lay down in detail the requirement of the market design as well as the infrastructure that can make it happen.

Gas markets have players at three levels, source, trunk transmission and users, both industrial and city gas networks. I am glad that the report has wisely eschewed any sweeping changes in the PNGRB Act that regulates the entire set of activity. However, through the Gujarat case study the report brings out as how the rest of the country can emulate example of this state to enhance gas usage at affordable prices, in its primary energy basket. This report has tried to work around a model, where the gas markets work seamlessly and provide all the stake holders, viz gas suppliers, transporters, city gas distributors, financiers and finally the consumers a level of satisfaction that perhaps is alluding one or the other. We should not forget that a sound market for gas would also provide the upstream players the required impetus to work with zeal. In a sense the report lays down some components of a game plan that are critical for energy access, energy security and energy sufficiency.

I note that the report has carried forward from the suggestion made in the National Infrastructure Pipeline Report” about separation of commodity and infrastructure providers. I feel setting up gas exchange is an idea whose time has already come. However, this presupposes separation of commodity seller and infrastructure provider in the transmission sector. As, in power sector this needs to be enforced to ensure that moral hazards are minimized and an efficient gas market emerges. Then only consumer would benefit.

To hasten trunk infrastructure and CGDs setting up of project preparation units has been suggested in the report. That would certainly hasten the processes for laying of trunk lines. Possibly integrating gas infrastructure into housing complexes can also be considered as a compulsory item in urban Development rules so that domestic gas connectivity can be provided quickly. This is the real last mile.

Extensive Data and comparative tables have been provided in the report. Conclusions are evidence based. These would be very useful and is a distinguishing feature of this report.

I do feel that this publication would be of great use to ordinary readers, policy makers, investors and researchers.

**Mr. Atanu Chakraborty**

Former Secretary,

Department of Economic Affairs,

Ministry of Finance, Government of India

# Foreword – Primus



**Mr. Nilaya Varma**

Under Prime Minister Shri Narendra Modi India has been vocal in its vision of energy security for all. India's energy security vision encompasses not just access to energy to the farthest corner of the country but access to clean energy. The idea is to ensure the availability of uninterrupted power at affordable prices.

Targets have been set to increase the renewable energy production of the country to 175 GW by 2022 and raise the share of natural gas in the primary energy mix to 15% by 2030. A number of other attempts have also been made in the direction of reducing the carbon footprint in compliance with the Kyoto Protocol and Paris Accord. At present, 1906 CNG stations are supplying clean fuel to run 35.17 lakh Indian vehicles. With the successful completion of the bidding for 10th round of the expansion of City Gas Distribution Network, clean gas is now accessible in 229 Geographical Areas (GAs) spread across 400 districts. This has resulted in the covering of 53% of the country's total geographical area and 70% of the total population with the structured gas supply.

At more micro-level initiatives like Pradhan Mantri Ujjwala Yojana (PMUY), faster distribution of new LPG connections, commissioning of new distributorships and digitisation of subsidies have nudged consumers to opt for LPG connections over traditional methods of cooking. In a phased manner, attempts are now being made by the government to cover cities with Piped Natural Gas.

Thus, in order for India to achieve its vision of energy security in providing affordable, accessible and acceptable forms of energy, infrastructure has a huge role to play. At present, despite best efforts made by successive governments, the country lacks in transportation infrastructure. The need of the hour is to strengthen government's plans and policies to build a robust network of infrastructure in tandem with the long-term vision for every sector.

Specifically, in the Oil and Gas space, there is a need for greater focus on laying a pipeline network to ensure affordable and faster delivery of minerals across the country. This report brought out by Primus Partners is aimed at highlighting some of the shortfalls in the existing oil and gas infrastructure in the country and suggest possible solutions in terms of policy interventions to bring a change in India's energy landscape.

**Mr. Nilaya Varma**

CEO & Co-Founder, Primus Partners





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# Introduction

“My vision for India’s energy future has 4 pillars – energy access, energy efficiency, energy sustainability and energy security”

– Shri Narendra Modi, Hon’ble Prime Minister of India

India until 2019-2020 ranked as the fifth largest economy globally and aspires to become a 5 Trillion Dollar economy by 2025, thus making it third largest in the world. The unusual circumstances put forth by the novel Coronavirus, however, led the national economy to contract by almost 24% putting a temporary halt on the growth story. However, the true resilience of a nation lies in overcoming challenges with equal dexterity.

For India to achieve its goal of a 5 trillion USD economy, the key lies in the development and governance of a robust infrastructure. While infrastructure building is often given its due share of importance, what still remains neglected is the governance and management of the available resources. The lack of effective distribution and allocation of such resources often leads to inefficient utilisation and under-performance.

## India’s Infrastructure Story

Hard infrastructure which is paramount for the development of any business or industry comprises of the transport sector, communications network and the energy sector. While the transport sector is needed to ensure physical connectivity in terms

of roads, rails and air; communications provide a medium for the exchange of information and includes a robust IT framework.

The energy sector, on the other hand, lies at the very basis of Indian industrial and domestic economy<sup>1</sup>. For industries, energy is needed as the primary input to drive production, run services and ensure continuity in processes. In an indirect way, energy is the provider of all basic amenities to the entire populace of the country. Demand for electricity lies at the core of healthcare, education, banking & finance and ample other sectors of the industry.

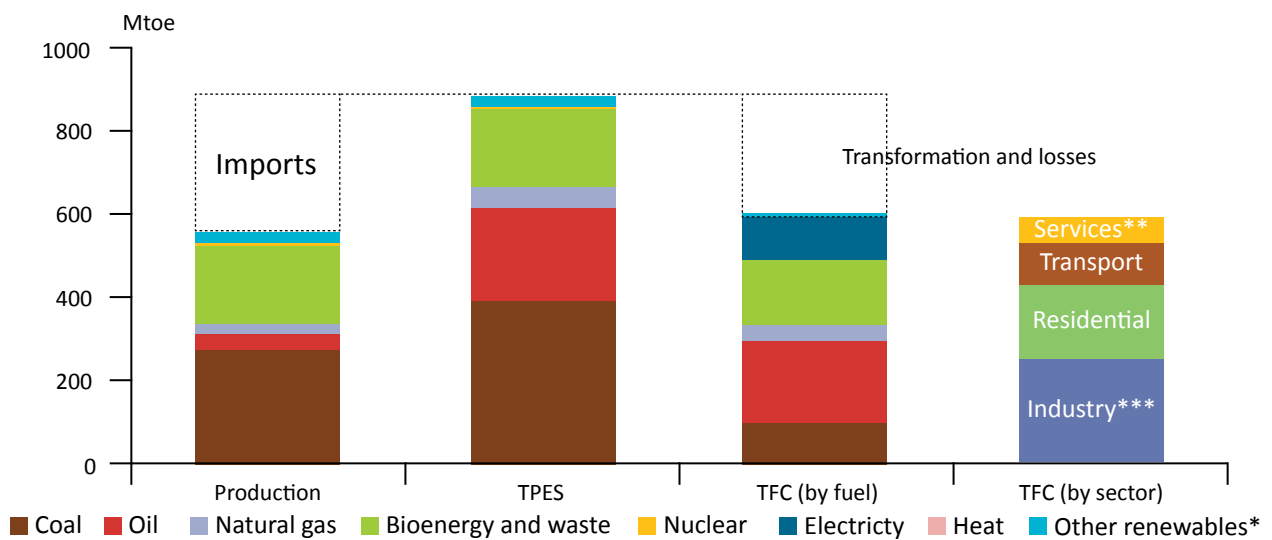
## Energy Sector in India

As the country moves on an aspirational path of steadfast growth and expansion, consumption patterns of energy are also changing rapidly. As per International Energy Agency’s India 2020 review of the country’s energy policy, India’s per capita energy demand is estimated to be at 0.44 tonnes of oil equivalent which is 30% of the global average of 1.29 tonnes.

While coal is the primary source of power generation in the country, Oil and Gas are the mass provider to

<sup>1</sup>When talking of energy as a sector it comprises of (i) Fossil fuels including petroleum, coal and natural gas (ii) electric power industry including generation and distribution (iii) nuclear power industry and (iv) renewable industry including alternative fuels.

**Figure 1.1: Overview of India's energy system by Fuel, 2017**



Domestic coal used in power generation and biofuels used in the residential sector from the main part of India's energy system, together with imported oil used in transport and industry

\*Other renewables includes hydro, wind and solar

\*\*Services includes commercial and public services, agriculture and forestry.

\*\*\*Industry includes non-energy consumption.

Notes: Bioenergy data are estimated by the IEA; the year runs from 1 April 2017 to 31 March 2018

Source: IEA (2019a), World Energy Balances 2019, [www.iea.org/statistics/](http://www.iea.org/statistics/).

the industry, followed by biomass for residual energy and cooking. Of the total energy produced within the country, 56 per cent is consumed by the industry itself.

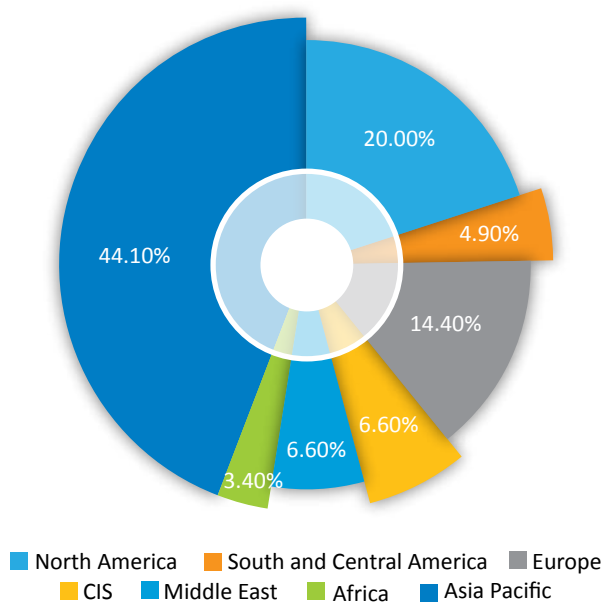
The second-largest chunk is consumed by the domestic sector to ensure sustenance of livelihood. As per the energy statistics of 2019, per capita consumption of energy showed a Compound Annual Growth Rate (CAGR) of 2.54% over the period of 2011-12 to 2017-18. The national estimates suggest a CAGR of 4.24% in energy consumption for the period from 2017 to 2040.

Globally, there has been an overall increase of 1.3 per cent of primary energy consumption in 2019. There has been a marginal decline of about 1 per cent in the primary energy consumption patterns of North America and Europe, the Commonwealth of Independent States (CIS) countries' consumption has shrunk by a minuscule 0.3 per cent, while all other regions of the world have followed an upward trajectory. The countries of Asia Pacific have recorded

the highest rise in energy consumption riding on the shoulders on developing countries like Bangladesh. The Asia Pacific countries have reported a collective

**Figure 1.2: Region wise share in global primary energy consumption in 2019 | Data Source: British Petroleum Statistical Review of World Energy 2020 (69th edition)**

% age share in primary energy consumption in 2019



rise of 3.3 per cent with Bangladesh and Vietnam individually increasing their shares of consumption by 18.6 per cent and 10.7 per cent, respectively.<sup>2</sup> China and India, however, continued to remain as the highest consumers of primary energy in the Asia Pacific consuming 24.3 per cent and 5.8 per cent of the continent's total share of energy respectively.<sup>2</sup> (Refer to Appendix 1 for a detailed bifurcation of consumption patterns of major economies in 2019). Natural Gas too has gained popularity as a major fuel in the primary energy mix consumption of the countries (Details mentioned in Appendix 2). For countries like Russia and Iran, the percentage share of natural gas is as high as over 50%.

India ranks as the third-largest consumer of energy in the world after the USA and China, with a share of 5.8% of the total primary energy consumed all over the world. The main sources of energy production in India are from either commercial or non-commercial sources<sup>3</sup>. Commercial sources occupy a more prominent position in terms of meeting the

bulk of industrial, transport and household demand while non-commercial sector caters to the rural and domestic sector.

Talking in terms of shortages, India falls short of its annual energy demand by 10.1% owing to limited production capacities. The energy sector is also faced by four most formidable barriers, which are energy subsidies, systemic inefficiencies, global competition and coping with climate change. There is also a gap between the demand and supply of energy, thus making India a power deficit nation with declining levels of oil production.

It is to address these challenges that the Government has taken pro-active measures in making India an energy surplus nation. From the Prime Minister's commitment of spending to the extent of 100 Billion USD in developing oil and gas infrastructure to over 10 million citizens giving up on their gas subsidies in order to ease fiscal pressure on the government machinery, steps are being taken in the right direction.

**Table 1.1: Region wise consumption of global primary energy in 2018 and 2019 along with the rate of change**

Region	Consumption in 2018 (exajoules)	Consumption in 2019 (exajoules)	%age change in 2019
North America	117.79	116.58	-1.0%
South and Central America	28.53	28.61	0.3%
Europe	84.76	83.82	-1.1%
CIS	38.81	38.68	-0.3%
Middle East	37.61	38.78	3.1%
Africa	19.39	19.87	2.5%
Asia Pacific	249.35	257.56	3.3%
<b>Total World</b>	<b>576.23</b>	<b>583.90</b>	<b>1.3%</b>

Data Source: British Petroleum Statistical Review of World Energy 2020 (69<sup>th</sup> edition)

<sup>2</sup>Data Source: British Petroleum Statistical review of World Energy 2020 (69<sup>th</sup> edition); pp 8-9 last accessed on December 7, 2020.

<sup>3</sup>Commercial Sources of energy production include thermal power, hydel power, power from oil, gas, nuclear etc. | Non-Commercial sources include non-institutionalized sources like firewood, and dung cakes.

## Role of Oil and Gas in India's Energy Landscape

Oil, termed to be one of the world's wealthiest resources has the power to transform not just nations but regions. It is the discovery of oil which has made the 5 Middle Eastern countries rank among the 25 wealthiest countries of the world. Thus, in redefining India's development story, energy's role cannot be diminished, and oil has a pre-eminent role to play.

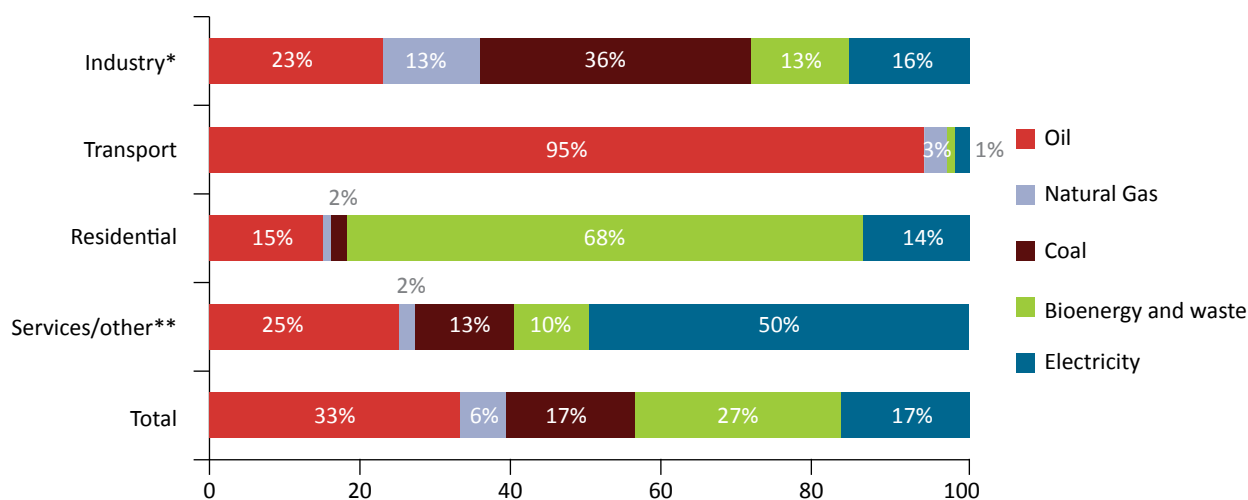
Besides being the third-largest consumer of energy, India is also the 3rd largest consumer of Oil in the world after China and the US. Oil and Gas form a part of the basket of the eight core sectors in India and thus are a major determinant in influencing the policies of all other sectors.

As per an estimate by the Ministry of Petroleum and Natural Gas, India currently has 41.87 billion tonnes of Oil and oil equivalent hydrocarbon resources in

its reservoir basins spread across three categories<sup>4</sup>. Category I has the basins which are being produced and exploited and is estimated to have 35,510.5 MMTOE in its reserves as of 2017. Category II has the basins which have contingent resources but are yet to be developed and monetised and are estimated to have 3878.1 MMTOE of Hydrocarbon reserves. Category III has basins which are prospective and are yet to be explored but are estimated at 2482.8 MMTOE of reserves.

Oil and Gas as sources of energy together provided for 44% of India's energy supply in 2010-11 and are expected to go up to 45% by 2024-25. India has also seen a net increase in its demand for energy with the industrial energy consumption increasing to 42% and the overall national energy consumption seeing a rise to almost 50%. The transport sector in India is dependent on Oil for 95% of all its energy needs and 98% when Oil and Gas are looked at together.

Figure 1.4: Total Final Consumption by Source and Sector



India's sectors show large variations in energy source, with clear dominance of oil in transport, bioenergy in the residential sector and electricity in commercial consumption.

\*Industry includes non-energy consumption.

\*\*Services/other includes commercial and public services, agriculture and forestry.

Note: The year runs from 1 April 2017 to 31 March 2018.

Source: IEA (2019a), World Energy Balances 2019, [www.iea.org/statistics/](http://www.iea.org/statistics/).

<sup>4</sup>Energising India's Progress (Annual Report 2019-20); Ministry of Petroleum and Natural Gas; 2019-20 as accessed on October 25, 2020

However, the oil and gas landscape in India is also marred by its share of challenges. Growing trade imbalance, the looming threat of climate change, lack of technological progression and absence of robust infrastructure are limiting the cost-efficient accessibility of Oil and Gas in the country.

The Government is mindful of the growing trade imbalance and has drafted policies to ensure Atmanirbharta in energy production and distribution. All this is being done while remaining true to the commitments made under the Paris accord of reducing Carbon emissions and ensuring capacity development of renewable energy production. Efforts are also being made to reduce import dependence on Oil, diversifying sources of supply and increasing investments in overseas oil fields.

However, in order to ensure the success of India's growth story, policy planning and analysis needs to

be done for the regulation of infrastructure in India. National Infrastructure Pipeline (NIP) announced by the Government of India is a positive step towards sectoral allocation of funds for development and regulation of relevant infrastructure required to ensure unimpeded growth, but the key to its success lies in the execution.

The inter-ministerial task force in its first report has allocated the highest share of 24% resources to the energy sector during the said period of FY 2020-25 thus giving the sector its due share of investments, what remains to be addressed is the regulation of the energy space to ensure equitable distribution thus making the growth story more inclusive. In this backdrop, the Oil and Gas Sector which is a major component of India's energy security fabric too needs to be re-assessed in terms of its operational efficiency and systemic effectiveness in order to realise the vision of an Energy Surplus India.

# Existing Channels of Transportation and Distribution of Oil and Gas

India's tryst with Crude Oil began with the exploration of the mineral in 1889 near Digboi in Assam. The Natural gas fields, on the other hand, were first discovered in Assam and Gujarat much later in the 1960s.

In the last century, the oil industry in India has grown from one private entity called the Assam Oil Company, which started the first oil refinery in India in 1901 to 23 operational refineries today. Out of these 23, 18 are under Public Sector, three under Private and two are in a Joint Venture. Indian Oil Corporation (IOC) is the largest refiner, followed by Bharat Petroleum and Reliance Industries.

India is reported to have produced 35.68 Mt of oil in 2017-18 with 600 MMT of proven oil reserves across the country. Gas reserves in 2017 stood at 1.2 trillion cubic metres with a production capacity of 31.83 BCM as reported in 2018.

## Oil Exploration

Crude Oil on exploration goes through multiple stages of exploration and refining before being transported to the Oil Marketing Companies (OMCs) and the end-user. State-owned ONGC is the biggest stakeholder in oil exploration in India with a 58.26% share in the total national oil production.

Both onshore and offshore explorations are permitted in the Indian basin. The permission to explore a specific geographic area or basin is obtained through the process of international competitive

bidding based on a revenue-sharing contract with the Government. Since 1991 the exploration policy of the Government of India has also evolved through various stages with the latest one being the Open Acreage Licencing Policy (OALP) adopted in 2017.

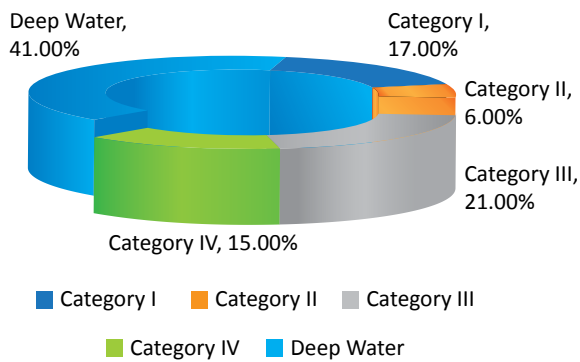
The OALP was looked at as a landmark change in the exploration policy of the country by granting interested companies the right to move their expression of interest in exploring an area, suo moto. Earlier, under the New Exploration Licencing Policy (NELP) only the sites/acreages identified by the government were put up for bidding. OALP also replaces the older profit-sharing model with a gross revenue sharing model.

Currently, crude oil and natural gas production in the country is happening in seven basins divided across 3 categories and deep waters. Category I basins are the ones with reserves and are being put into use for production and exploration, Category II basins are contingent resources and are yet to be monetised, Category III basins have prospective resources and are yet to be explored or discovered and Category IV basins are the ones which have an uncertain potential but by way of analogy with similar areas in other parts of the world might have some resources. Separately, there are deep water areas which are essential to offshore production.

## Oil Transportation

Transportation of oil forms a major component of the downstream segment of the Oil and Gas Industry. The onus of ensuring the regulation of refining,



**Figure 2.1: Distribution of Sedimentary Area (Category-wise)**

Data Source: Ministry of Petroleum and Natural Gas

processing, storage, transportation, distribution, marketing and sale of petroleum, petroleum products and natural gas lies on the Petroleum and Natural Gas Regulatory Board (PNGRB). Most of the transportation of oil and gas in India happens through four major modes: pipelines, roadways, railways and marine vessels.

## Pipelines

Pipelines are termed to be the most convenient way of transporting oil and gas amongst all the possible options. Globally, pipelines are the most preferred mode of transportation of goods and minerals across all terrains. 75% of the world's pipeline network lies in USA, Russia and Canada.

In the US, 70% of the transportation of crude oil and products happens through pipelines while 97% of oil is transported using them in Canada.

There are primarily two categories of pipelines which are used to transport crude oil, gas and their products:

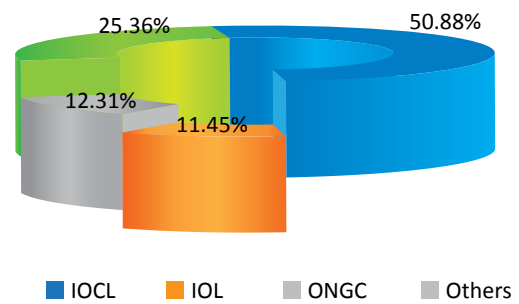
**Petroleum Pipeline:** These pipelines are used to transport petroleum and crude oil products from the site of exploration to the end destination. The petroleum pipeline is generally divided into two

kinds: *Crude Oil Pipelines* – used to transport oil from the site of exploration to refineries and *Product Pipeline* – used to transport final products such as gasoline to the market.

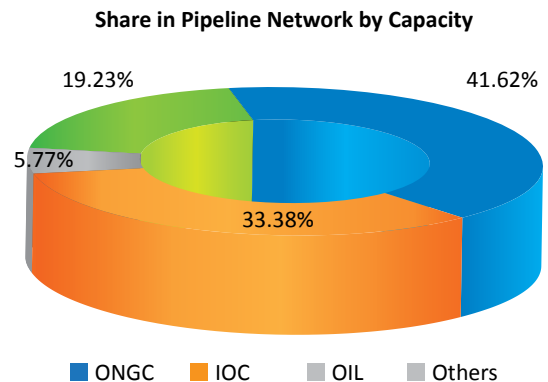
**Natural Gas Pipeline:** Natural Gas pipelines are used for the transportation of gas and products from stationary facilities to end destinations like homes or export centres.

## Status of Oil Pipeline in India

As on February 2, 2020 India is reported to have a total crude oil pipeline of 10,419 km along with an additional 18,169 km of pipes laid for transportation of crude oil products<sup>5</sup>.

**Figure 2.2: %age Share in total crude oil pipeline network (by length)**

Data Source: India Brand Equity Foundation

**Figure 2.3: %age Share in total crude oil pipeline network (by capacity)**

Data Source: India Brand Equity Foundation

<sup>5</sup>PPAC's Snapshot of India's Oil and Gas Data: Abridged Ready Reckoner (January 2020): Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas; February 18, 2020 last accessed on October 25, 2020

Indian Oil Corporation Limited (IOCL) accounts for 50.88% of the total crude oil pipelines laid in the country with a length of 5301 kms. State owned Oil and Natural Gas Corporation of India (ONGC) however has the highest share in crude oil transportation by volume.

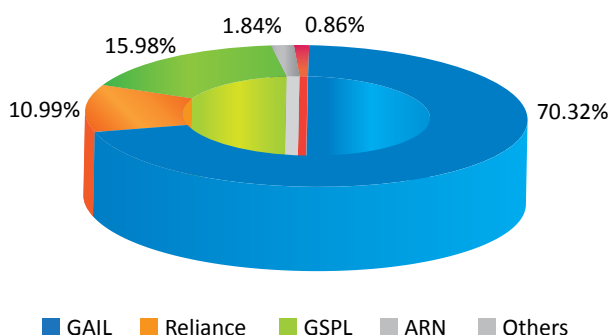
### Status of Natural Gas Pipeline in India

As on February 1, 2020 India had a Natural Gas Pipeline Network of 16,981 kms with a total carrying capacity of 387 MMSCMD.

Gas Authority of India Limited (GAIL) has laid the highest share of India’s natural gas pipeline with a 70.32% share in the total network. The top 3 contributors include GAIL, GSPL and Reliance.

**Figure 2.4: %age Share in total natural gas pipeline network (by length)**

Share in Total Natural Gas Pipeline Network (By Length)



Data Source: India Brand Equity Foundation

Under the New Infrastructure Pipeline, the Government has also approved the laying down of an additional pipeline for transportation of oil and gas across the country. While oil pipelines are the major carriers of crude oil, its products and natural gas they also prove to be the most effective.

### Strategic Advantage of Developing Pipeline Infrastructure

**Faster Delivery:** India is hugely dependent on imports to meet its local demands of oil and gas. While increasing domestic production will take

its own time to establish a condition of demand-supply equilibrium, what can be achieved in a relatively shorter period of time is better utilisation of transportation channels to ensure wider and faster delivery of oil and gas.

India has remained steadfast in its commitment to invest in cross-border pipelines to ensure safer and faster transportation of imported gas, however, it is the last mile connectivity from the import terminals to consumer stations that is missing. Developing an infrastructure network in line with the supply plans will ensure a better and more optimal use of the imported gas.

**Environment Friendly:** In 2017, India became the 80th country to ratify the Doha Amendment to the Kyoto Protocol for the second commitment period of 2017-2020. The ratification now puts India under a greater pressure to reduce its greenhouse gas emissions as per the internationally binding targets. Transportation of oil and gas by pipelines is reported to emit 61-77% lesser greenhouse gases as compared to transportation by rail over longer distances<sup>6</sup>.

As the demand grows and transportation of such minerals becomes even more complex in tune with the country’s development agenda, using more and more pipelines will lead to greener, cleaner and safer transportation of both oil and gas over longer distances.

**Economic Advantage:** Infrastructure development in any country leads to national development in terms of generating man days of employment thus driving the micro economy existing within.

Pipeline transportation being the most efficient way of transporting oil and gas both upstream and downstream will lead to larger volumes of the mineral flowing through it thus increasing the sectors contribution in the national GDP. Also, expansion of the existing infrastructure network will lead to greater manpower engagement.

<sup>6</sup>“Enbridge.com” as accessed on November 15, 2020

Figure 2.5: Map Depicting the major Natural Gas Pipeline Network in India

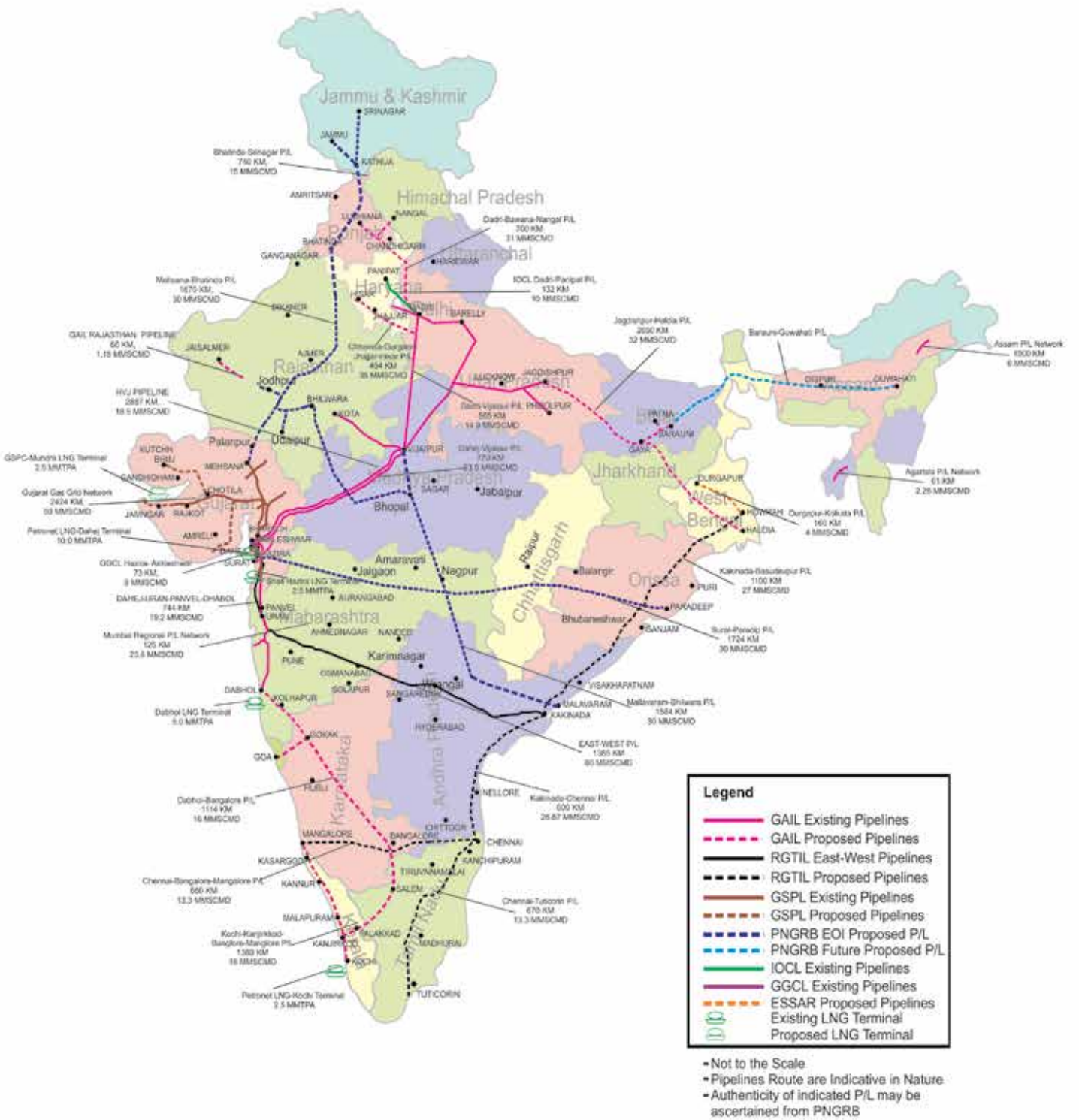


Image Source: PNGRB

**Example:** Pipeline construction between 2015-16 in the US led to an increase of 31.8 billion USD in annual labour income and a contribution of 46.9 billion USD to the national GDP<sup>7</sup>.

**Alternate uses of pipelines:** The pipelines while not being used for transporting the mineral they have been designed for could be used for the transportation of other minerals and gases thus leading to better cost utilisation. Also, there have been case studies of decommissioned gas pipelines being used as covers to lay fibre optic cables in difficult terrains; however, the success of such attempts is yet to be ascertained.

## Disadvantages

The disadvantages of pipeline transportation include high upfront investment cost while laying the pipeline and greater maintenance in rough terrains. However, this is offset by the longevity in use which lasts for decades.

## Roles and Regulators

### Petroleum and Natural gas Regulatory Board of India (PNGRB)

The PNGRB is tasked with the role of protecting the interests of both the consumers and the business entities alike while ensuring fair regulation of refining, processing, storing, transportation and distribution of Crude oil and its products and Natural Gas throughout the country.

The PNGRB is also the nodal body for inviting bids for any infrastructure expansion works for oil and gas in the country. The PNGRB invites bids for laying infrastructure and licences are allotted based on the prevailing policies. Ten rounds of bids for development of City Gas Distribution Networks (CGDN) have been completed successfully by the

PNGRB so far benefiting more than 70% of the country's population<sup>8</sup>.

With the successful completion of this latest round of CGD bidding, the country now has a CGD network in 228 Geographical Areas which comprise of 402 districts of the country spread across 27 States and Union Territories. By the end of 2029, with the 10th CGD Network distribution India will have an additional steel pipeline gas distribution network of 58,177-inch kilometre and 3578 additional CNG stations<sup>9</sup>.

### Directorate General of Hydrocarbons (DGH)

The establishment of DGH was a direct fallout of the liberalisation reforms of 1991 which broke the monopoly of Public Sector in the core industries of Oil and Gas exploration and production. Thus, DGH was setup as a supervising body managing the matters of leasing and licencing, ensure the safety and also look after the development, conservation and management of reservoirs of Hydrocarbon resources in India.

Setup under the administrative control of Ministry of Petroleum and Natural Gas, DGH reviews the exploration programmes of companies working in exploration and production. It also plays an advisory role to the Government of India in matters of licencing of new acreages and continuous use of existing ones. As a regulator, DGH also keeps a check on practices being adopted during exploration to ensure sound management of the reservoir.

Lastly, DGH is also the exploratory body for work on unconventional sources of energy like the possibility of use of Gas Hydrates, opportunities for Shale Gas Exploration and production and their commercial uses.

<sup>7</sup>"Pipelines, Rails and Trucks: Economic, Environmental and Safety impacts of transporting oil and gas in the U.S." ; strata.org last accessed on November 15, 2020

<sup>8</sup>"Press Release: Distribution of Letter of Intent for 50 Geographical Areas under the 10th CGD Bidding Round"; Petroleum and Natural gas Regulatory Board, Ministry of Petroleum and Natural Gas; March 1, 2019 as accessed on November 17, 2020

<sup>9</sup>Ibid.



# Challenges faced by the Oil and Gas Industry

India's Oil and Gas sector lies at the centre pin of its development story but is marred by multiple challenges both in terms of industrial and operational shortcomings. The challenges are multi-faceted in nature and range from ever-growing import dependence to non-inclusion of Oil in GST and the absence of adequate infrastructure in oil transportation.

## Growing Dependence on Import

According to a Report on Snapshot of India's Oil and Gas Data published by the Petroleum Planning and Analysis Cell, India's import dependence of crude oil (on consumption basis) stood at 85% in the year 2019-2020 which also made up for 25.1% of India's gross imports in terms of value<sup>10</sup>. The dependence dropped to 82.2% in August 2020 (Preliminary data) as compared to 84.4% during the same time last year. The drop is largely being accounted for the global lockdown and slowing down of economic activity owing to the pandemic.<sup>11</sup>

The larger question to be addressed is the growing import dependence of Indian industry for the supply of crude oil. Prime reason being attributed to this is the ageing of the currently operational oil wells which are being used for domestic extraction and production. The drying up of the wells is posing a

challenge in meeting the burgeoning demand.

While allocation of new oil wells has happened, the post allocation approvals slow down the process and thus a lot of time is wasted before these wells can be made operational and be used for extraction. Another fallout of the complications involved in the post allocation procedures and non-market driven pricing is the declining interest of both domestic and foreign players in participation in E&P related bidding.

Thus, inability of the Indian O&G industry to be able to ensure continuous supply from domestic sources is furthering the demand-supply gap leading to greater dependence on imports.

## Need for Robust Technological Infrastructure

Under the Government's recently rolled out Open Acreage Licencing Policy (OALP), interested bidders are invited to pick their suitable geographical locations for exploration by sending their expression of interests to the DGH. The basis of the OALP is reliant on the availability of data in the National Data Repository (NDR). Thus, a large part of the future of India's O&G Exploration is now reliant on geo-technological asset mapping.

<sup>10</sup>PPAC's snapshot of India's Oil and Gas Data: Abridged Ready Reckoner (August 2020)"; Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas; September 19, 2020 last accessed on December 7, 2020

<sup>11</sup>PPAC's snapshot of India's Oil and Gas Data: Abridged Ready Reckoner (August 2020)"; Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas; September 19, 2020 last accessed on December 7, 2020

Secondly, the Indian exploration companies are marred by technological challenges in terms of the availability of skills in exploration. The way to increase domestic production in India lies in the exploration of ultra-deepwater and deep-water oil and gas exploration, while efforts are being made by Indian domestic players to tap the potential of the high seas, lack of the right technology and outdated exploration facilities pose challenges. The exploitation of predictive modelling and big data analytics are key to improving the efficiency of upstream, midstream and downstream activities.

Upgradation of technological infrastructure around oil and gas assets is also necessary to ensure security. While strategic oil assets are protected and secured by the CISF in India, leakages and spillages in distribution channels are another form of the operational challenge being faced by the industry. Deployment of technological solutions like drone surveillance and geo-mapping can help in mitigating such risks and ensuring the safety and security of critical distribution channels.

## Securing E&P Assets

The twin challenges of lack of technological infrastructure and lack of security around key assets are largely intertwined. Most of the strategic oil assets of the country are either located in zones of high seismic activity or around areas of internal turbulence.

Central forces like CISF are mandated with the task of ensuring the physical security of such reserves from any attacks or hostile takeovers. In 2016, the Intelligence Bureau (IB) of India had issued an alert for beefing up of security around all O&G assets of the country backed on some unpleasant interceptions. While physical security of such assets has largely been catered for, what still remain to be addressed is the challenge posed by the attacks from the undefined cyber space.

Immunity of such assets can be ensured by building up on India's rich artificial intelligence capabilities. Internet of Things (IoT) devices like sensors, drones and other such surveillance equipment

can also be used to provide predictive data around seismic activities. Moreover, such mapping and monitoring is also useful in loss estimation in such case of distribution channel leakages or oil pilferages. Technological interventions are thus not only needed to improvise operational efficiencies but also to ensure the security and safety of such assets.

## Transportation of Oil

The majority share of oil transportation in India happens through pipelines which are also the cheapest and quickest form of transportation. The use of pipelines for transportation of natural Gas, its products, crude oil, petroleum and petroleum products has also eased the burgeoning burden on surface transport. Through the City Gas Distribution (CGD) Network and distribution of Gas through piped lines, the social base of resource availability has increased along with a reduction in leakages.

However, absence of adequate infrastructure and lack of resources pose certain challenges.

### i. Lack of adequate infrastructure

India currently has a pipeline infrastructure of over 45,000 kms including both Oil and Gas Pipelines. In order to achieve the ambitious target of increasing the use of primary energy in our energy mix to 15% by 2030 from the existing 6%, the transportation infrastructure needs to be expanded.

### ii. Policy Intervention

While PNGRB is tasked with the role of being the regulator for managing the transportation of oil and gas across the country, a clear pipeline policy is still missing. It is often the absence of a clear framework and structured policy which leads to bureaucratic delays leading to monopolisation in the hands of few players. Most of the oil pipelines in India (in length) are currently being laid by IOCL whereas GAIL is dominating the space for Gas Pipelines. Thus, the process of contracting and maintaining the pipelines should be more transparent and backed by project viability studies.

**iii. Price Supply conundrum**

The end-user cost of oil is not just simply dependent on the prices of crude oil but has a minority stake of various other factors as well. Cost of transportation is one such factor that determines the cost of Oil or Gas to the consumer. Thus, proper tariff regulation needs to be ensured to maintain the Advantage of cheaper mobility. While PNGRB has laid open-access guidelines and also earmarked transportation tariffs, the investment and expression of interest from private players are restricted to a minimum.

**iv. Lack of long-term plan**

While under the PNGRB a lot of ground has been covered in the way of successful bidding of multiple rounds of CGD and adding on to the total pipeline in the country, there is still an absence of a long-term vision for the sector. The long-term plan for the development of Oil and Gas Infrastructure needs to be envisioned in tandem with the national development plan of building smart cities, filling the demand supply gap, ease of mobility of oil and gas and access for all.

# Pipeline Infrastructure Development Entity

Being mindful of the multitude of challenges and absence of a long-term vision and frameworked policies for the sector, the industry has been vociferous in its demand for the establishment of a dedicated pipeline infrastructure development entity for oil and gas sector. To ensure wider and uniform availability of oil and gas across all regions for economic and social progress, country needs to augment its oil and gas trunk lines capacity.

Presently, PNGRB is the sole authority responsible for laying down guidelines with respect to the transportation of oil and gas in the country amongst its other tasks of regulating policies and decisions around processing, distribution, marketing and sale of natural gas, petroleum and its products. Certain regulatory reforms remain critical to the development and efficient usage of pipeline infrastructure for oil & gas sector In India. The entity (*for ease of reference being referred to as the National Pipeline Development Agency*) being proposed should have the mandate to design long-term vision, define projects, licence, and maintain the transportation of oil and gas through pipelines across India, as a part of PNGRB.

## Structure of the Proposed Entity

The agency being proposed shall be an entity under the umbrella of PNGRB, responsible for strategically designing the pipeline projects, in line with economic activities expected in the concerned regions, inviting equal representation from all stakeholders involved. The entity will ensure that the player marketing the commodity

is not the same as the entity developing infrastructure for that commodity. Thus, leading to a complete unbundling in the roles of marketer and transporter.

Complete separation of roles between the marketer and transporter will lead to reduction in the intra sector conflicts and help in expedition of the delivery of projects by reducing lean times. The unbundling of transmission and distribution segments has been suggested in National Infrastructure Pipeline report as well, with an objective to provide non-discriminatory access to gas transmission network. This will also ensure greater transparency in licencing, contracting, and ascertaining accountability. Separation of interests of players will negate the possibility of any possible monopolisation of market by a single player or the chances of having a market cartel.

## Role of the Agency (NPDA)

One challenge that has been highlighted time and again while elaborating on the challenges being faced by the O&G Industry is the delay in moving the imported gas and crude oil from coastal import terminals to demand centres, i.e., the absence of robust inland transportation network to ensure efficient and timely utilisation of the imported fuel. The NPDA thus being proposed will address this problem at the core. The NPDA will play the following roles to address the multi-layered challenges and regulate the logistics of Oil and Gas Industry in India.



### i. Defining long term vision plan

The NPDA will have mandate to develop a long-term pipeline infrastructure blueprint with definite milestones for the country, which shall serve as a guiding document for construction of pipelines. The vision plan shall be developed with an objective to address the energy requirement of economic corridors of the country, to address the regional imbalance of infrastructure availability, and to address the infrastructure and energy needs of strategically important geographies. The plan thus prepared shall ensure availability of energy to the farthest corners of the country, meeting the strategic objectives and shall ensure a boost to economic activities.

### ii. Project Implementation

In addition to developing a strategic plan for pipeline infrastructure, NPDA shall be responsible for designing and bidding out the projects based on the vision document. The entity will be responsible for demand assessment, network expansion assessment and feasibility analysis of such projects.

### iii. Promoting Ease of Doing Business

In the current scenario, PNGRB is tasked to invite bids and expressions of interest from interested players for the regulation, licencing, and maintenance of O&G pipelines. It is after the bids are secured, that the concerned firm has to approach PNGRB, Central Government and State Governments for the necessary approval and clearances. The multi-stakeholder approach though healthy to ensure fair competition leads to bureaucratic delays thus resulting in project cost over runs. On the other hand, a single point clearance system will further promote ease of doing business with clearly laid entry and exit policies.

## Business Structure

Owing to the importance of pipeline projects in economic and social growth of the country and in order to achieve the critical objective of energy

security, the pipeline projects by NPDA need to be considered under National Infrastructure Pipeline and the status of Infrastructure Projects should be awarded to them.

As mentioned above, the NPDA shall develop a long-term vision plan (proposed duration for the same is 10 years), in consultation with energy needs of the country, keeping in mind the strategic, economic, and social targets to be achieved in the said duration. On the basis of Vision Plan, the NPDA shall identify and design the pipeline projects in desired geographies, which will meet the desired infrastructure requirements and will meet the objectives.

With the projects identified, the NPDA shall conduct feasibility analysis and design a Pre-Feasibility Report (PFR). The PFR shall be a guiding document for the potential stakeholders, who would want to get involved in development of pipeline infrastructure. The entity will be bidding out the viable projects to suitable players, based on pre-defined criteria.

For the unviable projects, the NPDA shall explore alternate mechanisms to generate funds. One of such methods can be using PPP model under which it partners with a private firm for project implementation. The partnership firm will be selected based on the bids submitted by the investors with respect to the tender issued by the NPDA. The projects shall receive financial support from Government through any funding scheme, one of which can be Viability Gap Funding (VGF) Scheme.

Under this scheme, Government provides grant up to 20 per cent of the total capital cost of the project being implemented in Public Private Partnership (PPP) mode by a ministry, state government or statutory entity. An additional 20% of the project cost can be provided by state government, sponsoring ministry or the project authority to make project attractive for the investors. Potential investors bid for these projects based on the VGF needed. The project is awarded to the bidder which needs the least VGF assistance.

The NPDA shall enter into an Arbitral Award Escrow Account Agreement with the selected firm. The identified bank for the account will act like a trustee between both the parties. The agreement will include information like Project details, name of the concessionaire and type of project etc. The NPDA shall put some percentage of the funds allocated for the project in the ESCROW account. The percentage of the funds is pre-decided in the Arbitral Award Escrow Account Agreement with the selected organization. The funds are released to the organization responsible for the implementation of the project as per project need. This helps in ensuring that funds allocated for the project are not diverted for any other purpose.

### Learning from other Sectors

In India's development journey there has not been one casted development model, but it has been woven together with various piecemeal attempts unique to every sector. In the Oil and Gas Industry too, no one model can be applied in entirety, but lessons can be drawn from independent entities rolled out in the past to ensure the infrastructure development that the country is witness to.

India today has a total highway length of over 1,03,000 kms which handle almost 40% of the

national traffic yet occupy a miniscule share of just 1.3% of the total road network of the country. The National Highway Authority of India is the apex body responsible for the development, maintenance and management of the National Highways of the country. The Authority through the powers vested in it invites private players to bid for the development and management of the highways and based on the expression of interest and suitability of projects awards tenders. Such practices ensure transparency, regulation and existence of a level playing field amongst all players.

A parallel can also be drawn with the successful functioning of the Airport Authority of India (AAI). The AAI is responsible for the design, development, operation, and maintenance of Airports in India. In its endeavour to ensure the best services and facilities at both passenger and cargo terminals, AAI regularly invited bids from private players for expressions of interest in operating and managing airport terminals. The practice not only brings in private participation but also industrial experience of management, best class passenger service and amenities with greater chances of better and more efficient utilisation of the space available thus generating higher revenues. A very successful example of such out-sourcing are the Delhi and Hyderabad Airports run by GMR and the Mumbai Airport being run by GVK.

# Conclusion

Energy Security and leadership in energy consumption lies at the very basis of India's development story which will be written in the decades to come. In order to nudge a nation of 1.3 billion from traditional methods of energy consumption to a cleaner, safer and greener energy use pattern is a mammoth task. However, success lies in the details.

Any changes to be proposed in the energy consumption pattern need to be based on availability and ease of procurement of the alternates being proposed. The need of the hour is thus to have not just investments in building up the requisite infrastructure network but work around policies to support the development agenda. Our policies should thus be centred around institutional capacity building, promoting efficiency by cutting on lean times and ensuring separation of roles of regulators and benefactors.

Public Sector in India has played a major role in building up the Indian economy while striking the right balance with social development, however, the role played by the private sector too cannot be understated. Ever since the economic reforms of 1991, the Indian private sector has not only catalysed India's economic growth but has also come out as the alternate voice in matters of social and national development.

The Indian corporate industry boasts of subject and domain experts who with their experience and expertise have been able to become stakeholders in furthering the national agenda. The Economic Survey of 2019-20 released by the Government of India also talks in detail about the improvement in performance

of Central Public Sector Enterprises (CPSEs) post privatisation. Specific to the O&G Sector, the stakeholder equity of Bharat Petroleum Corporation Limited (BPCL) increased by 33,000 crores INR post the strategic disinvestment against its peer Hindustan Petroleum Corporation Limited (HPCL).

The idea of NPDA is thus being proposed after thorough analysis of success stories of private partnership in Infrastructure building in India and world over. Through the NPDA, an attempt is being proposed to be made in the direction of laying down a robust policy framework for transportation of oil and gas in the country.

With the introduction of economic corridors and Special Economic Zones, the development of hard infrastructure such as roads, rails, airports and ports has been expedited but the development of facilities for transportation of oil and gas and related infrastructure have taken a hit. With the Government on a mission of developing 100 Smart Cities all across the country, such pipeline networks become inseparable to the long-term national development vision.

Figure 2.5 shows a map depicting the extant of O&G pipeline network spread across the country. While the density of pipeline coverage is high in Northern and Southern India, North-Eastern part of the country is a clear blind-spot with states like Arunachal Pradesh being totally away from any pipeline whatsoever.

As per the projections contained in the Vision Document 2030 published by the PNGRB, demand for natural gas is expected to go down in the western part of the country from 43% to 32%<sup>12</sup> by 2029-

2030. While a surge in demand is expected in the Northern, Southern and Eastern part of the country. When these projections are super-imposed over the existing and proposed pipeline network as depicted in Figure 2.5, the projects to be developed in line with the proposed demand become prominent.

Thus, pipeline infrastructure development needs to be done with a long-term vision supported by empirical data to address the regional imbalance of infrastructure availability. The proposed NPDA should work on drawing an inclusive development plan of such a network so as to reduce the number of blind spots in the country and make energy more accessible to farthest and remotest corners in line to stimulate both demand and supply.

A case in point is the success story of Gujarat in ensuring the availability of natural gas throughout the state. In a time span of about two decades, Gujarat has not only increased the share of natural gas in its energy consumption mix but also accounts for 32% of the total gas consumption in the country<sup>13</sup>. Post the successful conclusion of the 9th and 10th round of CGD bidding, the state is now fully covered by the CGD Network.

The Government through the state-owned Gujarat State Petroleum Corporation (GSPC) along with the proactive participation of private players was able to create demand for gas in the state pillared on the presence of a robust pipeline network. Thus, infrastructure development and availability of gas became the reason for a shift towards gas-based economy in Gujarat instead of laying infrastructure based on demand.

The mandate of the proposed NPDA is also aligned with one of the many mandates of the National Infrastructure Pipeline (NIP) which aims to facilitate design, delivery and maintenance of public infrastructure as per global standards to stimulate demand.

An “Atmanirbhar Bharat” ensuring “energy justice” built on the foundations of “One Nation One Gas Grid” requires the stakeholder-ship of all of its 1.3 billion citizens to provide “energy security” to all. In line with the Government of India, the Indian private sector too is steadfast in its commitment to deliver the best while ensuring adherence to socially safe practices.

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<sup>12</sup>“Vision 2030: Natural Gas Infrastructure in India”; Industry Group for Petroleum and Natural Gas Regulatory Board of India; May 2013; last accessed on December 7, 2020

<sup>13</sup>“Setting an Example”; Indianinfrastructure.com as accessed on December 7, 2020

## Appendix 1

### Primary Energy Consumption Pattern of Global Economies in 2018 and 2019

Appendix 1.1: Primary Energy Consumption Pattern of Global Economies in 2018 and 2019 along with the growth pattern

Country	Consumption in 2018 (exajoules)	Consumption in 2019 (exajoules)	%age change in 2019
Canada	14.35	14.21	-0.9%
Brazil	12.13	12.40	2.2%
France	9.87	9.68	-1.9%
Germany	13.44	13.14	-2.2%
United Kingdom	7.96	7.84	-1.6%
Russian Federation	30.04	29.81	-0.8%
Iran	11.83	12.34	4.3%
Saudi Arabia	10.91	11.04	1.2%
United Arab Emirates	4.80	4.83	0.6%
South Africa	5.30	5.40	2.0%
Bangladesh	1.48	1.76	18.6%
China	135.77	141.70	4.4%
India	33.30	34.06	2.3%
Singapore	3.61	3.55	-1.5%
South Korea	12.55	12.37	-1.4%
Vietnam	3.72	4.12	10.7%

Data Source: British Petroleum Statistical Review of World Energy 2020 (69<sup>th</sup> Edition)

## Appendix 2

### Pattern of Global Primary Energy Consumption by Fuel in 2019

#### Appendix 2.1: Pattern of Global Primary Energy Consumption by Fuel in 2019

Country	Oil	Natural Gas	Coal	Nuclear Energy	Hydroelectricity	Renewables	Total
Canada	4.50	4.33	0.56	0.90	3.41	0.52	14.21
Brazil	4.73	1.29	0.66	0.14	3.56	2.02	12.40
France	3.15	1.56	0.27	3.56	0.52	0.61	9.68
Germany	4.68	3.19	2.30	0.67	0.18	2.12	13.14
United Kingdom	3.11	2.84	0.26	0.50	0.05	1.08	7.84
Russian Federation	6.57	16.00	3.63	1.86	1.73	0.02	29.81
Iran	3.92	8.05	0.05	0.06	0.26	-	12.34
Saudi Arabia	6.92	4.09	-	-	-	0.02	11.04
UAE	1.95	2.74	0.10	-	-	0.04	4.83
South Africa	1.18	0.15	3.81	0.13	0.01	0.12	5.40
Bangladesh	0.37	1.24	0.14	-	0.01	-	1.76
China	27.91	11.06	81.67	3.11	11.32	6.63	141.70
India	10.24	2.15	18.62	0.40	1.44	1.21	34.06
Singapore	3.06	0.46	0.03	-	-	0.01	3.55
South Korea	5.30	2.01	3.44	1.30	0.02	0.29	12.37
Vietnam	1.07	0.35	2.07	-	0.58	0.04	4.12

Data Source: British Petroleum Statistical Review of World Energy 2020 (69<sup>th</sup> Edition)

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