



A

DISSERTATION REPORT

ON

CITY GAS DISTRIBUTION: BUSINESS DEVELOPMENT AND ANALYSIS

By

Saroj Rani, 500070779

MBA Logistic and Supply Chain Management

At

Indian Oil Adani Gas Private Limited

Chandigarh



IndianOil-Adani Gas Pvt. Ltd.  
Chandigarh

Under the guidance

of

Mr. Kamaldeep Singh

AM (Associate Manager)

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR

MBA Logistic and Supply Chain Management

of

CENTRE FOR CONTINUING EDUCATION

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES, DEHRADUN

INDIA, JANUARY 2020

## APPENDIX – II

## ACKNOWLEDGEMENT

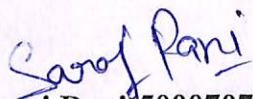
It is often said that life is a mixture of achievements, failures, experiences, exposures and efforts to make your dream come true. There are people around you who help you realize your dream. I acquire this opportunity with much pleasure to acknowledge the invaluable assistance of Indian Oil Adani Gas Private limited and all the people who have helped me through the course of my journey in successful completion of this project.

I wish to express my sincere gratitude to my Company Guide, **Mr. Kamaldeep Singh, Associate manager, Business Development (Marketing)**, at IOAG Private Limited for his guidance, help and motivation. Apart from the subject of my study, I learnt a lot from him, which I am sure, will be useful in different stages of my life. I would like to thank **Mr. Shubham Agrawal**, Assistant Manager (Marketing) for his help in understanding the Domestic – PNG and customer relationship management. I would also like to thanks **Mr. Gagan Mohan**, Assistant Manager (Marketing) Chandigarh for his guidance, review and helpful comments.

I would like to extend my heartfelt thanks to, **Mr. Sanjay Tarat**, DGM, IOAGPL Chandigarh for providing me with resourceful insights into the industry.

My sincere thanks to **Mr. Surinder Pal**, HR-Head IOAGPL for providing me the opportunity to work & providing all support at IOAG Pvt. Ltd..

I express my thanks to **University of Petroleum and Energy Studies, Dehradun centre for continuing education** for this opportunity.



Saroj Rani(500070779)

MBA Logistic and Supply Chain Management

[sarojchauahan87@gmail.com](mailto:sarojchauahan87@gmail.com)

Contact no.9781760562

Chandigarh



IndianOil-Adani Gas Pvt. Ltd.

**Letter of Acceptance**

Guide Name: Mr. Kamaldeep Singh

Designation: - Associate Manager (CGD-Projects)

Company: - IndianOil-Adani Gas Pvt Ltd

Full contact details: IndianOil-Adani Gas Pvt. Ltd.

Business Development (Gas)

Plot No.55, Aspire Tower, 5<sup>th</sup> Floor,

Industrial & Business Park, Phase-1,

Chandigarh-160002

Contact No.:- +918558815499

Email: - kamaldeep.singh@ioagpl.com

Subject:-Willingness for Guiding Dissertation of Saroj Rani SAP ID.500070779

Dear Sir,

Ms Saroj Rani is registered for MBA (Logistic and Supply Chain) program with the University Of Petroleum & Energy Studies, Dehradun in the 2018-2020 batch.

I hereby give my acceptance to guide the above student through the Dissertation work "**City Gas Distribution: Business Development and Analysis**": which is a mandatory academic requirement for the award of the EMBA degree.

Thanking You

Yours Sincerely



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## **List of Abbreviations**

**IOAGPL- Indian Oil Adani Gas Pvt Ltd**

**AGL- Adani Gas Ltd.**

**IOCL- Indian Oil Corporation Ltd**

**GAIL- Gas Authority of India Ltd.**

**ONGC-Oil and Natural Gas Corporation**

**PNGRB- Petrol and Natural gas regulatory Board**

**MoPNG- Ministry of petrol and natural gas**

**OPEC- Organization of Petroleum Exporting Countries**

**CGD- City gas distribution**

**PNG- Piped natural gas**

**CNG- Compressed natural gas**

**LNG- Liquefied natural gas**

**LPG- liquefied petroleum gas**

**GA- Geographical area**

**MMSCMD- Million metric standard cubic meter per day**

**DRS- District regulatory system**

**MRS- Meter Regulatory System**

**SR- Service regulator**



## 1. Executive Summary

Efficient, easy to transport and with a high calorific value, natural gas could play an important role in a clean energy future for India. The country is already home to 22 of the world's 50 most polluted cities. Realizing the perils in this scenario, and committed to protecting the environment, the Indian government has announced the aspiration to increase its share of natural gas in the overall energy consumption mix to 15 percent<sup>[1]</sup>, compared to the 2018 figure of 6.2 percent, as one of its important initiatives for a more sustainable future. Robust and proactive efforts to boost the use of natural gas could help India march towards meeting this aspiration. These could also be some of the most important levers to help the country reduce its carbon footprint by 33 to 35 percent from its 2005 levels, fulfilling its commitment to the United Nations Framework Convention on Climate Change (2015).

City Gas Distribution business is a growing business with providing service at cheaper price and convenience. It is aimed at providing cleaner fuel to the domestic commercial and Industrial customers. There are challenges in the market with neck to neck competition with LPG and other highly polluting products such as Pet coke and furnace oil that are available at very low prices.

This study further provides detailed profiling of Chandigarh GA with analysis of the of PNG potential with special emphasis on commercial prospects. The report has its focus on expansion of present MPDE network with study the investment feasibility. The project report also brings out certain recommendations that may be useful in delivering better services to the emerging PNG market.

There is a huge domestic and commercial potential that still need to be penetrated but with the long installation process and infrastructure heavy investments it will take some time to reach the target. An analysis of the sector 91 and sector 67 Mohali is conducted to find out the number of potential customers. To increase the revenue company can make some offers to add commercial PNG conations in there basket.

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<sup>1</sup> Ministry of statistics and program impimentaion, India

## 2. Introduction

This report is prepared to fulfil the requirement of the MBA Logistic and Supply Chain Management program of University of Petroleum and Energy Studies, Dehradun, Uttarakhand on “City Gas Distribution: Business development and analysis” at Indian Oil Adani Gas Private Limited. I have chosen Indian Oil Adani Gas Private limited because it is the fastest growing CGD Company over the country. It has recently acquired 22 new Geographical in the 9<sup>th</sup> bidding round and it is also working in full swing where company has started providing service.

The primary focus of the study is to understand the City Gas Distribution network, infrastructure and working of the organisation in developing the business. The domestic and commercial sector was analysed and the different requirements of the customers and businesses were understood.

The study include the geographical profiling of the Sector 91 and Sector 67 Mohali, Punjab and the B2B marketing with the sector 35 sector hotel. A case of hotel Maya is also discussed regarding the real life problems faced by marketing team and how to handle situations to achieve the best output in the situation.

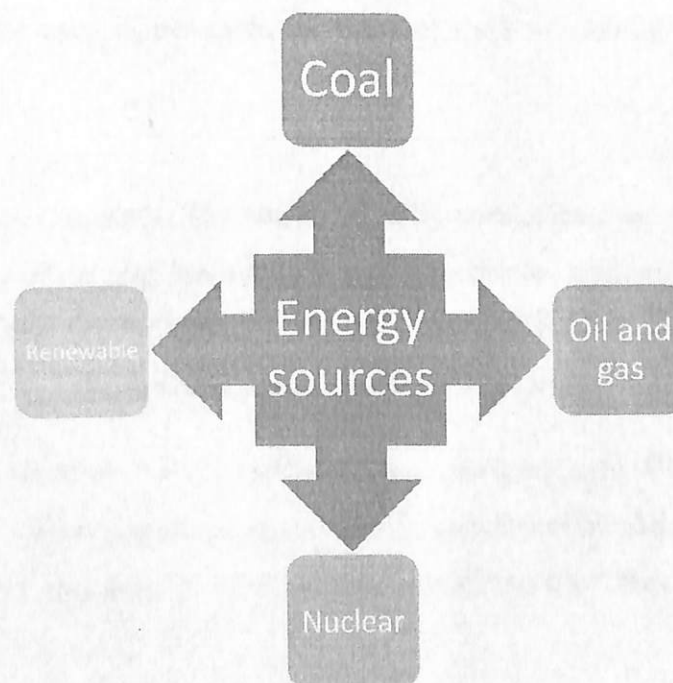


### 3. Literature Review

#### 3.1 Sources of energy

In this digitally driven world everything works with the help of energy. We need energy to run industrial, commercial and household operations. The general definition of Energy is the capacity of a physical system to perform work. Energy exists in several forms such as heat, kinetic or mechanical energy, light, potential energy, electrical, or other forms. Energy is the ability to do work. Energy sources could be classified as Renewable and Non-renewable. Today World's 80% of the energy is generated through non-renewable energy sources such as coal and petroleum products. These petroleum products are refined and processed to convert these into other form of energy such as heat, light and electricity. All these sources of the energy are essential to drive a nation.

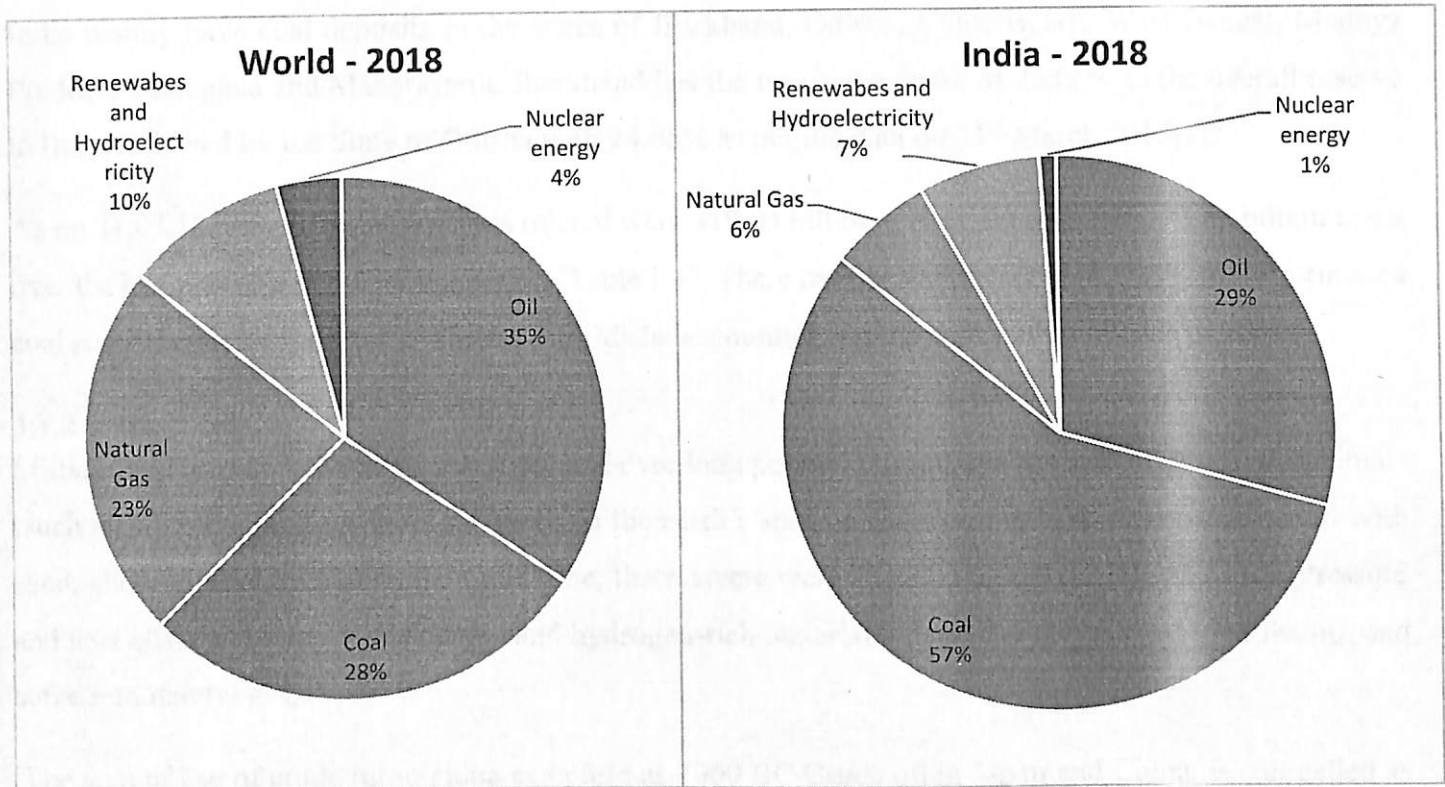
From the beginning humans are using various energy resources to make their life easier after the use of fire to heat themselves and cook food it became easier for the humans to habitat, fire also provided light at night and helped in keeping themselves warm. Humans domesticated animals and started agriculture After this coal came into picture. Coal was used as a fuel for heating and cooking that could burn for longer hours. With the start of Industrial era there was an increased demand of coal. During this though non- reliable steam powered engines were in use. With the advancement in steam engines mining improved so does the demand for coal increased. Now the coal was needed for the steam engines and also for the industries, after this there was a rise in the demand of coal. During this period other sources of energy were extracted from earth and there were various techniques were used to extract these



**Figure 1: Energy Sources**

fuel such as Crude Oil and Natural gas. Now there are various energy sources but the petroleum products popularity grew widely as these were most reliable energy sources and also these were not dependent on

natural environment. To run various machines energy is required just like our body need food. These machineries are of different type and require different types of energy sources or we have developed them as per there need some of the sources of energy are coal, oil and gas, Bio fuel, electricity. Below given energy mix pie chart represents that India's share of natural gas is 6% to the 23%<sup>[2]</sup> in the world.



**Figure2: Energy MIX analysis World and India<sup>[3]</sup>**

All the sources of energy are used as per there convince or their availability in the area some of these sources are explained below.

### 3.1.1 Coal

Coal is the most abundant of fossil fuels. The world currently consumes over 7,800 million tonnes of coal which is used by a variety of sectors including power generation, iron and steel production, cement manufacturing and as a liquid fuel. The majority of coal is either utilised in power generation that utilises steam coal or lignite, or iron and steel production that uses coking coal.

The role of coal in power generation is set to continue. Coal currently fuels 40% of the world's electricity and is forecast to continue to supply a strategic share over the next three decades. The largest coal producing countries are not confined to one region. The top five producers are China, the US, India, Indonesia, Australia and South Africa.

<sup>2</sup> BP Statistics

<sup>3</sup> PPAC

Coal is known as the most carbon-intensive fossil fuel and the continuing use of coal in global electrification could have implications for climate change mitigation strategies. The introduction of various carbon management schemes, particularly carbon capture and storage (CCS), is vital to mitigate the impact of future coal use on the environment.

### 3.1.1.1 Trends in India:

India mainly have coal deposits in the states of Jharkhand, Odisha, Chhattisgarh, West Bengal, Madhya Pradesh, Telangana and Maharashtra. Jharkhand has the maximum share of 26.06% in the overall reserve in India followed by the State of Odisha with 24.86% as per the data on 31<sup>st</sup> March 2018[4].

As on 31.03.18, the estimated reserves of coal were 319.04 billion tonnes, an addition of 3.88 billion tones over the last year in corresponding period (Table 1.1). There has been an increase of 1.23% in the estimated coal reserves during the year 2017-18 with Odisha accounting for the maximum increase of 2.6%.

### 3.1.2 Oil and Gas:

Millions to 100's of millions of years ago and over long periods of time, the remains of plants and animals (such as diatoms) built up in thick layers on the earth's surface and ocean floors, sometimes mixed with sand, silt, and calcium carbonate. Over time, these layers were buried under sand, silt, and rock. Pressure and heat changed some of this carbon and hydrogen-rich material into coal, some into oil (petroleum), and some into natural gas.

The sign of use of crude oil in china as before as 2000 BC Crude oil in Japan and China, is still called as stone oil. In 1847 it was extracted and used for making oil for lamp oil, at the same time obtaining a thicker oil suitable for lubricating machinery.

The industry grew through the 1800s, driven by the demand for kerosene and oil lamps. It became a major national concern in the early part of the 20th century; the introduction of the internal combustion engine provided a demand that has largely sustained the industry to this day. Today, about 90% of vehicular fuel needs are met by oil. Petroleum also makes up 40% of total energy consumption in the United States, but is responsible for only 2% of electricity generation. Petroleum's worth as a portable, dense energy source powering the vast majority of vehicles and as the base of many industrial chemicals makes it one of the world's most important commodities.

### 3.1.3 Natural Gas

Natural gas is a fossil energy source that formed deep beneath the earth's surface. Natural gas contains many different compounds. The largest component of natural gas is methane, a compound with one carbon atom and four hydrogen atoms (CH<sub>4</sub>). Natural gas also contains smaller amounts of natural gas

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<sup>4</sup> MOSPI India

liquids (NGL; which are also hydrocarbon gas liquids), and non-hydrocarbon gases, such as carbon dioxide and water vapour. We use natural gas as a fuel and to make materials and chemicals.

When natural gas is formed it moves into large cracks and spaces between layers of overlying rock. The natural gas found in these types of formations is sometimes called conventional natural gas. In other places, natural gas occurs in the tiny pores (spaces) within some formations of shale, sandstone, and other types of sedimentary rock. This natural gas is referred to as shale gas or tight gas, and it is sometimes called unconventional natural gas. Natural gas also occurs with deposits of crude oil, and this natural gas is called associated natural gas. Natural gas deposits are found on land and some are offshore and deep under the ocean floor. A type of natural gas found in coal deposits is called coalbed methane.

Properties of Natural Gas:

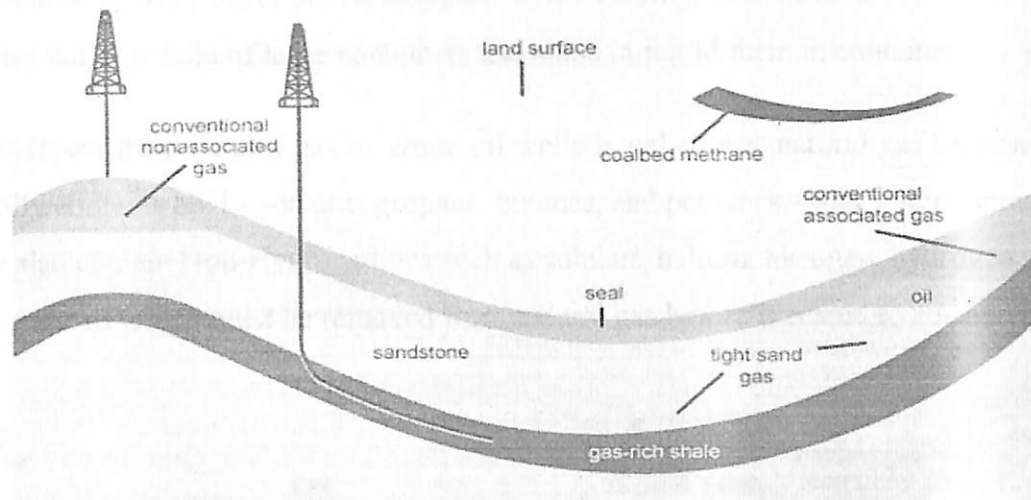
Composition is 90 % Methane (CH <sub>4</sub> ) and other hydrocarbons	
Colour	Colourless
Odour	Odourless
Specific gravity	0.6 w.r.t air
Boiling point	- 161.5° C
Melting point	- 185° C
Explosive limit	5% to 15% by volume in air
Auto ignition	540° C/1076 F

Table 1: Properties of Natural Gas

### Sources of Natural Gas

Raw natural gas may come from any one of three types of gas wells:

- **Crude oil wells**—Raw natural gas that comes from crude oil wells is called associated gas. This gas can exist separate from the crude oil in the underground formation, or dissolved in the crude oil. Condensate produced from oil wells is often referred to as lease condensate.
- **Dry gas wells**—These wells typically produce only raw natural gas that contains no hydrocarbon liquids. Such gas is called non-associated gas. Condensate from dry gas is extracted at gas processing plants and is often called plant condensate.
- **Condensate wells**—These wells produce raw natural gas along with natural gas liquid. Such gas is also called associated gas and often referred to as wet gas.



Source: Adapted from United States Geological Survey factsheet 0113-01 (public domain)

**Figure3:** Schematic geology of natural gas resources

### Production of Natural Gas

Geologists often use seismic surveys on land and in the ocean to find the right places to drill natural gas and oil wells. Seismic surveys create and measure seismic waves in the earth to get information on the geology of rock formations. Seismic surveys on land may use a thumper truck, which has a vibrating pad that pounds the ground to create seismic waves in the underlying rock. Sometimes small amounts of explosives are used. Seismic surveys conducted in the ocean use blasts of sound that create sonic waves to explore the geology beneath the ocean floor. If the results of seismic surveys indicate that a site has potential for producing natural gas, an exploratory well is drilled and tested. The results of the test provide information on the quality and quantity of natural gas available in the resource.

If the results from a test well show that a geologic formation has enough natural gas to produce and make a profit, one or more production (or development) wells are drilled. Natural gas wells can be drilled vertically and horizontally into natural gas-bearing formations. In conventional natural gas deposits, the natural gas generally flows easily up through wells to the surface.

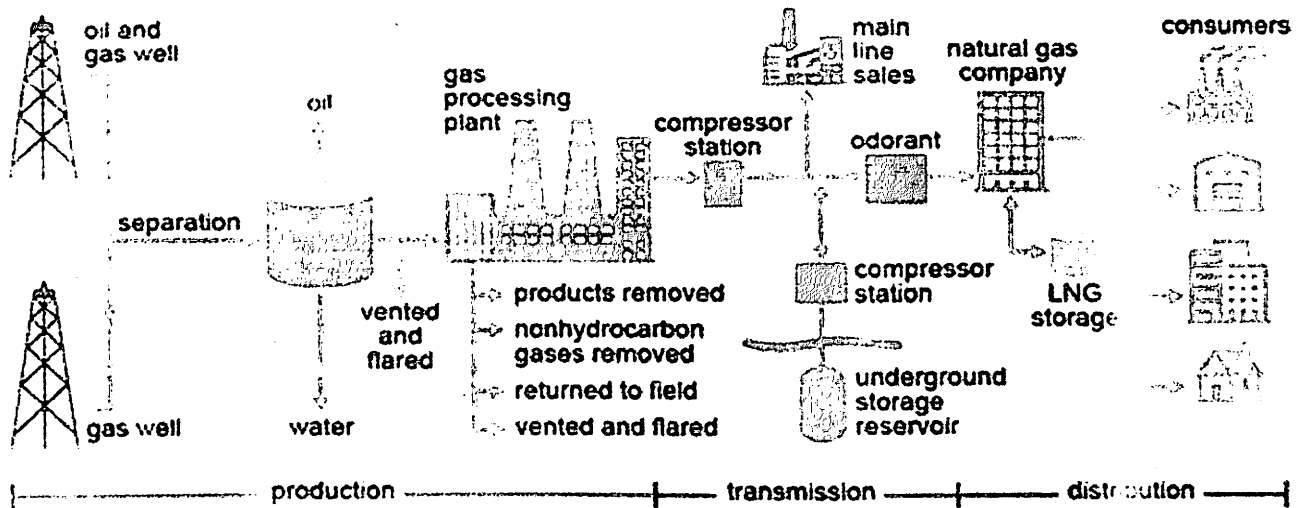
Natural gas is produced from shale and other types of sedimentary rock formations by forcing water, chemicals, and sand down a well under high pressure. This process, called hydraulic fracturing or fracking, and sometimes referred to as unconventional production, breaks up the formation, releases the natural gas from the rock, and allows the natural gas to flow to and up wells to the surface. At the top of the well on the surface, natural gas is put into gathering pipelines and sent to natural gas processing plants.

In earlier days' natural gas was released when oil was being dug and at that was it was considered as a problem, as it was difficult to handle and could not be consumed at that time. Only a small portion could be used for heating up and running machinery. After this industry was set to deliver the gas to the stations



from where it could be transported to the various parts of the country with the help of pipes and transported to another country with the help of large containers and ships in liquid form in containers

Natural gas withdrawn from natural gas or crude oil wells is called wet natural gas because, along with methane, it usually contains NGL—ethane, propane, butanes, and pentanes—and water vapours. Wellhead natural gas may also contain Non-Hydrocarbons such as sulphur, helium, nitrogen, hydrogen sulphide, and carbon dioxide, most of which must be removed from natural gas before it is sold to consumers.



**Figure 4: Natural Gas delivery and production**

From the wellhead, natural gas is sent to processing plants where water vapours and non-hydrocarbon compounds are removed and NGL are separated from the wet gas and sold separately. Some ethane is often left in the processed natural gas. The separated NGL are called natural gas plant liquids (NGPL), and the processed natural gas is called dry, consumer-grade, or pipeline quality natural gas. Some wellhead natural gas is sufficiently dry and satisfies pipeline transportation standards without processing. Chemicals called odorants are added to natural gas so that leaks in natural gas pipelines can be detected. Dry natural gas is sent through pipelines to underground storage fields or to distribution companies and then to consumers.

In places where natural gas pipelines are not available to take away associated natural gas produced from oil wells, the natural gas may be re-injected into the oil-bearing formation, or it may be vented or burned (flared). Re-injecting unmarketable natural gas can help to maintain pressure in oil wells to improve oil production.

Coal-bed methane can be extracted from coal deposits before or during coal mining, and it can be added to natural gas pipelines without any special treatment.

India plans to electrify millions of households that still burn wood for light, heat and cooking. Like China, it also plans to reduce its heavy reliance on thermal coal, a bigger polluter than gas. The gas would also be needed to provide power to electric vehicles, which India plans to account for all new car sales by 2030.



## 4. Company Profile

### 4.1 Indian Oil Adani Gas Private Limited:

A Joint Venture of Indian Oil Corporation Ltd India's flagship national oil company and highest ranked Indian company in the prestigious Fortune 'Global 500' listing & Adani Gas Ltd part of diversified ADANI GROUP and a leading city gas distribution company have formed a 50: 50 Joint Venture Company with an objective of developing natural gas distribution networks in various Indian cities to provide safe, convenient, reliable and environment friendly fuel (Natural Gas) to customers in industrial, commercial, domestic and transport sectors. The registered head office of Indian Oil Adani Gas is situated at 3rd Floor,306-309, Salcon Aurum, Plot No.4, Jasola District Centre, New Delhi- 110025.

**Vision:** To have pan India presence and secure authorization for as many cities as possible and become "*CGD Company of India*".

IOAGPL, incorporated in October 2013, is an equal JV of IOCL and AGL. IOAGPL was authorised by PNGRB through its order dated May 8, 2013<sup>5</sup>, to lay, implement, and operate CGD networks in Allahabad and Chandigarh. These CGD projects were put up for bidding in round two of the auctions. The company won CGD projects for Ernakulam, Panipat, and Daman in round four; Dharwad and Udham Singh Nagar in round five; South Goa and Bulandshahr in round eight. These nine projects are being implemented at an estimated cost of Rs 1590 crore in the first five years. PNGRB Board had issued letter of authorization for Allahabad, Chandigarh, Panipat, Udham Singh Nagar, Daman, Dharwad and Ernakulam to IOCL & AGL consortium.

IOAGPL recently welcomed Mr. Rajiv Sikka as the CEO of the company. On the list of Directors, Mr Shailesh Kumar Sharma, Mr. Suresh P Mangalani, Mr Sanjeev Goel and Mr. Naresh Poddar Guiding the company to reach its goals.

With the high potential company won the bid for the seven Geographical Areas till 8<sup>th</sup> CGD bidding round.

Sr No.	CGD Bidding Round	GA	State	Date of Authorisation
1	2	Chandigarh, Panchkula(part), SAS Nagar (part), Solan(part) and Allahabad (part) Districts	Chandigarh, Haryana, Punjab, Himachal Pradesh and Uttar Pradesh	8-May-2013

<sup>5</sup> PNGRB

2	4	Panipat, UT of Daman,	Haryana,Daman and Diu,	01-April- 2015
3	4	Ernakulam District	Kerala	14-October-2015
4	5	Udham Singh Nagar District	Uttrakhand	28-July-2015
5	5	Dharwad District	Karnatka	14- September- 2015
6	8	South Goa District	Goa	7-Feb-2018
7	8	Bulandshahr(part) District	Uttar Pradesh	6-March-2018

**Table 2: Geographical Areas till 8<sup>th</sup> CGD bidding round**

In 9<sup>th</sup> bidding round Indian oil Adani Gas Private Limited got 22 geographical areas and in 10<sup>th</sup> round Bidding round IOAGPL got bid for 1 Geographical area Jaunpur and Ghazipur Districts in Uttar Pradesh.

## **4.2 Indian Oil Adani Gas Chandigarh:**

Chandigarh office of IOAGPL was established in November 2013. The office is headed by Mr. Sanjay Tarth who is the DGM/Asset Head for Chandigarh GA.

Indian Oil-Adani gas pvt ltd, Chandigarh handles a vast geographical area which contains following of the major areas:

1. Chandigarh
2. Mohali
3. Panchkula
4. Dhanas
5. Manimanjra
6. Zirakpur
7. Dera bassi
8. Shimla

### **4.2.1 CGD Business in Chandigarh:**

Indian Oil Adani Gas provide piped natural gas and CNG in the geographical areas of Chandigarh. IOAGPL sources the natural gas from GAIL (Gas Authority of India Limited) Bhavana-Nangal pipeline at Rajpura.

As Gail is the India's largest marketer of natural gas It provides continues supply of natural Gas. A City Gate station is established at Rajpura it changes the gas pressure to 19 Bar from 31 Bar

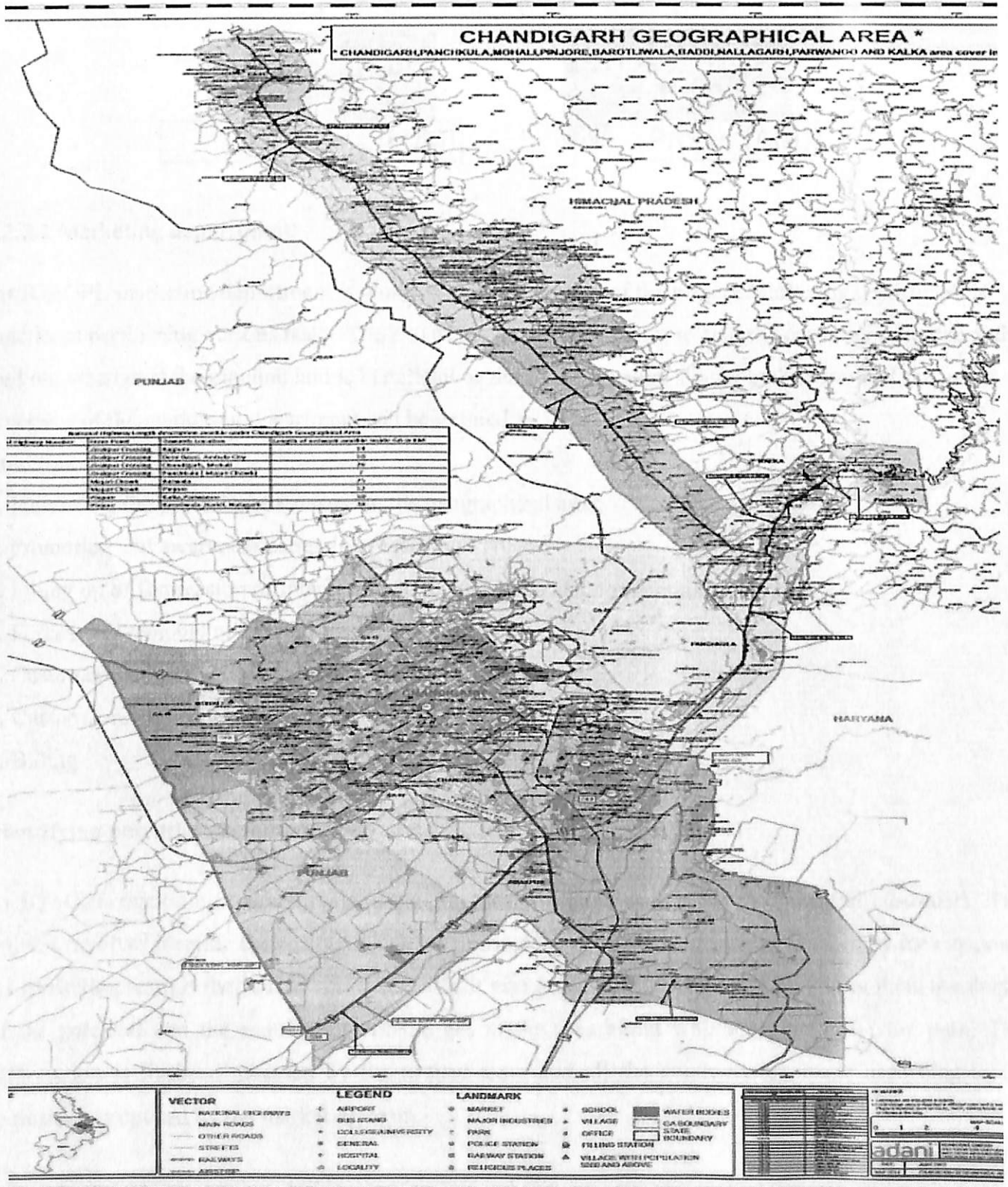
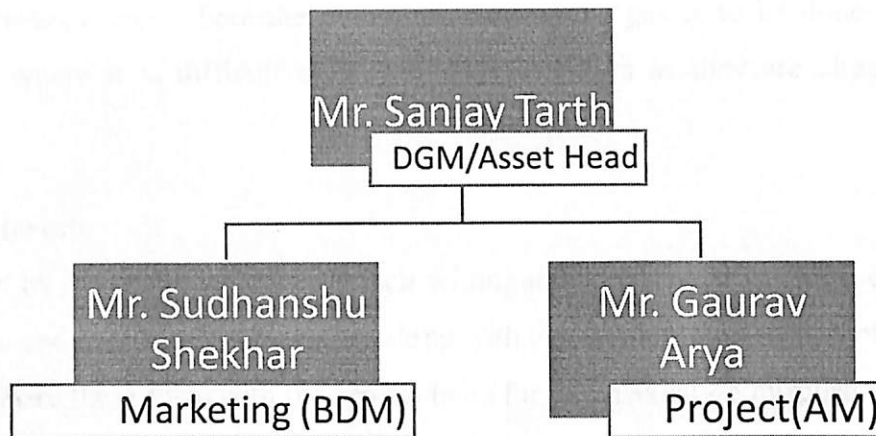


Figure5: Chandigarh Geographical area map

#### 4.2.2 Organisational Structure



##### 4.2.2.1 Marketing department:

At IOAGPL marketing department is working since beginning of the project Marketing department is functional performing various tasks. The aim of the marketing team is to find the customer potential and find out whether if the pipeline laid is beneficial or not or the pipeline should be laid some of the major functions of the marketing department can be defined as

##### Functions:

1. Identifying the potential customers in the geographical area.
2. Promotion and awareness campaign regarding PNG
3. Filling up of Expression of interests form the domestic and commercial customers
4. Forecasting demand of gas and materials
5. Customer care service
6. Customer relationship management
7. Billing

##### Identifying potential customers:

At IOAGPL marketing team surveys a geographical area and search for the potential customers. This process involves meeting the customers one on one and the expression of interest is filled by the customer. As marketing team is the first to survey the area it also guides the project team by giving them the details of the potential and the requirement of the gas in the area along with the pipeline laying path. This information is further processed by the project team and all the contracts are made according to the requisition proposed by the marketing team.

**Promotion and awareness:**

As PNG is new in this area the customers are made aware about the product its features, uses and all the safety procedures are explained to the customers. For filling up of the applications at large scale camps are organised in the nearby area where the commissioning of the gas is to be done in near future. In the commercial area where it is difficult to acquire the customers as they are already engaged with the customers.

**Expression of interest:**

This form is filled by the customer showing their willingness to apply for the PNG connection. This form contains the name and details of the customer along with the consumption pattern of the customer. Marketing team share these form with the project team for the installation purpose.

**Forecasting:**

Marketing team is also responsible for the forecasting the natural gas demand as marketing team needs to file nominations on GAIL India portal for the approximate demand in the near future. Marketing team have all the data and analysed the future demands and forecast the future potential. Here marketing team shares the information with the procurement and project team.

**Customer care service:**

At Indian Oil Adani Gas limited all the customer services are handled by the marketing team. A customer care centre is managed by the marketing team where complaints of the customers are addressed and also the cheque collection facility is also provided. Here customer satisfaction is utmost priority.

**Billing:**

Though most of the billing process is managed by headquarters but the distribution and printing work is handled by the marketing team. Billing is done bi-monthly for the domestic customers and for industrial and commercial customers billing is done every 15 days. There are approximately 12000 domestic customers under the office. The number of the customers is increasing every month as the project is in the initial phase. These customers are divided into two sectors for the purpose of billing as it will divide the billing distribution load every month. The customer is charged for minimum of 6 SCM in every billing.

Customer can pay bills using NEFT, PayTm, Cheque and from the company website using instant payment option.

#### 4.2.2.2 Project Department:

At IOAG Pvt ltd. Project team is headed by Mr. Gaurav Arya . Project team is responsible for laying down the pipelines in the area. Project team outsource the work by hiring the vendor for laying down the pipeline where the authorization has been granted by the municipal corporation. During the 9<sup>th</sup> CGD bidding Indian Oil Adani Gas Pvt Ltd. Won the bit for the nearby area of the Chandigarh Geographical Area Project team is currently working over a huge project with the help of which newly added Himachal Pradesh area will be able to receive the supply of piped natural gas. This project will be consisting of Mother and daughter stations as there is Non-feasibility of laying pipeline in the uneven terrain. A Mother station will be installed to fill the cascaded skid, with the help of which gas will be supplied to the Daughter stations present at the remote locations making the ease of using piped natural gas in the mountain terrain. All the new projects are handled with the help of the vendors. If the service required at the already charged network then the operations are handled by the project team.

#### Functions

- Building Infrastructure for laying pipeline.
- Infrastructure building for CNG.

Services handled by project department are given below

#### Operations and Maintenance (O&M):

The operations and maintenance department is responsible for the projects i.e. installing of the pipeline to the end customers. The team gets authorizations from the municipal corporation and laying of the pipeline is done. The team surveys the area where the work is needed to be done. Laying of steel and MDPE pipeline is done under project team in the area.

#### Compressed Natural Gas (CNG):

IOAGPL provides CNG service at different petrol pump stations in the Geographic area. As CNG is a cleaner fuel it is promoted to be used in the public and private transport vehicles. Currently Indian Oil Adani have 7 working CNG stations at Sector 44, Sector 17, Sector 37, Sector 56 in Chandigarh, there is one CNG station in Panchkula and one in Zirakpur at Rampur Kalan. There will be upcoming gas stations at Citco Sector 17 petrol pump, Phase 8 Mohali, Sector 70 S.A.S. Nagar (Mohali). CNG Team is responsible for maintenance and commissioning of the CNG Stations.

As of now the company is offering natural gas services i.e. Piped Natural Gas to Domestic, Commercial and Industrial customers and CNG for the transport.

As company is in intimal phase it is offering the zero application fee that means the customer has to pay when the first bill arrives. The schemes are as follows[11]

### **Domestic application schemes**

A Customer can opt from three schemes provided by the company at the time of installation.

#### **Scheme A - Full Payment scheme:**

In this scheme, customer pays connection charges of 5,618/- along with gas usage charge in first invoice. With a standard kitchen installation (connection security Rs 5000 Payment security deposit Rs. 500 form charges Rs. 118/-)

#### **Scheme B - EMI installation**

In this scheme customer pays only Rs. 1,618/- in first gas invoice in addition of gas usage and balance amount in the instalment of Rs. 200/- each in 24 bimonthly billing cycle/ invoice (i.e. 48 Months or 4 years). It also includes Payment security deposit: Rs 500/- and form charges Rs. 118/-

#### **Scheme C - Monthly rental scheme**

In this scheme customer needs to pay only Rs 618 in addition to the gas usage amount in first invoice and a monthly rental of Rs. 25/- would be charged till the connection is active or till the scheme id charged. The customer will get standard kitchen point. (Payment security deposit Rs. 500, Form charges Rs. 118.

For all the other charges customer can refer to the Tariff card available with the PNG Guide provided with the application form.

### **Summary of the present market situation**

- As suggested by the study and research carried out by planning, commercial and marketing department, a potential of approx. 1,70,000 has been identified for Chandigarh GA.
- Total Pipeline laid is 350 Km.
- Total no of Registrations till 1<sup>st</sup> March 2019 have been 30,000
- Total converted customers are 12,476.
- The total no of District Regulatory Systems operating are 5.
- Gas Charges:
  - Domestic: Rs. 29.23 /scm
  - Commercial: Rs. 47.84/scm
  - Industrial: Rs. 35/scm
  - CNG: Rs. 54.74/ Kg.



## **5. Objective**

Laying of pipeline is an expensive decision a company has to take as it requires huge capital and workforce investment. In oil and gas industry the gestation periods are longer so the decision for investment are taken carefully so that all the resources are used efficiently. The objective of the study is to survey the area and find out the potential customers. Sharing the right information with the project team for the further project work. Achieving the maximum customer penetration in the area.

## 6. Research methodology

The commercial units that are present in the Sector 35 Chandigarh and all the potential available i.e. commercial and domestic in sector 91 and 67 S.A.S. Nagar (Mohali). It includes the physical site visit and interaction with the customers or their representatives. The selected sample area is residential and commercial area. It consists of group society's independent bungalows and commercial establishments.

### Sources of data

The data that is used for the research is from two sources primary and secondary.

#### Primary Sources:

Data was collected with survey method by directly interacting with the consumers these could be residents or the representatives of the resident Societies, for the commercial customers the data is collected from the Managers of the establishments. Physical inspection of the area is done to find out the present status.

#### Secondary Sources

Secondary data was collected from the reports of the company.

**Internet:** The various sources of the information is collected from PNGRB website, eic.com, News articles etc.

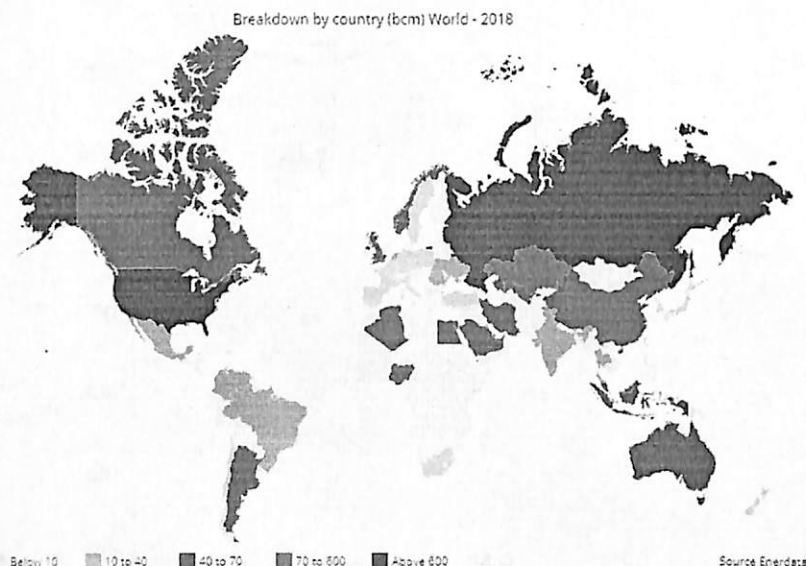
## 7. Analysis

### Natural Gas Scenario

#### 7.1 World Scenario

In the world Natural gas is abundantly available along with or without the crude oil wells. The top ten highest natural gas producing countries are shown below.

[6]



Top Producing countries	Production in BCM
United States	864
Russia	741
Iran	232
Canada	188
Qatar	168
China	160
Norway	127
Australia	125
Saudi Arabia	98
Algeria	96
Turkmenistan	85
Indonesia	75

Figure 6: World Scenario

Table 3: Natural gas producing countries

As from the above it can be seen that United States being the largest producer of natural in the recent trends there has been in the demand of natural gas world-wide. The highest consumer of natural gas is China. Russia being the largest supplier of RLNG (Reliquified Natural Gas) is filling the demands of the most of the European countries. Developed countries having well planned PNG system have contributed to the growth. As natural Gas is a cleaner fuel China is also using this for Generating hence deriving natural gas demand worldwide.

#### 7.2 Natural Gas scenario in India

Share of Natural Gas in India's energy basket is 6.2 % as against 23.4%[7] globally. In India, in the state of Gujrat itself, it is 25%. The country aims to achieve share of Natural Gas in our energy basket from 6.2% to 15% by 2030.

##### 7.2.1 The declining share of gas in India's energy mix

<sup>6</sup> Enerdata

<sup>7</sup> <http://pib.nic.in/PressReleaselframePage.aspx?PRID=1553241>

While India aspires to increase the share of natural gas in its energy basket, the share of gas in India's primary energy mix has been dropping, from 10 percent in 2010 to 6.2 percent in 2017 (Exhibit A). The total gas consumption has reduced from 162 mmscmd in FY 2011 to 145 mmscmd in FY 2018 (Exhibit B).

Gas share in India's primary energy mix has fallen from 10% in 2010 to 6.2% in 2017

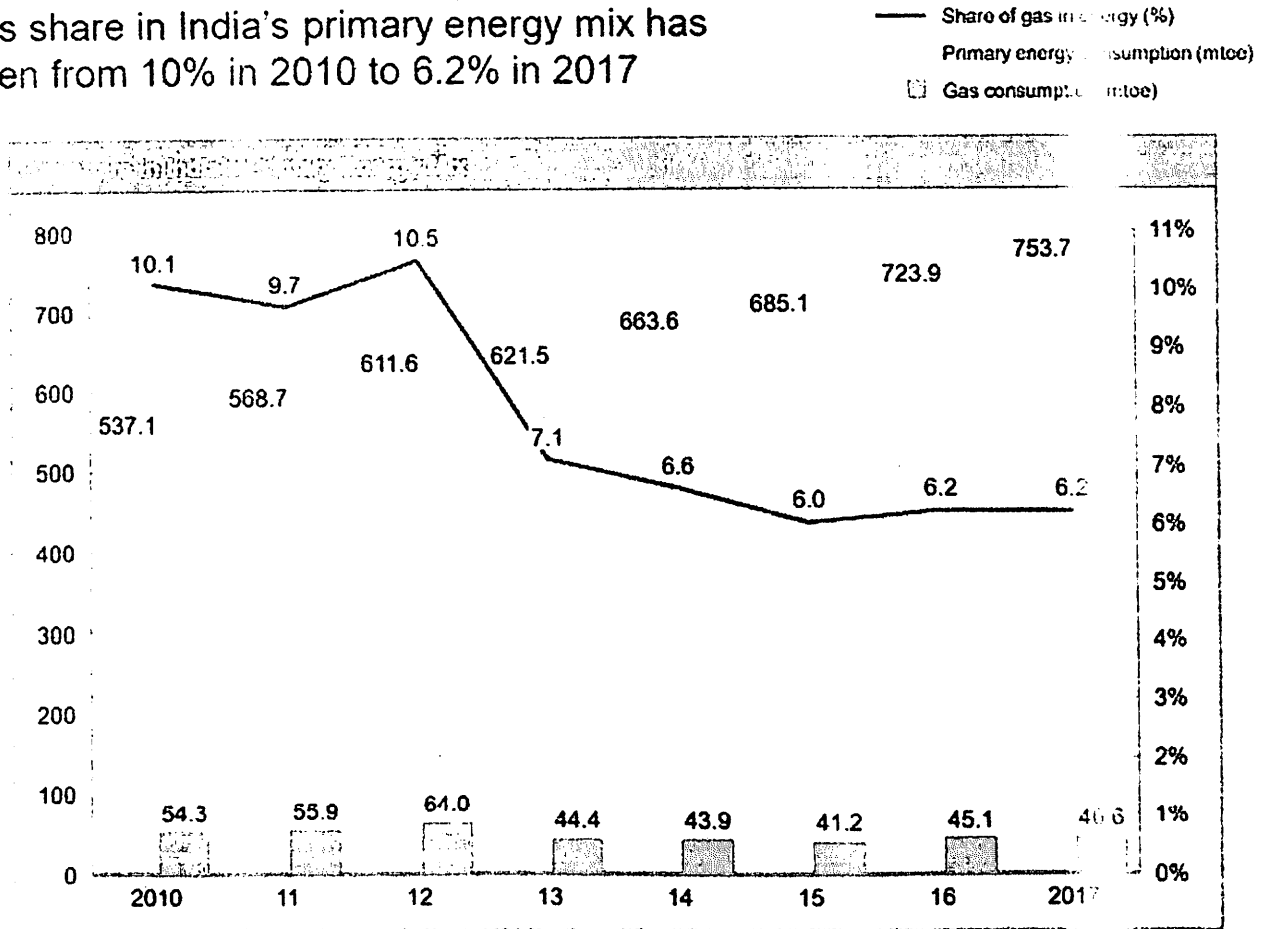
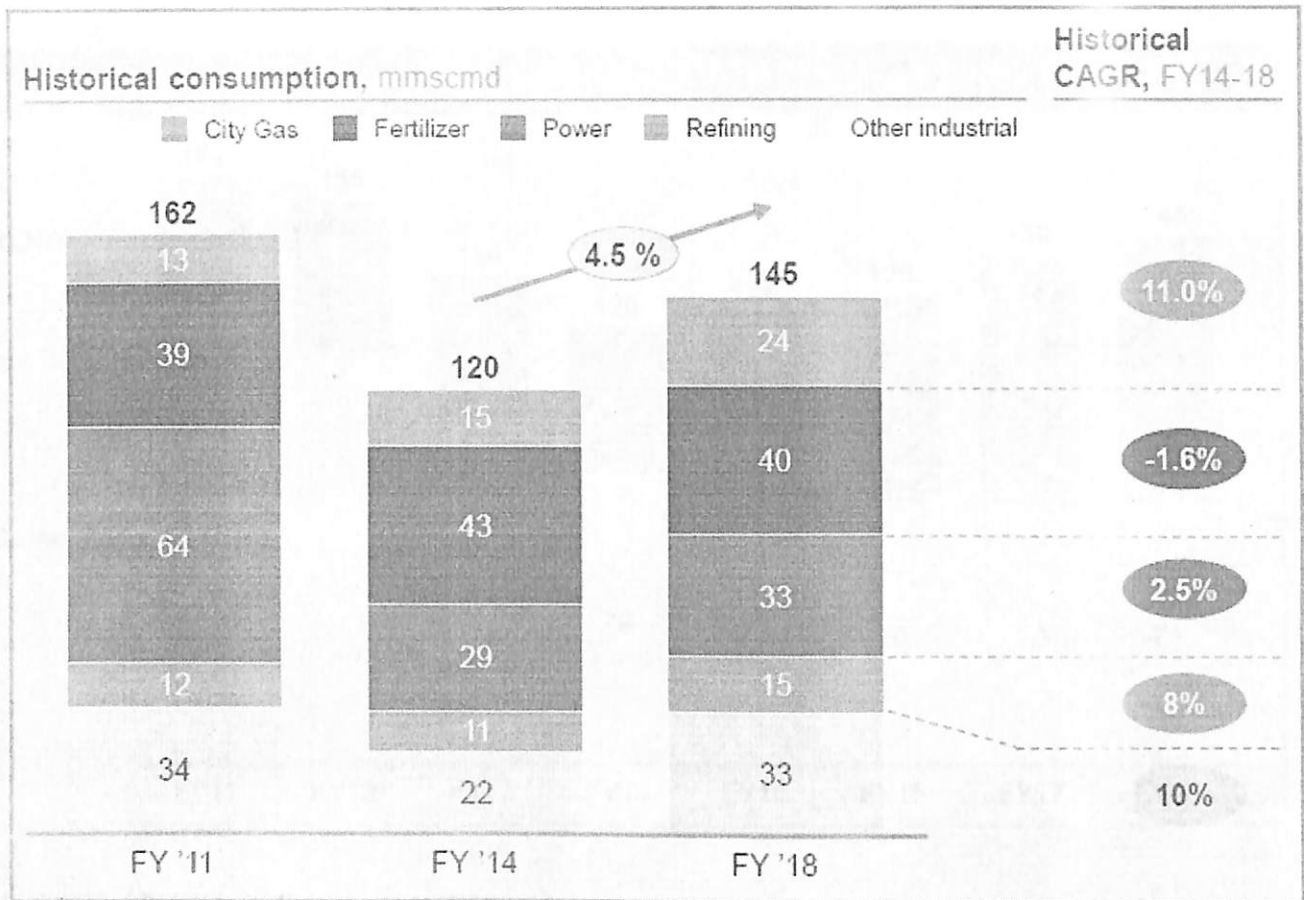


Table 4: Gas share in India's primary energy

### Evolution of natural gas consumption in India

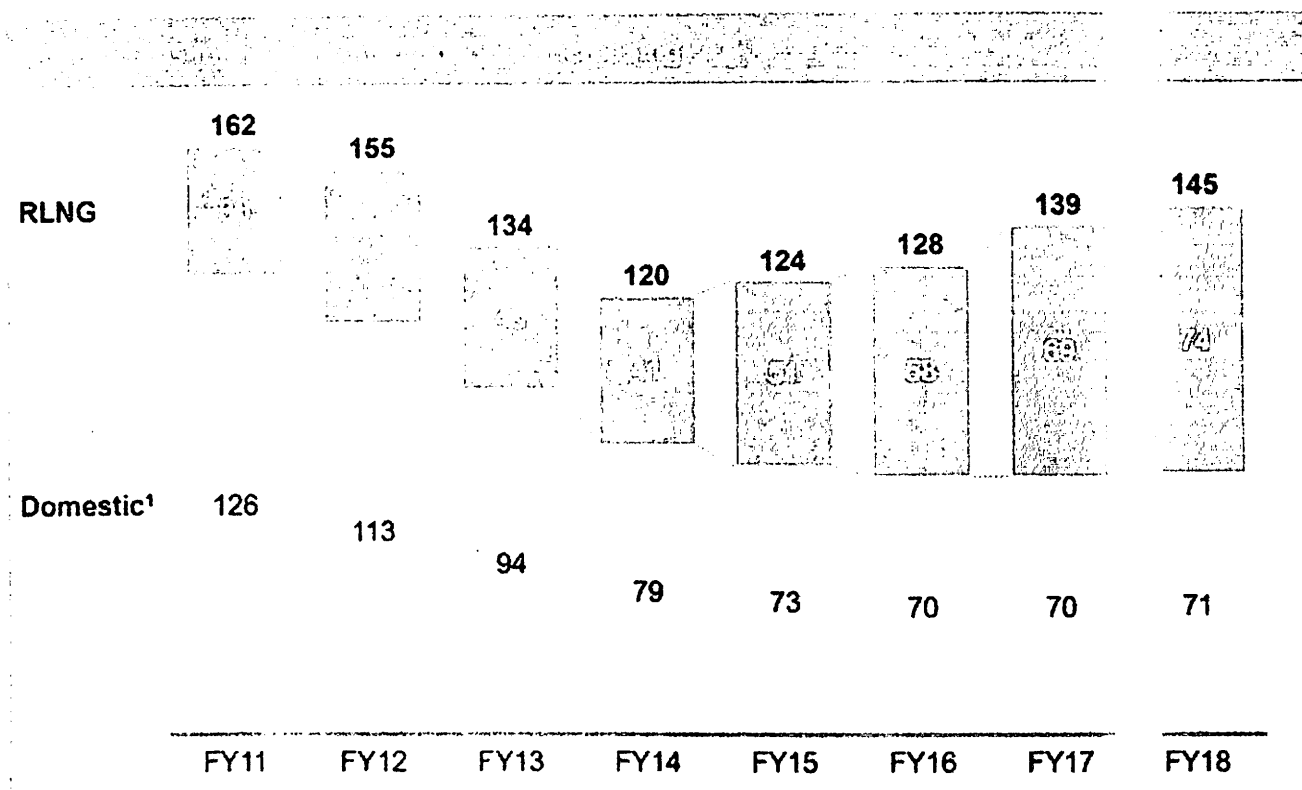


**Table 5: Evolution of natural gas consumption in india**

Multiple challenges have affected the growth of gas in India. A drop in domestic production has led to domestic gas being replaced by more expensive, imported Liquefied Natural Gas (LNG) (Exhibit C), which is costly versus the alternative fuels used in many sectors. This has restricted gas consumption despite high latent demand. A constrained outlook for consumption is limiting investments and prompting the postponement of infrastructure development projects. This has caused a logjam for the gas market.

Falling domestic production is largely responsible for a decreased share. The domestic production of natural gas has reduced by 46 percent since 2011, falling from 126 mmscmd in FY 2011 to 71 mmscmd in FY 2018. FY18 saw a minor uplift, but this was insufficient to even meet the growth in consumption in the same year, resulting in higher imports in FY 2018.

Import dependence on RLNG has been increasing given domestic production has declined



**Table 6: Mix of RLNG in India’s consumption**

The domestic production of natural gas has reduced by 46 percent since 2011, falling from 126 mmscmd in FY 2011 to 71 mmscmd in FY 2018. FY18 saw a minor uplift, but this was insufficient to even meet the growth in consumption in the same year, resulting in higher imports in FY 2018 (Exhibit C).

In many key consumer segments, LNG is not a commercially viable alternative to cheaper (if polluting) fuels like coal, furnace oil (FO), pet coke and naphtha. As an example, gas-based power plants operated at a capacity utilization or plant load factor (PLF) of about 23 percent on a national average, but 31 gas-based power plants—a total capacity of 14,305 megawatts—struggled or were stranded at nil to very low capacity utilization in 2018

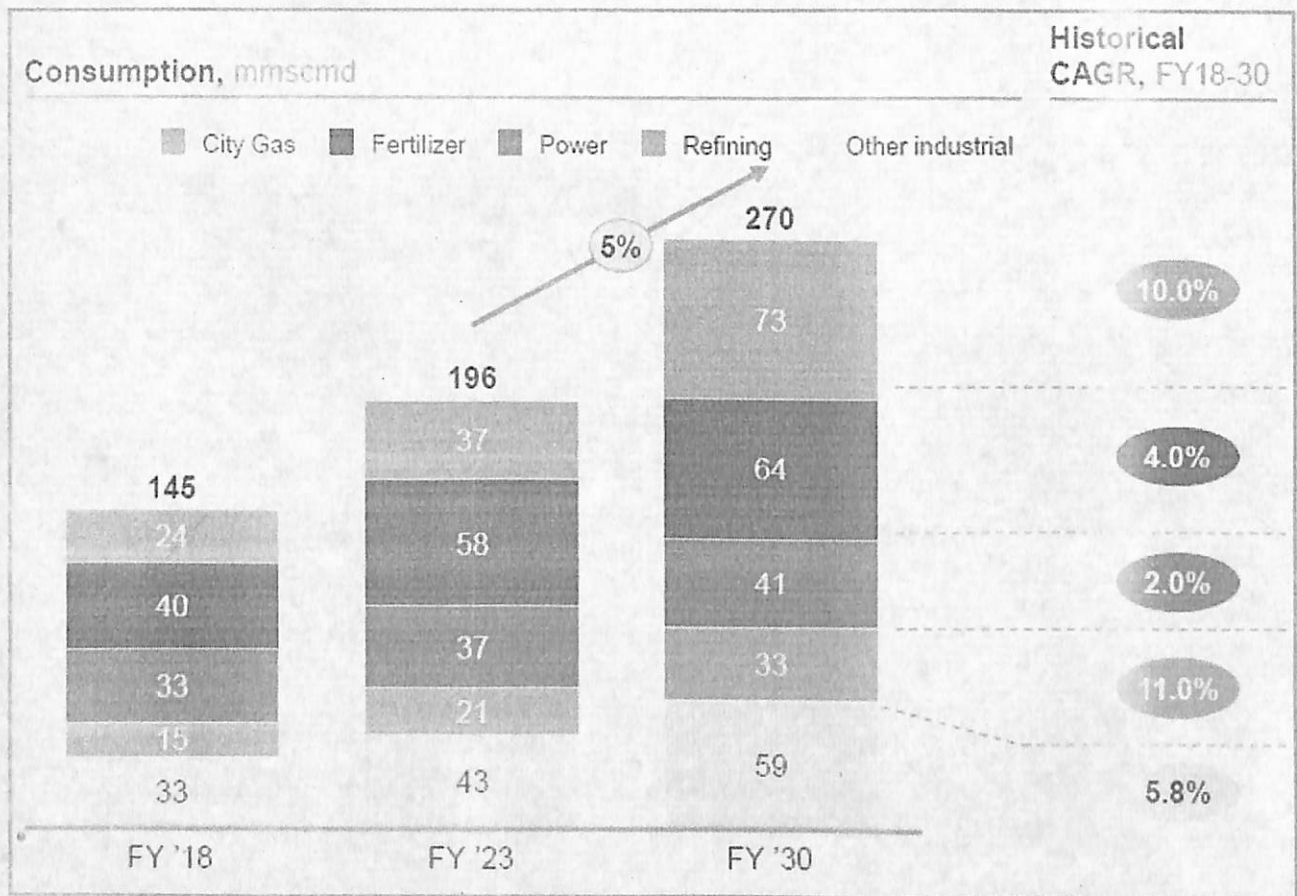
**7.2.2 Lack of infrastructure in some areas**

Multiple pipeline and infrastructure projects awarded by the Petroleum and Natural Gas Regulatory Board (PNGRB) have not achieved financial closure. For example, financial closure issues with the Surat-Paradip pipeline led to the PNGRB cancelling the license for the project in 2018. Delays often occur on account of the outlook on insufficient capacity utilization, resulting from a slow consumption offtake. This means that many areas of potential demand remain unconnected. In many geographical areas, City Gas Distribution

(CGD) expansion has been slow due to delays in securing multiple clearances and post bidding financial challenges for some of the new CGD entities.

1.2 Aspiring for a 15% share in the energy mix

It is estimated that "Business as Usual" (BAU) would result in a very minor increase in the gas share in the energy mix, i.e., to about 7 percent by 2030. Concerted, discontinuous actions across sectors could help propel Indian gas consumption closer to its 15 percent aspiration. As per projections, in a BAU scenario, gas could form less than 7 percent of India's expected total energy mix by 2030. In this scenario, India's gas consumption could grow at around 5 percent to reach 270 mmcmd by FY 2030 (Exhibit E).



SOURCE: Analysis based on data from MOPNG, WoodMac UDT, UDI, Expert interviews, Fortescue Armonia Outlook, IHS.

Table 7: Consumption, MMSCMD

7.3 India's long term vision towards natural gas

The Hon'ble Prime Minister made a commitment in COP21 Paris Convention in December 2015 that by 2030, India would reduce carbon emissions by 33% of 2005 level. Overall, Natural Gas as domestic kitchen fuel, fuel for transport sector as well as for industrial and commercial units, can play a significant role in reducing carbon emission.



Natural Gas (as CNG) is cheaper by 60% and 45 % as compared to petrol and diesel respectively. Domestic Piped Natural Gas (PNG) is cheaper by 40 % as compared to market- priced LPG and almost matches with the price of subsidised LPG.

India is also pushing for more scooters and motorcycles to run on compressed natural gas (CNG), with pilot schemes recently launched in major cities including New Delhi and Mumbai. The use of natural gas is also to be extended to Trains and ships in coming years. Beyond LNG, India is looking to access untapped domestic gas reserves off its east coast. India imports 45% of the total amount of natural gas it consumes. With the government's plan to raise the share of natural gas in the country's energy mix to 15% by 2030 from about 6.5% now, import of LNG is expected to rise. Natural gas consumption in the country rose 5% to 58 billion cubic meters in 2017-18. The government expects half of India to have access to piped gas for cooking and transport after the new city gas licensing round, which is currently underway. India is heavily investing in building LNG import terminals and pipelines to import and supply gas across the country. Local production is rising at a pace not enough to meet the rising domestic demand. Russia is the latest country to begin supplying long-term LNG to India after US, Australia and Qatar. Till two years ago, the country depended solely on Qatar for long-term supplies.

Major import natural gas terminals in India are Daheze, Hazira Dabor and Kochi with respectively 15,5,1.692,5 MMTPA capacity with a total of 26.7 MMTPA capacity

#### **7.4 Highlights of the Natural Gas consumption report for the month of April 2019:**

Gross production for the month of April 2019 was 2656 MMSCM (decrease of 0.3% over the corresponding month of the previous year). Total imports of RLNG for the month of April 2019 was 2502 MMSCM. Major consumers were fertilizer (27%), power (18%), CGD(18%), refinery(14%) and petrochemicals(7%) Domestic Natural Gas Net Production for Sale: Natural Gas producing companies use some quantity of gas for their own use as internal consumption while some quantity of gas is flared as a part of technical requirement. After flare, loss and internal consumption by gas producing companies, the net production for sale of gas to consuming sectors like power, fertilizer, CGD, refinery, petrochemicals etc. was approximately 77.9% of the gross production during April 2019.

LNG imports: LNG is procured by Petronet LNG Ltd., GAIL (India) Ltd., Gujarat State Petroleum Corporation Ltd., Reliance Industries Limited, Torrent Power Limited, Shell (formerly Hazira LNG Pvt. Ltd.), Indian Oil Corporation Limited & Bharat Petroleum Corporation Limited.

Major Oil and Gas players in India are IOCL, ONGC and GAIL.

## 7.5 Oil and Gas Reserves in India

State wise Estimated Reserves of Crude Oil and Natural Gas in India as on 31.03.2017 and 31.03.2018

States/ UTs/ Region	Crude Petroleum (million tonnes)				Natural Gas (billion cubic metres)			
	31.03.2017		31.03.2018		31.03.2017		31.03.2018	
	Estimated Reserves	Distribution (%)	Estimated Reserves	Distribution (%)	Estimated Reserves	Distribution (%)	Estimated Reserves	Distribution (%)
Arunachal Pradesh	1.52	0.25	1.74	0.29	0.72	0.06	1.26	0.09
Andhra Pradesh	8.15	1.35	7.94	1.34	48.31	3.75	59.89	4.47
Assam	159.95	26.48	160.34	26.97	158.57	12.30	161.65	12.07
Cold Bed Methane (CBM)	0.00	0.00	0.00	0.00	106.67	8.27	105.94	7.91
Eastern Offshore <sup>1</sup>	40.67	6.73	40.42	6.80	507.76	39.37	510.83	38.13
Gujarat	118.61	19.63	118.20	19.88	62.28	4.83	58.23	4.35
Nagaland	2.38	0.39	2.38	0.40	0.09	0.01	0.09	0.01
Rajasthan	24.55	4.06	17.99	3.03	34.86	2.70	54.85	4.09
Tamil Nadu	9.00	1.49	9.16	1.54	31.98	2.48	39.11	2.92
Tripura	0.07	0.01	0.07	0.01	36.10	2.80	35.20	2.63
Western Offshore <sup>2</sup>	239.20	39.60	236.25	39.74	302.35	23.44	312.52	23.33
<b>Total</b>	<b>604.10</b>	<b>100.00</b>	<b>594.49</b>	<b>100.00</b>	<b>1289.70</b>	<b>100.00</b>	<b>1339.57</b>	<b>100.00</b>
* CBM: Cold Bed Methane (Jharkhand, West Bengal and M.P.)								
Notes:								
1. Proved and indicated Balance Recoverable Reserves as on 1 <sup>st</sup> April.								
2. Western offshore								
3. Total may not tally due to rounding off								
Source: M/o Petroleum & Natural Gas								

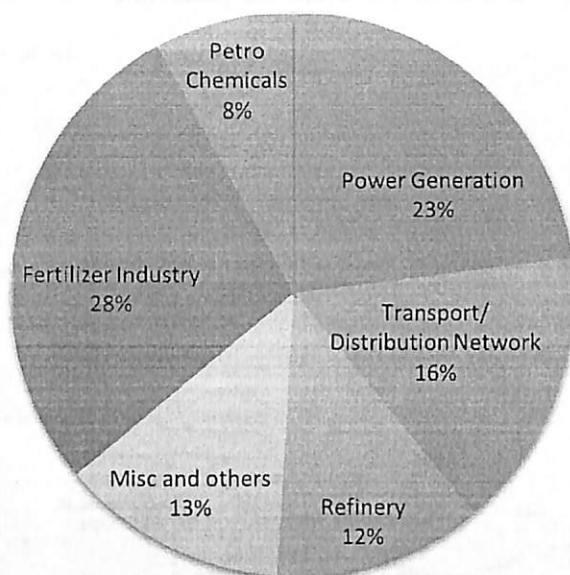
Table8: Oil and Gas Reserves in India

## 7.6 Usage of natural gas

The maximum use of Natural Gas is in fertilizers industry (27.78%) followed by power generation (22.77%) and 16.25% natural gas was used for domestic fuel for transport sector.

Industry wise off-take of natural gas shows that natural gas has been used both for Energy (60.68%) and Non-energy (39.32%) purposes.

### Industrywise take-off of Natural Gas in India during 2017-18



**Figure7: Natural gas sector wise take off**

The maximum energy intensive sector was industrial sector accounting about 56% of total energy consumption. Per Capita consumption of Energy showed a CAGR of 2.54% for the period 2011-12 to 2017-18[8].

#### 7.7 Gas industries and their networks:

Gas industry is mainly divided into three parts Upstream, midstream and Downstream. Upstream industry is related to extraction of oil and gas from Earth and major share is held by IOCL, GAIL, ONGC, Oil, Manglore Refining and Petrochemicals (Refining), ONGC Videsh Limited (Overseas E&P), Oil India Limited and other private players like Cairn, RIL, Niko, etc.

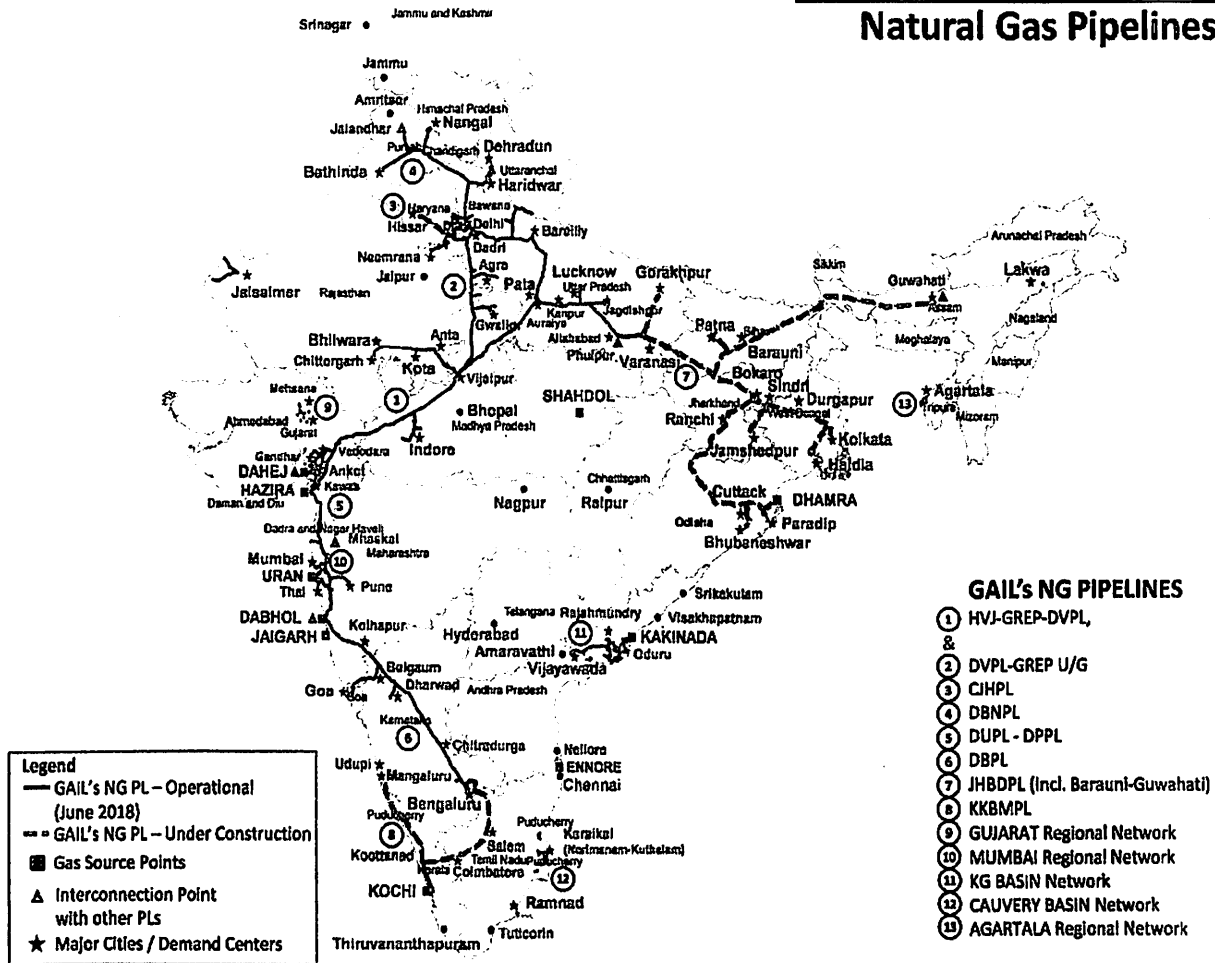
##### 7.7.1 Gas pipeline:

There are presently three major pipeline entities engaged in natural gas transportation across India namely GAIL, RGTEL/RGPL and GSPL. GAIL is operating about 11410 km of trunk pipelines in India comprising 68% of the Pan-India pipeline network. This includes HVJ, DVPL, DUPL/DPPL, Dadri-Bawana-Nangal and Dabhol-Bengaluru trunk pipelines to evacuate domestic gas as well as imported RLNG. In addition, GAIL also operates regional gas pipeline networks in Maharashtra, K.G.Basin, Cauvery Basin and Gujarat.

<sup>8</sup> Ministry of Statistics India

RGTEL and RGPL are operating 1784 km of pipelines (about 11% of pan India network), namely the East-West Pipeline (EWPL) to evacuate gas from KG-D6 field in Andhra Pradesh and the Shadol-Phulpur Pipeline respectively. GSPL is mainly focused in the state of Gujarat consisting of about 2618 km gas pipelines (about 16% of total). Currently all the companies are expanding their Natural Gas Infra in order to meet the growing demand.

### GAIL (India) Limited Natural Gas Pipelines



[9]

Figure8: Natural Gas Pipeline Structure In India

<sup>9</sup> Gail website

Share of the different entities in the transportation infrastructure is given below

S. no.	Transporter	Length in KM	Percentage share
1	GAIL	11410	68.04%
2	RGTEL / RGPL	1784	10.64%
3	GSPL	2618	15.61%
4	AGCL/DNPL	817	4.87%
5	IOCL	140	0.84%
	Total	16770	100.00%

**Table 9: The transportation infrastructure**

### 7.7.2 CGD Market players in India

Below here is the List of the entities working in the area as on 01.04.2018

PNG data		
State	Geographical Area Covered	Entity
Haryana	Sonipat, Faridabad, Gurgaon, Panipat, Rewari	Gail Gas Limited, Adani Gas Limited, Haryana City Gas Distribution Ltd, Indraprastha Gas Limited, Indian Oil-Adani Gas Pvt. Ltd.
Andhra Pradesh	Kakinada, Vijayawada, Kovvur & Nidadavole (West Godavari), Rajahmundry & Ravulapalem (East Godavari District)	Bhagyanagar Gas Limited, Godavari Gas Pvt.Ltd.
Telangana	Hyderabad	Bhagyanagar Gas Limited
Assam	Tinsukia, Dibrugarh, Sivasagar, Jorhat, Golaghat	Assam Gas Company Limited
Gujarat	Gandhinagar, Mehsana, Sabarkantha, Patan, Nadiad, Halol, Hazira, Rajkot, Khambhat, Palej, Valsad, Navsari, Surendernagar, Surat, Ankleshwar & Bhavnagar, Vadodara, Ahmedabad, Ahmedabad Urban, Anand, Palanpur	Sabarmati Gas Limited, Gujarat Gas Limited, Adani Gas Limited, Vadodara Gas Ltd, Hindustan Petroleum Corpn. Ltd., Charotar Gas Sahakari Mandali Ltd., IRM Energy

<b>Madhya Pradesh</b>	Dewas, Vijaipur, Gwalior, Indore including Ujjain, Pithampur	Gail Gas Limited, Aavantika Gas Limited
<b>Maharashtra</b>	Pune City including Pimpri Chinchwad along with adjoining contiguous areas of Hinjewadi, Chakan & Talegaon GA, Mumbai , Greater Mumbai including Thane City, Mira Bhayender, Navi Mumbai, Ambernath, Bhiwandi, Kalyan, Dombivli, Badlapur, Ulhasnagar, Panvel, Kharghar & Taloja, Raigarh District, Thane	Maharashtra Natural Gas Limited, Mahanagar Gas Limited, Gujarat Gas Limited
<b>Delhi/NCR</b>	National Capital Territory of Delhi (including Noida & Ghaziabad)	Indraprastha Gas Limited
<b>Rajasthan</b>	Kota	Rajasthan State Gas Limited
<b>Tripura</b>	Agartala	Tripura Natural Gas Company Limited
<b>Karnataka</b>	Bengaluru	Gail Gas Limited
<b>Uttar Pradesh</b>	Meerut, Mathura, Agra, Kanpur, Bareilly, Lucknow, Moradabad, Firozabad (TTZ), Khurja, Dibliyapur, Allahabad	Gail Gas Limited, Sanwariya Gas, Green Gas Limited , Central U.P. Gas Limited, Green Gas Limited, Siti Energy Limited, Adani Gas Limited, Indian Oil-Adani Gas Pvt. Ltd.
<b>Chandigarh</b>	Chandigarh	Indian Oil-Adani Gas Pvt. Ltd.
<b>Kerala</b>	Ernakulam	Indian Oil-Adani Gas Pvt. Ltd.
<b>Dadra &amp; Nagar Haveli</b>	UT of Dadra & Nagar Haveli	Gujarat Gas Limited
<b>Daman and Diu</b>	Daman and Diu	Indian Oil-Adani Gas Pvt. Ltd.
<b>Odisha</b>	Bhubaneshwar	GAIL (India) Ltd.
<b>Punjab</b>	Fatehgarh Sahib	IRM Energy Pvt. Ltd.
<b>Source: CGD companies</b>		

Table 10: PNG data

## **7.8 Regulatory Board - PNGRB**

The Petroleum and Natural Gas Regulatory Board (PNGRB) was constituted under The Petroleum and Natural Gas Regulatory Board Act, 2006 (NO. 19 OF 2006) notified via Gazette Notification dated 31st March, 2006. The Act provides for the establishment of Petroleum and Natural Gas Regulatory Board to protect the interests of consumers and entities engaged in specified activities relating to petroleum, petroleum products and natural gas and to promote competitive markets and for matters connected therewith or incidental thereto. Further as enshrined in the act, the board has also been mandated to regulate the refining, processing, storage, transportation, distribution, marketing and sale of petroleum, petroleum products and natural gas excluding production of crude oil and natural gas so as to ensure uninterrupted and adequate supply of petroleum, petroleum products and natural gas in all parts of the country.

PNGRB conducts the biddings for allocating the geographical areas. Geographical area is the allocated area to be distributed with natural gas. Recently 10<sup>th</sup> round of bidding was conducted and 50 GA's were allocated in 10 states Companies having a net worth of not less than Rs 150 crore can bid for GAs with a population of 50 lakhs and more while the same for GAs with a population of 20-50 lakh has been proposed at Rs 100 crore. Earlier to this in 9 CGD biddings conducted for 237 Geographical areas.

### **7.8.1 Functions & Power**

To ensure continuous supply of petroleum, petroleum products and natural gas in the event of war, natural calamity or other such circumstances, the central government can take over the management of the facilities of any entity or retail outlet. The affected entities will have an opportunity to be heard if possible and the collector of the district shall determine the compensation payable

- The Petroleum and Natural Gas Regulatory Board Fund shall be constituted. Grants, fees, penalties and charges received by the PNGRB will be credited to the fund. The Fund will be used towards expenses incurred in carrying out the provisions of the Act, including payment of salaries, allowance and pension.
- The PNGRB shall maintain a Petroleum and Natural Gas Register which will contain details of registered/ authorized entities. The register will be open to public viewing and any person can obtain a certified copy of any entry on payment of a fee.
- During an initial period of three years, the PNGRB shall monitor
- Agreements entered into and approved by the government before commencement of the act between oil companies for sharing petroleum, petroleum products or infrastructure facilities



- Setting up of dealerships and distributorships of motor spirit, superior kerosene, high speed diesel and LPG and CNG stations.
- The PNGRB appears to have independent powers to determine tariffs, the basis on which pipelines will be common or contract carriers etc.
- The regulations governing these issues will be made by the PNGRB and laid down in Parliament.

### **7.8.2 Access to Transmission Pipelines**

- Under the PNGRB Bill, all transmission pipelines (except pipelines to a specific customer and upstream pipelines) will be either common or contract carriers.
- The Revised Policy for Development of Natural Gas transmission pipelines and City or Local Gas Distribution Networks pipelines suggests that authorization for laying a pipeline will be done through a competitive bidding process.
- Parties will be given three months to declare interest in laying the pipeline. The total capacity of the pipeline will be that of the proposer as well as contracts entered into.
- The proposer will have to satisfy the condition that in future, capacity can be increased by 25% within a 120 day notice period. This excess capacity will be available for use on a non-discriminatory, open access, first come first serve basis.

### **7.8.3 Tariffs for Transmission**

- The tariffs for transmission of natural gas through common or contract carrier are to be determined by the Board.
- The draft regulations indicate that initial tariffs for pipelines may be determined on a cost of service basis which will include components such as operating cost, depreciation, reasonable rate of return on capital employed etc.
- The PNGRB will prescribe the methodology for determining the various components by benchmarking costs against similar projects and considering efficiency norms.
- While the cost plus formula does not provide incentives to improve efficiency, this is an issue that many regulators around the world are grappling with.
- In the United States, tariffs cover operating costs and a reasonable rate of return on capital

### **7.8.4 Drafts made by PNGRB**

- Draft Regulations on CGD Network Authorization
- Draft Regulations on CGD Exclusivity
- Draft Regulations on CGD Network Tariff & Attachment to CGD Network Tariff
- Regulations Authorizing Entities for Development of NG Pipelines

- Regulation for Pipeline Tariff for Natural Gas Pipelines: NG Pipelines Tariff Format
- Affiliate Code of Conduct
- Regulations for Declaring Common Carrier or contract carrier
- Regulations for Access code for NG Pipelines and CGD network

### **Notification on Tariff**

- “Network tariff” means the weighted average unit rate of tariff (excluding statutory taxes and levies) in rupees per million British Thermal Units (Rs./ MMBTU) for all the categories of consumers of natural gas in a CGD Network”

## 8. Comparison

### City Gas Distribution (CGD)

#### 8.1 History

Oil India Limited was first to start distribution of gas in Assam in 1960's. In Gujarat, Oil and Natural Gas Corporation (ONGC) started selling its associated gas to the neighbouring industries in 1970's. With the find of Oil / Gas at Mumbai high, supply of gas commenced to industrial consumers around Mumbai like MSEB, Tata and RCF. The gas pipeline networks were laid / owned by either ONGC or the customers.

With the gas discovery in south basin of Mumbai shores, the first cross country pipeline in India was conceptualized with Hazira as the landfall point in Gujarat. Gas Authority of India (GAIL) was formed in 1984, to act as a nodal agency for natural gas in India. GAIL constructed and operated this pipeline, which ran from Hazira to Jagdishpur via Bijaipur. This pipeline supplied gas to the fertilizer and power sector. Thereafter, entire existing assets of ONGC and development of new networks were transferred to GAIL. As a pilot project first city gas distribution project was taken up with the help of ONGC at Vadodara city in 1972. Historically due to scarcity of natural gas vis a vis demand, the supply of gas to other cities like Mumbai and Delhi, projects did not take off in absence of adequate gas allocation. Gujarat Gas Company Ltd. (GGCL) was the first commercial city gas distribution company in India. GGCL in association with British Gas developed distribution network in Bharuch and Ankleshwar cities. Subsequently, they expanded their network to Surat. Mahanagar Gas Limited (MGL) started city gas distribution to domestic, commercial and industrial customers in Mumbai in 1995. The focus of the company was to supply gas to domestic households and to transport sector and in an event of surplus cater to the industrial demand. Indraprastha Gas Limited (IGL) started city gas distribution to domestic, commercial and transport sector customers in Delhi in 1998. The focus of the company was to supply gas to transport sector.

#### 8.1.1 Objectives of developing CGD Network

- Consumers to get assured supply of CNG and PNG at cheapest possible price
- Domestic PNG and CNG to be priority - both in terms of pricing & gas volumes
- Incentivize maximum possible coverage for domestic PNG and CNG
- Quickest geographical spread (overall network coverage) during exclusivity period
- Monitor progress against measurable (with penal provisions, including termination of authorization for failure to achieve commitments
- Post-exclusivity, CGD network available to multiple players for marketing of PNG, CNG and if required, laying and building network as well.

### 8.1.2 CGD Network Safety

One of the primary concerns with respect to gas distribution is the safety and security of the pipeline network. The mesh of pipelines being used to distribute the gas needs to be maintained at the highest operating level, because any leak can lead to catastrophic accidents. The safety regulations are given the highest priority while issuing new licenses. The safety guidelines are coined by the PNGRB. The functions of the PNGRB are elaborated below:-

- To oversee the implementation of all the decisions of the Safety Council,
- To keep abreast of the latest design and operating practices in the area of safety and firefighting in the hydrocarbon processing industry in the developed countries, so as to develop standards and codes that would be suitable for the conditions in India;
- To liaise with the statutory organizations on current views and developments and help evolve a concerted effort for the industry;
- To carry out periodic safety audits, review, suggest procedures for improvements and report on the implementation of the suggestions to Safety Council;
- To collect the relevant information and exchange it with the members of the Oil Industry including information regarding accidents and disasters occurring in the oil industry, and so organize industry meetings for exchange of experience;
- To carry out enquiries into accidents, whenever required, and provide support to Enquiry Committees set up by the Government;
- To ensure implementation of all approved codes of practices for industrial hygiene;
- To review practices in the storage and handling of dangerous chemicals and ensure compliance with latest standards;
- To review disaster control procedures and company preparedness; j. To review in plant training programmes with regard to safety;
- To Specify critical drawings / layouts that need to be vetted by Safety Specialists at the design stage and carryout spot checks of design standards based on site audit findings to serve as feed-back for establishing new standards at the design stage, and
- To review zoning regulations around installations. Thus we see that this body is entrusted by the government of India to look after the technical standards and specifications that the companies must comply with, to do business in the city gas distribution industry. The network and specific systems are implemented with the assent of the Urban Local Body (ULB) present in the city. The company interested in developing the infrastructure for the distribution of gas, needs to formulate the plan

and involve the ULB in the loop. The ULB ensures that the company has an effective master plan and implements adequate safety measures. Few of the measures are: -

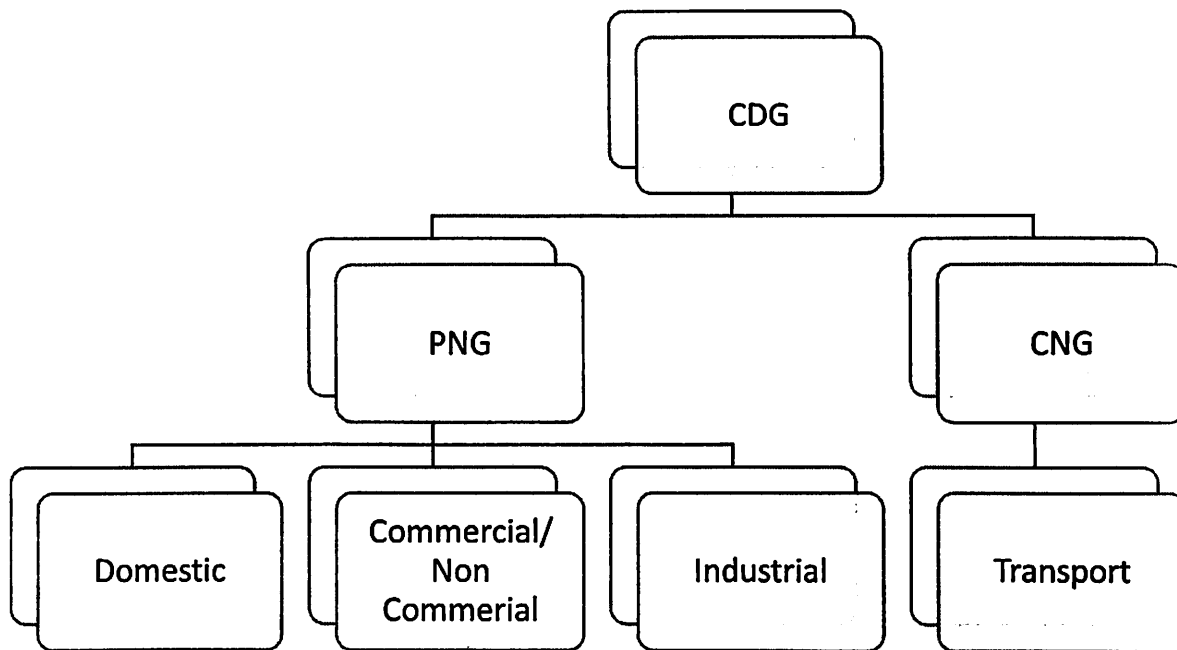
- a) Leak Detection Equipment (LDE), and also follows industry regulations like adding the right amount of Mercaptor in the gas for easy detection in case of leakage.
- b) Safety Education Programmes (SEP) are also initiated through different channels public broadcasting channels and locations for example awareness campaigns in schools, colleges.
- c) Lastly but not the least, Emergency Preparedness (EP) and disaster management plans are reviewed by the ULB as in this high risk business, the probability of occurrence of accidents cannot be ruled out. The companies which are in the process of establishing CGD have to collate with all these organizations and get appropriate clearances from them. The companies also do follow certain procedures as explained in the diagram follow to ensure the Health, Safety & Environment factor is maintained at the highest levels

This is one of the models in place and followed by the company, which shows the implementation of policies and procedures with respect to the industry standards. The prevalence of mock drills obviously confirms the concerns that organizations have regarding the safe use of network. Effective feedback collection, analysing and modifying procedures and certification of the procedures helps the company to maintain operational performance as well as ensure Health, Safety and Environment factors.

## **8.2 CGD Business verticals:**

The CDG Business is divided into two sections PNG (Piped Natural Gas) and CNG (Compressed Natural Gas). PNG Business is further divided into three sections as

- Domestic
- Commercial
- Industrial



**Figure 9: City Gas Distribution**

### 8.2.1 Domestic PNG

Domestic Customers use Natural Gas for cooking purpose and also for heating water through gas geysers. NG supplied through pipelines is rapidly replacing LPG gas cylinders among residential consumers.

### 8.2.2 Commercial PNG

Commercial PNG is mainly supplied to commercial customers that include hotels, restaurants, hospitals, corporate offices as well as canteens and pantries. Religious institutes, crematoriums and temples fall under the non-commercial category mainly for cooking, heating, and cooling applications.

#### Benefits

- Uninterrupted Supply (24 Hours).
- No Storage Required.
- Pay for What You Consume.
- Convenient, Hassle Free.
- Legal connection, no threat of being caught.
- Greater Safety.
- No Residual Gas wastage as in LPG Bottle.

#### Applications

- Hotel
- Restaurant

- Food court
- Hospital
- Educational Institute
- Religious Institute
- Industrial Pantry / Canteen
- Corporate offices

### 8.2.3 Industrial PNG

Natural gas has become the preferred fuel for varied industrial applications as it is environmentally friendly, easy to handle, reliable and requires zero storage space. Industrial PNG is used extensively by the following industries

- Hot Air Generator
- Chemicals, Dyes
- Paints
- Automobiles
- Engineering
- Textiles
- Food Processing
- Bakery
- Forging
- Pharmaceuticals
- Painting

### Applications for Industrial PNG

- Gas engine / Micro turbine / Turbine
- Steel Rolling Mill furnace
- Vapour absorption chiller / Vapour absorption machine
- Boiler
- Hot air generator
- Thermic fluid heater
- Biaxial furnace
- Flat Bed Dryer
- Ceramic Kiln
- Ceramic Printing Kiln
- Vertical Tray Oven
- Oven
- Drying furnace
- Incinerator
- Pantry / Kitchen
- Bakery

### 8.2.4 CNG

CNG stands for Compressed Natural Gas. It is gaseous fuel and is a mixture of hydrocarbons mainly Methane. For use in Automobiles as fuel substitute for other auto fuels such as petrol, diesel, Auto LPG etc., it is compressed to a pressure of 200-250 Kg/cm<sup>2</sup> to enhance the vehicle on-board storage capacity. It is the cleaner fuel as compared to other hydrocarbon based fuels being used in vehicles.



### 8.2.4.1 Benefits of using CNG

#### **Eco Friendly**

Commonly referred to as the green fuel because of its lead and sulphur free character, CNG reduces harmful emissions. Being non-corrosive, it enhances the longevity of spark plugs. Due to the absence of any lead or benzene content in CNG, the lead fouling of spark plugs, and lead or benzene pollution are eliminated.

#### **Increased life of oils**

Another practical advantage observed is the increased life of lubricating oils, as CNG does not contaminate and dilute the crankcase oil.

#### **High auto ignition temperature**

CNG is less likely to auto-ignite on hot surfaces, since it has a high auto-ignition temperature (540 degrees centigrade) and a narrow range (5%-15%) of in flammability. It means that if CNG concentration in the air is below 5% or above 15%, it will not burn. This high auto ignition temperature and narrow flammability range makes CNG as safer fuel.

#### **Low operational cost**

The operational cost of vehicles running on CNG, as compared to those running on other fuels, is comparatively low.

### 8.3 Process for Domestic Sector (PNG)

- Survey by marketing for potential analysis

A survey is conducted by marketing department for identifying the potential in an area defined by planning department. The marketing team carries out the survey and identifies the societies or buildings. Simultaneously the potential of the building is also identified. After identification of the society, the team approaches the society Chairman or Secretary for gas connection. If interested a camp or an audio visual session is organized where residents are informed about the benefits of natural gas. Once requisite number of registrations are received from a building, a survey is done by a cross functional team of marketing, planning and projects. They decide the course of pipeline and conversion aspects. The details of the project are sent to the HOD's for approval

- Expression of interest (EOI) from customer

After the awareness phase EOI forwards the number of interested customers to IOAGPL. As first hand confirmation EOI gets filled first a registration requisition form. It ensures the interest of customers.

- Registration

After receiving the requisition forms and request by marketing team for registration forms, registration forms are issued to team. Marketing team gets the form filled and collects the payment. The collected details are sent to data centre for entry into the database.

- Permission process initiated

Once, all the HOD's analyse the feasibility of project and approve the project the statutory permissions process is initiated. This includes permissions from Chandigarh Haryana Punjab Municipal corporation, Traffic, Fire department, Chief Controller of Explosives, etc.

- Laying of lines(MP/LP/GI)

After receiving permissions from the authorities' pipeline laying work is started. The pipeline laying includes laying of medium pressure line outside the society and low pressure and GI lines inside the society premises.

- Conversion

After laying the low pressure and GI network inside the society, finally meter control valve, regulator, meter and copper tubing is installed inside the kitchen of customer. Once all the installations are done inside the kitchen gas supply is started and bills are generated on bimonthly basis.

## **8.4 Infrastructure: City Gas Distribution Network**

The primary network of steel pipelines provides the core backbone connecting CGS to various DRS. The pressure levels for primary network are between 31 bar(g) to 19 bar(g). While most of the industrial customers are not required to be supplied at this pressure level, only a select few units have specific requirement for medium pressure delivery would be connected to through this network. The design of the primary network is based on the demand forecast to be catered. Secondary network system consisting of MDPE pipelines operates at pressure level between 4 bar(g) to 1 bar(g). MDPE pipeline network is planned for cluster of industrial, commercial or domestic units at low pressure. The secondary network is normally developed with MDPE pipes. Using the domestic / small commercial quantity and large commercial quantity values, and additional information, including location of customers, pressure requirements at major customers, availability of existing supply, and geographic features, optimum method of supply is determined and the network is designed and constructed accordingly. The supply facilities include the following: -

- High pressure Steel pipeline main
- Medium pressure Steel pipelines

- Low pressure MDPE mains
- Low pressure MDPE services
- CGS/ DRS / Hot Taps
- Service Connections
- Odorisation Facilities

### **Various stations involved in the network**

The various stations involved in the network are:

- City Gate Station (CGS)
- District Regulating Station (DRS)
- Pressure Reduction Station (PRS)

#### **8.4.1 City Gate Station (CGS):**

CGS for the network is normally located at Tap off point of the main transmission line or else connected by a spur line to the main transmission line. The CGS has an inlet supply main from the transmission pipeline, a pressure reduction system, a filtering unit, gas chromatograph and metering, odorant injection system and associated piping along with various monitoring and control systems. The gas transported at city gate station is at a high pressure. The pressure reduction facility comprises pressure regulator runs with standby units, each having an active /monitor regulator, each fitted with 'slam-shut' protection facilities. In addition, provision can be made for natural gas pre-heaters, as per the design requirements. It is recommended that a CGS be located in a fenced off secure area. To supply the remainder of the distribution system from the 26 bar maximum transmission pressure system, 'DRS' is required. The DRS will be similar in design to the City Gate with different capacity, except no allowance is normally required for gas heating.

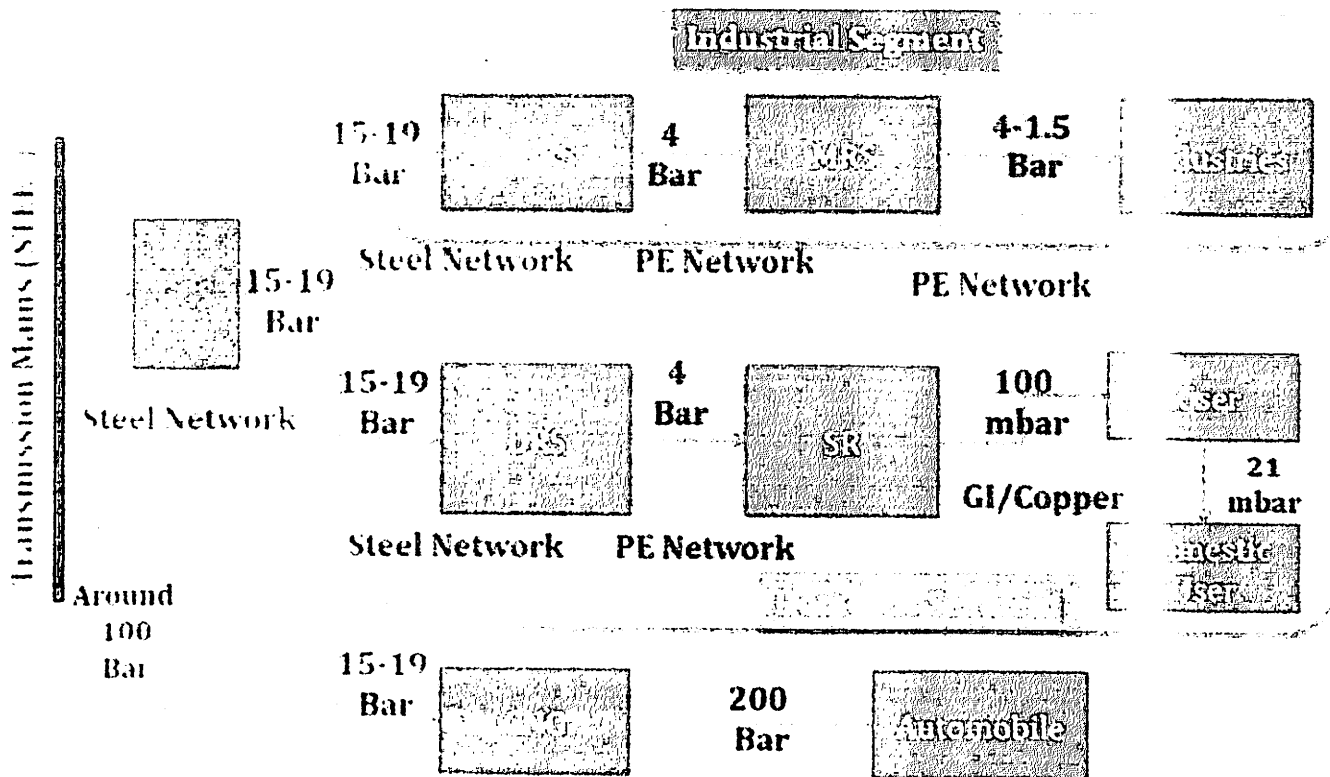


Figure: City Gas Distribution system

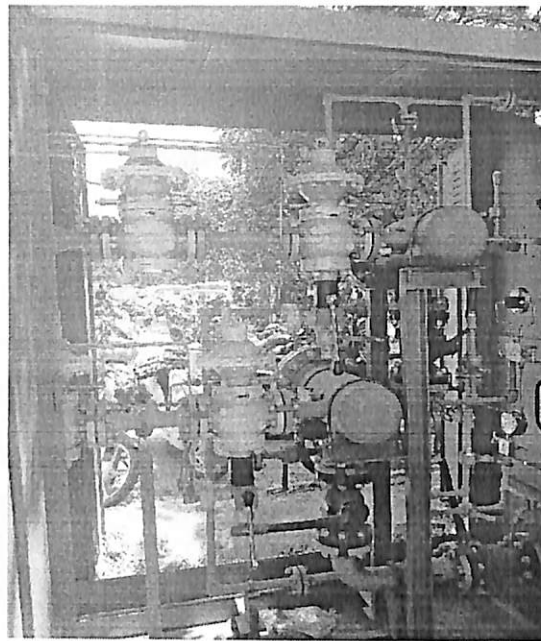
#### 8.4.2 Industrial Pressure Reduction Station (IPRS):

IPRS for the network is located in major Industries. It has a pressure reduction system, a filtering unit, Turbine metering system, valves etc. Based on the consumption profile of the user, customized arrangements are designed with metering arrangement. The IPRS has slam shut valves, pressure regulating valves, creep relief valve and vent, isolation valves, non-return valves and pressure gauges.

#### 8.4.3 District Regulating Station (DRS):

DRS for the network is located at strategic locations which are sometimes also known as field regulating stations to meet various demand centres for Domestic/ Industrial segment. It too has a pressure reduction system, a filtering unit, Turbine metering system, valves etc. Based on the consumption profile of cluster of users, customized arrangements are designed with online metering arrangement. The DRS too has a slam shut valves, pressure regulating valves, creep relief valve and vent, isolation valves and no-return valves. Basically there are three sections that describe the purpose and different component of stations located at a pressure levels interface

- The City Gate: interface between High Pressure and Medium Pressure;
- The Pressure Reducing Station: interface between Medium Pressure and Low Pressure
- The Service Connection: interface between network and end-user pressure.



**Figure10: District Regulatory System**

In City Gas Distribution Network 12"/8" dia main with 4"/ 3" / 2" dia branch lines, network has been laid in the city at a depth of 1.0 metre. and the new distribution lines have been laid at a depth of 1.5 metre. from ground level and operating at a pressure of 15 Kg/cm<sup>2</sup>. Pipeline has been extended to the premises of individual consumers from this network. The total length of pipeline network in each city is a little over 50 Km. Major portion of the network has been laid with steel pipe and some of it has been constructed using PE pipes. Primary protection to the pipeline against external corrosion has been given by PE / Coal Tar coating / cold tapes. Cathodic Protection has also been given in the network apart from coating of pipeline. Sectionalizing valves have been provided in the network at regular intervals. A separate valve has also been provided in each of the branch lines and again at the inlet to each consumer point. In case of emergency, gas supply in the affected section can be stopped by closing the upstream and downstream valves. Pipeline markers at every 50 mtrs. distance and warning signs at approx. 500 metres. Distance have also been installed for easy identification of pipeline. A continuous warning tape has been provided at the top of the entire pipeline in the city. Gas Venting facility has been provided at the City Gate Stations and also at each customer end for venting out the entire gas from the respective city gas networks in about 15 minutes in case of any emergency.

#### **8.4.4 CGD- Domestic Installation:**

Natural Gas is transported with the help of steel pipes or the Medium-density polyethylene (MDPE) to the area near to the transition fitting. In the figure given below it can be clearly observed that the GI pipeline is installed after the Transition fitting. Meter and meter regulator are installed to control the flow. Reduced pressure to 21mBarg is delivered to the Appliance.

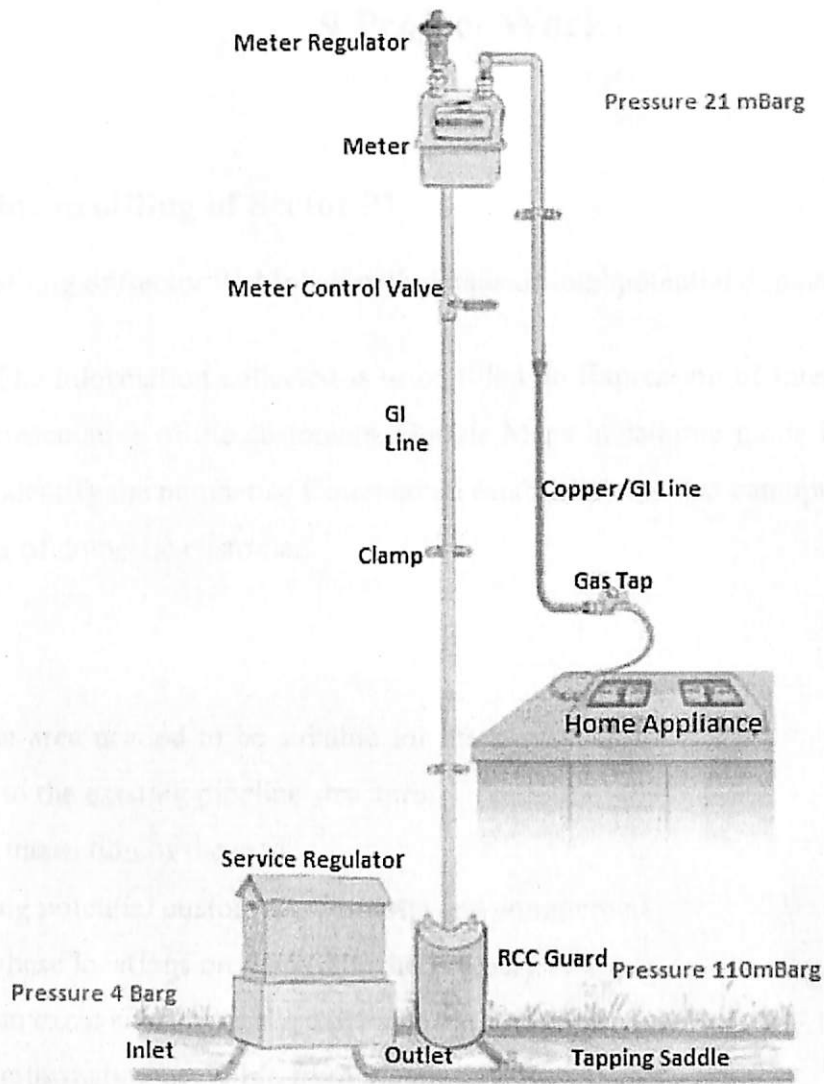


Figure11: Domestic Connection Schematic

## 9 Project Work

### Part A

#### 9.1 Demographic profiling of Sector 91

Demographic profiling of Sector 91 Mohali with details of total potential domestic and commercial units.

**Requirements:** The information collected is to be filled on Expression of Interest form by the potential customer or a representative of the customers. Google Maps in satellite mode for marking the area. The survey is done to identify the number of Commercial establishments that can opt for piped natural gas and estimating number of domestic customers.

**Procedure:**

1. Select the area needed to be suitable for the survey. Usually the sample area selected is one is adjacent to the existing pipeline structure.
2. Physical inspection of the area,
3. Identifying potential customers, domestic and commercial.
4. Identify these locations on map (Attached below)
5. Prepare an excel sheet to analyse the input information
6. Add the information available from previous data
7. Sharing the information with the project team

**1. Selecting the area:**

Survey is conducted for the area on the basis of the following parameters

- a. Adjacent to the existing pipeline path/connection.
- b. Number of potential customers.
- c. Feasibility of installing PNG connection

**2. Inspection of Area**

The area is surveyed to find out the number of potential customers in the area. The area is checked for the domestic and commercial potential. The communication is done with the help of filling up of the expression of interest by the customer or the representative of the group of customers. The customer need to fill the demographic details and the consumption pattern. The information from the domestic customers is more of the same consumption pattern however the information from the different types of commercials is different.



### 3. Identifying potential customers

Marketing team surveys the area and the area is segmented into commercial and domestic customers. Domestic customers are targeted and it is tried that all the customers are converted to the natural gas. Marketing team targets at 100% conversion. Commercial units that are Using other fuels are also made aware about the product. And they are also considered as the potential customers.

### 4. Identify these locations on map

This surveyed information of customers are marked on Google My Map. Here we attached below is the map of sector 91 Mohali where the survey was conducted to find the potential customers in the here. In the map the High rise towers are represented with the help of marker and domestic customers' flats are marked with the help of polygons.

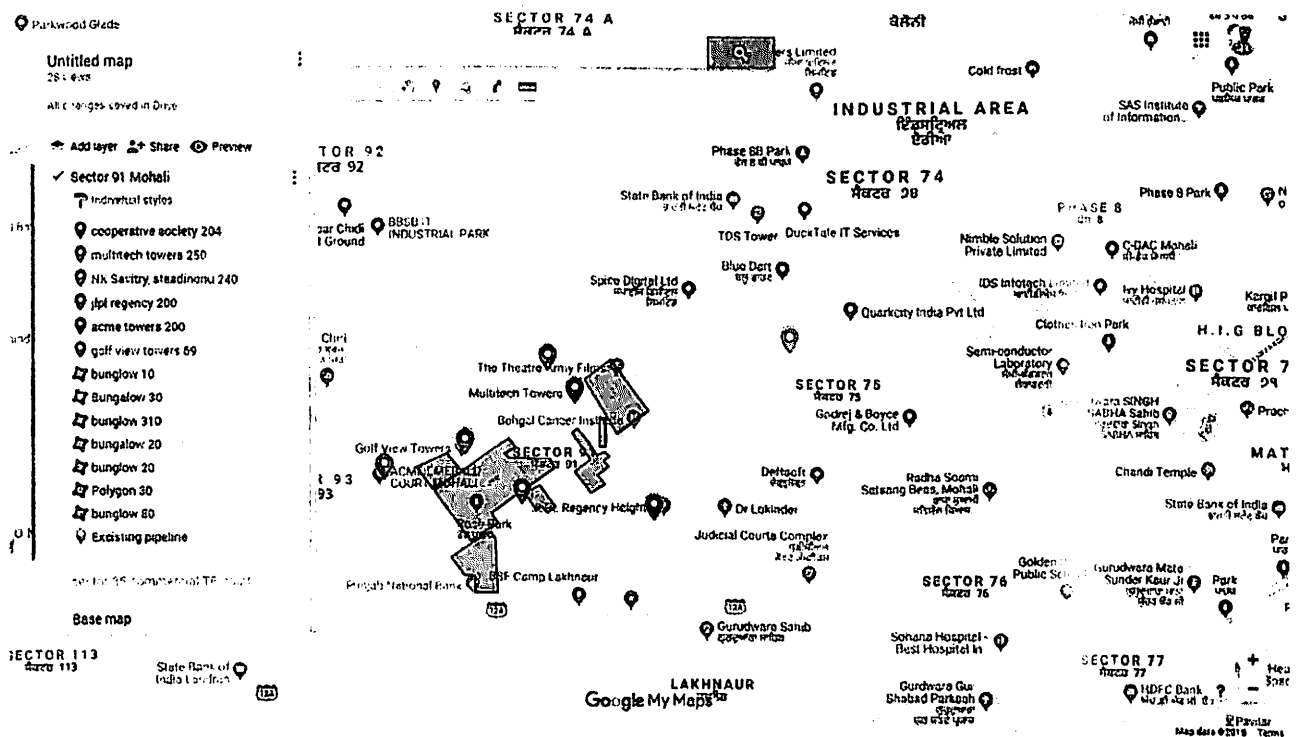


Figure12: Google My Map presentation

5. **Preparing the data:** This data is prepared with the help of an excel sheet this data is converted to an excel sheet representing the actual data from the site survey.

### Potential survey report

Sr. No.	High Rise Building	Potential
1	Co-operative Society	204
2	Multi-tech Towers	250
3	Steadinonu Towers	240
4	JLPL Regency	200
5	Acme Towers	200
6	Golf View Towers	69
	<b>Total</b>	<b>1163</b>

Area	Potential
Commercial	8
Flats	1163
Bungalow	500
<b>Total</b>	<b>1671</b>

Table11: Potential Survey Report

### 6. Adding additional information:

Additional information is also attached that there is an availability of the pipeline available at no more than 500 meters from where we can connect the area as there is an existing MDPE pipeline already laid down. Also to maintain the details of the newly developing societies.

### 7. Sharing the information with project team

8. This information is shared with the project team as they will check for the technical feasibility in the area. Calculating Return of investment in Sector 91 Mohali

Sr No	Type of Work	Rate (Rs.)
1	MDPE pipeline Laying(incl. of material)	500 per meter
2	GI pipeline Installation	400 per meter
3	Permission Cost (MDPE Laying)	800 per meter
4	Labour cost ( MDPE)	500
5	RFC Cost	3000

Table12: Calculating Return of investment in Sector 91 Mohali

Activity	Measure	Rate	Total Cost (Rs)
MDPE Laying	12 Km	1800 <sup>(1)</sup>	21,60,000
GI Laying	24000 KM	750 <sup>(2)</sup>	1,80,00,000
Installation Cost	1663 Nos	2000	33,26,000
RFC Cost	1663 Nos	3000	49,89,000
Total Cost			2,84,15,000

<sup>(1)</sup>Per meter Rate of Laying MDPE = Permission cost + Pipeline cost + Labour cost

<sup>(2)</sup>Per meter Rate of Laying MDPE = Pipeline cost + Labour Cost

### Domestic

>>Gas Price = Rs30 /SCM

>>Average monthly billing of customer:  $13.5 \times 30 = \text{Rs } 405$

>>Total Number of customers= 1663

>>Total yearly revenue from billing=  $1663 \times 405 \times 12 = \text{Rs. } 80,82,180$

### Commercial

>>Total Commercial Units : 8

>>Daily Consumption: 50 SCMD

>>Monthly consumption:  $50 \times 30 \times 8 = 12,000$

>>Commercial Rate: 48 Rs/SCM

>>Monthly Revenue=  $12000 \times 48 = \text{Rs } 5,76,000$

>>Annual Revenue =  $5,76,000 \times 12 = \text{Rs } 69,12,000$

>>Total annual revenue =  $69,12,000 + 80,82,180 = 1,49,94,180$

Based on the above analysis it can be seen that numbers of years in which the cost of infrastructure investment will return will be

$$= 2,84,15,000 / 1,49,94,180$$

= 1 year 4 Months (Approximate)

### **Findings and conclusion:**

- Company should start with this project as based on above calculations if there are 1663 households and 8 commercial units with average consumption of 13.5 and 50 SCM per month then the infrastructure cost can be covered in approximately 1 year and 4 months.
- The area is currently in the developing stage marketing team needs to take periodic updates of this area so that increased potential can be counted.
- The area is adjacent to the Mohali industrial sector so there are chances of establishment of commercial units in the near future.
- Some of the societies are already using the LPG banks so there is an opposition from societies as they have long term contracts with gas agencies.
- Most of the residential bungalows were highly decorated and they were also resistive because of the two reasons
  - External pipeline will affect the looks of the house
  - Most of these places were rent out and owners were not showing interest to avail the connection
- Newly developing societies were eager to take connection as their cost will reduce with the new PNG connection.
- Currently there are less commercial units available so this area might not be return generation for the organisation. As company delivers domestic gas at the subsidised price and commercial units at commercial rate the return of investment will be higher only in case of the commercial units

**Part B****9.2 Identification and conversion of the commercial customers from LPG to PNG, Sector 35 Chandigarh.****Methodology**

The process of collecting data is done with the collaboration of Marketing and Engineering department. Mainly data is related to the consumption of fuel and number of burners customer is using. This is done in the various visits.

**Initiation: Introduction to the company and the procedure**

In first visit information about the company and its product is given and the procedure is explained to the customers, here customers are informed that pipeline is being laid down near to your premises and you can avail the facility of using natural gas that is cheaper with various other advantages over the existing fuel that you are using. These potential customers were made aware about the benefits of using PNG. An intimation of the Engineer's visit is also given that our engineer will come and you are requested to give them permission to enter the kitchen for checking the cooking equipment's. Here if the customers agree to follow the procedure then process is followed by and engineers visit.

**Observations:**

1. Customers were already using the LPG connection
2. Were curious about the cost they need to pay for it and how much it will be beneficial for them.
3. Payment period and grace period.
4. Cost of Installation and conversion of pipeline and other equipment's were turns out to be

**Technical Visit: Load assessment by Engineer**

In Second visit an Engineer from company will visit the location and checks the burners and heaters that is used for the purpose of cooking and heating. While using standards for the standard for different burners (refer to table) this data is multiplied with the daily working hours and the number of LPG cylinders being consumed. Based on this Load assessment the engineer will suggest a meter that will be able to serve the purpose of the consumer under any circumstances.

Sr. Number	Burner	Consumption(SCMH)
1	4" burner	3
2	3" burner	3
3	Rod burner	5

Table13: Standard for different burners

**Observations:**

2. All the technical details related to the premises is collected.
3. Consumption pattern of the customer is analysed.

**The Proposal**

In third visit Marketing team visits the customer with a proposal that consist of the suggested meter, saving sheet and security amount to be paid with all the instructions that the consumer has to follow to avail the connection. Here manager will discuss with the owner to make a decision whether to accept or reject the proposal.

Sr. Number	Meter	Security Amount (INR)
1	G-6PD	25000
2	G-16PD	35000
3	G-25PD	65000
4	G-25RPD	3,85,000

Table14: Commercial meter refundable security amount

**Observations:**

Customers are made aware about the payment and formalities that are needed to be done. The conversion to Natural Gas is an important decision that need to be made by the commercial unit. It is a long term investment decision as the hotel will come with contract a new company. A customer can also demand for the savings that he will be able to do after conversion. This information is provided with the help of a saving sheet which is prepared according to the usage and fuel used by the customer.

If the customer accepts the proposal, then the customer pays in full for the connection and marketing team delivers this information to the operation team for further processing. A contractor chosen by the commercial unit as per there choice can do the internal pipeline fitting according to the requirement of the customers. After this business partner no and the customer account numbers are generated and Our team visited various hotels and restaurant establishments in sector 35 Chandigarh. As per now the installation of

the transition fittings has been done on the premises as per the data provided by the marketing team to the Project team.

### **Findings and Conclusion:**

From this research we have found that:

1. Customers are curious to convert to the new service. There is a need of Awareness Programmes for masses.
2. From receiving EOI to start of gas supply is a time taking process.
3. Customer feel it will be more convenient as compared to the LPG. It will also help them save time and money related to handling and storage of the LPG.
4. Higher refundable security for meter is also a matter of concern for small business entities.
5. As natural gas is new to the city customers are uncertain about continuity of the supply.
6. Customers have to get internal fittings done by the vendors at their cost. This is the reason of resistance towards PNG from some of the owners of establishments.



### 9.3 A case of Hotel Maya:

Hotel Maya an establishment in the Sector 35 which is using LPG form the time it started their operation. In the first meet they were really curious about the new service that will be available to them in the coming month. Our team introduced them to the features and pricing of the PNG. They were really eager to join us as of the first visit and Expression of interest was taken from them and they were informed that an engineer will visit their kitchen for the purpose of load assessment. When the kitchen was visited by the assigned engineer found out that there are 8 nos. of 4" burners and 6 nos. of 3 inch burners and they are using a Rod burner. The total flow requirement came out to be 52 SCMH if all the burners are operated at the same time. Engineer suggested that they should be using G-25RPD meter. Based on this assessment a proposal was designed. In the meeting on 25.06.2019 after reading the proposal it was found that customer was not satisfied with the proposal. There were concern of the customer which are given below

1. Meter security Deposit was really high i.e. Rs. 3,85,000
2. Internal conversion and pipeline fitting cost to be paid by the Hotel.

#### Suggestion and Changes in the proposal

1. As customer informed us that all the burners does not work for all the time. I gave the suggestion that the four burner gas stove they are using for making continental and Breakfast can be spared from conversion as they can still use LPG for it and the total consumption will be reduced to 40 SCMH (i.e.  $52 - 4 \times 3 = 40$  SCMH).
2. This reduced flow can be served by the gas meter G-25PD requiring a security deposit of Rs. 65000/- only

#### Outcomes:

Customer was satisfied with the proposal and agreed on the terms. The customer is ready for the conversion and will fill the application form and pay the deposit fee.

## 10. Conclusion & Recommendations

With a great working environment and growth potential I would like to give some suggestions that might be helpful in daily functioning of the company:

### 10.1 Commercial vertical:

As had a chance to interact with the commercial customers personally I found out that all the customers are showing same reasons for the unwillingness to opt the commercial connections as commercial customers are facing huge investment while conversion they should be given benefits while joining the company. Meter security can be payable with minimal interest charges. This will help in increased customer penetration. Commercial customers are the only ones that can increase the revenue to the company there should quicker procedure for the conversion for the commercial customers. Company should focus on the conversion procedure than the initial upfront payment.

### 10.2 SAP & Billing:

As the company is still in development phase there are some minor facilities that could make the life of the customers easier with these small updates in SAP like SMS for Billing, SMS for Cheque Bounce. Record of walk in customer complaint always must be recorded in SAP. It will facilitate the customer and company. There should be more bill collection centres. As PNG is the fuel of 21<sup>st</sup> century which is derived by digital initiatives, the customer should be able to know about its connection and billing status with the help of one touch on their mobiles.

### 10.3 Promotional/Awareness Activities

More promotion and awareness activities should be done regarding usage and safety of the gas. This can also help in attracting more customers and will help in increasing penetration rate. There should be advertisements on Cable television that could be beneficial to the domestic as well as commercial/ Industrial customers that will make the customers aware and more penetration could be done easily.

### 10.4 Collaboration with real estate companies:

Although Chandigarh area is already developed but nearby areas are being developed by the Real estate companies. Indian Oil Adani Gas should make tie ups with these companies so that they could avail the facility of PNG. With the help of this there will be maximum penetration in the area.

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