

Detailed Feasibility Report

**Geographical Area – Ajmer, Pali and
Rajsamand District**

Submitted to

Indraprastha Gas Limited



FEEDBACK INFRA
Making Infrastructure Happen

Feedback Infra Private Limited



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A. LIST OF ABBREVIATION

S. No.	Abbreviation	Full Form
1.	APM	Administered Pricing Mechanism
2.	CA	Charge Area
3.	CAGR	Compound Annual Growth Rate
4.	CAPEX	Capital Expenses
5.	CGD	City Gas Distribution
6.	CGS	City Gate Station
7.	CNG	Compressed Natural Gas
8.	DBS	Daughter Booster Station
9.	DRS	Districts Regulating Station
10.	EBITDA	Earnings Before Interest, Taxes, Depreciation & Amortization
11.	FO	Furnace Oil
12.	FY	Financial Year
13.	GA	Geographical Area
14.	GDP	Gross Domestic Product
15.	HSD	High Speed Diesel
16.	IRR	Internal Rate of Return
17.	LDO	Light Diesel Oil
18.	LMC	Last Mile Connectivity
19.	LPG	Liquefied Petroleum Gas
20.	MDPE	Medium-density polyethylene
21.	MMBTU	Million British thermal Unit
22.	MMSCMD	Million Standard Cubic Metre per day
23.	MS	Main Steel
24.	WP	Work over Program
25.	NH	National Highway
26.	OECD	Organisation for Economic Co-operation & Development
27.	OLS	On-line Station
28.	OMC	Oil Marketing Companies
29.	OPEC	Organization of Petroleum Exporting Countries
30.	OPEX	Operating Expenses
31.	PAT	Profit After Tax
32.	PFR	Pre-Feasibility Report
33.	PNG	Piped Natural Gas
34.	R-LNG	Regasified Liquefied Natural Gas
35.	RTO	Regional Transport Office
36.	SCMD	Standard Cubic Meter Per Day
37.	SCMH	Standard Cubic Meter Per Hour
38.	L-CNG	Liquefied- Compressed Natural Gas



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1. EXECUTIVE SUMMARY

1.1 Introduction

PNGRB has granted authorization to **Indraprastha Gas Limited (IGL)** (hereafter referred to as company) for development of city gas distribution in the geographical area of Ajmer, Pali and Rajsamand districts in Round X CGD Bidding Process.

Indraprastha Gas Limited (IGL) is one of India's leading natural gas distribution companies. Established in 1998, the company operates primarily in the National Capital Region (NCR) of New Delhi. IGL took over Delhi City Gas Distribution Project in 1999 from GAIL (India) Limited (Formerly Gas Authority of India Limited). The city gas distribution project was started to lay the network for the distribution of natural gas in the National Capital Territory of Delhi to consumers in the domestic, transport, and commercial sectors. With the backing of strong promoters – GAIL (India) Ltd. and Bharat Petroleum Corporation Ltd. (BPCL) – IGL plans to provide natural gas in the entire capital region.

In addition to domestic & automotive sector, the company is also supplying natural gas to commercial and industrial sectors through its pipeline network and continuously is in process of growing its pipe line network infrastructure to meet increasing demand of natural gas.

Indraprastha Gas Limited has appointed Feedback Infra Private Limited as a consultant for carrying out market survey, preparation of Detail Feasibility Report for Ajmer, Pali and Rajsamand GA.

1.2 Districts Profile

Ajmer districts is situated in the centre of Rajasthan State. The districts is surrounded by Jaipur and Tonk districts in East and Pali districts in west, Nagaur districts touches its North boundaries while Bhilwara districts in the South. The geology of districts is that of the Aravalli range which extends throughout the districts except the North-Western part which is flat and plain and covered by sand dunes. Almost whole of the area shows very strip vertical dugs and the rock are repeated several times in the section. It is quartzite section which forms highest peaks above the general level of range at Taragarh near Ajmer. The best rocks in the region are granites, felspathics chists, calgeneisses marble and quartzite exposed along the Ajmer-Nasirabad pass. Gneiss and granite are predominating towards Beawar section but towards Ajmer, the granite alternates with limestone, mica chists and Felspathetic quartzite, coarse grained marble, lime and building stone is seen in the South West plains of Ajmer. Among other minerals found in the districts are mica, asbestos, vemiculite, soap stone, masonry stone and brickclay. Granite deposite, are found at (Sendra), Beawar, Bandanwara and Kishangarh area.

Pali districts is one of the 33 districts of Rajasthan. Before the formation of Rajasthan this districts was a part of Jodhpur State. The districts takes its name from the town of Pali which is also the mineral wealth of the districts is largely non-metallic. The chemical grade limestone, Quartz, Feldspar and Calcite produced in the districts is also known for their quality. Other minerals are Asbestos, Soap stone, Magnesite, Gypsum, Marble and Barytes. Districts have substantial resources of Quartz feldspar, Asbestos. Lime Stone, Marble and Granite.



Rajsamand district was a part of Udaipur districts, which was formed a separate district later in April 1991. The districts is well known for his historical background, geographical features, natural, semiotic large mineral deposit and religious dedications. An artificial lake called Rajsamand lake and a place built on mountain which is called Rajmandir and city itself was given the name Rajnagar, which is nowadays is called Rajsamand. Rajsamand districts is particularly rich in mineral resources as a large variety of important minerals are found. The important Minerals are Lead and Zink, Asbestos, Dolomite, Lime stone, Marble and Granite, talc (Soapstone).

The total geographical area of the Ajmer, Pali and Rajsamand districts is 25,523 sq.km. According to 2011 census, the districts has a population of 57,77,222 and total households of 11,56,067. Ajmer and Pali and Rajsamand districts is well connected by railway and roadways.

Ajmer, Pali and Rajsamand districts has 25 CA's namely:

Table 1 List of Charge Areas

Charge Area ID	Name	Charge Area ID	Name
Charge Area- 01	Kishangarh	Charge Area- 14	Rajsamand
Charge Area- 02	Sarwar	Charge Area- 15	Nathdwara
Charge Area- 03	Kekri	Charge Area- 16	Kumbhalgarh
Charge Area- 04	Bhinay	Charge Area- 17	Bali
Charge Area- 05	Nasirabad	Charge Area- 18	Sumerpur
Charge Area- 06	Ajmer	Charge Area- 19	Desuri
Charge Area- 07	Peesangan	Charge Area- 20	Pali
Charge Area- 08	Masuda	Charge Area- 21	Rohat
Charge Area- 09	Beawar	Charge Area- 22	Marwar Junction
Charge Area- 10	Bhim	Charge Area- 23	Sojat
Charge Area- 11	Deogarh	Charge Area- 24	Raipur
Charge Area- 12	Amet	Charge Area- 25	Jaitaran
Charge Area- 13	Railmagra		



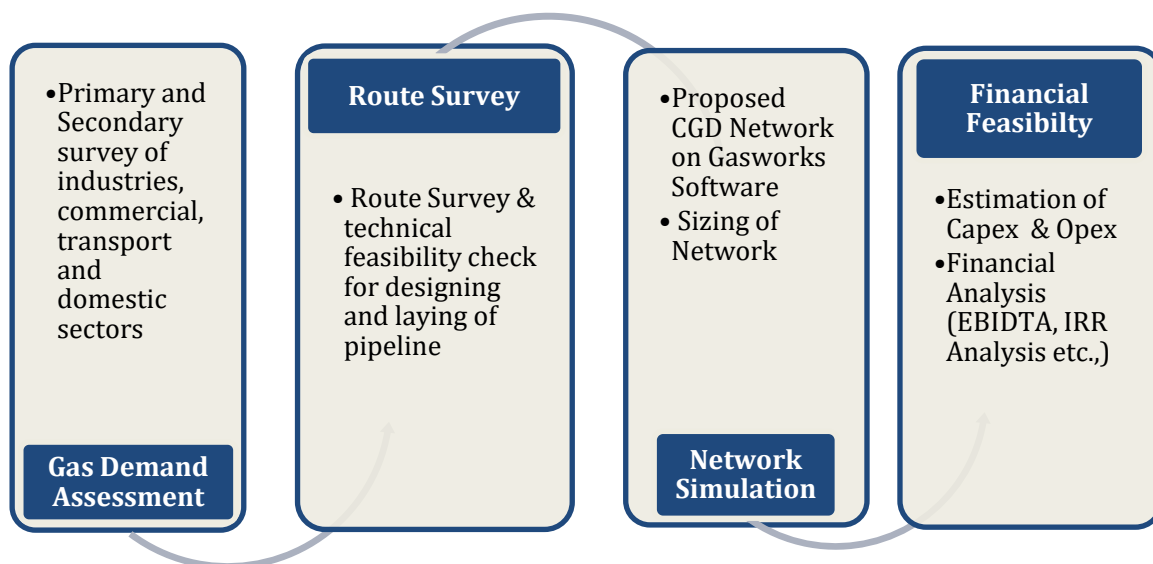
Figure 1 Ajmer, Pali and Rajsamand Districts PNGRB Map

(Enclosed)

1.3 Approach & Methodology

The DFR was carried out in four stages to collate all important parameters which are impacting the demand of natural gas and profitability of the project. These stages are explained as under:

Figure 2 Approach & Methodology



1.4 Demand Assessment

Demand assessment of natural gas in Ajmer, Pali and Rajsamand districts is carried out by a bottom up approach based on primary survey and secondary research. The primary survey was carried out for industrial, commercial; transport and domestic sectors and all the major demand centres/clusters were identified to cater the natural gas demand in the Ajmer, Pali and Rajsamand geographical area. Major potential gas customers & anchor load were identified during the survey for the estimation of realizable demand. In industrial & commercial segment, energy fuel requirements of the alternative fuels used by the various industries & commercial establishments were collected to assess demand. For transport segment, RTO data of registered vehicles was collected from the transport RTO office for demand estimation. A traffic survey is conducted for floating traffic to calculate the number of cars passing from various NH/SH excluding the SUVs. On the other hand, for estimating domestic demand, household data provided in Census is used. On the basis of primary & secondary survey data, and by applying various year-on-year switchover rates, the realizable demand for 25 years is estimated.



The total realizable demand from sectors i.e., industrial, transport, commercial and domestic sector is estimated to be 2.83 MMSCMD with transport sector having share of 2.06 MMSCMD (~73% of total demand), industrial sector contribution is estimated to be 0.28 MMSCMD, domestic sector is estimated to be 0.39 MMSCMD and commercial sector is estimated to be 0.10 MMSCMD in the 25th year.

Table 2 Realizable Demand (in MMSCMD)

Realizable Demand	Y1	Y5	Y8	Y10	Y15	Y25
	FY 20	FY 24	FY 27	FY 29	FY 34	FY 44
Domestic	0.00	0.17	0.38	0.38	0.38	0.39
Industrial	0.00	0.09	0.14	0.15	0.19	0.28
Commercial	0.00	0.02	0.03	0.04	0.07	0.10
Transport	0.00	0.43	0.70	0.79	1.07	2.06
Total	0.00	0.71	1.25	1.37	1.70	2.83

1.5 Gas Sourcing

The tap-off point identified for feeding CGD network in Ajmer, Pali and Rajsamand is as follows:

Table 3 Tap-off Details

Districts Name	Tap-off Point	Pipeline	Entity
Ajmer, Pali and Rajsamand	SV 4010	Mehsana-Bhatinda Pipeline (Proposed)	GIGL
	SV 4011	Mehsana-Bhatinda Pipeline (Proposed)	GIGL
	SV 06	Barmer-Pali Pipeline (Existing)	GIGL

SV-4010 tap-off point on proposed Mehsana-Bhatinda Pipeline in Daulatkhedha village near Mangliyawas and SV-4011 tap-off point on proposed Mehsana-Bhatinda Pipeline in Rajosi village near Nasirabad are considered for the feeding of CGD network in Ajmer district. SV-06 tap-off point on existing Barmer-Pali Pipeline in village Deoli near Sumerpur tehsil is considered for the feeding of Pali district. The city gas stations has been planned near all SV stations.



1.6 Technical and Financial details

Indraprastha Gas Limited has received the authorization to set up city gas distribution project in Ajmer, Pali and Rajsamand districts from PNGRB in CGD round 10 bidding with the following targets:

Table 4 PNGRB Target in 8th year

GA Name	State	Network Tariff INR/MMBTU	Compression Charge INR/KG	CNG Stations	PNG Connections	Steel Pipe (Inch- km)
Ajmer, Pali and Rajsamand	Rajasthan	30	2	198	1,000,994	1944

The year-wise approximate phasing of the creation of physical infrastructure by the entities as per CGD Authorisation Regulations and operational year description as per PNGRB would be as under:

Table 5: Year-wise approximate phasing

Year Number as per PNGRB	Period	Number of Domestic PNG Connection (Cumulative)	Number of CNG Stations (Cumulative)	Length of Steel pipeline (in inch- km) (Cumulative)
0	FY 2019	-	0	0
1	FY 2020	-	0	1116.80
2	FY 2021	1,00,094	30	2246.80
3	FY 2022	2,00,189	60	2551.60
4	FY 2023	3,00,283	90	2587.60
5	FY 2024	4,00,378	119	2622.40
6	FY 2025	6,00,566	149	2658.40
7	FY 2026	8,00,755	179	2694.40
8	FY 2027	10,00,944	198	2717.20

The penetration and the number of CNG stations is considered based on PNGRB MWP targets. The Steel pipeline (inch km) length is derived after physical survey of each CA, network sizing & optimization using Gasworks and configuring the CGD network in the best possible and optimal manner.



Table 6 No. of Household Connections

Particulars	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27
Target %	0%	10%	20%	30%	40%	60%	80%	100%
PNG Household (Cumulative)	-	1,00,094	2,00,189	3,00,283	4,00,378	6,00,566	8,00,755	10,00,944

Table 7 CNG Stations Phasing

Particulars	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27
Target %	0%	15%	30%	45%	60%	75%	90%	100%
COCO 1200 SCMH	0	6	12	18	24	30	36	40
DODO/RO 450 SCMH	0	24	48	72	95	119	143	158
Total CNG Stations (Cumulative)	0	30	60	90	119	149	179	198

Table 8 Feasible Steel (Inch-km)

Particulars	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27
Target %	5%	20%	40%	60%	70%	80%	90%	100%
Steel Inch-km (Cumulative)	97.2	291.60	388.80	388.80	194.40	194.40	194.40	194.40

Table 9 DRS Phasing

Particulars	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27
DRS 2000 SCMH (Cumulative)	-	4	9	13	25	36	47	56

The CGD network is configured in the best possible optimal manner so as to derive realistic Capex and Opex numbers.



The cumulative CAPEX and OPEX are as follows:

Table 10 Capex (INR cr.)

Capex (Cumulative)	Y1	Y5	Y8	Y10	Y15	Y25
	FY 20	FY 24	FY 27	FY 29	FY 34	FY 44
CGS	44.05	68.96	87.53	99.64	103.55	161.92
CNG	0.00	284.11	491.95	491.95	491.95	1324.60
CGD Infrastructure – Steel	17.51	266.92	428.05	428.13	428.22	429.14
CGD Infrastructure – MDPE	9.93	677.22	1735.22	1736.49	1737.83	1751.96
Last Mile Connectivity	0.00	472.04	1240.66	1241.36	1242.10	1249.86
CNG Unregulated	2.87	15.11	24.32	30.05	44.38	73.04
IDC	0.00	0.00	0.00	0.00	0.00	0.00
Total CAPEX	74.35	1796.04	4023.59	4037.76	4043.84	4824.29

Table 11 Opex (INR cr.)

Opex	Y1	Y5	Y8	Y10	Y15	Y25
	FY 20	FY 24	FY 27	FY 29	FY 34	FY 44
CGS and CGD	1.14	52.77	120.13	124.55	147.94	238.06
CNG	33.05	245.84	411.60	475.27	686.79	1680.30
Total Opex	34.19	298.61	531.73	599.81	834.73	1918.36

Natural Gas price on various segments (domestic, commercial, industrial and transport) is determined from cost plus basis. Selling & Distribution cost and utility margin added to Input Gas Cost with an escalation of 3% to determine the Natural Gas price.

Table 12 Gas Selling Price

Particulars	Units	Y1	Y5	Y8	Y10	Y15	Y25
		FY 20	FY 24	FY 27	FY 29	FY 34	FY 44
PNG – Domestic	INR/SCM	27.72	28.18	31.33	34.77	37.23	44.19
PNG – Commercial	INR/SCM	47.77	48.44	56.82	64.15	69.54	85.36
PNG – Industrial	INR/SCM	40.77	41.23	48.70	55.28	60.12	74.45
CNG – Transport	INR/kg	56.50	57.61	64.22	71.03	75.89	89.63



1.7 Conclusion

The total realizable natural gas demand of Ajmer, Pali and Rajsamand districts for the 8th & 25th year is 1.25 MMSCMD & 2.83 MMSCMD respectively. The total cumulative Capex to be incurred in Ajmer, Pali and Rajsamand in 8th & 25th year (Operational year as per PNGRB) is 4023.59 Crores & 4824.29 Crores respectively. 100% equity ratio is kept for capex funding with long term debt rate taken as 10%.

The relevant financials are given below in the table:

Table 13 Snapshot of Financials (in INR cr.)

Parameters	Y1	Y5	Y8	Y10	Y15	Y25
	FY 20	FY 24	FY 27	FY29	FY 34	FY 44
Capex (Cumulative)	74.35	1796.04	4023.59	4037.76	4043.84	4824.29
Revenue	-	771.65	1731.03	2066.48	2974.08	6313.13
EBIDTA	(17.09)	106.83	456.37	528.22	757.95	1449.75
PAT	(17.09)	55.51	178.36	267.08	425.00	833.38

Table 14 Financial Indicators

Parameters	Units	Values
Project IRR	%	15.1%
NPV	INR crore	188
Payback Period	Years	13.4

The project is technically feasible & economically viable with a project IRR of 15.1%.

2. APPROACH & METHODOLOGY

This report presents a comprehensive picture of the natural gas market of Ajmer, Pali and Rajsamand GA by way of market study and summation of data from multiple sources, both primary and secondary.

2.1 Research Methodology

Primary Research Survey:

Primary Field Survey conducted for the data collection for the GA is done in the following ways:

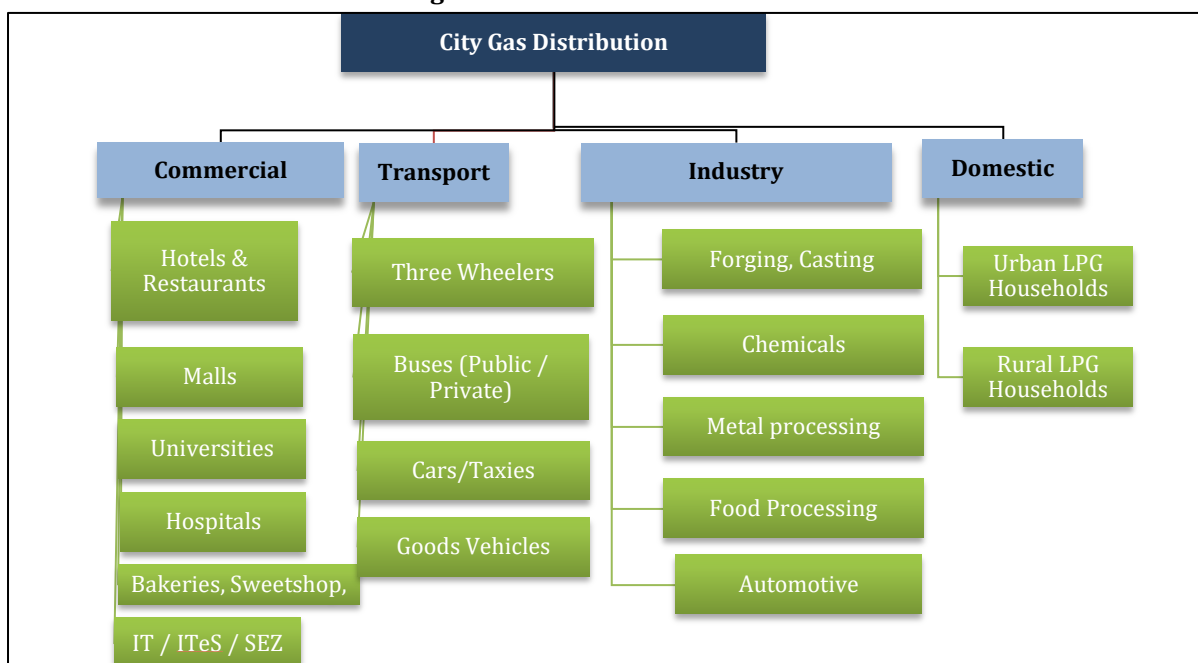
- I. Face to face meetings with the various industrial communities, pollution department, Public Works Departments etc. to find out the important industrial clusters, upcoming and long-term plans in the various communities, possible natural gas off-takers and presence of anchor loads in the regions
- II. Meeting with industrial consumers in the specified industrial clusters
- III. Meeting/Interviewing the consumers to understand their energy/ fuels requirement and rationale for using any specific kind of fuels
- IV. Meetings and interviews with the consumers to understand the price sensitivity of various fuels from consumer perspective and the change in technology required to switch to natural gas

Secondary Research Survey:

The secondary research is carried out for the collection of the data related to the Industrial, Commercial, Transport and Domestic Sector. Research data is also collected by making the use of the newspaper, research papers, journals, surfing through various websites etc. as per the requirement.

The various sectors covered for the estimation of demand in the project is pictorially represented as follows:

Figure 3 Various Sectors Covered

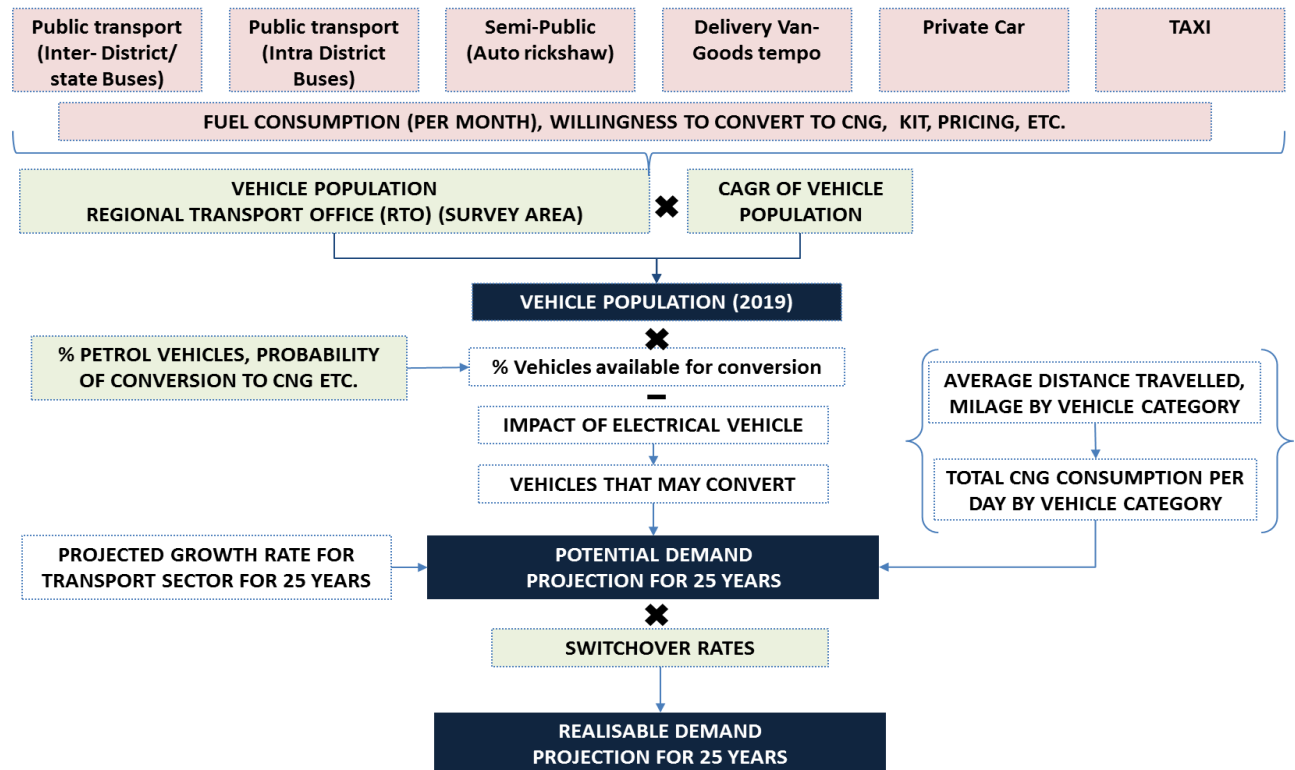


2.2 Methodology adopted for different sectors

2.2.1 Transport Sector

Demand Assessment for the transport sector is carried out by anchoring on the number of RTO vehicles present within the districts. The overall methodology for the estimation of transport demand is defined pictorially as follows:

Figure 4 Methodology for transport demand estimation



The demand for transport sector is determined by first identifying the number of vehicles available in a specified GA from RTO data. Using this RTO data for past 5 years, compounded annual growth rate (CAGR) is calculated for each vehicle segment. The RTO data is further extrapolated using the CAGR of vehicle population to arrive at vehicle population in 2019. Based on the past data as an anchor and the estimated CAGR for each vehicle category, number of vehicles in each category is projected for the entire project duration i.e. 25 years. The growth rate assumed, to avoid any anomalies, is first given a max cap and also given a smoothed tapering rate after 8th year of operation.

Percentage vehicle available for conversion for private cars and taxis is taken as the state average percentage of 4-wheeler petrol vehicles. Further, the following parameters are considered for demand assessment based on vehicle and fuel type:

- Willingness to convert to CNG
- Impact of electrical vehicle is not considered for any vehicle category
- Average distance travelled and mileage of the vehicle of the respective vehicle category
- Equivalent fuel consumption per day by each vehicle category in SCMD
- Projected growth rate for transport sector for 25 years

Based on the above parameters and suitable growth rates, extrapolation of the data is carried out to estimate the potential demand of the Natural Gas. Finally, the projected vehicles in each

fuel wise category is multiplied with average consumption (estimated for each vehicle category by considering appropriate distance travelled and mileage achieved) to determine the estimated demand for transport sector. For the estimation of the realizable demand of CNG, the concept of the switchover factor is applied.

2.2.1.1 Methodology Adopted for Floating Traffic

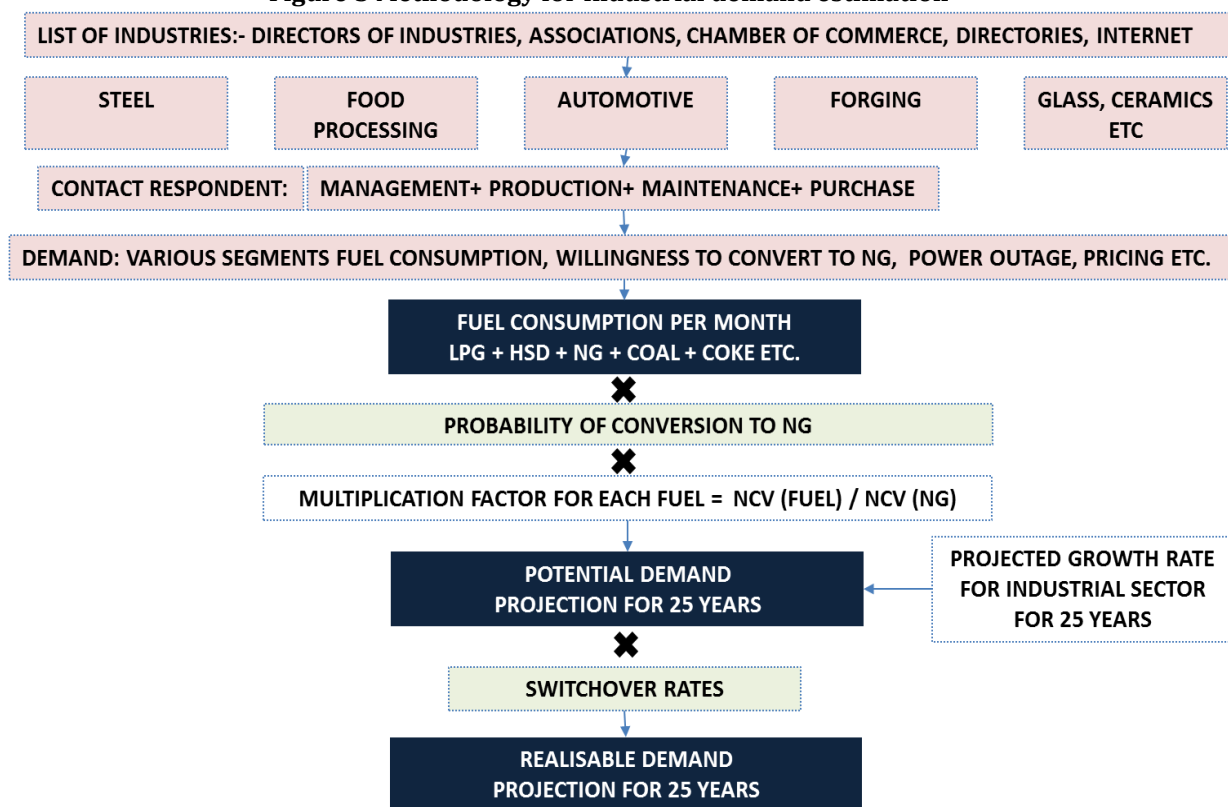
A traffic survey is conducted to calculate the numbers of cars passing from the NH/SH 448, 48, 58, 61, 62, 16 and 758 excluding the SUVs. Survey of cars (excluding SUV's) was done at entry and exit points of these highways. Basically, the number of vehicles along the national highway was estimated for normal hours, peak hours and non-peak hours.

2.2.2 Industrial Sector

The primary survey is conducted for all type of industries. It is observed that the key industries that may switch easily to Natural Gas are Forging, Casting & Steel industries, Automobile, Engineering & Glass/Ceramics etc. First, the consumption of the different fuels used by such industries is retrieved by carrying out the primary research method. This is followed by the calculation of the equivalent Natural Gas SCMD for the respective industries.

After the determination of average consumption of fuel in each CA from primary research, a secondary research is conducted to determine the number of total industries present in the GA available for natural gas conversion. This is further multiplied with appropriate switchover rates and 5-year average manufacturing sector growth rate (obtained from state economic survey reports) to determine the fuel wise demand for each CA. The growth rates and switch over rates considered, are tapered after 8th year. The realizable demand of Natural Gas is calculated using the appropriate switchovers rates for the respective alternative fuels used in the industry. The methodology described above is pictorially represented below:

Figure 5 Methodology for industrial demand estimation



2.2.3 Commercial Sector

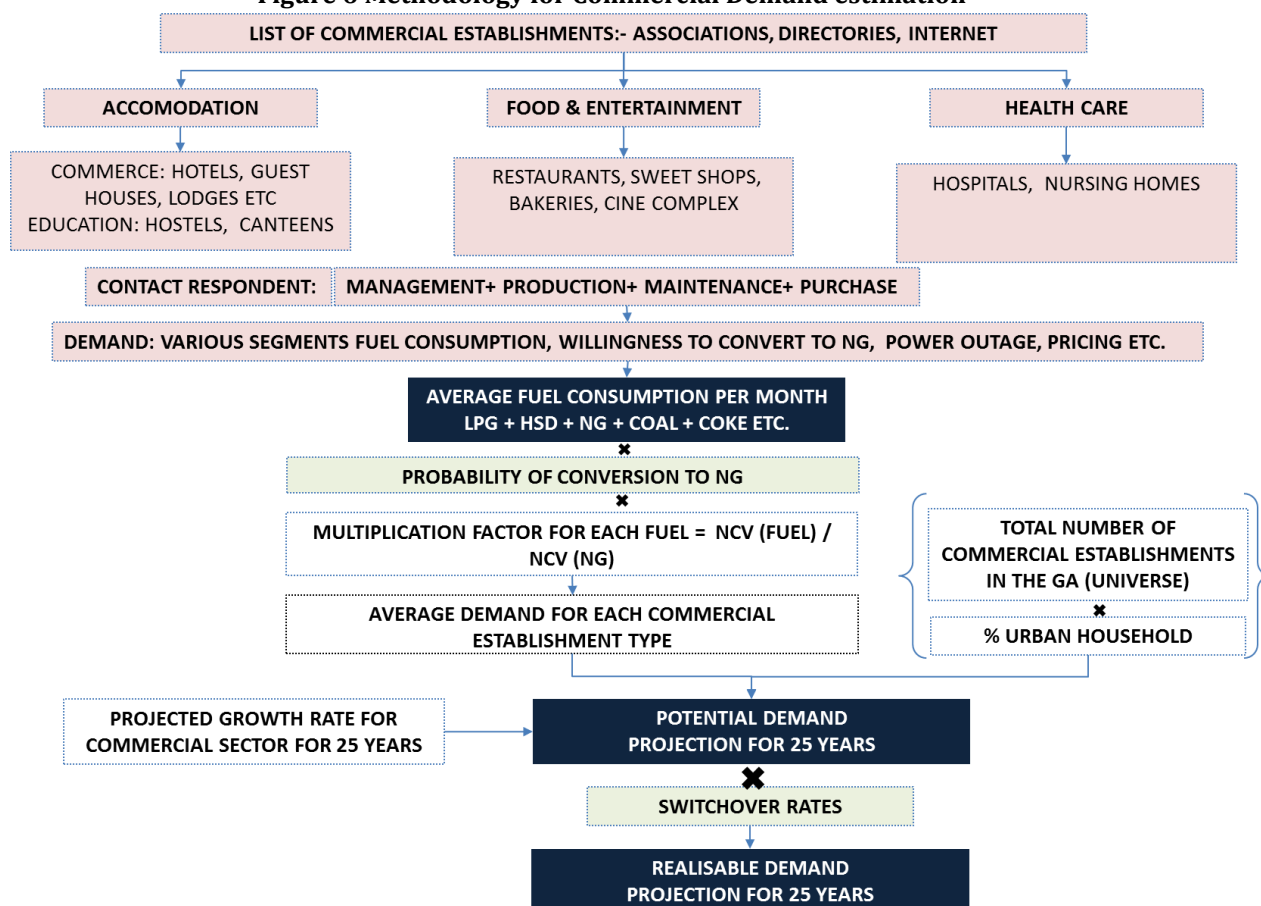
In the case of commercial sector, the data is collected through primary data collection and secondary studies. Commercial establishments can be classified into the three main types as follows

- Accommodation: It covers the hotels, guest houses, resorts, hostels, canteens etc.
- Food & Entertainment: Food & Entertainment covers the mainly restaurants, sweet shops, bakeries, cine complexes etc.
- Health care: Hospitals & nursing homes are covered in this category.

During primary survey, the data related to fuel consumption per month, customer's willingness to convert, power outage and factors related to pricing are considered. Then, the equivalent consumption for natural gas is determined by cross multiplying with appropriate conversion factors determined for each fuel category on a heat equivalence basis.

This average consumption for each commercial establishment category is then multiplied with the total number of commercial establishments available in the universe to determine the total universal demand. Again, this universal demand is distributed across CAs using population wise share. This demand is also estimated by considering an appropriate switching factor and 5-year average service sector growth rate (obtained from state economic survey reports). The methodology described above is pictorially represented below:

Figure 6 Methodology for Commercial Demand estimation



2.2.4 Domestic Sector

Data related to the number of households, population of rural area, urban area and total population and LPG penetration districts wise is extracted from official census website. The 2011 census LPG connections which are calculated by multiplying % LPG penetration and number of households, is projected till FY 19 using the historical CAGR.

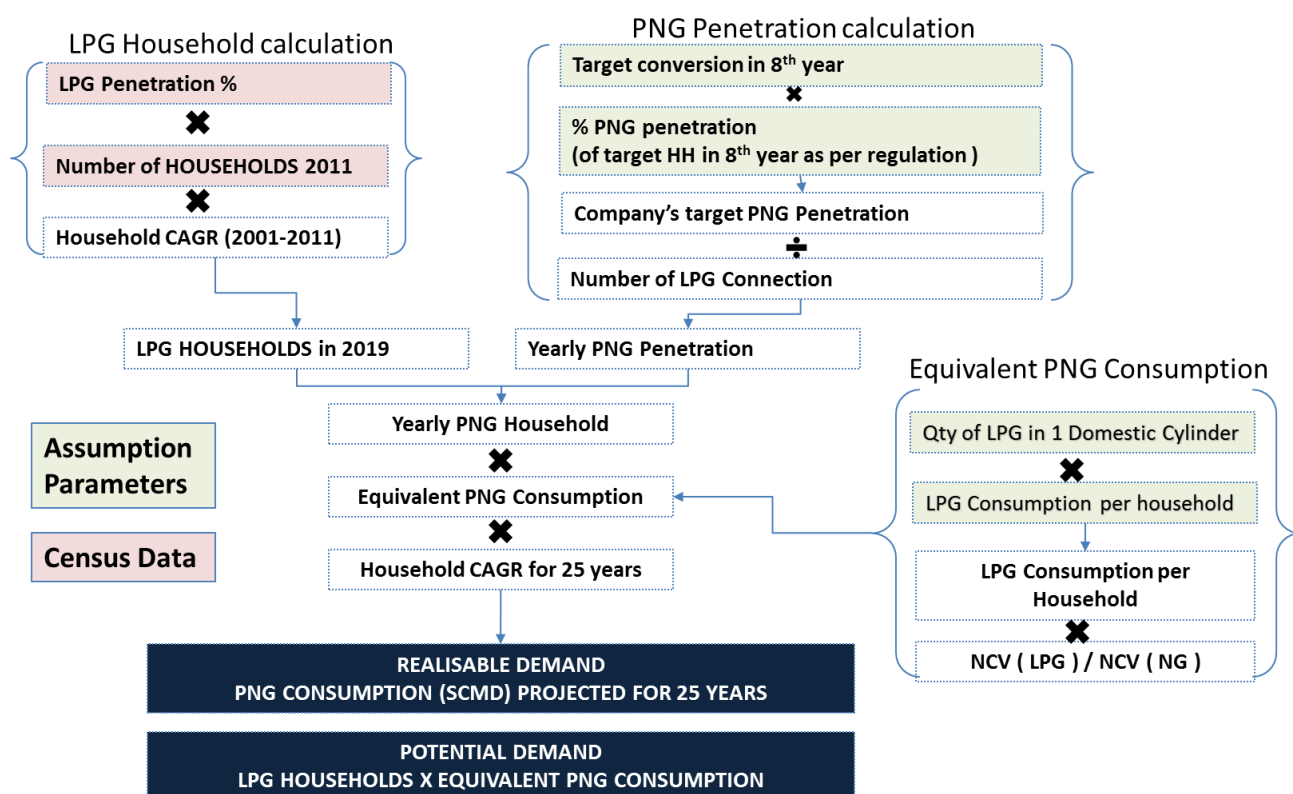
Company's target PNG penetration is calculated using the percentage household conversion target in 8th year multiplied by year-wise work programme as per the PNGRB CGD regulation dated 3rd April 2018. Yearly PNG Penetration is then calculated by multiplying company's target PNG penetration with the number of LPG connections in 2019.

Using the LPG households in 2019 and yearly PNG penetration, number of PNG households is calculated. Equivalent PNG consumption is calculated using the equivalent calorific value (of Natural Gas over LPG) and LPG consumption per household.

Realisable demand of Natural Gas is calculated by multiplying the yearly number of PNG households with equivalent PNG consumption in SCMD and the data is extrapolated for future years by applying growth rates.

Potential demand of Natural Gas is calculated using number of LPG households and equivalent PNG consumption. Projection of Potential & Realizable Demand for PNG is calculated for Rural and Urban for 25 years. Pictorially, the methodology adopted for the domestic sector, in order to reach to an appropriate conclusion is represented as follows:

Figure 7 Methodology for Domestic Demand estimation



3. NATURAL GAS DEMAND ASSUMPTIONS

The approach adopted for demand assessment of Natural Gas in GA is a bottom up approach based on primary demand survey and secondary research. The primary survey was carried out for industry, commercial, transport and domestic consumer category. For the industry and commercial category, the anchor load or major potential gas consumers were identified and surveyed. A sampled survey was conducted for the consumers in each of the consumer category to arrive at average potential gas consumption per consumer for each consumer category. The average consumption per consumer was then multiplied with the total universe of the existing consumers in each of the consumer category. The analysis of the data & related parameters was further discussed with the stakeholders to develop demand drivers & demand growth assumptions for overall demand assessment.

3.1 Growth Rate Assumptions

The growth rates considered for commercial and industrial sectors are obtained from 5-year average of growth rate of the state in which GA resides. For industrial sector, GSDP manufacturing growth rates are considered and for commercial sector, GSDP services growth rates are considered respectively from 2013-2014 to 2017-2018 as shown below:

Table 15 Average GSDP growth rate 2013-14 to 2017-18

Year	India			Rajasthan		
	Overall	Industrial	Services	Overall	Industrial	Services
Average (FY14 to FY18)	7.01%	7.66%	8.34%	7.15%	4.00%	7.15%

Long term growth rate of India is taken from OECD long term baseline projections. The state long term growth is then calculated by multiplying the ratio of long-term growth rate and average growth rate of India (for last 5 years) for industry and service sectors with the average growth rate of the state (for last 5 years) for industry and service sectors respectively.

Table 16 Long term growth rates

Growth Rate	Value	Remarks
India's Long-term GDP Growth Rate considered	4.81%	From OECD Projections
State - Overall Long-term GDP Growth Rate	4.90%	State overall growth rates
State - Industry Long-term GDP Growth Rate	4.00%	Index of Industrial Production
State - Services Long-term GDP Growth Rate	7.15%	Economic Survey of Rajasthan

Documents referred for the growth rate projections are as follows:

- RBI publications: Handbook of Statistics on Indian Economy
- Index of Industrial Production of Rajasthan
- Handbook of Statistics of Indian States- RBI (2017-18)
- Department of Economics and Statistical Analysis
- Economic survey of Rajasthan (last 5 years report)
- OECD reports

3.2 Demand Assumptions

Sector-wise assumptions which form the basis of estimation of demand of gas from different sectors till 25th year of the project based on above variables is presented in the section below:

3.2.1 Transport Sector

Vehicles within GA

The demand for natural gas in transport segment is expected to be primarily driven by the following categories of vehicles:

- Passenger Vehicles
- Private cars/taxis/cabs
- Light commercial vehicles/Goods vehicles
- Public Transport buses
 - Inter-Districts buses
 - Intra-Districts buses

For transport sector, growth rates are determined from the growth of vehicle for the past 5 years from 2014 to 2018. The vehicular population of all the private vehicles was obtained from the state statistical department and districts RTO for each charge area. Also, this derived growth rate is given a maximum cap and a tapering rate to determine a smooth growth rate, avoiding any abnormal growth.

Table 17 Growth rate for transport sector

Transport Sector	Y1	Y5	Y8	Y10	Y15	Y25
	FY 20	FY 24	FY 27	FY29	FY 34	FY 44
Buses Intra District	3.12%	3.12%	3.12%	3.11%	3.11%	3.09%
Buses Inter District	10.00%	10.00%	10.00%	9.97%	9.97%	9.77%
Autorickshaws	4.63%	4.63%	4.63%	4.60%	4.60%	4.56%
Goods Vehicles	10.00%	10.00%	10.00%	9.90%	9.90%	9.71%
Private motor cars	10.00%	10.00%	10.00%	9.90%	9.90%	9.71%
Taxis	4.00%	4.00%	4.00%	3.99%	3.99%	3.95%

Floating factor:

Ajmer, Pali and Rajsamand districts is surrounded by Jaipur, Bhilwara, Jodhpur, Udaipur, Sirohi, Jalore, Chittorgarh, Barmer districts. These areas are already authorized by PNGRB for City Gas Distribution projects under various rounds of CGD bidding. Hence, floating demand is calculated charge area wise to cater the floating vehicles demand of these districts which are passing through Ajmer, Pali and Rajsamand districts.

Switchover rates:

For the estimation of the realizable demand of CNG, the concept of the switchover factor based on the fuel pricing and vehicle need by the people is applied. For calculating year on year conversion to CNG following annual addition and maximum potential are considered:

Table 18: Maximum potential and annual addition considered for switchover rates

Vehicle Type	2 nd Year	Max Potential %
Public transport (Inter- Districts/ state Buses)	10.00%	65.00%
Public transport (Intra Districts Buses)	10.00%	65.00%
Semi-Public (Auto rickshaw)	15.00%	95.00%



Vehicle Type	2 nd Year	Max Potential %
Delivery Van- Goods tempo	10.00%	40.00%
Private Car	10.00%	40.00%
Taxi	15.00%	75.00%
Cars along NH	5.00%	45.00%

Table 19 Yearly Switchover rates

Vehicle Type	Y1	Y5	Y8	Y10	Y15	Y25
	FY 20	FY 24	FY 27	FY29	FY 34	FY 44
Inter- Districts/state Buses	0.0%	40.0%	65.0%	65.0%	65.0%	65.0%
Intra Districts Buses	0.0%	40.0%	65.0%	65.0%	65.0%	65.0%
Semi-Public (Auto rickshaw)	0.0%	60.0%	95.0%	95.0%	95.0%	95.0%
Delivery Van- Goods tempo	0.0%	40.0%	40.0%	40.0%	40.0%	40.0%
Private Car	0.0%	40.0%	40.0%	40.0%	40.0%	40.0%
Taxi	0.0%	60.0%	75.0%	75.0%	75.0%	75.0%
Cars along NH	0.0%	20.0%	35.0%	45.0%	45.0%	45.0%

Demand from Districts vehicles estimation and assumptions:

Assumptions for travel within GA are as follows:

Table 20 Assumption for travel within GA

Vehicle Type	Average operating days/month	Average distance travelled per day (Km)	Average Mileage (Km/SCM)	Total distance for a month (Km)	CNG Consumption per month (SCM)	Total CNG per day (SCMD)
Public transport (Inter-District/ state Buses)	27	280	4.15	7,560	1,822	59.89
Public transport (Intra District Buses)	30	200	3.63	6,000	1,652	54.32
Semi-Public (Auto rickshaw)	27	130	25.94	3,510	135	4.45
Delivery Van- Goods tempo	27	80	8.30	2,160	260	8.56
Private Car	20	47	15.53	943	61	2.00
Taxi	27	180	18.28	4,860	266	8.74

This potential demand is projected for the time frame of 25 year considering the transport sector growth rates. Category wise year on year switchover rates were considered to arrive at the realizable demand from the potential demand. The category wise number of vehicles registered in the city as per RTO data is provided as follows:

Table 21 Total Vehicles of Ajmer

S. No.	Particulars	FY 14	FY 15	FY 16	FY 17	FY 18
1	State transport (Intra District)	3,966	4,131	4,251	4,272	4,296
2	Buses (Inter District)	109	180	233	305	327



3	Semi-Public (Auto rickshaw)	8,558	8,966	9,304	9,676	9,853
4	Delivery Van- Goods tempo	5,470	7,267	8,890	10,619	11,425
5	Private Car	53,878	60,438	67,863	75,203	78,354
6	Taxi	5,348	5,573	5,855	6,150	6,277
	Total	77,329	86,555	96,396	1,06,225	1,10,532

Table 22 Total Vehicles of Rajsamand

S. No.	Particulars	FY 14	FY 15	FY 16	FY 17	FY 18
1	State transport (Intra District)					164
2	Buses (Inter District)	907	964	1,027	1,124	1,173
3	Semi-Public (Auto rickshaw)	2,022	2,226	2,372	2,496	2,672
4	Delivery Van- Goods tempo	1,285	1,334	1,385	1,449	1,503
5	Private Car	9,728	10,945	12,292	13,768	15,362
6	Taxi	1,616	1,742	1,802	1,947	2,008
	Total	15,558	17,211	18,878	20,784	22,882

Table 23 Total Vehicles of Pali

S. No.	Particulars	FY 14	FY 15	FY 16	FY 17	FY 18
1	State transport (Intra District)	1,480	1,537	1,584	1,665	1,715
2	Buses (Inter District)	28	47	70	108	119
3	Semi-Public (Auto rickshaw)	3,344	3,521	3,770	3,976	4,160
4	Delivery Van- Goods tempo	2,507	3,531	4,468	5,341	6,174
5	Private Car	15,379	17,489	19,688	22,247	24,865
6	Taxi	4,059	4,228	4,385	4,485	4,611
	Total	26,797	30,353	33,965	37,822	41,644

Table 24 Total Vehicles of GA -Ajmer, Pali & Rajsamand

S. No.	Particulars	FY 14	FY 15	FY 16	FY 17	FY 18
1	State transport (Intra District)	6,353	6,632	6,862	7,061	7,184
2	Buses (Inter District)	137	227	303	413	610
3	Semi-Public (Auto rickshaw)	13,924	14,713	15,446	16,148	16,685
4	Delivery Van- Goods tempo	9,262	12,132	14,743	17,409	19,102
5	Private Car	78,985	88,872	99,843	1,11,218	1,18,581
6	Taxi	11,023	11,543	12,042	12,582	12,896
	Total	1,19,684	1,34,119	1,49,239	1,64,831	1,75,058

3.2.2 Industrial sector

Calculation of natural gas demand from any industrial sector includes important assumptions; these are as under:

i. Calorific Values:

The Gross Calorific Value (GCV), Net Calorific Value (NCV), Probability of conversion to natural gas (%) and Multiplication Factor (GCV of alternative fuel / GCV of Natural gas x 1000) for various alternative fuels are as follows:

Table 25 GCV, NCV and probability of conversion to NG of alternative fuels

Fuel	Natural Gas (NG)	Furnace Oil (FO)	Light Diesel Oil (LDO)	Liquid Petroleum Gas (LPG)	High Speed Diesel (HSD)
Unit	Kcal / SCM	Kcal / litre	Kcal / litre	Kcal / Kg	Kcal / litre
GCV	9,350	10,500	10,700	11,900	10,800
NCV	8,415	9,500	8,710	11,000	8,700
Probability of conversion to NG (%)	100%	100%	100%	100%	100%
Multiplication Factor	1	1,129	1,035	1,307	1,034

ii. Switchover rates:

For the estimation of the realizable demand of natural gas, the concept of the switchover factor based on the fuel pricing by the consumers is applied. Switchover rates are considered based on the industry standards and the database of consultant and also as per the discussions with the client. Switchover rates of various fuels are capped to a certain potential based on their nature as given in the table below.

Alternative gaseous fuels such as LPG and Propane have high potential of conversion than alternative liquid fuels as gaseous fuels are available at comparative higher price than natural gas. Solid fuels are difficult to convert due to their easy availability at cheaper price. For industries, maximum switchover is considered in first five years as the infrastructure will be available to use and natural gas can be fed to the industries. Switchover rates from alternative fuels to natural gas is as follows:

Table 26 Maximum potential and annual addition considered for Switchover rates

Fuel Type	For First 8 Years		After 8th Years	
	Base Scenario	Max Potential %	Base Scenario	Max Potential %
Furnace Oil (FO)	3%	30%	3%	50%
Light Diesel Oil (LDO)	5%	40%	5%	50%
Liquid Petroleum Gas (LPG)	10%	80%	10%	90%
High Speed Diesel (HSD)	10%	60%	10%	90%
Natural Gas	20%	100%	20%	100%

Table 27 Yearly switchover rates

Fuel Type	Y1	Y5	Y8	Y10	Y15	Y25
	FY 20	FY 24	FY 27	FY 29	FY 34	FY 44
Furnace Oil (FO)	0.0%	12.0%	21.0%	27.0%	42.0%	50.0%



Light Diesel Oil (LDO)	0.0%	20.0%	35.0%	40.0%	40.0%	40.0%
Liquid Petroleum Gas (LPG)	0.0%	40.0%	70.0%	80.0%	80.0%	80.0%
High Speed Diesel (HSD)	0.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Natural Gas	0.0%	80.0%	100.0%	100.0%	100.0%	100.0%

3.2.3 Commercial Sector

Calculation of natural gas demand from commercial sector includes important assumptions; these are as under:

- i. **Average SCMD for various categories of commercial sector based on primary and secondary research are as follows:**

Table 28 Average SCMD for Commercial Sector

S. No.	Commercial Sector	Average SCMD
1.	Medium Hotels (3 Stars)	41
2.	Small Hotels	20
3.	Restaurants	14
4.	Sweetshops	20
5.	Bakeries	10
6.	Hospitals	3
7.	Institutes	5
8.	Hostels	7
9.	Malls	17
10.	Gurudwaras & Temples	9
11.	Schools	15

- ii. **Switchover rates for commercial sector are as follows:**

Table 29 Switchover Rates for Commercial Sector

Particulars	Y1	Y5	Y8	Y10	Y15	Y25
	FY 20	FY 24	FY 27	FY29	FY 34	FY 44
Switchover Rates	0.0%	20.0%	35.0%	45.0%	58.0%	58.0%

3.2.4 Domestic Sector

For domestic sector, following assumptions were considered:

i. CA wise CAGR growth:

Growth rates are considered from the overall CAGR growth of population from 2001 to 2011 census data. The growth rate considered are tabulated as follows:

Table 30 CAGR growth rate of domestic sector

Charge Area	Urban growth rate			Rural growth rate		
	1 to 8 years	8 to 15 years	15 to 25 years	1 to 8 years	8 to 15 years	15 to 25 years
CA-01	3.41%	2.21%	1.71%	3.06%	2.81%	2.56%
CA-02	2.77%	1.57%	1.07%	2.73%	2.48%	2.23%
CA-03	2.75%	1.55%	1.05%	2.70%	2.45%	2.20%
CA-04	2.42%	1.22%	0.72%	2.43%	2.18%	1.93%
CA-05	2.42%	1.22%	0.72%	2.75%	2.50%	2.25%
CA-06	2.58%	1.38%	0.88%	2.84%	2.59%	2.34%
CA-07	2.42%	1.22%	0.72%	2.42%	2.17%	1.92%
CA-08	3.69%	2.49%	1.99%	2.42%	2.17%	1.92%
CA-09	3.02%	1.82%	1.32%	3.24%	2.99%	2.74%
CA-10	2.42%	1.22%	0.72%	2.42%	2.17%	1.92%
CA-11	2.42%	1.22%	0.72%	2.42%	2.17%	1.92%
CA-12	4.58%	3.38%	2.88%	2.42%	2.17%	1.92%
CA-13	2.42%	1.22%	0.72%	2.42%	2.17%	1.92%
CA-14	5.00%	3.80%	3.30%	2.42%	2.17%	1.92%
CA-15	3.45%	2.25%	1.75%	2.42%	2.17%	1.92%
CA-16	2.42%	1.22%	0.72%	2.42%	2.17%	1.92%
CA-17	2.42%	1.22%	0.72%	2.42%	2.17%	1.92%
CA-18	2.42%	1.22%	0.72%	2.42%	2.17%	1.92%
CA-19	2.42%	1.22%	0.72%	2.42%	2.17%	1.92%
CA-20	2.71%	1.51%	1.01%	2.42%	2.17%	1.92%
CA-21	2.42%	1.22%	0.72%	2.79%	2.54%	2.29%
CA-22	2.42%	1.22%	0.72%	2.42%	2.17%	1.92%
CA-23	2.42%	1.22%	0.72%	2.42%	2.17%	1.92%
CA-24	2.42%	1.22%	0.72%	2.59%	2.34%	2.09%
CA-25	2.42%	1.22%	0.72%	2.42%	2.17%	1.92%

ii. CA wise Households:

Table 31 CA wise Households -2011

Charge Area	Households- 2011				
	Rural	Urban	Rural%	Urban %	Total
CA-01	46,484	28,353	62%	38%	74,837
CA-02	24,902	3,605	87%	13%	28,507
CA-03	33,113	7,577	81%	19%	40,690
CA-04	23,916	-	100%	0%	23,916
CA-05	24,787	9,078	73%	27%	33,865
CA-06	40,439	1,16,262	26%	74%	1,56,701



Charge Area	Households- 2011				
	Rural	Urban	Rural%	Urban %	Total
CA-07	23,968	-	100%	0%	23,968
CA-08	36,356	7,253	83%	17%	43,609
CA-09	39,779	28,960	58%	42%	68,739
CA-10	33,505	2,303	94%	6%	35,808
CA-11	19,834	3,504	85%	15%	23,338
CA-12	19,566	5,002	80%	20%	24,568
CA-13	27,874	-	100%	0%	27,874
CA-14	30,269	17,011	64%	36%	47,280
CA-15	42,182	9,380	82%	18%	51,562
CA-16	32,648	-	100%	0%	32,648
CA-17	44,023	8,810	83%	17%	52,833
CA-18	30,566	10,195	75%	25%	40,761
CA-19	40,800	8,095	83%	17%	48,895
CA-20	28,438	43,810	39%	61%	72,248
CA-21	22,288	-	100%	0%	22,288
CA-22	41,495	2,519	94%	6%	44,014
CA-23	35,608	11,157	76%	24%	46,765
CA-24	43,600	-	100%	0%	43,600
CA-25	42,692	4,061	91%	9%	46,753

Source: Census 2011

iii. Assumptions for LPG equivalent Natural Gas requirement

Table 32 Assumption for LPG equivalent Natural Gas requirement

Assumptions - LPG equivalent natural gas requirement		
Household - for Cooking Purpose (Urban)		
1 LPG Cylinder lasts in Winters	28	days/cylinder
1 LPG Cylinder lasts in Summers	50	days/cylinder
No. of Winter months	2	months/year
Summer months	10	months/year
Quantity of LPG in 1 Domestic Cylinder	14.2	kg/cylinder
Household LPG consumption per month for cooking	9.64	Kg/month
Equivalent PNG consumption for cooking	0.42	SCMD
Household - for Cooking Purpose (Rural)		
No. of days each cylinder lasts	53	days/cylinder
Household LPG consumption per month for cooking	8.04	kg/month
Equivalent PNG consumption for cooking	0.35	SCMD

iv. Number of Household connections:

Table 33 No. of Household Connections

Particulars	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27
Target %	0%	10%	20%	30%	40%	60%	80%	100%
PNG Household	-	1,00,094	2,00,189	3,00,283	4,00,378	6,00,566	8,00,755	10,00,944

4. NATURAL GAS DEMAND ASSESSMENT

Demand assessment of natural gas in Ajmer, Pali and Rajsamand districts is carried out by a bottom up approach based on primary survey and secondary research. The primary survey was carried out for industrial, commercial; transport and domestic sectors and all the major demand centres/clusters were identified to cater the natural gas demand in the Ajmer, Pali and Rajsamand geographical area. Major potential gas customers & anchor load were identified during the survey for the estimation of realizable demand.

4.1 Transport Sector

This potential demand is projected for the time frame of 25 year considering the transport sector growth rates. Category wise year-on-year switchover rates were considered to arrive at the realizable demand from the potential demand.

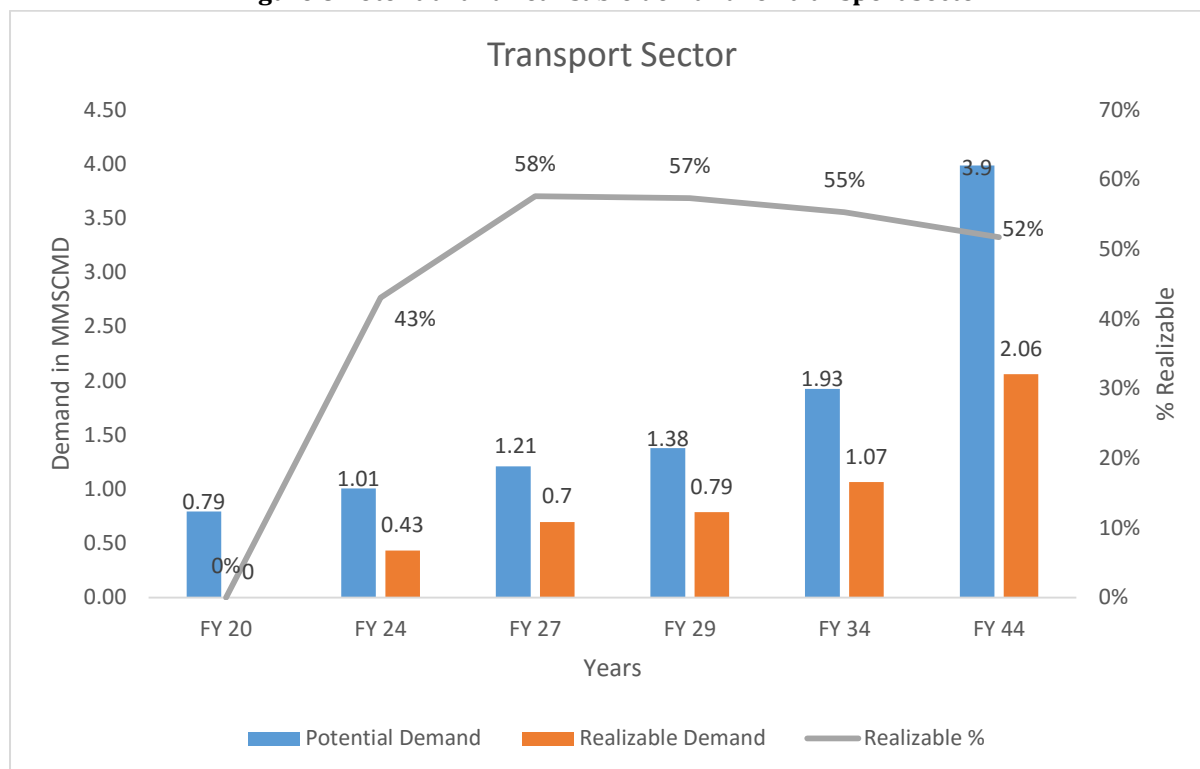
Potential demand and realisable demand of transport sector till 25th year is as follows:

Table 34 Potential and realisable demand of transport sector

Demand (MMSCMD)	Y1	Y5	Y8	Y10	Y15	Y25
	FY 20	FY 24	FY 27	FY29	FY 34	FY 44
Potential Demand	0.79	1.01	1.21	1.38	1.93	3.99
Realizable Demand	-	0.43	0.70	0.79	1.07	2.06

Potential demand and realizable demand (in MMSCMD) for transport sector is represented through graph:

Figure 8 Potential and realisable demand for transport sector



4.2 Industrial Sector

Potential demand and realisable demand of industrial sector till 25th year is as follows:

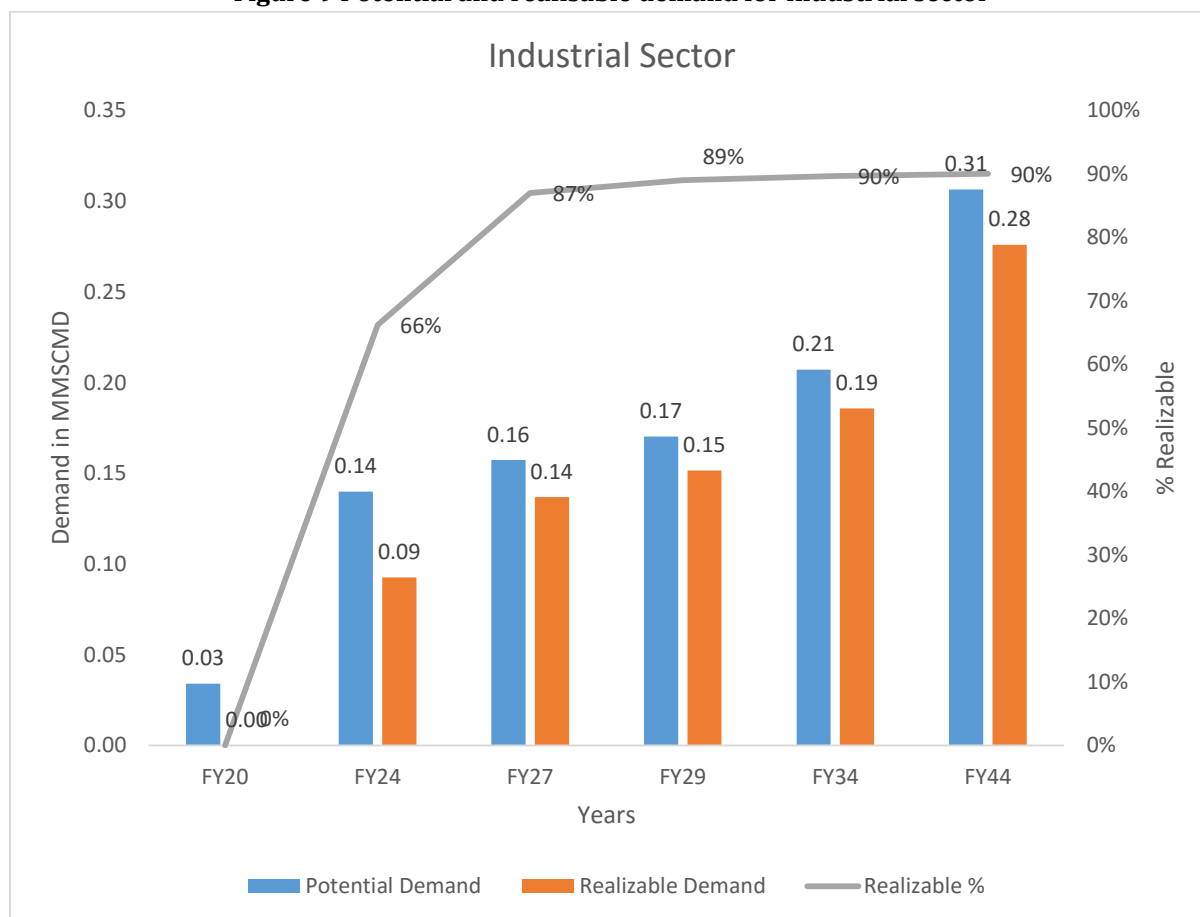
Potential demand has been estimated based on the primary and secondary survey findings as detailed above. Potential demand projected up to 25 years of project life is then converted into realizable demand using the switchover ratios and projected growth rate assumed for the entire 25-year period. The potential demand is tabulated below:

Table 35 Potential and realisable demand for industrial sector

Demand (MMSCMD)	Y1	Y5	Y8	Y10	Y15	Y25
	FY 20	FY 24	FY 27	FY29	FY 34	FY 44
Potential Demand	0.03	0.14	0.16	0.17	0.21	0.31
Realizable Demand	-	0.09	0.14	0.15	0.19	0.28

The graphical representation of realizable and potential demand (in MMSCMD) for industrial sector is shown as follows:

Figure 9 Potential and realisable demand for industrial sector



4.3 Commercial Sector

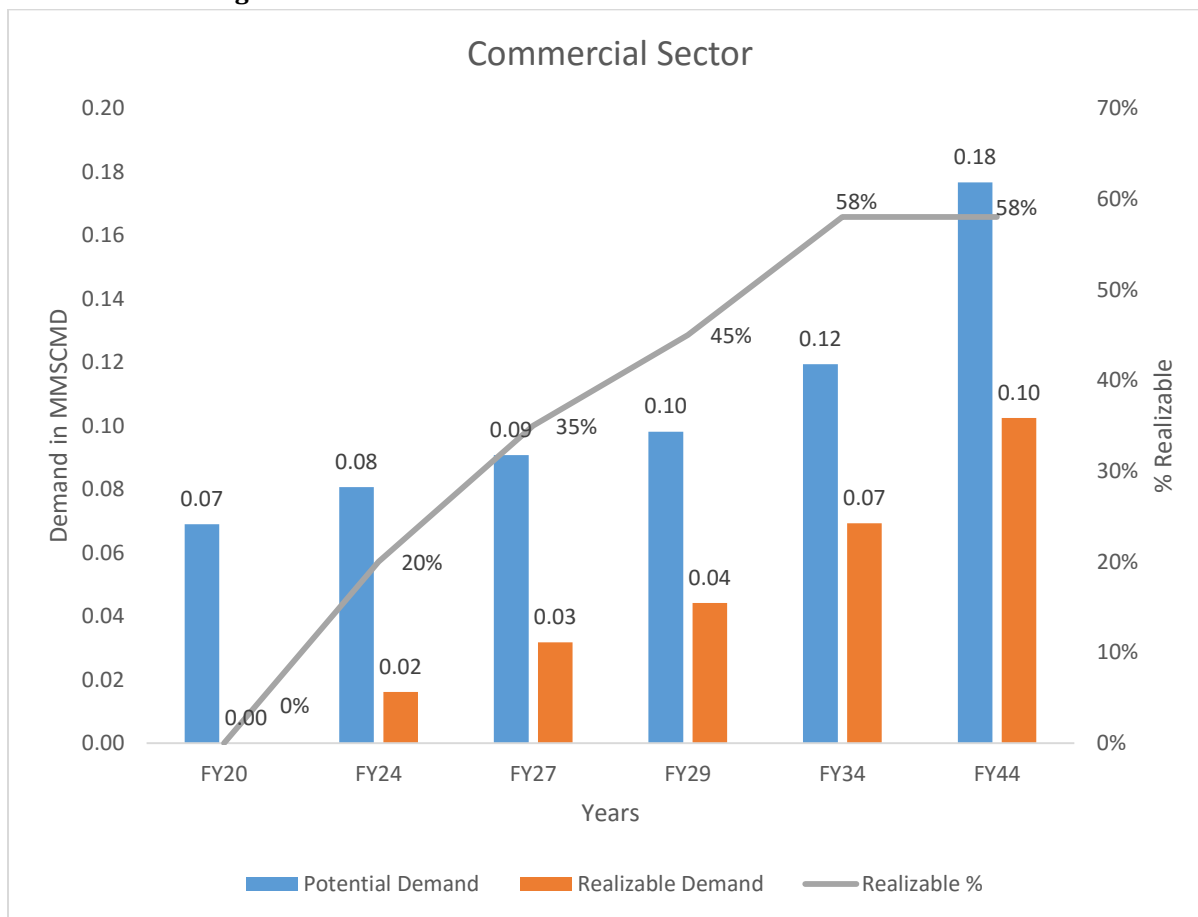
Potential demand and realisable demand of commercial sector till 25th year is as follows:

Table 36 Potential and realizable demand estimation for commercial segment

Demand (MMSCMD)	Y1	Y5	Y8	Y10	Y15	Y25
	FY 20	FY 24	FY 27	FY29	FY 34	FY 44
Potential Demand	0.07	0.08	0.09	0.10	0.12	0.18
Realizable Demand	-	0.02	0.03	0.04	0.07	0.10

The following graph shows the potential demand and realizable demand (in MMSCMD) and the percentage of potential demand getting converted in first year of operation.

Figure 10 Potential and realisable demand for commercial sector



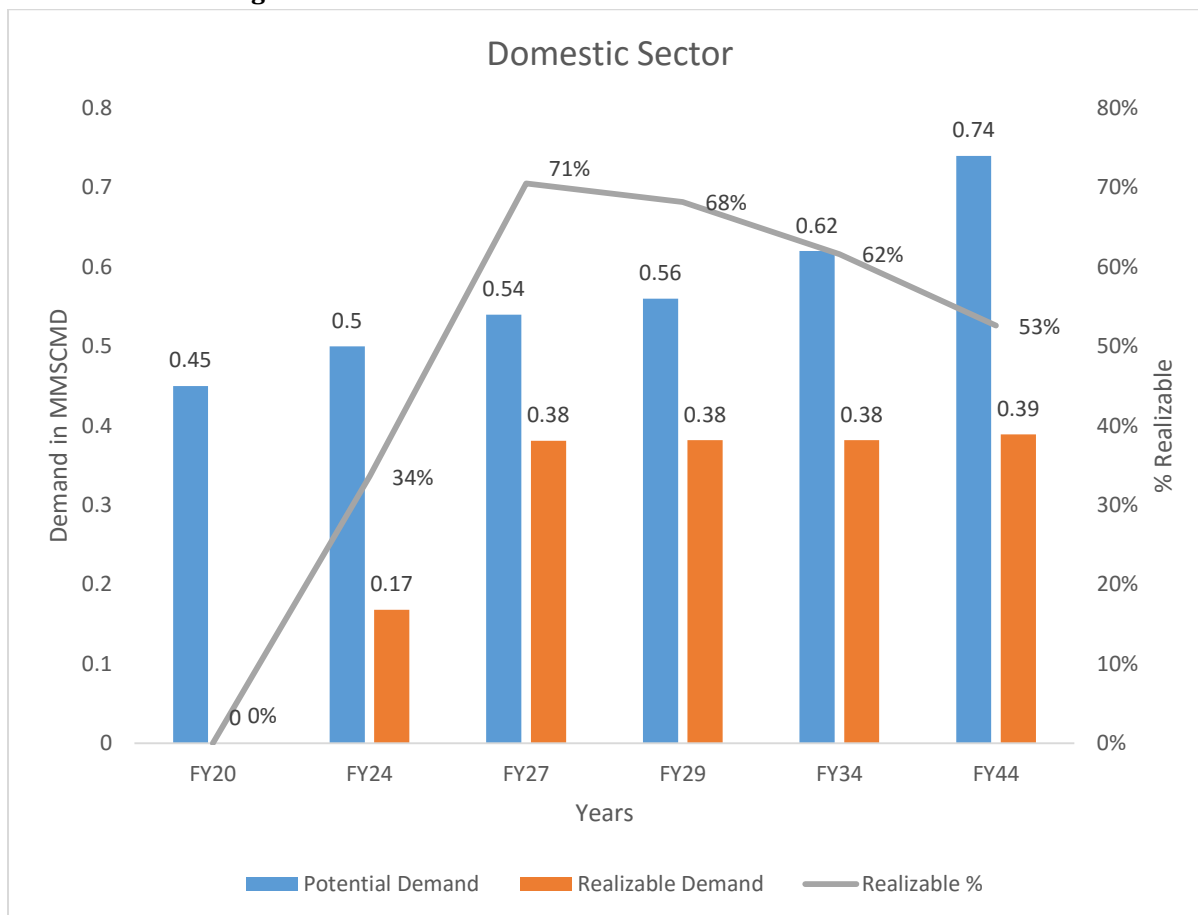
4.4 Domestic Sector

Potential demand and realisable demand of domestic sector till 25th year is as follows:

Table 37 Potential and realisable demand for domestic sector

Demand (MMSCMD)	Y1	Y5	Y8	Y10	Y15	Y25
	FY 20	FY 24	FY 27	FY29	FY 34	FY 44
Potential Demand	0.45	0.50	0.54	0.56	0.62	0.74
Realizable Demand	-	0.17	0.38	0.38	0.38	0.39

Figure 11 Potential and realisable demand for domestic sector





4.5 Overall Potential & Realizable Demand

The total potential demand from sectors i.e., industrial, transport, commercial and domestic sector is estimated to be 5.21 MMSCMD with transport sector having share of 3.99MMSCMD (~77% share of total potential demand), domestic sector to be 0.74 MMSCMD, commercial sector to be 0.18 MMSCMD and industrial sector to be 0.31 MMSCMD in the 25th year.

The potential demand is estimated to increase from 2.00 to 5.21 MMSCMD from 8th year to 25th year of project. Similarly, realizable demand for the districts is estimated to be 1.25 MMSCMD in the 8th year of the project and is estimated to grow to 2.83 MMSCMD in 25th year of the project.

Table 38 Overall Potential Demand

Potential Demand (MMSCMD)	Y1	Y5	Y8	Y10	Y15	Y25
	FY20	FY24	FY27	FY29	FY34	FY44
Domestic	0.45	0.50	0.54	0.56	0.62	0.74
Industrial	0.03	0.14	0.16	0.17	0.21	0.31
Commercial	0.07	0.08	0.09	0.10	0.12	0.18
Transport	0.79	1.01	1.21	1.38	1.93	3.99
Total	1.34	1.72	2.00	2.20	2.87	5.21

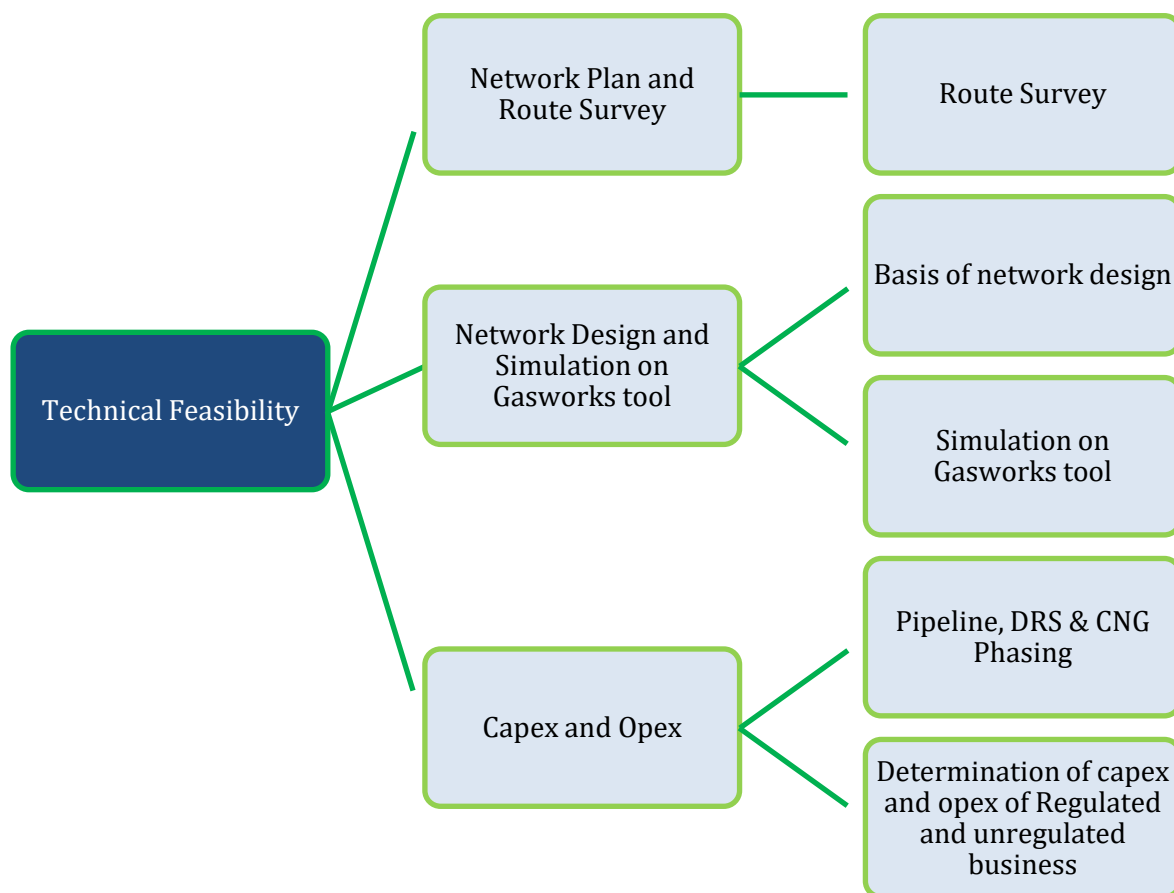
Table 39 Overall Realizable Demand

Realizable Demand (MMSCMD)	Y1	Y5	Y8	Y10	Y15	Y25
	FY 21	FY 25	FY 28	FY 30	FY 35	FY 45
Domestic	-	0.17	0.38	0.38	0.38	0.39
Industrial	-	0.09	0.14	0.15	0.19	0.28
Commercial	-	0.02	0.03	0.04	0.07	0.10
Transport	-	0.43	0.70	0.79	1.07	2.06
Total	-	0.71	1.25	1.37	1.70	2.83

5. TECHNICAL FEASIBILITY: FIELD ENGINEERING SURVEY & DESIGN OF CGDN

5.1 Approach & Methodology

The approach and methodology along with the key activities performed in conducting the technical feasibility study including field engineering survey and designing the CGD network for setting up of city gas distribution business in Ajmer, Pali and Rajsamand GA is defined pictorially as follows:





5.2 Design of CGD Network

5.2.1 Design Basis/Philosophy Considered for CGD Network Simulation Design

A detailed market assessment of natural gas demand across all the four segments was conducted for 25 years. On the basis of 25th year natural gas demand, the major demand centres were mapped & identified. Network is planned in such a way that it caters all the major demand centres.

A detailed market assessment of geographical area (GA) is conducted for 25 years & peak demand in SCMH for the 25th Year is estimated on each sector based on following hourly operations:

Table 40 Hourly operation considered

Segments	Hourly operations considered
Domestic	4
Industrial	16
Commercial	12
Transport	18

A 20% extra load is considered at each entry & exit point of the network as per the PNGRB regulation for the open access consumers for the purpose of designing & simulation of the CGD network. The designing of the pipeline network is done on the basis of considering the 25th year demand of all the four segments. The total load considering the 20% extra load of the open access consumer, which the entire network will cater in the 25th year.

The City Gas Distribution network and associated equipment are designed as per Technical Standard T4S approved by Petroleum and Natural Gas Regulatory Board (PNGRB). The main International standard referred is ASME/ANSI B 31.8. The optimization of the entire pipeline network has been done by conducting the simulation process on the Gasworks tool as per the desired inlet and outlet (farthest point minimum) pressure specified by the client

5.2.2 Design of City Gate Station (CGS)

The City Gate Station for GA is designed for 25th year peak SCMH of gas throughput based on the total natural gas demand of all sectors. Design parameters considered for sizing of individual components of CGS Metering & Pressure Reduction Skid (MPRS) are mentioned in table below.

Table 41: CGS Design Parameter

Description	Value
Design Pressure	42 bar
Pressure-Out	35 bar for Local Distribution
Specific Gravity of Natural Gas	0.6
Design temperature	45°C
Joint Factor	1
Location Class	4
Design Life	25 years
Gas Velocity (Maximum)	30 meters/sec

5.2.3 Steel Main Ring Design Parameters

The Steel Ring Main is designed to carry total gas to be distributed among all the customer segments in all demand areas of GA. The steel main will carry gas from CGS to online CNG stations and DRS. Gas pressure in the Steel Ring Main will be 49-19 bar.

Table 42: Steel Ring Main Design Parameters

Description	Value
Design Pressure (Maximum)	42 bar
Minimum Pressure in Steel Ring	19 bar
Material Specification	API 5L X-60
Corrosion Allowance	0.5 mm
Minimum Wall Thickness	6.4 mm
Corrosion Protection	3 layer PE coated and Cathodic Protection
Gas Velocity (Maximum)	30 meter/sec
Gas Flow Equation Used	Colebrook White/ Fundamental Pipe Equation with flow dependent (Colebrook White) friction factor

5.2.4 PE Pipeline Design Parameters

The PE pipeline network for distribution of low-pressure natural gas to domestic, commercial & industrial consumers in city area is designed to operate at 4.0 bar to 75 millibar pressure. This network will carry gas from DRS to Service Regulator (SR) and then to individual consumer. PE pipeline network will be laid underground along city street roads.

Table 43: PE Pipeline Design Parameters

Description	Value
Operating Pressure	4 bar
Minimum Pressure	75 mbar in LPPE
Pipe Material	IS 14885 or ISO 4437, PE 80(Yellow) & PE 100(Orange), SDR 11.
Pipe Sizes	180 mm, 125 mm, 63 mm, 32 mm, 20 mm in MPPE/LPPE Network

5.2.5 CNG Station Design Parameters

As per the CNG demand in the 25th year of operations, the CNG demand and dispensing capacity are determined. The CNG stations are planned as per the demand growth. The design parameter for the CNG station is as follows:

Table 44: CNG Station Design Parameters

Description	Value
Inlet Pressure (minimum)	19 bar
Outlet Pressure	210 bar
Cascade capacity Mother Station On-line Station	3000 water litre capacity
Online Station Capacity	650 and 1200 SCMH with 2x2 dispensers for cars and autos and 1x1 bus dispenser
Dedicated Bus filling station capacity	1200 SCMH with 1 high flow bus dispenser for online and mother station each



5.2.6 Peak Demand

Charge area wise peak demand in 25th year (in SCMH) is as follows:

Table 45: Charge area wise peak demand in 25th year (in SCMH)

Segment	Domestic	Industrial	Commercial	Transport	Total
CA-01	8,418	66	740	10,220	19,444
CA-02	1,300	-	94	3,919	5,313
CA-03	2,123	-	198	5,572	7,893
CA-04	911	-	-	3,403	4,314
CA-05	2,880	39	237	4,923	8,079
CA-06	21,910	2,453	3,035	20,492	47,891
CA-07	1,279	-	-	3,099	4,378
CA-08	3,426	13,695	189	5,793	23,104
CA-09	8,005	1	756	9,042	17,805
CA-10	2,035	-	60	2,306	4,401
CA-11	1,512	-	91	1,503	3,106
CA-12	2,298	51	131	1,582	4,062
CA-13	1,285	-	-	2,184	3,469
CA-14	6,617	112	444	3,823	10,997
CA-15	3,837	86	245	3,710	7,877
CA-16	1,634	-	-	2,336	3,970
CA-17	2,992	52	230	3,915	7,189
CA-18	2,767	4	266	3,109	6,147
CA-19	2,965	-	211	3,419	6,595
CA-20	8,215	619	1,144	5,211	15,188
CA-21	728	-	-	2,033	2,760
CA-22	2,167	65	66	3,404	5,703
CA-23	3,205	0	291	3,510	7,007
CA-24	2,229	3	-	2,909	5,142
CA-25	2,574	-	106	3,120	5,800




5.3 Implementation Plan

To cater the demand of Ajmer & Pali for the life span of 25 years, steel pipeline covering the major demand centers is planned. In order to feed the Rajsamand district, the LNG by Road from Dahej model is considered.

Deoli Tap-off for Pali and Peesangan & Nasirabad tap-off for Ajmer is considered. No pipeline connectivity is available in Rajsamand district & even it is not feasible to lay pipeline from Pali or Ajmer district to Rajsamand district due to the mountainous and rocky terrain.

Total demand i.e. PNG & CNG demand of Rajsamand district for 25 years is to be catered via LNG by road from Dahej terminal. A small network of ~15 KM is also planned for Natural gas distribution.

Table 46: Gas Sourcing & Pipeline Connectivity Scenario

Scenario	Demand Considered	Tap-Off	Pipeline	LNG
Feeding Ajmer & Pali via pipeline and Rajsamand via LNG by Road	Ajmer	Peesangan Nasirabad		LNG  (For First Five Years Only)
	Pali	SV-06, Deoli, Sirohi		
	Rajsamand	×	×	LNG 

LNG-LCNG Mother Stations to feed the 30 DB Stations in Ajmer Pali & Rajsamand for 5 years is also planned. Phasing of the same is provided in the table as below:

Particulars	LNG/L-CNG Station or Mother Station	L-CNG Station
Ajmer	1	15
Pali	1	10
Rajsamand	1	5
Total	3	30

30 CNG stations i.e. 2nd year MWP is totally based on LNG/L-CNG stations operating on wet lease model. This whole concept is considered for first five year only. Storage tanks are planned at three locations – Ajmer, Pali (for first five years) & Rajsamand (25 year



Ajmer, Pali and Rajsamand districts node details

The network design & simulation work was conducted on the SYNERGEE simulation software. All the details pertaining to the capacity, diameter, thickness, pressure, temperature ratings, network route etc., are provided and the detailed output/report obtained from SYNERGEE has also been enclosed for the reference.

(Enclosed)



6. ESTIMATION OF CAPITAL & OPERATING EXPENDITURE

6.1 Bill of materials

Based on the natural gas demand, network design & PNGRB minimum work program phasing, a detailed year on year bill of material is prepared as follows:

Table 47 Bill of material

S. No.	Particular	Units	25 Years	1st 8 Years	Y1	Y5	Y8	Y10	Y15	Y25
					FY 2020	FY 2024	FY 2027	FY 2029	FY 2034	FY 2044
1	Compressor 450 SCMH (DODO)	#	198	99	-	14	9	-	-	-
2	Compressor 450 SCMH (RO)	#	119	59	-	9	6	-	-	-
3	Compressor 1200 SCMH	#	89	40	-	6	4	-	-	9
4	No. of dispensers (Bus)	#	89	40	-	6	4	-	-	9
5	No. of dispensers (Cars)	#	178	80	-	12	8	-	-	18
6	DRS 1000 SCMH	#	66	56	-	12	9	1	-	1
7	Service Regulator	#	660	660	-	66	132	-	-	-
8	Steel Grid -12"	Kms	136	136	7	14	14	-	-	-
9	Steel Grid -8"	Kms	106	106	5	11	11	-	-	-
10	Steel Grid -6"	Kms	40	40	2	4	4	-	-	-
11	180mm MDPE Pipeline including MDPE per DRS	Kms	717	687	30	118	71	3	-	3
12	125mm MDPE Pipeline	Kms	1,101	1,101	-	110	220	-	-	-
13	63mm MDPE Pipeline	Kms	2,092	2,092	-	209	418	-	-	-
14	32mm MDPE Pipeline	Kms	5,725	5,725	-	573	1,145	-	-	-
15	20mm MDPE Pipeline	Kms	2,092	2,092	-	209	418	-	-	-
16	Steel Inch km	Inch-km			136	272	272	-	-	-
17	MWP Steel & MDPE Inch km	Inch-km			312	11,705	26,228	26,246	26,264	26,405



6.2 Capital Expenditure

Based on the equipment and their phasing, the estimation of broad Capex was carried out. For the computation of Capex, the unit rate of items considered was based on the data available in the public domain and the database of consultant and also as per the discussions with the client. The table below depicts the total Capex (for all segments) in INR crore:

Table 48 CGS Capex

S. No.	Particular	Units	Y1	Y2	Y3	Y5	Y8	Y10	Y15	Y20	Y25
			FY 2020	FY 2021	FY 2022	FY 2024	FY 2027	FY 2029	FY 2034	FY 2039	FY 2044
1	Main Components										
	Pressure Reduction System (PRS)	INR cr	1.00	1.00	1.00	-	-	-	-	-	-
	Odorizing unit	INR cr	0.50	0.50	0.50	-	-	-	-	-	-
	Firefighting system with Gas and fire detectors	INR cr	0.50	0.50	0.50	-	-	-	-	-	-
	Capital spares	INR cr	0.05	0.05	0.05	-	-	-	-	-	-
	LCNG Capex	INR cr	28.24	1.21	1.32	1.56	1.93	0.53	0.65	9.97	1.38
	Subtotal	INR cr	30.29	3.26	3.37	1.56	1.93	0.53	0.65	9.97	1.38
2	Incidentals										
	GST	INR cr	5.45	0.59	0.61	0.28	0.35	0.09	0.12	1.79	0.25
	Inland Hdq. (IC)	INR cr	0.61	0.07	0.07	0.03	0.04	0.01	0.01	0.20	0.03
	Subtotal	INR cr	6.06	0.65	0.67	0.31	0.39	0.11	0.13	1.99	0.28
3	Civil, Erection and others										
	Civil work	INR cr	0.73	0.73	0.73	-	-	-	-	-	-
	Erection	INR	1.51	0.16	0.17	0.08	0.10	0.03	0.03	0.50	0.07



S. No.	Particular	Units	Y1	Y2	Y3	Y5	Y8	Y10	Y15	Y20	Y25
			FY 2020	FY 2021	FY 2022	FY 2024	FY 2027	FY 2029	FY 2034	FY 2039	FY 2044
		cr									
	Work contract tax on civil work	INR cr	0.09	0.09	0.09	-	-	-	-	-	-
	Work contract tax on erection	INR cr	0.18	0.02	0.02	0.01	0.01	0.00	0.00	0.06	0.01
	Insurance	INR cr	0.05	0.01	0.01	0.00	0.00	0.00	0.00	0.02	0.00
Subtotal		INR cr	2.56	1.01	1.01	0.09	0.11	0.03	0.04	0.57	0.08
4	Land	INR cr	1.63	0.33	0.33	-	-	-	-	2.29	-
Subtotal		INR cr	1.63	0.33	0.33	-	-	-	-	2.29	-
5	Engineering Components										
	Detailed Engineering, Construction, supervision and project management	INR cr	0.51	0.07	0.07	0.02	0.03	0.01	0.01	0.19	0.02
	GST on Services	INR cr	0.09	0.01	0.01	0.00	0.01	0.00	0.00	0.03	0.00
Subtotal		INR cr	0.60	0.08	0.08	0.03	0.04	0.01	0.01	0.23	0.03
6	Owner's Costs										
	Start-up and commissioning expenses	INR cr	-	-	-	-	-	-	-	-	-
	Owner's management expenses	INR cr	1.20	0.16	0.16	0.06	0.07	0.02	0.02	0.45	0.05
Subtotal		INR cr	1.20	0.16	0.16	0.06	0.07	0.02	0.02	0.45	0.05
7	Other Costs										
	Contingencies	INR	1.71	0.22	0.23	0.08	0.10	0.03	0.03	0.64	0.07



S. No.	Particular	Units	Y1	Y2	Y3	Y5	Y8	Y10	Y15	Y20	Y25
			FY 2020	FY 2021	FY 2022	FY 2024	FY 2027	FY 2029	FY 2034	FY 2039	FY 2044
		cr									
	Subtotal	INR cr	1.71	0.22	0.23	0.08	0.10	0.03	0.03	0.64	0.07
	Total		44.05	5.71	5.86	2.14	2.64	0.72	0.89	16.13	1.88

Table 49 CGD Infrastructure Capex

S. No.	Particular	Units	Y1	Y2	Y3	Y5	Y8	Y10	Y25
			FY 2020	FY 2021	FY 2022	FY 2024	FY 2027	FY 2029	FY 2044
1	Material Costs								
	DRS 2000 SCMH	INR cr	-	1.52	1.96	4.99	4.09	0.48	0.75
	Service Regulator	INR cr	-	0.13	0.13	0.14	0.31	-	-
	Steel Grid -12"	INR cr	3.58	11.05	15.18	8.05	8.80	-	-
	Steel Grid -8"	INR cr	2.16	6.66	9.15	4.85	5.30	-	-
	Steel Grid -6"	INR cr	0.65	2.02	2.77	1.47	1.61	-	-
	180mm MDPE Pipeline	INR cr	3.79	8.35	9.00	16.81	11.09	0.50	0.77
	125mm MDPE Pipeline	INR cr	-	6.96	7.17	7.61	16.62	-	-
	63mm MDPE Pipeline	INR cr	-	3.38	3.48	3.69	8.06	-	-
	32mm MDPE Pipeline	INR cr	-	2.45	2.52	2.68	5.85	-	-
	20mm MDPE Pipeline	INR cr	-	0.52	0.54	0.57	1.24	-	-
	Domestic Connections	INR cr	-	82.16	84.63	89.78	196.22	-	-
	Subtotal	INR cr	10.17	125.20	136.52	140.64	259.18	0.98	1.53
2	Incidentals								
	GST	INR cr	1.83	7.75	9.34	9.15	11.33	0.18	0.27
	Inland Hdlg. (IC)	INR cr	0.20	0.86	1.04	1.02	1.26	0.02	0.03
	Subtotal	INR cr	2.03	8.61	10.38	10.17	12.59	0.20	0.31
3	Erection Cost								
	DPRS	INR cr	-	0.08	0.10	0.26	0.22	0.02	0.04
	Steel Grid -12"	INR cr	2.45	7.58	10.41	5.52	6.03	-	-
	Steel Grid -8"	INR cr	1.41	4.34	5.97	3.16	3.46	-	-



S. No.	Particular	Units	Y1	Y2	Y3	Y5	Y8	Y10	Y25
			FY 2020	FY 2021	FY 2022	FY 2024	FY 2027	FY 2029	FY 2044
	Steel Grid -6"	INR cr	0.48	1.49	2.04	1.08	1.18	-	-
	180mm MDPE Pipeline	INR cr	2.62	5.78	6.24	11.65	7.69	0.34	0.54
	125mm MDPE Pipeline	INR cr	-	8.27	8.52	9.04	19.75	-	-
	63mm MDPE Pipeline	INR cr	-	10.19	10.49	11.13	24.33	-	-
	32mm MDPE Pipeline	INR cr	-	22.47	23.15	24.56	53.67	-	-
	20mm MDPE Pipeline	INR cr	-	8.19	8.44	8.95	19.56	-	-
	Subtotal	INR cr	6.96	68.40	75.36	75.35	135.89	0.37	0.57
4	Civil Works - DPRS	INR cr	-	0.37	0.39	0.45	0.89	0.01	0.01
	Subtotal	INR cr	-	0.37	0.39	0.45	0.89	0.01	0.01
5	Incidentals								
	GST on erection cost	INR cr	0.84	8.21	9.04	9.04	16.31	0.04	0.07
	GST on civil works	INR cr	-	0.04	0.05	0.05	0.11	0.00	0.00
	Insurance	INR cr	0.02	0.24	0.27	0.27	0.49	0.00	0.00
	Subtotal	INR cr	0.86	8.50	9.35	9.37	16.91	0.05	0.07
6	Land Restoration								
	Steel Grid -12"	INR cr	1.26	3.89	5.34	2.83	3.09	-	-
	Steel Grid -8"	INR cr	0.98	3.02	4.15	2.20	2.41	-	-
	Steel Grid -6"	INR cr	0.37	1.13	1.55	0.82	0.90	-	-
	180mm MDPE Pipeline		1.76	3.89	4.19	7.83	5.17	0.23	0.36
	125mm MDPE Pipeline	INR cr	-	6.71	6.91	7.33	16.02	-	-
	63mm MDPE Pipeline	INR cr	-	12.75	13.13	13.93	30.44	-	-
	32mm MDPE Pipeline	INR cr	-	34.88	35.93	38.12	83.31	-	-
	20mm MDPE Pipeline	INR cr	-	12.75	13.13	13.93	30.44	-	-
	Subtotal	INR cr	4.37	79.01	84.33	86.99	171.77	0.23	0.36
7	Land	INR cr	-	2.97	3.10	3.62	7.14	0.05	0.08
	Subtotal	INR cr	-	2.97	3.10	3.62	7.14	0.05	0.08
8	SCADA	INR cr	0.75						
	GST	INR cr	0.09						
	Subtotal	INR cr	0.84	-	-	-	-	-	-
9	Engineering Components								



S. No.	Particular	Units	Y1	Y2	Y3	Y5	Y8	Y10	Y25
			FY 2020	FY 2021	FY 2022	FY 2024	FY 2027	FY 2029	FY 2044
	Detailed Engineering, Construction, supervision and project management	INR cr	0.32	4.14	4.50	4.61	8.62	0.02	0.04
	GST on Services	INR cr	0.06	0.75	0.81	0.83	1.55	0.00	0.01
	Subtotal	INR cr	0.38	4.88	5.30	5.43	10.18	0.03	0.05
10	Owner's Costs								
	Owner's management expenses	INR cr	0.75	9.66	10.49	10.75	20.12	0.06	0.09
	Subtotal	INR cr	0.75	9.66	10.49	10.75	20.12	0.06	0.09
11	Other Costs								
	Contingencies	INR cr	1.08	13.80	14.99	15.35	28.74	0.08	0.13
	Subtotal	INR cr	1.08	13.80	14.99	15.35	28.74	0.08	0.13
Total			27.44	321.39	350.21	358.12	663.42	2.05	3.19

CNG Capex:

Capex incurred on setting up CNG station is broadly classified as follows:

- 1. Regulated CNG Capex:** Regulated CNG Capex involves the cost of online compressors and equipment between inlet valves to discharge flange and other related facilities which covers civil works and erection costs of these materials.
- 2. Unregulated CNG Capex:** Unregulated CNG Capex involves the cost of facilities beyond the discharge valve of the online compressor for CNG, booster compressors, land for CNG stations and all equipment and facilities which are related to the activity of dispensing of CNG



Table 50 CNG Capex Regulated

S. No.	Particular	Units	Y1	Y2	Y3	Y5	Y8	Y25
			FY 2020	FY 2021	FY 2022	FY 2024	FY 2027	FY 2044
1	Material Costs							
	Compressor 1200 SCMH	INR cr	-	5.47	5.64	5.98	4.36	16.21
	Compressor 450 SCMH (DODO)	INR cr	-	13.05	13.44	13.66	9.74	-
	Compressor 450 SCMH (RO)	INR cr	-	7.83	8.06	8.20	5.84	-
	Other Electricals	INR cr	-	6.56	6.75	6.93	4.96	3.88
	Pipings	INR cr	-	3.18	3.28	3.36	2.41	1.88
	Fire Fighting System 1200 SCMH (COCO)	INR cr	-	0.64	0.66	0.70	0.51	1.88
	Fire Fighting System 450 SCMH (DODO)	INR cr	-	2.23	2.29	2.33	1.66	-
	Fire Fighting System 450 SCMH (RO)	INR cr	-	0.14	0.15	0.15	0.11	-
	Flow Meter 1200 SCMH (COCO)	INR cr	-	0.13	0.13	0.14	0.10	0.38
	Flow Meter 450 SCMH (DODO)	INR cr	-	0.32	0.33	0.33	0.24	-
	Instrumentation	INR cr	-	3.32	3.42	3.51	2.51	1.97
	Scada Per CNG Station		-	0.09	0.09	0.09	0.06	0.14
	Subtotal	INR cr	-	42.96	44.24	45.38	32.49	26.33
2	Incidentals							
	GST	INR cr	-	3.97	4.09	4.23	3.04	4.74
	Inland Hdlg. (IC)	INR cr	-	0.86	0.88	0.91	0.65	0.53
	Subtotal	INR cr	-	4.83	4.98	5.14	3.69	5.27
3	Erection Cost							
	Compressor 1200 SCMH	INR cr	-	1.22	1.26	1.33	0.97	3.61
	Subtotal	INR cr	-	1.22	1.26	1.33	0.97	3.61
4	Civil Works							
	Compressor 1200 SCMH	INR cr	-	10.63	10.95	11.62	8.46	31.47
	Land Rate (800 Sq.m.)	INR cr	-	1.43	1.62	1.22	0.89	3.32
	Subtotal	INR cr	-	12.06	12.57	12.84	9.35	34.79
5	Incidentals							
	GST on erection cost	INR cr	-	0.15	0.15	0.16	0.12	0.43
	GST on civil works	INR cr	-	1.45	1.51	1.54	1.12	4.17
	Insurance	INR cr	-	0.07	0.08	0.08	0.06	0.08



S. No.	Particular	Units	Y1	Y2	Y3	Y5	Y8	Y25
			FY 2020	FY 2021	FY 2022	FY 2024	FY 2027	FY 2044
	Subtotal	INR cr	-	1.67	1.73	1.78	1.29	4.69
6	Engineering Components							
	Detailed Engineering, Construction, supervision and project management	INR cr	-	0.84	0.87	0.89	0.64	0.97
	GST on Services	INR cr	-	0.15	0.16	0.16	0.12	0.17
	Subtotal	INR cr	-	1.00	1.03	1.05	0.76	1.15
7	Owner's Costs							
	Owner's management expenses	INR cr	-	1.97	2.03	2.08	1.50	2.27
	Subtotal	INR cr	-	1.97	2.03	2.08	1.50	2.27
8	Other Costs							
	Contingencies	INR cr	-	2.81	2.90	2.98	2.14	3.24
	Subtotal	INR cr	-	2.81	2.90	2.98	2.14	3.24
Total			-	68.51	70.74	72.59	52.20	81.34

Table 51 CNG Capex Unregulated

S. No.	Particular	Units	Y1	Y2	Y3	Y5	Y8	Y20	Y25
			FY 2020	FY 2021	FY 2022	FY 2024	FY 2027	FY 2039	FY 2044
1	Material Costs								
	Cascades (3000 lit.)	INR cr	-	0.70	0.72	0.77	0.56	-	3.45
	Dispensers (Bus)	INR cr	-	0.64	0.66	0.70	0.51	1.08	1.88
	Dispensers (Cars)	INR cr	-	1.15	1.18	1.25	0.91	1.95	3.39
	ERV & Fire Fighting Equipment	INR cr	2.55	2.55	2.55	-	-	-	-
	Subtotal	INR cr	2.55	5.03	5.11	2.71	1.98	3.03	8.73
2	Incidentals								
	GST - Cascades	INR cr	-	0.13	0.13	0.14	0.10	-	0.62
	GST - Dispensers	INR cr	-	0.50	0.51	0.55	0.40	0.85	1.48
	Inland Hdlg. (IC)	INR cr	0.05	0.10	0.10	0.05	0.04	0.06	0.17
	Subtotal	INR cr	0.05	0.23	0.23	0.19	0.14	0.06	0.80
3	Erection Cost	INR cr	-	1.10	1.13	1.17	0.84	1.87	1.19



S. No.	Particular	Units	Y1	Y2	Y3	Y5	Y8	Y20	Y25
			FY 2020	FY 2021	FY 2022	FY 2024	FY 2027	FY 2039	FY 2044
	Subtotal	INR cr	-	1.10	1.13	1.17	0.84	1.87	1.19
4	Incidentals								
	Work Contract Tax	INR cr	-	0.13	0.14	0.14	0.10	0.22	0.14
	Insurance	INR cr	0.00	0.01	0.01	0.01	0.00	0.01	0.01
	Subtotal	INR cr	0.00	0.14	0.14	0.15	0.10	0.23	0.16
5	Engineering Components								
	Detailed Engineering, Construction, supervision and project management	INR cr	0.04	0.09	0.09	0.06	0.04	0.07	0.15
	GST on Services	INR cr	0.01	0.02	0.02	0.01	0.01	0.01	0.03
	Subtotal	INR cr	0.05	0.11	0.11	0.07	0.05	0.09	0.18
6	Owner's Costs								
	Start-up and commissioning expenses	INR cr	-	-	-	-	-	-	-
	Owner's management expenses	INR cr	0.09	0.21	0.22	0.14	0.10	0.17	0.35
	Subtotal	INR cr	0.09	0.21	0.22	0.14	0.10	0.17	0.35
7	Other Costs								
	Contingencies	INR cr	0.13	0.31	0.31	0.19	0.14	0.25	0.50
	Subtotal	INR cr	0.13	0.31	0.31	0.19	0.14	0.25	0.50
Total			2.87	7.13	7.26	4.62	3.35	5.71	11.90

Table 52 Line Gas Pack

Particular	Units	Y1	Y5	Y8	Y10	Y15	Y25
		FY 20	FY 24	FY 27	FY29	FY 34	FY 44
Line Gas Pack	INR Lakh	-	7.39	10.57	0.00	0.00	0.00



6.3 Operating Expenditure

The table below depicts the total Opex (for all segments) in INR crore:

Table 53 CGD and CGS Opex

S. No.	Particular	Units	Y1	Y5	Y8	Y10	Y15	Y20	Y25
			FY 2020	FY 2024	FY 2027	FY 2029	FY 2034	FY 2039	FY 2044
1	Manpower Cost								
	Regular Manpower								
	Executives	INR cr	-	1.60	1.96	2.24	3.15	4.41	6.19
	Non-Executives	INR cr	-	0.42	0.86	0.98	1.38	1.93	2.71
	Manpower Finance	INR cr	-	1.12	1.37	1.57	2.21	3.10	4.34
	Contracted Manpower								
	CGS - Security Guard	INR cr	-	0.38	0.46	0.53	0.74	1.04	1.47
	CGS - Contract Manpower	INR cr	-	0.38	0.46	0.53	0.74	1.04	1.47
	Steel Grid Line - Contract Manpower	INR cr	-	0.42	0.82	0.94	1.32	1.86	2.61
	Domestic and Commercial Connection - Contract Manpower	INR cr	-	1.43	4.23	4.84	6.79	9.52	13.35
	Industrial Connection - Contract Manpower	INR cr							
	Subtotal	INR cr	-	5.75	10.17	11.65	16.33	22.91	32.13
2	Admin, Overhead, O&M Costs								
	Cascade Hydrotesting		-	0.52	1.14	1.57	1.40	1.63	2.45
	Administration Charges	INR cr	-	1.07	1.54	1.54	1.54	1.54	1.54
	Overheads	INR cr	-	0.21	0.30	0.30	0.30	0.30	0.30
	O&M of CGD network	INR cr	-	13.03	30.39	37.52	56.67	86.44	134.97
	R&M of CGD	INR cr	0.41	21.24	51.06	51.09	51.12	51.24	51.46
	R&M of CGS	INR cr	0.66	1.03	1.31	1.49	1.55	2.06	2.43
	Meter reading, DMA & Other charge	INR cr	-	2.74	5.61	0.60	0.60	0.60	0.60
	Bank Charges - Performance Bond	INR cr	0.005	0.004	0.004	0.004	0.004	0.004	0.004
	Loss Due to Performance Bond	INR cr		-	-	-	-	-	-
	Bank Charges - Bid Bond	INR cr	0.00	-	-	-	-	-	-
	Annual Cost per ERV	INR cr	0.06	0.21	0.23	0.24	0.28	0.33	0.37
	Subtotal	INR cr	1.14	40.06	91.58	94.36	113.46	144.12	194.12
3	Utilities								



	Insurance	INR cr	-	6.96	18.38	18.54	18.14	16.16	11.81
	Subtotal	INR cr	-	6.96	18.38	18.54	18.14	16.16	11.81
	Total		1.14	52.77	120.13	124.55	147.94	183.19	238.06

Table 54 CNG Opex

S. No.	Particular	Units	Y1	Y5	Y8	Y10	Y15	Y20	Y25
			FY 2020	FY 2024	FY 2027	FY 2029	FY 2034	FY 2039	FY 2044
	COCO Opex								
a	Manpower - Owned stations (1200 SCMH)	INR cr	-	46.37	97.01	119.62	200.89	328.19	581.12
b	O&M 1200 SCMH Motor Driven (COCO)	INR cr	-	8.27	15.05	15.97	18.51	21.46	30.48
c	Administration Charges	INR cr	-	6.96	14.55	17.94	30.13	49.23	87.17
d	Overheads	INR cr	-	4.64	9.70	11.96	20.09	32.82	58.11
e	R&M Charges	INR cr	-	8.91	15.44	15.44	15.44	31.88	40.24
f	Power	INR cr	-	28.24	58.73	72.68	116.99	191.96	321.27
g	Insurance	INR cr	-	1.62	2.11	1.35	0.35	5.22	4.74
h	Annual Maintenance Cost for SCADA-CNG station	INR cr	-	0.10	0.18	0.19	0.22	0.25	0.36
1	Total	INR cr	-	105.09	212.77	255.16	402.62	661.02	1,123.48
	Per CNG Station Cost	INR cr		4.38	5.32	6.38	10.07	16.53	22.93
	DODO/RO Opex								
a	Daughter Booster station LCV cost	INR cr	-	23.54	39.16	39.16	39.16	39.16	39.16
b	Dealer Commission	INR cr	-	23.19	44.23	51.65	71.92	102.09	147.80
c	O&M 600 SCMH Motor driven (DODO)	INR cr	-	-	-	-	-	-	-
d	O&M 450 SCMH Motor driven (DODO)	INR cr	-	29.51	53.63	56.90	65.96	76.47	88.65
e	R&M Charges 600 SCMH	INR cr	-	-	-	-	-	-	-
f	R&M Charges 450 SCMH		-	7.11	12.32	12.32	12.32	25.44	30.71
g	Power	INR cr	-	22.54	46.87	58.00	93.36	153.18	245.22
h	Insurance	INR cr	-	1.29	1.68	1.08	0.28	4.17	3.62
i	Annual Maintenance Cost for SCADA-CNG station	INR cr	-	0.50	0.90	0.96	1.11	1.29	1.56
j	LNG Fuelling Terminal Opex	INR cr	33.05	33.07	0.04	0.05	0.06	0.07	0.10
2	Total	INR cr	33.05	140.76	198.83	220.11	284.17	401.87	556.82
	Per CNG Station Cost	INR cr		1.48	1.26	1.39	1.80	2.54	3.52
	Total		33.05	245.84	411.60	475.27	686.79	1,062.88	1,680.30



Table 55 Total Opex

Particular	Units	Y1	Y5	Y8	Y10	Y15	Y20	Y25
		FY 2020	FY 2024	FY 2027	FY 2029	FY 2034	FY 2039	FY 2044
Total OPEX	INR cr.	34.2	299	532	600	835	1246	1918
OPEX per SCM	INR/SCM	-	14.07	12.43	12.29	13.71	16.16	19.09



7. DEVELOPMENT PLAN AND SCHEDULES

7.1 General

Generally, the implementation of city gas distribution project mainly involves the installation & erection of CGS, laying of steel main ring, DRS/IPRS/ CNG Stations and polyethylene network to reach up to individual consumer. The project is planned for implementation from the date of grant of authorization with carbon steel pipeline penetration in all the charge areas within five years. The expansion of CGD network which includes last mile connectivity to industry, commercial and domestic customers and setting up of CNG stations is driven by the projected demand in each of the charge areas every year.

7.2 Pre-Operational Approvals

Some of the critical approval, listed below are planned to be obtained prior to commencement of construction.

- Right of Way / Right of Use;
- Clearance from Pollution Control Agencies/Various Utilities Departments (Water, HT Lines etc.);
- Permission to lay hydrocarbon pipeline.

7.3 City Gate Station

The construction of CGS includes the following:

- Identification and purchase of suitable land plot near the tap-off
- Basic engineering of civil and Mechanical activities
- Award of works contract to contractors
- Construction, testing and commissioning

7.4 Steel Main Grid

The construction of Steel Main Grid/Ring includes the following activities:

- Configuration and design of pipelines
- Acquisition of RoU/RoW for pipeline route
- Basic and detailed engineering
- Procurement of pipes and fittings
- Construction (Laying of pipes)
- Testing and commissioning
- Cathodic protection

7.5 City Gas Distribution (PE Network)

The construction of PE Network shall start immediately along with steel network. The DRS and SR will be installed at selected locations to supply PNG to domestic, commercial and industrial gas customers.

The main activities include the following:

- Survey and route finalization
- Basic & detailed engineering
- Laying of PE pipes



- Erection of DRS and SR
- Testing and commissioning of PE network
- Installation of GI pipe connection in consumers premises

The network laying and installation of GI pipe connection are ongoing activities and as per market penetration.

7.6 CNG Stations

The construction of CNG Stations includes the following activities:

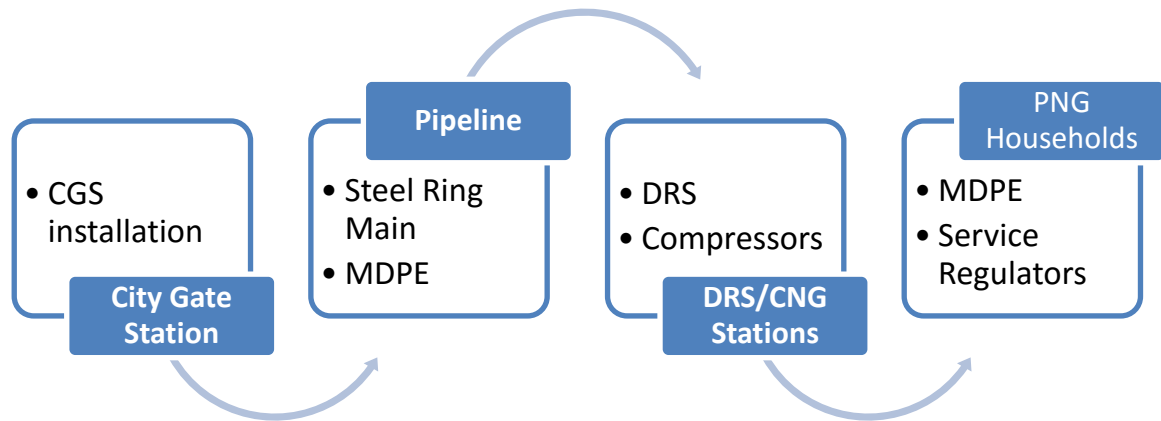
- Identification of suitable locations
- Basic and detailed engineering as per demand
- Statutory approvals
- Award of purchase orders and works contract
- Land development and civil construction
- Compressor, cascade and dispenser erection
- Connection with steel mains
- Electrical works
- Testing and commissioning and beginning of CNG sales

Indraprastha Gas Limited will develop own Mother CNG Station at CGS and other location. All other stations will be developed under DODO model, in which, CNG stations will be owned and operated by the dealer. Under DODO model, the entire earmarked dealer plot shall be developed exclusively for setting up of CNG. After carrying out the detailed techno-commercial survey, CNG station site will be selected and the plot owner applicant desirous of setting up CNG station will have to enter into a long-term agreement with the company. In addition to that, the CNG equipment (compressor/ cascade/ dispenser, etc.) will be installed and commissioned by the company while adhering to all the statutory rules/guidelines related to fire and safety.

The guidelines also ask the dealer to arrange all the permissions to set up CNG Station including change of land use, necessary clearance, license, etc. at own expense and cost. All necessary permissions required from all statutory authorities (like Chief Controller of Explosives (CCOE)/PESO-Nagpur and local office, NHAI, Building proposal, Factory department, Environment department, local Municipal office, HUDA, CFO, PCB, Directorate of Health & Safety, Local Office, Traffic Police etc. for setting up of CNG stations has to be arranged by the dealer. The dealer shall be paid commission by the company as per the sales achieved based on the fixed dealer commission.

7.7 Implementation Plan

CGD network is a hierarchical network with one city gas station feeding several DPRS/CNG stations forming the steel/MDPE main pipeline network within the city. The implementation or setting up of the CGD network within the GA happens in the phased manner. Various activities/phases involved in the setting of CGD network is represented pictorially below:





Steel Ring Main

The map depicting the planned steel ring main network for the Ajmer, Pali and Rajsamand districts as follows:

Figure 12 Steel Main P/L Network

(Attached: Steel pipeline map)



Steel Pipeline

The shortest optimal network route was planned after conducting the route survey covering all the major demand centres. The simulation design of the same has been conducted on the Gasworks software to get the optimal diameters of the pipes considering all the boundary limits like pressure, temperature and pipe efficiency etc.

The summary of steel pipeline planned of various diameters with their node length is given as follows:

Table 56 Feasible Length of Steel Pipeline

Steel Pipeline Diameter (in Inch)	Units (in KM)
12	136.10
8	105.80
6	39.60

MDPE Pipeline Phasing

The MDPE is planned for providing the domestic, commercial and industrial connections connecting to the main steel ring main via various planned DRS. Estimation of MDPE network to be laid in order to provide the domestic connections includes the following assumptions:

Assumptions considered for MDPE Estimation for domestic connections:

Table 57 Assumptions for MDPE Pipeline per DRS & per Connection

PE Length Calculations	Units	Metres per HH considered	% distribution
For a city with mix of multi-storied and individual households	Mtrs/HH	11.00	
180mm MDPE Pipeline Network	Mtrs/HH	0.22	2%
125mm MDPE Pipeline Network	Mtrs/HH	1.10	10%
63mm MDPE Pipeline Network	Mtrs/HH	2.09	19%
32mm MDPE Pipeline Network	Mtrs/HH	5.72	52%
20mm MDPE Pipeline Network	Mtrs/HH	2.09	19%
180mm MDPE Pipeline Network	Mtrs/DRS	3,000	



Table 58 Feasible No. of household connections (Cumulative)

Particulars	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27
Target %	0%	10%	20%	30%	40%	60%	80%	100%
PNG Household	-	1,00,094	2,00,189	3,00,283	4,00,378	6,00,566	8,00,755	10,00,944

Table 59 Feasible Steel (Inch-km) (Cumulative)

Particulars	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27
Steel Inch-km	1116.80	2246.80	2551.60	2587.60	2622.40	2658.40	2694.40	2717.20

Table 60: MDPE Phasing (Cumulative)

S. No.	Particular	Units	Y1	Y5	Y8	Y10	Y15	Y25
			FY 20	FY 24	FY 27	FY 29	FY 34	FY 44
1	180mm MDPE Pipeline including MDPE per DRS	Kms	30	342	687	690	693	717
2	125mm MDPE Pipeline	Kms	0	440	1101	1101	1101	1101
3	63mm MDPE Pipeline	Kms	0	837	2092	2092	2092	2092
4	32mm MDPE Pipeline	Kms	0	2290	5725	5725	5725	5725
5	20mm MDPE Pipeline	Kms	0	837	2092	2092	2092	2092

DRS Phasing

Table 61: DRS Specification

S. No.	Particulars	Value
1.	DRS Capacity	2000 SCMH
2.	DRS Efficiency	100%

Considering the demand in each CA the DRS are installed to cater the demand of various charge area, as depicted in the following table:

Table 62 DRS Phasing

Particulars	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27
DRS 2000 SCMH	-	4	9	13	25	36	47	56

Table 63 CNG Station phasing for 8 years

Particulars	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
	FY 20	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26	FY 27
Target %	0%	15%	30%	45%	60%	75%	90%	100%
COCO 1200 SCMH	0	6	12	18	24	30	36	40
DODO/RO 450 SCMH	0	24	48	72	95	119	143	158
Total CNG Stations	0	30	30	30	29	30	30	19
Total CNG Stations (Cumulative)	-	30	60	90	119	149	179	198



8. BUSINESS PLAN & FINANCIAL VIABILITY

Broadly analysing financial feasibility of the project, it is derivative of following key parameters:

1. Gas Pricing and Margins
2. Pricing assumptions
3. Selling prices projection
4. Financial projections

8.1 Gas pricing and Margins

In accordance with “New Domestic Natural Gas Pricing Guidelines, 2014”, issued by Ministry of Petroleum and Natural Gas, Government of India the price of domestic natural gas for the period of April 2019 to September 2019 is USD 3.69/MMBTU on Gross Calorific Value (GCV) basis. For PMT the price considered is USD 5.73/MMBTU. Basic price for domestic gas is considered in the ratio of 83% of APM and 17% of PMT.

As per the new formula of PLL-Ras gas Long Term LNG, slope of 12.67% of Brent crude price is considered for RLNG pricing. Constant pricing is used based on the current fuel prices of Diesel, LPG and Furnace oil which are taken without price escalation for the entire duration of the project i.e. 25 years

The projected price for the next 25 years of Brent crude and Indian basket were provided and the same pricing has been used to calculate the alternative fuel price.

Gas mix for all segments:

Domestic produced gas is allocated to all sectors as per Gas Utilization Policy of the Government. The domestic gas is first allocated to the priority sector such CGD sector for PNG (Domestic) and CNG (Transport), as per their actual consumption. Domestic gas allocation exercise is reviewed half yearly by GAIL India Ltd. PPAC shall within completion of 20 days of a half year submit the average consumption of gas by each CGD entity in transport and domestic segments to GAIL.

Further to meet fluctuation in demand of transport and domestic segments, GAIL is authorised to supply domestic gas 10% over and above the 100% requirement of CNG (transport) and PNG (domestic) of individual CGD entity calculated as per the last half yearly consumption. GAIL will accordingly divert domestic gas (except NELP gas) from Non-Priority sector by applying pro-rata cuts to meet the above requirement of CNG (transport) and PNG (domestic) of individual CGD entities. The whole exercise should be completed by GAIL within 1 month from the completion of the half year and after completion of the exercise GAIL shall submit a compliance report to MoP&NG giving the details of the quantity of domestic gas allocated to CGD sector for consumption in CNG (transport) and PNG (domestic) segments. Any demand over and above domestic gas may be met through imported R-LNG which is imported under open general license on mutually agreed terms.



On the basis of above principle, the share of domestic gas and R-LNG has been calculated, which is tabulated in the table below:

Table 64 Share of Domestic Gas and R-LNG to different segments

Share %		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y10	Y15	Y25
		FY	FY	FY	FY	FY	FY	FY	FY	FY	FY	FY
		21	22	23	24	25	26	27	28	30	35	45
Domestic Gas	Domestic	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
	Transport	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
	Commercial	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
	Industrial	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %

Table 65 Fuel Characteristics

Particulars	Unit	Value
Furnace Oil (FO)	Kcal/Kg	10,500
Light Diesel Oil (LDO)	Kcal/SCM	10,700
Liquid Petroleum Gas (LPG)	Kcal/Kg	11,900
High Speed Diesel (HSD)	Kcal/Kg	10,800
Natural Gas (NG)	Kcal/SCM	9,350
Natural Gas (NG)	Kcal/Kg	13,090
Motor Spirit	Kcal/Litre	11,200
Barrel to Litre conversion	Kcal/Kg	159
MMBtu to SCM	Kcal/Kg	26.95

Table 66 Gas Purchase Assumptions

Particulars	Value
GST on gas transportation	12.00%
CST on RLNG (after C-form rebate)	2.00%
Customs duty	2.50%
GST on regasification	18.00%
GST on FO	18.00%
GST on LDO	18.00%
VAT- Diesel (Rajasthan)	18.00%
VAT - Petrol (Rajasthan)	26.00%
VAT- CNG	5.50%
VAT- Domestic PNG Sales	5.50%
VAT- Commercial PNG Sales	5.50%
VAT- Industry Sales	5.50%
Set off Available (Input VAT Credit)	No
Excise on CNG	14.00%
GST on Commercial LPG	18.00%
GST on Domestic LPG	5.00%
Surcharge on Custom Duty	10.00%

Table 67 Other Costs & Margins

Particulars	Units	Values
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Particulars	Units	Values
Marketing Margin – APM	INR/Thousand SCM	200.00
Marketing Margin – PMT	INR/Thousand SCM	507.58
Regasification Charges	\$/MMBtu	0.71
Marketing Margin – RLNG	INR/MMBtu	13.68
Dealer Commission for CNG Stations	INR/Kg	2.65
Shipping Cost	\$/MMBtu	0.50
Slope for Natural Gas	%	12.67%
Fixed Component of RLNG for DES Delivery	\$/MMBtu	0.82
APM Share	%	83%
Other Domestic Share	%	17%
Price of Natural Gas – APM	\$/MMBtu	3.69
Price of Natural Gas – PMT	\$/MMBtu	5.73
Gas Loss (Operational)	%	1.0%

Table 68 Pipeline Tariff

Particulars	Mehsana-Bhatinda P/L	Gujarat Regional N/W	Barmer-Pali P/L (Wt. Average)
INR/MMbtu	33.00	11.07	22.36



Landed Gas Cost:

Table 69 Landed Cost for all Segments

Particulars	Units	Y1	Y5	Y8	Y10	Y15	Y25
		FY 20	FY 24	FY 27	FY 29	FY 34	FY 44
Domestic segment	INR/SCM	11.73	12.83	14.53	15.73	19.22	28.45
Commercial segment	INR/SCM	29.53	35.42	40.66	44.53	56.13	89.80
Transport segment	INR/SCM	11.73	12.83	14.53	15.73	19.22	28.45
Industrial segment	INR/SCM	29.53	35.42	40.66	44.53	56.13	89.80

Gross Margins:

Table 70 Gross Margin (INR/SCM)

Particulars	Units	Y1	Y5	Y8	Y10	Y15	Y25
		FY 20	FY 24	FY 27	FY 29	FY 34	FY 44
PNG – Domestic	INR/SCM	14.99	16.87	18.43	19.55	22.67	30.46
PNG – Commercial	INR/SCM	16.39	18.44	20.15	21.38	24.79	33.31
CNG – Transport	INR/SCM	20.59	23.42	25.76	27.45	32.12	43.82
PNG – Industrial	INR/SCM	9.55	10.75	11.74	12.46	14.44	19.41

8.2 Selling price for all segments

To estimate the selling price of all segments, cost plus method is used. In this method, Input Gas Cost of domestic APM & PMT and R-LNG taken with price escalation of 2.3% for the entire duration of the project i.e. 25 years. However, escalation of 3% on selling & distribution cost and utility margin is considered for deriving of final selling price.

Table 71 Selling Price

Particulars	Units	Y1	Y5	Y8	Y10	Y15	Y25
		FY 21	FY 25	FY 28	FY 30	FY 35	FY 45
PNG – Domestic	INR/SCM	28.18	31.33	34.77	37.23	44.19	62.15
PNG – Commercial	INR/SCM	48.44	56.82	64.15	69.54	85.36	129.88
PNG – Industrial	INR/SCM	41.23	48.70	55.28	60.12	74.45	115.21
CNG – Transport	INR/kg	57.61	64.22	71.03	75.89	89.63	124.86



8.3 Financial Details and Projections

Debt to Equity ratio is kept at 0:100 for Capex. Consumer deposit and registration charges for household segment which is INR 3000 per connection is partially used to fund the CAPEX.

Projected P&L Account for the Integrated Business Segment:

Table 72: P&L Account for Integrated Business (INR crore)

S. No.	Particular	Units	Y1	Y5	Y8	Y10	Y15	Y25
			FY 2020	FY 2024	FY 2027	FY 2029	FY 2034	FY 2044
1	Revenues from Core Business							
a	Domestic	INR/Lakh	-	15,943	41,571	49,156	58,768	83,644
b	Commercial	INR/Lakh	-	2,727	6,424	9,584	18,246	35,931
c	Transport	INR/Lakh	-	48,923	97,718	1,17,551	1,76,269	4,18,297
d	Industrial	INR/Lakh	-	8,571	25,388	30,070	42,674	85,866
e	Network Tariff	INR/Lakh	-	-	-	125	636	3,318
f	Compression Tariff	INR/Lakh	-	-	-	161	816	4,258
g	Revenue from Consumer Deposit	INR/Lakh	-	1,001	2,002	0	(0)	(0)
	Subtotal	INR Lakh	-	77,165	1,73,103	2,06,648	2,97,408	6,31,313
	Transport Revenue Share	%	0%	63%	56%	57%	59%	66%
2	Other Income							
a	Government Grant - Revenue Treatment	INR/Lakh	-	-	-	-	-	-
3	Total Income (1 + 2)	INR Lakh	-	77,165	1,73,103	2,06,648	2,97,408	6,31,313
4	Expenses							
a	Total Opex	INR Lakh	1,709	58,945	1,27,466	1,53,825	2,21,613	4,86,339
	Subtotal	INR Lakh	1,709	58,945	1,27,466	1,53,825	2,21,613	4,86,339
5	EBITDA (3 - 4)	INR Lakh	(1,709)	18,220	45,637	52,822	75,795	1,44,975

The project IRR for the CGD Project in Ajmer, Pali and Rajsamand districts is 15.01%.

9. RISK ASSESSMENT AND MITIGATION PLAN

The project has certain elements of risks during project implementation as well as operations. Some of the common risks have been identified and mitigation mechanism has been identified. At the initial stages, the risks are vested with the company till such time they are mitigated and appropriately allocated. The suggested risk mitigation structure is tabulated below:

Table 73 Risk Evaluation and Mitigation Matrix

Risk event	Effect	Mitigation Mechanism
Change in allocation policy	Impact on profitability	Government altered the domestic gas allocation policy in 2015 and accorded top priority to city gas. Domestic city gas (CNG, residential PNG) now get 100% feedstock requirements from inexpensive APM gas, subject to a maximum limit of 10% higher than the consumption of the past 6 months and initial allocation of 6000 SCMD. Changes in this policy may affect projections significantly. Since the revenue of the project are highly dependent upon CNG demand, therefore to ensure returns, an increase in CNG selling price and marketing efforts would need to be made by Indraprastha Gas Limited
Large size of GA	Impact on CAPEX and profitability	The CAPEX may increase when providing connectivity to each demand center due to larger size of GA. Hence, a recon survey was connected to ensure that pipeline is passing through all the demand center.
PNGRB Penalty	Impact on EBITDA and profitability	Penalties due to shortfall in achieving cumulative work program targets as per PNGRB regulations may become higher because of under achievement of the bid parameters. This will impact the profitability. The financial model has been incorporated with various scenarios and sensitivities for estimating penalties as per regulation. The management is advised to consider the importance of individual parameters and prioritize them, to mitigate penalty risk and ensure that the cumulative achievement of CGD network at the end of three contract year should not falls short of 30% of the weighted average of the cumulative work program.
Growth rate for CNG demand	Impact on CNG Demand	A conservative approach is considered where Growth rate for transport vehicles is tapered after 8 years.
GST	Impact on revenues and profitability	The financial projections are dependent on Gas prices. An introduction of GST rates in natural gas may increase or decrease the Gas price depending on the GST rate (under which Natural Gas will fall) which may affect the projections significantly. GST will improve the demand as it will decrease the effective gas cost for industrial and commercial users as they can claim input tax credit which in turn will mitigate the effect of price increase or decrease.



Risk event	Effect	Mitigation Mechanism
	GST on CAPEX items	Input tax credit incurred on the Capex items including materials and services can be taken and accordingly it can be passed on to the vendors.
Non-availability of tap off - pipeline risk	Impact on CAPEX and project viability	Non-availability of Tap off for existing and upcoming pipeline may affect the Capex significantly and may lead project to be unviable.
Pipeline Tariff	Impact on gross margins, revenue and profitability	Increase in Pipeline tariff may reduce the margins and in turn impact the profitability. However, as the proposed unified tariff methodology is under active consideration by PNGRB, and is expected to be lower than the tariff applicable under additive tariff methodology; this risk is expected to be mitigated to large extent. Also, Sensitivity has been incorporated in the financial analysis to check the profitability in both the situation.
Availability of APM Gas	Impact on CGD project viability	Availability of APM Gas, in the present scenario is one of the most crucial factors in the viability of City Gas Distribution Business. Government altered the domestic gas allocation policy in 2015 and accorded top priority to city gas. Domestic city gas (CNG, residential PNG) now get 100% feedstock requirements from inexpensive APM gas.
Project Execution	Impact on revenues and profitability	The timely execution of the project is the critical factor in determining the profitability of the project. For timely project execution it is proposed to hire experienced EPC consultants.
Gas Price	Impact on the profitability Impact on the penetration rate	Gas prices are pegged to the alternate fuels by giving a suitable discount on the same. This ensure that natural gas remains competitive in the market. Further from regulatory perspective CGD company has marketing freedom to determine their retail selling price. Hence any scenario is not envisaged, where the company may incur loss in gross margins.
Demand Risk	Underutilization of capacity leading to loss of revenue	Realisable demand is considered based on the primary survey and on conservative basis. Significant variation is not envisaged.



10. ANNEXURES

Annexure 1: PNGRB MAP



Annexure 2: Industrial Establishments Surveyed

S. NO.	CATEGORY	INDUSTRY NAME	ADDRESS	DAILY QUANTITY CONSUMED	FO	LDO	LPG	HSD-Production
				SCMD	KL	KL	MT	KL
1	Steel	Standard Alloys India Private Ltd.	F-26, B & 27, Parbatpura Industrial Area, Nasirabad Road, Ajmer	998.0		25		
2	Food Processing	Ajmer Food Product Pvt. Ltd. (Parle G Plant)	F-62-63, Industrial Area, Parbatpura, Ajmer	6,147.7			140	
3	Tyre Pyroil	Bhim Industry						
4	Dairy/Food Processing	Ajmer Dairy (Saras Milk)	kanpur road Opposite H M T, Rajasthan 305001	9,928.1		65	167	
5	Steel	Castamet Works Private Limited	Kharwa, Masuda, Beawar Tehsil, Ajmer	1,317.4			30	
6	Food Processing	Mega Green food Tech - Roopangarh	Bhadun Road, Roopangarh, Palri Bhoptan, Rajasthan 305814	656.4				18.9
7	Dyeing	Kohinoor Tie Dye	Gs 206 punayta, Industrial Area Phase 4, Pali, Rajasthan 306401	137.7			3.135	
8	Food Processing	Sarda Biopolymer	H-105-112, 4th Phase, Industrial Area, Pali	307.4			7	
9	Food Processing	Sarda Gums & Chemicals	Industrial Area, Pali	399.2		10		
10	Adhesives	Falcofix Suparshva Adhesive	25/D, H M Nagar, Industrial Estate, Falna,	347.3				10
11	Food Processing	Laxmi Bakers Pvt	F-38-A, Parbatpura Industrial Area, Ajmer	219.6			5	



S. NO.	CATEGORY	INDUSTRY NAME	ADDRESS	DAILY QUANTITY CONSUMED	FO	LDO	LPG	HSD-Production
				SCMD	KL	KL	MT	KL
		Ltd						
12	Stone	Mohit Marble	Parbatpur Industrial Area					
13	Food Processing	Vijay Breads	Near HMT	219.6			5	
14	Food Processing (NGO)	Akshaya Patra	Ganesh Tekri Road, Nathdwara	500.6			11.4	
15	FMCG	Miraj Group	Miraj Campus , Upli Odan, Nathdwara	146.0			3.325	
16	Mechanical	Carriage Workshop	Railway Quarters, Ajmer	2,229.1		48		
17	Cement	Ambuja Cement Ltd.	Rabriyawas, Jaitaran Tehsil, Pali	173.7				5
18	Food Processing	Sarda Biopolymers	H-105-112, 4th Phase, Industrial Area, Pali	439.1			10	
19	Aluminium	PG Foils Limited	PO. Pipalia Kalan-306-307, Raipur Tehsil, Pali	5,328.5	100		7.3	35
20	Steel	Om Shivam Steel Industry	Plot No.G-60, RIICO Industrial Area, Makhupura, Ajmer	159.7		4		
21	Steel	Standard Alloys India Private Ltd.	F-26, B & 27, Parbatpura Industrial Area, Nasirabad Road, Ajmer	1,037.9		26		
22	Food Processing	Mahaveer Mills	RIICO Industrial Area, Kekri Tehsil, Ajmer	138.9				4
23	Steel	Urmil Technofab	H1-39, Industrial Area, Parbhatpura, Makhupura, Ajmer	113.8	3			
24	Metal	Shresht Alloys Pvt. Ltd.	No-12,15, RIICO Industrial Area, Makhupura, Near Pabatpura, Ajmer	399.2		10		
25	Ceramic	Vighnesh Lime	Village Pipara, Post AP Kalu, Jaitaran	758.5	20			



S. NO.	CATEGORY	INDUSTRY NAME	ADDRESS	DAILY QUANTITY CONSUMED	FO	LDO	LPG	HSD-Production
				SCMD	KL	KL	MT	KL
		Industries	Tehsil, Pali					
26	Ceramic	Chandi Marbles Limited	NH-8, Near Police Line, Rajsamand	303.4	8			
27	Ceramic	Babu Marbles Pvt. Ltd.	Sukher, Nh-8, Near Police Line, Amet Tehsil, Rajsamand	694.6				20
28	Ceramic	Satyam Shivam Minies	NH-8, Aidana, Rajsamand	104.2				3
29	Ceramic	Manleshwar Marble Mines	NH-8, Kelwa Road, Rajsamand	156.3				4.5
30	Ceramic	Mahashiv Mines	NH-8, Atma, Rajsamand	138.9				4
31	Ceramic	Manleshwar Mines Pvt. Ltd.	NH-8, Atntalia, Rajsamanad	104.2				3



Annexure 3: Commercial Establishments Surveyed

S. NO.	HOTEL NAME	ADDRESS	LPG CYLINDER (NOS.) 19 Kgs
1	Hotel Man Singh Palace	Gaurav Path, Vaishali Road, Ajmer	40
2	Hotel Cross Lane	445, Power House, 10, Jaipur Rd, Near City, Hathi Bhata, Ajmer, Rajasthan	50
3	Hotel Data INN	Sri Nagar Road, Near, Raja Cycle Circle, Pal Bhichala, Ajmer	35
4	Hotel Grand Xenia	Foy Sagar Rd, Hathi Kheda, Ajmer	80
5	Hotel Gulmarg	Gaurav Path, Near Petrol Pump, Vaishali Nagar, Ajmer	48
6	Hotel Ajmer INN	23/16 Prithivi Raj Marg, Purani Mandi Churi Bazar	90
7	Hotel Hallimax	Kishangarh, Ajmer, NH-8, Ajmer Road, Ajmer, Ajmer	30
8	Via-Lakhela Resort & Spa	Pratap Marg, Fort Road, Adjacent to Lakhela Lake,, Kumbhalgarh	50
9	The Aodhi	P.O: Kelwara, District Rajsamand, Kumbhalgarh	60
10	Navdeep Resort	8, Nathuwas, Nathdwara	40
11	Regenta Inn Embassy Ajmer	Opposite. City Power House, Jaipur Road, Sundar Vilas, Ajmer	60
12	Hotel Madni Royal	Lakhan Kothari, Ajmer	20
13	Hotel L.N Courtyard	Shastri Nagar Road ,Near Sbbj Bank, Ajmer	30
14	Bravia Hotel	Bravia Hotel Near Urban Haat, Vaishali Nagar, Ajmer	25
15	Neelkamal Hotel	Kaiser Ganj Road, Parao, Ajmer	60
16	Hotel Surya Mahal	Jodhpur Road, Shankheshwar Colony, I.O.C Colony, Beawar, Ajmer	90
17	Hotel Mansarovar & Vatika	Dirst Branch Pali Sirohi Road, Near Old Bus Stand, Sumerpur Pali, Second Branch Hotel Pali	22
18	Malgudi Days Restaurant And Café	Behind Bus Stop, Kundas, Counge Nagar Road, Ajmer	67
19	Shiv Mahima Dhaba	Ajmer Plaza, Opp. Sheetla Mata Mandir, National Highway 89, Ajmer	30
20	The Big Bunny Family Restaurant	No. A-50, Ashiana Road, Adarsh Nagar, Ajmer	15
21	Arora's Veg. & Non Veg. AC Family Restauranr	ICICI Bank ATM, Shanti Pura, Ajmer	15
22	Elite Family Restaurant	Gruond Floor, KEM Complex Station Road, Ajmer	20
23	Balaji Restaurant	Opp. Road Ways Bus Stand, Ajmer	20
24	Rajdeep Hotel & Restaurant	Near New Majestic Cinema Road, Ajmer	6



S. NO.	HOTEL NAME	ADDRESS	LPG CYLINDER (NOS.) 19 Kgs
25	The Tandoor Restaurant	College Road, Near Patel Ground, Muslim Mohalla, Ajmer	30
26	Naya Thikana The Family Dhada	Near Divya Deep Marriage Garden, Bajrang Garh, Ajmer	15
27	Crazy Tales	Guru Kripa Buliding, Ana Sagar, Link Road, Mall Mohalla, Ajmer	8
28	Baba Restautant	Near Kendriya Vidyalaya No.2, Chotu Bhai Ka Dhaba, Foy Sagar Chouraha, Ajmer	7
29	7 Spices	Siddi Complex, Near Ajanta, Ajmer	6
30	Pandit Restaurant	Mahaveer Circle, Barhadari Road, Subhash Park, Ajmer	60
31	The Dera Restaurant	Makadwali Road, Near Bhairav Baba Mandir, Ajmer	5
32	Coffoholic	Near Mango Masala Sardar Patel Marg, India Motor Circle, Ajmer	60
33	Silver Leaf Restaurant	Hotel Embassy, Opposite City Power House, Jaipur Road, Ajmer	60
34	Foodorla - Online Food Station	Foodorla Tower, Near Raj Honda Show Room, Bramhapuri - Kutchery Road, Ajmer	5
35	Jai Hind Restaurant	Madar Gate Road, Near Clock, Tower Parao, Ajmer	60
36	Chawla's	Shop No.10, Opp. Bhaisa Complex Khailand Market, Ajmer	6
37	The Vega Mall Havmor Restaurant	2nd Floor, Vega The Mall, Sardar Patel Marg, Ajmer	40
38	The Barrack	A-7, Nasirabad Road, Shalimar Colony, Adarsh Nagar, Ajmer	30
39	Maharaja's Restaurant	NH-8, Parbatpura Bye Pass, Ajmer	8
40	Kathi Junction	Gyan Marg, B Block, Pansheel Nagar, Ajmer	2
41	Satguru Food Court	Cine Mall, Gaurav Path, Ajmer	3
42	The Courtry & Town Café	Apna Nagar, Vaisali Nagar, Ajmer	20
43	Lalитай Fine Dinihg Redefined	Cine World Road, Near Mittal Hospital, Ajmer	6
44	Royal Spice Restaurant	Aravali Vihar Colony, Ajmer	20
45	Qlive Kitchen Restaurant	B.T.E. Tower, Gaurav Path, Opposite Reliance Fresh, Vaishali Nagar, Ajmer	7



S. NO.	HOTEL NAME	ADDRESS	LPG CYLINDER (NOS.) 19 Kgs
46	Khokha The Lounge	Basement Bhati Tower, Gaurav Path, Opposite Reliance Fresh, Ajmer	15
47	Café Shanti Munch	Jamni Kund Road, Pushkar, Ajmer	3
48	Gangaram Amarchand Halwai	Naya Bazar, Dargah Bazar, Ajmer	35
49	Rasgulla Shop	Peer Mitha Gali, Dargh Bazar, Ajmer	30
50	Shree Ajay Sweet	Makhupura, Ajmer	5
51	Shree Dev Dudh Bhandar	Police Line, Ajmer	45
52	MMD Sweet	Ghee Mandi Road, Dargah Bazar, Ajmer	15
53	Bikaner Sweets And Mankeen	Beawar Road, Ramganj, Ajmer	8
54	Top Misthan Bhandar	Dhola Bhatta, Near Radha Krishna Mandir, Ajmer	20
55	Jai Jodhpurn Sweets And Namkeen	Saat Pepli Balaji Mandir Ke Samne, Nasirnad Road, Ajmer	8
56	Krishna Chat Bhandar	Ram Dhara Gali, Purani Mundi, Ajmer	23



Annexure 4: Residential Establishments Surveyed

S. No.	Establishments	CA
1	Kishangarh Road	Ajmer
2	Loha Khan Colony	Ajmer
3	Jyoti Nagar	Ajmer
4	Anand Nagar	Ajmer
5	Gyan Vihar Colony	Ajmer
6	Dayanand Colony	Ajmer
7	Keshav Nagar	Pali
8	Gayatari Nagar	Pali
9	Nathdwara	Rajsamand
10	Ajitgarh	Rajsamand



Annexure 5: Total Retail Outlets

District	State	IOCL	HPCL	BPCL	Others	Total
Ajmer	Rajasthan	78	39	5	11	133
Pali	Rajasthan	62	49	21	0	132
Rajsamand	Rajasthan	34	6	2	11	53
Total		174	94	28	22	296



Annexure 6: Design & Engineering Simulation Works

- Annexure 6.1: SYNERGEE Pipeline Report
- Annexure 6.2: Schematic diagram
- Annexure 6.3: Pipeline Report – Node Subsection



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