INTERNSHIP REPORT

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General Information About Company

Sabarmati Gas Ltd. (Joint Venture of GSPC & BPCL)

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Gandhinagar - 382 021

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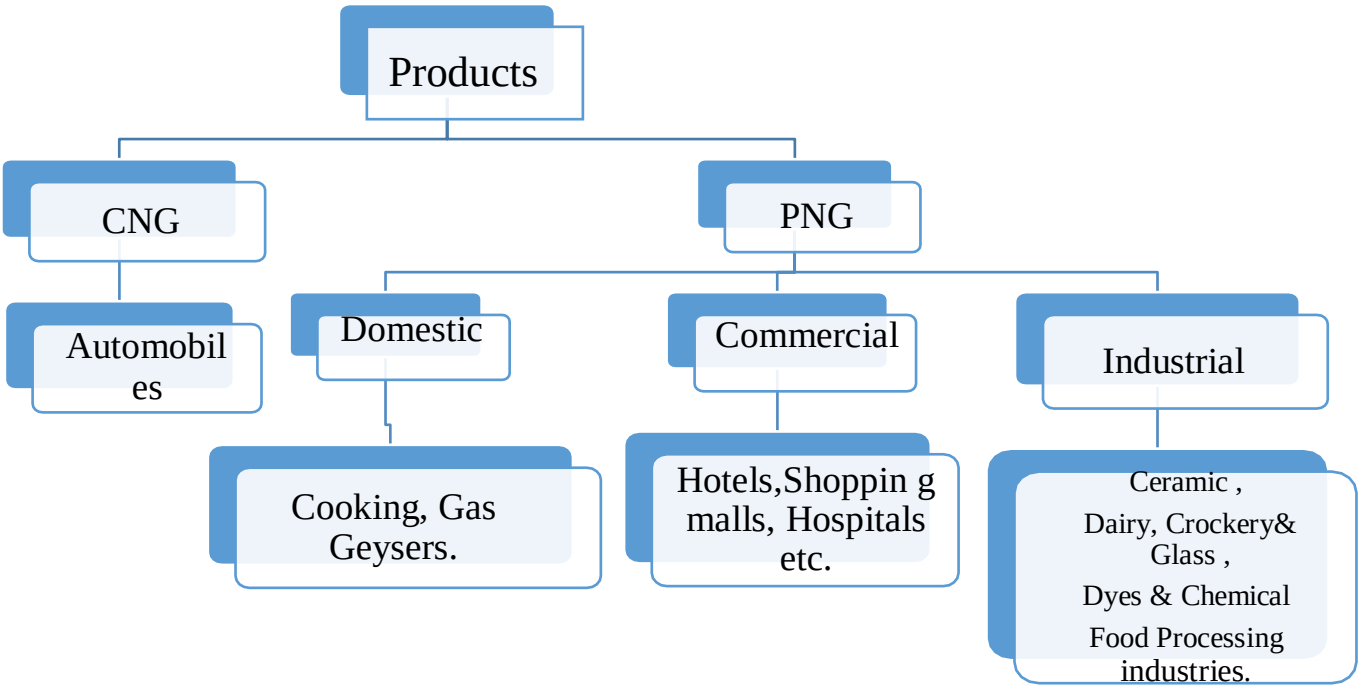
Promoted by: - Joint Venture of Gujarat State Petroleum Corporation(GSPC) & Bharat Petroleum Corporation Limited (BPCL)

- Sabarmati Gas Limited (SGL) was incorporated on 6th, June 2006, a joint venture company of Bharat Petroleum Corporation Limited (BPCL) and Gujarat State Petroleum Corporation (GSPC), has been conceived to retail natural gas by implementing gas distribution networks in Northern Gujarat.
- The objective of Sabarmati Gas Limited is to construct, operate, and maintain natural gas distribution system to supply piped natural gas to various sectors i.e. Industrial, Domestic, Commercial, and Transportation. Industrial demand comprises demand from small and medium scale industries. The Company operates in a fairly large network in all the five districts of Gandhinagar, Mehsana, and Himmatnagar, Patan & Aravalli of North Gujarat.

- SGL predominately serves 4 segments in its whole spectrum of retailing of Natural Gas. These four segments are Domestic, Industrial, and Commercial/Non Commercial customers through PNG and automobiles through its CNG outlets.

Products and Services covering:



CGD Industry in India

- **History**

  - The CGD business in India dates back to 1857 when Calcutta Gas Company and Bombay Gas Company commenced operations in Calcutta (now Kolkata) and Bombay (now Mumbai) respectively, with coal gas as the primary input. Subsequently, however, the industry remained by and large dormant, until Oil and Natural Gas Corporation Limited (ONGC) and Assam Gas Company Limited entered the business in the mid-to-late- 1980s.

  - The commercial success of these companies in the ensuing period along with improving gas supplies has drawn several new entrants to the CGD business in the recent past. Even while the industry has been gathering momentum, GoI has set up a regulator, the Petroleum and Natural Gas Regulatory Board (PNGRB), which has, among other mandates in the hydrocarbon sector, the mandate of regulating the CGD business. PNGRB has recently finalized a set of guidelines for the CGD sector. The list of companies from CGD sectors is as below:

State	Company Name
Gujarat	Adani Energy, Gujarat Gas, Sabarmati Gas, HPCL, Vadodara Gas, Charotar Gas, Torrent gas, IRM Energy
Delhi / NCR	Indraprastha Gas, Delhi
Maharashtra	Mahanagar Gas and Maharashtra Natural Gas
Andhra Pradesh/Telangana	Bhagyanagar Gas Ltd. and Hyderabad Godavari Gas Pvt. Ltd.
Rajasthan	Rajasthan State Gas Limited, Torrent Gas

U.P.	Green Gas, Central UP Gas, Siti Energy, GAIL Gas, Sanwaria Gas, Indraprastha Gas, Adani Gas, Indian oil- adani gas
Tripura	Tripura Natural Gas Co. Ltd (TNGCL) Agartala
Haryana	Haryana City Gas Ltd., GAIL Gas Ltd., and Adani Gas Ltd
West Bengal	GEECL
Karnataka	GAIL Gas Ltd.
Chandigarh	IOC-Adani
Daman	IOC-Adani

Departments in CGD Company in General

CGD company has a function to provide piped natural gas & compressed natural gas to the end consumers (Domestic, Industrial, Commercial & vehicles) In a particular geographical area (GA) by pipeline network laid, maintained and operated by the company.

CGD company comprises various departments with different functional areas but should work in synergy for the smooth function of the Company.

- **General Departments**

I) Finance Department

The function of this department include:

- Preparing Budget and forecasting
- Planning & organizing company finance
- Management of Company cash flow
- Financial Reporting and analysis.
- Management of Investment of the company
- Tax management
- Financial management of Company Resources

II) Human Resources Department

The Function of this Department includes: -

- Recruitment and selection of new employees
- Ensure compliance of company operation with laws
- Manage relations with other companies
- Maintaining good working conditions
- Management of employ relations
- Training & development of employees

III) Marketing & Sales Department: -

This department is divided into several sub-divisions.

A. CNG Marketing
B. PNG Marketing
    - Domestic PNG Marketing
    - Industrial PNG Marketing
    - Commercial PNG

Marketing Their functions are: -

- Direct and Indirect potential customer interaction
- Develop a promotional program to attract new customers
- Promote the company through different media platforms.
- Development of feasibility plan for potential industry customer
- Design and organize promotional event & campaign to reach the consumers
- Design company brochure and promotional material
- create the identity of the company in the market
- The market survey of Geographical area
- Represent the company in seminars, conferences, or meetings.

IV) Health & Safety Department

This department plays a major role in maintaining the health & safety of the personals & equipment of the company & its associates.

Their functions are: -

- Develop and execute zero accident policy
- Ensure company follow best practice to improve HSE performance rather than just compliance of the company to legal, statutory rules and regulations of the government
- Develop a Comprehensive and compulsory action plan to execute the policy.
- Provide and channelize resources for the implementation of HSE policy.
- Development, operation & monitoring of Emergency response system(ERS), Disaster management system(DMS) and other safety
- Plan safety and awareness program for personals working for the company & contractor at the site.
- Coordinate and guide other departments to follow the safety procedure & norms at the site during operations.
- Conducting an internal audit of the safety system at the site.
- Promote HSE in the work culture of the company by recognizing and rewarding the contributors for improving the HSE performance of the company.
- Timely review of HSE Policy

• Technical Departments:

I) Operation & Maintenance Department

This department in the CGD Company is responsible for smooth & safe operations of the company equipment's, this department has divisions like

❖ PNG Operation & Maintenance Department:-

The main function of these departments are:-

- Ensure a continuous supply of gas at the required pressure to the end PNG customers
- Scheduled checking of high-pressure gas pipeline to find and remove leakage or defect if any
- Timely checking & maintenance of safety device and metering skid at the customer facility for their smooth & accurate operations.
- Regular maintenance of service regulator, district regulation system for smooth operations of the equipment.
- Ensure damage to pipelines or leakage is attended to as soon as possible while following the best safety procedures.
- Replace or repair damaged equipment or part of gas pipeline

❖ CNG Operation & Maintenance Department:-

The main function of these departments are

- Ensure safe operational practice at CNG Station
- Reduce the breakdown time of the station
- Scheduled maintenance of compressor (Both Hour based and time-based) for its smooth operation
- Maintain the good working condition at station
- Scheduled checking of cascade for leakage or other faults
- Ensure proper working of all Gauges in the equipment
- Ensure timely cleaning of filtering device to remove dust
- Replace or repair damaged part of the equipment like dispenser at the station
- Check availability of safety equipment's at the station within their service life

II) Project & Planning Department: -

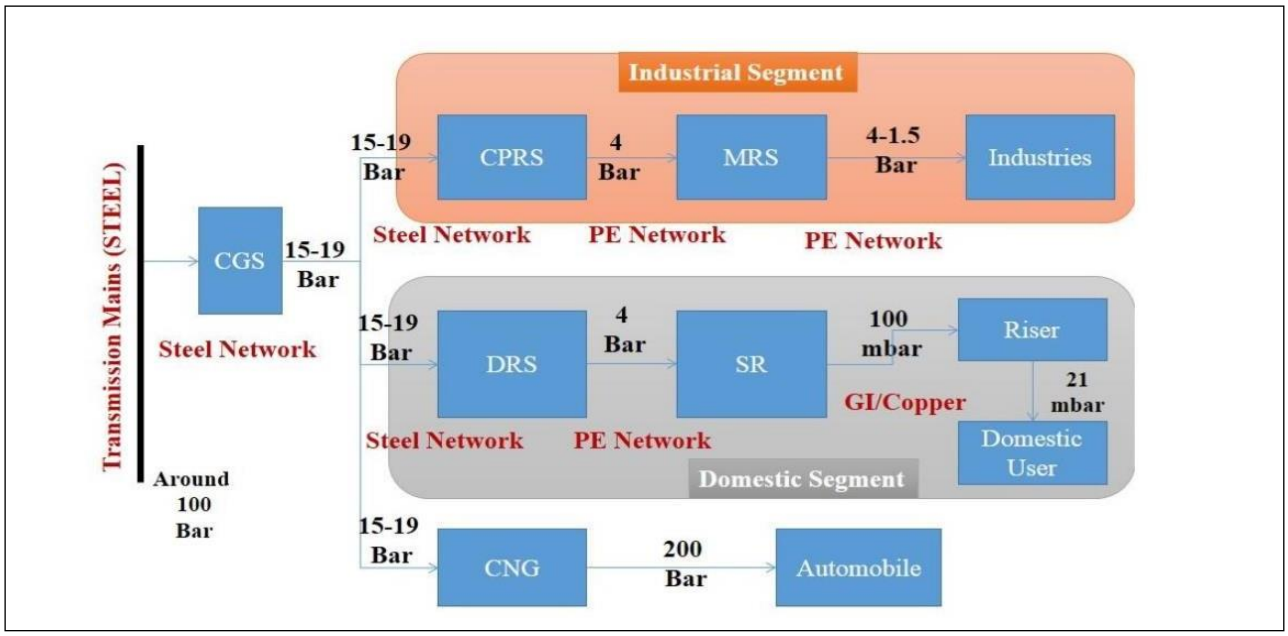
The function of this department includes: -

- ❖ Design Prefeasibility report of potential work area or Project
- ❖ Decide project capacity on basis of consumer base & expected demand
- ❖ Selection of a proper site
- ❖ Designing, Execution, and commissioning of Project
- ❖ Cost Calculation
- ❖ Equipment Requirement and clearance from the respective authority
- ❖ Staff Requirement

Components of CGD Network

A typical PNG network consists of if the following components:

I. CGS
II. DRS
III. Valve Chamber
IV. SR
V. CNG Station



(Diagram: CGD value chain**)**

- **CGS:**

CGS is the tap-off point of a high-pressure natural gas transmission pipeline, where pressure is reduced to 25-30 barg from 45-50 barg. The main components of City Gas Station and their functions are as follow:

- **Filtration skid:**

Dust particles and liquid coming along with the gas stream are separated by high efficient filters in KOD. Gas pressure is maintained the same from the CGS inlet to the filtration skid. After the filtration two streams are divided into two streams or pipelines. The line which is in function is known as an active line while another one is called a passive line or stand-by stream.

- **Pressure Reduction Skid:**

A pressure reduction skid is used to reduce the pressure of the gas stream from 40-45 bars to 25-30 bars. Creep relief valve and Slam Shut off valve is being installed in this skid for the safety purpose.

- **Metering Skid:**

A metering skid is installed for the gas flow measurement. An orifice meter is used in this metering skid; because of the large pressure drop requirement. The various parameters such as temperature in the various sections of the line pressure at the inlet & outlet joints, flow inlet & outlet are monitor by the SCADA systems in the control room.

- **Odourization Unit:**

An Odourization unit is installed for the addition of Ethyl Mercaptan in the gas stream. The dozing unit of the Ethyl Mercaptan should be 9 mg/m3. This unit consists of a pneumatic panel, level indicator, and a filter. This unit is directly connected to the mainline after the metering skid.

District Regulating System:

- DRS is the device used to reduce the pressure from 19 bars to 4 bars. It is the interface between the steel grid network and the medium pressure PE network. It is located at various demand centers for domestic
  /commercial users.
- Gas at high pressure enters into the filter, where borosilicate cartage is provided to remove the impurities and solid particles.
- There is a pressure gauge attached to it which measures the differential pressure. If differential pressure reaches 0.5, immediate cleaning of the filter is required. And if differential pressure reaches 1 barg then the filter stops working.
- Above filter safety relief valve is provided to vent off inlet gas if pressure increase more than 42 kg/cm2 as a maximum pressure handling capacity of steel pipe is 49 kg/cm2.
- DRS outlet pipeline can resist pressure up to 7 kg/cm2.
- Chances of the trip in DRS are mainly due to back pressure-induced when the flow is stopped in the downstream line.
- There is the provision of pressure reduction valves as the main function of DRS is to reduce the pressure. The following table shows the pressure reduction capacity valves for active stream and stand-by stream:

Active Stream	
VALVE	REDUCED PRESSURE (in Bar)
PRV- ACTIVE	4
PRV-MONITOR	4.5
CRV	5
SSV	5.2

Stand-by Stream	
VALVE	REDUCED PRESSURE(in Bar)
PRV- ACTIVE	3.7
PRV-MONITOR	4.5
CRV	5
SSV	5.5

- **Service Regulator**

  - It is used to reduce the pressure from 4 bars to 110 millibars and to maintain the flow. Flow can be of 200 SCMH (Standard Cubic Meter per Hour), 150 SCMH, 100 SCMH, or 50 SCMH based on the requirements.

  - 50 SCMH capable to fulfill the demand of approx. 150 domestic connections theoretically.

Design criteria	
Inlet Pressure	1.5 to 5.0 bar-g
Outlet Pressure	110 mbar-g
UPSO	40 – 60 mbar
OPSO	145-175 mbar

Operation & Maintenance (Metering)

- **Metering**

  - Metering is one of the important parts of the O&M department at SGL.
  - Meters are installed as per different premises.
    1. Domestic Premise
    2. Commercial Premise
    3. Industry Premise

- **Types of meters used in CGD**

  - Diaphragm Meter (use in Domestic/commercial)
  - Rotary Positive Displacement Meter (RPD) (use in Industry)
  - Turbine Meter (use in Industry)
  - EVC Meter (use in Industry)

- **Meters used in CGD**

Type	Qmax
G6	10
G10	16
G16	25
G25	40
G40	65
G65	160
G160	250
G250	400
G400	650
G650	1000
G1000	1600

- **Valves**

  - Ball Valve
  - Gate Valve
  - Pressure Regulating (PRV) Valve
  - Slam shut off Valve
  - Check (NRV) Valve

- **MRS**

  - Meter Regulating station is installed for the gas flow measurement.
  - The rotary meter is used for measuring the volume of incoming gas.
  - MRS used to Reduce the gas pressure from 4 bar to 4-1.5 bar as per the industry required.

- **Components of MRS**

  - Typical photo of MRS
  - Filter, Temperature, and pressure gauge
  - Rotary meter, Turbine meter, and EVC(Electronic volume corrector)

- **Valves for controlling the flow**

I. Slam Shut off Valve

- Slam Shut-off valve is installed immediately after the filter & before the Regulator.
- It normally remains open, in case the outlet pressure of the regulator exceeds the permissible limit.
- The slam shut-off valve senses pressure through the impulse line & immediately shuts off the flow downstream.

II. Creep relief valve

- Pressure relief valves are a dependable means of protecting a regulator or downstream systems, storage vessels, and other systems against overpressure conditions by relieving the excess gas pressure.
- Designed to protect against excessive pressure in systems and vessels, suitable for use as creep relief and as part of stream discrimination in systems and vessels.

III. Non-returnable valve

- These valves are very useful in preventing the backflow of water to the pump.
- These valves have a minimum head loss and can be very competitive in terms of long service life.
- Non-slam and quick closing characteristics have made this product a very useful product.

GIS – Geographical Information System

- A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data.
- GIS is used as a tool in both problems solving and decision-making processes, as well as for the visualization of data in a spatial environment (Map).
- GIS has 5 key factors i.e Hardware, Software, Data, People, and analysis to prepare different reports.
- GIS Maps is also facilitated to other statuary auditors/ Companies on request.
- Gas Objects/features that are being captured in GIS are shown in the screenshot.
- GIS and Synergee (network planning software) integration for planning/extending the current Gas Pipeline network and determining capacity utilization of different sections of pipeline to achieve maximum utilization of existing Pipeline.
- Identification of isolation valve in upstream and downstream in case of planned or unplanned outages/leakages to isolate the section of pipeline to reduce gas loss.

Advantages of GIS In CGD:

- GIS helps in asset management by locating pipeline assets such as main and service lines by tracking their coordinates and calculating their relative distances
- Leak management and analysis is swifter as GIS provides faster response time in case of a leak or an accident, by sharing the information of the incident to the response team
- GIS stores consumer data and various thematic maps can be prepared to identify future potential consumers and plan the pipeline network accordingly
- Study of demand and supply of consumers through survey and mapping can help in the expansion planning of the pipeline network and prediction of the future growth can be accessed
- To produce calculations such as pressure, inlet quantity of the gas, etc., as well as to generate maps and BoM showing various design parameters at all nodes and lines
- Network size critically designed to ensure supply pressure at consumer & intermediate points without over/ under sizing any element
- Flexibility to change the design to suit the site conditions
- Ability to manually adjust the automatically calculated locations
- For operations and maintenance, it is important to identify weak sections of the pipeline and to replace the segment to prevent a leak or an accident. Pipes made of steel or iron are subject to rust due to environmental factors that need to undergo cathodic protection.

- Optimal DPRS location, service area & routing for substantial cost saving.
- Plan route to ensure maximum reach with minimum length.
- Reduce network design time.

5 component of GIS:

A working GIS integrates five key components: hardware, software, data, people, and methods**.**

- Hardware. Hardware is the computer on which a GIS operates.
- Software. GIS software provides the functions and tools needed to store, analyze, and display geographic information.
- Data
- People
- Methods

The software of GIS:

- ArcGIS (Esri) ArcGIS 9.x
- 2 Geo media (Hexagon Geospatial)
- 3 MapInfo Professional (Pitney Bowes)
- 4 Global Mapper (Blue Marble)
- 5 Manifold GIS (Manifold)
- 6 Small world (General Electric)
- 7 Bentley Map
- 8 Map Viewer and Surfer (Golden Software)

Our projector during an internship under the GIS Department

- In GIS, We learned how to located the industries and commercial locations and the process to display connectivity of a particular customer in the GIS software.
- We visited some sites along with the technician's help we located the connectivity and we took the coordinates of the Valve chamber and MRS/Meter.
- And then we learned to plot the connection of the industry valve chamber with the header line.
- We visited Kudasan, Kadi and Chhatral sites.
- In kudasan, we visited a total of 8 commercial sites to know their pipeline connectivity with the valve chamber and metering unit.
- Where we find out some commercial connections which were directly connected from the domestic with the help of regulator and risers.
- In kadi and chhatral, we visited a total of 25 commercial and industrial sites to know their connectivity and measures the coordinate of the valve chamber and MRS/meter to plot it in the GIS map as an exercise.

Some objectives of the GIS solution

Information management: GIS enables the gas industry in managing pipe network information, device information, user information, economic information, and environmental information

Integrity management: Gas distribution companies constantly face several risks in the form of leakages, corrosion, excavation damages, and unplanned outages. Against this backdrop, CGD companies need to tackle integrity requirements. For this, GIS technology helps utilities understand the existing network elements such as mains, service valves,

regulators, and cathodic sections and meters. It proves information about the material used for piping, diameter, operating pressure, and leaks in pipes and maintains history.

Leak management: GIS technology provides leak survey tools that allow a gas utility to administer leakage in the distribution system. Leaks are plotted on digital GIS maps, and leak repair schedules can be automatically generated and sent to repair crews located nearest to a leak.

Risk management: GIS identifies exposed pipes in a particular location. If CGD companies expect the demand for gas to increase in this location, they can make prior plans to replace the vulnerable pipes and reduce the risk of damage.

Corrosion management: Underground gas distribution pipes are prone to corrosion due to their proximity to the earth. This requires steel pipelines to be cathodically protected. In this case, GIS technology proves companies are a visual display of those pipe segments that are covered by cathodic protection and those that are not.

Conclusion

- This report gives a piece of brief information about the city gas distribution network. It covers all information about pipeline connectivity to all domestic, commercial, and industrial sites including the location of the valve chamber and meter/MRS and main header lines.
- Moreover, hands-on experience with the help of our guides also gave us opportunities to hone our practical skills.
- Apart from the technical learning, the most important thing that we learned is to work in the corporate environment and to fulfill our goals in a time-based work environment where there is a fixed schedule to complete each task given to us.