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Design of Natural Gas Pipeline

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Abstract: ***India today has an in depth network of underground pipelines used for the transportation and distribution of gas. Large factories, fertilizer factories and other industrial enterprises are the most consumers in PNG and today, however, with the rise in its popularity, it's currently utilized in the domestic sector similarly as a fuel within the automotive sector in large metropolitan cities. To bring gas to those end users within the boundaries of a significant city, it's necessary to create city gas distribution pipeline networks. India today has an intensive network of underground pipelines used for the transportation and distribution of fossil fuel. Large factories, fertilizer factories and other industrial enterprises are the most consumers in PNG and today, however, with the rise in its popularity, it's currently employed in the domestic sector additionally as a fuel within the automotive sector in large metropolitan cities. To bring gas to those end users within the boundaries of a significant city, it's necessary to create city gas distribution pipeline networks, these networks have already been founded within the cities of Delhi, Mumbai, Vadodara, Firozabad, Kanpur and plenty of more such networks are planned within the near future. Given the infrastructure and layout available in typical Indian cities, it becomes difficult to make such gas distribution networks without separate corridors for competing utilities. Reckoning on pressures, flow rates and economic criteria, these networks may be constructed with steel pipes, polyethylene (PE) pipes or a hybrid PE-steel pipe system. In contrast to borehole pipelines, which stretch for miles directly through open fields, the CGD network is more complex. These are located in densely populated areas, and an oversized number of network branches meet the wants of users in several locations in an exceedingly city.***

Although they're much smaller long and size than background pipelines, a city's network is far more dispersed and diverse. The rise within the number of branches means over the amount of sleeves, bends, reducers, fittings, etc. within the network, with the exception of the quantity of delivery points for the availability of fossil fuel. Due to the assorted activities of third parties other city agencies, the chance of injury and accidents is even on top of the substantial pipelines. of these factors require better security systems integrated into the network and therefore the need for special preparation to manage any emergency situation.

Keywords: PNG, CGD.

I. INTRODUCTION

The gas distribution of the city or the CGD refers to the transport or distribution of natural gas to the commercial or industrial and industrial and industrial sector (GNC) using a pipeline network. Natural gas is a non-renewable hydrocarbon that is used as an energy source for heating and cooking. The natural gas pipeline (PNG) is definitely a sensible option for clean and practical cooking in the household. Much more than just giving the grant to the poor. Natural gas, which is much lighter than air, disappears quickly and the risk of fire or explosion is much lower with PNG than with LPG, which is heavier than air, PNG is economical compared to GPL. This is the reason why PNG pipelines are widespread. Natural gas transport to the consumer for domestic, commercial or industrial sectors and transport through a pipeline network. PNG depends on the high infrastructure. Oil India Limited was the first to start the gas distribution in Assam in 1960. In Gujarat, the oil gas and natural gas (CGSB) society began selling its gas associated with the contiguous industries in 1970's.with the discovery. Oil and Gas in Mumbai the high supply of gasoline begins with the industrial customer around Mumbai, TATA and RCF. Pipeline networks have been deposited and owned by the CGSB or customers. With gas detection in the southern basin of Mumbai Shores, the first cross-border pipeline in India was designed with Hazira as the point of activity in Gujarat. The Gaseous Authority of India (Gail) was created in 1984 to act as nodal agency for natural gas in India. Gail builds and exploited this pipeline, which ran from Hazira to Jagdishpur via Bijaipur. This pipeline has provided gas with fertilizer and the food sector. After purchasing existing CGSB assets and the development of new networks were transferred to Gail.

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II. PROBLEM STATEMENT

In Nasik, all users currently use the LPG cylinder for the purpose of cooking, as well as for commercial uses, so that fuel needs very high, but this fuel is too expensive right now and it becomes difficult quarter day. The process of obtaining the cylinder at our site is to take a lot of time and the fact that this user has experienced a lot of problem at the time of booking and at the time of reception of the cylinder, because the customer must check the cylinder leaks, particular cylinder weight that received for the supplier all the time. We anticipate a natural gas line of conduct as a solution to this problem. The government is also considering building pipelines in many places. We will use the GIS technique to ensure proper natural pipeline planning in less time .

III. SCOPE OF PROJECT

In recent years, the natural gas market in India has increased expressively due to its higher development of transmission and distribution infrastructure. India should have 32,727 km of natural gas pipeline with a design capacity of 815 mmscmd (millions of standard metric cubic meters per day) in place 2030. The planned demand, demand and capacity of anticipated pipeline at the source the projection period has been provided. Fig 1 and 2

MMSCMD	2012-2013	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Total demand	243	265	290	326	378	409	438	465	490	516
Total supply	146	167	196	244	300	367	384	389	394	400
Total design capacity of pipelines	404	534	594	642	722	722	726	726	726	782
Capacity at source of pipeline	274	327	387	435	515	515	519	519	519	555

Figure no. 1

	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Total demand	545	571	598	626	654	684	714	746
Total supply	431	437	442	448	454	461	467	471
Total design capacity of pipelines	782	782	782	782	782	782	782	815
Capacity at source of pipeline	555	555	561	561	561	561	561	582

Figure no. 2

IV. OBJECTIVES

A. Provide clean and green fuels for domestic, commercial, industrial and automotive sectors.
B. Provide each user very simply and security in manipulation and also economical.
C. Design and maintain different gas pressure levels to meet the demand for various gas user segments.

V. DESIGN METHODOLOGY

1) *Step 1:* - Problem definition.
2) *Step 2:* - Study of literature research and collection of research papers related to this topic.
3) *Step 3:* -Data collection from the study area. And finalized the collected data from the guidelines
4) *Step 4:* - Survey on route selection
5) *Step 5:* - Design of the pipeline and calculation (pressure, pipe diameter, flow, type of flow and speed and viscosity)
6) *Step 6:* - Material selection according to IS.
7) *Step 7:* -. Data analysis.
8) *Step 8:* - Design for the natural gas distribution via pipelines in the study area.

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VI. ADVANTAGES

A. Ecological.
B. Safer and easier to use.
C. Compare less expensive to another source of fossil combustible energy

VII. DESIGN CALCULATION OF NATURAL GAS PIPELINE

The residential area of Panchvati is 99, 02798 sq. ft. and 800 family stay in that area. Frist calculating the consumption of cylinder in this area then calculate the PNG consumption.

A. LPG

1) Price of 1 cylinder = 815RS

2) Weight of 1 cylinder = 14.2kg

3) Year consumption of cylinder for each family 7
(approx. 5 member in each family)

4) (7*14.2) = 99.4 kg/ consumption in 1 year

5) Monthly consumption of LPG
[99.4/12] = 8.2 kg

6) Cost of 1 cylinder =815rs
[815/14.2] = 57.34rs/kg

7) 1 month cost of LPG use
(57.34*8.2) =470.633rs/month

8) Area wise gas consumption (800family)
(8.2kg*800) =6560kg/ month for 800 family.

9) cost
(6560*57.34)=376150 RS.

B. PNG

Family has 5 members, then the average consumption per month is approx. 10 units (per unit cost is Rs 25).

1) For 800 family
Use of PNG of 1 family/month is
(1/x=1.164/10) = 8.59 Kg
Where
X=uses of PNG
10= uses of PNG SCM.

2) 1unit = 1.164 scm = 1 kg

3) Coast calculation
1 unit =25rs
1kg =21.477 Rs.

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4) PNG use per month **= (8.59*21.477)**
=184.4rs for 1 family

5) For 800 family
= (184.4*800) = 14752 Rs.

C. Natural Gas Properties

6) specific volume of a gas = vgas = 1/ρgas = 1.53

7) specific weight of a gas = γgas = (ρgas)(g) = 15.009

8) g is the acceleration due to gravity (32.17 ft / sec2 or 9.81 m / s2)

9) Specific Gravity:
ρgas = (Ggas)(ρair)
Density of air is 0.0764
ρgas = (0.65)(0.0764) = 0.050 ibm/ft3

10) Molecular Weight:
MWgas = (Ggas)*(MWair)
MWgas = (0.65)*(28.97) = 18.8

D. Average Pipeline Pressure
Pave = (2/3)[(P13 - P23)/(P12 - P22)]
Pave = (2/3)[(9003 - 3103)/(9002 - 3102)]
= 653.7 psig

E. Compressibility Factor
Z = 1/{1 +[(653)(344400)(10)1.785*0.65)/(528)3.825]}
Compressibility factor (Z) = 1

F. Viscosity
√=μ/ρ
μg = 1*10-4 * KV EXP {XV [ρg/62.4]γv }
μg =0.01163 cp

G. Flow Rate
Q = ṁRTZ/144p
Q = 62.9 CFM

H. Panhandle Equation
Q= 435E(Tb / Pb)1.0788 (P12-e5 P22)0.5394 D2.618
D = 26 inch d = 25 inch

I. Flow of Pipe
Re = DVρ/μ ,
Re = (26*33.07*0.050)/2.42*10-7
Re= 1.77 *10-7
The Reynolds number is >4000 so flow is turbulent

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J. The Darcy Weisbach Equation

hL = f(L/D)(V2/2g)
hL = 194.8 ft.

K. Frictional Pressure Drop Can Be Calculated

ΔPF = ρghL
= (0.050*37.17*194.8)
=313 psf = 2.17 psi

Pressure drop is always less than 10%
The compressibility Darcy equation is appropriate

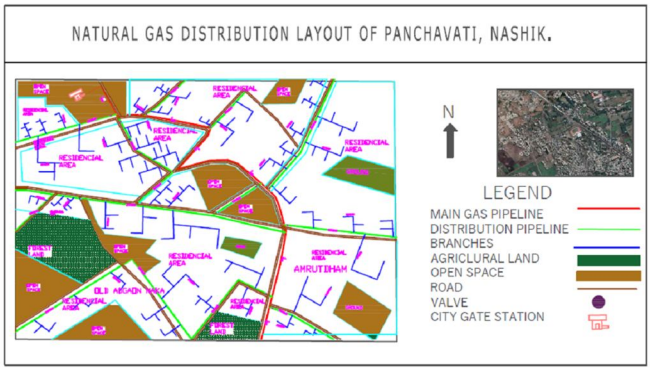


Figure: - Natural Gas Distribution Map

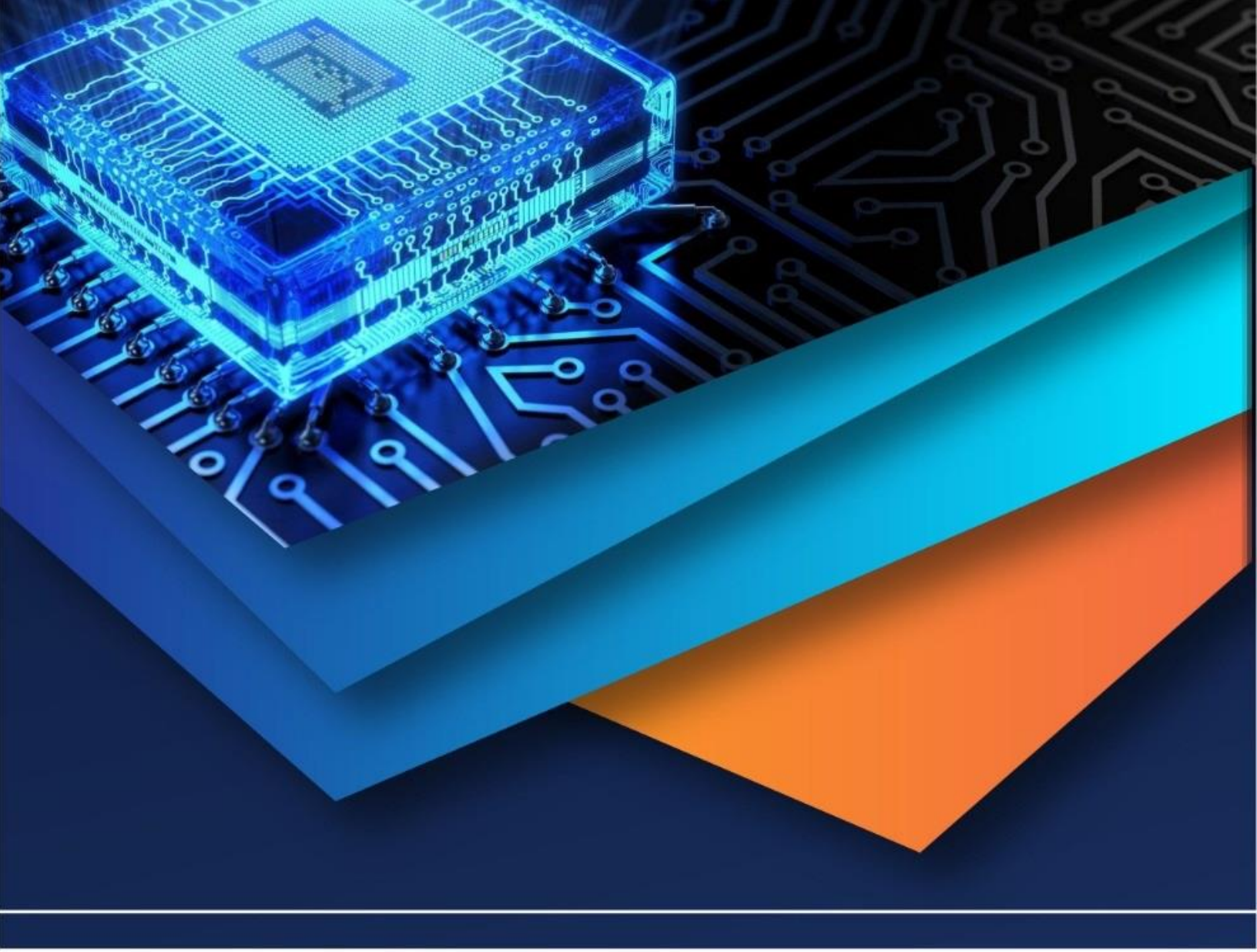
VIII. CONCLUSION

After providing and distributing the natural gas pipeline in the study area, it help reduce the problem of users and consumers. Natural is the lowest carbon, hydrocarbon, odors, colorless and non-toxic. Its heat of cooking and heating. The natural gas of the pipe is cheaper than other combustibles and it is also economical.

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