# REPLACEMENT OF LPG TO PROPANE GAS IN BICYCLE MANUFACTURING INDUSTRIES

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***Abstract*** **:** Liquid Petroleum Gas (LPG) is a major resource in engineering industries where it is being heavily utilized for the purpose of heating and production. It comprises of a mixture of propane, butane, and its hydrocarbons. Since it is a clean gas with high calorific value, it is heavily used. This has also caused a tremendous increase in the price of LPG. Moreover, it is well known that propane gas has higher calorific value and pressure than LPG. Also, it is lower in cost and has lesser weight as compared to LPG. In this paper, a paradigm shift from normal LPG to propane gas has been deployed for the execution of brassing, heating and production processes. Also, we have elaborated our observations of a 14 days experiment at a bicycle plant when the fuel was changed from normal LPG to propane. The total saving of fuel consumption was 301.6 kg which helped in the cost reduction of 2.73 lacs. This transformation can prove to be a boon for the upcoming manufacturing industries.

***Index Terms*** **- LPG, propane, calorific value.**

## I. INTRODUCTION

Air pollution is a serious global problem occurring in our environment due to increase in population and high LPG demands. LPG is used in domestic sector under policies of Indian government such as Pradhan Mantri Ujjwala Yojana. It is also used for commercial purposes, such as cooking and production. Since the conventional fuels are getting depleted day by day, switching to alternative fuel has become a mandatory requirement so as to suffice futuristic demands and sustainable environment.

LPG (Liquid Petroleum Gas) is the mixture of propane ($C_3H_8$), butane ($C_4H_{10}$) and its hydrocarbons [1]. Also, LPG has a small amount of propylene and butylene. It is used as a fuel in vehicles, cooking appliances and heat production instruments. Being a gas, LPG mixes with air in any ratio at normal pressure and temperature. Approximately 55% of the gas is extracted from natural gas purification and the remaining 45% is prepared from crude oil refining [2].

On the other hand, propane gas is extracted from natural gas. It is colourless and odourless at ambient temperature and pressure. Moreover, it can be stored in liquid state under a certain pressure and temperature. Propane gas also has clean burning property [3]. In addition, the gas has zero scaling losses as opposed to gases like sulphur, lead or carbon. Furthermore, propane gas has higher calorific value, and pressure, and lower weight, and cost as compared to LPG.

While using propane gas, there is no need to change the air fuel ratio. Moreover, the gas can be used in manufacturing units of glass, tubes, and bicycles [4]. Not only this, the propane gas is also used in paint shops. In paint shops, the gas is used to run the burner and oven in which drying of the components takes place.

**Figure 1**: Brassing by LPG and oxygen

Figure 1 shows brassing in a cycle industry using LPG and oxygen. Here, initially, the cycle joints are joined with the help of liquid brass. Then the raw tubes are degreased, and the frame and fork are manufactured manually and automatically. To proceed with, the brass wires are melted with the help of the combustion of LPG and oxygen gas [5]. LPG is also used (or consumed) in bonderising plants. There are four bonderising plants in the engineering industry. The components are then dried after phosphating in

the bonderising plants. In addition, some amount of LPG gas is also used in saddle plant because the basic frames of the saddle have to be dried. The mixing ratio of LPG and oxygen is taken as 1:3 which is an economically sound ratio.

## II. EXPERIMENTAL SETUP

In the bicycle plant, there were two bullets each having LPG gas capacity of 10 MT (Metric Ton). These tanks had to be filled using unloading tanks [6].

The experimental setup is as follows: Sandwich valves are provided before the connection of ROV, drain pipe and pressure gauge. If the ball valves are opened immediately, then the gas or liquid can't pass out from the bullets. However, two *safety valves* are provided on each bullet. These valves will automatically operate when the pressure in the tanks exceeds 12 kg/cm$^2$.[7] *Roto gauge* is the mechanical device which helps calculate the percentage of liquid gas left in the bullets. *Vaporizer* is connected at the centre of the bullets and the consumer. It is used to convert liquid to vapour gas by using its heat. *Pumps* are provided in the yard for filling liquid from unloading tanks to loading tanks. *Pop action valves* behave like a safety valve in pipes when the pressure exceeds the threshold value [8]. The experimental setup of the plant is clearly shown in Figure 2.

**Figure 2**: Experimental setup of Propane gas Plant in Ludhiana, India

In the process of replacing LPG with propane gas, the additional requirements are the ROV, HAL and compressors. *ROV (Remote operating Valve)* is pneumatically operated whenever any gas leakage takes place accidentally. A safety alarm named *HLA (High level Alarm)* is provided on each bullet. At the time of liquid filling in bullets, HLA cuts off the pump supply (because the liquid filling process is done by pumps) whenever the liquid being filled in the bullets reaches to 85% capacity of the bullets. Furthermore, sometimes, the vapour remains in the unloading tank as it could not be extracted [9]. Thus, one *compressor* is provided in the yard to extract the remaining vapour from the tank.

## III. RESULTS AND DISCUSSION

This experiment was conducted in the bicycle plant for 14 days in the month of April – May. The main aim of the experiment was to replace LPG with propane gas and keep a track on the energy consumption and cost of the project.

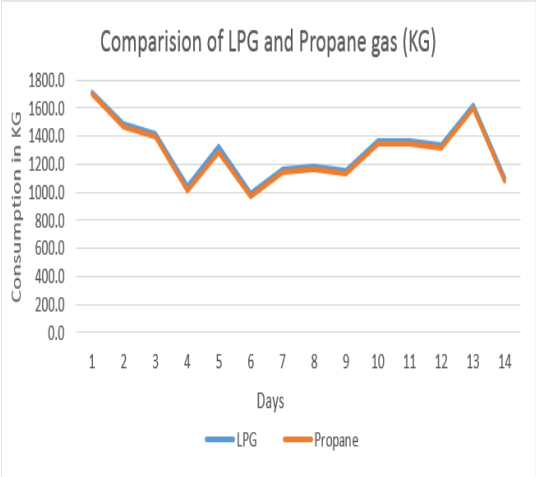


**Figure 3**: Comparison of LPG and Propane gas consumption in 14 days

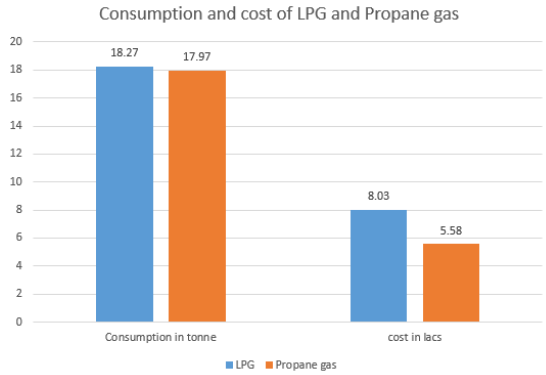


**Figure 4**: Consumption and cost of LPG and propane gas in 14 days

The consumption of LPG and propane gas was noted for 14 days during the experiment and plotted, as depicted in Figure 3. The average daily consumption of LPG was 1700 kg per day with the cost 44 Rupees per kg, whereas the average daily consumption of Propane gas was 1690 kg per day with the cost 32 Rupees per kg, as shown in Figure 4. Interestingly, the average value of the gas saved was 21.6 kg per day, and the amount of cost saved was approximately 17600 Rupees per day.

## IV. CONCLUSION

Propane gas has higher calorific value and pressure for better heating of material that increases the production of cycles. Moreover, propane gas can be easily mixed with air in case of any accident or leakage because of its light weight property. In a bicycle plant, we found that the total propane gas saving was 301 kg and the total cost saving was 2.48 lacs in 14 days. In addition, this project has been carried out in the bicycle plant on the basis of the above detailed experimental analysis of replacement of LPG with propane gas. This project has been successfully executed in a bicycle manufacturing industry of Ludhiana, India. One can also implement similar replacement in other manufacturing plants so as to check the experimental feasibility of propane gas for energy conservation and cost reduction, in general.

## V. REFERENCES

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