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Dual Fuel Bike (LPG cum Petrol)

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Abstract: **Gaseous fuels such as liquefied petroleum gas (LPG) and liquefied natural gas (LNG) have been widely used in commercial vehicles. This project evaluated an experimental investigation on Liquefied Petroleum Gas (LPG) as an alternative fuel for four-stroke spark ignition engine. The primary objective of the study was to determine the performance and the exhaust emissions of the engine using different fuels. The engine used in the study was originally a single cylinder, four-stroke spark ignition engine and minor modifications were carried out to permit the experiments to run on LPG fuel. During the running, the engine was coupled to a ropeway dynamometer to measure several engine performance parameters and a 5-gas analyzer with non-dispersive infra-red (NDIR) was inserted into the engine exhaust tailpipe for measuring the exhaust emissions. Experimental investigations have been carried out to performance and emissions of single cylinder four-stroke spark ignition engine at full throttling position of engine and different load conditions is used to different fuels (Gasoline and LPG) at various compression ratios (4.67:1,5.49:1).The engine performance studies were conducted with engine setup. Parameters like brake power, brake fuel consumption and brake thermal efficiency were calculated. The test result indicated that LPG fuel have closer performance to Gasoline fuel. However, the brake specific energy consumption shows an improvement with LPG as a fuel replacement. The concentration levels of CO, CO2 and unburnt HC recorded are found to be lower than the gasoline fueled engine.**

Keywords: **dual fuel bike, (LPG), four-stroke spark ignition engine, cylinder.**

I. INTRODUCTION

Brief description:

Our project is duel fuel bike which can be capable of running on two type of fuel i.e. PETROL and LPG. Both can be interchangeable in running condition. It means when your bike is running on petrol then you can change the fuel system i.e. from petrol to LPG or vice a versa. Petrol gives high power and LPG gives better millage and ecofriendly.so it gives advantages of both.

1.1 Dual-Fuel Bike:

DUAL-FUEL term itself suggest us that the using of two fuel in a system. Our dual-fuel bike project is to run a bike on two fuels i.e. LPG and PETROL. Usually a bike normally runs on a petrol fuel in some cases diesel powered bikes are also available in markets, but the problem is that these fuel's resources are in the danger of scarcity and also burning these fuels raises global warming which is also a great threat to the entire world.

Running bike on LPG and Petrol is combination from which we can actually select what we want, POWER or EFFICIENCY. Although we can run the bike entirely on LPG as we can see in the recently available BS4 pollution control BHARAT norms rated cars and busses which is capable of running on LPG, but the problem is that we can't put a bigger LPG tank as we have space limitation in the bike.

1.2 LPG (Liquefied Petroleum GAS) [1][2][3]:

The use of gaseous fuels i.e. Liquefied Petroleum Gas (LPG) for an automotive application has been under taken in different parts of the world for varying reasons. The Committee has reviewed the global scenario, in particular, the status of the CNG and LPG vehicle commercialization programs taken up in various countries. The Committee has taken note of the on-going efforts for promoting the use of these alternative fuels in the country.

In India, LPG is the main domestic fuel in urban areas. The indigenous availability of LPG is expected to fall much short

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of the household demand alone. As such none of the above mentioned conditions, which made LPG as a competitive auto fuel in other countries, exist. For these reasons, LPG to be competitive as an auto fuel, in India would need Government support by way of substantially lower taxation.

The idea behind this project generated by observing the LPG operated I.C. engine car. The same gas aspirated engine can be used to drive the two wheeled vehicle. From LPG cylinder the gas is supplied for burning the gas inside the engine cylinder. The separate GAS KIT we are going to install on Bike to feed the metered amount of gas mixed with the air to the engine cylinder finally through the carburetor.

1.3 Objectives of Our Project:

Our project have many objectives, some of them are as follows:

1. Reducing the running cost of the vehicle by using cheaper fuel in the engine.
2. Avoiding emission of the engine by burning a clean fuel in the engine.
3. Increasing engine running life
4. Preventing scarcity of Non-regenerative fuels by reducing their uses.

To achieve these objectives in our project we need following components.

List of Components Required:

- Bike
- LPG kit
  - Multifunction Valve (Filler Connector , Fuel Indicator , Petrol Solenoid Valve)
  - Electronic Control Unit
  - Pressure Regulator
  - Wire Harness
  - Auto LPG Hoses
  - Mixer Assembly
  - Change-Over Switch
- LPG Tank

Scope:

As of rising population and limited source of transportation in the metropolitan city like Mumbai, A bike having good maintenance, Low running cost and less Emission have a good scope to replace conventional single fueled petrol or diesel powered engine.

1.5 Significance [2][3][4][6]:

Carburetor technology has failed to control the uneven supply of petrol with the incoming air stream to engine at various levels. It is inbuilt and inherent draw back that in some circumstances the sucking air stream sucks excess petrol at carburetor venturi, resulting in petrol wastage and pollution.

Now let us replace this redundant carburetor technology with new revolutionary LPG gas technology, which promises: -

- Cent % fuel efficiency.
- With clean exhaust and Zero Pollution.

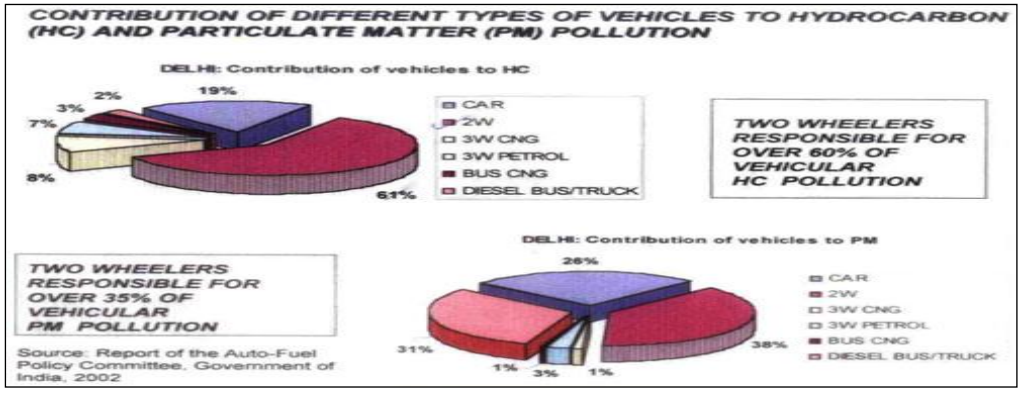

Figure 1.1: Contribution of different Vehicles in Pollution

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If this new technology is implemented with right spirit in India alone, on in-use vehicles (Existing Vehicles) plus new vehicles added during the year, then new LPG gas technology will save fuel worth Rs.200 crores per day. Or 73000 Crore rupees (Seven Kharab Thirty Arab Rupees) annually in foreign exchange only. Even more importantly this will prevent entry of 1.5 crores tons of carbon and NOx pollutant from Air per day in India alone LPG Project will drastically improve Air quality, millions of urban people suffering from Air Pollution. Even lot more saving will be on account of engine life & maintenance.

1.6 LIMITATIONS [3][4]:

There are some of the limitations of our projects, they are:

- Less LPG refueling stations.
- Rural areas don't have Natural gas filling stations.
- Small LPG tank.
- Cost for conversion of bike is high.

Although the project has some limitations, but those limitations can be avoided by implying a company fitted LPG kit bike. This will reduce the cost of the LPG conversion and company can fit a bigger LPG tank in better place rather to install it in the Dikky. If the company fitted LPG kit bike will be available in the future, it will demand more Natural gas stations for refueling them which force government to increase the number of natural gas fueling stations.

2. RESEARCH PAPERS STUDIES

I. Brief Knowledge:

LPG is obtained from the process of natural gas and crude oil extraction and as by-product of oil refining. Its primary composition is a mixture of propane and butane. It has higher octane number (105) than petrol (91-97).The use of LPG in internal combustion engines yielded higher thermal efficiency and better fuel economy compared to unleaded gasoline. This is due to mainly the higher octane rating which permits greater engine compression ratio without the occurrence of knock.LPG also has higher heating value compared to other fuels and can be liquefied in a low pressure range of 0.7 to 0.8MPa at atmospheric pressure. Gaseous fuels such as liquefied petroleum gas (LPG) and liquefied natural gas (LNG) have been widely used in commercial vehicles, and promising results were obtained in terms of fuel economy and exhaust emissions. LPG gas as a low carbon and high octane number fuel produces lower carbon dioxide (Co2) emission as compared to gasoline. The use of LPG as an alternate fuel for road vehicles has been studied extensively in recent years i.e., approximately 4 million vehicles are operating on LPG worldwide. Most of these were mainly light, medium and heavy-duty trucks originally operated on gasoline and later converted to LPG using approved and certified conversion kits.

II. Experimental Setup

The four-stroke spark ignition engine used in this study has a displacement of 256.56cc and a compression ratio of 4.67:1. It is a single cylinder; naturally aspirated, forced air cooled with a bowl in piston combustion chamber and equipped with a single overhead camshaft (SOHC).The engine was coupled to a ropeway dynamometer using a connector. The performance of the engine running on both gasoline and LPG were basically determined from data obtained from the dynamometer. The ropeway dynamometer permits different load measurement in this study. A NDIR 5-gas analyzer was positioned at the exhaust tailpipe for emission measurement. The analyzer has the capability of sampling various exhaust products such as hydrocarbon (HC), carbon monoxide (CO), and carbon dioxide (CO2) with the option of oxygen (O2) and oxides of nitrogen (NOx).

TABLE 2.1: Comparison of LPG and Gasoline properties

Characteristics	LPG	Gasoline
Chemical Formula	C_3H_8	C_8H_{18}
Boiling point (^oC)	- 44	30-225
Molecular weight (hg/Kmol)	44.1	114.2
Density at 15^0Ckg/l(	0.53	0.7372
Research Octane number	100	96-98
Stoichiometric air fuel ratio (kg/kg)	15.6	14.7

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Flame speed (m/s)	48	52-58
Upper flammability limits in air (% vol.)	74.5	7.6
Lower flammability limits in air (% vol.)	4.1	1.3
Calorific value (kJ/kg)	46100	43000

III. Following the experimental methodology can be used:

- The LPG kit, pressure valve and regulator are assembled with each other as per the shown in the experimental setup.
- "ON" the LPG cylinder regulator.
- Before start the engine ensure any leakages in the set up.
- LPG supply to the engine is controlled by a regulator or vaporizer. This converts the LPG into a vapour.
- The vapour is fed into a mixer located near the intake manifold. Where it is mixed with filtered air before being drawn into the combustion chamber.
- When we apply load on rope dynamometer it will get heated up. So we will continually supply coolant water.
- At different load conditions we will take shaft speed in RPM with the help of tachometer, using different fuels .i.e. Gasoline, LPG.
- Time collection of 30cubic capacity of fuel consumption for Gasoline and 16g LPG consumption using at different load condition
- From the results we will calculate Torque (T), Brake power (BP) and Break Thermal Efficiency (Ƞbth).

IV. Conclusion:

Following are the main results obtained from the study of various research papers:

- Mass of fuel consumption for LPG is relatively high as compared to Petrol at different higher power outputs.
- Brake Specific Energy Consumption (BSEC) of Gasoline and LPG values are gradually decreasing w.r.t. increasing the Brake Power. Using Gasoline fuel, the BSEC consumption values slightly lower than the using LPG fuel. Because the C.V. of Gasoline is (43MJ/Kg) less compared to the LPG (46.1MJ/Kg).
- Brake thermal Efficiency of the engine is gradually increasing w.r.t. increasing the Power. When using Gasoline fuel the Efficiency values slightly higher than the using LPG fuel.
- CO emissions are very low and quite constant at various power outputs as compared to Petrol.
- HC emission increases with power output but are relatively lower than petrol emissions.
- NOx is higher or almost similar for LPG when compared with Gasoline at higher power output.
- CO2 emissions are similar for both LPG and petrol but LPG emissions decreases if power output increases.

As compression ratio increases, brake thermal efficiency increases. LPG has a higher octane rating and hence the engine can run effectively at relatively high compression ratios without knock. The CO and HC emissions increase as the compression ratio, speed, and load increase. In the case of using LPG in SI engines, the burning rate of fuel is increased, and thus, the combustion duration is decreased. Therefore, the cylinder pressures and temperatures Predicted for LPG are higher compared to gasoline. LPG is free of lead and has very low sulphur content. Combustion of gaseous fuels like LPG occurs in a nearly uniform fuel air mixture leading to a reduction in incomplete combustion deposits such as soot on the walls of combustion chamber. When using Gasoline fuel the BSEC consumption values slightly lower than the using LPG fuel. Because the C.V. of Gasoline is (43MJ/Kg) less compared to the LPG (46.1MJ/Kg).When load increase on the engine the CO, HC and CO_2 emissions also increase. However, these emissions are higher for Gasoline when compared with LPG.

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3. SUMMARY, CONCLUSION, AND FUTURE SCOPE

1. Summary:

The whole summary of the project is that we are working on a four cylinder car engine kit and make it possible to work on our bike either in carburetor and mixer engine or fuel injected engine. However it is a complicated task to reconfigure the kit, but we will do our best to reconfigure kit and make it possible for successfully run on our single cylinder S.I. engine bike.

We have to manufacture our LPG tank which fits in the Bike Dikky as well it must store enough LPG so that average travel can be done on the bike in one refill.

2. Limitations:

There are some of the limitations of our projects, they are:

- Less LPG refueling stations.
- Rural areas don't have Natural gas filling stations.
- Small LPG tank.
- Cost for conversion of bike is high.

Although the project has some limitations, but those limitations can be avoided by implying a company fitted LPG kit bike. This will reduce the cost of the LPG conversion and company can fit a bigger LPG tank in better place rather to install it in the Dikky. If the company fitted LPG kit bike will be available in the future, it will demand more Natural gas stations for refueling them, which force government to increase the number of natural gas fueling stations.

3. Conclusion:

The above project is to minimize overall running cost of the Bike and making it useful for daily use by reducing its cost. Also we can to reduce the Harmful Emissions and decrease the danger of ozone depletion by utilizing a clean fuel in our bike engine.

There are also some features of the project, which are:

- Low running Cost.
- Increase in total run of bike in one refill.
- Low Emissions.
- Decrease in maintenance.
- Increase in engine life.
- Less wear and tear in piston cylinder.
- Cold starting Improves.

Daly usage of bike gives the following results:

- On daily usage, normal person rides a bike for 50km.
- Recent price of Petrol= 77rs/ltr and LPG=50rs/ltr.
- Normal mileage of 150cc, for Petrol- 55km/ltr , LPG-50km/ltr (Theoretically)
- Calculating monthly running cost (for daily 50 kms)
- LPG & Petrol – Rs 1785
- Petrol- Rs 2100

Saving of Rs 315/-(Savings depends on the LPG usage with respect to Petrol)

4. Future Scope:

In this revolutionary time where technology is drastically changing every day, Automobile sector is also developing, growing and changing. Nowadays Fuel-Injection bikes are coming into markets which gives proper air-fuel ratio and instant throttle response whenever required without wasting petrol. By using those technologies our project can also be made more efficient. some modifications which enhance our project.

We can use two fuel-injectors in our single cylinder bike , one for petrol and other for LPG. We set our ECU such that when we throttle our engine ecu uses petrol injector to fuel our engine with petrol and on cruising condition where low

torque is required our ECU commands LPG fuel to supply LPG into Cylinder .By this arrangement our Fuel supply becomes dynamic and in the traffic conditions our lot of fuel saves. On the other hand dynamic fuel changing does not give feel of low power output as we feels in pure LPG bike.

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