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Gas Power Generator

K U Mehar[1], Ahsan K K[2], Hasif Azad[3], Haris P A[4]
[3]B-TECH Student, Dept. of Mechanical Engg. KMEA Engineering college, Eranakulam, Kerala, India.
[4]Professor, Dept. of Mechanical Engg. KMEA Engineering college, Ernakulam, Kerala, India.

Abstract: The existing technology of small scale production electricity for households are done by diesel and petrol generators. They are much polluting and less fuel efficient. The cost of maintenance is high. The LPG Gas Power Generator is a modification of existing power generators which have more efficiency and low pollution. The main disadvantage of existing power generators running on liquid fuels are bulky in size and produce more noise while operation. Nowadays silent power generators are widely available in markets, which have an acoustic enclosure to minimize the sound effects. The proposed Gas power Generator in this project doesn't require such complex noise reduction equipment. The emissions are less polluting and their health risks are minimal for the proposed model in this project. This project tries to solve the above discussed issues relating to liquid fueled generators. The new proposed engine for the generator runs on gaseous fuel called LPG which is cheaper and abundantly available. LPG is more efficient and it can be used in emergency situations as it available in almost all houses. The proposed model was constructed and tested. The Proposed
LPG Power Generator operated more efficiently than liquid fueled power generators.
Keywords: Power Generator, LPG, Petrol, Diesel, Efficiency, Pollution.

I. INTRODUCTION

Electricity generation is the process of generating electric power from sources of primary energy. For utilities in the electric power industry, it is the stage prior to its delivery to end users (transmission, distribution, etc.) or its storage (using, for example, the pumped-storage method).

A characteristic of electricity is that it is not freely available in nature in large amounts, so it must be "produced" (that is, transforming other forms of energy to electricity). Production is carried out in power stations (also called "power plants"). Electricity is most often generated at a power plant by electromechanical generators, primarily driven by heat engines fueled by combustion or nuclear fission but also by other means such as the kinetic energy of flowing water and wind. Other energy sources include solar photovoltaic and geothermal power.

Small scale electricity generation is carried out by diesel power generators and petrol power generators. Generators that are currently available are petrol and diesel generators. Although these generators works with heavy loads but they cause excess pollution. The efficiency of these generators are low compared to LPG generators. The LPG are easily available and they have low pollution and have much efficiency.

LPG **-** liquefied petroleum gas or liquid petroleum gas – (LP gas), the constituents of which are propane and butane, are flammable hydrocarbon fuel gases used for LPG heating, cooking and vehicles. Liquefied Petroleum Gas is typically referred to by its acronym – LPG. LPG is mixture of flammable hydrocarbon gases that include propane, butane, isobutane and mixtures of the three LPG gases. LPG is commonly used for home heating gases, cooking, hot water, and autogas – fuel for LPG cars and vehicle. .LPG gas comes from oil and gas wells, as it is a fossil fuel. LPG gas manufacturing process includes natural gas processing and the crude oil refinery process. LPG, liquefied through pressurization, comes from natural gas processing and oil refining. In different countries, the LPG heating fuel gases supplied can be propane, butane or propane-butane blends. In Australia, LPG is just propane. To explain LPG, Propane is LPG but not all LPG is propane. LPG **-** Liquefied petroleum gas or liquid petroleum gas, also denoted as just propane or butane, are both flammable hydrocarbon gases used as fuel for LPG heating gases, cooking and vehicular fuel. LPG is made up of carbon and hydrogen atoms forming propane and butane whilst natural gas is made up of lighter methane, the simplest carbon and hydrogen molecule. LPG is comprised primarily of propane and butane LPG heating gases, whilst the natural gas primary constituent is methane. LPG is made up of a group of flammable hydrocarbon gases that are liquefied through pressurization and commonly used as fuel. Natural gas is liquefied cryogenically. LPG is made up of a number of gases under the LPG products label, including propane, butane, isobutane and mixtures of these gases and are also referred to as natural gas liquids – NGL.LPG is stored in steel vessels ranging from small BBQ gas bottles to larger gas cylinders and tanks.

The existing generators are diesel and petrol generators. A diesel generator is the combination of a diesel engine with an electric generator (often an alternator) to generate electrical energy. Proper sizing of diesel generators is critical to avoid low-load or a shortage of power. Sizing is complicated by the characteristics of modern electronics, specifically non-linear loads. In size ranges around 50 MW and above, an open cycle gas turbine is more efficient at full load than an array of diesel engines, and far more compact, with comparable capital costs; but for regular part-loading, even at these power levels, diesel arrays are sometimes preferred to open cycle gas turbines, due to their superior efficiencies. A petrol-generator is the combination of an electrical generator and a petrol engine mounted together to form a single piece of equipment. This combination is also called a Petrol generator. In many contexts, the engine is taken for granted and the combined unit is simply called a generator. A petrol generator may be a fixed installation, part of a vehicle, or made small enough to be portable.

The main disadvantage of existing generators are in it being bulky, the other disadvantages are that it produces more noise. But that can be offset using the silent generator which uses an acoustic enclosure to minimize the sound effects. The time taken for the installation process is longer than other gas engines. The engine emits more risky exhaust fumes than other gas generator sets.

This project investigates the possibility of using a LPG (liquid petroleum gas) generator power system for low-cost electricity production which can satisfy the energy load requirements of a typical remote and isolated rural area. In this context, the optimal dimensions to improve the technical and economical performances of a system are determined according to the load energy requirements.

II. LITERATURE REVIEW

There is growing evidence to suggest that LPG will have an important role to play within the global Power Generation sector in the next 10 to 20+ years. As the trend towards renewables continues throughout many parts of the world, and with coal increasingly seen as a power generation source of the past rather than the future, the role of gaseous fuels as a lower carbon, flexible way to generate electricity has never been more important.

The International Energy Agency (IEA) anticipates a 50% growth in the demand for natural gas in the period 2016 to 2040 – with much of this growth associated with electricity generation, and a continuation of the trend away from using coal-fired power plants.

Where pipeline infrastructure exists in close proximity to the demand, natural gas is clearly the gaseous fuel of choice. However, many countries do not have an established network of natural gas pipelines. In countries where these do exist, infrastructure is often reserved for areas of high population density and/or centers of industrial activity, leaving more remote areas with little or no access to natural gas. In such cases, there is a clear opportunity for LPG to provide a solution for power generation – especially when new power plants are necessary to meet increasing electricity demand.

Over time, we expect natural gas grid infrastructure to expand in many regions throughout the world. However, in some countries, power shortages are becoming critical issues today and governments cannot afford to wait for five to ten years before natural gas pipelines are in place to fuel new-build power plants. Therefore, in a bid to provide security of electricity supplies, governments are increasingly considering the potential for using LPG as a ‘bridging’ fuel. In these cases, power plants fueled by LPG are built – often with short one to two year lead times - but with a longer-term plan to convert to natural gas once the pipeline infrastructure is in place.

In the future, there is also likely to be an emerging opportunity associated with the use of LPG Power Generation in combination with renewables such as solar PV (photovoltaics) and wind power. These ‘hybrid’ (or micro grid) projects are likely to be particularly well-suited to remote, or island, locations which currently rely on expensive diesel to meet their power needs. While this is not a topic explored within this study, it will likely be a focus area for future projects carried out by the WLPGA

According to 2010–12 estimates, proven world reserves of natural gas, from which most LPG is derived, stand at 300 trillion cubic meters (10,600 trillion cubic feet). Added to the LPG derived from cracking crude oil, this amounts to a major energy source that is virtually untapped and has massive potential. Production continues to grow at an average annual rate of 2.2%, virtually assuring that there is no risk of demand outstripping supply in the foreseeable future. As one of the cleanest conventional fuels available, LPG has become a viable choice to facilitate the generation of off-grid electricity. LPG enables highly efficient decentralized generation through self-containing generators and combined heat and power systems. LPG also complements renewable energy sources and technologies which depend on specific weather conditions or daylight. LPG has become a highly desirable fuel alternative in the emergent fuel cell technology spectrum. For these types of localized power generation, LPG is clean burning and has a carbon footprint that is lower than that of diesel and significantly lower than gasoline. It is easily stored in both large tanks or in smaller gallon cylinders and has a significantly longer shelf life than conventional alternatives. It is available during power outages and LPG-powered units have lower noise levels.

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III. METHODOLOGY

Normally generators have mainly four parts , they are engine ,armature ,voltage regulation unit and a fuel tank .The liquefied petroleum gas generator have another part other than normal power grid generator is vaporizer and a regulator. That is the basic component of LPG generator are fuel tank, regulator, vaporizer, engine, armature and voltage regulation unit

A. Regulator

A pressure regulator is a valve that controls the pressure of a fluid or gas to a desired value. Regulators are used for gases and liquids, and can be an integral device with a pressure setting, a restrictor and a sensor all in the one body, or consist of a separate pressure sensor, controller and flow valve. Two types are found: The pressure reduction regulator and the back-pressure regulator

A pressure reducing regulator's primary function is to match the flow of gas through the regulator to the demand for gas placed upon it, whilst maintaining a sufficiently constant output pressure. If the load flow decreases, then the regulator flow must decrease as well. If the load flow increases, then the regulator flow must increase in order to keep the controlled pressure from decreasing due to a shortage of gas in the pressure system. It is desirable that the controlled pressure does not vary greatly from the set point for a wide range of flow rates, but it also desirable that flow through the regulator is stable and the regulated pressure is not subject to excessive oscillation. A pressure regulator includes a restricting element, a loading element, and a measuring element

1) The restricting element is a valve that can provide a variable restriction to the flow, such as a globe valve, butterfly valve, poppet valve, etc.
2) The loading element is a part that can apply the needed force to the restricting element. This loading can be provided by a weight, a spring, a piston actuator, or the diaphragm actuator in combination with a spring.
3) The measuring element functions to determine when the inlet flow is equal to the outlet flow. The diaphragm itself is often used as a measuring element; it can serve as a combined element.

In the pictured single-stage regulator, a force balance is used on the diaphragm to control a poppet valve in order to regulate pressure. With no inlet pressure, the spring above the diaphragm pushes it down on the poppet valve, holding it open. Once inlet pressure is introduced, the open poppet allows flow to the diaphragm and pressure in the upper chamber increases, until the diaphragm is pushed upward against the spring, causing the poppet to reduce flow, finally stopping further increase of pressure. By adjusting the top screw, the downward pressure on the diaphragm can be increased, requiring more pressure in the upper chamber to maintain equilibrium. In this way, the outlet pressure of the regulator is controlled.

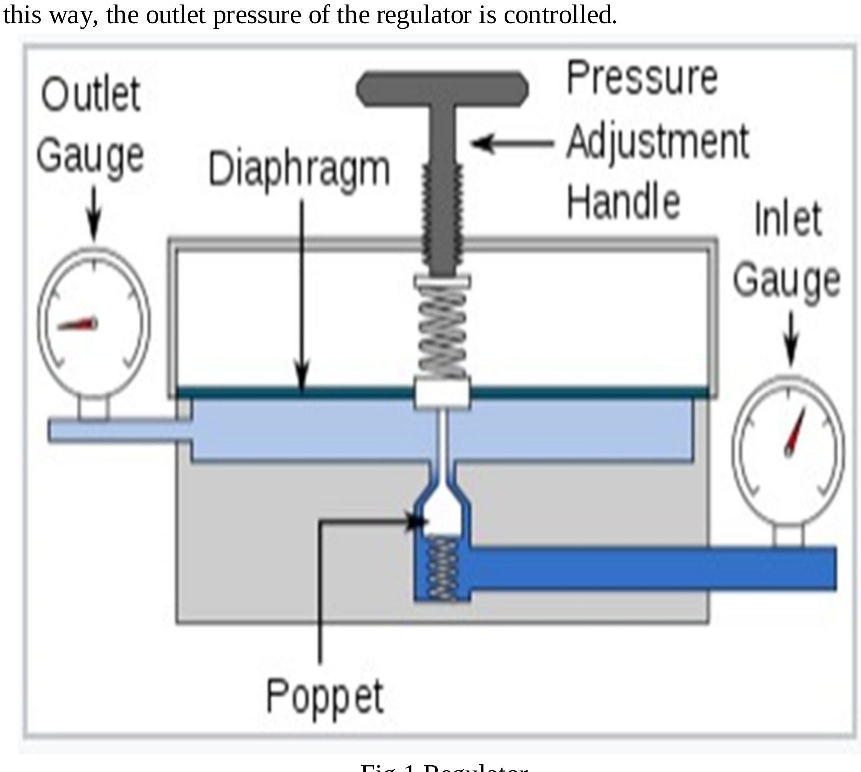

Fig 1 Regulator

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B. Vaporizer

Liquefied Petroleum Gas or LPG is a mixture of hydrocarbons, generally, propane and butane. LPG vapor is much denser than atmospheric air on earth and can easily catch fire. When exposed to air, LPG can be extremely harmful. Any leakage of the gas during storage or transportation can be risky so it is stored and transported in the liquid form.

Fig 2 Vaporizer

C. Engine

An engine or motor is a machine designed to convert one form of energy into mechanical energy. Heat engines, like the internal combustion engine, burn a fuel to create heat which is then used to do work.

An internal combustion engine (ICE) is a heat engine in which the combustion of a fuel occurs with an oxidizer (usually air) in a combustion chamber that is an integral part of the working fluid flow circuit. In an internal combustion engine, the expansion of the high-temperature and high-pressure gases produced by combustion applies direct force to some component of the engine. The force is applied typically to pistons, turbine blades, rotor or a nozzle. This force moves the component over a distance, transforming chemical energy into useful work.

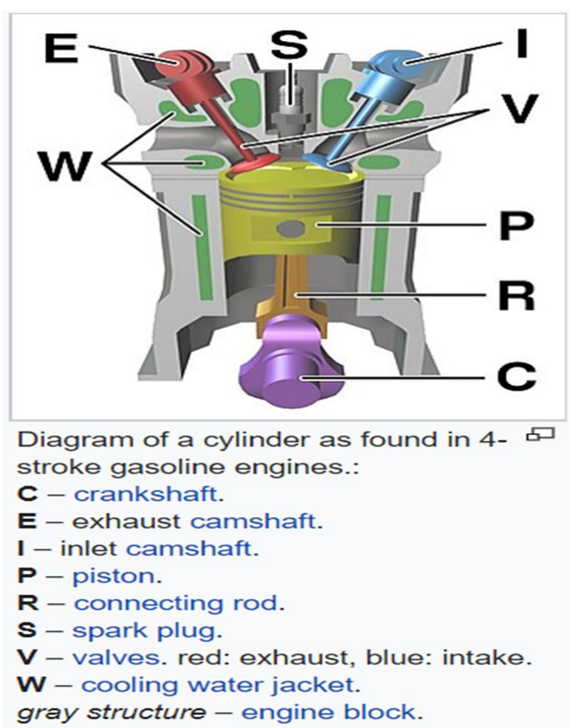

Fig 3 IC Engine

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D. Armature

An armature is the component of an electric machine which carries alternating current. The armature windings conduct AC even on DC machines, due to the commutator action (which periodically reverses current direction) or due to electronic commutation, as in brushless DC motors. The armature can be on either the rotor (rotating part) or the stator (stationary part), depending on the type of electric machine. The armature windings interact with the magnetic field (magnetic flux) in the air-gap; the magnetic field is generated either by permanent magnets, or electromagnets formed by a conducting coil.

The armature must carry current, so it is always a conductor or a conductive coil, oriented normal to both the field and to the direction of motion, torque (rotating machine), or force (linear machine). The armature's role is twofold. The first is to carry current across the field, thus creating shaft torque in a rotating machine or force in a linear machine. The second role is to generate an electromotive force (EMF).In the armature, an electromotive force is created by the relative motion of the armature and the field. When the machine or motor is used as a motor, this EMF opposes the armature current, and the armature converts electrical power to mechanical power in the form of torque, and transfers it via the shaft. When the machine is used as a generator, the armature EMF drives the armature current, and the shaft's movement is converted to electrical power. In an induction generator, generated power is drawn from the stator. A growler is used to check the armature for shorts, opens and grounds.

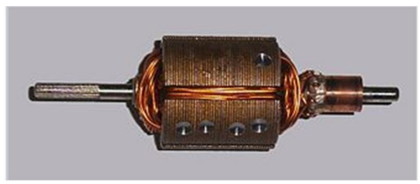

Fig 4 DC Armature of a miniature motor

E. Voltage Regulator

A voltage regulator is a system designed to automatically maintain a constant voltage level. A voltage regulator may use a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages. Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the output of the plant. In an electric power distribution system, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage independent of how much power is drawn from the line.

1) *Electronic Voltage Regulators:* A simple voltage/current regulator can be made from a resistor in series with a diode (or series of diodes). Due to the logarithmic shape of diode V-I curves, the voltage across the diode changes only slightly due to changes in current drawn or changes in the input. When precise voltage control and efficiency are not important, this design may be fine. Since the forward voltage of a diode is small, this kind of voltage regulator is only suitable for low voltage regulated output. When higher voltage output is needed, a zener diode or series of zener diodes may be employed. Zener diode regulators make use of the zener diode's fixed reverse voltage, which can be quite large. Feedback voltage regulators operate by comparing the actual output voltage to some fixed reference voltage. Any difference is amplified and used to control the regulation element in such a way as to reduce the voltage error. This forms a negative feedback control loop; increasing the open-loop gain tends to increase regulation accuracy but reduce stability. (Stability is avoidance of oscillation, or ringing, during step changes.) There will also be a trade-off between stability and the speed of the response to changes. If the output voltage is too low (perhaps due to input voltage reducing or load current increasing), the regulation element is commanded, up to a point, to produce a higher output voltage–by dropping less of the input voltage (for linear series regulators and buck switching regulators), or to draw input current for longer periods (boost-type switching regulators); if the output voltage is too high, the regulation element will normally be commanded to produce a lower voltage. However, many regulators have over-current protection, so that they will entirely stop sourcing current (or limit the current in some way) if the output current is too high, and some regulators may also shut down if the input voltage is outside a given range (see also: crowbar circuits)

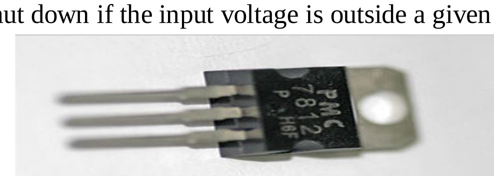

Fig 5 Electronic voltage regulator

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IV. TESTS

A. Emission Test

An emission test cycle is a protocol contained in an emission standard to allow repeatable and comparable measurement of exhaust emissions for different engines or vehicles. Test cycles specify the specific conditions under which the engine or vehicle is operated during the emission test. There are many different test cycles issued by various national and international governments and working groups. Specified parameters in a test cycle include a range of operating temperature, speed, and load. Ideally these are specified so as to accurately and realistically represent the range of conditions under which the vehicle or engine will be operated in actual use. Because it is impractical to test an engine or vehicle under every possible combination of speed, load, and temperature, this may not actually be the case.[2] Vehicle and engine manufacturers may exploit the limited number of test conditions in the cycle by programming their engine management systems to control emissions to regulated levels at the specific test points contained in the cycle, but create a great deal more pollution under conditions experienced in real operation but not represented in the test cycle. This results in real emissions higher than the standards are supposed to allow, undermining the standards and public health. The emission test is done to both petrol engine and lpg engine and these results are compared and concluded.

B. Noise Test

Noise is arrogant and a polluting feature of and through this test we compare the noise levels produced by petrol engines and LPG engines. Measurements in the engine bay area include:

1) Near-field measurements close to the different sources
2) Far-field measurements for sound power estimations
3) Sound intensity measurements
4) Microphone arrays for sound source location
5) Acoustic transfer function (ATF) measurements

a) *Near-Field Measurements:* The near-field measurements are best done at standardized positions distributed in the engine bay and close to where the noise sources are located. The measurement result can be used as a noise indicator and for comparison with other test vehicles. A single position selected from many microphone positions can bes found to be a good indicator for the problematic noise during measurements at operating conditions. This result will then be used for verification of different engine calibrations for example.

b) *Far-Field Measurements:* Far-field measurements for sound power estimation are performed in a hemi-anechoic chamber equipped with a low-noise, vibration and harshness (NVH) chassis dynamometer. Engineering methods require few measurement microphones, three to four can be used, while precision methods require a minimum of 20 measurement microphones. The microphones are typically positioned in a hemisphere around the engine, and the sound power versus frequency is calculated.

c) *Sound Intensity Measurements:* Sound intensity measurements can be used for noise source location. This is mostly done in a NVH hemi-anechoic test chamber in combination with other NVH vehicle testing, but can be performed at other locations as well since the intensity technique is quite tolerant to the acoustic environment. This type of testing is mostly suitable for engine operating conditions at idle or at fixed engine rpm and gear in neutral. The result is a ranking of the different sources at different frequencies. Countermeasures with improved engine covers can easily be verified this way.

d) *Acoustic Transfer Function Measurements*

The ATF testing is used to capture an average insertion loss, and the result will be used for:

- Verification of engine requirements
- Comparison to benchmarks
- Computer-aided engineering (CAE) correlation

These measurements need careful instrumentation since the result is determined as an average of several paths. The sound source is moved between several locations and the response is also measured at several positions in the engine bay. It is common to have up to 12 source locations and 36 response positions, so the final number of measurements can be several hundreds. The number of responses to measure is chosen as needed depending on test time and accuracy.

C. Efficiency Test

In this test we measure the efficiency of the both petrol engine and LPG engine and we compare the results and find which is more efficient and what methods are used to improve the efficiency of the engine.

V. RESULT AND CONCLUSION

A. According To Emission Test

1) The combustion of liquefied petroleum gases (LPG) like propane is more complete and efficient than gasoline or diesel, which means that the amount of carbon monoxide and hydrocarbons is far less. The emission from the tailpipe of an LPG engine are mostly just carbon dioxide and water. It emits virtually no soot.
2) LPG fuel typically costs around half the price of petrol. Although cars are unlikely to be more fuel-efficient when running on LPG.
3) Petrol produces pollutants like Particulate matter volatile organic compounds, Nitrogen oxides, Carbon monoxide, Sulfur dioxide, Greenhouse gases Liquefied Petroleum Gas contains a mixture of Propane and Butane – both derived from distillation of crude oil. In terms of the by-products of their combustion, the only gas that is released is CO2. So, LPG as fuel will generate Carbon Dioxide
4) Comparing to petrol engine LPG engine produces much lower pollutions like;

a) CO by 30% in urban cycle and by 10% in extra urban cycle,
b) HC by 30% in urban cycle and by 51% in extra urban cycle,
c) NOx by 41% in urban cycle and by 77% in extra urban cycle and
d) CO2 by 10% in urban cycle and by 11% in extra urban cycle

B. According to Noise Test

1) Noise level produced by the gasoline engine are much higher as they have 6 to 7.5 compression ratio.
2) As LPG is much cleaner fuel it doesn't produce any noise.

C. According to Efficiency Test

1) LPG is a much cleaner fuel
2) LPG is also doesn't produce any unburnt particles
3) Also petrol fuels remains unburnt causes much efficiency to LPG fuel

VI. CONCLUSION

From these tests we can conclude that LPG is much better compared to other fuels. According to emission test LPG is less pollutant than gasoline engines and according to noise test LPG engines have less noise compared to other engines and similarly in the efficiency test LPG engine works with same power and load that a petrol engine can handle with less fuel also LPG is cheaper than gasoline.as LPG burns more easily and produces more heat its more efficient and also at lower price make it more efficient.

As the LPG is much cleaner and safer fuel it is more easy to use, also better at emergency situations like flood LPG is available at every house than other fuels so it much helpful.by doing these test we can conclude that LPG generator are much easy to operate and safe to environment and human

REFERENCE

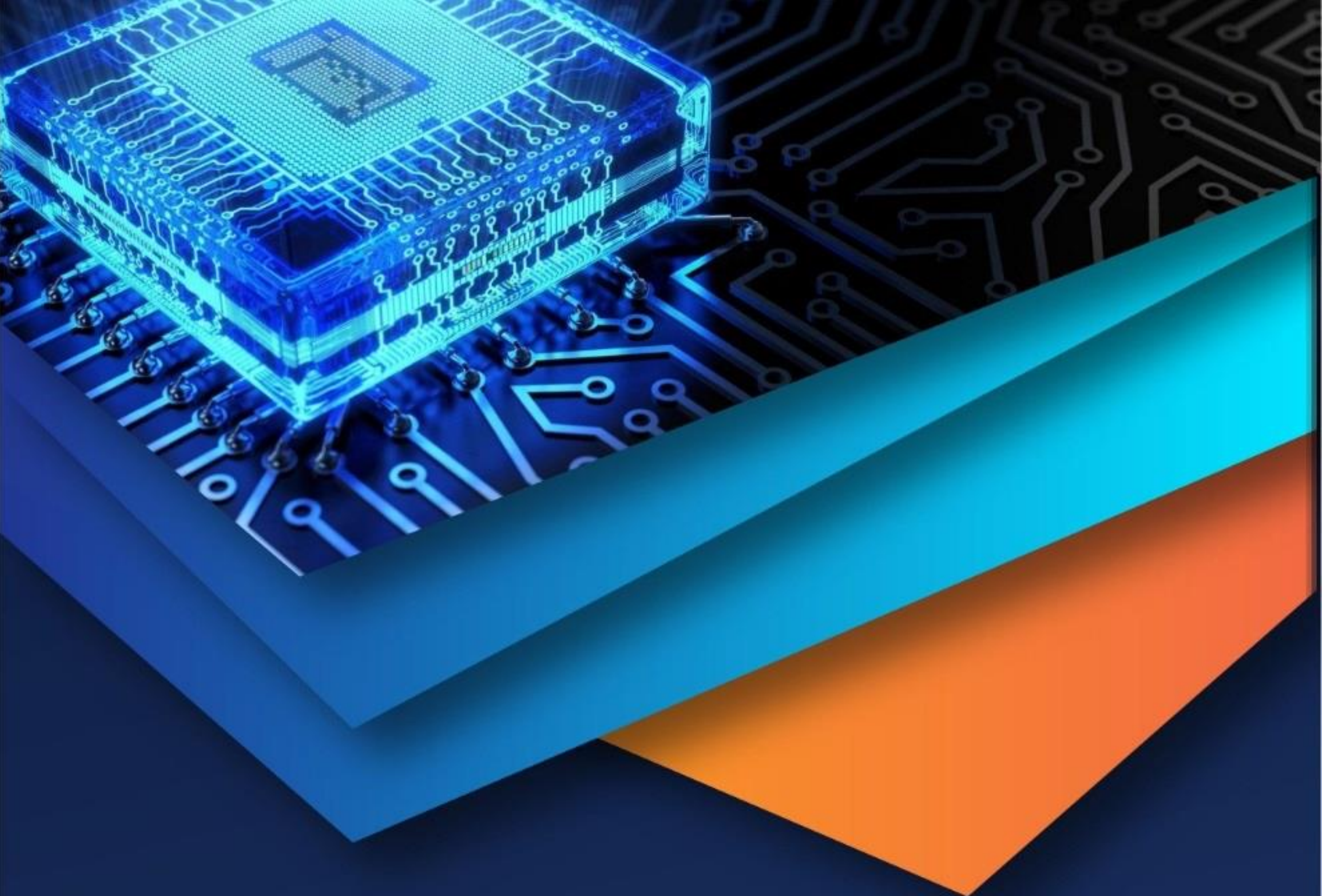
[1] K. S.Reddya ,S .Aravindhana Tapas , K. Mallick, Investigation of performance and emission characteristics of a biogas fueled electric generator integrated with solar concentrated photovoltaic system - Renewable Energy Volume 92, July 2016, Pages 233-243

[2] Mustafa Aydin, Ahmet Irgin, and M. Bahattin Çelik, The Impact of Diesel/LPG Dual Fuel on Performance and Emissions in a Single Cylinder Diesel Generator, Appl. Sci. 2018, 8, 825; doi:10.3390/app80508251

[3] E. Porpatham, A. Ramesh, B. Nagalingam, Effect of swirl on the performance and combustion of a biogas fuelled spark ignition engine, Energy Convers. Manag. 76 (2013) 463e471.

[4] C. Lim, D. Kim, C. Song, J. Kim, J. Han, J.-S. Cha, Performance and emission characteristics of a vehicle fuelled with enriched biogas and natural gases, Appl. Energy 139 (2015) 17e29.

[5] Christopher J. Brown, Test Report for Portable Electric Generators. U.S. Consumer Product Safety Commission Global LPG Power Generation, Market Development & Recommendations for Future Growth by World LPG Association.



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