I J C T A, 9(41), 2016, pp. 257-266 ISSN: 0974-5572

A REVIEW: Electronic Dual Fuel Injection System

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ABSTRACT

Customary fossil fills assets are exhausting at a disturbing rate. Broad utilization of customary powers is prompting the natural issues. To alleviate related issues part of examination work is in advancement to locate the substitute energizes. Double fuel method of operation calls for negligible adjustments in the motor and is turned out to be more compelling. This control is being governed by the ECU systems. This paper reviews the work done by the different researchers which aids to improve the performance parameters of engine. This study also helps to showcase the need of ECU for reducing the pollution parameters of the engine.

Keywords: Double fuel, ECU infusion, Bio-gas, Diesel motors.

1. INTRODUCTION

A double fuel motor is a pressure ignition (CI) motor where the essential vaporous fuel source is pre-blended with air as it enters the burning chamber. This homogenous blend is touched off by a little amount of diesel; the 'pilot'; that is infused towards the end of the pressure stroke. In the present study, an immediate infusion CI motor, was fuelled with three distinctive vaporous fills; methane, propane and butane. The motor execution at different vaporous focuses was recorded at 1500rpm and ¼, ½, and ¾ load with respect to full heap of 18.7kW. Keeping in mind the end goal to examine the ignition execution, a three zone heat discharge rate investigation was connected to the information. The subsequent mass blazed rate information is utilized to help comprehension of the execution attributes of the motor in double fuel mode.

Numerous examination works recommended a movement in use of powers from fluid energizes to vaporous fills. Utilization of vaporous fills is one of the unmistakable methodologies, since vaporous energizes are plentifully accessible and clean smoldering powers. They likewise lessen the threat of natural contamination. Vaporous fills have been being used in completely committed mode and in the double fuel mode. Diesel-CNG and Diesel-LPG motors are broadly utilized as a part of different applications.

Traditional energizes are gotten from fossil fills. In the present situation of fuel emergency biomass gasification is one of the promising innovation, as the biomass is renewable furthermore is good to the current innovation. India has an expansive potential for renewable vitality, around an expected total of more than 100,000 MW. Furthermore, the extension for producing force and warm applications utilizing sunlight based vitality is immense. Be that as it may, just a small amount of the total potential in renewable vitality assets has been used in this way. Biomass as a wellspring of Renewable Vitality is most imperative in perspective of its supportability and also financial feasibility in admiration of its utilization both for provincial charge and Mechanical application.

In this section, a portion of the essential exploration papers identified with diesel motors, gas motors, biomass gasification and double fuel motors execution under different working conditions and emanations are looked into.

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2. DUAL FUEL INJECTION SYSTEM

Double Fuel Infusion Framework is working with Diesel and LPG. Checking of this framework is done at 1000-1500 rpm. In this framework temperature sensor is utilized, which detects the temperature inside the motor. At the point when temperature turns out to be sufficient to smolder LPG, the framework begins the admission of LPG. Till temperature of interior motor to blaze LPG is insufficient, the motor uses Diesel. The scientists utilized solenoid valves to switch on/off LPG.

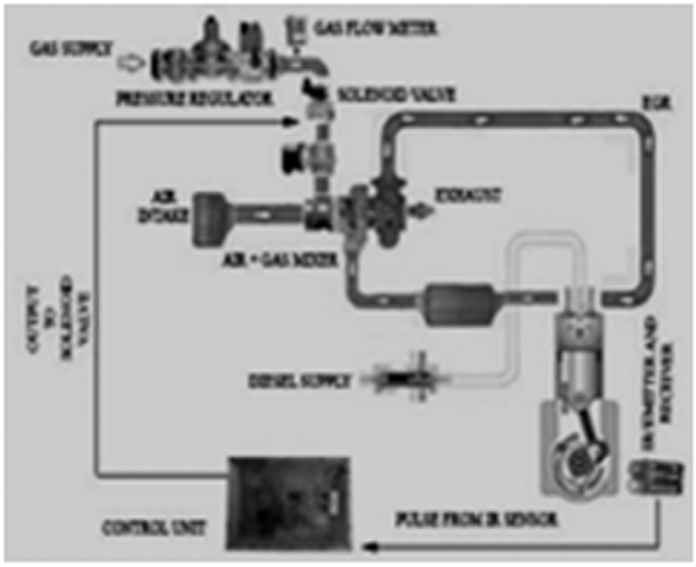

Figure 1: Experimental Setup of Dual Fuel Injection System [9]

A. GAS Stream METER: its check the measure of gas supplied to motor.

B. Weight Controller: it manages the infusion of LPG in motor.

C. SOLENOID VALVE: Solenoid valve is utilized to switch on/off the stream of LPG.

D. DIESEL SUPPLY: Switch on/off the stream of diesel.

E. ECU: Electronic Control Unit faculties and controls stream of LPG and Diesel.

F. IR SENSOR: detects Fly wheels.

This whole detail can be visualized in figure 1.

3. ANALYZING PART BASED ON STUDY

Consequences of a broad writing research in the field of Double Fuel Infusion Framework to upgrade the fuel productivity of motor. The point by point work attempted by various researchers and scientists in the field of double fuel infusion is displayed. The audit incorporates hypothetical and also the test work embraced every once in a while alongside the improvement of the Double Fuel Infusion Framework.

In this paper the specialist recommended that Bio fills got from biomass are considered as great contrasting option to petroleum powers. Biogas, a biomass inferred fuel can be utilized as a part of inner ignition (IC) motors, on account of its nature of clean smoldering. Biogas offers minimal effort and low outflow. It can be utilized as a substitute fuel to melted petroleum gas (LPG) and packed common gas (CNG). The double filling is prescribed to be the best one for biogas CI operation. To expand the warm effectiveness of double powering, a drop of CO, is blended in biogas due to which the strength of engine components will not be exaggerated. This paper also describes the composition best suitable for combustion. [1]

Table 1
Biogas Composition [1]

Components	*Amount (%)*
Methane	50-70
Carbon Dioxide	30-40
Hydrogen	5-10
Nitrogen	1-2
Water Vapour	0.3
Hydrogen Sulphide	Traces

This paper displays using vaporous fuel recourses in changed over diesel motors. The changed over engines produce power by reducing exhaust discharges. At high loads, with double fuel motors more

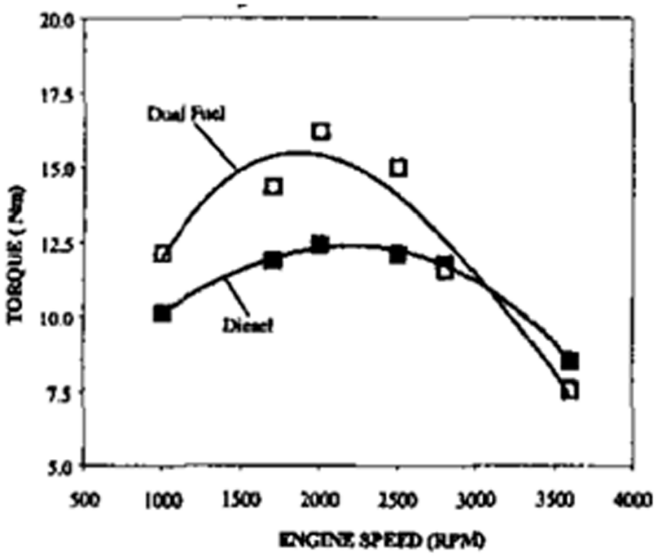

Figure 2: Comparison of torque between diesel and dual-fuel systems under max. Operating conditions [2]

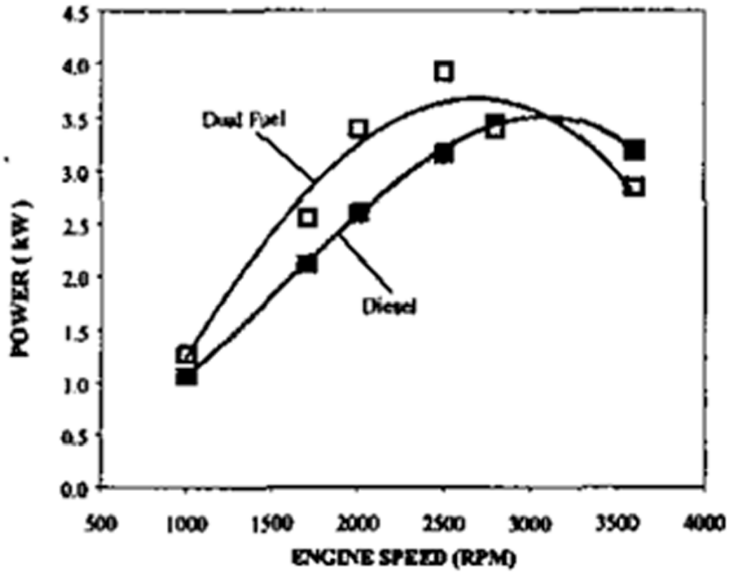

Figure: 3 Comparison of brake power between diesel and dual-fuel system under maximum operating conditions [2]

proficiency and force can be accomplished at high. Double fuel motors don't work easily for light loads. On the premise of productivity and fumes discharge estimations the scientists reasoned that the double fuel framework results in enhanced working than the first diesel motor. It was also depicted that it is not easy to maintain the gas to air ratio. The ECU is the heart of dual fuel which injects the fuel at specific time and for specific duration. The test was conducted by varying the RPM of the engine starting from 1900 to 3600. The results are very surprising. The experimental result shows that there is gradually increase in the torque at complete load in dual fuel engine. It was also analyzed that the torque also decreases as the rpm increases from 2500 rpm. It is well described in figures 2 and 3. [2]

This paper presents survey about the outflow trademark and fuel utilization of a double fuel motor. A double fuel motor uses essential fuel as the pilot fuel, for example, Diesel and the optional fuel, for example, NG, LPG or Hydrogen. Double fuel motor decreases the poison emanation and in addition fuel utilization. To enhance the ignition procedure in motor and to lessen the outflow toxins amid burning, optional fuel is premixed with the motor admission air, after the infusion of pilot fuel in little sum. The analyst tries to demonstrate the decrease of emanation contaminations and fuel utilization by the utilization of double fuel motor which results in expansion of blend temperature and fire speed by making a lower discharge. [3]

In this paper, specialists presented a neural system based control framework for fine control of the admission air/fuel proportion in a bi-fuel motor. This control framework is an extra module for a current vehicle maker's electronic control units (ECUs). The ECU is adjusted for gas and gives a decent control of the admission air/fuel proportion with gas. The neural system based control framework is produced to permit the transformation of a gas ECU to a bi-fuel structure with packed regular gas at insignificant expense. The viability of the neural control framework is shown by utilizing a reenactment of an Avoid four-stroke bi-fuel motor. The scientist proposed a control framework that uses a savvy control module that decreases expense of supplanting existing ECU when a gas motor is changed over to a bi-fuel structure. This system proves to produce better results by change in the air/fuel ratio control, execution and fumes outflows of bi-fuel motor. [4]

In this research work an old JAP engine was used, which was controlled by the electronic fuel system. The main motive of this research was the injection of water in spark ignition engine. The water inlet was controlled by the monostable circuit. Its circuit is shown in figure 4. The small circuit is used without any microcontroller.

This circuit worked as a trigger circuit. The amount of water inlet was stored and measured by the ECU. These data is then analyzed using LabView. It also helps in switching ON and OFF the solenoid valve. The

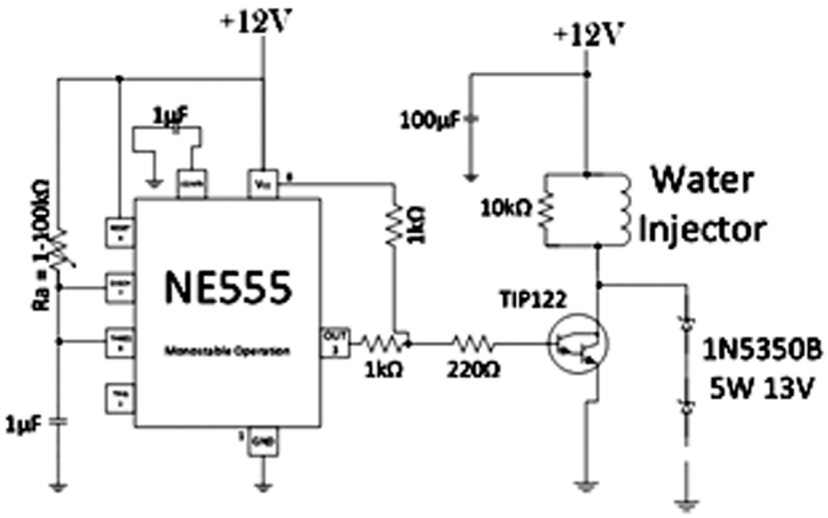

Figure 4: Water Injection Controller Schematic. [5]

test setup results in quasi linear relationship between maximum brake torque (MAP) and manifold absolute pressures (MAP). This result gave a clear picture that charge air cooler is more effective with water injection as a means of inter-cooling. [5]

To meet the demand on precise control of electronic control in diesel engine, On the basis of brief analysis for cylinder pressure physical meaning, mechanism and sketch of electronic control based on cylinder pressure feedback is presented. Electronic control system with dual micro-processor based on MPC555 and DSP56F807 is designed, Hardware of pressure acquisition unit (PAU) is presented, include fiber-option pressure sensor, encoder and electric circuit.

Hardware of electronic control unit (ECU) is designed, which include power drive and signal processing circuit. Software for dynamic acquisition and control system is programmed. Primary test in 4100 diesel engine with high pressure common rail system is made testing result showed an effect of electronic control of common rail based on cylinder pressure feedback. Electronic system helps in controlling the NOx using feedback system. [6]

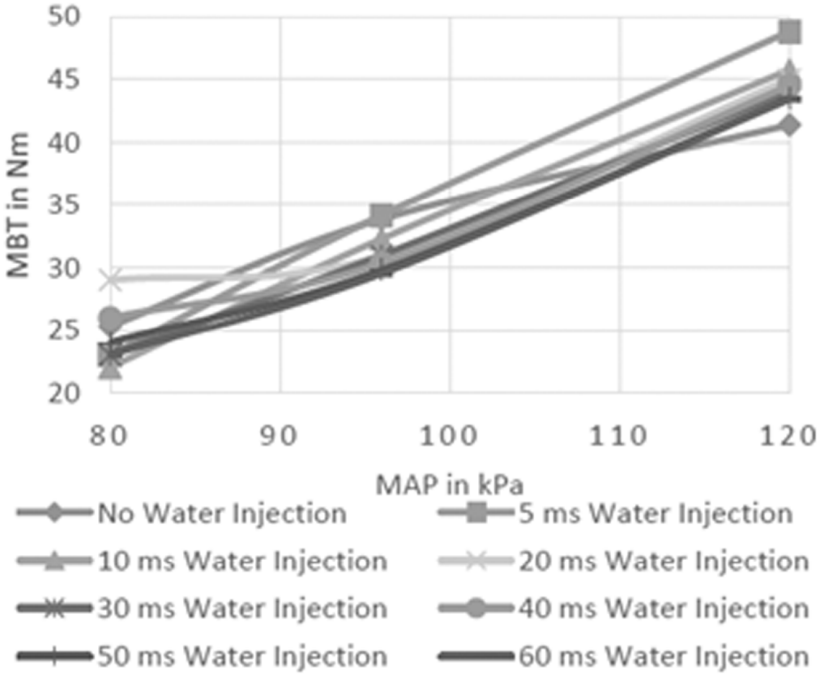

Figure 5: MBT vs MAP at 1600 rpm, Air not Heated at 120kPa [5]

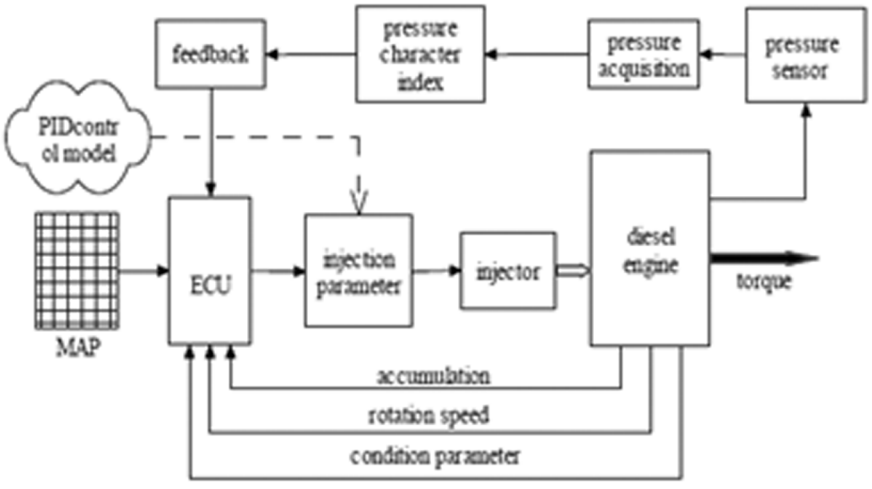

Figure 6: Pressure feedback control sketch [6]

In this paper an advanced combustion technology named Homogeneous Charge Compression Ignition (HCCI) is presented. HCCI has potential to substantially reduce particulates and NOx simultaneously and deliver efficiencies comparable to conventional CI combustion. Dual fuel approach is a well-established technique to make use of different types of fuels in diesel engines and the main advantage of such engines is their lower smoke, HC emissions. In the present work, experimental investigations were carried out on a single cylinder four stroke compression ignition (CI) engine fuelled with diesel in single fuel mode and CNG and HOME injection in a modified dual fuel mode AND using HCCI operation mode.

Gaseous fuel like CNG was injected into the intake manifold using a suitable injector and Electronic Control Unit (ECU) facilities. From the results obtained, it is observed that HCCI engines yielded better results than dual fuel engines in conventional mode. However, emissions such as NOx and smoke were lower whereas emissions like HC and CO was increased.

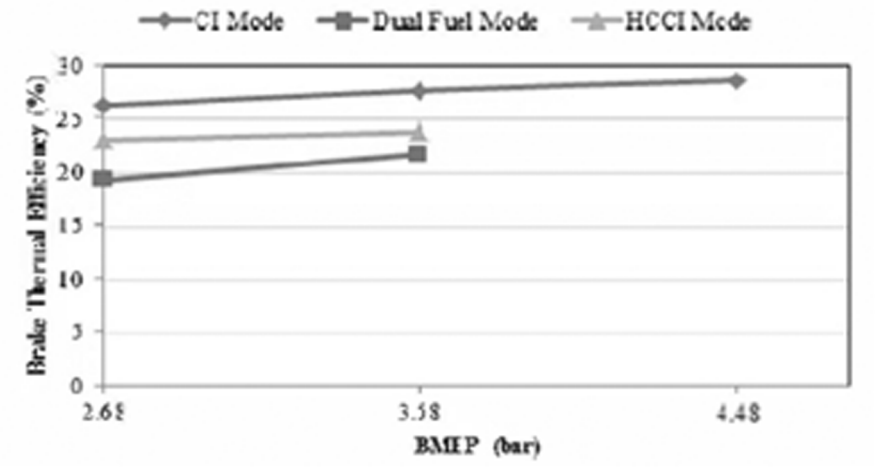

Figure 7: Variation of brake thermal efficiency with brake power. [7]

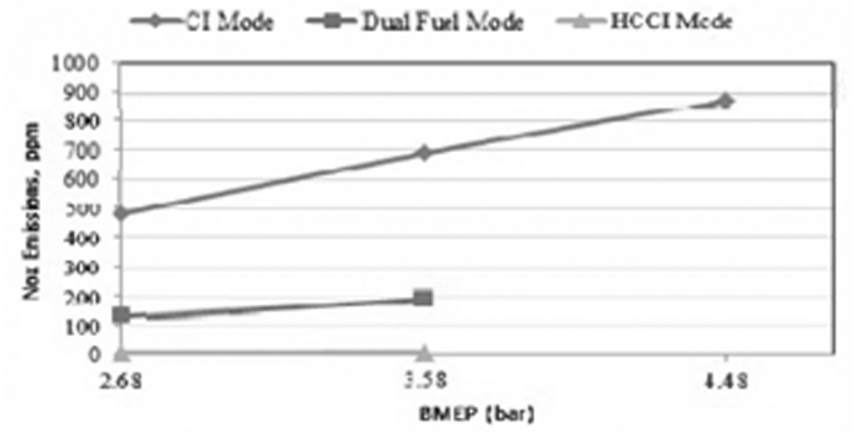

Figure 8: Variation of nitric oxide. [7]

The NOx and smoke emissions were decreased to about 98% and 90 - 94% respectively. [7]

In this paper, looks into blend control framework model of the biogas-gas double fuel motor. This framework embraces electronic control unit (ECU), and utilizing MC9S12XS128 small scale control unit (MCU) as the center. As per the yield control signs of blend control framework model and the signs acquired of damper opening, controlling the valves of engine using the stepper motor. This is done with a specific end goal to control the biogas amount. In this way, we can gain the best air-fuel proportion of double fuel which match with the relating of trademark tests has been completed on different conditions.

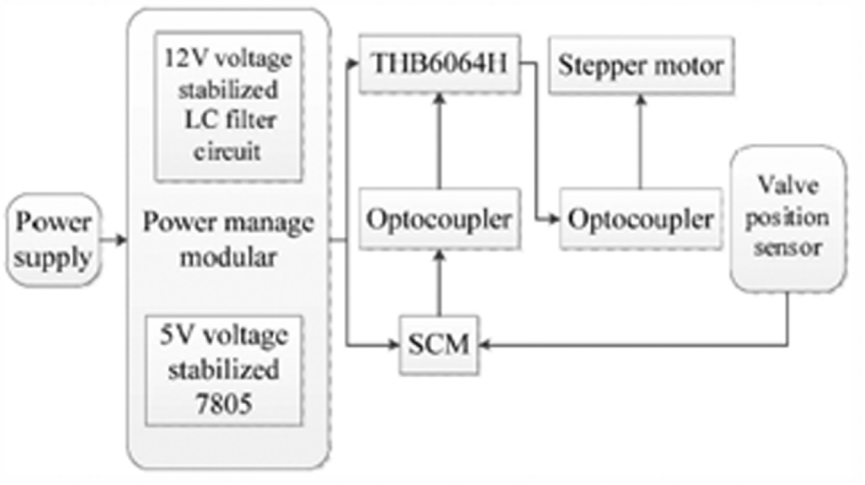

Figure 9: Dual-fuel engine control system principle diagram. [8]

The after effects of this paper demonstrate that: this control framework can meet the requests on deferent states of the biogas-gas double fuel motor and can conform effectively. It gives a viable device to the investigation of the biogas-gas double fuel motor. [8]

The scientists exhibit a blend control framework model of the LPG double fuel motor. This framework embraces electronic control unit (ECU), and utilizing PIC16F877A as the main controller controlling the engine. It is equipped with the IR sensors to regulate the fuel supply in the engine using solenoid valves. Thus the best air-fuel proportion is acquired utilizing double fuel which matches with the comparing trademark tests; those were completed by considering on different conditions.

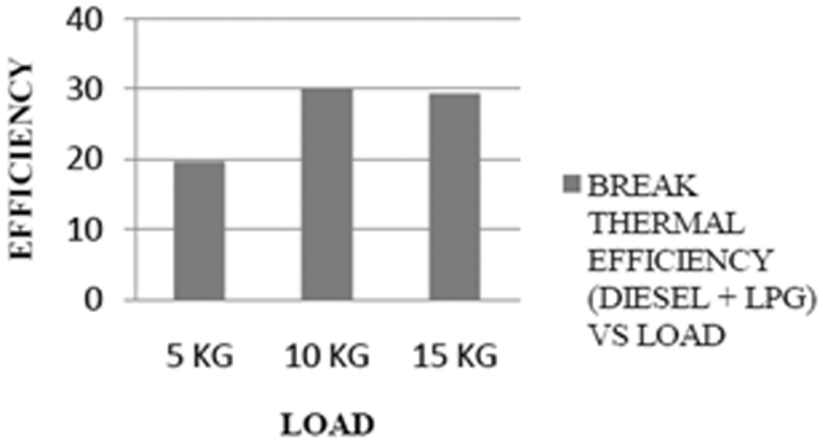

Figure 10: (a) Break Thermal Efficiency (Diesel + Lpg) Vs Load. [9]

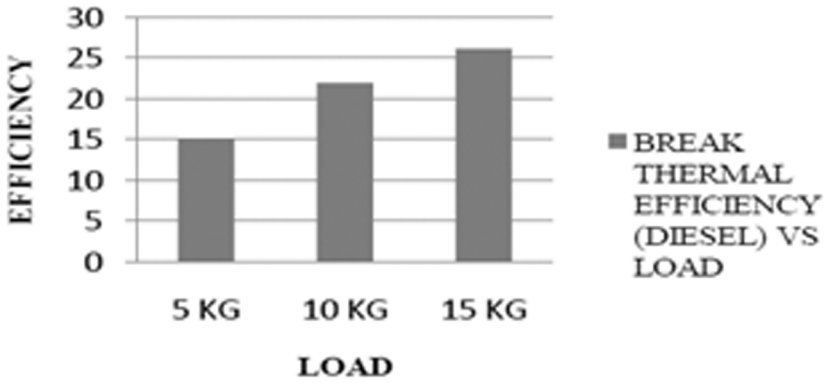

Figure 10: (b) Break Thermal Efficiency (Diesel) Vs Load. [9]

The examination done by the analyst's gave the graphical representation of performance of dual fuel engine. These graphs show that ECU increases the break thermal efficiency and reduces the emissions. [9]

In this paper the researcher modified the DICI engine to dual-fuel. Here diesel is considered to be the main fuel and biogas as primary fuel. The implementation of EGR is also done with the experimental setup and the researcher studied the performance and emission characteristics of the engine with and without

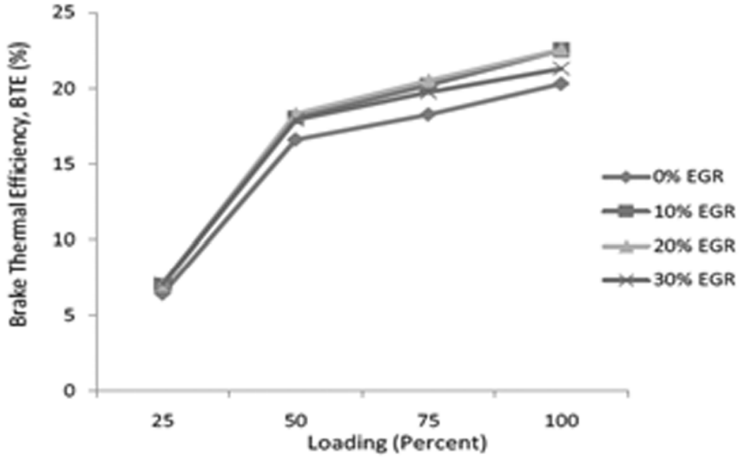

Figure 11: Brake thermal efficiency vs engine load. [10]

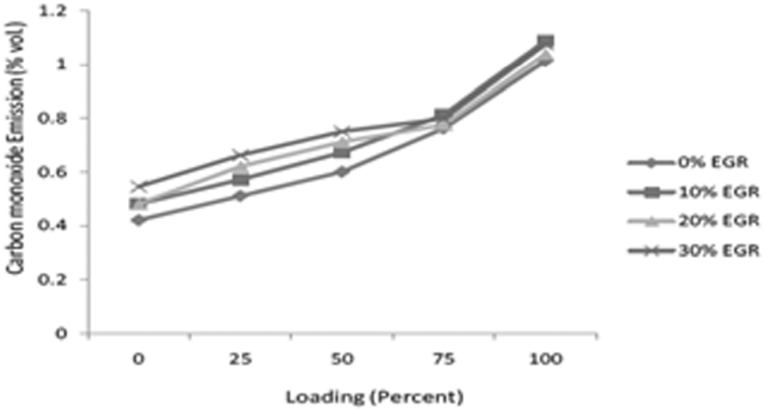

Figure 12: Brake thermal efficiency vs engine load. [10]

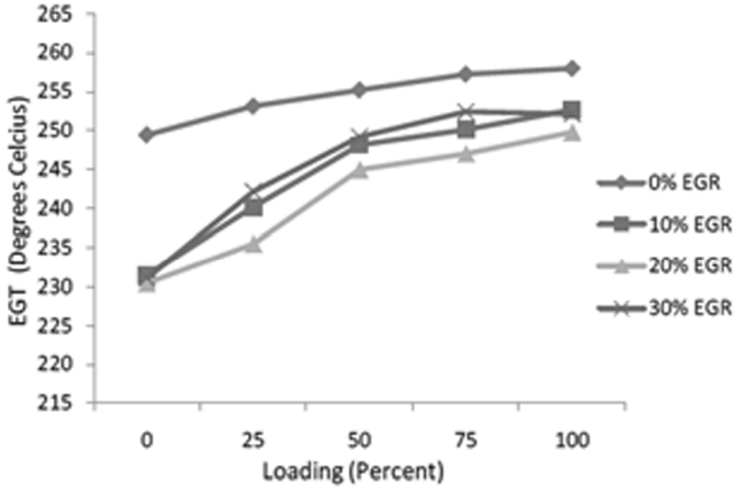

Figure 13: Exhaust gas temperature vs engine load. [10]

EGR support. The study is analyzed with different EGR from 0% to 30%. The experimental set up demonstrated that EGR decreases SFCR and rise in BTE.

As percentage of EGR increases, the BTE increase was up to 10.3 % at one fourth load and 14.3% at complete load using single fuel but as system was connected to Dual fuel intake the BTE increase was up to 9.5 % at one fourth load and 11.2% at complete load. In this paper researcher also mentioned that controlling of engine temperature is must to control the NOx. [10]

4. CONCLUSION

It is a test to plan and execute a financially savvy double fuel infusion motor that works at 100% in vaporous fuel. To supplant a diesel fuel with regular gas augments motor support interims. Number of experimental output show's that engine can perform even better using electronic control systems. Manny experimental setup also depict that HCCI engine is much better than the double infusion motors in terms of BTE and NOx values. Moreover the ECU for temperature control, EGR control and fuel flow control are yet to be changed according to the load used, to the HC & CO emission at middle & low loads. Some end results are drawn from the work present on dual fuel engine.

- Dual fuel engines suffer from the problems such as poor BTE and high HC at low load.
- There is high noise level in double fuel infusion motor as compared to single fuel engine. But it reduces as the speed of engine increases.
- High temperature damages the nozzle in dual fuel much earlier as compared to single fuel nozzles.
- At low load diesel (first most important fuel) is to be used only and as the load increases LPG (secondary fuel) intake should increase.
- Different (combination of different substances) gave different exhaust, but LPG mixture with 30% butane was the best blend used for dual fuel engine.
- Higher (press or force into a smaller space) ion ratio improves the (wasting very little while working or producing something) of engine, but knocking should be below knocking level.
- The high BTE is gained by making injection timing perfect. Early injection causes higher ion noise.

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