CHAPTER V

CONCLUSION

With using a proper HCNG blended as a secondary source of engine with the minimum pilot diesel in the internal combustion engine, performances of the internal combustion engine can be increased. Furthermore using HCNG blended with pilot diesel injection in the internal combustion engine through a lean burned strategy with special designed diesel and CNG dual fuel system and additional hydrogen generation system; burning velocity, complete perfect combustion, increased of horsepower and increased of engine torque all lead to better engine performances. A significant engine horsepower and engine torque increased on average by 30% with using HCNG blended with the pilot diesel engine comparing to the pure diesel operation. Along with improvement in engine performances, smoke is also reduced substantially on average by 10% under normal EURO IV standard requirement from the OEM standards. From the results of the experiment on fuel economy, the travelling distance under HCNG DDF on average increased by 177% in distance per 1 liter of diesel as comparing to normal diesel operation.

This study indicates that HCNG is safe to use for the diesel engine with chosen engine and proper designed of HCNG diesel dual fuel system. Further researches of using HCNG as a secondary source in the pilot diesel engine can be done with many other different strategies. In addition to that, future research must also keep the optimum balance of higher performances along with keeping the lowest emission levels while maintaining higher fuel economic in all different type of strategies in making HCNG diesel dual fuel system for the internal combustion engine.

With using a proper HCNG blended as a secondary source of engine with the minimum pilot diesel in the internal combustion engine, emission levels can be substantially decreased. This study indicates that HCNG is safe to use for the diesel engine with chosen experimental engine and proper designed of HCNG diesel dual fuel system. From the experimental results, it is clearly seen that using HCNG diesel dual fuel system in diesel engine can reduce emission levels below the EURO IV emission requirements as well as normal diesel operation. The results indicated that

the average CO emission decreased by 12.97%, HC emission decreased by 15.84%, NO_x emission decreased by 1.16% and PM emission decreased by 9.14% with the diesel HCNG dual fuel mode from low RPM (800) to highest RPM (4000).

Recommendation

Further researches of using HCNG as a secondary source in the pilot diesel engine to reduce emission levels can be done with many other different strategies with the need of making sure the correct injection of different fuel are properly injected into the engine at the perfect timing.

Some useful recommendations are listed below.

1. The injection of the HCNG needs stronger injector that can accommodate instant injection when needed

2. Pilot diesel injection cut off can be most improved with connecting cut off point with eight different variable signal from available cut off signal of the vehicle

3. Installation of the catalytic control with oxygen sensor preferably prior and after exhaust of the engine

4. For better results in fuel economy, overall design of the complete vehicle needs new design to make sure there is no unnessarily weigh and ensuring aerodynamic of the vehicle

5. A strong complete electronic controlled need to be redesigned to ensure long lasting performance

6. A driving pattern of the driver needed to be properly trained to maximize the benefit of the overall system

Lastly, future research must also keep the optimum balance of higher performances along with keeping the lowest emission levels while maintaining highest possible fuel economy in all different type of approaches in developing any alternative source of fuels for diesel engine.