

Hydrogen Internal Combustion Engines

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ABSTRACT

The search for alternatives to fossil fuels has been a continuing challenge. The search to create an emissions free vehicle is a challenging task. While some see electric vehicles as the answer, some question the infrastructure and resources required to make these vehicles. This project will investigate a different source of power for internal combustion engines, hydrogen. Internal combustion engines(ICE) are proven technology that can be made to run on hydrogen. While developing an efficient hydrogen engine has its challenges it also has benefits in its zero carbon emissions. This project will compare the complexity, efficiency, and capabilities of gasoline engines to hydrogen engines. The difficulty of hydrogen comes from its low ignition point, about 1/10 of gasoline's ignition point. This leads to pre ignition in the cylinder which will cause imminent engine failure. This is a problem that can be fixed through design and the timing of the intake engine. Hydrogen engines power depends on the delivery method of the hydrogen to the engine resulting in 85% or 120% of the power that a typical gasoline engine would make. With continued research and development hydrogen could replace gasoline as a fuel source for internal combustion engines.

OBJECTIVES

To research previous attempts at hydrogen powered internal combustion engines for automobiles. Use these findings to determine the advantages and disadvantages of hydrogen as a fuel source for internal combustion engines

METHODS

- How the gasoline powered ICE works
- How the hydrogen powered ICE works
- Examples of hydrogen ICE
- Comparison of hydrogen and gasoline ICE

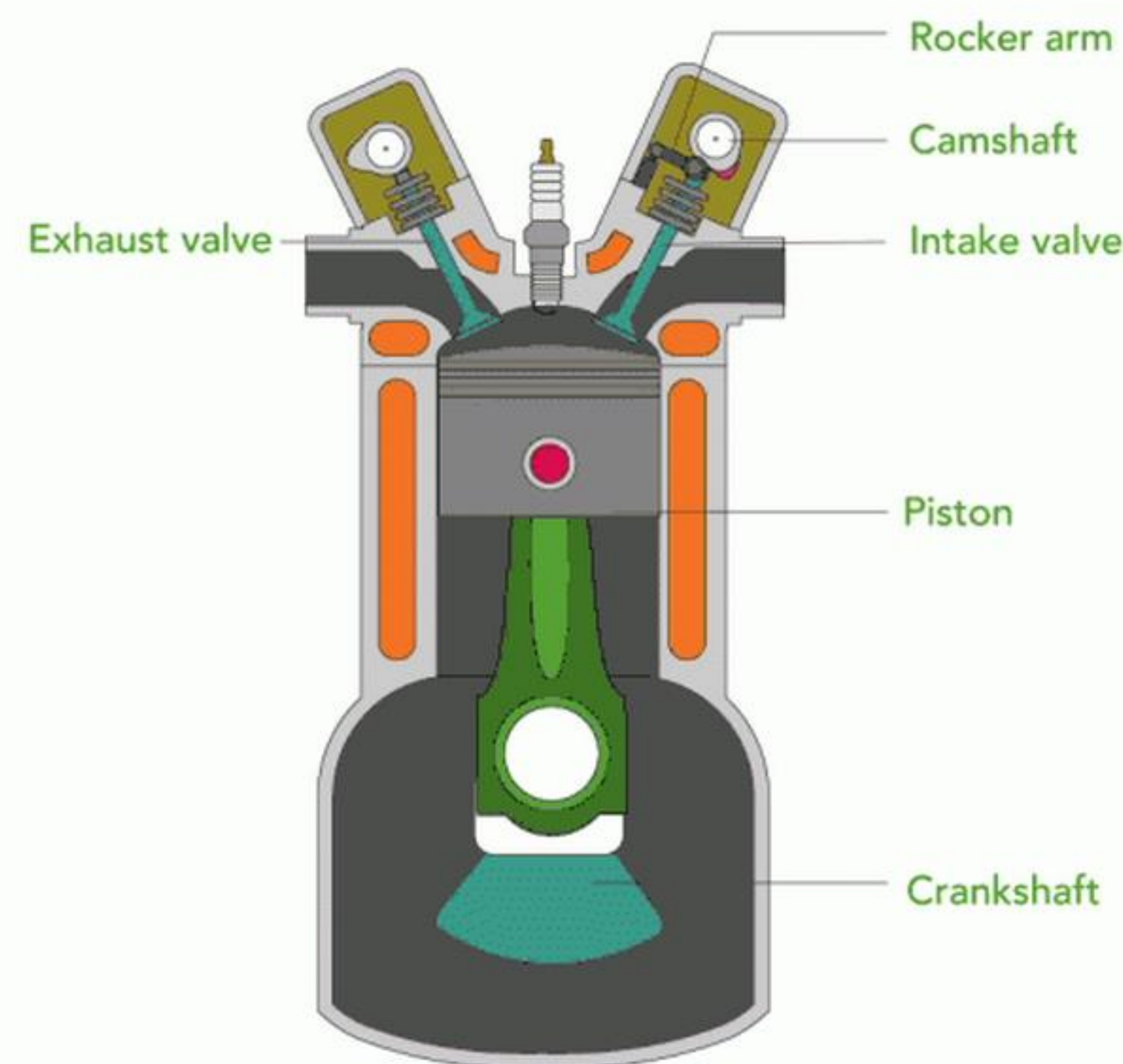


Figure 1. Standard 4 stroke ICE cylinder

RESULTS

- Hydrogen require much tighter tolerances in the engine
- Hydrogen burns cleaner producing only NOx and H2O
- Hydrogen storage both gas and liquid requires large tank size
- Liquid nitrogen requires better cooling and fuel pumps

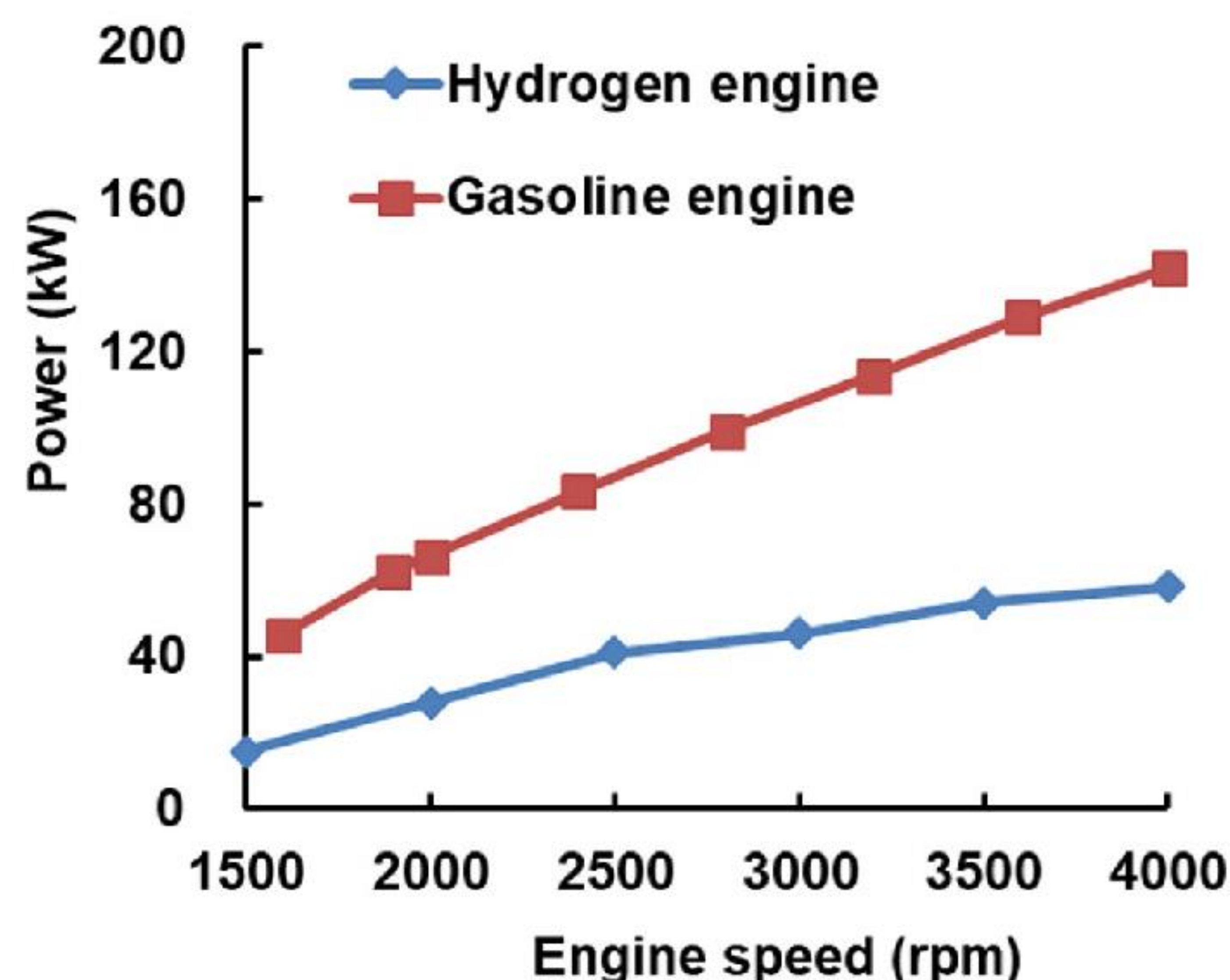


Figure 2. . Power comparison between gasoline and hydrogen

DISCUSSION/FUTURE WORK

Hydrogen is a potential fuel source to reduce pollution of commuter vehicles, but there are substantial problems that need to be solved. The storage of the hydrogen is the largest due to the large size and either a pressurized tank in the vehicle or the fuel boiling off as the tank's temperature rises. In the case of liquid hydrogen, the fuel pump is a major problem as none can withstand the incredibly low temperature.

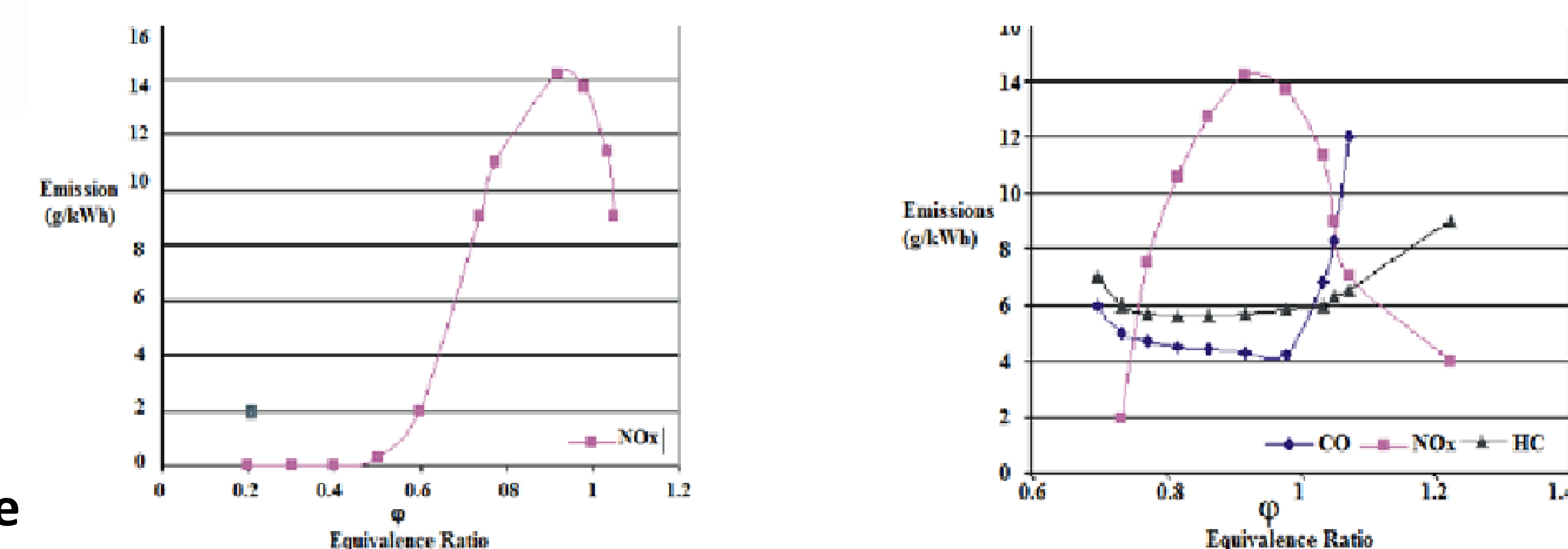


Figure 7: Emissions for Hydrogen Engine (left) for Gasoline Engine (right) [11]

Figure 3. Emissions comparison between hydrogen and gasoline

CONCLUSIONS

Hydrogen can power an ICE, but the disadvantages outweigh the advantages. The tighter tolerances and larger fuel tanks makes hydrogen impractical for an average commuter vehicle.

References

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