VI.H.3 Performance, Reliability, and Emissions Characterization of Reciprocating Internal Combustion Engines Fueled with Hydrogen/Natural Gas Blends

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Objectives

Evaluate the feasibility of using blends of hydrogen and natural gas as a fuel for conventional natural gas engines. The evaluation will include measurements of engine performance, namely, efficiency and emissions. In addition, detailed in-cylinder measurements of key physical parameters will be taken. The outcome will be a detailed knowledge base of the impact of using hydrogen/natural gas blends with regard to engine performance criteria.

Approach

The technical approach proposed is to measure the performance, efficiency, and emissions of a Cummins B5.9G natural gas engine under a variety of test conditions. Natural gas will be supplied from the city lines and then compressed to pressures up to 300 psig. Hydrogen will be supplied from high pressure cylinders. The engine performance, efficiency, and emissions will be determined under a variety of operating conditions as well as under a variety of configurations. Specifically, the impact of how the hydrogen and natural gas is blended and how the hydrogen and natural gas are admitted to the engine will be determined.

In addition to performance, efficiency, and emissions, ionization sensing and fiber optic pressure sensing systems will be used to analyze the in-cylinder processes. This information is critical to developing a thorough and complete understanding of how the blended fuel mixtures impact engine operation.

Accomplishments

- Initiated purchase of engine and components. Fabricated and assembled experimental apparatus for tests.
- The engine was started and some data was collected to satisfy the 12/31/05 milestone.

Conclusions and Future Directions

- Complete the first round test with natural gas and hydrogen blends.
- Analysis of base line data and optimization plan of engine performance and emissions tests.
- Initiate optimization tests for performance and emissions.