

Use of hydrogen in transport and power sector in India

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Abstract

Life on earth has been caught between twin crises arising out of fossil-fuel starvation as well as environmental degradation due to combustion of fossil fuels. The developing countries have been the worst victim of this situation. The internal combustion engines, which have been proven almost indispensable for such applications, have faced tough challenges for their survival.

Hydrogen is the unique fuel with the potential for providing the eventual freedom from both the crises. Presently hydrogen is emerging as a very promising option in Indian context. National Hydrogen Energy Board of India has prepared a road map including well-defined strategic implementation scheme to meet the country's energy needs. Hydrogen application in Internal Combustion (IC) engines forms a major activity of this programme. This paper describes the use of hydrogen in existing designs of internal combustion engines used both in transportation sector and as decentralised energy units.. Amongst the various modes of fuel induction techniques adopted for engine operation, timed manifold injection has been observed to be the most effective for optimum performance and low emission characteristics in the existing Spark Ignition (SI) engines. The diesel engines have been shown to be very effective in dual fuel mode and adopt a substantial level of energy substitution. Charge dilution techniques such as introduction of inert gases and water have been very successfully used in substantially reducing the knocking tendency of the engine.

This paper also discusses the technology of operating an existing engine with an optimum blend of hydrogen and Compressed Natural Gas (CNG). Such an approach is very much relevant to India where CNG has already been very widely in several types of vehicles in India.

Key Words — Hydrogen, Timed Manifold Injection, Oxides of Nitrogen, Equivalence ratio, Dual Fuel Engine.