Flex-Fuel Vehicle Development to Promote Synthetic Alcohols as the Basis of a Potential Negative-CO2 Energy Economy

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Abstract

The engine of a high performance sports car has been converted to operation on E85, a high alcohol-blend fuel containing nominally 85% ethanol and 15% gasoline by volume. In addition to improving performance, the conversion resulted in significant improvement in full-load thermal efficiency versus operation on gasoline. This engine has been fitted in a test vehicle and made flex-fuel capable, a process which resulted in significant improvements in both vehicle performance and tailpipe CO_2 when operating solely on ethanol blends, offering an environmentally-friendly approach to high performance motoring. The present paper describes some of the highlights of the development of the flex-fuel calibration to enable the demonstrator vehicle to operate on any mixture of 95 RON gasoline and E85 in the fuel tank. It also discusses how through detailed development, the vehicle has been made to comply with primary pollutant emissions legislation on any ethanol-gasoline mixture up to E85.

The paper presents a strategy for vehicle manufacturers to work with the legislating bodies to accelerate the move towards biofuels. This is based on the desirability of higher performance afforded by alcohol-fuel operation when linked to a CO_2-offset factor for vehicles biased towards operation on biomass-derived alcohol-based fuel. It is hoped that this approach of offering an appreciable improvement in performance when using the CO_2-beneficial alcohol fuel will encourage purchasers of high-performance vehicles to seek out and use the biofuel preferentially, despite a reduction in tank range due to the reduced volumetric energy content. This strategy will ensure the desirability of alcohol fuelling to the rest of the market, creating a ‘top-down’ effect. It is argued that this will accelerate the proportion of fuel energy usage derived from biofuels at a greater rate than blending it into the general fuel stock on a wholesale basis.

Finally, the development of engines biased towards operation on alcohol-based fuels will allow greater thermal efficiency and increased levels of engine downsizing, both contributing to improved vehicle fuel consumption and hence a greater proportion of distance travelled using renewable fuel. This avenue of development can only be undertaken if encouragement of the infrastructure necessary for the customer to obtain the alcohol-blend fuel is undertaken by the legislating bodies and the fuel companies. While another liquid fuel presents some problems of distribution, it is argued that this approach is preferable to that requiring molecular hydrogen to be distributed to and stored on board passenger vehicles. This is because such liquid fuels can be introduced with gradual modifications to the existing infrastructure. The introduction of such fuels in a flex-fuel energy economy can be the first step to renewable production of methanol. This will effectively create a fuel for the future transport scenario which can reduce the amount of CO_2 in the atmosphere. Very importantly, this cohesive approach permits a soft start and transition to a ‘synthetic alcohol energy economy’ for all of the major stakeholders in the transportation sector: customers, manufacturers and fuel suppliers.

Technical Paper	Practicality of Alcohols as Motor Fuel
Technical Paper	Improving the Cold Start Performance of Alcohol Fueled Engines Using a Rich Combustor Device
Technical Paper	Elemental Composition Determination and Stoichiometric Air-Fuel Ratios of Gasoline Containing Ethanol

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Topic

- Fuel consumption
- Energy consumption
- Ethanol
- Gasoline
- Methanol
- Hydrogen fuel
- Biofuels
- Carbon monoxide
- Fuel tanks
- Downsizing

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Also In

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