Hydrogen Fuel Injection System
Technology Fact Sheet for Canadian Hydrogen Energy Company Ltd.

Performance Claim
Canadian Hydrogen Energy Company’s Hydrogen Fuel Injection (HFI) System when installed on a 1992 Detroit diesel (60-series) heavy duty engine using low sulphur (< 15 ppm) diesel fuel and tested on a “go-Power” (Model DT-2000) heavy-duty engine dynamometer rated at 800 HP with the application of the AVL 8-Mode Heavy-Duty Cycle for engine testing displayed the following performance:

1. reduced fuel consumption by 4.44%;
2. reduced THC emissions by 6.17%;
3. reduced CO emissions by 0.39%;
4. reduced NOx emissions by 4.34%; and
5. reduced PM emissions by 7.0%.

Technology Application
While the test was performed on a diesel truck engine, the HFI technology is adaptable to a broad range of applications, including light trucks, buses, SUV’s, stationary generators, trains, boats, off-road forestry and mining equipment, motor homes and emergency services vehicles.

Performance Conditions
The performance claim evaluation was based on data and information provided by the Canadian Hydrogen Energy Company Ltd. regarding the HFI retrofit kit. The kit was installed and tested in a 1992 Detroit diesel heavy-duty engine (60-series) using low sulphur (< 15 ppm) diesel fuel and tested on a “go-Power” (Model DT-2000) heavy-duty dynamometer rated at 800 HP. The test was based on the widely used “AVL 8-Mode Heavy – Duty Cycle” for engine performance and emissions testing.

The AVL 8-mode test cycle runs at selected constant engine speeds. Measured data is applicable for on-road engine applications. The data provided by the Canadian Hydrogen Energy Company Ltd. is comprised of two test sets: (i) baseline performance (without HFI) and (ii) HFI performance (with hydrogen injection). The claim by the Canadian Hydrogen Energy Company Ltd. is based on the comparison of the baseline and HFI test results.

Technology Description
Through electrolysis, the Hydrogen Fuel Injection (HFI) kit generates hydrogen and oxygen, which are injected directly into the intake manifold. Published data show that hydrogen burns nearly one order of magnitude faster than petroleum fuels, thus approaching ideal thermodynamic cycle; and hydrogen has a shorter flame quench distance, allowing flames to travel closer to the cold zones, thus improving combustion. These hydrogen properties improve engine performance and emissions.

A simplified single step combustion reaction is represented as:

\[ \text{DIESEL} + \text{HYDROGEN} + \text{AIR} \rightarrow \text{HC} + \text{CO} + \text{CO}_2 + \text{H}_2\text{O} + \text{NO}_x \quad (1) \]
Technology Description (cont’d)
For incomplete combustion, equation (1) above results in exhaust products, including unburned hydrocarbon (HC) and carbon monoxide (CO). The NO\textsubscript{x} is formed mainly from the combustion air, and it is strongly temperature dependent.

For direct injection diesel engines, the Hydrogen Fuel Injection (HFI) kit injects the gases during intake so that it thoroughly mixes with intake air prior to diesel injection. The electrolysis cell of the HFI kit is constructed of seamless nickel tubing and the water chamber is made of seamless stainless steel. The Canadian Hydrogen Energy Company Ltd. indicated that the power for the electrolysis is supplied from the vehicle’s engine battery and hydrogen is only produced, on demand, when the vehicle engine is operating.

Verification
The performance claim verification was based on the following data and information provided by Canadian Hydrogen Energy Company Ltd:
1. California Environmental Engineering Facility (CEE) Certification of emissions testing by California Air Resource Board (CARB)
2. Patent for the electrolysis kit to be used in internal combustion engines
3. Performance data from CEE laboratory
The data provided by Canadian Hydrogen Energy Company Ltd. comprised of two test sets:
1. “BASELINE” (without the HFI) to establish the baseline for engine emissions; and
2. “PRE-TURBO” with the HFI installed.

The claim is based on a comparison of the baseline test results to the “PRE-TURBO” test results. The verification was completed by Bodycote Material Testing Canada Inc. (BMTC) (Mississauga, Ontario) using ETV Canada’s General Verification Protocol (March, 2000).

What is the ETV Program?
The Environmental Technology Verification (ETV) Program is a joint Environment Canada - Industry Canada initiative delivered by ETV Canada. The ETV Program is designed to support Canada’s environment industry by providing credible and independent verification of technology performance claims.

For more information on Hydrogen Fuel Injection System please contact:
Canadian Hydrogen Energy Company Ltd.
182 Wellington St W
Bowmanville, Ontario
Canada, L1C 1W3
Contact: Ira Lyons, President
Phone: 800 550 4066 ext 236
Fax: 905 697 7018
E-mail: ilyons@chechfi.com
www.chechfi.com
ETV Canada Contact Information:
ETV Canada
2070 Hadwen Road Unit 201A
Mississauga, Ontario
L5K 2C9  Canada
Tel: (905) 822-4133
Fax: (905) 822-3558
E-mail: etv@etvcanada.ca
www.etvcanada.ca

Limitation of Verification
Environment Canada, ETV Canada, and the Verification Entity provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the information supplied remains solely with the applicant or vendor and the liability for the purchase, installation, operation (whether consequential or otherwise) is not transferred to any other party as a result of the verification.

Printed June 2005       Expires June 2008