State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-680

Relating to Exemptions under
Section 27156 of the Vehicle Code

Best Hydrogen Hybrid LLC
BHH Cell System

Pursuant to the authority vested in the Air Resources Board by Section 27156 of the Vehicle Code; and

Pursuant to the authority vested in the undersigned by Sections 39515 and 39516 of the Health and Safety Code and Executive Order G-02-003;

IT IS ORDERED AND RESOLVED: That installation of the BHH Cell System hydrogen generator device, manufactured by Best Hydrogen Hybrid LLC (8348 Liverpool Circle, Littleton, CO 80125), has been found not to reduce the effectiveness of the applicable vehicle pollution control systems, and therefore, the BHH Cell System is exempt from the prohibitions in Section 27156 of the Vehicle Code for installation on Caterpillar, Cummins, Detroit Diesel, International, Mercedes Benz, Mack, and Volvo 1984-2009 model year heavy-duty diesel engines from 5.9 liters to 16.0 liters.

The BHH Cell System device consists of a 5-quart water reservoir and a metal case containing the hydro cell generator, various electrical components, electrical wiring and connectors, and a polyethylene supply hose for the hydrogen gas.

This Executive Order is based on emission test results using Heavy-Duty Federal Test Procedure (FTP) Transient Cycle test and Euro III European Stationary Cycle (ESC) test submitted by Best Hydrogen Hybrid LLC with the BHH Cell System device.

If evidence provides the Air Resources Board with reasons to suspect that the BHH Cell System device will affect the durability of the emission control system, Best Hydrogen Hybrid LLC shall be required to submit durability data to show that the durability of the vehicle emission control system is not, in fact, affected and/or that the add-on or modified parts demonstrate adequate durability.

This Executive Order is valid provided that installation instructions for the BHH Cell System device do not recommend tuning the vehicles to specifications different from those of the vehicle manufacturer.

Changes made to the design or operating conditions of the BHH Cell System device, as exempt by the Air Resources Board, which adversely affect the performance of the vehicle's emission control system, shall invalidate this Executive Order.

Marketing of the BHH Cell System device using identification other than that shown in this Executive Order or for an application other than that listed in this Executive Order shall be prohibited unless prior approval is obtained from the Air Resources Board.

Exemption of the BHH Cell System device shall not be construed as exemption to sell, offer for sale, or advertise any component of the kit as an individual device.

This Executive Order shall not apply to any BHH Cell System device advertised, offered for sale, sold with, or installed on a motor vehicle prior to or concurrent with transfer to an ultimate purchaser.

This Executive Order does not constitute any opinion as to the effect the use of the BHH Cell System device may have on any warranty either expressed or implied by the vehicle manufacturer.

No claim of any kind, such as "Approved by the Air Resources Board," may be made with respect to the action taken herein in any advertising or other oral or written communication.

In addition to the foregoing, the Air Resources Board reserves the right in the future to review this Executive Order and the exemption provided herein to assure that the exempted add-on or modified part continues to meet the standards and procedures of California Code of Regulations, Title 13, Section 2222, et seq.

THIS EXECUTIVE ORDER DOES NOT CONSTITUTE A CERTIFICATION, ACCREDITATION, APPROVAL, OR ANY OTHER TYPE OF ENDORSEMENT BY THE AIR RESOURCES BOARD OF ANY CLAIMS OF THE APPLICANT CONCERNING ANTI-POLLUTION BENEFITS OR ANY ALLEGED BENEFITS OF BEST HYDROGEN HYBRID LLC'S BHH CELL SYSTEM DEVICE.

Violation of any of the above conditions shall be grounds for revocation of this Executive Order. The Executive Order may be revoked only after a ten day written notice of intention to revoke the Executive Order, in which period the holder of the Executive Order may request in writing a hearing to contest the proposed revocation. If a hearing is requested, it shall be held within ten days of receipt of the request, and the Executive Order may not be revoked until a determination is made after the hearing that grounds for revocation exist.

Executed at El Monte, California, this 29 day of October 2010.

Annette Hebert

Annette Hebert, Chief
Mobile Source Operations Division

EVALUATION SUMMARY

Manufacturer Name: Best Hydrogen Hybrid LLC

Name of Device: BHH Cell System

Background:

Best Hydrogen Hybrid LLC of 8348 Liverpool Circle, Littleton, CO 80125 has applied for exemption from the prohibitions in Section 27156 of the California Vehicle Code for its BHH Cell System device. The device is designed for use on Caterpillar, Cummins, Detroit Diesel, International, Mercedes Benz, Mack, and Volvo 1984-2009 model year (MY) heavy-duty diesel engines between 5.9 liters and 16.0 liters.

Recommendation:

Grant exemption to Best Hydrogen Hybrid LLC as requested and issue Executive Order D-680.

Device Description:

The BHH Cell System device produces hydrogen through an electrolysis process by supplying electricity from the vehicle's battery to stainless steel metal plates submerged in reservoirs containing distilled water and an activator (potassium hydroxide). The device consists of a 5-quart water reservoir and a metal case containing the hydro cell generator (which contain the stainless steel anode and cathode metal plates), various electrical components, electrical wiring and connectors, and a polyethylene supply hose for the hydrogen gas.

Discussion/Basis for the Recommendation:

This exemption is based on the following emission tests conducted on two heavy-duty diesel engines with Best Hydrogen Hybrid LLC's BHH Cell System device installed:

1. FTP transient cycle test on a 1998 MY Cummins ISM-11 10.8 liter diesel engine.
2. FTP transient cycle and Euro III ESC 13-mode steady-state tests on a 2007 MY Detroit Diesel Series 60 14.0 liter diesel engine.

The emission test results are shown below:

Hot-Start FTP Transient Cycle Emission Test
1998 MY Cummins ISM-11 10.8 liter Diesel Engine
Engine Family WCEXH0661MAD

	FTP Transient Cycle Emissions (grams/bhp-hr)			
	NMHC	CO	NOx	PM
FTP Emission Standards	1.3	15.5	4.0	0.10
FTP Results w/BHH Cell System Installed	0.182	1.18	3.944	0.074

1. Testing laboratory – Olson-EcoLogic Engine Testing Laboratories in Fullerton, California

Hot/Cold-Start FTP Transient Cycle Emission Test
2007 MY Detroit Diesel Series 60 14.0 liter Diesel Engine
Engine Family 7DDXH14.9ELY

	FTP Transient Cycle Emissions (grams/bhp-hr)				
	NMHC	NOx	NMHC+NOx	CO	PM
FTP Emission Standards	0.14	1.16	1.3	15.5	0.01
FTP Two Test Average w/BHH Cell System Installed	0.003	0.525		0.419	0.003
FTP results with DF	(0.003x2.75)= 0.008	(0.525x1.028)= 0.540		(0.419x1.059)= 0.44	(0.003+0.003)= 0.006
FTP results with DF and UAF	0.01	0.55	0.56	0.45	0.006
Final results	Pass	Pass	Pass	Pass	Pass

Notes: 1. Testing laboratory – California Environmental Engineering in Santa Ana, California
2. Deterioration factors (DF) are either multiplicative or additive.
3. Upward adjustment factors (UAF) are all additive.

Euro III ESC 13-Mode Steady-State Emission Test
2007 MY Detroit Diesel Series 60 14.0 liter Diesel Engine
Engine Family 7DDXH14.9ELY

	Euro III ESC Emissions (grams/bhp-hr)				
	NMHC	NOx	NMHC+NOx	CO	PM
ESC Emission Standards	0.14	1.16	1.3	15.5	0.01
ESC Test Results w/BHH Cell System Installed	0.014	0.997		0.254	0.0076
ESC results with DF	(0.014x1.889)= 0.026	(0.997x1.011)= 1.008		(0.254x1.200)= 0.30	(0.0076+0.001)= 0.009
ESC results with DF and UAF	0.03	1.01	1.04	0.30	0.009
Final results	Pass	Pass	Pass	Pass	Pass

Notes: 1. Testing laboratory – California Environmental Engineering in Santa Ana, California
2. Deterioration factors (DF) are either multiplicative or additive.
3. Upward adjustment factors (UAF) are all additive.

All comparative exhaust emission test results for FTP transient cycle testing on the 1998 Cummins ISM-11 engine modified with the BHH Cell System device showed that the modified engine met the exhaust emission standards. All exhaust emission test results for FTP transient cycle testing and EURO III ESC emission testing, with the deterioration factors and upward adjustment factors included, on the 2007 Detroit Diesel Series 60 engine modified with the BHH Cell System device showed that the modified engine met the exhaust emission standards. Similar results are expected when Best Hydrogen Hybrid LLC's BHH Cell System device is used on the 1984-2009 model year heavy-duty diesel engines stated in this application.