

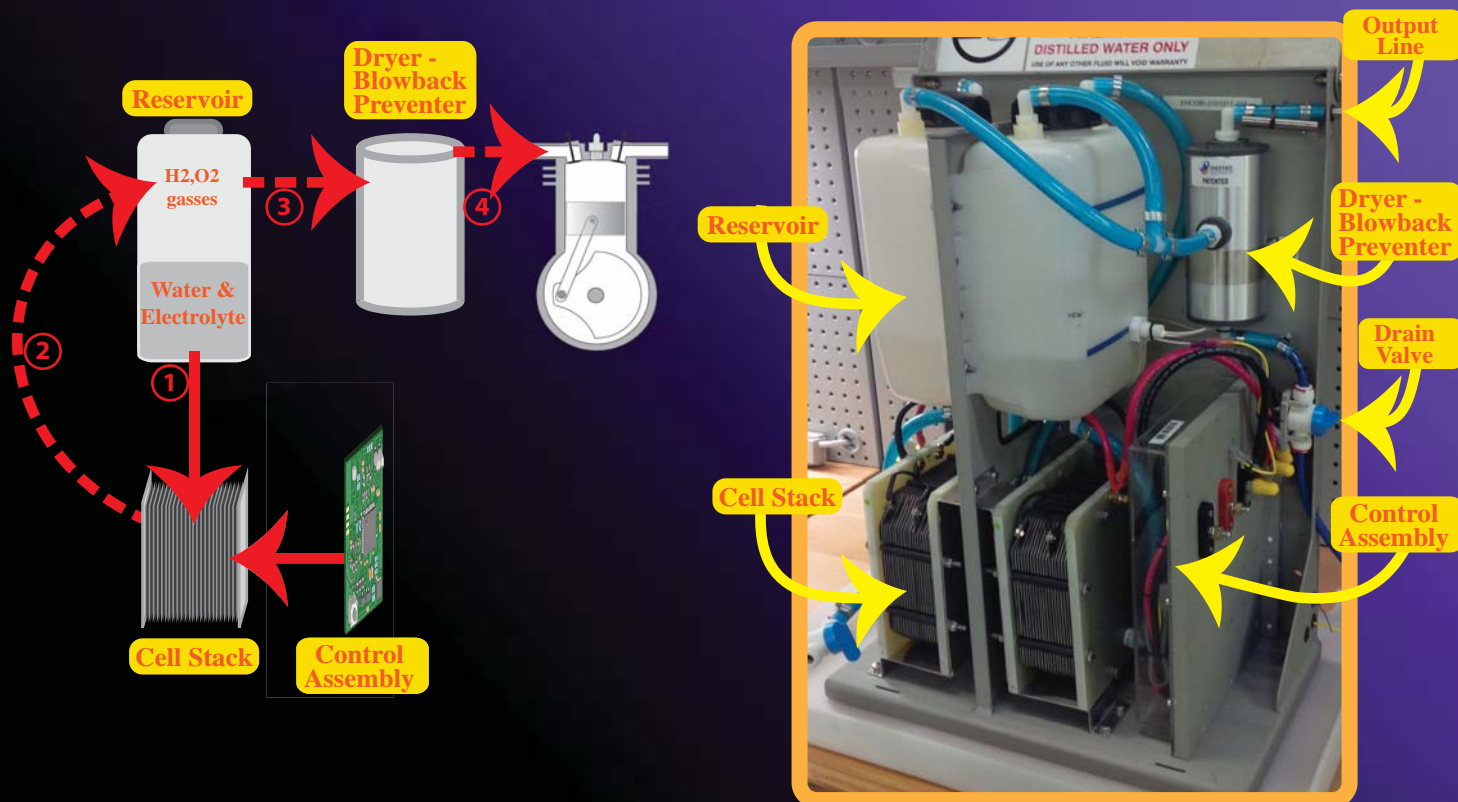


# EMPIRE HYDROGEN ENERGY SYSTEMS INC.

## Understanding the System



**Empire Hydrogen's Fuel Enhancement System<sup>®</sup>** splits water into Hydrogen ( $H_2$ ) and Oxygen ( $O_2$ ) molecules. A small amount (200ppm) of these gases flow through the air intake of a diesel truck, bus, generator or any internal combustion engine. Hydrogen burns ten times faster than diesel and acts as an accelerant, causing the fuel to burn faster, cleaner and more completely. This results in 3% more power, 10%-20% less fuel consumption and greenhouse gases, 48% less NOx and a  $\frac{2}{3}$  reduction in diesel particulates, DPF regen cycles and cleaning.



Distilled water and electrolyte are stored in reservoirs. We recommend topping up the water at each diesel refill. Electrolyte need only be replenished every 3 months.

Water flows slowly from the reservoir into the cell stack. Electrical current travels through the cell stack, splitting the water into Hydrogen ( $H_2$ ) and Oxygen ( $O_2$ ) molecules.

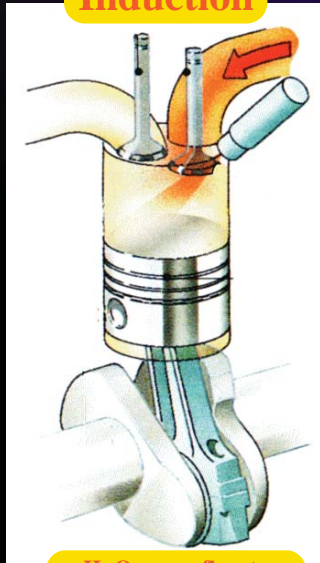
Electrical current is managed by a patent pending circuit board control assembly that connects directly to a truck's CANbus system, allowing for second-to-second control of  $H_2, O_2$  gas production according to 12 engine performance parameters.

Gases flow through the water reservoir at slightly above normal atmospheric pressure. The gases continue through a drier/blowback preventor to achieve optimum humidity.

The gases follow the output line to the engine's normal air intake manifold and into the cylinders. The blowback preventor stops any possible backfire from entering the system.

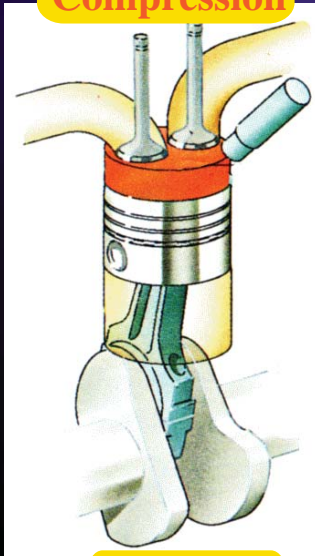


### Induction



H<sub>2</sub>, O<sub>2</sub> gases flow to the air intake at 200ppm

### Compression



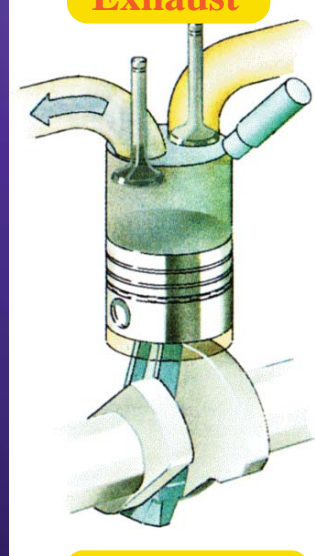
A 3% increase in horsepower

### Power



Virtually all of the diesel is ignited

### Exhaust



Diesel particulates are reduced by up to 65%

### Fuel Economy & Horse Power at High Engine Loads:

Diesel engine efficiency drops above 60% engine load when accelerating, driving uphill or hauling a heavy load. This is because the volume of air intake is fixed while the fuel intake increases with throttle pressure. The imbalance of oxygen-to-diesel results in unburned diesel, a reduction in fuel economy and engine efficiency. Empire's Fuel Enhancement System introduces both Hydrogen (H<sub>2</sub>) and Oxygen (O<sub>2</sub>) gases into the ignition process. The added Oxygen significantly improves the fuel burn, resulting in a 10%-20% improvement in fuel efficiency and a 3% increase in horse power.

### Smog Causing Emissions at Light Engine Loads:

Diesel hydrocarbon and particulate matter emissions occur mainly at light engine loads. This is a result of lean air-fuel mixing where the flame speed is too low for complete combustion. Unburned hydrocarbons flow out the exhaust as smog causing particulate matter, nitric oxide (NO<sub>x</sub>) and greenhouse gases (CO). The Empire Fuel Enhancement System introduces a small amount of Hydrogen (H<sub>2</sub>) and Oxygen (O<sub>2</sub>) gases into the engine during the induction stroke. As the piston compresses, the Hydrogen gas ignites at the initiation of the power stroke with a dramatically expanded flame front with a 48% reduction in NO<sub>x</sub>.



Hydrogen burns ten times faster than diesel, causing the fuel to burn much faster and virtually completely, resulting in  $\frac{2}{3}$  reduction in diesel particulates with corresponding reduction in daily regen downtime, semi-annual DPF filter cleaning and periodic DPF replacement.

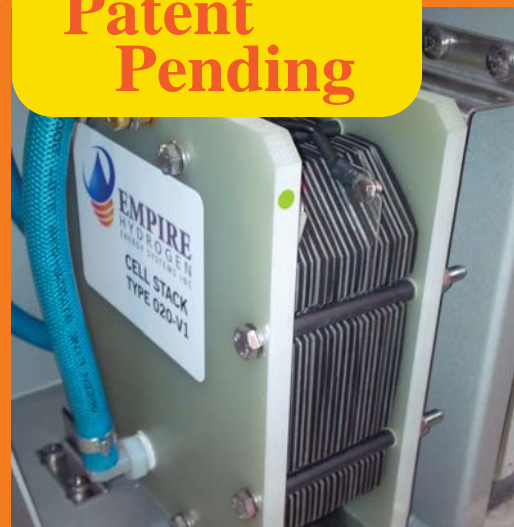
## Blowback Preventer Patented



**Patented dryer/blowback preventor** performs two tasks:

- The cannister captures any moisture carried by the  $H_2, O_2$  gases.
- In the event of backfire, ceramic beads arrest any possible flame from reaching gases remaining in the reservoir.

## Cell Stack Patent Pending



**Patent pending Cell Plate designs** allow for greater efficiency in the release of  $H_2, O_2$  accelerant gas bubbles along with reduced electrical resistance and cooler cell operation.

## Power Supply Patent Pending

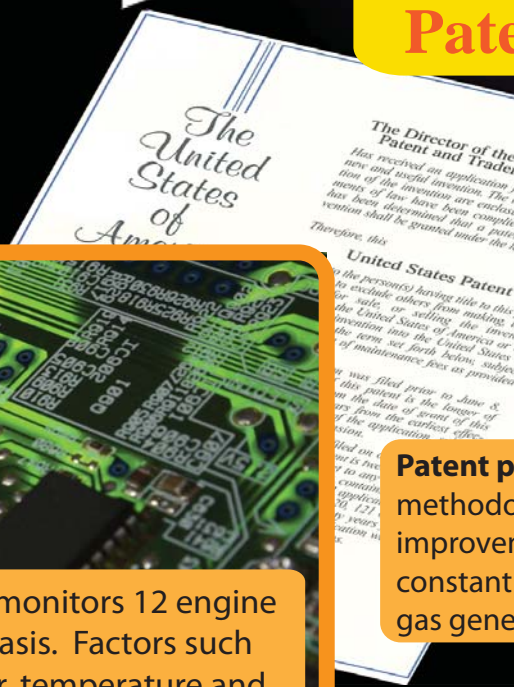
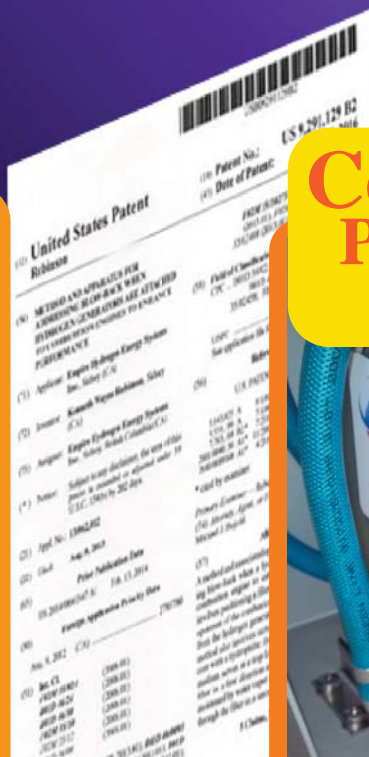


**Patent pending power supply** methodologies offer significant improvement to Empire's constant current accelerant gas generation.

## Control Assembly Patent Pending



**Patent pending Control Assembly** monitors 12 engine parameters on a second-to-second basis. Factors such as throttle position, gear, horsepower, temperature and fuel flow are used to control the precise amount of  $H_2, O_2$  accelerant gases required for optimum performance.











## Fuel Consumption

Vehicle	Average Savings	Highest Savings	Lowest Savings
Caterpillar 14.6 L	16.9%	30.2%	7.5%
Mack 12.0 L	21.7%	29.7%	16.7%
Cummins 15.0 L	17.6%	21.8%	16.8%

### **Chris Hutchins, Friesen Bros. Transport - 2002 Kenworth C12**

"My Kenworth chip truck is used on a haul that normally used 420 litres of fuel per day. After the hydrogen injection system was installed we recorded a reduction of 40 to 50 litres per day (9.5%-11.5% savings) using the same driver and the same weight load."

### **Ron Basi, JenCan Transport - 2003 Kenworth 15 L Cummins**

"In the city we're picking up about half a mile per gallon, but on the highway it's gone up - I've picked up a whole mile per gallon on a few trips. We were averaging in town between high 3's and 4 mpg. Sometimes we'd hit a 4 1/2, depending on traffic. Now I'm hitting 5's."

### **Glen Burns, Vihar Construction - John Deere 12.5 L Generator**

"This generator is used 9 months a year, 24 hours a day, 6 days a week. We have always monitored the fuel consumption and knew that it burned 78.74 litres per hour. Under the same conditions the plant now consumes 63.78 litres; saving \$13.47 an hour."

### **Nick Jawanda, Target Pacific Coast Transport**

"I have a 2012 Kenworth ISX Cummins 15L 500 hp fitted with an Empire system in February. My January average mileage was 5.2 mpg. February average mileage was 6.06 mpg. I am happy with what I'm seeing."



## Greenhouse & Noxious Gasses

Vehicle	CO <sub>2</sub>	DPM	NO <sub>x</sub>
2008 Ford F350 6.4L Diesel	-21%	-62%	-60%
2007 Dodge 5.9L Cummins DI	-25%	-75%	-38%
2007 GMC W5500 5.5L Diesel	-11%	-73%	-61%
1994 Detroit Diesel 60 Series	-31%	-86%	-24%

### **Chris Hutchins, Friesen Bros. Transport - 2002 Kenworth C12**

"When I'm following a lot of these big trucks with the dual stacks they're just creaming out the black smoke, and as you can tell ... I get white smoke out of mine, and that's about it."

### **Brian Dearden, Fernhill Freight and Storage**

"We have also noticed an increase in time between regen cycles on the sytem's emissions unit. It has gone from an average of 300km to 360km, depending on the driving conditions."

### **Peter Friesen, Friesen Bros. Transport**

"When the system is on you can smell it. It has a totally different smell, a sweet smell... as compared to a choking diesel smell. The driver reported less black smoke."



**From Carbon to Clean**



## Horsepower

Load Factor	Run Position	Power Output	Power Change
200 hp	Test 1	197.2 hp	+2.90%
	Test 2	148.5 hp	+10.9%
500 hp	Test 1	374.9 hp	+3.00%
	Test 2	427.1 hp	+0.80%

### **Chris Hutchins, Friesen Bros. Transport - 2002 Kenworth C12**

"I'm picking up maybe half a gear in power, and it's definitely running smoother."

### **Ron Basi, JenCan Transport - 2003 Kenworth 15 L Cummins**

I only have one driver. He does the same loads; he drives the same route... and he said, "Ron, the truck, it doesn't seem so rough when I first start it in the morning since I got the Empire system on it." I said what do you mean? "Well, I can feel it. It doesn't feel so bumpy when it's started up."

### **Peter Friesen, Friesen Bros. Transport**

"The two drivers we have that use it have definitely noticed a difference. Increase in power, the truck seems to run smoother, on a cold start it doesn't what they call, "hunt" as much. So it definitely makes a difference."

### **Rick Story, Total Delivery**

"The most impressive aspect of the system is the increase in power that has been most apparent when driving up steep inclines. With the system my truck is now capable of maintaining higher speed up hills and is no longer the cause of hold ups."



**EMPIRE**  
**HYDROGEN**  
ENERGY SYSTEMS INC.



# Vancouver Island Green Business of the Year

**Empire Hydrogen Energy Systems**

Suite 7 - 10189 McDonald Park Rd.

Sidney, BC, Canada, V8L 5X5

+1.778.426.0911

Admin@EmpireHydrogen.com