HEMS GLOBAL

HYDROGEN BASED DIESEL REDUCTION SYSTEM FOR TRANSPORT & HAULAGE SYSTEMS

- **15%** LESS DIESEL USAGE
- **15%** LESS CARBON DIOXIDE
- SIGNIFICANT **REDUCTION** IN SMOKE
- **18%** LESS CARBON MONOXIDE

SYSTEM OVERVIEW

HEMS' patented[1] hydrogen based diesel reduction technology injects hydrogen into a diesel engine through the air in-take, which results in a more efficient combustion process and cleaner emissions. The technology has been developed for commercial engines operated by Transport and Haulage businesses.

COMMERCIAL DIESEL ENGINE FITTED WITH HEMS' TECHNOLOGY PROVIDES THE FOLLOWING ADVANTAGES:

COSTS
15% reduction in costs of fuel consumption (net costs of hydrogen)

ENVIRONMENT
15% reduction in CO_2 produced by the engine

POLLUTANTS
Significant reduction in black smoke for older engines

POWER
Increase in power which results in better driver flexibility

R&D into HEMS' technology commenced in 2009, to safely and efficiently control and deliver hydrogen into internal combustion engines. In 2012, a trial program was completed in Germany and Austria by UWS Environmental Services. This was conducted by world renowned environmental scientist Dr Walter Stolz. In 2015, HEMS System was certified by Dr Hien Ly (CFS International)[2] to meet and exceed the Australian standards. In late 2015, HEMS Global obtained the necessary regulatory approvals, making it market ready for all types of diesel engines.

HEMS' hydrogen based diesel reduction technology has been engineered to work seamlessly and safely with any fleet. The design features include:

- Easily retro-fitted with a low footprint and negligible impact to vehicle dimensions or payload.
- Engine starts on diesel and reverts to diesel when hydrogen runs out or is turned off.
- HEMS' hydrogen re-fill stations efficiently re-fill the vehicle while insitu.
- Guaranteed supply of hydrogen to all our customers.
- Extensive product warranty and insurance program.

INDUSTRY APPLICATION

The HEMS System is ready for installation on all types of diesel engines:

TRANSPORTATION AND HAULAGE: ARTICULATED TRUCKS, RIGID TRUCKS, BUSES, RAIL, EARTHMOVING AND CONSTRUCTION, MINING, DIESEL GENERATORS, MARITIME

Transport and haulage fleets are significant consumers of diesel. Freight transport activity is generally expected to increase inline with population growth and economic activity. To meet demand, most of the diesel in Australia is imported and subject to regional based pricing. Diesel costs are a significant input cost for fleet operators. The rising and volatile diesel prices can significantly affect the profitability of a business.

According to the Tracking 2020 Report (published Dec. 2015 by Dept. of Environment, Australian Government), the Transport and Haulage sector which includes articulated trucks, rigid vehicles and light commercial vehicles is expected to increase to ~ 38MtCOe annually (approximately 40% of total transport emissions). Diesel is projected to remain as a primary fuel for the industry being the least cost fuel in the foreseeable future.

WHO WOULD BENEFIT?
Fleet owners who are seeking to reduce the operating costs and improve the company's green footprint by reducing diesel usage.

1. *PCT patent application (PCT/AU2012/000975) was filed on 20 August 2012 by HEMS Systems Pty Ltd*
2. *Profile of Clean Fuel Services International http://www.cfsinternational.com.au/hien.php and Dr Hien Ly*

BENEFITS ANALYSIS

OPERATING COSTS SAVINGS

HEMS System utilised on diesel vehicles will experience attractive cost savings from lower diesel consumption. The system reduces the amount of diesel required to operate an engine. The system is expected to save fleet owners 15% reduction in costs of fuel consumption (including the cost of hydrogen).

Through the R&D stages, the system has been continuously trialled on different vehicles and engines under different operating conditions with the HEMS System both ON and OFF. Analysis of the data logs from recent trials of buses show average diesel consumption reduction for older model engines of 28% and for newer vehicles of 21%.

FUEL CALCULATOR

Vehicles with higher fuel burn rates and distances travelled will achieve higher $ cost savings from the system. As a guide, the tables here provide working examples of trucks and construction equipment and the $ cost savings. Our team can help you calculate the expected savings from the system.

Table below consists of 3 transport vehicles with various fuel burn rates.

		VEHICLE		
Haulage Distances (yearly)	Kilometres	50,000	75,000	100,000
Average Diesel Fuel Burn	Kilometres/Litre	2.5	2.5	2.5
Diesel Consumption	Litres	20,000	30,000	40,000
Costs of Diesel (5)	$A/Litre	1.00	1.00	1.00
Annual Spend on Diesel	$A	20,000	30,000	40,000
FULL YEAR COST SAVINGS ON DIESEL NET COST OF HYDROGEN	$A	3,000	4,500	6,000

The calculations of savings in the table above uses the diesel pump price at a point in time which has been adjusted for GST and fuel credits.

ENVIRONMENTAL BENEFITS

In 2012, commercial trials were conducted on buses in Austria and Germany to measure emissions levels. The test was a measure of emissions of a bus utilising hydrogen gas as a catalyst to diesel only. The results table here is part of an independent test in 2012 by Dr Walter Stolz (UWS Environmental Science), a highly regarded environmental scientist.

Substance or parameter	Unit	Measurement result for run 1 (without hydrogen)	Measurement result for run 2 (without hydrogen)	PERCENTAGE REDUCTION
Oxygen	% by vol.	16.6	14.9	10%
Dust	[mg/m³N]	18	14	22%
Carbon monoxide (CO)	[mg/m³N]	303	248	18%
Nitrogen oxide as NO_2	[mg/m³N]	2710[1)]	2710[1)]	11%
Org. CHC	[mg/m³N]	99	60	40%

[1)] rounded to mg/m³

Environmental and health concerns of diesel emissions have increased over the last decade. HEMS System provides fleets with an immediate reduction to the carbon footprint.

IMPROVE DRIVER UTILITY & COMFORT

Commercial vehicle drivers will notice immediate differences when operating their vehicles with HEMS System operating. Drivers will observe a significant reduction in black smoke as well as noticeable improvement in engine power. The HEMS System will improve driver flexibility especially when the vehicle is under load.

HOW DOES THE HEMS SYSTEM WORK?

HYDROGEN

Hydrogen is a gas, lighter than air and non-toxic. Hydrogen burns very quickly and is by far the safest of all fossil fuels. Under optimal combustion conditions, hydrogen is a fuel source which generates an accelerated burn rate with a clean burn that produces an increase in power and reduced black smoke.

Hydrogen is **widely used and understood** in industrial chemical production, fuels and space exploration where large amounts of power are required.

Accessibility of hydrogen gas as a fuel source has improved in the last 10 years with the evolution of commercial hydrogen production technologies ie. cracking, electrolysis etc.

Adaptation of hydrogen dry gas as a catalyst in an internal combustion engine using HEMS Global's solution has the following advantages:

- **Able to safely utilise the characteristics of hydrogen**
- **Delivers improved engine efficiency, fuel consumption and power output**
- **Reduction in emissions with a cleaner burn**
- **Will not interfere in the normal operation of the vehicle's engine management system as it is not used as an alternate fuel**

INSTALLATION

HEMS System installations will be performed by our team of certified trained staff. Installation takes a few hours and can be conducted at HEMS' facility or at approved clients' site. Alternatively, large fleet operators can obtain recognised training from an accredited institution to be able to carry out installations on their fleet. The system will be certified and registered for compliance post installation.

HEMS SYSTEM

The HEMS hydrogen based diesel reduction system consists of:

- An on-board hydrogen pressurised storage container. The pressurised container has all the safety components required under AS-2030.
- A hydrogen refilling connector located on the side of the vehicle.
- HEMS' patented electronic control unit is connected to HEMS' sensors to control and deliver hydrogen.
- Valves, tubing and fittings are rated for hydrogen gas and pressure.

HEMS' patented control and delivery system controls the flow of hydrogen to the engine for all operating conditions. The system will only operate when the system is on and the engine is operating and running. It is an independent system that does not interfere with the running of the diesel engine and the vehicle's warranty.

The system is retro-fitted with low footprint and negligible impact to vehicle dimension or payload. The on-board hydrogen storage capacity can be customised to meet the vehicle's operational needs.

SAFETY

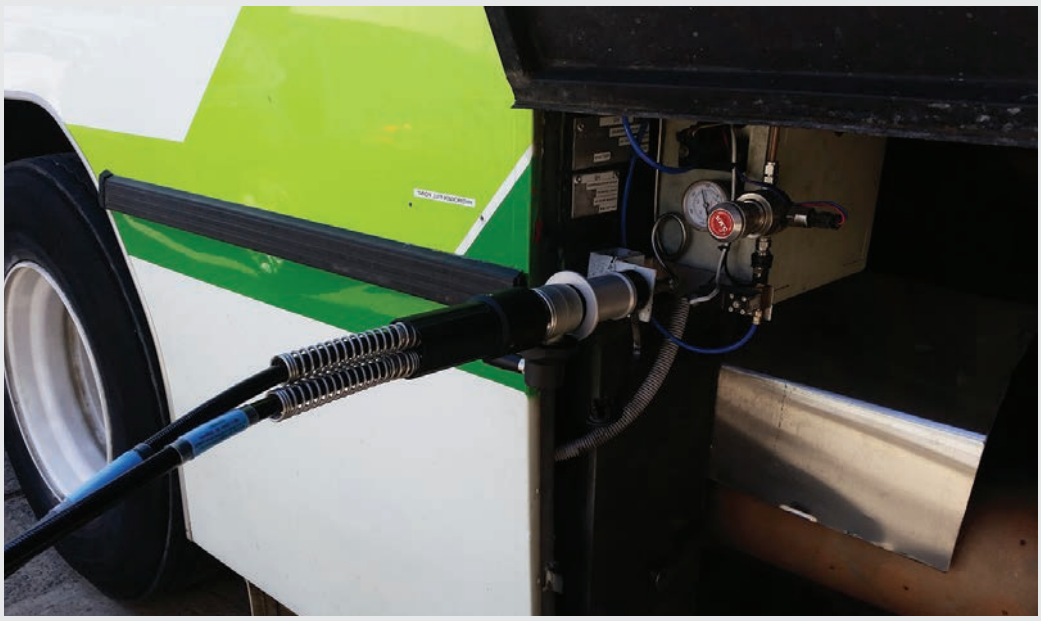
The HEMS System has been engineered to meet and exceed strict Australian safety standards. HEMS has applied stringent safety controls which exceed the AS/NZS 2739 standard to store and regulate dry hydrogen gas. The system has been independently certified by Dr Hien Ly.

- The patented control and delivery system regulates the flow of hydrogen.
- Hydrogen detectors are used to shut down the system in an unlikely event of a hydrogen leak to ensure safety of all personnel and the vehicle.
- All components are sourced from reputable suppliers from US, Germany, Australia and Japan specifically designed for use with hydrogen.
- All components are intrinsically safe and flameproof.
- The system does not interfere with the engine's normal control system as it is not used as an alternate fuel.

HEMS SUPPORT SERVICES

HEMS REFILLING STATIONS

Users of the HEMS System will have a guaranteed supply of hydrogen. The vehicle can be filled with hydrogen from the HEMS hydrogen stations. The nozzle on the filling station is connected to the vehicle's receptacle and suitable for fast fill. The filling system automatically shuts off when it is full.



PRODUCT SUPPORT

To ensure that our customers get the best results of their system, HEMS will continue to support all our customers through:

- 2-year extensive product warranty in the event the system does not meet expectations (subject to certain conditions).
- On-going technical support program for all HEMS System customers.
- Comprehensive insurance program in place.
- Financing options available for fleet owners.

HEMS GLOBAL

ABOUT HEMS

HEMS Global is an Australian based engineering business and developer of the HEMS System located in Sydney, Australia. HEMS management have over 60 years of knowledge and expertise in the transport sector and engine systems. The team has spent over 6 years focussed on the research, testing and certification of the system which safely regulates hydrogen flow. The HEMS System has been subjected to extensive trials here in Australia and in Europe and is the only proven hydrogen based diesel reduction system.

HEMS GLOBAL

ENQUIRE HOW HEMS SYSTEM CAN POWER YOUR FLEET:

E: sales@hemsglobal.com.au
A: 119 Willoughby Road, Crows Nest NSW 2065 Australia
P: +61 (02) 9965 3737

A: 7-15 Water Street, South Strathfield NSW 2136 Australia
P: +61 (02) 9642 8282 F: +61 (02) 9642 8484
W: www.hemsglobal.com.au
Follow us at: www.linkedin.com/company/hems-global