

# **Reducing Global Warming by Integrating Electromagnetic Treatment of Fuels within Internal Combustion Engines**

By

Dr. Hal Campbell, Professor  
California State University – Humboldt  
College of Natural Resources and Sciences

The rapid advance of technology over the past thirty years has brought with it many innovative changes and as a result of this progress, we enjoy an assortment of new consumer products that have enriched our lives and provide enormous benefit to us all. Computers have shrunk in size and advanced in capability and sophistication. Cell phone and satellite networks now cover virtually every corner of the globe, providing instant communications. Additionally, medical imaging technologies can now aid with the diagnosis of a variety of illnesses and new surgical and drug therapies have extended life expectancies well beyond where it was only a few decades ago. Countless examples of such advancements in technology, as applied to virtually every aspect of human endeavor have enjoyed similar progress. So why it, with all the technological progress that has occurred over the past thirty years, that automobile manufacturers are still forced to rely on adaptations of 1970's technology (in the form of catalytic converters) to reduce exhaust emissions from a car's engine ?

In the 1970's automobile manufacturers scrambled to find an effective solution to rising air pollution levels and respond to demands by both consumers and governments alike to lower air pollution and smog caused by automobile emissions. In response to the Clean Air Act that mandated the adoption of more environmentally responsible methods of dealing with declining air quality as a result of automobile emissions, U.S. automobile manufacturers attempted to mitigate the problem by adopting the use of catalytic converters on all new vehicles. This approach was taken in order to reduce the levels of dangerous carbon monoxide, hydrocarbons, and oxides of nitrogen being spewed from the car's exhaust. Unfortunately however, while federal, state, and local governments were passing laws to impose strict standards for air quality that included abolishing back yard burn barrels and mandating the construction of expensive infrastructures that could deliver cleaner burning natural gas to homes for heating, automobile manufacturers were electing to install [incinerators] on every car manufactured to decrease the amount of poisonous gases being produced. Catalytic converters are (functionally) nothing more than complex incinerators that use a three-way catalyst process to superheat unburned fuel traveling through the car's exhaust.

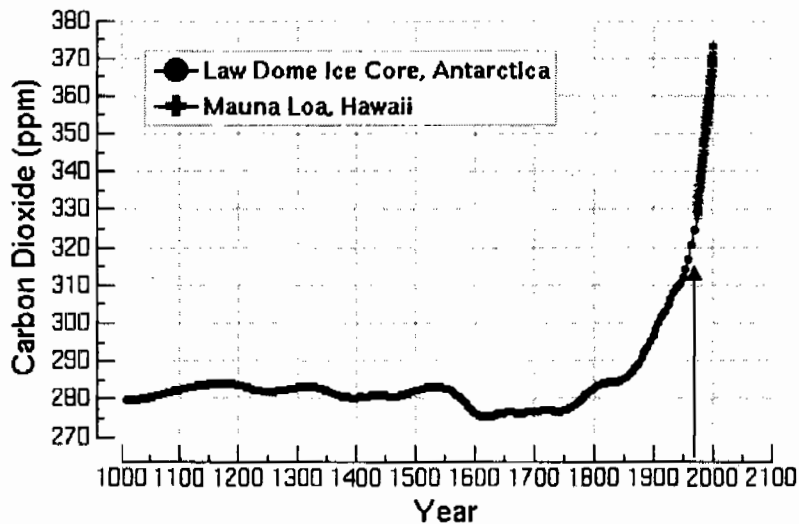
For the most part, catalytic converters do a good job of incinerating pollutants harmful to humans before they can escape into the atmosphere, but recent studies confirm that this benefit comes at a significant cost to the environment. What few realized in the 1970's was that even though catalytic converters offered a short term solution to the air pollution crisis, the incineration process that these devices used to deal with unburned gasoline and

diesel fuel, would dramatically intensify global warming. The reason for this consequence is that the superheating process used by catalytic converters to get rid of unburned fuel actually results in an increase in green house gas emissions (GHG) in the form of increased levels of carbon dioxide and nitrous oxide being expelled from the car's exhaust system. Carbon dioxide is a direct by-product of the incineration of harmful carbon monoxide gas and nitrous oxide emissions from motor vehicles are caused primarily by the conversion of oxides of nitrogen ( $\text{NO}_2$ ) into nitrous oxide ( $\text{N}_2\text{O}$ ) by vehicle catalytic converters. Catalytic converters were never intended to be a long term solution to the problem of air pollution caused by internal combustion engines, but rather they were adopted as a short term option, until advances in technology could offer a more effective solution. Unfortunately, thirty years has passed and the automobile industry is still relying on this temporary solution. (1) *U.S. Department of Energy, Energy Information Administration, Emissions of Green House Gases in the U.S., 1997.*

Finally there is an innovative discovery emerging from the laboratory that makes it feasible to augment the effectiveness of the catalytic converter with a new process to lessen green house gas emissions. Developed by a company called Save the World Air Inc., and marketed under the brand name EcoChargR, this revolutionary new technology has been proven effective at reducing the amount of unburned gases being expelled from internal combustion engines, resulting in a substantially lower amount of engine waste requiring incineration by catalytic converters. The processes underlying this new discovery have been validated by findings of a multi-year study sponsored by the Rand Corporation and conducted at Temple University. (2) *R. Tao, Journal of Modern Physics, Viscosity Reductions in Liquid Suspensions by Electric of Magnetic Fields, 2005)*

As mentioned previously, the basic function of a catalytic converter is to incinerate unburned fuel and oil being expelled from the exhaust system of an internal combustion engine. Catalytic converters use a catalyst (usually platinum or palladium), to affect a chemical reaction with carbon monoxide, oxides of nitrogen, or hydrocarbon that result from (less than optimal) combustion processes. Consequently, catalytic converters adversely affect engine performance by restricting air flow through the engine, to control exhaust gases through the converter to treat unburned engine waste. This process decreases horsepower and lowers fuel economy. In order for catalytic converters to work properly, they must superheat escaping gases to incinerate these harmful waste by-products. A significant drawback is that cold engines do not heat catalytic converters to the temperature required to incinerate escaping gases, subsequently resulting in lower levels of performance by the catalytic converter, essentially mitigating their effect. To make matters worse, studies have also cited that damaged or aged catalytic converters regularly malfunction, again resulting in diminished performance. At the heart of the global warming debate should be a demonstrated concern over the use of catalytic converters as a singular methodology to eliminate exhaust emissions. By adopting this short-term fix to poisonous gas production, we have created a more serious problem, called global warming, because the by-products of catalytic incineration of CO, NOX, and HC from their original state (which are harmful to humans) are green house gases carbon dioxide ( $\text{CO}_2$ ) and nitrous oxide ( $\text{N}_2\text{O}$ ), which are harmful to the environment and principally responsible for global warming.

As cited in numerous scientific reports the principle causes of Global Warming are worldwide increases in carbon dioxide (CO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), methane, water vapor, CFCs, and ozone. Highway vehicles (passenger cars, light trucks, and heavy duty trucks, and others) are estimated to constitute 77% of the total Green House Gas (GHG) emissions for the United States by mobile sources and an equal percentage can be extrapolated to other regions using this form of emissions reduction. It is interesting to note, that from 1990 to 2001, GHG (Green House Gas) for the United States, as a result of mobile sources of related emissions, increased by 24.3%, from 1,172 to 1,456 (Gg). This increase in GHG emissions comes despite the fact that from 1990 to 2001, CO emissions from mobile combustion in the U.S. have decreased from 98,328 to 66,857 (Gg), and NO<sub>x</sub> emissions have declined by 5.746 to 3.942 (Gg). Even with these reductions, Green House Gas emissions have risen by 24.3 percent. A strong correlation between the use of catalytic converters as a source of emissions control as measured by the mean number of vehicles equipped with such technology, as compared to increases in GHG is clearly evident. So to, is the relationship that exists in elevating GHG emissions and mean global temperatures. The use of catalytic converters in passenger cars, light trucks, and heavy duty trucks since 1973 to present times has seen a complete reversal, from practically no such devices being used in 1973 to nearly all vehicles manufactured being equipped with these devices today. Clearly the explanation for the global increase in GHG emissions is multivariate in nature and due (partly) to the aggregate effect of a variety of variables that include (a) an increase in vehicle miles driven annually, (b) an increase in the number of vehicles produced annually, but also and perhaps most significantly to (c) the percentage of vehicles now in use equipped with catalytic converters. (3) *United States Environmental Protection Agency, Methodology for Estimating Emissions of CH<sub>4</sub>, N<sub>2</sub>O, and Criteria Pollutants from Mobile Combustion, Annex E, 2001*



(Source: National Oceanic and Atmospheric Administration)

To help mitigate the effect of global warming caused by the use of catalytic converters, it has been discovered that treatment of fuels by electromagnetic field, prior to combustion, has been proven to affect changes in the molecular structure of crude oil and derivative fuels, thereby resulting in a decrease in surface tension and favorable alteration in viscosity levels. The process of exposing fuel to electric or magnetic fields subsequent to carburetion or fuel injection and just prior to combustion, has been verified to enhance the combustion process thereby increasing the exposure of fuel molecules (that are normally contained within the inner regions of fuel clusters) so that oxygen molecules can bond with more individual fuel molecules. This enhanced level of combustion, results in more fuel molecules, per cluster, being ignited and subsequently lessening the amount of unburned fuel being exhausted from the engine. This enhanced combustion process also decreases the amount of unburned fuel waste requiring incineration by the catalytic converter. Such an increase in engine effectiveness also results in improved gas mileage, because more particles of fuel (per cluster) are being combusted, thereby requiring fewer clusters of fuel being needed by the engine, per mile of travel. Since CO<sub>2</sub> is a natural by-product of the incineration of CO, the only effective way to reduce the production of this GHG is to incinerate less CO. Additionally, since N<sub>2</sub>O is a natural by-product of incineration of NoX, the only way to effectively reduce the production of this GHG is also to incinerate less NoX. (4) R. Tao, *Journal of Energy and Fuels, Reducing the Viscosity of Crude Oil by Pulsed Electric or Magnetic Field, 2006*

Electromagnetic treatment of fuels prior to combustion can serve to achieve this objective and provide a practical method by which to lower the volume of unburned gases requiring incineration by catalytic converter. The products created by Save the World Air Inc., are the only known method to achieve this objective and can be applied to a wide variety of consumer products such as automobiles, motorcycles, marine engines, lawn and garden equipment, generators, and diesel engines to lessen the volume of harmful contaminants produced each year. Because the technology is based on the application of magnetic fields to fuel molecules, prior to combustion, and because the devices use permanent magnets to alter fuel viscosity, these devices never wear out and do not require heating to function. The company's EcoChargR product has been proven effective not only in reducing emissions, but also in improving gas mileage and increasing horsepower. In repeated tests conducted by EPA and EURO certified laboratories, EcoChargR was determined to significantly lower CO, NoX, and THC emissions. This consumer product is based on a patented process that uses high strength magnetic fields to alter the molecular structure of gasoline and diesel fuels, just prior to combustion and thereby affects changes in the viscosity of these fuels so that they can be used more effectually. (5) Investigate Effects of Magnetic Fields on Fuels, R. Tao, Temple University, 2004.

Independent tests of this technology were conducted at the EPA recognized Northern California Diagnostics Laboratory in 2001 on an early model Ford to test for effects on older automobiles, that did not use catalytic converter technology. These tests were conducted in strict conformance to EPA testing protocols, which do not provide for alteration of fuel-air mixture, resulted an amazing 71% reduction in overall exhaust emissions, while also garnering a correspondingly impressive 49% increase in gas

mileage for the test vehicle. These tests confirm that integration of high strength magnetic fields within the fuel delivery and pre-combustion process could be used successfully to reduce exhaust emissions and thereby lessen the need for catalytic incineration of unburned exhaust gases. The consequence of such an approach would be to decrease the amount of GHG's being produced by automobiles each year and also reducing emissions from other consumer products using internal combustion engines. (*Save the World Air Inc., 2001*)

More recently, tests of a newer version of the device were announced. In these trials, which were conducted on a 4-stroke motorcycle, the EcoChargR yielded emissions reductions that significantly exceeded those prescribed by EURO II Standards. The tests were conducted in December 2005 at the Automotive Emission Laboratory, Pollution Control Department, Ministry of Natural Resources and Environment of Thailand, and were performed jointly with S.P. Suzuki of Thailand, the authorized distributor of Suzuki products in Thailand. In these tests THC, NoX, and CO were reduced by 56%, 65%, and 74% respectively. Gas mileage increased by 33% and horsepower increased by 19%. The reductions in exhaust emission levels in this test were (again) achieved without benefit of a catalytic converter.

In April of 2006, STWA reported that the EcoChargR had successfully passed EURO3 emission standards, besting their previous performance, during tests conducted at the National Motorcycle Quality Inspection & Certification Center in Shanghai, China. These tests blended the EchoChargR magnetic field with a catalytic converter and demonstrated not only reductions in CO, NoX, and THC, but also in CO and N2) as well. These tests are seen to clearly validate the conclusion that significant reductions in GHG emissions can be achieved by incorporating magnetic treatment of fuel as a pre-treatment to catalytic conversion. (*Save the World Air Inc., 2006*)

Scientific confirmation of the physics associated with the application of magnetic fields to crude oil and derivative fuels (gasoline and diesel fuel) have been presented in two leading industry journals over the past two years. The results of this extensive scientific study were published, and are available for review, in the Journal of Energy and Fuels (Reducing the Viscosity of Crude Oil by Pulsed Electric or Magnetic Field, R. Tao and X. Xu), and also in the Journal of Modern Physics B (Viscosity Reduction in Liquid Suspensions by Electric and Magnetic Fields, R. Tao and X. Xu). These reports substantiate that pulsed magnetic and electric fields do, in fact, have a favorable effect on altering the viscosity of oil and their derivative fuels. These findings again confirm that such a systemic approach can serve as a viable emissions pre-treatment system to lessen the amount of gas requiring incineration by catalytic converters, as well as use of this technology on smaller engines (used by consumers to power a variety of equipment) to substantially lessen untreated CO, NoX, and THC emissions.

According to the World Health Organization, "climate change represents one of the greatest environmental and health equity challenges of our times: wealthy, energy-consuming nations are most responsible for global warming, yet vulnerable, low-income populations, least prepared for the impacts of climate change, are most at risk. The extent

of climate change is uncertain, but this irreversible global experiment represents a gamble with our children's future. The failure of the global community to come together and implement a meaningful strategy to reduce greenhouse gas emissions does not breed optimism.” Recent estimates place the number of deaths worldwide, as a direct result of air pollution, at nearly 750,000 people annually in urban areas. The catastrophic effect caused by global warming is expected to dwarf this number and change our environment in such a way as humankind has never before experienced. Global warming is expected to manifest its destruction in rising sea levels that displace large numbers of people throughout the world, combined with changes in average annual temperatures that result in disruptions to food supplies and increases in disease. Adoption of this new magnetic treatment process of fuel to lessen GHG emissions is clearly the viable option the world has been awaiting, and this technology presents a demonstrable alternative if we are to avoid the catastrophic consequences that await our planet. (6) *World Health Organization, Climate Change Report, 2001*)

As technology and science have advanced over the past three decades, so too has our understanding of the limitations of certain technologies (like the catalytic converter) to provide a comprehensive solution to the air pollution problem. We now recognize that by adopting catalytic converters, we created a more severe and long lasting global warming crisis. Since the adoption of catalytic converters, average global temperatures have risen steadily to a point where they are now the highest in the history of our planet. The continued use of catalytic converters as the only source of pollution control, presents a clear and present danger to the world's population. Integration of pulsed magnetic fields to enhance fuel delivery and exhaust systems is clearly a meritorious alternative.

References:

(1) U.S. Department of Energy, Energy Information Administration, Emissions of Green House Gases in the U.S., 1997.

(2) R. Tao, Journal of Modern Physics, Viscosity Reductions in Liquid Suspensions by Electric of Magnetic Fields, 2005)

(3) United States Environmental Protection Agency, Methodology for Estimating Emissions of CH<sub>4</sub>, N<sub>2</sub>O, and Criteria Pollutants from Mobile Combustion, Annex E, 2001

(4) R. Tao, Journal of Energy and Fuels, Reducing the Viscosity of Crude Oil by Pulsed Electric or Magnetic Field, 2006)

(5) Investigative Effects of Magnetic Fields on Fuels, R. Tao, Temple University, 2004

(6) World Health Organization, Climate Change Report, 2001