ECO Fuel Systems, LLC

ECOFuelMax.com

(866) 374-0002

Reduce Pollution – Maintenance Expenses

How the ECO Works

- **ECO Systems Fuel Filter/Enhancer is a proven patented system that works by increasing the Reid Vapor Pressure in fuel, utilizing Electrostatic energy (electrolysis). Results are a more combustible cleaner burning fuel (40%-70%+) No Chemicals or Maintenance, No Warranty issues, life expectancy 20+ years:**

    - **Diesel RVP +/-.6% to +/- 1.0% (60%)**
    - **Gasoline RVP +/-7.4% to +/-8.2% (11%)**
    - **Methane/CNG RVP +/-9.6% to +/-12.7% (11.2%)**

- **ECO System only treats fuel, no motor modifications, no Warranty issues.**
- **ECO System is CARB Approved. No Emission System modifications.**
- **Works on All Fuels: Gasoline, Diesel, Propane, Bio-fuels, Ethanol Blends, and Natural Gas.**
- **A complete burn means fewer Hydrocarbons released into the atmosphere, increased horsepower, efficiency and reduced maintenance.**
- **Reduce Diesel Particulate Matter (Soot), 40% to 70%+, Less DPF Maintenance.**
- **Reduced REGEN Cycles can reduce fuel consumption by omitting wasted fuel due to Forced REGEN Cycles (8-10 gal.).**
- **Installed on School Buses, Coach Buses, Trucking, EMS, Waste, Police, Heavy Equipment, etc. for over 15+ years. See Who Uses it.**
- **Low in cost (click here), can last 20+ years.**
- **90 Day No Risk Satisfaction Money Back Guarantee**
- **BBB A+ rated 10+ years. CARB Approved**

Any questions email or call and speak to a Human.

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Info@ECOFuelMax.com
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How it Works

Whitepaper Richard Carlson

A Developer of the DPF & Catalytic Converter's

US Testing Laboratory Certified Tests

Reduce Hydrocarbon Pollution 40% - 70%+

Guaranteed – No Risk

(866) 374-0002

Info@ECOFuelMax.com

Operating Principles of ECO Systems Fuel Enhancer

by
Richard Carlson
smogboss@aol.com

Objective:

Many tests have been conducted on the ECO Systems family of products. These tests have consistently shown improved fuel efficiency in a variety of engines and fuels types. The objective of this study is to establish how the device produces the observed improvements in combustion and how they relate to natural gas fuel engines and burning equipment.

Device Description:

The ECO Systems device consists of a steel tube containing a series of copper disks with a center hold and holes formed between the disks and the inside of the steel tube. The device does not contain magnets, consume chemicals, or use external electrical power. The device is produced in several sizes. The same device design is used for liquid fuels and for natural gas. The design promotes turbulent flow and extensive metal to fluid (liquid or gas) surface contact. The device is installed inline to an existing pipeline by cutting out a section, threading the ends and using pipe unions to attach the device. The device is manufactured by Emissions Technology, Inc., (ETI) of Tulsa, OK. The product is labeled ECO-x where x is the product model (size).

ECO Systems Sponsored Tests:

ETI has sponsored several tests to establish the fuel efficiency and emission reduction benefits plus any physical-chemical changes in the treated fuel. Teeter (1), determined that there was no significant effect on surface tension or chemical composition of diesel fuel, although vapor pressure was increased and pour point temperature was lower in the treated fuel compared to untreated fuel. Johnson (2) evaluated the vapor pressure changes due to the device in diesel fuel and gasoline and believed they were significant (not quantified) and related to improved combustion. A test conducted by SGS US Testing Co. (3) on a natural gas burner showed a 1.8% increase in combustion gas temperature at constant methane and air supply when using the ECO System fuel enhancer. A test conducted for the Texas Commission for Environmental Quality (4) showed an average reduction in HC and NOx emissions of 6-7% and 1% in fuel consumption from 4 high-mileage gasoline vehicles when using the ECO-System device.

Suggested Mechanism:

Based on the device description, several possible mechanisms (magnetic force, chemical reactivity or compositional changes, flow restriction or line pressure modulation) cannot occur. However, extensive laboratory and field research has established (5) that low conductivity flowing fluids can generate electrostatic charges on pipes and hoses. An equal and opposing charge occurs within low conductivity fluids, a process called flow electrification and the resulting current is usually referred to as a streaming current. The electrostatic charge density (Coulombs/kg) of a fluid in a duct or tube increases with increased flow velocity and decreases with increased mass flow density. This is basically related to the frequency of molecular collisions of the fluid with the duct surfaces.

Independent Research Reports:

Gasoline, diesel fuel, and natural gas have low electrical conductivity. This phenomenon results in well known transportation and handling risk because the electrostatic charge can cause a sudden spark that can ignite the fuel. Parameters causing increased levels of electrostatic potential include (5):

- Decreasing fluid conductivity
- Increasing flow velocity
- Increasing turbulence due to bends, constrictions, etc
- Increasing temperature of the fluid
- Decreasing humidity of the fluid.

Many technical papers discuss the beneficial effects of electrostatic charge on fuel atomization and distribution in liquid fuels. Leuteritz (6) reported that induced electrostatic charge of diesel fuel affected the core of the fuel spray such that additional waves were produced causing earlier breakup of the spray leading to smaller droplet diameters and larger spray angles. DiSalvo (7) expanded on this by showing that electrostatic energy improved atomization of diesel fuel yielding a significant improvement in combustion uniformity and efficiency. Parsons (8) determined that a negative charge induced in liquid flowing fuel survives through the injector orifice because the fuel is electrically insulating. The resulting spray pattern is better atomized and dispersed due to the electrostatic forces. Allen (9) reported data on an induced electrostatic charge in the fuel which resulted in improved atomization of diesel fuel. The paper reports that the physical mechanism is to reduce the inherent surface tension of the droplet surface. Reducing surface tension will generally increase the observed vapor pressure of liquid fuels which has been a commonly reported effect of the ECO-System device.

The above reports support the conclusion that liquid fuels are electrostatically charged by turbulent flow caused by impact of fuel droplets with the metallic surface; and that, once charged, retain that charge long into the engine, where the effect can be seen in improved dispersion and more rapid cylinder pressure rise.

Application of ECO Systems Fuel Enhancer to Natural Gas Engines and Gas Burners:

The data reported above was based on electrostatic properties in liquid fuels. However, natural gas also is non-conductive and is predominately methane. Lu (10) reported a generalized model for determining the entraining electrostatic charge in flowing compressed natural gas, generally referred to as the streaming current. Natural gas flowing through the ECO-System device accumulates electrostatic charge due to gas/surface collisions which is enhanced by the turbulence inherent in the device design. Mattheson Tri-Gas (11) reported that electrostatic charges are generated by flowing methane and they may be sufficiently high to cause explosive discharge in the presence of gas leaks. Methane is a non-polar molecule with strong covalent bonds between carbon and hydrogen atoms. This makes the molecules resistant to magnetic forces but still susceptible to electrostatic charging.

The Gas Research Institute has studied the effects of electrostatic charging on piping failures and gas explosions. Ersoy (12) reported that friction of high velocity flowing natural gas in a pipe will generate an electrostatic charge. Any obstacles in the flow path increase turbulence and friction and in turn increase the generation of static charge on the pipe and in the flowing gas.

Field Tests of ECO System Fuel Enhancer:

Tests were conducted on a natural gas engine and boiler plant operating in the San Joaquin Valley. These tests consistently showed a 2% reduction in fuel used for the same work output.

Grimmway Farms Pump PE185 (02-18-2009)	Baseline	ECO-GAS	% Change
Gas Input (cu.ft./hr)	1469.39	1440.00	-2.00
Energy Input (Therms/hr)	15.16	14.86	-1.98
Work (Acre-ft/hr)	0.145	0.145	0.00
Therms/Acre-ft	104.85	102.75	-2.00
Langer Farms Miura 7.9MBTU Boiler (05-5-2009)			
Low Load Gas Input (cu.ft.)	2434	2391	-1.77
High Load Gas Input (cu.ft.)	6462	6308	-2.38

Residential Gas Appliance Tests of ECO Systems Fuel Enhancer:

Tests were run on a residential stove/oven by measuring the time required to raise water in a sauce pan and to heat the oven a fixed number of degrees. An ECO-5 gas unit was installed on the gas line entering the stove. The heating time was reduced 2-3%.

Boil Water Test (7-10-2009)	Baseline	ECO-GAS	% Change
Starting air temperature (F)	70	70	0.00
Starting water temperature (F)	64	64	0.00
Amount of water (oz)	128	128	0.00
Time to reach 200F (seconds)	1,291	1,253	-2.94

Oven Pre-heating Test (7-10-2009)	Baseline	ECO-GAS	% Change
Starting oven wall temperature (F)	67	67	0.00
Time to reach 350F (seconds)	471	459	-2.55

Discussion:

The data collected from tests of the ECO Systems Fuel Enhancer has shown consistent 2% energy efficiencies in natural gas fueled engines, a boiler, and residential appliances. The principal of operation has been shown to be electrostatic charging of the fuel by the Fuel Enhancer, because other principals of operation (chemical reaction, magnetic charge, catalytic reforming of the fuel, external electrical charging or plasma) are not embodied in the Fuel Enhancer. Technical literature supports that fuel, once charged, retains the charge for the time required to travel from the Fuel Enhancer into the engine or gas burner due to the low electrical conductivity of natural gas. The electrostatically charged gas molecules promote more complete fuel/air mixing which results in more complete combustion and the observed energy saving. This electrostatic charge effect is small compared to the inherent energy of the fuel molecule and is insufficient to reach an explosive discharge potential.

Conclusions:

1) The ECO-System Fuel Enhancer design promotes electrostatically charging of flowing fluids, including natural gas.
2) Natural gas fuels are electrostatically charged by flowing through the Fuel Enhancer.
3) Electrostatically charged fuel retains its charge during the time required to transit the fuel delivery system into the engine or burner.
4) Electrostatically charged fuel mixes with air and burns more efficiently than uncharged fuel resulting in reduced fuel consumption for the same work performed.
5) Electrostatically charged fuel from the Fuel Enhancer has provided a reproducible 2% energy savings in a number of tests.

References:

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2. Johnson, Kent, "Personal correspondence," 1991.
3. SGS US Testing Co, Report No. FT97-0033, 6/2/1997.
4. Thomason, J.W., "Emissions Reducing Benefits of the ECO-Systems Retrofit Device," Final Report, TCEQ Contract No. 02-R01-27G, January, 2005
5. Graham Hearn, "Static Electricity," Guidance for Plant Engineers, Wolfson Electrostatics, 2002.
6. U. Leuteritz, "A Novel Injection System for Combustion Engines Based on Electrostatic Fuel Atomization", SAE Paper 2000-01-2041, June 2000.
7. Di Salvo, R., et al, "Electrostatic Atomization Insertion into Compression Ignition Engines, SAE Paper 2002-01-3053, June 2002.
8. Parsons, M, et al, "Electrospray for Fuel Injection", SAE Paper 972987, October, 1997
9. Allen, J., et al. "Experimental Test Results from a Novel Low Power Electrostatic Port Fuel Injector for Small Engines," SAE Paper 2005-32-0090, October 2005.
10. Lu, Z.Y., H. Fox, "New Numerical Algorithm on Electric Streaming Currents in Turbulent Flow," American Institute of Aeronautics and Astronautics, 1996
11. Material Safety Data Sheet, Methane, Matheson Tri-Gas, Copyright 2009
12. Ersoy, D. "Static Discharge Failure of PE Pipe," Gas Technology Institute Report #GRI 05/147, 2003, page 7.

Credentials of Richard Carlson:

1. Master of Science degree in Environmental Engineering from UCLA.
2. Member - Society of Automotive Engineers for over 15 years.
3. 25 years performing and managing emission and performance tests at independent vehicle and engine testing laboratories in Southern California for government and corporate clients.
4. 12 years developing, testing, and certifying catalytic converters for major aftermarket catalytic converter manufacturer.
5. 5 years developing, testing, and certifying diesel emission control systems such as particulate filters, selective catalytic systems, and lean NOx traps.

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ECO Fuel System Filter/Enhancer

SGS Certified Vapor Pressure Reports

Diesel (+60% combustion)
Propane (+19.8% combustion)
Gasoline (+9% combustion)
Methane - CNG (+11.2% combustion)

Cleaner Burning Fuel Reports

United States Testing Company, Inc.

Tulsa Division

1341 NO. 108th EAST AVENUE TULSA, OKLAHOMA 74116
TELEPHONE: AREA CODE 918-437-8333

REPORT OF TEST

CLIENT: Emissions Technology Inc.
P.O. Box 471916
Tulsa, OK 74147-1916

Attn: Alex Collin

NUMBER
91-0047
3/4/91

SUBJECT:

Testing of diesel fuel samples for vapor pressure by the Reid mehtod.

SAMPLE IDENTIFICATION

Two jars of diesel fuel marked "Treated Diesel 2-20-91" and "Untreated Diesel 2/20/91".

RESULTS

	Treated	Untreated
Vapor Pressure, psig	1.0	0.6

The Reid vapor pressure is a measurement of the stabilized pressure exerted by a volume of liquid fuel at 100°F. The test is an indirect measurement of combustion characteristics. When more liquid volatilizes into the pressure chamber the vapor pressure increases. Higher fuel volatility indicates hotter burning characteristics. Therefore, higher vapor pressure indicates a hotter, consequently cleaner, burning fuel.

Marty
Dean Ramey
March 19, 1992

SIGNED FOR THE COMPANY
C. Richard Finley
Mgr/Laboratory Services

Laboratories in: New York • Chicago • Los Angeles • Houston • Tulsa • Memphis • Reading • Richland

United States Testing Company, Inc.

Tulsa Division

1341 NO. 108th EAST AVENUE TULSA, OKLAHOMA 74116
TELEPHONE: AREA CODE 918-437-8333

REPORT OF TEST

NUMBER
91-0073
3/22/91

CLIENT: Emissions Technology Inc.
P. O. Box 471916
Tulsa, OK 74147-1916

Attn: Alex Collin

SUBJECT: Testing of unleaded gasoline for Reid Vapor Pressure.

SAMPLE IDENTIFICATION

Two samples of regular unleaded gasoline, one untreated, one treated with Ecolizer.

TEST RESULTS

Untreated Sample	7.6 lbs.
Treated W/Ecolizer	8.4 lbs.

The Reid vapor pressure is a measurement of the stablized pressure exerted by a volume of liquid fuel at 100°F. The test is an indirect measurement of combustion characteristics. When more liquid volatilizes into the pressure chamber the vapor pressure increases. Higher fuel volatility indicates hotter burning characteristics. Therefore, higher vapor pressure indicates a hotter, consequently cleaner, burning fuel.

NOTARY PUBLIC

notary
Exp March 17, 92

SIGNED FOR THE COMPANY
C. Richard Finley, Manager
Laboratory Services

Laboratories in: New York • Chicago • Los Angeles • Houston • Tulsa • Memphis • Reading • R

JS-D-OPS-04-03 T

SGS U.S. Testing Company Inc.

1381 North 100th East Avenue • Tulsa, OK 74116 • Tel: 918-437-8333 • Fax: 918-437-8487

CLIENT: Emissions Technology Inc.
P.O. Box 471918
Tulsa, OK 74147-1918

Attn: Clark Daywalt

Test Report No:	162482	Date:	November 2, 2001

SUBJECT: Pressure Tests.

REFERENCE: Letter.

SAMPLE ID: Two (2) samples identified as "ECO Units" were received from the client on 10/29/01. The samples received were [illegible]" NPT by 8" in length. The samples were received in good condition.

PROCEDURE: The samples were evaluated by gradually applying a 10,000 psi hydrostatic pressure for 1 minute or until failure. No revisions to this report will be allowed after 90 days of the report date.

RESULTS: Sample: [illegible]" NPT by 8" length
Both samples held 10,000 psi for one minute without failure.

TEST DATE: 11/1/01.

SIGNED FOR AND ON BEHALF OF SGS U.S. TESTING COMPANY INC.

Simmons
Dept. Manager/Product Evaluation

Dale E. Holloway
Tulsa Branch Director

REPORT OF TEST

SGS U.S. Testing Company Inc.
1341 North 108th East Avenue
Tulsa, OK 74116
Tel: 918-437-8333
Fax: 918-437-8487

CLIENT: Emissions Technology, Inc.
P.O. Box 471916
Tulsa, OK 74174

Attn: Clark Daywalt

SUBJECT: Efficiency testing of ECO Systems by use of a methane source.

REFERENCE: Verbal 5/2/97.

SAMPLE ID: Client refers to the sample as "ECO System, Model ECO-2".

PROCEDURE: The testing procedure used a flow meter, monitoring methane flow, to measure the temperature of a gas brooder. With a thermal couple located in the brooder, the temperature of the flame was evaluated in comparison to methane flow. Tests were recorded with and without the sample ECO System in line with the brooder.

RESULTS: The results are on the following pages.

TEST DATE: 5/06/97.

Eric Hundley, Engineer

Signed for the Company
Dale E. Holloway
Tulsa Branch Director

bk

REPORT OF TEST

SGS U.S. Testing Company Inc.

Client: Emissions Technology, Inc.

RESULTS:

Brooder Temperature Test Standard Installation

Sample Number	Measurement (SCFH air)	Temperature (°C)	Flow Rate (ft^3/min)	Flow Rate (BTU/hr)
1	6.0	900	0.134	8840
2	10.0	1050	0.224	14800
3	14.0	1110	0.313	20600
4	18.0	1145	0.403	26600

Brooder Temperature Test With ECO System

Sample Number	Measurement (SCFH air)	Temperature (°C)	Flow Rate (ft^3/min)	Flow Rate (BTU/hr)
1	6.0	925	0.134	8840
2	10.0	1060	0.224	14800
3	14.0	1135	0.313	20600
4	18.0	1160	0.403	26600

REPORT OF TEST

SGS U.S. Testing Company Inc.

Client: Emissions Technology, Inc.

CONCLUSION:

Three temperature points were evaluated for flow differences made with the ECO System and without. These points are evaluated in terms of flow difference and percent efficiency difference.

EVALUATED TEMPERATURE POINTS

Sample	Temperature (°C)	Flow Difference (ft^3/min / BTU/hr)	Efficiency Difference (%)
1	925	.0150 / 990	11.2
2	1110	.0298 / 1967	9.6
3	1150	.0530 / 3490	12.7
		AVERAGE - 2150 BTU/hr	11.2 %